

Taxonomy and Conservation Status of *Acantholimon laxiflorum* Boiss. ex Bunge (*Plumbaginaceae*)

Musa DOĞAN

Middle East Technical University, Department of Biology, 06531 Ankara - TURKEY

Hayri DUMAN

Gazi University, Faculty of Science and Arts, Department of Biology, 06500 Ankara - TURKEY

Galip AKAYDIN

Hacettepe University, Faculty of Education, Department of Biology, 06532 Ankara - TURKEY

Received: 08.10.2002

Accepted: 02.05.2003

Abstract: *Acantholimon laxiflorum* Boiss. ex Bunge (*Plumbaginaceae*), a local endemic species in Turkey, was subjected to taxonomic analysis in order to clarify its taxonomic status, because this species seems to have been wrongly treated and overlooked since it was first described by Boissier. The species is restricted to the east of Arsuz (C5 Hatay, Turkey) along dry riverbank, where it grows in rocky places on serpentine rocks. A full description and an illustration of the species are given, along with some additional information dealing with its ecology, phyto geography and conservation status.

Key Words: *Acantholimon*, *Plumbaginaceae*, Taxonomy, Conservation.

Acantholimon laxiflorum Boiss. ex Bunge (*Plumbaginaceae*) Türünün Taksonomisi ve Korunma Statüsü

Özet: Türkiye'de lokal bir endemik tür olan *Acantholimon laxiflorum* Boiss. ex Bunge (*Plumbaginaceae*)'un taksonomik statüsünün anlaşılabilmesi için detaylı taksonomik analizler yapılmıştır. Bu türün, E. Boissier tarafından tanımlandıktan sonra yanlış değerlendirildiği görülmektedir. Arsuz'un (C5 Hatay, Türkiye) doğusunda, kuru dere yatakları boyunca, serpantin kayalıklar üzerinde yetişen bu türün ayrıntılı tanımı ve çizimi yanında ekolojisi ve fitocoğrafyası ile korunma statüsü hakkında da bilgiler verilmiştir.

Anahtar Sözcükler: *Acantholimon*, *Plumbaginaceae*, Taksonomi, Korunma

Introduction

The genus *Acantholimon* Boiss. was first described by Boissier (1879) in his *Flora Orientalis*, in which he recognised 74 species. This genus is mainly distributed from South East Europe to Central Asia, and some species are also found in South America. The genus is of considerable ornamental importance, with attractive long-lasting flowers. In Turkey, the first revision of *Acantholimon* was carried out by Bokhari & Edmondson (1982) in Davis' *Flora of Turkey and the East Aegean Islands*, in which they recognised 25 species and indicated the possibility of finding additional species, either imperfectly known (two species) or doubtfully recorded (nine species), from Turkey. They placed all the

Acantholimon species found in Turkey into three sections: *Acantholimon*, *Tragacanthina* Bunge and *Staticopsis* Boiss. One can easily recognise the members of sect. *Tragacanthina* by their heteromorphic leaves, lax inflorescence and tubular calyx. This section includes only two closely related species, *A. curviflorum* Bunge and *A. quinquelobum* Bunge, in Turkey, although more species are present in other countries. In sect. *Acantholimon*, inflorescence is capitate, the leaves are heteromorphic and the spikelets are (1-)2-5 flowered and 2-6 bracteate. This section covers *A. bracteatum* (Girard) Boiss. and *A. petuniiflorum* Mobayen. In sect. *Staticopsis*, the leaves are monomorphic and the inflorescence is a simple or branched spike. The latter section covers the remaining

species in the Flora. The section was further divided into three subsections: *Caryophyllacea* Bunge (including *A. venustum* Boiss., *A. halophilum* Bokhari, *A. acerosum* (Willd.) Boiss., *A. caryophyllaceum* Boiss., *A. armenum* Boiss. & Huet, *A. kotschyii* (Jaub. & Spach) Boiss., *A. confertiflorum* Bokhari, *A. dianthifolium* Bokhari and *A. libanoticum* Boiss.), *Microcalycina* Bunge (including *A. spirizianum* Mobayen) and *Androsacea* Bunge (including *A. glumaceum* (Jaub. & Spach) Boiss., *A. caesareum* Boiss. & Ball, *A. huetii* Boiss., *A. calvertii* Boiss., *A. hypochaerum* Bokhari, *A. puberulum* Boiss. & Ball, *A. reflexifolium* Bokhari, *A. ulicinum* (Willd. ex Schultes) Boiss., *A. damassanum* Mobayen, *A. saxifragiforme* [Hauskn. & Sint. ex] Bokhari and *A. strigillosum* Bokhari). Muvaffak et al. (2001) conducted a taxonomic study on the *Acantholimon* species found in Ankara province and grouped them into three subsections: *Caryophyllacea*, *Halophiliacea* Muvaffak & Doğan and *Androsacea* of sect. *Staticopsis*. One of these, subsect. *Halophiliacea*, was described for the first time on the basis of the evidence obtained by means of numerical taxonomy.

