Anna Geraci & Rosario Schicchi

Cytogeographical investigation of *Scilla autumnalis* (*Hyacinthaceae*) in Sicily

Abstract

Geraci, A. & Schicchi, R.: Cytogeographical investigation of *Scilla autumnalis* (*Hyacinthaceae*) in Sicily. — Fl. Medit. 12: 177-182. 2002. — ISSN 1120-4052.

The ploidy level of fifteen populations of *Scilla autumnalis* L. was investigated in Sicily. On such basis, both tetraploid and exaploid levels were found occurring in the study area, in addition to old and new other diploid populations. Furthermore, B-chromosome were found in the Favignana islet (Egadi archipelago, W-Sicily). The results are discussed here with respect to the occurrence of different ploidy levels in the whole distribution area of this species.

Introduction

The genus *Scilla* L. (*Hyacinthaceae*) is a very heterogeneous group widely distributed in the Mediterranean area. There are included species autumn-flowering that, from the morfological and karyological point of view, remarkably differ from the spring-flowering ones belonging to *Scilla* sensu stricto (Speta 1979). Owing to such differences, recently both *Scilla autumnalis* L. and *S. obtusifolia* Poir. were transferred to the genus *Prospero* Salisbury (Speta 1983, Ebert & al. 1996). Furthermore six new endemic species of the same genus have been described from Crete (Speta 2000).

S. autumnalis is distributed throughout a wide area from the Atlantic coasts of England, Portugal and Spain to the Caucasus, i.e. the whole mediterranean region, France, northern Balkans and the Pontic region.

It usually occurs in garigues and dry grasslands as well as in the hollows of limestone rocks even with the slightest layer of substratum. The flowering period extends between the end of August and the end of September (Fig.1).

From the karyological point of view, the basic chromosome number of *S. autumnalis* is $n = 7$ (Battaglia 1952) or, $n = 6$ in some eastern areas, (Ebert & al. 1996). Populations showing $2n = 14, 28, 42, 56, 63, 70$ are dispersed in the whole range (Speta 1993). Diploids occur in North-Africa, the Southern Iberian peninsula, Sardinia, Sicily, Malta, Greece, and throughout the coast between the Asia minor and Israel. Polyploids mainly occur in Spain, Morocco, Italian Peninsula, Sardinia, Balcanica Peninsula, France and England (Speta

1993, Battaglia 1957, 1964, Corsi & al. 1996). In these last two countries diploids have not been recorded.

In Italy *S. autumnalis* is more frequent in the Mediterranean zones, and becomes rare northwards. Diploid populations were recorded in Sicily (Battaglia 1957), Sardinia and Pantelleria (Battaglia 1964) and in Campania (Southern Italy) (Ebert & al. 1996). Tetraploids occur in several Italian localities (Battaglia 1957, Illuminati et al. 1995) and in Sardinia (Battaglia 1964). Exaploid populations have finally been found in the karstic area near Trieste (Battaglia 1957). In Sicily previous reports concern diploids only, from Scicli (South East of Sicily), locality Croce near Catania, S. Caterina Villermosa (in Central Sicily) and Floridia near Siracusa. In plants collected in these last two populations, B-chromosomes were found (Battaglia 1957 & 1963, Guillen & Rejon 1984).

In this work a cytogeographic investigation has been carried out analysing fifteen populations of *S. autumnalis* in order to evaluate the levels of ploidy in Sicily. This in comparison with the general ploidy level variation within the whole distribution of the species.

Material and methods

The plants were collected from 15 sites whose locations comprehensively represent the *S. autumnalis* distribution in Sicily. These are reported in Tab.1.

Table1. Locations, altitude, date of collection of the plant material studied.

