

THE FLORA IBERICA PROJECT: RESULTS AND PROBLEMS

SANTIAGO CASTROVIEJO

Abstract

Objectives, content and results of the *Flor Iberica* project are explained. Information on the 21 programmed volumes is given, particularly on the four already published.

Introduction

The fields of botany and zoology in Spain have reached the most decisive moment of the century. By all indications, never before has so much money been invested, never have so many professionals been doing research and publishing so much as occurs today. In spite of all this, we are far from being able to say that we know our natural environment (or its biological diversity) well.

There are three main reasons for this: a, the richness and diversity of our natural environment, b, the historical backwardness in this type of research, and c, the marginal emphasis given –with a few notable exceptions– to taxonomy by the postwar botanical school in Spain.

If we analyze the first two of these factors in relation to our knowledge of vascular plants, we find that by the middle of this century the majority of European countries (including Portugal) had already compiled numerous accounts of their national floras as well as of regional and provincial ones. In Spain, by contrast, the only work worthy of comparison to these (*Prodromus Florae Hispanicae, insularumque Balearium*) was written between 1878 and 1891 by an Austrian, Mauritius Willkomm, in collaboration with a Dane, John Lange.

While in the rest of Europe specimen collection has been essentially concluded, with the floras of those territories well-represented in scientific collections (herbaria), in Spain we continue to discover new species and new areas.

A glance at Table 1 gives an impression of the importance of our biodiversity in the plant kingdom, based on data taken by numerous authors, as presented in the symposium “La flore du bassin méditerranéen: assai de systématique synthétique” organized by the C.N.R.S. in 1975.

No comparison can be made to the Atlantic or Central European countries (United Kingdom, Germany, Holland, Belgium, Scandinavia, etc.), nearly all of which have between 1200 and 2000 species. This is a very low amount relative to the number of species found in the Mediterranean countries of substantial size. The floras of countries such as Egypt and Libya are relatively species-poor, due to the rather narrow Mediterranean zone in these areas where the desert extends fairly close to the coast.

How rich is our flora really? Table 2 summarizes data from various works which have attempted to include all our vascular plants, based, of course, on the information

Country (author)	n of species
Spain (E.F. Galiano)	ca. 7.500
Portugal, Mad. & Azores (A.R. Pinto da Silva)	3.117
Mediterranean France (R. de Vilmorin)	ca. 3.000
Italy (G. Moggi)	5.500-6.000
Greece (Greuter & al.)	ca. 5.500
Turkey (P.H. Davis)	ca. 8.000
Egypt and Libya (L. Boulos)	2.085
Algeria and Tunisia (P. Quézel & D. Bounaga)	ca. 3.300
Morocco (C. Sauvage)	ca. 4.200

Table 1. Species richness of mediterranean countries. Source: GUINOCHET, M., GUITTONNEAU, G. OZENDA, P., QUÉZEL, P. & CH. SAUVAGE (eds.) 1975, "La flore du bassin méditerranéen: assai de systématique synthétique" C.N.R.S., Paris, 1975. (The figures, compiled 20 years ago, have comparative but not absolute value today. For data on Spain, see the estimates given at the end of the present article.)

Willk.	Fl. Eur.	Elenc.	Checklist	
species	5.089	5.250	5.926	5.597
Subsp. + vars.	500	698	611	1.541
Total	5.900	5.948	6.537	7.138