Since the summer of 2000, and for a three-year period, a revisional study of the genus *Acantholimon* has been carried out in Turkey by M. Doğan and G. Akaydin, who have collected a large number of specimens. Examination of these specimens has revealed five new species: *Acantholimon birandii* (Doğan & Akaydin, 2001), *A. avanosicum* (Doğan & Akaydin, 2002a), *A. karamanicum* (Akaydin & Doğan, 2002), *A. anatolicum* (Doğan & Akaydin, 2002b) and *A. yildizelicum* (Akaydin, 2002).

In August 2000, H. Duman collected a few *Acantholimon* specimens from Arsuz province in Hatay (C5, sensu Davis 1965) during an excursion to collect fruiting *Sideritis libanonica* Labill. After a close examination of the specimens and consulting on their identity with Doğan and Akaydin, additional flowering material was collected from the area in 2001. The specimens were also cross-checked with various *Acantholimon* accounts given in the relevant floras and monographs, such as *Flora Orientalis* (Boissier, 1879), *Flora Iranica* (Rechinger & Schiman-Czeika, 1974), *Flora Europaea* (Tutin et al., 1972), *Flora of USSR* (Linchevskii, 1952), *Flora of Syria, Palestine and Sinai* (Post, 1933) and *Die Gattung Acantholimon* Boiss. (Bunge, 1872). More specimens, either collected from the field or stored

at herbaria in Ankara (ANK, GAZI, ISTF and HUB), were also examined for the same purpose.

When Doğan examined the types of Boissier kept at Geneva (G) in April 2002, he studied the holotype of *Acantholimon laxiflorum* Boiss. ex Bunge, which was collected from Arsuz in 1862 by Kotschy (nr. 128). This matches the specimens of H. Duman perfectly. The main objective of this study is to clarify the taxonomic and conservation status of *A. laxiflorum* and to provide a detailed description and an illustration of the plant (Fig. 1). The author abbreviations follow Brummitt and Powell (1992).

Acantholimon laxiflorum Boiss. ex Bunge, in *Mém. Acad. Sci. Pétersb. ser. 7*, 18: 28 (1872)!

Syn. *A. venustum* Boiss. var. *laxiflorum* (Boiss. ex Bunge) Bokhari in *Notes R.B.G. Edinb.* 32: 70 (1972)

[sect. *Staticopsis* Boiss.- subsect. *Caryophyllacea* Bunge] (Figures 1, 2.)

Laxly pulvinate, glaucous-green shrublet; base of previous leaves persistent, circinnate. Leaves green to glaucous-green, linear-triquetrous, subulate, 18-65 x 1-1.5(-2) mm, margins scabrid, narrow hyaline on lower parts, with yellowish spiny tip to 1.5 mm. Scapes simple, 18-38 cm, distinctly longer than leaves, glabrous. Spikes simple, laxly distichous, 15-30 cm. Spikelets 16-36, 1-flowered, 13-15 mm, shorter than internodes in lower part, equal or longer than in upper part. Outer bract distinctly shorter than inner bracts, herbaceous, ovate-triangular, 6-8 mm, with narrow hyaline margin, acuminate, shortly cuspidate, glabrous; inner bracts 9-11 mm, oblong-lanceolate, with broad hyaline margins, acuminate-cuspidate, longer ones pilose, shorter glabrous. Calyx infundibular, 11-14 mm, sparsely pilose on tube (especially on veins); limb brownish or rarely dirty white, 10-lobed, lobes truncate-obtuse, margins erose, c. 8-9 mm in diameter; veins dark brown, not excurrent, sparsely pilose below, glabrous above. Petals pink.

TYPE: [C5 Hatay, Turkey] in glareosis fluvii Nahr Syad infra pagum Ursusa montis Amani, Syriae bor., 200', 2.7.1862, *Kotschy* 128 (G!).

