

Original Research

Determining the Natural *Gypsophila* L. (Coven) Taxa Growing in Tunceli (Turkey)

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ABSTRACT:

56 species belonging to 60 taxa (out of 126 species in the World) of Caryophyllaceae family grows naturally in Turkey with *Gypsophila* sps L. as the third largest genus. The endemism ratio of the genus is 60% in Turkey. Because Turkey is the gene center of *Gypsophila* and economically very valuable; determining the geographic distribution and biological characteristics of the taxa is very necessary. They have well-developed roots, that prevent soil erosion. Because of containing saponin (10-25 %) in their root, its extract is used as fire extinguisher, gold polisher, cleaner and softener of delicate fabrics and crispness giving substance for halva. It is also used for making liqueur, herbal cheese, ice cream and some other foods. Some taxa are boron hyper accumulators and vegetative mining can be conducted by hyper accumulation. They are also thought to be the cleaning tools for toxid areas by fitoremediation.

In this study, 12 records from eight *Gypsophila* taxa were collected around Tunceli. These are *G. aucheri* Boiss. (1), *G. elegans* Bieb. (1), *G. pallida* Stapf. (2), *G. perfoliata* L. var. *perfoliata* (1), *G. ruscifolia* Boiss. (3), *G. sphaerocephala* Fenzl ex Tchihat var. *cappadocica* Boiss. (1), *G. venusta* Fenzl (1) and *G. viscosa* Murray (2). With addition of *G. briquetiana* Schischk. and *G. hispida* Boiss. the total number is reaching to 10 and it shows that the city is an important diversity center of the genus. *G. aucheri*, *G. briquetiana* and *G. sphaerocephala* var. *cappadocica* are endemic to Turkey and *G. pallida*, *G. perfoliata* L. var. *perfoliata*, *G. venusta* and *G. viscosa* are determined to be new records for Tunceli.

Keywords:

Coven, *Gypsophila*, Habitat, Biodiversity, Tunceli, Turkey.

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INTRODUCTION

Caryophyllaceae family distributes mostly in Mediterranean region of southern hemisphere. It has a large diversity with over 2000 species. *Gypsophila* L. genus, which has 126 species on the World, has natural distribution in the Irano-Turanian and Mediterranean phytogeographic regions (Williams, 1989; Sumaira *et al.*, 2008). There are about 500 species of Caryophyllaceae family in Turkey. More than half of totally 126 *Gypsophila* species in the world are found in Caucasian, the North Iraq and the North Iran regions. There are about 56 *Gypsophila* species found in Turkey. Many of them are known from the type collection. *G. heteropoda* Freyn & Sint. subsp. *minutiflora* Bark. is a rare endemic taxon peculiar to Cappadocia sub region in Inner Anatolia of Turkey and an endangered taxa on global scale (Ekim *et al.*, 2000; Ozhatay *et al.*, 2005). *Gypsophila* L. is the third biggest genus of Caryophyllaceae family after *Silene* L. and *Dianthus* L. (Davis, 1967; Davis *et al.*, 1988; Güner *et al.*, 2000; Çelik *et al.*, 2008; Korkmaz and Özçelik, 2011b). The most important factor for the distribution of this genus is the soil structure which contains gypsum, lime and calcium; these are important for these plants to grow. There are gypsum habitats around Sivas, Çankırı, Çorum, Ankara, Eskişehir, Niğde and Erzincan. Because of that, *Gypsophila* taxa are rich in these areas.

Soap root has been exported from Anatolia for a long time. The collection of coven from natural habitats and extraction have been increasing rapidly especially in the Eastern and South-east Anatolia for nearly 40 years (Kılıç, *et al.*, 2008). In Turkey *Gypsophila* taxa are generally known by the name “Çöven Otu” and they are mostly used by the public for different purposes. The word “Soaproot” or “Soapworth” terms are used for *Gypsophila* species; in Europe the members of the genus are widely known as “Baby’s Breath”. In Turkey the plants are also called “Dişi Çöven, Tarla Çöveni, Helva Çöveni, Şark Çöveni” by the local people (Kılıç, *et al.*,

2008; Korkmaz *et al.*, 2010; Korkmaz and Özçelik, 2011a).

