Allium cithaeronis Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri (Alliaceae), a new species from Greece

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Abstract

BOGDANOVIĆ, S., C. BRULLO, S. BRULLO, G. GIUSSO DEL GALDO, C. M. MUSARELLA & C. SALMERI (2011). Allium cithaeronis Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri (Alliaceae), a new species from Greece. *Candollea* 66: 377-382. In English, English and French abstracts.

A new species of *Allium* sect. *Scorodon* Koch, *Allium cithaeronis* Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri, is described and illustrated from Greece. Its chromosome number ($2n = 16$), karyogram, leaf anatomy, ecology, and taxonomical relationships are examined. For some morphological features, such as exserted stamens from perigon and tuberculate lobes in the upper part of the ovary, it represents a very isolated species within the section *Scorodon*.

Key-words

ALLIACEAE – Allium cithaeronis – Allium sect. *Scorodon* – Taxonomy

Résumé

BOGDANOVIĆ, S., C. BRULLO, S. BRULLO, G. GIUSSO DEL GALDO, C. M. MUSARELLA & C. SALMERI (2011). Allium cithaeronis Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri (Alliaceae), une nouvelle espèce de Grèce. *Candollea* 66: 377-382. En anglais, résumés anglais et français.

Une nouvelle espèce d'*Allium* sect. *Scorodon* Koch, *Allium cithaeronis* Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri, est décrite et illustrée de Grèce. Le nombre chromosomique ($2n = 16$), le caryogramme, l'anatomie foliaire, l'écologie et les affinités taxonomiques sont donnés. En raison de ses caractéristiques morphologiques particulières comme les étamines saillantes du périgone et l'ovaire présentant des lobes tuberculeux dans la partie supérieure, ce taxon représente une espèce très isolée dans la section *Scorodon*.

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Submitted on November 23, 2009. Accepted on August 29, 2011. Edited by P. Bungener

Online ISSN: 2235-3658 *Candollea* 66(2): 377-382 (2011)

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Introduction

During field investigations on the orophilous flora of Greek mountains, a very peculiar population of *Allium* L. was found on the top of MontKithairon in Boeotia (C Greece). This plant forms dense tufts localized among the dwarf shrub vegetation colonizing the summit plateau (about 1400 m). It is a small geophyte, with superficial clustered bulbs, characterized by short spathe valves, few-flowered and compact umbel, simple and exserted stamens, ovary with visible nectaries. On the basis of these features, this plant can be referred to *Allium* sect. *Scorodon* Koch, which is typically represented by species with punctiform or very circumscribed geographical distribution. According to literature (Stearn, 1978, 1980, 1981; Garbari & al., 1979; Miceli & Garbari, 1979; Phitos & Tzanoudakis, 1981; Tzanoudakis, 1983, 1992; Tzanoudakis & Vosa, 1988; Brullo & Tzanoudakis, 1989; Brullo & al., 1992, 1993, 1994, 2001; Tzanoudakis & Kollmann, 1991; Hanelt & al., 1992; Trigas & Tzanoudakis, 2000, Friesen, 2001), this section is represented in Greece by several species, mostly endemic and found in coastal and inner stands. From herbarium and field investigations, the MontKithairon population is morphologically well differentiated from the other ones of *Allium* sect. *Scorodon* s.l., hitherto known from Greece. Therefore, it is described as a species new to science.

Material and Methods

The investigation is based on about 40 living flowering bulbs collected on the top of MontKithairon (C Greece) and cultivated in the Botanical Garden of Catania (Italy). The morphological analysis of diacritic characters was made on fresh material; the voucher specimens are deposited in ATH, CAT, G, FI, UPA, and ZA. In addition, several specimens of *Allium* sp. pl., preserved in many European Herbaria (B, BM, C, CAT, FI, G, HUJ, ISTE, K, M, P, PR, PRC, RO, W, WU, ZA) and belonging to other species of *Allium* sect. *Scorodon*, have been examined and compared.

The leaf anatomy was studied on leaf blades of maximum size coming from the living original collection, sectioned using a freezing microtome.

