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A new autumn-flowering species of *Allium (Liliaceae)* from the island of Sifnos (Cyclades, Greece)

Abstract

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Allium apolloniensis is described as a species new to science, illustrated and compared with related species of *A.* sect. *Codonoprasum.* It is apparently restricted to the Cyclades in the central Aegean and of particular interest for the phylogeny of the genus because it is tetraploid ($2n = 4x = 32$).

Key words: monocotyledons, *Alliaceae,* taxonomy, central Aegean, karyology.

During our investigations on the Greek flora, an interesting autumn-flowering species of *Allium* L. was found for the first time in October 2003 by the first author on the island of Sifnos (Cyclades, central Aegean). Flower colour and phenology were reminiscent of *A. callimischon* Link belonging to *A.* sect. *Brevispatha* Vals., but important diagnostic features revealed it actually as a member of *A.* sect. *Codonoprasum* Rchb. Fieldwork in the following year provided two other localities on Sifnos. The adequate material then collected permitted us to recognize it as a species new to science, distinct in morphology and karyotype from related species of *A.* sect. *Codonoprasum*.

Allium apolloniensis B. Biel, Kit Tan & Tzanoud., **sp. nov.**
Holotype: Greece, Kiklades, island of Sifnos, Nomos Kikladon, 0.2 km south of Chersonisos, rocky phrygana slope above harbour near Aspri Vigla, on limestone and marble, 40 m, 37°02'N, 24°39'E, 24.10.2004, *Biel 04.547* (C; isotypes: B, herb. Biel) – Fig. 1A-D.

Allium apolloniensis differt ab *A. platakisii* bulbillis parvis numerosis, inflorescentia hemisphaerica, antheris purpureis, polline purpureo, chromosomatum numero tetraploideo. *Allium platakisii* a specie nova differt bulbo principali unico, inflorescentia fastigiata, antheris flavis, polline flavo, chromosomatum numero diploideo.

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Perennial, not smelling or tasting of garlic. *Bulb* ovoid-globose, 14-20 × 10-15 mm; outer tunics greyish to papery white, white within; inner ones reddish brown to magenta-pink on outside, membranous, becoming lacerate at base. *Bulblets* numerous, produced during winter and spring above ground level, ensheathed initially by protective prophyll (Fig. 1D). *Prophyll* membranous, whitish, veined green. *Leaves* 4-6, linear-filiform, pendent, 5-25(-32) × 0.1-0.3 cm, subcanaliculate, fistulose, obtuse, conspicuously ribbed, glabrous, light green, sheathing up to 4/5 of stem. *Scape* solitary, erect, (6-)20-35(-60) cm tall, terete, striate, 2-3 mm in diameter at base, glabrous, often suffused purplish brown or pink above. *Spathe valves* 2, opposite, filiform, rather unequal with at least one valve longer than umbel, dilated to 3 mm at base, longer valve 2.5-9.5 cm, shorter valve 1-2.8 cm, subacute, persistent. *Inflorescence* hemispherical, 2-4 cm across, lax to moderately dense with 6 to over 30 flowers per umbel. *Pedicels* slender, filiform, 4-11 mm, subequal. *Perianth* narrowly campanulate, glabrous; segments slightly spreading but not conspicuously flared, 6-7 × 1.6-2 mm, outer c. 0.5 mm longer than inner, linear-oblong, obtusely apiculate, white to pale pink, sometimes suffused with darker pink towards the reddish or greenish central vein. *Stamens* included; filaments simple, subequal, 2/3-3/4 of the perianth length; anthers oblong, c. 1 mm, dark reddish purple; pollen purple. *Ovary* 6-lobed, obovoid, c. 3 mm, cream, truncate and greenish above; nectaries inconspicuous or absent; style slender, 1.8-2 mm, white; stigma small, capitate. *Capsule* 3-valved, trigonous, 4-5 mm in diameter, shiny green. *Seeds* large, irregularly oblong-ovoid, c. 5 × 2 mm, shiny black.