Turkish Covens are commonly obtained from *Gypsophila graminifolia* Bark. *G. arrostii* Guss.var. *nebulosa* (Boiss. and Heldr.) Bark., *G. eriocalyx* Boiss., *G. bicolor* (Freyn&Sint.) Grossh., *G. perfoliata* L., *G. venusta* Fenzl subsp. *venusta* and *Ankyropetalum gypsophiloides* Fenzl. (İnan, 2006; Kılıç, *et al.*, 2008). *G. ruscifolia* Boiss. and *G. bitlisensis* Bark. are the least preferred species. The most preferred species are *G. bicolor*, *G. arrostii* and *A. Gypsophiloides* (Baytop, 1984; Özçelik, and, Özgökçe, 1999; Korkmaz and Özçelik, 2011a).

Saponin chemical was first produced from the roots of *Saponaria officinalis* (Baytop, 1984). The amount of saponin in the roots of *Gypsophila* taxa differs from 4 % to 25 % (Sezik, 1982). *Gypsophila bicolor* (Van Çöveni), *G. arrostii* var. *Nebulosa* (Beyşehir, Isparta Çöveni), *G. perfoliata* (Niğde Çöveni), *G. venusta* subsp. *Venusta* and *G. eriocalyx* (Çorum-Yozgat Çöveni) are most preferred taxa for obtaining coven extract in Turkey (H’eroldand Henry, 2001; Battal, 2002).

Soap root extract is composed of sugar, resin and saponin. It protects the plant from germ and fungal infection, increases the nutritive value and facilitates the digestion. The production phases of the extract starts with cutting the roots in the form of chips and continuous with boiling them for two times. After second boiling stage the extract can be obtained. (Korkmaz *et al.*, 2010; Korkmaz and Özçelik, 2011a).

The main areas of the use of them are in the food industry, the chemistry, in hygiene industry, in horticulture, in mining, in whitening gold and in fire extinguishers. They have antimicrobial effect and used in medicines. Every year the average export of soap root from Turkey is about 90 tones by gaining approximately 66 000 US Dollars (Baytop, 1984; Korkmaz and Özçelik, 2011a; Özçelik and Özgökçe, 1996).

This study was aimed to determine the *Gypsophila* taxa naturally distribute in the province of Tunceli city of Turkey.

MATERIALS AND METHODS

Material of this study contains *Gypsophila* taxa growing around Tunceli. With regard to this aim we have collected eight taxa of the genus from 13 different localities in the area. Collection date, record number, habitat types and some other properties of the identified taxa were determined (and given in Table 1). For the identification of taxa Flora of Turkey and the East Aegean Islands (Davis, 1967) has been used extensively. Identifications were done with the help of stereo-zoom microscope. Identified samples were converted to

herbarium specimen. Economic importance of the taxa is given according to our early papers (Özçelik and Özgökçe, 1999; Korkmaz *et al.*, 2010; Korkmaz and Özçelik, 2011a,b).

As it is given in the Table-2, endemic taxa and the risk categories, phytogeographic regions, altitudes, life forms and new records have been determined. Turkish names of *Gypsophila* taxa grows around Tunceli have been determined from Türkiye Bitkileri Listesi (Güner *et al.*, 2012) as they were given in Table 2. Endemic taxa of the genus and their threat categories have been determined from Ekim *et al.* (2000) and given in the same table.

Table 1. Locality and habitat information of *Gypsophila* taxa collected around Tunceli

