Alessandro Chiarucci & Vincenzo De Dominicis

The diversity and richness of the serpentine flora of Tuscany

Abstract

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The floristic check-list of ultramafic (serpentine) outcrops of Tuscany is presented. Papers, dating from 1841 to 1998 concerning flora, vegetation, ecophysiology and soil, were accurately checked in order to obtain floristic data which were stored in a data base. From the analysis of the resulting checklist 809 sub-generic taxa were recorded, i.e. about 14.5% of the whole Italian flora. The most represented families were *Compositae* (12.6%), *Graminaceae* (11.6%), *Leguminosae* (10.4%), *Caryophyllaceae* (5.0%), *Rosaceae* (4.9%), *Labiatae* (4.5%), *Umbelliferae* (3.3%) and *Cruciferae* (3.2%). The life form spectrum was dominated by hemicryptophytes and therophytes in accordance with the general features of the Tuscan flora, whereas the proportion of woody species (chamaephytes and phanerophytes) was relatively higher. The list of endemic and serpentine-preferential plants is provided and some taxa needing in-depth studies are discussed.

Introduction

Ultramafic (serpentine) outcrops are located in several sites of Tuscany and they host a very distinctive flora with endemic and rare plants. The nature of serpentine soils and their island-like distribution are important factors for race-selection and speciation (Pichi Sermolli 1948; Chiarucci & al. 1998). Many botanists have been involved with the study of the Tuscan serpentine flora: in 1538, Andrea Cesalpino noted the peculiarity of this flora and described an "*Alysson*" linked to serpentine soils. In the second half of 19th century and in the first half of the 20th century, many botanists (e.g. G. Amidei, T. Caruel, A. Fiori and R. E. G. Pichi Sermolli) studied this flora. In the last decades, most of the research was done by O. Vergano Gambi and colleagues who discovered *Alyssum bertolonii* - the same "*Alysson*" of Cesalpino - as the first nickel-hyperaccumulator plant and worked on the ecophysiology of serpentine plants. Few studies on floristics and phytogeography were published in the last decades. From 1992, a project on vegetation ecology of Tuscan serpentine soils was started in Siena, which also provided many phytogeographical data.

The aim of this project was to realise a plant checklist of Tuscan serpentine soils in order to test island biogeography theory (MacArthur & Wilson 1967). In fact, serpentine outcrops can be considered as inland-on-mainland environments and biogeography theory can

help to understand their species richness and species distribution (Kruckeberg 1991). The first step of the project consisted in the compilation of a preliminary check-list based on published data, whereas a future part will involve field and herbarium work.

Data collection and analysis

A data-base was prepared to store the floristic data. All the publications about Tuscan ultramafics - from Amidei (1841) onwards - were checked for floristic data. Nomenclature was standardised according to Pignatti (1982), for most species, Chiarucci & al. (1995), for serpentinophytes, and Moraldo (1986), for the genus *Stipa*. The plant names originally published by the different authors were stored in the data-base to allow future nomenclature checks. Floristic data were stored with the reference to the ultramafic outcrop or outcrops to which they refer. In this paper we provide the first results concerning: a) taxonomic diversity; b) life-form spectra; c) endemic taxa; d) taxa needing in-depth taxonomic studies.

Results and discussion

The analyses of the published papers resulted in a provisional checklist, consisting of 809 sub-generic taxa, i.e. about 14.5% of the whole Italian flora (Pignatti 1982). The most represented families were *Compositae* (107 taxa, 12.6% of the flora), *Graminaceae* (99, 11.6%), *Leguminosae* (89, 10.4%), *Caryophyllaceae* (43, 5.0%), *Rosaceae* (42, 4.9%), *Labiatae* (38, 4.5%), *Umbelliferae* (28, 3.3%), *Cruciferae* (27, 3.2%), *Orchidaceae* (25, 2.9%), *Cyperaceae* (21, 2.5%), *Liliaceae* (21, 2.5%), *Scrophulariaceae* (20, 2.3%), *Ranunculaceae* (18, 2.1%). The relative importance of the families observed in this flora

Table 1. The life-form spectrum of the total flora recorded for Tuscan ultramafics, compared with the life-form spectra of the Northern Apennine ultramafics (Ferrari & al. 1991), the flora of Tuscany and the flora of Italy (Pignatti 1994).

