

A NOTE ON THE SEX CHROMOSOMES OF THE VALENCIAN ENDEMIC, *SILENE DICLINIS* (CARYOPHYLLACEAE)

por

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Abstract

NIGTEVECHT, G. VAN & H. C. PRENTICE (1985). A note on the sex chromosomes of the Valencian endemic, *Silene diclinis* (Caryophyllaceae). *Anales Jard. Bot. Madrid* 41(2): 267-270.

A pair of morphologically differentiated sex chromosomes is reported from the Valencian endemic, *Silene diclinis*. In *S. diclinis*, the sex chromosomes differ in centromere position, but X and Y chromosomes are approximately equal in length. In the other dioecious species in *Silene* sect. *Elisanthe*, the Y chromosome is considerably longer than the X chromosome.

Resumen

NIGTEVECHT, G. VAN & H. C. PRENTICE (1985). Nota sobre los cromosomas sexuales del endemismo valenciano *Silene diclinis* (Caryophyllaceae). *Anales Jard. Bot. Madrid* 41(2): 267-270 (en inglés).

Se da noticia de un par de cromosomas sexuales morfológicamente diferenciados para el endemismo valenciano *Silene diclinis*. En *Silene diclinis* los cromosomas sexuales se diferencian por la posición del centrómero, siendo los cromosomas X e Y aproximadamente iguales en longitud. En las otras especies dioicas de *Silene* sect. *Elisanthe* el cromosoma Y es considerablemente más largo que el X.

Silene diclinis (Lag.) Lainz is endemic to the province of Valencia in SE Spain (PRENTICE, 1976, 1983; MANSANET & MATEO, 1980). *S. diclinis* is included in section *Elisanthe* (Fenzl) Fenzl of *Silene*. The five other European species in section *Elisanthe* are *S. latifolia* Poiret**, *S. dioica* (L.) Clairv., *S. heuffelii* Soó, *S. marizii* Samp. and *S. noctiflora* L. (see CHATER & WALTERS, 1964; PRENTICE, 1978). All the section *Elisanthe* species are diploid ($2n=24$) and five of the species are dioecious: *S. noctiflora* is the only hermaphrodite. The sex determination system has been extensively investigated in *S. latifolia* and *S. dioica* (see e.g. WESTERGAARD, 1940, 1958; NIGTEVECHT, 1966). Sex determination is controlled principally by X and Y chromosomes with

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(**) Now thought to be the correct name for the species that has been known as *S. alba* (Miller) E. H. L. Krause and *S. pratensis* (Rafn) Godron & Gren.

females being the homogametic (XX) sex and males being the heterogametic (XY) sex (BLACKBURN, 1924; LÖVE, 1944; NIGTEVECHT, 1966).

The distinctive heteromorphic sex chromosomes were first demonstrated by BLACKBURN (1923) and WINGE (1923) in *S. latifolia*. In both *S. latifolia* and *S. dioica* the X and Y chromosomes differ in centromere position (being submetacentric and metacentric respectively) and in overall length. The Y chromosome is considerably longer than the X chromosome (BLACKBURN, 1924; WARMKE & BLAKESLEE, 1939; DEGRAEVE, 1980), the Y/X ratio being approximately 1.5 (e.g. NIGTEVECHT, 1966; DEGRAEVE, 1980).

The hermaphrodite *S. noctiflora* does not have a differentiated pair of chromosomes (SCHÜRHOFF, 1925; DEGRAEVE, 1980) but heteromorphic sex chromosomes were reported from *S. marizii* (*Melandrium glutinosum* Rouy) by BLACKBURN (1928) —cf. also FERNANDES & LEITAO (1971)—. Sex chromosomes have not been reported from the Balkan species, *S. heuffelii*.

However, MORISSET & BOZMAN (1969: fig. 1) present an illustration of meiosis in a male hybrid between *S. heuffelii* (male) and *S. diclinis* (female). In this figure, the largest chromosome of the largest bivalent is probably the Y chromosome, which could only have been derived from *S. heuffelii*. Apart from the study of MORISSET & BOZMAN (1969) which does not mention the sex chromosomes, *S. diclinis* has only been investigated cytologically by DEGRAEVE (1980).