Locality	Altitude [m. s.l.m.]	Date of collection	Id.
Fontanarossa (Erice) (Trapani)	500	October 1999	1
Limestone cliffs, road Valderice–Erice (Trapani)	450	October 1999	2
Monte Cofano (Trapani)	400	October 1998	3
San Vito Lo Capo (Trapani)	70	October 1999	4
Road near Scopello S.S.187 (Trapani)	100	September 1999	5
Monte Gallo (Palermo)	250-300	October 1999	6
Cozzo di S.Pietro (M. Catalfano) (Palermo)	300	October 1996	7
Rocca di Caltavuturo (Palermo)	700	September 1999	8
Silva Riformati (Petralia Sottana–Madonie) (Palermo)	1100	October 1996	9
Portella Bifolchi (Geraci Siculo - Madonie) (Palermo)	1050	October 1996	10
Favignana (Egadi Islands) (Trapani)	50-100	October 1997	11
Portella Scalazza (Marianopoli) (Caltanissetta)	700	September 1996; 1999	12
Riserva Naturale dello Zingaro (Trapani)	100-150	September 1997; 1999	13
Road Siracusa nord-Belvedere (Siracusa)	200	October 1999	14
Road Siracusa-Floridia (Siracusa)	250	October 1999	15

For each locality at least 15 bulbs were collected and were cultivated in pots in the Botanical Garden of the University of Palermo.

For the karyological analysis, root tips were pretreated with 0.3% colchicine for 3 hours, and fixed in a mixture 3:1 absolute alcohol - glacial acetic acid for at least one hour and finally stained by Schiff's reagent after hydrolysis with HCl 1 N for seven minutes at 60°C (Darlington & La Cour 1960).

At least ten metaphase plates for each sample were counted.

Results

The chromosome number and the relevant level of ploidy of the studied populations are given in Table 2.

Results show that eleven populations are diploid $2n = 14$. In particular diploids were found in most of the localities in north-western Sicily (near Trapani, mountains around Palermo, and Madonie mountains). A population located in the Natural Reserve of Zingaro (Trapani Province) presented $2n = 42 = 6x$. Besides, in the diploid populations in the Favignana islet (Egadi Island – Trapani Province) a B - chromosome ($2n = 14 + 1B$) has been found.

Exaploid level has been observed in plants from the southern part of the Sicily (near Siracusa). In plants collected in the locality Portella Scalazza near Marianopoli (Caltanissetta, C-Sicily) both diploids and tetraploids ($2n = 28$) have been found occurring in the same population (Fig. 2, 3).

Table 2. Chromosome number and ploidy level of the populations investigated.

Identification	Locality	Chromosome number (*2n*)	Ploidy level
1	Fontanarossa (TP)	14	2x
2	Valderice (TP)	14	2x
3	Monte Cofano (TP)	14	2x
4	San Vito Lo Capo (TP)	14	2x
5	Scopello (TP)	14	2x
6	Monte Gallo (PA)	14	2x
7	Monte Catalfano (PA)	14	2x
8	Caltavuturo (PA)	14	2x
9	Petralia Sottana (PA)	14	2x
10	Geraci Siculo (PA)	14	2x
11	Favignana (TP)	14 + 1	2x + 1
12	Marianopoli (CL)	14, 28	2x, 4x
13	Zingaro (TP)	42	6x
14	Belvedere (SR)	42	6x
15	Floridia (SR)	42	6x

Fig. 1 – *Scilla autumnalis*: detail of inflorescence.