No	Taxon	Record number	Date	Locality	Habitat
1	<i>G. aucheri</i> Boiss.	K: 1769	03.07.2009	Tunceli: Tunceli-Pertek, 10 km to Pertek	Rocky places
2	<i>G. elegans</i> Bieb.	K: 1741	02.07.2009	Tunceli: Erzincan- Pülümür, near to Pülümür	Rocky places
		K: 1740	02.07.2009	Tunceli: Erzincan- Pülümür, near to Pülümür	Rocky places
3	<i>G. pallida</i> Stapf.	K: 1748	02.07.2009	Tunceli: Tunceli- Ovacık, 40 km to Ovacık	Inclined slopes
4	<i>G. perfoliata</i> L. var. <i>perfoliata</i>	K: 1745	02.07.2009	Tunceli: Pülümür-Tunceli, near to Pülümür	Rocky slopes
		K: 1746	02.07.2009	Tunceli: Pülümür-Tunceli, 30 km to Tunceli	Rocky slopes
5	<i>G. ruscifolia</i> Boiss.	K: 1760	02.07.2009	Tunceli: Tunceli-Ovacık, 10 km to Ovacık	Flowing slopes
		K: 1761	02.07.2009	Tunceli: Ovacık, Munzur Çayı Gözeleri	Rocky places
6	<i>G. sphaerocephala</i> Fenzl ex Tchihat var. <i>cappadocica</i> Boiss.	K: 2588	12.06.2011	Tunceli-Erzincan, Munzur Mountain	Rocky slopes
		K: 2638	11.07.2011	Tunceli-Erzincan Munzur Mountain	Slopes
7	<i>G. venusta</i> Fenzl	K: 1749	02.07.2009	Tunceli: Tunceli- Ovacık, 25 km to Ovacık	Rocky slopes
8	<i>G. viscosa</i> Murray	K: 1750	02.07.2009	Tunceli: Tunceli Ovacıkarası, 25 km to Ovacık	Rocky slopes
		K: 1752	02.07.2009	Tunceli: Tunceli-Ovacık, 10 km to Ovacık	Rocky places

K: Korkmaz

Table 2. Taxonomic information of *Gypsophila* taxa growing around Tunceli

No	Taxon name (Turkish name)	Endemic	Fl.	P.G. region	Altitude (m)	Life form	New record or recorded before
1	<i>G. aucheri</i> Boiss. (Taş Çöveni)	Endemic (VU)	6-7	Ir.-Tur.	1200-1600	P	Tunceli, Pertek
2	* <i>G. briquetiana</i> Schischk. (Gül Çevgeni)	Endemic (LR)	7-8	Ir.-Tur.	1700-2500	P	Tunceli, Ovacık, Munzur Mountain
3	<i>G. elegans</i> Bieb. (Hoş Çöven)	-	6-7	Ir.-Tur.	650-2600	A	New record to Tunceli
4	* <i>G. hispida</i> Boiss. (Kıllı Çöven)	-	6-7	Ir.-Tur.	1100-2150	P	Tunceli, between Tunceli and Ovacık
5	<i>G. pallida</i> Stapf. (Şark Çöveni)	-	6-8	Ir.-Tur.	850-2000	P	New record to Tunceli
6	<i>G. perfoliata</i> L. var. <i>Perfoliata</i> (Helvacı Çöveni)	-	6-8	-	1000-1500	P	New record to Tunceli
7	<i>G. ruscifolia</i> Boiss. (Acem Çöveni)	-	6-7	Ir.-Tur.	300-1800	P	Tunceli, Ovacık
8	<i>G. sphaerocephala</i> Fenzl ex Tchihat var. <i>cappadocica</i> Boiss.	Endemic (LR)	7-8	Ir.-Tur.	800-1900	P	Tunceli, Munzur Mountain
9	<i>G. venusta</i> Fenzl (Kara Çöven)	-	5-7	Ir.-Tur.	300-1600	P	New record to Tunceli
10	<i>G. viscosa</i> Murray (Sadırlı Çöven)	-	4-6	Ir.-Tur.	350-1400	A	New record to Tunceli

* :*Gypsophila* taxa not available in the area, P: Perennial, A: Annual, P.G.: Phyto-geographic, Fl.: Flowering period

RESULTS AND DISCUSSION

The results of the study are summarized in Table -1 and Table-2. As seen in Table-1, 8 *Gypsophila* taxa were collected from the area in 2009 and 2011. All of the plant samples were collected from Pülümür, Tunceli, Ovacık and Munzur Mountains. Generally, the collected plants are naturally grown in rocky and slopy places. Photograph of all collections were taken during the field work. Totally 8 *Gypsophila* taxa were collected from 13 different localities. As seen in Table-2 there are 10 *Gypsophila* taxa determined in the flora of Tunceli.