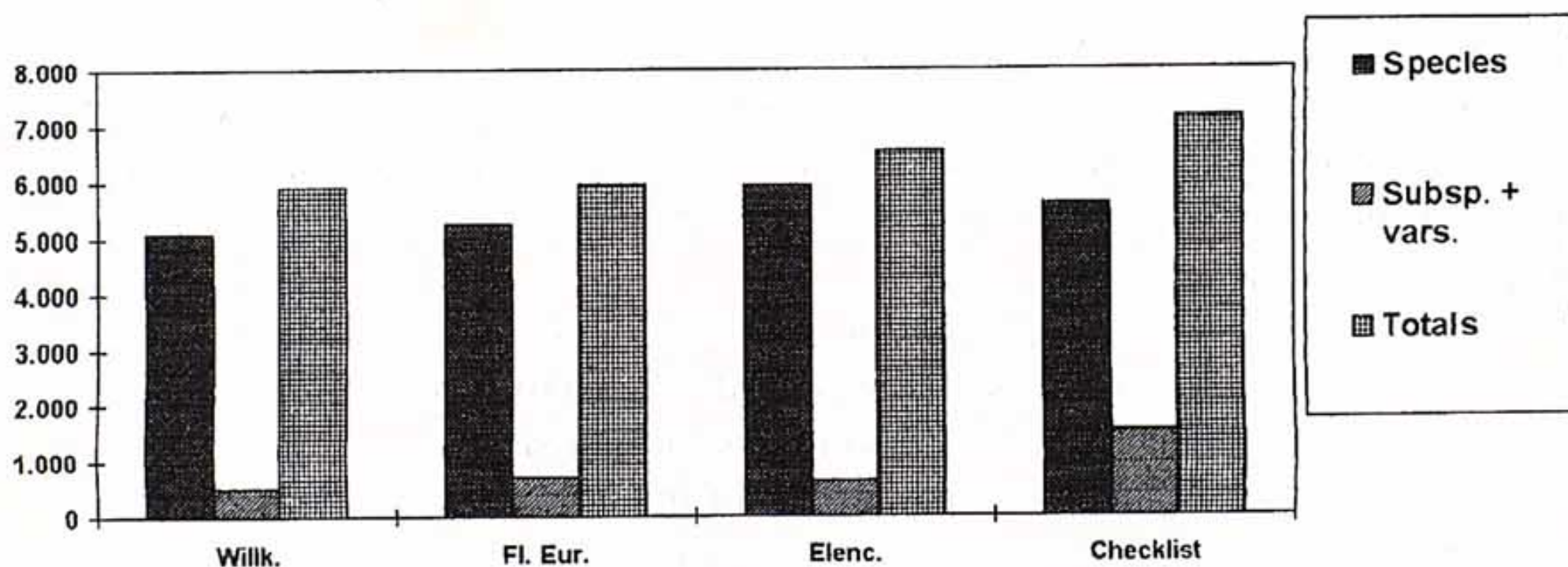


Table 2. Our floristic diversity. Sources: Willk.: M. WILLKOMM & J. LANGE. 1961-1880. *Prodromus florum hispanicae* ... 3 vols. Stuttgart. and M. WILLKOMM. 1893. *Supplementum prodromi florum hispanicae*. Stuttgart; Fl. Eur.: TUTIN & al. (eds.). 1964-1980. *Flora Europaea*. 5 vols. Cambridge Univ. Press.; Elenc.: E. GUINEA & A. CEBALLOS. 1978. *Elenco de la flora vascular española*. ICONA. Madrid. Checklist: B. E. SMYTHIES. 1984-1986. *Flora of Spain and the Balearic Islands. Checklist of Vascular Plants*. Englera 32(1) & 3(2). Berlin.

available at the time. It is apparent that the oldest works gave low estimations of the species number relative to figures given in more modern works. Over time, the estimates of species number have become progressively greater. The most current data can be taken from *Flora iberica*, in which little more than 20% of our vascular plants have been studied, with 1798 species and subspecies identified. If we extrapolate this data to the total, we get a figure of approximately 8500 species and subspecies. This indicates that Spain, even with the Canary Islands excluded, is the country with the richest vascular plant biodiversity in all of Europe and the Mediterranean.

