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Karyological data of some plant species native to South Italy

Abstract

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The somatic chromosome number, karyotype morphology, geographical distribution and ecology of five plant species from the indigenous flora of southern Italy and Sicily are presented. The study includes in particular four species of *Allium* subgen. *Allium* (*Allium agrigentinum*, *A. apulum*, *A. diomedeum, A. chamaespathum*), *Ptilostemon greuteri* and *Salvia ceratophylloides*. Five out six of these species are strict endemics and all of them are very rare and differently threatened based on the IUCN criteria. Karyotype microphotographs for all taxa are provided and their karyotype morphology is discussed.

Keywords: *Allium*, endemism, karyology, *Ptilostemon*, *Salvia*, Sicily, southern Italy.

1976. *Allium agrigentinum* Brullo & Pavone — 2*n* = 2x = 16 (Figs 1A & 2A).

Si: Sicily, Aragona presso le Maccalube, 15 Jun 1994, *Brullo s.n.* (CAT) – type locality.
— Sicily, Calanchi argillosi sotto Troina, 29 May 1993, esemplare coltivato, *Brullo s.n.* (CAT).

Allium agrigentinum is an endangered Sicilian endemic species (Troìa & al. 2018) that typically grows in clay gullies in the Mediterranean steppe-type habitats of the central part of Sicily at an elevation of 100-700 m asl.

The chromosome number of the species (2*n* = 16) was reported for the type locality by Brullo & al. (2001), but no information regarding the chromosome complement and karyotype features have yet been provided. The diploid chromosome number 2*n* = 16 is confirmed for a new locality in addition to the *locus classicus*. The karyotype mainly consists of more or less median chromosomes and 1-2 submedian pairs. Plants from the type locality have, in particular, 4 pairs of metacentric chromosomes, 3 pairs of meta-submetacentric type (arm ratio between 1.30-1.67), and one submetacentric pair. No evident satellites have been detected. Thus, the chromosome formula can be resumed as: 2*n* = 2x = 8m + 6msm + 2sm = 16.

Chromosome total lengths range on average from 9.3 ± 1 µm to 5.39 ± 0.7 µm, while the values of symmetry indices M_{CA} and Cv_{CL} are 13.5 and 17.7 respectively.

The chromosome complement of the other population (Troina, not shown) is slight different from that one of the type locality in having 2 submetacentric pairs, while the biggest and the smallest pairs in size have secondary constrictions on the short arms of the homo-

logues; thus, in this population the chromosome formula can be expressed as: 2*n* = 2x = 6m + 2m-SAT + 2msm +2msm-SAT + 4sm = 16.

1977. *Allium apulum* Brullo, Guglielmo, Pavone & Salmeri — 2*n* = 2x = 16 (Figs 1B & 2B).

It: Puglia, Torre di Inserraglio, sul litorale roccioso calcareo, 31 May1992, *Brullo & Minissale* (CAT) - type locality.
— Puglia, Monte Sant'Angelo, Gargano, esemplare coltivato, 12 Jun 1986, *Brullo s.n.* (CAT).
— Puglia, Monti sopra Manfredonia, Gargano, 3 Jun 1982, *Brullo & Signorello* (CAT).
— Puglia, Vieste, Gargano, 6 Jun 1982, *Brullo s.n.* (CAT).

Allium apulum is a rare species endemic to the Apulia region in South Italy, where it occurs in the rocky ledges on coastal cliffs, and in ephemeral meadows among Mediterranean garrigues and maquis, up to 550 m of elevation. Based on the IUCN criteria, the species is currently assessed as Least Concern (LC) in the Italian national Red List (Wagensommer & al. 2018).

The chromosome number of the species (2*n* = 16) was reported by Brullo & al. (2001), who did not present neither any metaphase plate, nor the karyogram. The diploid count 2*n* = 16 can be confirmed for some additional localities other than the type one. The karyotype is composed by 5 metacentric pairs and 3 meta-submetacentric pairs, one of which (with arm ratio 1.61) actually tending towards the submetacentric type. The smallest metacentric pair was found to be microsatellited on the short arms of the homologues in the samples from Monte Sant'Angelo (Foggia). Thus, the karyotype formula can be summarized as: 2*n* = 2x = 8m + 2m-SAT + 6msm = 16. Chromosome total lengths range on average among the studied populations from 13 to 8.8 µm for the longest chromosome and from 7.0 to 5.0 µm for the shortest chromosome, while the values of symmetry indices M_{CA} and Cv_{CL} are 11.21 and 18.81 respectively.

1978. *Allium chamaespathum* Boiss. — 2*n* = 2x = 16 (Figs 1C & 2C).

