

On the karyology of the representatives of the genus *Silene* L. s. l. (*Caryophyllaceae*) from Southern Transcaucasia

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Abstract: Nineteen species of the genus *Silene* L. s.l. from Southern Transcaucasia have been karyologically studied. For three species the first count is reported. Idiogram of the species *Melandrium latifolium* (POIR.) MAIRE has been constructed, with a pair of sex chromosomes indicated.

Keywords: *Silene*, karyology, karyotype, Southern Transcaucasia.

Introduction

The cosmopolitan genus *Silene* L. s.l. includes nearly 700 species (MELZHEIMER 1988). Up to now, there has not been any unanimous opinion about its delimitation. In particular, the independence of the genera *Melandrium* ROEHL. and *Pleconax* RAFIN. remains questionable.

The monographic investigation of the genus *Silene* s.l. of Southern Transcaucasian flora required not only morphological and geographic investigations but also involvement of karyological data. It is necessary for both a more precise definition of the systematic position of a number of taxa, and for revealing phylogenetic relationships within the genus *Silene* s. str.

The karyological examination of this large genus has been carried out for a long time. Certain information about the chromosome numbers and the karyotypes of the *Silene* species has been and continues to be published (LÖVE 1942, BARI 1973, MELZHEIMER 1974, POHLMANN 1977, GHAZANFAR 1983 etc.). Many papers deal with the problems of evolution and with the significance of hybridization and polyploidy (HEASLIP 1951, KRUCKEBERG 1955, 1961, 1969, BLACKBURN, MORTON 1957, MELVILLE 1960, GHAZANFAR 1989 etc.). Extremely interesting and elaborate is the paper of

DEGRAVE (1980), where an account of a detailed investigation of the karyotypes of 99 *Silene* species is given.

According to the latest data, 300 species of the genus have been studied. Most of them have a basic number of $x=12$, and only 3 species have $x=10$. These are mostly the diploids, $2n=24$ (224 species, 74%) or $2n=20$ (3 species, 1%), and only 57 species (19%) are tetraploids, $2n=48$. Moreover, cytotypes with an odd ploidy level were found: triploid cytotype ($2n=36$) in *S. nocturna* L. (NATARAJAN 1978) and pentaploid one ($2n=60$) in *S. scouleri* HOOK. (KRUCKEBERG 1954). Polyploid series in *S. ciliata* POURR. ($x=12$) has a range from $2n=24$ ($2x$) to $2n=240$ ($20x$). The existence of polyploid series proves that the polyploidy here is one of the bases of the speciation. FERNANDES and LEITAO (1971) revealed a connection between the degree of ploidy and life cycle. They particularly pointed out that polyploids are generally represented by perennials. Intra-specific polymorphism in the genus *Silene* was reported: B-chromosomes were found in *S. saxifraga* L. (FAVARGER et al., sec. MELZHEIMER 1974), in *S. legionensis* LAG. (KÜPFER 1974), in *S. radicata* BOISS. et HELDR. subsp. *pseudoradicosa* RECH. f. (MELZHEIMER 1974) and in *S. niederi* HELDR. ex BOISS. (MELZHEIMER 1978).

For Southern Transcaucasia 34 species of the genus *Silene* s.l. are given. We have karyologically investigated 17 species of the genus *Silene* s. str. of three subgenera and eight sections, 1 species of the genus *Pleconax* and 1 species of the genus *Melandrium*. Chromosome numbers for three species have been reported for the first time. We have confirmed the chromosome numbers for the other species reported in the literature on the material from other regions.

Material and methods

Chromosome numbers were counted in root tips of plants obtained from seeds collected in the natural conditions. Herbarium vouchers of the studied specimens are kept in the Institute of Botany of the Academy of Science of Armenia (ERE). The numbers cited in the text correspond to the numbers of the cytological collection.

Roots were pretreated with 0.2% colchicine for 2 hours, fixed in Battaglia (5:1:1:1) for 10 min. (BATTAGLIA 1957). Then the material was subjected to a cold hydrolysis in HCl solution (1:1) for 20 min. Preparations were stained according to the Feulgen technique.