With this great degree of diversity, the identification of wild Spanish plants –an essential task in much of the work of ecologists, agronomists, and foresters– could present considerable problems. Without any reliable reference work, one had to refer to the now-classic *Flora europaea* (Cambridge 1964-1980), the only work which, encompassing all of Europe, includes our territory. With the use of this work, the errors characteristic of such a general work are incorporated, and the user is faced with the additional problem of having to identify the plants of interest among all European floristic elements.

Under such circumstances the *Flora iberica* project was born as a national effort to pay off the historical debt which botanists as a group owe to society, with the degree of quality that can be expected this point in the twentieth century. It is obviously not the most appealing project for a taxonomist, since a large part of the work consists of compiling and summarizing the abundant data already published, but it is indeed the most urgent in Spanish Botany.

As a result, a project with the following characteristics was defined:

Objectives

1. Update information on the flora of the Iberian Peninsula and the Balearic Islands, by original taxonomic research as well as by synthesis of data available in the literature.
2. Facilitate the identification of vascular plants to all professionals of other fields with such a need, as well as to amateurs and naturalists.
3. Stabilize the scientific names of the Plants in our flora

Characteristics

1. Taxonomic synthesis based on original research carried out using modern approaches
2. Clear and precise scientific terminology in morphological descriptions.
3. Geographic distribution of native plants in our territory, based almost exclusively on data confirmed by means of at least one herbarium specimen (Basic Herbaria).
4. High quality original drawings of all the endemics and at least one species of each genus.
5. Rigorous literature search of all names applied to plant in our territory, such that one may easily determine to which plant an author refers with a particular name.

6. Strict application of the International Code of Botanical Nomenclature in the selection of a correct name for each plant.

7. Standardization in accordance with international norms of all cited names of authors, autonomous works, and journals.

8. Sound explanation of etymology and indication of the stressed syllable for all accepted generic, specific and intraspecific names.

9. Clear and succinct data on habitat, flowering period, general distribution, common names, and traditional uses for each taxon.

10. Reliable commentary, where appropriate, on problems with variability, nomenclature, etc., for a given taxon.

Fortunately, government institutions (the *Dirección General de Investigación Científica y Técnica* as well as the *Consejo Superior de Investigaciones Científicas*) appreciated the magnitude and significance of the project, and the instigator group received the administrative and financial support necessary to begin. This support was limited at first (1979-80), but became clearer and more decisive since the official meetings of the DGICYT beginning in 1983-84.

The instigator group is comprised of researchers from the Real Jardín Botánico (CSIC, Madrid), Centro Pirenaico de Ecología (CSIC, Jaca) and the Instituto Botánico da Universidade (Coimbra), with the support of the Conservatoire et Jardin Botaniques de la Ville de Genève (Switzerland), and Dr. h.s.c. M. Laínz, S.J., whose work in supervising text and style has been extremely valuable.

In the years that followed, some researchers left the project, while many others from numerous institutions joined (e.g., the Departamento de Botánica de la Universidad de Salamanca, Departamento de Botánica de la Facultad de Farmacia de la Universidad de Barcelona, and the Departamento de Biología Vegetal-II de la Facultad de Farmacia de la Universidad Complutense). Today we can say that almost all Spanish and Portuguese plant taxonomists participate in one way or another in the project.

The heterogeneous assemblage of contributors are grouped into the following committees with very clearly defined functions:

Editors (vary with each volume; the following are or have been editors: Drs. C. Aedo, C. Benedí, S. Castroviejo, S. Cirujano, C. Gómez-Campo, M. Laínz, G. López González, P. Montserrat, R. Morales, J. F. Muñoz Garmendia, C. Navarro, G. Nieto Feliner, J. Paiva, E. Rico, S. Talavera, B. Valdés and L. Villar)

Authors of the syntheses of the different genera (more than 50, from 7 countries)

Consultants (more than 60 from 6 countries)

Botanical Artists (Dr. E. Sierra Ráfols and others -Juan Castillo, José Pizarro, Marta Chirino, etc.- for the next volumes), *Philologists* (Drs. J. M. Liaño† and M. Martínez), *documentalists* and *editing technicians*, etc.