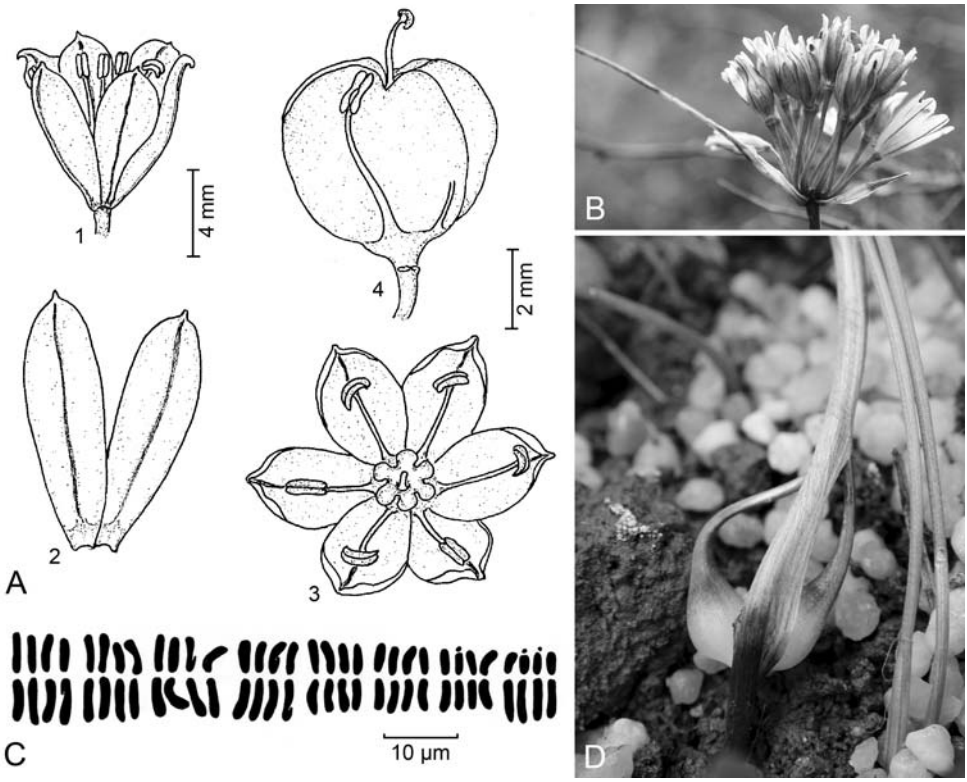

Fig. 1. *Allium apolloniensis* – A1: flower; A2: outer view of outer and inner perianth segments; A3: perianth spread to show ovary and stamens; A4: young capsule; B: inflorescence showing unequal spathe valves; C: karyogram ($2n = 4x = 32$); D: bulblets produced during winter and spring above ground, protected initially by prophyll. – A: drawn from the holotype, C: from *Tzan 04/1,* B+D: photographs by Biel of cult. *Biel 04.557.*

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Additional material examined (paratypes). – SIFNOS: Nomos Kikladon, c. 3 km NNW of Kalambelas, Apollonia, pine-covered phrygana slope to the east of ditch drying out in summer, on marble, 170 m, 36°59'N, 24°42'E, 26.10.2004, *Biel 04.557* (herb. Biel); c. 3.2 km NNW of Kalambelas, Apollonia, near Moustou, rocky east-exposed phrygana slope with *Calicotome villosa* and *Juniperus phoenicea* dominant, on marble, 220 m, 37°00'N, 24°42'E, 11.10.2003, *Biel 03.321* (fragment herb. Kit Tan).

Cultivated material of *Biel 03.321, 04.547, 04.557* exists at Höchberg and at the Botanic Garden Berlin-Dahlem, Germany, and at the University of Patras.

Etymology. – The epithet indicates the link of the new species with Apollonia, the capital of the island, where it was first discovered in October 2003.

Karyology. – Living material from two populations (cult. *Tzan 04/1* from the type locality, *Tzan 04/2* from Apollonia, both UPA) was investigated cytologically; pre-treatment and staining of root-tips from potted bulbs followed Tzanoudakis (1983). In both populations the chromosome number $2n = 32$ was found. From karyotype analysis and knowledge that the basic chromosome number of x = 8 characterizes all Greek species of *A.* sect. *Codonoprasum* we consider the new species a tetraploid ($2n = 4x = 32$).