Additional specimen examined: C5 Hatay: Arsuz, Avclarsuyu Deresi (Nahr Syad), 30 m, on serpentine rocks, dry stream sides, lat 36°22'58"N, long 35°53'01"E, 9.8.2000, *H. Duman* 8422 (Chorotype:



Figure 1. *Acantholimon laxiflorum* Boiss. A: habit, B: spikelet, C: calyx, D: bracts, E: outer bract, F: inner bract, G: outer and inner bract.

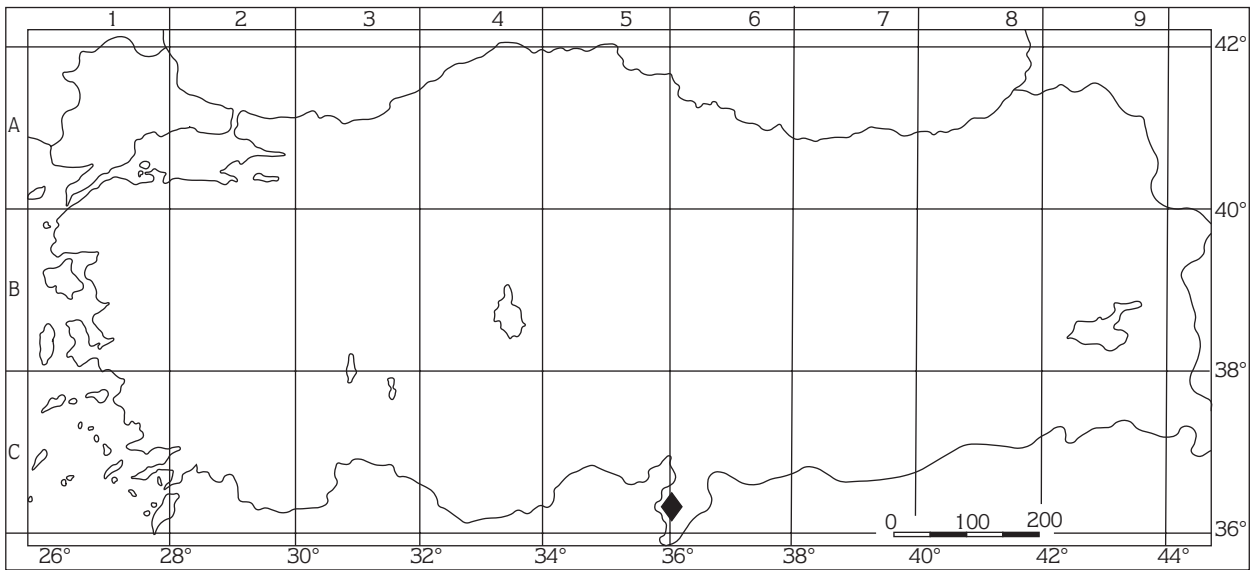


Figure 2. Distribution of (◆) *Acantholimon laxiflorum* Boiss. in Turkey.

GAZI). Ibid. 23.6.2001, *H. Duman* 8588 (Chorotype: GAZI, ANK, HUB). South Anatolia. Only known from the type locality.

Result and Discussion

Since its first publication (Bunge, 1872), *Acantholimon laxiflorum* has been restudied only by Bokhari & Edmondson (1982), who combined it as a variety under *A. venustum* Boiss. and cited a number of specimens from the grid squares B7, C2 and C3 in Turkey. Surprisingly deviating from the protologue (which refers only to the Kotschy collection), they cited a specimen from Elmalı (C2 Antalya) collected by Bourgeau (no. 295) as a type specimen. Bourgeau's specimen seems to be a lax form of *A. venustum* without circinnate leaf bases. This species grows on rocky igneous slopes, limestone hills, mountain steppe, and *Pinus* and mixed forests at higher altitudes (650-2350 m). By contrast, *A. laxiflorum* is a lowland endemic which grows in rocky places on serpentine rocks at an altitude of 30-60 m and is restricted to the Arsuz area in Hatay (type locality).

However, as indicated in Table 1, *A. laxiflorum* seems to be quite distinct from *A. venustum* as well as *A. calvertii* with regard to its morphological, ecological and phytogeographical properties. An identification key for the newly described Turkish endemics, including *A.*

laxiflorum with circinnate leaf bases from the previous year, was given by Doğan & Akaydin (2003).

