Margarita Lazarova Markova

Karyology of some species of *Alkanna (Boraginaceae)* from Bulgaria

Abstract

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The diploid chromosome number $2n = 2x = 20$ is reported for two Balkan endemics *(Alkanna primuliflora and A. stribrnyi)* and two Bulgarian endemics *(A. stojanovii and A. jordanovii),* and their characteristic karyotypes are illustrated.

Introduction

The genus *Alkanna* Tausch is one of the smaller genera of the *Boraginaceae*. According to Strid (1991), it comprises about 50 species and shows greatest diveersity in the southern part of the Balkan Peninsula and S. Anatolia, where it is represented by a large number of local and regional endemics.

According to Kožuharov (1989), six species are found in Bulgaria, five of them being Balkan and Bulgarian endemics. *Alkanna primuliflora* Griseb. and *A. stribrnyi* Velen. are Balkan endemics. Another Balkan endemic, *A. graeca* Boiss. & Spruner, is represented in Bulgaria by an endemic subspecies: *A. graeca* subsp. *slavjankae* Kožuharov. *A. stojanovii* Kožuharov and *A. jordanovii* Kožuharov are two further Bulgarian endemics. The present study deals with 4 of the 6 taxa that occur in Bulgaria.

Material and methods

All karyologically studied plants were from natural habitats, as follows:

- *A. primuliflora* var. *primuliflora:* Central Rodopi mountains, dry and rocky places by Asenova krepost, c. 320 m, 27 May 1973, *L 235.*
- *A. stribrnyi* subsp. *stribrnyi:* Central Rodopi mountains, dry and rocky places by Asenova krepost, c. 320 m,28 May 1981, *L 1153;* Thracian lowlands, dry and stony slopes of the hill Besaparski Ridove, c. 300 m, 12 Jul 1989, *L 1772;* Toundja hill area, dry and rocky places between Jambol and village Goljam Dervent, c. 150 m, 26 Jun 1988, *L 1717.*

- *A. stojanovii:* Toundja hill area, dry, stony slopes of a hill near Topolovgrad, c. 300 m, 4 July 1984, *L 1471.*
- *A. jordanovii:* Thracian lowlands, stony slopes of the hill Besapeski Ridove, c. 300 m, 10 May 1971, *L 158.*

Chromosome numbers were counted on somatic cells of root tips, treated by the method described by Markova (1970). The karyograms were established on the basis drawings of metaphase plates. Vouchers have been deposited at SOM.

Results

A. primuliflora var. ***primuliflora.*** – $2n = 20$ (Fig. 1A).

A Balkan endemic: Bu, Gr (E., N.), Ju (S., E.), Tu (Rechinger 1965, Kožuharov 1972, 1989, Huber-Morath 1978).

The diploid number $2n = 20$ was counted on a sample of population *L235* (Markova and Ivanova 1974). The karyotype consists of $2n = 2x = 10sm + 6st + 4sm\text{-}SAT = 20$ chromosomes (Fig. 1A).

A. stribrnyi subsp. ***stribrnyi.*** – $2n = 20$ (Fig. 1B-D).

A Balkan endemic: Bu, Gr (N.), JU (S., E.) (Rechinger 1965, Kožuharov 1972, 1989).

Alkanna stribrnyi has a limited distribution in Bulgaria: Mt Slavjanka, the Central Rodopi mountains and the Thracian lowlands (Kožuharov 1989). Its locality in the Toundja hill area is a new record.

The diploid chromosome number $2n = 20$, counted on all three populations, coincides with that previously published for one of them *(L1153)* by Markova (1983; see Table 1).

Populations from three different floristic regions have now been studied, and their cytotypes established. The karyotype of population *L1717* has $2n = 2x = 2m + 16\ sm + 2sm\text{-}SAT = 20$ chromosomes (Fig. 1B); that of population *L1153,* $2n = 2x = 8sm + 8st + 2sm - SAT + 2st\text{-}SAT = 20$ chromosomes(Fig. 1C); and that of population *L1772*, $2n = 2x = 4m + 6sm + 6\ st + 2\ sm\text{-}SAT + 2st\text{-}SAT = 20$ chromosomes (Fig. 1D).