The sponsors since the initial stages have been:

CAICYT (Comisión Asesora de Investigación Científica y Técnica).

DGICYT (Dirección General de Investigación Científica y Técnica).

C.S.I.C. (Consejo Superior de Investigaciones Científicas).

“Acciones Integradas” Program of the Ministerio de Educación y Ciencia.

Among our collaborators we must first of all mention the Conservatoire et Jardin Botanique de la Ville de Genève, which has generously provided us, especially at the beginning, with all necessary bibliographical support, as well as making available their extremely valuable herbarium collections. Similarly, we must recognize the most important Iberian herbaria, which generously assisted by providing their collections to the authors of the syntheses. These herbaria are listed below alphabetically according to their international abbreviations:

- BC, Instituto Botánico de Barcelona
- BCF, Facultad de Farmacia, Universidad de Barcelona
- COI, Instituto Botánico da Universidade, Coimbra
- G, Conservatoire et Jardin Botaniques de la Ville de Genève
- GDA, Facultad de Farmacia, Universidad de Granada
- GDAC, Facultad de Ciencias, Universidad de Granada
- JACA, Centro Pirenaico de Ecología (CSIC, Jaca)
- MA, Real Jardín Botánico (CSIC, Madrid)
- MAF, Facultad de Farmacia, Universidad Complutense, Madrid
- MGC, Facultad de Ciencias, Universidad de Málaga
- SALA, Facultad de Ciencias, Universidad de Salamanca
- SEV, Facultad de Ciencias, Universidad de Sevilla

Thanks to this support and other assistance (BM K S P FI MPF, etc.) we have been able to work with extremely valuable material. Table 3 summarizes the specimens studied for each of the volumes completed to date.

With the crucial task of documentation an attempt was made to be very thorough, which has led us to the generation of data bases (bibliographical, chorological, taxonomic, etc.) which are in themselves important results. Table 4 summarizes the contents of these data bases.

Vol.	n. of specimens studied
I	c. 22.000
II	c. 35.000
III	c. 50.000
IV	c. 50.000

Table 3. Herbarium material studied in each volume of *Flora Iberica*.

Type of data base	n. of entries
Chorological	240.000
Taxonomical	24.000
Authors of taxa	1.518
Books and pamphlets	860
Journals	488
Reprints	4.050

Table 4. Data bases generated for *Flora Iberica*.

Perhaps the most notable feature has been the willingness of European taxonomists to participate in the writing of syntheses of the genera in which they specialize (authors), as well as the revision and correction of manuscripts (consultants). Table 5 summarizes this collaboration numerically (the figure in parentheses indicates the number of countries represented by the members of each group).

Concerning the team's output and the pace at which the volumes appear, despite an initial impression of slowness in the preparation and editing of the syntheses (species descriptions), an examination of Table 6 shows a moderate rate of production comparable to those of the most important floras assembled in the second part of the twentieth century. Table 6 should be interpreted with certain other factors taken into account, such as the budget (*Flora iberica* has one of the lowest) and the size of the team — although

Vol.	Editors n.(countries)	Authors n.(countries)	Consultants
I	7 (2)	30 (5)	19 (6)
II	7 (2)	49 (9)	32 (9)
III	10 (2)	28 (5)	28 (6)
IV	11 (2)	41 (5)	25 (5)
V	5 (2)	23 (3)	—

Table 5. Researchs contributing to the *Flora Iberica* project.