The karyotype (Fig. 1C, Table 2) is ± symmetrical concerning both centromeric position and chromosome size differentiation. In the somatic metaphase plates the only recognizable (marker) chromosomes are four submetacentric (sm) ones which are distinct not only by their centromeric position but also by the presence of a secondary constriction near the telomere of the short arm (satellite chromosome of type sm^A, sensu Tzanoudakis 1983). Very rarely, one of the smaller metacentric chromosomes appeared also to be satellited (m^A, Fig. 1C). Within the group of 28 metacentric chromosomes, any kind of subgrouping is difficult. Secondary constrictions are not always present, the centromere is more or less in median position (arm ratio values 1-1.3), and

Table 1. Diagnostic characters of *Allium apolloniensis, A. platakisii* and *A. archeotrichon*.

	Allium apolloniensis	*Allium platakisii*	*Allium archeotrichon*
Bulblets	present	absent	absent
Sheaths and leaves	glabrous	glabrous	densely pilose
Spathe valves	at least one much longer than pedicels	longer than pedicels	subequalling or slightly longer than pedicels
Inflorescence	hemispherical	fastigiate	fastigiate
Perianth segments [length]	6-7 mm	6-7 mm	to 6 mm
Anthers	dark reddish purple	yellow	yellow or purplish pink
Pollen	purple	yellow	yellow
Chromosome number	$2n = 32 = 4x$	$2n = 16 = 2x$	$2n = 16 = 2x$

Table 2. Haploid complement (x) of *A. apolloniensis* ($2n = 4x = 32$). Mean relative length (= R) and mean arm ratio (= r) values were obtained from drawings and measurements of individual chromosomes from five metaphase plates. Based on the karyotype analysis the asymmetry index values (see Brullo & al. 1999) are: TF % = 44.5, REC index = 81.3 and SYi = 80 %.

Chromosome number	Chromosome type	r	R
1	m	1.10	15.2
2	m	1.20	14.6
3	m	1.06	13.8
4	m (msm)	1.33	13.1
5	m	1.10	11.6
6	m	1.13	10.7
7	m	1.14	9.6
8	sm^A	2.17	10.7

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the individual chromosomes mean relative length (R) values decrease gradually from c. 15 %, the longer, to c. 10 %, the shorter (see Fig. 1C, Table 2). Such small size differentiation does not permit recognition of homologous chromosomes (Levan & al. 1965, Matern & Simak 1967) and so their arrangement in Fig. 1C is to some extent provisional. It should be noted that the sm^A chromosomes are not the smallest of the complements and that among the metacentrics, some more intermediate in size (no. 4 in Table 2) appear as anisobrachial ones with arm ratio values of c. 1.3.

The new species appears to be the only endemic species of *Allium* in Greece with a polyploid cytotype. Polyploidy is not rare in Greek species of *Allium* (Tzanoudakis & Vosa 1986; Tzanoudakis 1992, 2000a) but none of the known Greek endemics are exclusively polyploid. Another tetraploid species, recently described from the island of Evvia, *A. dirphyanum* Brullo & al. (2003), actually belongs in our opinion to the species complex of *A. savii* Parl., which is relatively widespread in the Mediterranean.

Distribution and ecology.– Allium apolloniensis was collected in three different localities on Sifnos. Floristic exploration on the nearby islands of Serifos and Kythnos in October 2003 and on Folegandros and Sikinos in October 2004 revealed neither *A. apolloniensis* nor other autumn-flowering *Allium* species.

The habitats, including the type locality, are rocky calcareous slopes at moderate altitudes of 40-220 m. Small populations were found sheltered in spiny shrubs from grazing by sheep and goats. The accompanying vegetation includes the characteristic and commonly encountered constituents of degraded maquis and phrygana, such as *Anagyris foetida* L., *Calicotome villosa* (Poir.) Link, *Coridothymus capitatus* (L.) Rchb.f., *Erica manipuliflora* Salisb., *Genista acanthoclada* DC., *Juniperus phoenicea* L., *Phagnalon graecum* Boiss. & Heldr., *Phlomis fruticosa* L., *Pistacia lentiscus* L., *Prasium majus* L., *Sarcopoterium spinosum* (L.) Spach, *Teucrium divaricatum* Heldr. subsp. *divaricatum* and *T. polium* subsp. *capitatum* (L.) Arcang. There were also numerous annuals and geophytes such as *Anacamptis pyramidalis* (L.) Rich., *Arisarum vulgare* O. Targ.-Tozz., *Asphodelus ramosus* L., *Cyclamen graecum* Link, *Muscari commutatum* Guss., *Pallenis spinosa* (L.) Cass., *Scilla autumnalis* L. and *Urginea maritima* (L.) Baker.