Ecology and Phytogeography

The steno-endemic *Acantholimon laxiflorum* is found on serpentine rocks along the coast, and some populations are confined to dry stream banks above Arsuz, where it grows together with a few other rare species, such as *Sideritis libanotica* Labill. subsp. *libanotica*, *Phlomis amanica* Vierh. (local endemic), *Stachys annua* (L.) L., *Satureja thymbra* L., *Thymus cilicicus* Boiss. & Ball (endemic), *Anchusa aucheri* DC., *Ankyropetalum arsusianum* Kotschy ex Boiss. (local endemic), *Centaurea antiochia* Boiss. var. *antiochia* (endemic), *Phagnalon graecum* Boiss. and *Ptilostemon diacantha* (Labill.) Greuter subsp. *turcicus* Greuter. These lowland areas of the Amanos Mountains facing the Mediterranean Sea are rather interesting because many Irano-Turanian and Saharo-Arabian elements are also found in habitats next to cultivated land. The vegetation types in the Amanos Mountains have been fully investigated by Kehl (1998). Akman (1995) also provided a good deal of information about the plant associations in the forest ecosystem lying slightly higher than the habitat from which *A. laxiflorum* has again been collected.

Table 1. A comparison of *Acantholimon laxiflorum*, *A. venustum* and *A. calvertii*.

	<i>A. laxiflorum</i>	<i>A. venustum</i>	<i>A. calvertii</i>
Habit	Laxly pulvinate shrublet	Laxly to densely pulvinate shrublet	Laxly pulvinate shrublet
Leaves	18-65 x 1-1.5 (2) mm, linear-triquetrous to subulate, glaucous-green, margins scabrid, previous year's leaf bases circinnate	15-40 x 1-2 mm, linear to inear-lanceolate, glaucous to glaucous-green, margins scabrid, previous year's leaf bases not circinnate	20-35 x 0.8-1 mm, linear-triquetrous, green, margins ciliolate-scabridulous, previous year's leaf bases circinnate
Scapes	Exceeding leaves, 18-38 cm, with 1-2 scales, glabrous	Exceeding or equalling with leaves, 6-10 cm, with 2 scales, scabridulous	Exceeding leaves, 5-15 cm, with 1 - scale, glabrous
Inflorescence	Simple laxly distichous spike	Simple laxly distichous spike	2 branched, densely distichous spike
Spike	150-300 mm long, with 16-36 spikelets	20-50 mm long, with 7-15 spikelets	18-30 mm long, with 6-10 spikelets
Spikelets	13-15 mm, 1-flowered	12-14 mm, 1-flowered	12-17 mm, 1-flowered
Bracts	Unequal, glabrous, pilose on the innermost bract only	Unequal, glabrous	Subequal, puberulous to glabrous
Outer bract	6-8 mm, ovate-triangular, acuminate with narrow hyaline margin	3-6 mm, ovate-triangular, acute to acuminate with narrow hyaline margin	7-8 mm, triangular-lanceolate, acuminate with narrow hyaline margin
Inner bracts	9-11 mm, oblong-lanceolate, acuminate-cuspidate, with broadly hyaline margin	7-9 mm, oblong-lanceolate, keeled acute to obtuse, cuspidate, with broadly hyaline margin	8-10 mm, narrowly oblong-lanceolate, acuminate, with broadly hyaline margin
Calyx	11-14 mm, sparsely pilose on tube; limb brownish, 10-lobed; veins not excurrent	14-15 mm, pilose on tube; limb pink to purple or brownish, 5-lobed; veins reaching margin	10-12 mm, sparsely pilose on tube; limb white or purplish, 10-lobed; veins reaching margin or excurrent
Petals	Pink	Deep pink	Bright pink
Flowering time	7 – 8	6 – 8	6 – 8
Habitat	Serpentine	Igneous slopes, limestone hills, steppe, mixed forest	Igneous rocks, limestone slopes
Altitude	sl. – 60 m	650 – 2350 m	1210 – 3535 m
Phytogeography	Mediterranean	Irano-Turanian	Irano-Turanian

Arsuz (now called Uluçınar) is on the coast and comes under the influence of the Mediterranean climate with mild, wet winters and long hot, arid summers with almost constant droughts broken by occasional thunderstorms in the summer months. The western slopes of the Amanos Mountains receive about 1000–1200 mm of precipitation per year. The yearly average temperature in the area varies between 19 °C and 20 °C and the monthly average temperature is

always above 7 °C. This guarantees continuous growth by many plant species (Akman 1995).