G. aucheri, *G. briquetiana* and *G. sphaerocephala* var. *cappadocica* are endemic taxa available in the vicinity. Threat (risk) category of *G. aucheri* is Vulnerable (VU) and the other two taxa is at the category of Low Risk (LR). Flowering periods of the taxa changes from April to August. All of the determined taxa are Irano-Turanian phytogeographic region elements and distributes from 800 to 2500 m altitudes in the area. *G. elegans* and *G. viscosa* are annual life forms and the others are perennial life forms. *G. aucheri*, *G. briquetiana*, *G. elegans*, *G. hispida*, *G. ruscifolia* and

G. sphaerocephala var. *cappadocica* are early recorded in Tunceli but, *G. pallida*, *G. perfoliata* var. *perfoliata*, *G. venusta* and *G. viscosa* (4 taxa) are new records. Habitat types of *Gypsophila* taxa growing naturally in the province are rocky places, in clined or flowing slopes and slopes of mountains. Their flowering period starts in July. The general vegetation type of the plants are arid or semiarid steppes.

Soap roots have economic value in medicine, food, decoration and cleaning and chemistry to produce saponin. It is used as fire extinguisher, gold polisher, fabric, cleaner and for purification of contaminated soil such as by removing the boron. In addition, it is possible to perform vegetative mining by boron hyper-acumulation from soil to the upper parts of the plant (Babaoğlu *et al.*, 2004; Korkmaz and Özçelik, 2011a). Turkish soaproot is mostly obtained from *G. graminifolia*, *G. bicolor*, *G. arrostii* var. *nebulosa*, *G. eriocalyx*, *G. perfoliata* var. *anatolica*, *G. venusta* and *Ankyropetalum gypsophiloides* species and the gene center of both of the species is Turkey (Korkmaz and Özçelik, 2011a,b). The harvest time of these plants is from March to June. Because the roots of these plants are generally used, the plants don't produce seeds for the next years. So, the plants are increasingly disappearing from the nature and under the threat of extinction. This problem becomes more important when the plants are rare or endemic. Because of unemployment soap roots have been collected for a long time in the rural parts of the country. For preservation of *Gypsophila* species they should not only be collected from nature but also its cultivation should be planned and other soap root yielding plant species should be identified.

The most important floristic study related with Tunceli in the area is Flora of Munzur Dağları (Yıldırım, 1995). The mountains are situated between Erzincan and Tunceli in B7 grid square and in Irano-Turanian phytogeographic region. It starts from Kemaliye and reach to Pülümür at the west-east direction

as forming a natural border between Erzincan and Tunceli. The width of the mountain is 25-30 km and the length of it is 100-130 km. Altitude of the area changes from nearly 850 to 3462 m. The climate of the area is hot and dry summers and long and snowy winters. According to the study there are 1407 vascular plant species. The number of endemic species is 275 and some of them were described as new to science. In this study *G. briquetiana* Schischk., *G. sphaerocephala*, *G. ruscifolia*, *G. elegans* Bieb, *G. bitlisensis* Bark. and *G. hispida* Boiss. are given in the list of the plants. Munzur Dağları is one of the most important ÖBA (Önemli Bitki Alanı) of Turkey with its very rich floristic diversity. Munzur Valley is also an important national park of the country. There are 43 plant species peculiarto Munzur Dağları. In addition to the study of Yıldırım (1995) Özhatay *et al.* (2005), this is another important study on biological diversity of the mountains. *Gypsophila briquetiana* Schischk., *Gypsophila elegans* Bieb. and *Gypsophila ruscifolia* Boiss. are three species of the genus growing in the area of Munzur mountains (Koyuncu and Arslan, 2009). Polat *et al.* (2012) evaluated ethno botanical studies performed in the Eastern Anatolian region including Tunceli. According to this study there are only five ethnobotanical study (Tuzlacı ve Doğan, 2010; Yıldırım, 1985; 1991; 1994 a;b) conducted in Tunceli. Also in another study performed by Karlıdağ in (2009) related with both of Elazığ and Tunceli, they determined local names and medicinal uses of 53 plants. The least studied cities in East Anatolian region are Ağrı, Ardahan, Bingöl, Bitlis, Erzincan, Kars, Muş, Hakkari and Tunceli. So, it is necessary to record and prevent ethnobotanical culture in these cities by conducting news tudies (Polat *et al.*, 2012).