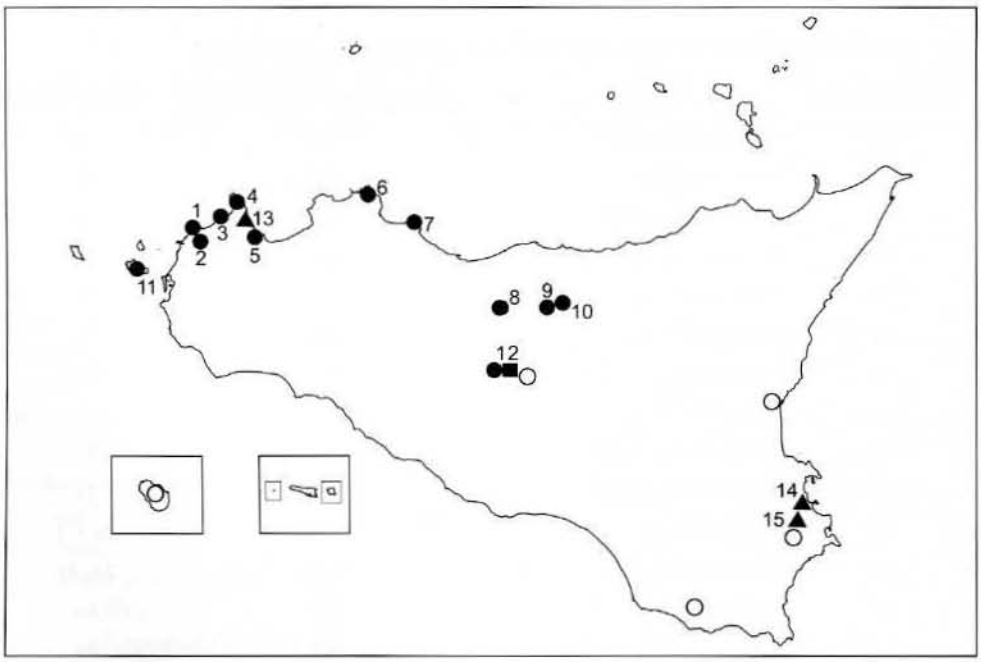

Fig. 2. Occurrence of the cytodemes races of *S. autumnalis* in Sicily.
(O) $2n = 14$ literature datum; (●) $2n = 14$; (■) $2n = 28$; (▲) $2n = 42$.

Discussion and conclusion

Scilla autumnalis is a polyploid complex occurring in Central – Europe and Mediterranean area.

Poliploidy can become a positive event in wild populations, when it is accompanied by other genetic-evolutionary processes increasing the adaptative ability (Stebbins 1971).

Therefore polyploid radiation from the relevant diploids and their subsequent spreading could be correlated to their adaptative response to different ecological conditions in both short and long periods.

When a polyploid complex reaches a successfull evolutionary stage, the occurrence of diploid ancestors numerically decreases in the whole geographical range up to extintion (Favarger 1984).

Concerning Sicily, *S. autumnalis* mostly appears diploid, therefore this region could be placed in the geographic context of south-east mediterranean basin in which diploids are most frequent. On the other hand, the occurrence of polyploids shows the possible correlation between Sicily and the central-south European area where polyploid populations are more frequent.

As for the sympatric occurrence of both diploid and polyploid chromosome races of *S.*