Life-form	Number of *taxa*	Percentage of the flora	Northern Apennine ultramafics	Italian flora	Tuscan flora
Therophytes	222	27.4%	17.7%	25.1%	30.7%
Geophytes	98	12.2%	10.3%	12.1%	14.1%
Idrophytes	2	0.2%	0.0%	2.6%	2.7%
Hemicryptophytes	324	40.0%	52.0%	41.7%	37.5%
Chamaephytes	60	7.4%	9.2	10.3	6.2%
Phanerophytes	103	12.8%	10.8	8.5	5.8%
Total	**809**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

agrees with that observed by Ferrari & al. (1991) for the flora of the ultramafic outcrops of northern Apennines, Italy. From the analysis of the Raunkiaer life-form spectrum it emerged that 40% of the flora consisted of hemicryptophytes, followed by therophytes, as for the whole flora of Italian peninsula and the flora of Tuscany (Pignatti 1994). With respect to the Italian flora a relatively higher proportion of woody species (phanerophytes and chamaephytes) was found. The comparison with the Northern Apennine ultramafics (Ferrari & al. 1991) showed a higher proportion of therophytes and a significantly lower amount of hemicryptophytes which reflect the relatively more Mediterranean features of the climate of Tuscany.

The serpentine endemic taxa recorded were 11 (Table 2). Obviously, since this checklist originates from published data, all of them were already known for Tuscan ultramafics, but some of them with a different taxonomic status and/or names; Among these *Stipa etrusca* Moraldo and *Biscutella pichiana* Raff. ssp. *pichiana* were the last to be described as autonomous taxa (Moraldo 1986, Raffaelli & Fiesoli 1993). Eleven serpentine-preferential plants were also found (Table 2), but the distribution of most of them is scarcely known for Tuscany and new floristic studies could change their distribution range. The distribu-

Table 2. Serpentine endemics and locally serpentine-preferential plants.

Serpentine endemics
Alyssum bertolonii Desv.
Armeria denticulata (Bertol.) DC.
Asplenium cuneifolium Viv.
Biscutella pichiana Raff. ssp. *pichiana*
Centaurea aplolepa Moretti ssp. *carueliana* (Micheletti) Dostal
Euphorbia nicaeensis All. ssp. *prostrata* (Fiori) Arrigoni
Leucanthemum pachyphyllum Marchi et Illuminati
Minuartia laricifolia (L.) Sch. et Th. ssp. *ophiolithica* Pignatti
Stachys recta L. ssp. *serpentini* (Fiori) Arrigoni
Stipa etrusca Moraldo
Thymus acicularis W. et K. var. *ophioliticus* Lacaita
Locally serpentine-preferential plants
Artemisia saxatilis W. et K.
Euphorbia spinosa L. ssp. *spinosa*
Festuca inops De Not.
Festuca robustifolia Mgf.-Dbg.
Genista januensis Viv.
Iris lutescens lam.
Notholaena marantae (L.) Domin ssp. *marantae*
Onosma echioides L.
Plantago holosteum Scop.
Silene paradoxa L.
Stipa tirsa Steven
Trinia glauca (L.) Dumort. ssp. *glauca*

tion of *Stipa tirsa* Steven is, on the other hand, well known since this species has its single known locality for the Italian peninsula on the serpentine of Upper Tiber Valley (Pichi Sermolli 1948, Pignatti 1982), where it is endangered by pine afforestation (Chiarucci & al. 1996).

Some interesting taxa were also present on Tuscan serpentine and in-depth studies are needed to clarify their taxonomic position. Among these, a taxon of *Linum* belonging to the *L.* gr. *alpinum*, a taxon of *Anthemis* similar to *A. montana* L. (Chiarucci & al. 1998) and a taxon of *Sesleria* similar to *S. insularis* Sommier, but with marked differences (Rossi & Ubaldi 1995, Chiarucci & al. 1998). All these taxa are probably restricted to ultramafic outcrops and they are presently known to be restricted to one (*Anthemis*) or two (*Linum* and *Sesleria*) ultramafic sites of Tuscany.

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Address of the authors:
A. Chiarucci & V. De Dominicis Dipartimento di Biologia Ambientale, Università di Siena, Via P.A. Mattioli 4, 53100 Siena, Italy. — Phone +39 (0)577 298872, fax +39 (0)577 298860, e-mail chiarucci@unisi.it