The karyological analyses were made on mitotic plates from root-tip cells of cultivated bulbs, pre-treated with 0.3% colchicine water solution, fixed in ethanol-acetic (3:1) and stained according to the Feulgen technique. Metaphases observations and chromosome measurements were made using the image analysis systems IKAROS 4.6 (Metasystem) and AXIOVISION 5.1 (ZEISS). Karyotyping was done with the software Cromolab© 1.1. (Brullo, 2002-2003) specialized in recognizing chromosome pairs, ordering them by size and classifying by morphology, and assembling the karyotype formula based on the centromere position (Levan & al., 1964; Tzanoudakis, 1983).

Results

Allium cithaeronis Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri, **spec. nova** (Fig. 1)

> **Holotype: Greece. Sterea Ellas:** MontKithairon in stazioni cacuminali a ca. 1400 m. di quota, 38°11 63 N, 23°14 46 E, 3.VII.2007, *Brullo, Musarella 50.07* (holo-: CAT; iso-: ATH, CAT, FI, G, UPA, ZA).
>
> *Bulbus 10-15 × 7-10 mm, tunicis exterioribus coriaceis, brunneis. Scapus 6-11 cm altus. Folia semicylindrica, viridia, 40-60 × 2-2.5 mm. Valvae spathae inaequales, major 1-2.2 cm longa, minor 0.8-1.3 cm longa. Inflorescentia compacta, 6-15 floribus. Tepala elliptica, 4-5 × 1.8-2 mm, albo-rosea, apiculata. Stamina e perigonio exserta, filamentis albidis, subaequalibus, 3.5-4 mm longis, antheris luteo-pallidis, ca. 1 mm longis. Ovarium subcylindricum, 2.5-3 × 1.4-1.5 mm, superne dilatatum in 6 lobos tuberculatos, tumulis nectariorum bene visillibus. Capsula subglobosa, 3-3.5 mm diametro.*

Bulb ovoid, 10-15 × 7-10 mm, with membranaceous whitish inner tunics, the outer ones coriaceous, dark brown. *Stem* 6-11 cm high, cylindrical, glabrous, erect, covered by the leaf sheaths for 1/2-2/3 of its length. Leaves 4, semicylindrical, glabrous, green, smooth, 4-6 cm long, 2-2.5 mm wide. *Spathe* persistent, with two valves unequal, subequal or longer than the inflorescence, the larger 6-7-nerved, 1-2.2 cm long, the smaller 3-5-nerved, 0.8-1.3 cm long. *Inflorescence* compact, 1-2 cm in diameter, 6-15 flowered, with subequal pedicels 4-6 mm long. *Perigon* campanulate, with equal tepals, white-pinkish tinged with purple, green-purplish midrib, elliptical, apiculate at the apex, 4-5 mm long and 1.8-2 mm wide. *Stamens* exserted from perigon, with simple white filaments, subequal, 3.5-4 mm long, below connate into an anulus 1 mm high. *Anthers* pale yellow, elliptical, 1 × 0.8 mm, rounded at the apex. *Ovary* green-yellowish, subcylindrical broadened at the top in 6 tuberculate lobes, 2.5-3 mm long, 1.4-1.5 mm wide, with basal mounds of nectaries well visible. *Style* white, 05.-0.7 mm long. *Capsule* green, trivalved, subglobose, 3-3.5 mm in diameter, with 6 small ovoid appendages on the top.

Etymology. – The specific epithet refers to "Cithaeron" the old name of MontKithairon in Boeotia (Greece).

Habitat and Distribution. – Allium cithaeronis is localized on the top of MontKithairon (about 1400 m), an isolated mountain near Erythres (C Greece). This species has a flowering peak in June, and it is member of a dwarf shrubby vegetation characterized by many prostrate or caespitose orophytes, such as *Thymus parnassicus* Halacsy, *Crepis incana* Sm., *Asperula rigidula* Halacsy, *Cerastium candidissimum* Correns, *Silene radicosa* Boiss. & Heldr., *Minuartia attica* Vierh., *Galium thymifolium* Boiss. & Heldr., *Nepeta argolica* Chaub., *Festuca janpertii* (St-Yves)