A. stojanovii. – $2n = 20$ (Fig. 1E).

A Bulgarian endemic, with a limited distribution in dry stony places, on limestone, in the southern Mt Pirin, the Thracian lowlands and the Toundja hill area (Kožuharov 1989).

The karyotype shows $2n = 2x = 18sm + 2sm\text{-}SAT = 20$ chromosomes *(L1471).*

A. jordanovii. – $2n = 20$ (Fig. 1F).

A Bulgarian endemic with a limited distibution in the Thracian lowlands and the Toundja hill area (Kožuharov 1989).

The karyotype consists of $2n = 2x = 18sm + 2st = 20$ chromosomes *(L158).*

Discussion

According to Darlington & Wylie (1955), the basic chromosome number for the genus *Alkanna* is $x = 11$. This assumption is based on the published counts, by Strey (1931) and Britton (1951), of $2n = 22$ for *A. orientalis* (L.) Boiss. Although that species has been

comparatively well studied, no other cytotypes with a diploid number of 22 have since been reported.

According to Löve & Löve (1961), the basic chromosome number for *Alkanna* is $x = 7$, while Loon (1987) states that there are two basic numbers: $x = 7$ and 10. Grau (1968) reports one secondary basic number, $x_2 = 15$, for *A. baeotica* A. DC., which he thinks could be of significance for the genus. The available literature offers scant data on the chromosome number of *A. baeotica*. The karyologically studied taxa are mainly endemics (Table 1). All taxa included in the present study are diploids with $2n = 2x = 20$ chromosomes.