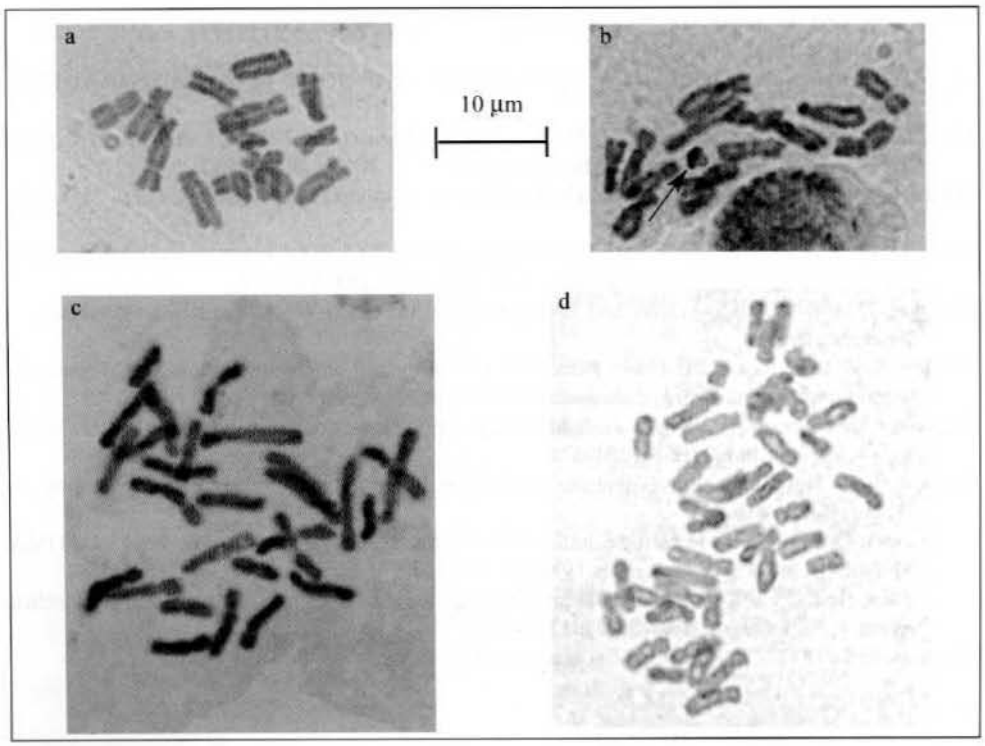

Fig. 3 Mitotic metaphase plates of *S. autumnalis*. a) M. Catalfano $2n = 14$; b) Favignana $2n = 14 + 1$ B; c) Marianopoli $2n = 28$; d) Belvedere $2n = 42$ (scale bar 10 µm).

autumnalis in the Mediterranean sensu strictu, this could be explained by absence of important factors to impose a definite geographical direction on the evolution of polyploids.

In the central-south European area diploids become more and more rare until disappearing as it is shown in Northern Italy, France and England where the northern distribution limit is found.

In conclusion, Sicily where both diploid and polyploid chromosome races occur together, may be considered as an area where the conditions for the ancestor's diploid cytotype preservation still exist and at the same time as a potential centre for future sympatric evolution in the Mediterranean starting from the present polyploid complex.

Acknowledgments

This study has been done within a research project funded by MIUR (Contribution ex 60%) which is gratefully acknowledged.

References

Battaglia, E. 1952: Filogenesi del cariotipo nel genere *Scilla*. II. Il cariotipo diploide di *Scilla autumnalis* L. — Atti Soc. Toscana di Scienze Naturali, Mem. LIX serie B: 130-145.

— 1957: *Scilla autumnalis* L.: biotipi *2n, 4n, 6n* e loro distribuzione geografica. — Caryologia **10(1)**: 75-95.

— 1963: Una mutazione con B-cromosomi, 2n = 14 +3B, in *Scilla autumnalis* L. (*Liliaceae*). — Caryologia **16(3):** 609-618.

— 1964: *Scilla autumnalis* L.: nuovi reperti di biotipi cariologici *2n, 4n, 6n*. — Caryologia **17(3)**: 557-565.

Corsi G., Garbari F. & Ghelardi A. 1996: Reports [In: Kamari, G., Felber, F & Garbari F. (eds) Mediterranean chromosome number reports-6]. — Fl. Medit. **6**: 249-262.

Darlington C D., & La Cour F. 1960: The handling of chromosomes. — George Allen & Unwin, London.

Ebert, I., Greilhuber, J. & Speta, F. 1996: Chromosome banding and genome size differentiation in *Prospero* (*Hyacinthaceae*): diploids* — Pl. Syst. Evol. **203**: 143-177.

Favarger, C. 1984: Cytogeography and Biosystematics. In: Grant W.F.: Plant Biosystematics. — Academic Press.

Guillen, A. & Ruiz Rejon, M. 1984: Structural variability and chromosome numbers Variation in natural populations of *Scilla autumnalis* (*Liliaceae*). — Plant Syst. Evol. **144**: 201-207.

Illuminati, O. Spinosi, K., Bianchi, G. & Marchi, P. 1995 Numeri cromosomici per la Flora italiana. — Inf. Bot. Ital. **27(2-3)**: 261-274.

Speta, F. 1979: Karyological investigations in *Scilla* in regard to their importance for taxonomy. — Webbia **34(1)**: 419-431.

— 1993: The Autumn-Flowering Squills of the Mediterranean Region. — Proceed. 5th OPTIMA Meeting Istanbul 8-15 september 1986 pp. 109-124.

— 2000: Beitrag zur Kenntnis der Gattung *Prospero* Salisb. (Hyacinthaceae) auf der griechischen Kreta. — Linzer.biol. Beitr. **32(2):** 1323-1326.

Stebbins, G. L. 1971: Chromosomal Evolution in Higher Plants. — Edward Arnold, London.

Addresses of the authors:
Dott. Anna Geraci, Prof. Rosario Schicchi, Dipartimento di Scienze Botaniche dell'Università degli Studi di Palermo, via Archirafi 28 – I-90123 Palermo.