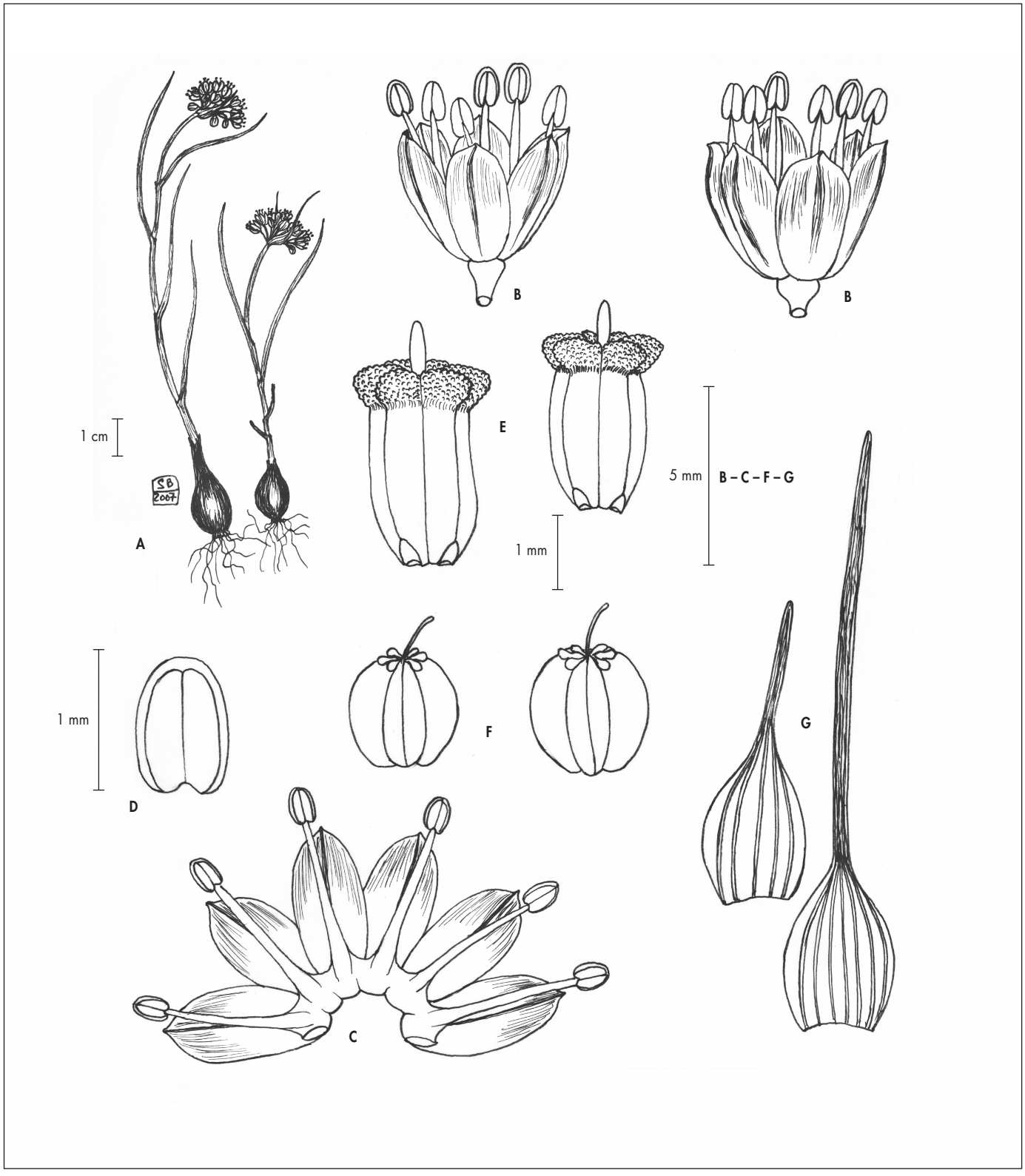


Fig. 1 – *Allium cithaeronis* Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri. **A.** Habit; **B.** Perigons; **C.** Open perigon with stamens; **D.** Anther; **E.** Ovaries; **F.** Capsules; **G.** Spathe valves.

[MontKithairon, *Brullo & Musarella s.n.* (CAT)] [Drawn by Salvatore Brullo]

Markgr.-Dannen., *Anthemis cretica* L., *Pterocephalus perennis* Coult., *Achillea holosericea* Sibth. & Sm., *Paronychia macedonica* Chaudhri, etc. This vegetation is extremely peculiar and interesting from the phytogeographical viewpoint. Unfortunately, this vegetation appears nowadays quite degraded, especially for the intensive overgrazing.