It: Calabria, Capo dell'Armi, Reggio Calabria, 18.09.2008, *C. Brullo, S. Brullo, G. Giusso, R. Guarino, C. Marcenò s.n.* (CAT).

Allium chamaespathum is a typical Balkan element. It is endemic to the SW half of Balkan peninsula and some Aegean islands. The species is apparently widespread occurring in several localities, from S Albania, to continental Greece (especially Attic peninsula and Peloponnese), Ionian islands, some W Aegean islands, Crete, with an interesting extension to the southern Italy (Calabria), which represents its westernmost geographic limit. The IUCN status (Economou 2011) for this species is currently assessed as Data Deficient (DD), due to its scattered and not well-known distribution, but in most territories the species is threatened and very rare, with isolated and restricted populations (often few

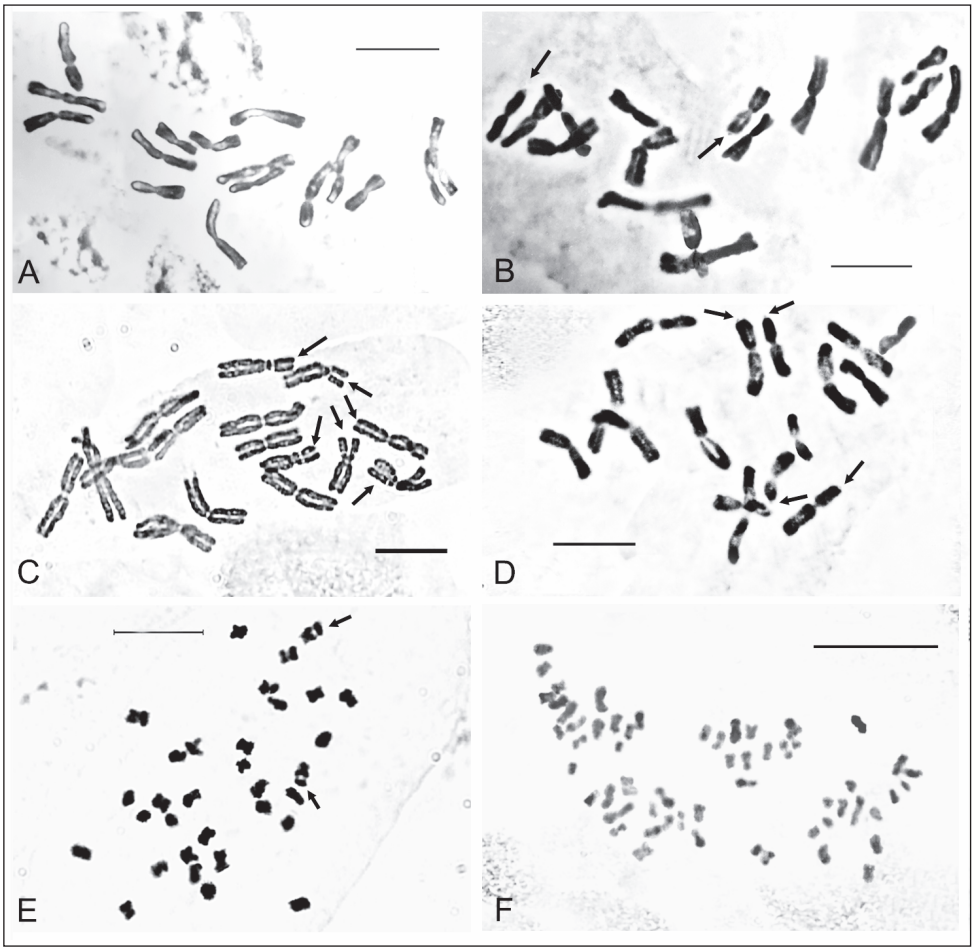

Fig. 1. Microphotographs of mitotic metaphase plates of the studied taxa: **A**, *Allium agrigentinum* from Aragona (Sicily), 2*n* = 16; **B**, *Allium apulum* from Mt. Sant'Angelo (Apulia), 2*n* = 16; **C**, *Allium chamaespathum* from Capo dell'Armi (Calabria), 2*n* = 16; **D**, *Allium diomedeum* from Ins. Tremiti (Apulia), 2*n* = 16; **E**, *Ptilostemon greuteri* from Mt. Inici (Sicily), 2*n* = 32; **F**, *Salvia ceratophylloides* from Reggio Calabria (Calabria), 2*n* = 54. – Scale bars = 10 μm.

dozens of individuals). Plants grow in rocky calcareous places (from the coasts to more than 2,000 m of elevation); habitats are usually represented by garrigues and grasslands, more rarely by open woodlands and dunes, sometimes also roadsides.

