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Species Variability and Geographic Differentiation in Thymus of Ardabil Province and Clustering of Different Species Based on the Climatic Conditions

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Abstract: Ardabil province is a region in North - west of Iran, this land has different climate for example semi -tropical step, semi cold step and extremely cold step. Ardabil also has different altitude from 20 m to 4811 m level over the sea; so the presence of that condition makes the diversity of flora on the land increase. In order to investigate the geographical distribution of species of the genus Thymus in Ardabil, we collected species of thymus and identified them and studied relation between distribution and climate factors, kind of bed rock sand pH and soil structure . In this study we found 8 species of thymus including: *T. caucasicus*, *T. daenensis*, *T. fedeschenkoi*, *T .kotisshyanus*, *T. migricus*, *T. persicus*, *T. teratretter*, *T. trnscaucasius*. Their distribution was related to orientation altitude and kind of mother sand. By cluster analysis, they were grouped into 2 clusters, the first cluster included species of *persicus ,migricus and fedeschenkoi,* distributed on the debris and loamy acidic soil with alluvium and andisite bed rock and high altitude. The second cluster including other species of thymus was located on the low altitude and alkaline soil.

Key words: Geographic Differentiation · Species Variability · Thymus

INTRODUCTION

Thymus genus belongs to labiatae family that has 14 species in different parts of Iran which some of them are found exclusively in Iran [1]. Wild plants, even after the advent of agriculture, constituted an important part of the human diet especially in poor rural communities. Wars and times of famine were periods when the knowledge of such plants was especially important for communities [2] .Although there is huge data on the medicinal and culinary use of plants in Europe, the available material is usually dispersed in small ethnographic papers published in native languages. There is not an up-to-date exhaustive study on all Europe's edible plants, comparable with Merman's Native American Ethnobotany [3], except for a popular guide by Couplan [4]. Although attempts to compile worldwide lists of wild edible plants exist [5], they are far from exhaustive.

The aerial parts and volatile constituents of thyme, a perennial dwarf shrub, are used as a medicinal herb. *Thymus* species are commonly used for herbal tea, flavoring agents (condiment and spice) and medicine [6]. Among the species grown in Iran, *T. daenensis* Celak. and *T. kotschyanus* Boiss. and Hohen. are more widely used for these purposes. Infusion and decoction of aerial parts of *Thymus* species are used to produce a tonic, carminative, digestive, antispasmodic, anti-inflammatory, antitussive and expectorant and for the treatment of colds in Iranian traditional [1]. Recent studies have shown that Thymus species have strong antibacterial, antifungal, antiviral, antiparasitic, spasmolytic and antioxidant activities [6]. The aromatic and medicinal properties of the genus *Thymus* have made it one of the most popular medicinal plants [7]. Human interventions in plant breeding has always aimed to increase production, improve quality and protect plants against pests. Negative ecological impacts resulting from the use o f chemicals and cultivation limited the number of genotypes. This last aspect is particularly serious since it leads to genetic erosion that is a reduction in the species gene pool [8]. Progress in plant breeding requires a broad genetic basis. Knowledge of genetic diversity in crop species and their wild relatives is of critical importance for crop improvement [9]. For traditional Iranian medicinal

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plants, the major constraints in achieving higher yield and consistency are lack of genetic variability, absence of suitable genotypes for different planting systems, poor harvest index and susceptibility to diseases. Research on most endemic medicinal plants has lagged behind that of crops; therefore, improvements depend on the utilization of the available genetic diversity.

The genus *Thymus* includes about 350 species worldwide and widely distributed in temperate zone [1]. Geographical distribution of different species of *Thymus* depended weather and soil condition. A relationship between genetic variability and geographic distribution has been observed in several species of aromatic plants, for instance, Artemisia *annua* [10], *Tanacetum vulgare* [11] and some plants of the Lamiaceae family [12-14]. The greatest challenge of conservation is to preserve genetic variability in order to ensure the evolutionary processes [13, 15]. The limited number of individuals and high rates of inbreeding may lead to increased homozygosity and reduction of the vigor of individuals, expression of deleterious characters, increased seed abortion, reduced fertilization and germination rates and consequently a vicious circle that may lead to the disappearance of the population [13]. More conservation strategies should be considered to protect the endangered accessions from the risk of extinction. For example, low genetic variation and limited geographic distribution of some *T. daenensis* accessions in the extremes of the Zagros Mountains can intensify this problem [15,16]. there are species diversity of thymus and geographical distribution condition in province of Ardabil .the propose of this study is identification and geographical distribution of *Thymus* sp. related to soil and weather condition.

MATERIALS AND METHODS

The investigated research region is Ardabil province in the north west of Iran confined between 37.4 to 39.42 N long, 47.2 to 48.55 eastern latitude. This province is a mountainous region arid and has various climates. In this research the species of *Thymus* were collected from the different region of province and investigating of ecological features such as altitude the place of dispersion, direct side and the gradient percentage type of soil, soil pH and type of bed rock. Also weather information were obtained from metrology center of Ardabil. Data of *Thymus* sp. were analyzed by cluster analysis of UPGMA method on based of characters of located with SPSS software.