Karyology. – Allium cithaeronis is a diploid specie with a somatic chromosome number $2n = 16$ (Fig. 2A), which is rather common within the genus *Allium*. The chromosome complement is regular and homogeneous, mostly characterized by metacentric pairs. Only two pairs tend towards the submetacentric type (arm ratio exceeding 1.30) and are indicated as "msm"

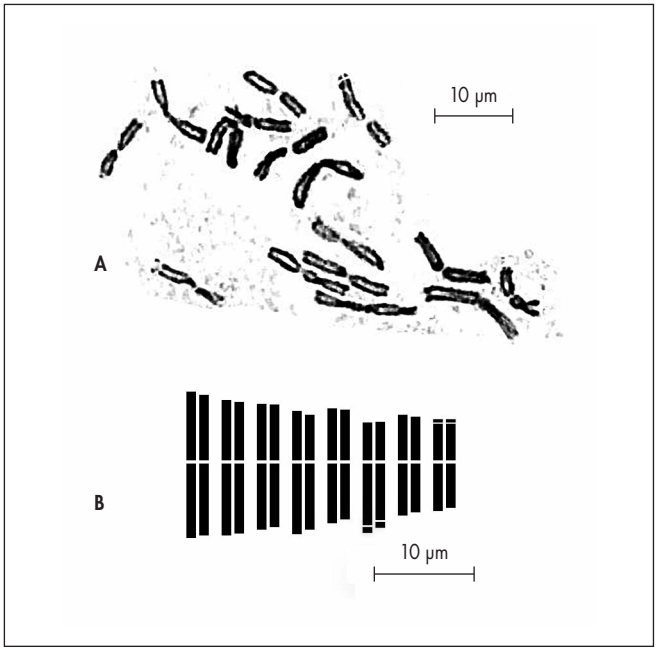


Fig. 2 – *Allium cithaeronis* Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri. **A.** Metaphasic plate ($2n = 16$); **B.** Karyogram.

according to Tzanoudakis (1983). Short satellites were well evident just in few metaphases, occurring on the long arm of one msm pair and on the short arm of the smallest metacentric pair (Fig. 2B). The karyotype formula can be resumed as $2n = 2\times = 16$: 10 m + 2 m^{sat} + 2 msm + 2msm^{sat}. The absolute chromosome length varies from 14.40 ± 1.83 µm for the longest chromosome, to 8.15 ± 1.26 µm for the shortest one, while the relative length ranges from 8.05 ± 0.37% to 4.55 ± 0.17%. Many different indices were also calculated to evaluate the symmetry degree of the chromosome complement; all values remarked a high homogeneity in the karyotype of *A. cithaeronis* (Table 1).

Leaf anatomy. – The leaf cross section of *A. cithaeronis* shows a subelliptical outline. The epidermis is covered by a well developed smooth cuticle. The stomata are numerous and distributed along the whole perimeter. The palisade tissue is regular and compact and consists of one-layered cylindrical cells. The spongy tissue is compact or with larger intercellular spaces and bigger cells in the centre. In the peripheral part of the spongy tissue several secretory canals occur. The vascular bundles are 13, of which 7 are abaxial (4 of which bigger) and 6 are adaxial (Fig. 3).

Discussion. – As already stated before**,** due to some morphological features, mainly regarding spathe valves, stamens and ovary, *A. cithaeronis* should be included in the *A.* sect. *Scorodon* Koch s.l. Several authors (Valsecchi, 1974; Cheshmedzhiev, 1975; Hanelt & al., 1992; Friesen & al., 2006; Brullo & al., 1995, 2008) have already highlighted that this section represents a not natural group, since it includes several taxa morphologically rather heterogeneous. Actually, some species, previously referred to this section, have been recently included in other distinct sections, such as *Allium* sect. *Brevispatha* Valsecchi (type: *A. parciflorum* Viv.), *Allium* sect. *Cupanioscordon* Cheshm. (type: *A. cupanii* Rafin.), *Allium* sect. *Eremoprasum* (Kamelin) F. O. Khass., R. M. Fritsch & N. Friesen (type: *A. sabulosum* Stev.), *Allium* sect. *Avulsea* F. O. Khass. (type: *A. rubellum* M. Bieb.), etc. As concerns *Allium* sect. *Scorodon* s. str., it has been attributed to the subgenus *Polyprason* Radić, while the just mentioned sections belong to the subgenus *Allium* (see Friesen & al., 2006). Unfortunately, we did not do any molecular analyses on *A. chitaeronis*, but we deem that, basing on morphological evidences, this species should be, at least for the time being, included in *Allium* sect. *Scorodon* s. str. (type: *A. moschatum* L.). In fact, this section is characterized by spathe valves acuminate or cuspidate, not much developed and usually shorter than umbel, stamen filaments simple or with two short teeth in the lower part and ovary with well visible nectaries. However, *A. cithaeronis* shows a character rather unusual for the species of this section, such as stamens clearly exserted from the perigon. According to Stearn (1980) and Kollmann (1984), only some Anatolian and Central Asian alliums of this section show this morphological feature: *A. microspathum* Ekberg, *A. wendelboanum* Kollmann, *A. sabulosum* Bunge, and *A. sieheanum* Kollmann. Many diacritic features regarding size and shape of the stems, leaves, spathe valves, umbels, flowers and capsule allow to well distinguish them from *A. cithaeronis*. In particular, the ovary of the above mentioned species is always without broadened lobes in the upper part.