Flora	Year init.	1st vol.	Sp. publ.	Total	%	Sp./ year	year compl.
<i>Europaea</i>	1958	1964	11.557	11.557	100	770	1978
<i>USSR</i>	1931	1933	17.520	17.520	100	515	1964
<i>Australia</i>	1979	1981	2.631	18.000	15	329	2043
<i>W.Tr.Afr.</i>	1851	1954	7.349	7.349	100	387	1972
<i>Neotrop.</i>	1968	1968	4.624	90.000	5	220	2397
<i>S. Africa</i>		1966	2.843	19.500	15	123	2124
<i>Zambes.</i>	1956	1960	3.215	9.300	35	110	2044
<i>Tr.E.Afr.</i>	1949	1952	6.425	10.500	61	173	2013
<i>Malesiana</i>	1947	1954	4.837	25.000	19	138	2135
<i>Iberica</i>	1981	1984	1.798	8.500	20	129	2005

Table 6. Rates of production of the most important regional vascular plant floras and flora ibérica. Source: R. M. POLHILL. 1989. Production rates of major regional floras. *Fl. Males. Bull.* 1: 11-22. (Data on *Fl. Iberica* were compiled for the present article; among published species the subspecies are also included in order to give them a similar consideration.)

Abbreviations used: Year init.: Year in which flora initiated; 1st vol.: Year of publication of first volume; Species publ.: Number of species published; Total: Total number of species in the territory; %: Percentage of species already studied in relation to the total number; Sp./year: Average number of species published per year; Year compl.: Year of actual or projected completion; *Europaea*: *Flora Europaea*; *W. Tr. Afr.*: *Flora of West Tropical Africa*; *Neotr.*: *Flora Neotropica*; *S. Africa*: *Flora of Southern Africa*; *Zambes.*: *Flora Zambesiaca*; *Tr. E. Afr.*: *Flora of Tropical Eastern Africa*; *Malesiana*: *Flora Malesiana*; *Iberica*: *Flora Iberica*.

it has received great international support, our team is small compared to those of *Flora Neotropica*, *Flora of Australia*, *Flora Malesiana*, *Flora Europaea*, etc. To this it must be added that two more volumes will appear shortly, which when taken into account increases significantly the calculated rate of production.

Here it is also necessary to point out that in 1994 some measures were adopted to change the functioning of the team (committees) such that preparation and publication are expedited without any loss of quality. These measures will also result in an acceleration of the production rate.

Table 7 shows the general plan of the work, indicating the editors responsible for each volume and the number of species, according to *Fl. Eur.*, which will be treated. It should be noted that, in accordance with the new program, each of the volumes in

Vol.	content	n. taxon	year publi.	editors
I	Lycopodiaceae-Papaveraceae	411	1986	SC, ML, GL, PM, FMG, JP & LV
II	Platanaceae-Plumbaginaceae	653	1989	SC, ML, GL, PM, FMG, JP & LV
III	Plumbaginaceae-Capparaceae	381	1993	SC, CA, SCB, ML, ML, PM, RM, FMG, CN, JP & CS
IV	Cruciferae-Monotropaceae	407	1993	SC, CA, CGC, ML, PM, RM, FMG, GNF, ER, ST & LV
V	Primulaceae-Saxifragaceae	181	1996	SC, RM & JP
VI	Rosaceae	166	1997	FMG & CN
VII	Leguminosae	435	1998	ST & BV
VIII	Haloragaceae-Euphorbiaceae	175	1997	CB, GNF, JM & JP
IX	Rhamnaceae-Polygalaceae	126		FMG & CN
X	Araliaceae-Umbelliferae	215		SJ & GNF
XI	Gentianaceae-Boraginaceae	295		BV
XII	Verbenaceae-Callitrichaceae	330	1998	RM
XIII	Plantaginaceae-Scrophulariaceae	352		ER
XIV	Myoporaceae-Campanulaceae	13		
XV	Rubiaceae- Dipsacaceae	170		
XVI	Compositae	799		
XVII	Butamaceae-Juncaceae	9		
XVIII	Cyperaceae-Lemnaceae	171	1999	SC
XIX	Gramineae	454		
XX	Liliaceae-Dioscoreaceae	236		
XXI	Orchidaceae	81		