RESULTS AND DISCUSSION

Along the research, 8 species of genus *Thymus* were collected; recognized and their ecologic specialty was examined inspected in natural of province (Table 1). The species of genus *Thymus* in Ardabil region were distributed on the 1300 to 3700 meter altitude and sandy and loamy alkaline to acidic soil with Basalt to Dacoit bed rock. Different conditions were found for natural growth of *Thymus* sp. in Ardabil province, specially in terms of soil and bed rock and altitude. For example, in the Meshkin region with increasing altitude *Thymus kotschyanus* and *T. tratertteri* were *T. fedeschenkoi* and *T. migriacus*. Genetic variation of different species of genus *Thymus* were detained by geographical distribution (Table 1). A relationship between genetic variability and geographic distribution has been observed in several species of aromatic plants, for instance, *Artemisia annua* [10], *Tanacetum vulgare* [11] and some plants of the Lamiaceae family [12-14]. The greatest challenge of conservation is to preserve genetic variability in order to ensure the evolutionary processes [13, 15]. The limited number of individuals and high rates of inbreeding may lead to increasing homozygosity and reducing the vigor of individuals, expression of deleterious characters, increased seed abortion, reduced fertilization and germination rates and consequently a vicious circle that may lead to the disappearance of the population [13]. More conservation strategies should be considered to protect the endangered accessions from the risk of extinction.

The cluster analysis on basis of soil and located distribution (Fig. 1) showed that the 8 species were grouped on the 2 cluster. The first cluster included species of *persicus ,migricus and fedeschenkoi* distributed on the debris and loamy acidic soil with alluvium and andisite bed rock and high altitude. The second cluster included other species of *Thymus* that were located on the low altitude and alkaline soil.

Zaefizadeh and Imani [1] reported that among the above species, chemical compounds of types of *T. kotschyanus* and *T.persicus* was recognized. *T. kotschyanus* at 50%of flowering bears 25 recognized compounds, which form 99.3 percent of essential oil. They also reported that the main compounds in the essential oil of *T. kotschyanus* are p-cymene (5.3%), gama terpenene (10.3%), thymol (19%) and carvacrol (41.4%). Also the main compounds of collected *T.persicus* at khalkal region includes p-cymene (21.3%), gama terpenene (19.5%), thymol(36%) and carvacrol (2.5%).

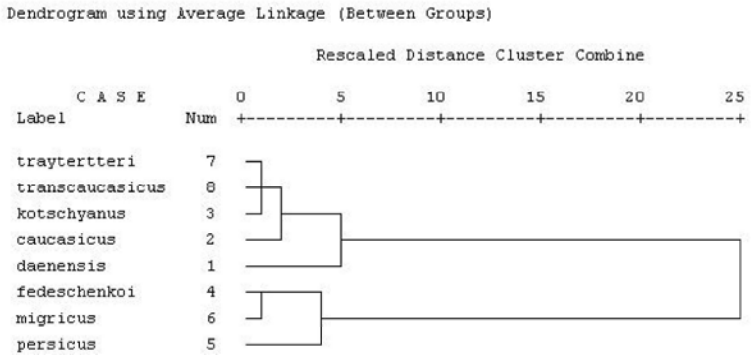

Fig. 1: Cluster analysis of *Thymus* different species on based of soil and weather condition

Table 1: Different species of *Thymus* sp. and their distribution in Ardabil province

Species	Side direct	Altitude	Soil ph	Structure soil	Time flowering	Distribution	Type bed rock	Geographical characters
Daenensis	Southern	1329	Alkaline	Sandy	Jun	Ardabil	Dacoit	38-20-57.6N 47-57-31.6E
Caucasicus	Southern	1400-2000	neutral	Lomi-silti	Jun	Ardabil	Lime stone	37-11-2.1N 47-57-32.6E
Kotschyanus	Southern	1700-2500	Alkaline	Sandy	jul-jun	Meshkin sabalan	Basalt	38-19-34N 47-51-9.3E
Fedeschenkoi	Southern	3500-3700	Alkaline	dibris	jun	Maeskin	Andesite	38-18-35N 47-52-9E
Persicus	Southern	3000	Acidic	lomi	may –jun	Khalkhal	Aluvium	37-35-22N 48-38-52E
Migricus	Southern	3500-3700	Acidic	dibris	jul	meshkin	Andesite	38-19-39N 47-51-11E
Tratretteri	Southern	1700-2500	Alkaline	lomi	may	meshkin	Basalt	38-19-35N 47-51-9E
Transcaucasicus	Southern	2000	Alkaline	sandy	jun	khalkhal	Lime stone	37-36-25N 48-38-55E

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