CONCLUSION:

There are 60 naturally growing *Gypsophila* taxa in the Turkey. Many species of the genus are highly

potential to be used in economy. *G. sphaerocephala* and *G. perfoliata* are known as boron hyper accumulators and they are very important for boron mining. Because of their well- developed root stock they can be used for soil erosion. They easily regulate themselves to the drought in summer by storing water in their leaves and enlarged roots (Sameh *et al.*, 2011).

As İnan (2006) said, collecting plants in an uncontrollable way from natural environments, industrialization, urbanization, enlargement of fields for agricultural goal, overgrazing, tourism, environmental pollution, deforestation, forest fires are main factors threatening the diversity of plants in Turkey. Because of these factors many endemic, economic and traditionally used medicinal plants are increasingly disappearing. There are at least 10 *Gypsophila* taxa growing around Tunceli. *G. aucheri*, *G. briquetiana* and *G. sphaerocephala* var. *cappadocica* are endemic taxa available in the province. Threat category of *G. aucheri* is Vulnerable (VU) and it needs protection studies. The most important factor that threat these taxa in the area is animal husbandry.

The richness of the area with regard to *Gypsophila* (coven) taxa is very necessary to use these species in economic development of the city. Because of that reason construction of a saponin factory in the region or in East Anatolian region have huge importance for the people living in the region. Instead of collecting these plants from the nature culturing these species to produce saponin is another necessity for preserving the threatened species. Moreover, ecological, chemical, genetic, ethno-botanical, culturing and conservation studies on these taxa should be planned and performed in the near future immediately.

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REFERENCES

- Babaoğlu M, Gezgin S, Topal A, Sade B and Dural H. 2004.** *Gypsophila sphaerocephala* Fenzl ex Tchihat: A Boron Hyper accumulator Plant Species That May Phytoremediate Soils with Toxic B Levels, Turkish Journal of Botany, 28 (3): 273-278.
- Battal H. 2002.** A Research on the production of a soapwort extract. M.Sc. Thesis, Ankara University. Ankara.
- Baytop T. 1984.** Therapy with medicinal plants in Turkey (Past and Present). İstanbul Üniversitesi Eczacılık Fakültesi Yayınları, No: 40, İstanbul.
- Çelik A, Özçelik H, Özmen İ, Özgökçe F, Korkmaz M and Muca B. 2008.** Türkiye *Gypsophila* L. ve *Ankyropetalum* Fenzl (Caryophyllaceae) Cinslerinin Revizyonu ve Saponin Düzeylerinin Belirlenmesi. TÜBİTAK; TBAG ProjeNo:107T147.
- Davis PH, Cullen J and Coode MJE. 1967.** Flora of Turkey and the East Aegean Islands. Edinburgh University Press, Edinburgh. 2: 149-171.
- Davis PH, Mill RR and Tan K. 1988.** Flora of Turkey and the East Aegean Islands. Vol. 10, Edinburgh University Press, Edinburgh.
- Güner A, Özhatay N, Ekim T and Başer KHC. 2000.** Flora of Turkey and the East Aegean Islands. Edinburgh University Press. 11: 49.
- Ekim T, Koyuncu M, Vural M, Duman H, Aytaç Z and Adıgüzel N. 2000.** Red Data Book of Turkish Plants (Pteridophyta and Spermatophyta). The Council of Protecting the Turkish Nature Press, Ankara.
- Güner A, Aslan S, Ekim T, Vural M and Babaç MT. 2012.** A Check List of the Flora of Turkey (Vascular Plants). Nezahat Gökyiğit Botanik Bahçesive Flora

Araştırmaları Derneği Yayını, İstanbul.

H'erold MC and Henry M. 2001. UDP-Glucuronosyl transferase activity is correlated to saponin production in *Gypsophila paniculata* root in vitro cultures. *Biotechnology Letters*. 23: 335–337.

İnan M. 2006. Çukurova Koşullarında Farklı Kökenli *Gypsophila* L. Türlerinde Kök Verimlerine ve Saponin İçeriklerinin Araştırılması, Ph.D Thesis, Çukurova University, Adana.

Kılıç CS, Koyuncu M and Güvenç A. 2008. Soaproot Yielding Plants of East Anatolia and Their Potential in Nature. *Turkish Journal of Botany*. 32(6):489- 494.