DEGRAEVE (1980) made an extensive comparative karyological study of the genera *Lychnis*, *Melandrium* and *Silene*. As expected, DEGRAEVE (*l.c.*) showed pronounced size differences between the sex chromosomes in *S. latifolia* sensu lato (including both *Melandrium album* Garcke and *M. boissieri* Schischk.) and *S. dioica* (*M. rubrum* Garcke = *M. sylvestre* Röhl.). No heteromorphism was detectable in the equivalent chromosome pair in *S. diclinis* (*M. dichline* Willk.). But DEGRAEVE (*l.c.*) used the root tips from germinated seeds for the cytological investigations, and remarked that all the individuals might have been female.

We have examined root tip squash preparations from adult male and female plants of *S. diclinis* (cultivated material derived from the wild-collected sample from Játiva, Prentice 1974/134). The plants were kept at 1°C for 15 hours; subsequently root tips were fixed in Carnoy's fluid (3 parts ethanol: 1 part glacial acetic acid) and were stained with basic-fuchsin (Feulgen) after 8 minutes hydrolysis in 1N HCl at 59°C. We confirm that there is a morphological difference between sex chromosomes in *S. diclinis* (fig. 1). As in *S. latifolia* and *S. dioica*, the *S. diclinis* Y chromosome is approximately metacentric whereas the X chromosome is submetacentric. However, we found only a slight difference in length between the X and Y chromosomes (Y/X approximately = 1.1). The size difference is more obvious in the other species (NIGTEVECHT, 1966; DEGRAEVE, 1980).

The Y chromosome plays the same role in sex determination as in the other dioecious section *Elisanthe* species. In a series of artificial crosses in which *S. diclinis* was used as the male parent ($\times S. dioica$) (PRENTICE, 1978); $\times S. latifolia$ (Nigtevecht unpublished); $\times S. marizii$, $\times S. heuffelii$ (Prentice unpublished), the progeny were all normal male or female individuals. If the Y

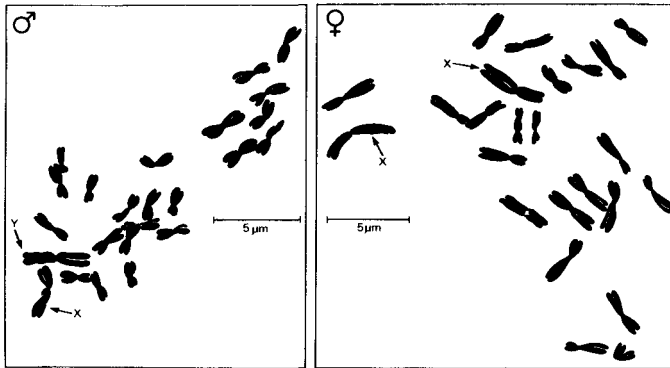


Fig. 1.—Camera lucida drawings of the chromosomes in squash preparations of root-tips of *Silene diclinis*: ♂, the largest two chromosomes are heteromorphic, X and Y; ♀, the largest two chromosomes are homomorphic, submetacentric, 2X.

chromosome is malfunctional, the sex determining system breaks down (WESTERGAARD, 1946; NIGTEVECHT, 1966) and interaction between the X chromosome and the sex determining elements on the autosomes produces populations with female and hermaphrodite (but no male) individuals. This does not happen in the *S. diclinis* crosses.

NYGREN (1957) suggested that the sex chromosomes in section *Elisanthe* species might have been derived from a pair of autosomes in *Lychnis*. DEGRAEVE (1980) points to *S. diclinis* as a possible intermediate in the evolution of sex chromosomes. Certainly *S. diclinis* does occupy a morphologically distinct position within section *Elisanthe* (PRENTICE, 1976), but speculation about its ancestral role seems premature.

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