Allium apolloniensis flowers and fruits in October, it would seem before the onset of autumn rains.

Conservation status. – Allium apolloniensis with less than 10 localities known on one island has to be classified as "Vulnerable" according to criteria C2a (IUCN 2001).

Relationship. – Based on the absence of conspicuous nectaries at the base of the ovary and on inflorescence morphology, in particular the two opposite spathe valves, which are unequal with at least one valve much longer than the pedicels, *Allium apolloniensis* clearly belongs to *A.* sect. *Codonoprasum.* The narrowly campanulate perianth and included stamens place it in the *A. paniculatum* group, but it is well distinguished from most Greek species of this group by its flowering period in autumn and its almost white flowers. The above combination of characters occurs in only two other species of this section, viz., *A. platakisii* Tzanoud. & Kypriotakis (Tzanoudakis & Kypriotakis 1993) and *A. archeotrichon* Brullo & al. (1999), which were described from the islet of Pontikonisi off NW Crete and the island of Rhodos, respectively. These two species are probably the closest related taxa and in our diagnosis we have compared it with *A. platakisii*. *A. apolloniensis,* however, has a number of different morphological and karyological features (Tables 1-2). *A. archeotrichon* is characterized by solitary bulbs, pilose leaves and sheaths, spathe valves subequalling or only slightly longer than the pedicels, fastigiate inflorescences and perianth segments up to 6 mm in length. In *A. apolloniensis* the main bulb is accompanied by numerous small bulblets, the sheaths and leaves are glabrous, at least one spathe valve is much longer than the pedicels, the inflorescence is hemispherical with more numerous flowers and the perianth segments are up to 7 mm in length. *A. apolloniensis* is tetraploid while *A. archeotrichon* is diploid. The differences between *A. apolloniensis* and *A. platakisii* are equally distinct. The latter has only renewal bulbs for vegetative propagation, more robust stems, fastigiate inflores-

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cences, shorter spathe valves broader at base, ± cylindrical perianths, yellow anthers and a diploid karyotype. With regard to the other autumn-flowering species of *A.* sect. *Codonoprasum* in Greece (Tzanoudakis 2000a, 2001; Brullo & al. 2003) these all differ by their more lax inflorescences and the dull pinkish brown or greenish brown flowers.

Allium aegilicum Tzanoud., described from the island of Antikithira, is an autumn-flowering species in *A.* sect. *Codonoprasum* with rose-pink flowers but has a smaller, subcylindrical to slightly urceolate perianth (Tzanoudakis 2000b). Flower shape and colour of *A. apolloniensis* most closely resemble that of the autumn-flowering *A. callimischon;* the latter is well differentiated by several morphological and cytological characters, which place it in *A.* sect. *Brevispatha*.

Floristic and phytogeographical considerations. – Most of the autumn-flowering *Allium* species mentioned above are restricted to the S Aegean island arc or occur also in neighbouring insular or continental biogeographical regions. *A. apolloniensis* is the only autumn-flowering member of *A.* sect. *Codonoprasum* discovered in the Cyclades (central Aegean). It would seem that the existence of an autumn-flowering species in this area related to *A. platakisii* and *A. archeotrichon* would justify earlier statements (Tzanoudakis & Kypriotakis 1993, Brullo & al. 1989) that species with such a life cycle are relicts of an old Mediterranean flora before the Aegean landmass fragmented. Strong phytogeographical barriers were set up between the Cyclades and Crete, which have been separated for more than 5 million years (Greuter 1972).

According to Tzanoudakis & Vosa (1986) the central Aegean is the phytogeographical region of Greece with the most polyploid *Allium* taxa and it is postulated that this distribution pattern has resulted from a long period of geographical isolation. Polyploidy and local endemism rarely occur together in Greek *Allium* species and thus we are pleasantly surprised to find with *A. apolloniensis* a tetraploid endemic.

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