Allium cithaeronis shows also some relationships with certain species of the *Allium* sect. *Codonoprasum* Reichenb., particularly with those ones belonging to the *A. stamineum* Boiss. group. These affinities chiefly regard the habit and the stamens exserted from the perigon, but the spathe valves much longer than umbel, and ovary without visible mounds of nectaries allow to distinguish the species of *A. stamineum* group from *A. cithaeronis* (Brullo & al., 2007).

Table 1. – Measurements and chromosome classification of *Allium cithaeronis*.

Chrom.	Absolute length (µm)									Relative length %									Ratio		
	Long arm			Short arm			Total length			Long arm			Short arm			Total length					
	Mean	±	S.D	Mean	±	S.D.	Mean	±	S.D.	Mean	±	S.D.	Mean	±	S.D.	Mean	±	S.D.	l/s	CI	Type
1	7.54	±	0.89	6,86	±	0,98	14.40	±	1,83	4.22	±	0.15	3.84	±	0.28	8.05	±	0.37	1.10	47.65	m
2	7.17	±	1,08	6,64	±	1.01	13.81	±	2.08	4.00	±	0.23	4.00	±	0.23	7.70	±	0.45	1.08	48.06	m
3	7.21	±	0.97	6.11	±	1.06	13.32	±	2.01	4.03	±	0.21	3.40	±	0.14	7.43	±	0.27	1.18	45.89	m
4	7.02	±	0.96	5.85	±	0.83	12.87	±	1.78	3.92	±	0.07	3.26	±	0.09	7.18	±	0.16	1.20	45.43	m
5	6.60	±	0.99	5.73	±	0.80	12.32	±	1.79	3.68	±	0.02	3.20	±	0.03	6.87	±	0.05	1.15	46.48	m
6	6.44	±	0.95	5.65	±	0.97	12.09	±	1.92	3.59	±	0.13	3.14	±	0.12	6.74	±	0.24	1.14	46.72	m
7	7.06	±	0.97	4.98	±	0.53	12.04	±	1.50	3.94	±	0.18	2.79	±	0.13	6.73	±	0.29	1.42	41.37	msm
8	6.61	±	1.25	4.61	±	0.50	11.23	±	1.66	3.67	±	0.19	2.59	±	0.24	6.26	±	0.24	1.43	41.09	msm
9	5.98	±	1.52	5.23	±	0.99	11.21	±	2.49	3.30	±	0.41	2.91	±	0.27	6.21	±	64.00	1.14	46.65	m
10	5.62	±	1.27	5.10	±	1.03	10.71	±	2.28	3.11	±	0.35	2.84	±	0.36	5.95	±	0.69	1.10	47.58	m
11	6.21	±	0.98	3.79	±	0.61	10.00	±	1.45	3.47	±	0.37	2.11	±	0.18	5.58	±	0.38	1.64	37.88	msm^{sat}
12	5.67	±	0.78	3.89	±	0.56	9.65	±	1.38	3.18	±	0.41	2.17	±	0.19	5.40	±	0.49	1.46	40.25	msm^{sat}
13	5.23	±	0.70	4.56	±	0.94	9.79	±	1.58	2.92	±	0.18	2.53	±	0.19	5.45	±	0.18	1.15	46.58	m
14	4.90	±	0.85	4.40	±	1.00	9.30	±	1.84	2.73	±	0.09	2.44	±	0.26	5.17	±	0.35	1.11	47.33	m
15	4.77	±	0.93	3.65	±	0.39	8.48	±	1.43	2.65	±	0.11	2.05	±	0.08	4.72	±	0.09	1.30	43.08	m^{sat}
16	4.50	±	0.86	3.65	±	0.50	8.15	±	1.26	2.50	±	0.14	2.04	±	0.19	4.55	±	0.17	1.20	44.80	m^{sat}