Results

Melandrium latifolium (POIR.) MAIRE (= *Silene latifolia* POIR. subsp. *latifolia*, *Melandrium boissieri* SCHISCHK.) - $2n=24$, Armenia, Martuni region, Ajridja place, steppe-meadow, 2250 m. 11.07.1989, Nersesian, C-1934.

Pleconax conoidea (L.) ŠOURKOVÁ (= *Silene conoidea* L.) - $2n=20$, Armenia, Krasnoselsk region, canyon slopes near Artanish village, 22.07.1989, Nersesian, C-1862.

Silene araxina TRAUTV. - $2n=24$. The chromosome number is given for the first time. Armenia, Azizbekov region, near Kechut reservoir, canyon of the Arpa river, rocks, 1800 m, 12.07.1989, Gabrielian, Nersesian, C-1936.

- S. arguta* FENZL - $2n=48$, Armenia, Eghegnadzor region, near Getikvank, up the Eghegis river, 16.08.1990, Manakian, C-1887; Abovian region, near Garni, bank of the Azat river, 16.06.1990, Nersesian, C-1892.
- S. bupleuroides* L. - $2n=24$, Armenia, Krasnoselsk region, canyon slopes near Artanish village, 22.07.1989, Nersesian, C-1875.
- S. caucasica* (BUNGE) BOISS. - $2n=24$, Armenia, Botanical Garden of Erevan, Department of Armenian flora, 3.07.1990, Nersesian, C-1889.
- S. chlorifolia* SMITH - $2n=24$, Armenia, Vardenis region, along the railway, between Dzil and Dara villages, along the road, 23.07.1989, Nersesian, C-1876.
- S. compacta* FISCH. ex HORNEM. - $2n=24$, Gugark region, canyon of the right tributary of the Debet river, Debet village, 1100-1300 m, 7.08.1989, Nersesian, Oganesian, C-1863.
- S. depressa* Bieb. - $2n=24$, Armenia, Tumanian region, along the road to the summer pastures in mountains of Dsegh village, near Khndzorokhsky place, rocks, 1500-1600 m, 9.08.1989, Nersesian, C-1886.
- S. dichotoma* EHRH. - $2n=24$, Armenia, Krasnoselsk region, Artanish village, 22.07.1989, Nersesian, C-1931; Vardenis region, along the railway, near Dara village, 23.07.1989, Nersesian, C-1932.
- S. italica* (L.) PERS. - $2n=24$, Armenia, Azizbekov region, Dzermuk town, near fish-breeding farm, edge of forest, 2100 m, 12.07.1989, Nersesian, C-1992.
- S. lasiantha* C. KOCH - $2n=24$. The chromosome number is given for the first time. Armenia, Martuni region, Ajridja place, steppe-meadow, 2250 m, 11.07.1989, Nersesian, C-1877.
- S. marschallii* C.A. MEY. - $2n=24$, Armenia, Eghegnadzor region, between Areni and Khachik villages, in the 14 km from Areni village, steppe, 2000 m, 13.07.1989, Nersesian, C-1929.
- S. meyeri* FENZL ex BUHSE - $2n=24$. The chromosome number is given for the first time. Armenia, Ararat region, Dzandam-Dara canyon near Sovetashen village, rocks, 4.08.1989, Nersesian, C-1935.
- S. noctiflora* L. - $2n=24$, Armenia, Botanical Garden of Erevan, 19.06.1989, Nersesian, C-1873.
- S. ruprechtii* SCHISCHK. - $2n=24$, Armenia, Tumanian region, near the summer pastures in mountains of Dsegh village, Shaluduz place, along the river, 09.08.1989, Nersesian, C-1874.
- S. spergulifolia* (WILLD.) BIEB. - $2n=24$, Armenia, Hrazdan region, Takiarlu village, southern slope, mountain steppe, 1950 m, 18.07.1989, I. Gabrielian, Melikian, C-1865.
- S. viscosa* (L.) PERS. - $2n=24$, Armenia, near Kamo town, to the right of the road from Kamo town to Hrazdan town, 24.06.1989, Nersesian, C-1930.

