

## Reserves and Prospects for the Use of the Medicinally Important Species *Thymus Caucasicus* Wild. Ex Ronniger

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**Abstract.** The article provides information on the reserves, prospects for use, and conservation measures of *Thymus caucasicus* Wild. ex Ronniger, a species distributed in the Ganja–Gazakh region. As is known, the flora of Azerbaijan is remarkable for its rich phytocenoses of medicinally important plants that have no substitutes and are not found anywhere else in the world. Azerbaijan's medicinal plant resources, which possess rich reserves, are exported abroad, where new pharmaceutical preparations are produced and then sold back to us at very high prices. As a result, natural reserves decline and the scope of use becomes limited. Taking all this into account, the species *Thymus caucasicus*, which is rich in essential oils, has been comprehensively studied.

The studies were conducted in the Ganja–Gazakh region—specifically in the Dashkasan, Gadabay, Shamkir, and Goygol districts—across various vegetation types at elevations of 700–1900 m above sea level. During our research, *Thymus caucasicus* was studied within different plant communities, and the reserves of the species were assessed. In the Shamkir and Tovuz districts, the reserves of *Thymus caucasicus* were very low compared to other districts, whereas in Gadabay, Dashkasan, and Goygol the reserves were satisfactory.

Therefore, implementing conservation measures for the species in the Shamkir and Tovuz districts is an urgent issue. Annual monitoring should be carried out in these areas, and the habitats where the species occurs should be protected. For populations of *Th. caucasicus* occupying small areas, small protected reserves should be established, and continuous monitoring of the populations should be ensured.

**Keywords:** medicinal plant, plant grouping, reserve, conservation measures

### Introduction

The nature of Azerbaijan is fascinating and, at the same time, highly valuable. Its diverse forests, steppes, lakes, rivers, valleys, and mountains are exceptionally beautiful. Particularly impressive are the rich phytocenoses of medicinally important plants in the flora of Azerbaijan, many of which have no substitutes and are not found anywhere else in the world. Azerbaijan's medicinal plant resources, which possess abundant reserves, are exported abroad, where new pharmaceutical preparations are produced and then sold back to the country at very high prices.

In addition, it is regrettable to note that, during the transition period, “a group of profiteers” have acted ruthlessly toward nature, harvesting rare and valuable medicinal plants in a destructive manner without following any collection regulations and bringing them to markets for personal gain.

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Taking all these factors into account, it is considered appropriate to study the reserves and prospects for the use of *Thymus caucasicus* Wild. ex Ronniger, a species distributed in the Ganja–Gazakh region.

## Methods

The studies were conducted in the Ganja–Gazakh region across various vegetation types at elevations of 700–1900 m above sea level. The systematic position of the species was determined according to generally accepted principles, including APG IV ([www.worldfloraonline.org](http://www.worldfloraonline.org)), World Flora Online (Botanical Journal of the Linnean Society, 181(1), pp. 1–20), and The Euro+Med PlantBase (<http://ww2.bgbm.org/>), through which the taxonomy and nomenclature of the species were clarified.

In studying the bioecological characteristics of the species, the following sources were used: *Flora of Azerbaijan*, *Flora of the Caucasus* (Grossheim, 1945; Flora of Azerbaijan, 1952), E.M. Gurbanov's *Systematics of Higher Plants* (Gurbanov, 2009), A.M. Asgarov's *Plant World* (Asgarov, 2016), Volume III of *Conspectus of the Flora of the Caucasus* (2012), as well as works by N.N. Portenier (2012) and other scientists.

Geobotanical studies of the plant communities (cenoses) in which the studied species occurs were carried out according to generally accepted methods in geobotany (Pedrotti, 2013). The structure and composition of the vegetation, the number of species present, as well as the edificator and dominant species—in other words, the floristic and geobotanical characteristics of the study areas—were examined, and floristic richness was assessed using Drude's five-point scale (Drude, 1887; 1906). In each district, focal plots were established, and natural reserves were calculated using experimental methods for geobotanical indicators and Yaroshenko's mathematical calculations (Yaroshenko, 1946–1967).

## Materials and Discussion

The research material used in this study was *Thymus caucasicus* Wild. ex Ronniger (Caucasian thyme). The investigations were carried out in the Ganja–Gazakh region, specifically in the Dashkasan, Gadabay, Shamkir, and Goygol districts. *Thymus caucasicus* Wild. ex Ronniger is a semi-shrub plant reaching 9–17 cm in height (Fig. 1). Its leaves are ovate or ovate-triangular, and its flowers are capitate, rarely elongated-capitate in form. The species was first described from the Caucasus. It is distributed in the lower, middle, and upper mountain belts (1200–2800 m), inhabiting dry gravelly and sandy stony substrates, rocky outcrops, steep cliffs, screes, and stony dry-grass slopes.

During our investigations, *Thymus caucasicus* was studied within various plant communities, and the reserves of the species in the studied area were assessed. Based on literature data, the antimicrobial properties of *Thymus caucasicus* have also been identified. The aqueous extracts and essential oil of this species exhibit stronger bactericidal properties compared to other species (Bakhshaliyeva & Jalilova, 2018).

The leaves are used in the spice industry and in the preparation of various beverages. Infusions are also used in the treatment of different diseases. Due to its high essential oil content, *Thymus caucasicus* is considered promising for use in the treatment of respiratory tract diseases and has expectorant properties. In addition, it is a valuable melliferous (honey-producing) plant.