Complement length (2*n*): 179.36 ± 26.92 µm – **Symmetry indices:** Stebbins' Cat.: 1A; AI: 1.09; CV_{CI}: 15.77; CV_{CI}: 6.92; A1: 0.18; A2: 0.16; REC: 76.36; SYi: 81.90; TF%: 44.99

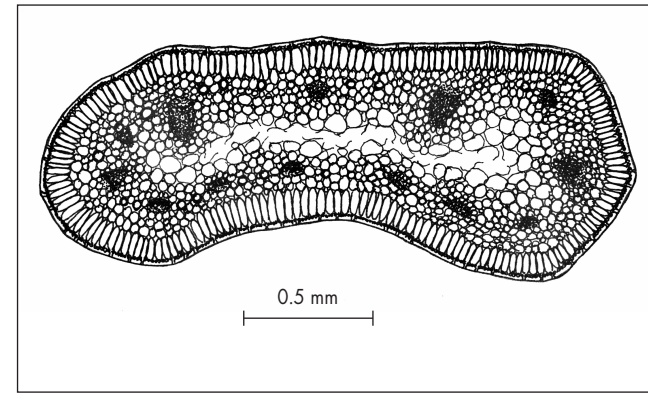


Fig. 3 – *Allium cithaeronis* Bogdanović, C. Brullo, Brullo, Giusso, Musarella & Salmeri. Leaf cross section.

Therefore, based on the current knowledge on the genus *Allium* in Greece, *A. cithaeronis* can be considered a species taxonomically quite isolated, especially for some morphological characteristics. Moreover, it should be stressed that *A.* sect. *Scorodon* s. str. groups many rare species, usually well differentiated and showing an extremely localized distribution, such as *A. meteoricum* Halácsy, *A. maniaticum* Brullo & Tzanoud, *A. calamarophilon* Phitos & Tzanoud., *A. lagarophyllum* Brullo, Pavone & Tzanoud., *A. chalkii* Tzanoud. & Kollmann, *A. runemarkii* Trigas & Tzanoud (Brullo & Pavone, 1983; Tzanoudakis, 1983, 1992; Tzanoudakis & Vosa, 1988; Brullo & Tzanoudakis, 1989; Brullo & al., 1992, 1993, 1994).

Acknowledgments

We are very grateful to the curators of the Herbaria B, BM, C, CAT, FI, G, HUJ, ISTE, K, M, P, PR, PRC, RO, W, WU, ZA for loans and help during our visits for material consultation.

References

Brullo, F. (2002-2003). *CromoLab*© Version 1.1. Catania: Dipartimento di Botanica, Università di Catania.

Brullo, S., A. Guglielmo, P. Pavone & C. Salmeri (2001). Cytotaxonomical notes on some rare endemic species of Allium (Alliaceae) from Greece. *Caryologia* 54: 37-57.

Brullo, S., A. Guglielmo, P. Pavone & C. Salmeri (2007). Cytotaxonomic considerations on Allium stamineum Boiss. group (Alliaceae). *Bocconea* 21: 325-343.

Brullo, S. & P. Pavone (1983). Allium franciniae, specie nuova dell'Isola di Marettimo (Arcipelago delle Egadi). *Webbia* 37: 11-22.

Brullo, S., P. Pavone & C. Salmeri (1992). Allium rhodiacum (Liliaceae), a new species from Rhodos (Greece). *Willdenowia* 22: 89-95.

Brullo, S., P. Pavone & C. Salmeri (1995). Considerazioni citotassonomiche e fitogeografiche su Allium cupanii Rafin s.l., gruppo critico dell'area mediterranea. *Giorn. Bot. Ital.* 129: 117.

Brullo, S., P. Pavone & C. Salmeri (2008). Considerazioni filogenetiche e citotassonomiche su Allium sez. Cupanioscordum Cheschm. (Alliacae). *In:* Spampinato, G. & G. Signorino (ed.), *103° Congresso Nazionale della Societą Botanica Italiana. Riassunti, Relazioni, Comunicazioni, Poster: 68.* Università Mediterranea di Reggio Calabria.