The species is known to be diploid with a somatic chromosome number 2*n* = 16 (Bothmer 1974, Tzanoudakis 1985). The Italian population was found to have the same diploid chromosome count (Brullo & al. 2010), but the karyotype features were not showed. All the investigated plants have the typical karyotype structure of the sect. *Allium* L., with chromosomes having linear satellites; in particular, there are 12 metacentric pairs

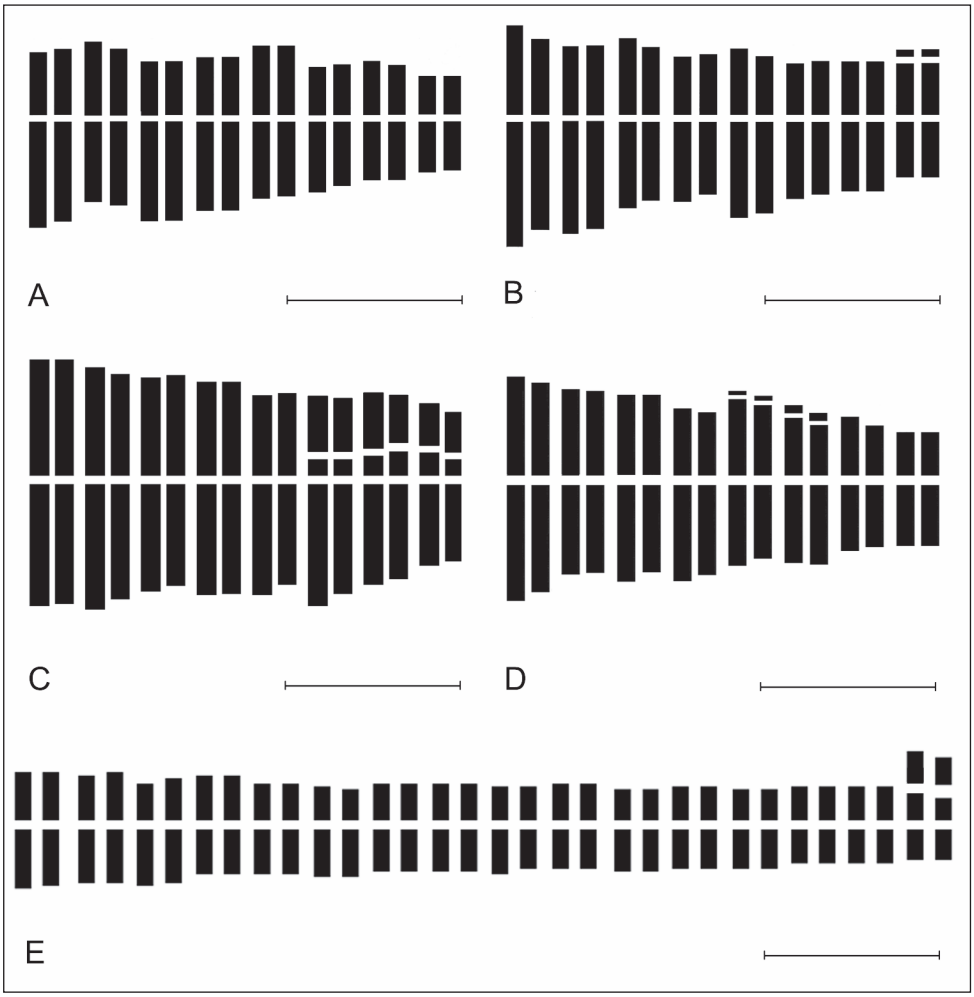

Fig. 2. Karyograms of the studied taxa: **A**, *Allium agrigentinum* from Aragona (Sicily), 2*n* = 16; **B**, *Allium apulum* from Mt. Sant'Angelo (Apulia), 2*n* = 16; **C**, *Allium chamaespathum* from Capo dell'Armi (Calabria), 2*n* = 16; **D**, *Allium diomedeum* from Ins. Tremiti (Apulia), 2*n* = 16; **E**, *Ptilostemon greuteri* from Mt. Inici (Sicily), 2*n* = 32. – Scale bars = **A-D,** 10 μm & **E,** 5 μm.

and 3 subtelocentric pairs with long linear satellites. Thus, the karyotype formula is: 2*n* = 2x = 10m + 6st-SAT = 16. The chromosomes on average vary in size from 14.1 ± 0.6 μm to 8.75 ± 1.3 μm, while the length of linear satellites is on average 3.2-2.3 μm, corresponding to c. 30% of the total chromosome length. The values of symmetry indices M_{CA} and Cv_{CL} are 28.1 and 15.4 respectively. On the whole, our results for the population studied are in accordance with previous reports from the Balkan peninsula (Bothmer 1974; Tzanoudakis 1985).