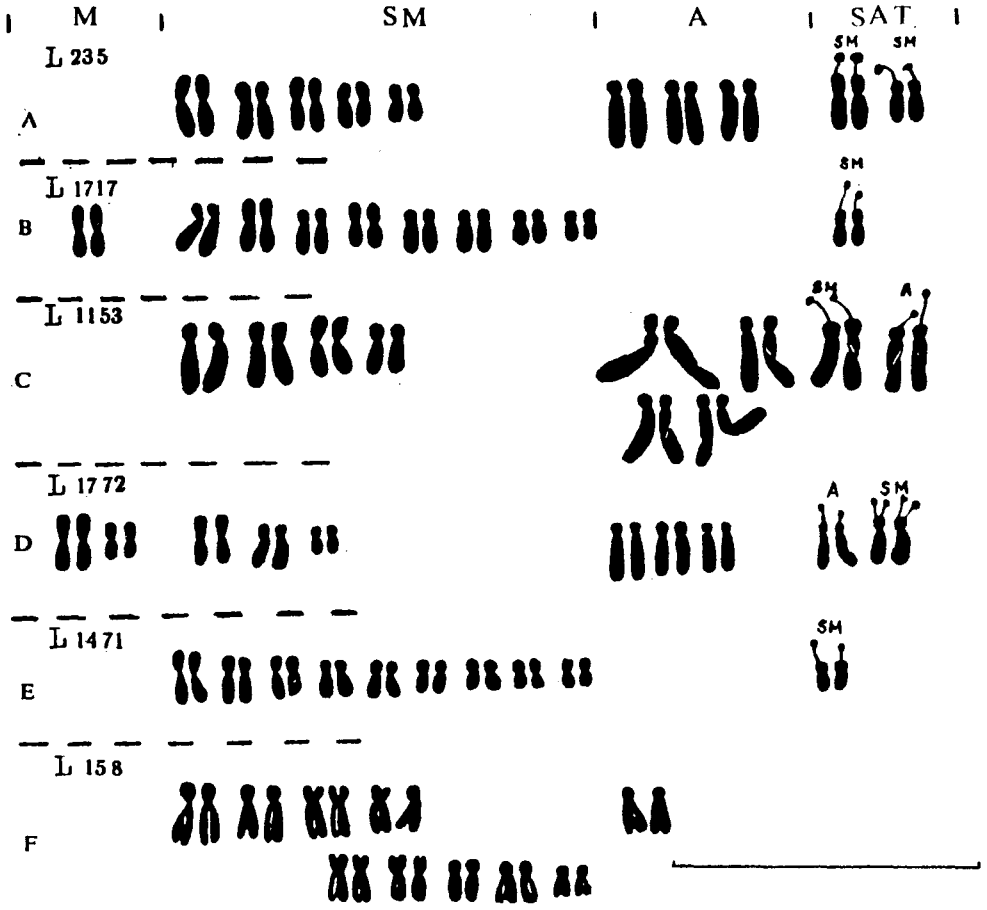

Fig. 1. Karyograms of *Alkanna* taxa from Bulgaria (all with $2n = 20$ chromosomes): A, *A. primuliflora* var. *primuliflora;* B-D, *A. stribrnyi* subsp. *stribrny;* E, *A. stojanovii;* F, *A. jordanovii*. – Scale bar = 10 μm.

Table 1: Somatic chromosome numbers of all endemic *Alkanna* species investigated so far.

Taxon	*x*	2*n*	endemic of	references
A. hellenica	7	28	Greece	Grau (1968), Kamari & Papatsou (1973)
A. corcyrensis Hayek	7	28	Balkan Peninsula	Damboldt & Phitos (1971)
A. lutea DC.	7	28	W. Mediterranean	Dahlgren & al. (1971)
A. primuliflora	10	20	Balkan Peninsula	Markova & Ivanova (1974)
A. stribrnyi	10	20	Balkan Peninsula	Markova (1983)
A. stojanovii	10	20	Bulgaria	
A. jordanovii	10	20	Bulgaria	
A. pindicola Hausskn.	15	30	Balkan Peninsula	Strid & Andersson (1985)
A. baeotica	15	30	Greece	Grau (1968)

According to Kožuharov (1989), the two species he described as new Bulgarian endemics, *Alkanna stojanovii* and *A. jordanovii,* are descendants of a previous common gene pool that gave rise to a group of yellow-flowered species when its area was disrupted and differentiation occurred in insular isolation. He considers *A. stojanovii* to be close to *A. graeca.* Kožuharov (1972) gives the number $2n = 30$ for *A. graeca,* but this probably refers to the previous count of *A. graeca* subsp. *baeotica* (A. DC.) Nyman *(A. baeotica)* of Grau (1968).

According to Kožuharov (1989), *Alkanna jordanovii* is a vicariant of *A. methanea* Hausskn. from Central and S. Greece and of *A. sandwithii* Rech. fil. from S.E. Albania. No karyological data on either of these species are available.

The literature data on endemic species of *Alkanna* karyologically studied so far (Table 1) suggests the distinction of three groups, each with a different basic number and with a constant ploidy level. The diploid level ($2x$) is linked to the basic numbers $x = 10$ and 15, while the taxa with $x = 7$ are all tetraploid ($4x$).

The few previous karyological studies of the genus left the problem of chromosome morphology almost untouched. The presence of two pairs of satellite chromosomes in the karyotypes of *Alkanna primuliflora* var. *primuliflora* and *A. stribrnyi* subsp. *stribrnyi* (Fig. 1A, C, D) has its parallel in A. *hellenica* (Boiss.) Rech. fil. (Kamari & Papatsou 1973) and *A. baeotica* (Grau 1968).

It would be of interest to obtain karyological data on other Bulgarian endemic infraspecific taxa, which will therefore be the subject of further study.

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Address of the author:
Dr Margarita Markova, Institute of Botany, Bulgarian Academy of Sciences, Akad. G. Bončev Str. 23, BG-1113 Sofija, Bulgaria.