Brullo, S., P. Pavone, C. Salmeri & D. Tzanoudakis (1994). Cytotaxonomical revision of the Allium obtusiflorum group (Alliaceae). *Fl. Medit*. 4: 179-190.

Brullo, S., P. Pavone & D. Tzanoudakis (1993). Allium lagarophyllum (Liliaceae), a new species from Greece. *Willdenowia* 23: 107-111.

Brullo, S. & D. Tzanoudakis (1989). Allium maniaticum (Liliaceae), a new species from S Greece. *Willdenowia* 19: 111-114.

Cheshmedzhiev, J. V. (1975). Cytotaxonomic studies of several species of onion of section Codonoprasum Reichenb. *Dokl. Bulg. Akad. Nauk* 28: 795-798.

Friesen, N. (2001). The genera Allium L. and Caloscordum Herbert. *In:* Malyshev, L. & G. Peshkova (ed.), *Fl. Siberia* 4: 43-91, 174-192.

Friesen, N., R. M. Fritsch & F. R. Blattner (2006). Phylogeny and new infrageneric classification of Allium L. (Alliaceae) based on nuclear ribosomal DNA ITS sequences. *Aliso* 22: 372-395.

Garbari, F., W. Greuter & P. Miceli (1979). The Allium cupani group: a preliminary taxonomic, caryological and leaf anatomical study. *Webbia* 34: 459-480.

Hanelt, P., J. Schultze-Motel, R. Fritsch, J. Kruse, H. I. Maass, H. Ohle & K. Pistrick (1992). Infrageneric grouping of Allium. The Gatersleben approach. *In:* Hanelt, P., K. Hammer & H. Knüpffer (ed.), *The genus Allium. Taxonomic problems and genetic resources*: 107-123.

Kollmann, F. (1984). Allium L. *In:* Davis, P. H. (ed.), *Fl. Turkey & E. Aegean Island* 8: 98-211.

Levan, A., K. Freda & A. A. Sandberg (1964). Nomenclature for centromeric position on chromosomes. *Hereditas* 52: 201-220.

Miceli, P. & F. Garbari (1979). Cromosomi ed anatomia fogliare di quattro Allium diploidi di Grecia. *Atti Soc. Tosc. Sci. Nat. Mem.*, ser. B., 86: 1-23.

Phitos, D. & D. Tzaunodakis (1981). A new species of Allium from Eoboea (Greece). *Bot. Chron.* 1: 11-13.

Stearn, W. T. (1978). European species of Allium and allied genera of Alliaceae: a synonymic enumeration. *Ann. Mus. Goulandris* 4: 83-198.

Stearn, W. T. (1980). Allium L. *In:* Tutin, T. G., W. H. Heywood, N. A. Burges, D. M. Moore, D. D. H. Valentine, S. M. Walters & D. A. Webb (ed.), *Fl. Eur.* 5: 49-69.

Stearn, W. T. (1981). The genus Allium in the Balkan Peninsula. *Bot. Jahrb. Syst.* 102: 201-213.

Trigas, P. & D. Tzanoudakis (2000). Allium runemarkii (Liliaceae), a new species from the island of Evvia (W Aegean, Greece). *Nord. J. Bot.* 20: 89-92.

Tzanoudakis, D. (1983). Karyotypes of ten taxa of Allium section Scorodon from Greece. *Caryologia* 36: 259-284.

Tzanoudakis, D. (1992). Karyotype variation and evolution in the Greek Allium. *In:* Hanelt, P., K. Hammer & H. Knüpffer (ed.), *The genus Allium. Taxonomic problems and genetic resources:* 305-320.

Tzanoudakis, D. & F. Kollmann (1991). Allium chalkii (Liliaceae), a new species from East Aegean Island of Chalki (Greece). *Israel. J. Bot.* 40: 61-64

Tzanoudakis, D. & C. G. Vosa (1988). The cytogeographical distribution pattern of Allium (Alliaceae) in the Greek Peninsula and Islands. *Pl. Syst. Evol.* 159: 193-215.

Valsecchi, F. (1974). Osservazioni embriologiche, sistematiche ed ecologiche su Allium parciflorum Viv. *Giorn. Bot. Ital.* 108: 81-93.