S. vulgaris (MOENCH) GARCKE - $2n=24$, Armenia, Krasnoselsk settlement, Gjoral-Dara place, in peas crops, 25.07.1989, Nersesian, C-1864.

Discussion

The studied species are represented by diploid cytotypes and only *S. arguta* - by tetraploid cytotype, $2n=48$ (Fig. 1.a). All the species have a basic number of $x=12$, except for *Pleconax conoidea*.

The basic number $x=10$ characterizes species of the genus *Pleconax*. This genus was separated from the genus *Silene* by RAFINESQUE-SCHMALTZ (1840). Most investigators do not accept the independence of *Pleconax* (BOISSIER 1867, ROHRBACH 1868, SCHISCHKIN 1936, GROSSHEIM 1945, KARJAGIN 1952, AVETISYAN 1956, CHATER, WALTERS 1964, COODE & CULLEN 1967, MELZHEIMER 1988 etc.), whereas others (ŠOURKOVÁ 1971, IKONNIKOV 1977 etc.) recognize it. The difference in basic number of the representatives of this genus from the other *Silene* s.l. proves the divergent nature of this taxon. DEGRAEVE (1980) suggested a hypothesis of a loss of two chromosome pairs (11 and 12) in the karyotype of typical *Silene* representatives. Judging from the karyological data, this group of annuals is considerably advanced in evolutionary sense. The genus *Pleconax* is distinguished from the typical *Silene* representatives by its large number of calyx veins (15, 20, 30 or 60), which actually are not branched and do not develop anastomoses. Hence we consider the restoration of the genus *Pleconax* as well-balanced. It should be mentioned, that some investigators give $2n=24$ for a number of species of this group (BLACKBURN 1928, LÖVE 1942, BLACKBURN & MORTON 1957, PUECH 1963, 1968, DAMBOLDT & PHITOS 1966). These species might possibly have undergone a chromosome evolution. However, we have obtained $2n=20$ for *P. conoidea* (Fig. 1b).

The karyotypes of all the investigated species are symmetric, with prevailing metacentric and submetacentric chromosomes. The chromosomes are generally small (1,0-2,0 μm), and that fact hampers a detailed investigation of karyotypes.

The species *Melandrium latifolium* is of a particular interest, because of the independence of the genus *Melandrium*, recognized by some investigators (BOISSIER 1867, SCHISCHKIN 1936, GROSSHEIM 1945, KARJAGIN 1952, AVETISYAN 1956 etc.), which is not supported by others (CHATER & WALTERS 1964, COODE & CULLEN 1967, MELZHEIMER 1988 etc.). Nevertheless, as a result of karyological investigations, sex chromosomes in karyotypes of species of this genus were found (BLACKBURN 1923, WINGE 1923). This fact proves a considerable DNA redistribution in the karyotype and an evolutionarily advanced status of the genus. A pair of very large sized (in comparison with autosomes) female sex chromosomes (XX) is also well marked in the chromosome set of the investigated specimens of *M. latifolium* (Fig. 2). These chromosomes (5-6 μm) are metacentric. Autosomes of *M. latifolium* are represented by 7 pairs of metacentric (2, 3, 5, 6, 8, 10, 11) and 4 pairs of submetacentric (1, 4, 7, 9) chromosomes. The size of the autosomes varies from 1.5 μm to 3 μm . Pair 1 has a small satellite on the short arm. The presence of the sex chromosome system, in combination with other features, distinguishing the *Melandrium* representatives from the typical *Silene* representatives (dioecism, five styles in female flowers), in our opinion, allows to recognize the independence of the genus *Melandrium*.