This is a chorotype: (local) endemic!

Conservation status

The range of this local endemic species is restricted to a single location (B1a). The populations are pure,

occupying an area of less than 10 km², the number of mature individual specimens being less than 200 (criterion B2 and C), (IUCN, 2001). We thus suggest that this species be placed in the IUCN Critically Endangered (CR) category.

Acknowledgements

The authors wish to thank the regius keeper of the Royal Botanic Garden, Edinburgh (E) for making

duplicates of Davis' *Acantholimon* material available as a gift to Professor Musa Doğan, as well as the keeper of the Jardine Botanic Garden, Geneva (G) for allowing them to use their herbarium facilities. Special thanks are also due to the Scientific and Technical Research Council of Turkey (TÜBİTAK, TBAG-1781) for its financial support for the revision of *Acantholimon* in Turkey, and to the following herbaria, ANK, GAZI, ISTF and HUB, for making their herbarium material available.

References

- Akaydin G & Doğan M (2002). A new species of *Acantholimon* Boiss. (*Plumbaginaceae*) from Western Taurus Mountains of Turkey. *Israel J Plant Sciences* 50: 67-71.
- Akaydin G (2002). A new species of *Acantholimon* Boiss. *A. yildizelicum* (*Plumbaginaceae*) from North Anatolia, Turkey. *Nordic J Bot* 22, (in press).
- Akman Y (1995). *Türkiye Orman Vegetasyonu*. Ankara.
- Boissier E (1879). *Flora Orientalis* 4: 823 - 854. Geneve and Basel: Reg. Acad. Scient.
- Bokhari MH & Edmondson JR (1982). *Acantholimon* Boiss. In: Davis PH (ed.). *Flora of Turkey and the East Aegean Islands*, 7: 478-502. Edinburgh: Edinburgh University Press.
- Brummitt RK & Powell CE (eds.) (1992). *Authors of Plant Names*. Kew: Royal Botanic Gardens, Kew.
- Bunge A (1872). *Die Gattung Acantholimon* Boiss. L' Academie Imperiale des Sciences de St. Petersburg, No. 2. 1-72.
- Davis PH (ed.) 1965: *Flora of Turkey and the East Aegean Islands* Edinburgh: Edinburgh University Press.
- Doğan M & Akaydin G (2001). A new species of *Acantholimon birandii* (*Plumbaginaceae*) from the Central Anatolian Steppe in Turkey. *Nordic J Bot* 21: 481-484.
- Doğan M & Akaydin G (2002a). A New Species of *Acantholimon* Boiss. (*Plumbaginaceae*) from Turkey. *Bot J Linnean Soc* 138: 365-368.
- Doğan M & Akaydin G (2002b). A New Species of *Acantholimon* Boiss., *A. anatolicum* (*Plumbaginaceae*) from Ankara, Turkey. *Bot J Linnean Soc* 140: 443-448.
- Doğan M & Akaydin G (2003). Two new species in *Acantholimon* sect. *Staticopsis* (*Plumbaginaceae*) from Turkey. *Ann Bot Fennici* 40: 53-58.
- IUCN. (2001). *Red List Categories: Version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- Kehl H (1998). Eine landschaftsökologische Komplexanalyse im Amanus der Südost-Türkei – Zu den Ursachen extrazonaler Vegetation. CD-ROM: ISBN 3-00-003156-1.
- Linchevskii IA (1952). *Acantholimon* Boiss. In: Shishkin BK & Bobrov EG (eds.). *Flora SSSR* 18: 221-275. Moscow and Leningrad: Botanicheskii Institut Akademii Nauk SSSR. (Translated from the Russian by the Israel Program for Scientific Translations, Jerusalem 1977).
- Muvaffak A, Doğan M & Bilgin CC (2001). Numerical Taxonomic Study of the Genus *Acantholimon* Boiss. (*Plumbaginaceae*) in Ankara Province. *Israel J Plant Sci* 49: 297-300.
- Post GE (1933). *Flora of Syria, Palestine and Sinai*. 510-511. Beirut: American Press.
- Rechinger KH, Schiman-Czeika H (1974). *Flora Iranica: Plumbaginaceae* 108: 27-154. Graz, Austria: Akademische Druck-u. Verlagsanstalt.
- Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM & Webb DA (1972). *Flora Europaea*. 3: 30. Cambridge: Cambridge University Press.