Table 7. General plan of flora ibérica. Scientific Editors: CA = Carlos Aedo, CB = Carles Benedí, SC = Santiago Castroviejo, SCB = Santos Cirujano, CGC = César Gómez Campo, ML = Manuel Laínz, GL = Ginés López González, PM = Pedro Montserrat, RM = Ramón Morales, FMG = Félix Muñoz Garmendia, CN = Carmen Navarro, GNF = Gonzalo Nieto Feliner, JP = Jorge Paiva, ER = Enrique Rico, CS = Carlos Soriano, ST = Salvador Talavera, BV = Benito Valdés, LV = Luis Villar (edit. colab. JM = Julián Molero, SJ = Stephen Jury).

Notes: Families are ordered in accordance with Stebbins (1974) "*Flowering plants - Evolution above the species level*".

preparation will include fewer species than the four already published. In this way, the number of scientists responsible for each volume is thereby reduced, the families already completed can be published more promptly without being held up by other authors, and the volumes become more manageable.

Results

After almost 15 years of work, with four volumes published and three in an advanced phase of preparation, the results obtained indicate that the need for revision of our flora is greater than what we initially supposed. The results should be measured not only by the number of volumes published, but also by various other significant parameters, such as:

1. Research articles published in scientific journals (Our journal *Anales Jard. Bot. Madrid*, now includes a series entitled *Notulae taxinomicae, chorologicae, nomenclaturales, bibliographicae aut philologicae in opus Flora iberica intendentes*, which presents most of the findings of the authors of the syntheses).

2. Extensive data bases (Table 4) with many applications, partially published. Creation of the series *Archivos de Flora Iberica*, resulting in six volumes including "números cromosómicos", "corología ibérica" y "nombres vernáculos".

Vols.	I	II	III	IV	Total
New species	8	5	33	147	
New subsp.	3	9	2	3	17
New spec. combs.	1	1	16	15	66
New subsp. combs.	10	25	16	15	66
Total	22	40	60	26	168

Table 8. New taxa and nomenclature included in *Flora Iberica*.

Vol.	I	II	III	IV	Total
Genera	103	89	46	91	329
Species	352	555	352	343	1.602
Subsp.	35	92	21	48	196
Total (excl. vars.)	387	647	373	391	1.798
Fl. Europaea	357	501	272	315	1.445
% incr.	7,75	23,57	28,08	19,44	19,63

Table 9. Taxa recognized in *Flora Iberica* and *Flora Europaea*. Note: varieties are excluded because they are few in number (25 in vol. I; 7 in vol. II; 9 in III and 13 in IV) and would distort the comparison with *Flora Europaea*, which does not accept them; figures for the latter work were taken from those families included in the corresponding volumes of *Flora Iberica*.

3. Contributions new to science. Table 8 summarizes the most important findings. If we compare, as illustrated in Table 9, the data on the number of species and subspecies appearing in the four first volumes with the corresponding figures given in *Flora Europaea*, we find that the number of plants recognized in our flora has increased by about 20%, a surprising amount at this stage. Such figures are particularly striking in certain families, for example the Caryophyllaceae, where the increase in recognized taxa approaches 30%.

Not all the Iberian additions made to *Flora Europaea* are species new to science; the additions also comprise plants known previously from other regions, and others previously described but not subsequently accepted, as well as new finds never before identified.

4. Enrichment of herbaria resulting from plant collection campaigns, not only in poorly known zones of the Iberian Peninsula but also in other regions of floristic affinity (Alps, Central French Massif, Portugal, Morocco, etc.)

5. Other less visible but important results are those related to the training of researchers and the establishment of a standard of quality and style, as well as the cohering and invigorating effect of the project upon part of the botanical community. Another notable benefit has been the experience of international collaboration, allowing our teams to work more closely with those abroad.

Address of the author:

Dr. S. Castroviejo, Real Jardín Botánico, C.S.I.C., Pza. Murillo nº 2, 28014 Madrid, Spain.