**Figure 1.** *Thymus caucasicus* Wild. ex Ronniger

Traditionally, in folk medicine, infusions are used, and the powdered form is applied as a compress for inflammation of the sciatic nerve. An infusion prepared with honey or in the form of an ointment is believed to “cleanse the chest and lungs,” facilitate the expulsion of sputum, and relieve pain. Thyme aids digestion. Thyme baths are beneficial for nervous disorders, radiculitis, rheumatism, skin rashes, as well as joint and muscle diseases. For external rubbing, mixtures containing thyme essential oil are used. Studies were conducted to determine the natural distribution of *Thymus caucasicus* in different areas, as well as its variability, biological and phytocenological characteristics, productivity, and other features.

The meadows of the Gadabay district are mainly used extensively as pastures and hayfields. In winter, due to sharp temperature fluctuations, anthropogenic impacts are reduced to almost zero. In these areas, dark mountain-meadow soils are more widely distributed compared to other districts. Such soils are highly resistant to erosion. As shown in Table 1, the productivity of *Thymus caucasicus* in this area was within normal limits. Up to 80 species of flowering plants were recorded in the plant communities of the area. In plant communities formed by species such as *Rumex acetosa*, *Senecio othonnae*, *Alopecurus laguroides*, *Dactylis glomerata*, *Campanula latifolia*, *Trifolium pratense*, *Poa bulbosa*, *Cerastium purpurascens*, *Minuartia arenaria*, and others, the abundance of *Thymus caucasicus* was assessed at 2 points.



**Figure 2.** The status of *Thymus caucasicus* within plant communities in the Gadabay district

In the Goygol district, *Thymus caucasicus* occurs sporadically and individually in small patches on steep slopes within formations dominated by variegated fescue. In this association, the diameter of the turfs of the studied *Thymus caucasicus* reaches 20–25 cm. The soil of the experimental site consists of mountain-meadow soil with a pH of 5.0–5.5 and a humus content of 10–20%. A total of 20–25 species were recorded in the association, with *Carex tristis* and *Festuca rupicola* among the dominant species. The abundance of *Thymus caucasicus* was assessed at 1 point.

In the Dashkasan district, the species is more widely distributed, mainly across mountainous areas. The study of the phytocenological characteristics and reserves of *Thymus caucasicus* was conducted in the area of Khoshbulag village. Research was carried out in steppe and petrophytic vegetation types. Within the fescue-thyme formation group (*Festucetum-Thymosum*), the associations *Festucetum valesiaca* (valesian fescue-hill thyme) and *Festucetum ovina-Thymosum collinus* (sheep fescue-hill thyme) were identified. Overall, 25 species were recorded within this formation group. The abundance of hill thyme (*Th. collinus*) was assessed at 3–4 points, while the subdominant species, valesian fescue (*F. valesiaca*), was assessed at 2 points. The abundance of *Th. caucasicus* in this plant community was assessed at 2 points.

In petrophytic vegetation types, *Thymus caucasicus* participates in communities together with drought-resistant species such as *Thymus collinus* Bieb., *Th. kotschyanus* Boiss. et Hohen., *Th. fominii* Klok. et Shost., *Stachys inflata* Benth., *S. aspera* Michx., *S. arvensis* L., *Cousinia macroptera* C.A. Mey., *Ziziphora tenuior* L., *Z. turcomanica* Juz., *Teucrium polium* L., *Amygdalus communis* L., *Atraphaxis spinosa* L., and other drought-tolerant plants. Based on data obtained during expeditions, the technical significance and productivity of *Thymus caucasicus* were studied using various methods. The species was investigated in three replicates on 10 m<sup>2</sup> sample plots. The number of individuals, fresh biomass, average weight per individual, and productivity per hectare were determined. For example, in the Gadabay district, an average of 5–6 individuals per 1 m<sup>2</sup> was recorded, the weight of a single individual ranged from 480 to 860 g, and productivity was calculated at 30–31 tons per hectare.

Based on the obtained data, the biological reserves, exploitable reserves, and annual allowable harvest volume of *Thymus caucasicus* were determined.

**Table 1.** *Regional reserves of Thymus caucasicus*

№	Districts	Total area, ha	Average weight per plant, g	Number of plants per hectare	Yield, ha/kg	Natural reserves, t		
						Biological reserves	Exploitable reserves	Annual allowable harvest
1	Gadabay	1132	68	2780	189,04	213,99	85,60	21,40
2	Dashkasan	1025	59	3900	230,10	235,85	94,34	23,59
3	Shamkir	43	370	595	215,4	119,45	73,61	6,25
4	Tovuz	259	473	2423	1190, 58	686,4	371,85	37,15
5	Goygol	1058	70	3827	267,89	283,43	113,37	28,34

As can be seen from table 1, the reserves of *Thymus caucasicus* in the Shamkir and Tovuz districts are very low compared to other districts. In contrast, the reserves in the Gadabay, Dashkasan, and Goygol districts are satisfactory. Therefore, the implementation of conservation measures for the species in the Shamkir and Tovuz districts is one of the most urgent issues. For this reason, annual monitoring should be carried out in these areas, and the sites where the species occurs should be protected. For populations of *Th. caucasicus* occupying small areas, small protected reserves should be established, and continuous monitoring of these populations should be ensured.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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