Korkmaz M, Özçelik H and Özgökçe F. 2010. Economic Importance and Using Purposes of *Gypsophila* L. and *Ankyropetalum* Fenzl (Caryophyllaceae) Genera of Türkiye. Second International Symposium on Sustainable Development 8-9 June 2010, Sarajevo.

Korkmaz M and Özçelik H. 2011a. Economic Importances of *Gypsophila* L., *Ankyropetalum* Fenzl and *Saponaria* L. (Caryophyllaceae) Taxa of Turkey. *African journal of Biotechnology*. 10(47):9533-9541.

Korkmaz M and Özçelik H. 2011b. Türkiye'nin *Gypsophila* (Caryophyllaceae) Taksonlarının Sistematik ve Morfolojik Özelliklerine Katkıları, Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Dergisi. 15 (3):148-160.

Koyuncu M and Arslan N. 2009. Munzur Vadisi'nin Biyolojik Çeşitliliğinin Korunması. Ulaşılabilir Yaşam Derneği, Ankara.

Özçelik H and Özgökçe F. 1996. Taxonomic Contributions to Genus *Gypsophila* L. (Caryophyllaceae) from East Anatolia (Turkey). In: Ozturk MA, Secmen O, Gork G ed(s). *Plant life in southwest and central Asia: vol.1*. Izmir, Türkiye: Ege University Press pp.195-209.

Özçelik H and Özgökçe F. 1999. *Gypsophila bitlisensis*

Bark. ve *Gypsophila elegans* Bieb. Üzerinde Morfolojik, Taksonomik ve Ekolojik Araştırmalar, 1st International Symposium on Protection of Natural Environment and Ehrami Karaçam, Kütahya, Türkiye, pp. 295-313.

Özhatay N, Bayfield A and Atay S. 2005. Türkiye'nin 122 Önemli Bitki Alanı. WWF Türkiye Doğal Hayatı Koruma Vakfı, İstanbul.

Polat R, Çakılcıoğlu U, Ertuğ F and Satıl F. 2012. An evaluation of ethnobotanical studies in Eastern Anatolia, *Biological Diversity and Conservation*. 5(2):23-40.

Sameh SA, Samir A, Hessini K, Abdely C, Lachaal M and Soltani A. 2011. Effects of soil properties on water and mineral nutrition of *Beta macrocarpa* Guss. *Pakistan Journal of Botany*. 43(6): 2861-2868.

Sezik E. 1982. The Origin and the Quality of the Turkish Soaproots. *Journal of Ankara University Faculty of Pharmacy*. 12(1.2): 41-64.

Sumaira S, Mir AK, Akbar AM and Asma J. 2008. Pollen morphology of the Genus *Silene* (Silene-Caryophyllaceae) from Pakistan, *Biological Diversity and Conservation*. 1: 74–85.

Tuzlacı E, Doğan A. 2010. Turkish folk medicinal plants, IX: Ovacık (Tunceli), *Marmara Pharmaceutical Journal*. 14(3):136-143.

Williams FN. 1989. Revision of the specific forms of the Genus *Gypsophila* L. *Journal of Botany*. 27: 321–329.

Yıldırım Ş. 1995. Flora of Munzur Dağları (Erzincan-Tunceli). *OT Sistematik Botanik Dergisi*. 2(1): 1-78.

Yıldırım Ş. 1985. Vernacular names and some usages of plants of the Munzur Mountains, *Doğa Bilim Dergisi*. 2(9): 593-597.

Yıldırım Ş. 1991. Munzur Dağlarının tıbbi ve endüstriyel bitkileri, Fırat Havzası Tıbbi ve Endüstriyel Bitkileri Sempozyumu, Ankara. pp. 83-102.

Yıldırım Ş. 1994a. Local names of some plants from Munzur Mountains (Erzincan–Tunceli) and the uses of a few of them (II). *İbid.* 1(2): 43-46.

Yıldırım Ş. 1994b. Munzur Dağlarının (Erzincan-Tunceli) ağaç ve çalı türleri ile bunların kullanım değerleri. *Ot Sistematik Botanik Dergisi.* 1(1): 23-40.

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