1979. *Allium diomedeum* Brullo, Guglielmo, Pavone & Salmeri — $2n = 2x = 16$ (Figs 1D & 2D).

It: Italia meridionale, Tremiti, San Domino, 18 Jul 1985, *Brullo*, *Minissale*, *Signorello & Spampinato* (CAT).

Allium diomedeum is an endangered species (Wagensommer & al. 2018) endemic to the Tremiti Islands, in the Adriatic Sea (Apulia, southern Italy). It is found in the shady rocky ledges of coastal cliffs and in the undergrowth of pine woods at the sea level. The chromosome number of the species ($2n = 16$) was reported for the type locality (San Domino, Tremiti Ins.) by Brullo & al. (2001) without further evidence of the karyotype structure. The chromosome complement of *A. diomedeum* mainly consists of more or less submedian pairs, with one pair submetacentric. Secondary constrictions were detected on the short arms of one metacentric pair and the submetacentric one. The karyotype formula can be summarized as follows: $2n = 2x = 8m + 2m\text{-SAT} + 4msm + 2sm\text{-SAT} = 16$. Chromosome total lengths range on average from 12.3 ± 0.5 µm of the longest chromosome to 6.1 ± 0.8 µm of the shortest chromosome, while the values of symmetry indices M_{CA} and Cv_{CL} are 11.20 and 20.83 respectively.

1980. *Ptilostemon greuteri* Raimondo & Domina — $2n = 4x = 32$ (Figs 1E & 2E).

Si: Castellammare del Golfo, Monte Inici, rupi calcaree della valle Il Finestrone, 07 Jul 2004, *Brullo, Campo, Musarella & Sciandrello* (CAT).

Ptilostemon greuteri is a very rare chasmophyte only known from a single locality on Mt. Inici, near Trapani, where it grows in a small valley in the NE limestone slopes. Differently from the other taxa of *Ptilostemon* occurring in Sicily [*P. niveus* (C. Presl) Greuter and *P. stellatus* (L.) Greuter], this is a perennial shrub up to 1.5 m tall, or more in cultivation, belonging to the section *Ptilostemon*. The species is currently assessed as Critically Endangered (CR) in the Italian national Red List (Rivers 2017). The chromosome complement is reported as $2n = 24$ by Raimondo & Domina (2006) being unique in *Ptilostemon* subg. *Ptilostemon*. Conversely, our investigations on the same single population revealed a tetraploid chromosome complement with $2n = 32$, the same as the other species of the sect. *Ptilostemon* (Greuter 1973; Tzanoudakis 1986; Brullo & al. 1991). The karyotype structure of this species is provided here for the first time. The karyotype is quite homogeneous and regular with very small chromosomes mainly of median type, varying in size from 3.22 to 2.06 µm; one pair is macrosatellited on the short arms of the homologues. The chromosomal formula can be represented as $2n = 4x = 24m + 2m\text{-SAT} + 6msm = 32$. It must be highlighted that the species is actually a diploidized tetraploid, with coupled homologues instead of tetraplets, as well exemplified by the occurrence of a single macrosatellited chromosome pair.

1981. ***Salvia ceratophylloides*** Ard. — 2*n* = 6x = 54 (Fig. 1F).

It: Calabria, Contrada Serro dei Morti press Puzzi (Reggio Calabria), 340 m, 24 May 2004, *Crisafulli, Maiorca & Spampinato* (CAL).

The count 2*n* = 54 is the first report for this species, which is a rare narrow endemism of southern Italy (Calabria), circumscribed to the suburban surroundings of Reggio Calabria, on coastal strip hilly ridges between 250 and 450 m of elevation (Spampinato & al. 2019). Based on the IUCN criteria, the species is currently assessed as Critically Endangered (CR) in the Italian national Red List (Spampinato & al. 2011; Rossi & al. 2014). *S. ceratophylloides* belongs to the subgenus *Sclarea* (Moench) Benth., Section *Plethiosphace* Benth., and is a part to the group of *S. pratensis* (Spampinato & al. 2019).

The chromosome number 2*n* = 54 reported in this study can be considered a hexaploid arrangement in accordance with the basic number x = 9 which is reported for some its allied taxa (*S. pratensis, S. haematodes*) resulting diploid with 2*n* = 18 (Del Carratore & Garbari 1996). A detailed analysis of the karyotype features is not presented because some small chromosomes appeared with indistinct centromeres.

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