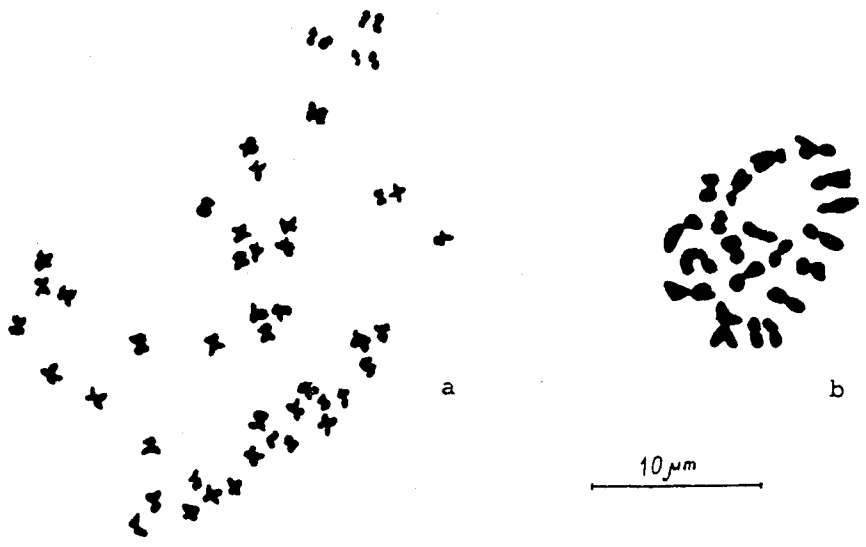


Fig. 1. - Karyotypes of a) *Silene arguta*; b) *Pleconax conoidea*

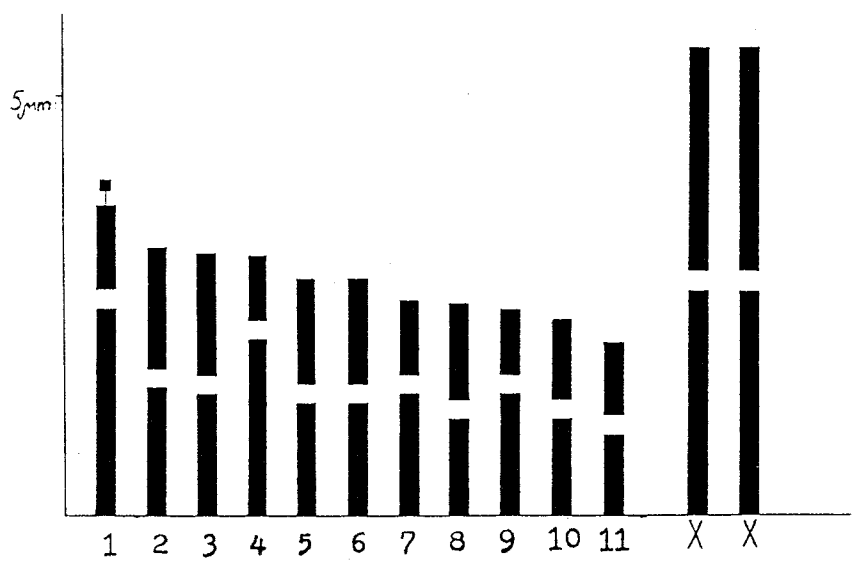


Fig. 2. - Idiogram of *Melandrium latifolium* (haploid set of autosomes and pair of sex chromosomes).

Summary

Karyological studies of 19 species of the genus *Silene* L. s. l. from Southern Transcaucasia are reported. Chromosome numbers ($2n=24$) for *Silene araxina* TRAUTV., *S. lasiantha* C. KOCH and *S. meyeri* FENZL ex BOISS. et BUHSE are given for the first time. Idiogram of the species *Melandrium latifolium* (POIR.) MAIRE is constructed, with a pair of sex chromosomes indicated. It has been noted, that karyological data, in combination with other macromorphological features, allows to recognize the independence of the genera *Pleconax* RAFIN. and *Melandrium* ROEHL.

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