AGRI GEN RES 018

GENETIC RESOURCES OF SAFFRON AND ALLIES (*CROCUS* SPP)

The CROCUSBANK Project

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What is Saffron?

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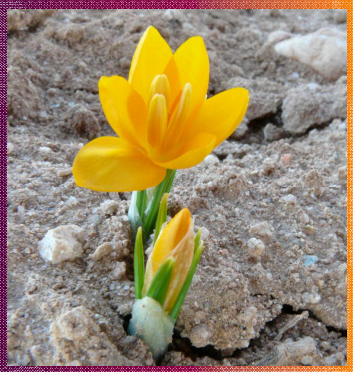
The Genus *Crocus* include other species economically important



85 species
Europe, North Africa and temperate Asia

The origin of saffron is Greece

frescoes of Thera, Santorini

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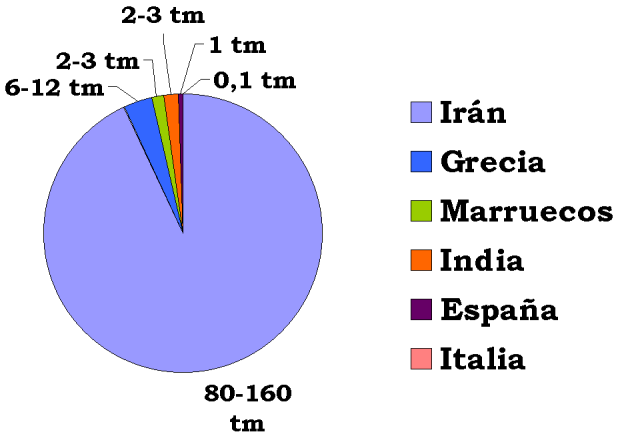
World production



Socio-economic aspects

Highest priced spice
- 11,000€/kg (average 1,500-2,200€)

55,000 Ha worldwide, 200-250 tones/year

Saffron is profitable and competitive (non-subsidiary crop)

Social importance
- Small-scale crop
- Stop declining populations in rural areas

New uses related to human well-being

The quality and prestige of the market correspond to the European brands

European Saffron under Protected Denominations of Origin (PDO):
- "Krokos Kozanis", Greece
- "Azafrán de la Mancha", Spain
- "Zafferano dell'Aquila" , Italy
- "Zafferano de San Gimignano", Italy
- "Zafferano di Sardegna", Italy
- "Zafferano delle Colline Fiorentine", Italy
- "Munder Safran", Switzerland

Others pending:

- "Safran du Gâtinais", France
- "Safran du Quercy", France
- "Safran de Provence", France
- "Safran du Tarn et du Laugarais", France
- "Safran de la Font Saint Blaise", France
- "Zaferano di Cascia", Italy
- "Azafrán del Jiloca", Spain
- "Azafranes del Campo de Bello", Spain

Biodiversity of saffron is in danger

Genetic erosion

The CROCUSBANK Project

OBJECTIVES

1. Collection, multiplication, conservation and documentation of *Crocus* genetic resources
   i. Exploration and collection of germplasm of saffron and related species.
   ii. Elaboration of a list of descriptors for the characterisation of the genus *Crocus.*
   iii. Multiplication of the collected plant material for its conservation in the Bank of Plant Germplasm of Cuenca (Spain).
   iv. Elaboration of an effective documentation system.
   v. To make available this material to potential users by distribution of corms, tissue culture and DNA samples.

OBJECTIVES

2. Characterization and evaluation of *Crocus* genetic resources
   i. Morphological: Floral features, corm size
   ii. Phenological: Flowering and relationship of climate, latitude and altitude
   iii. Cytological characterization: Chromosome numbers, genome size, ploidy level and identification of hybrids
   iv. Phytochemical: Chemical composition of saffron using chromatographic [GC/MS, HPLC/MS] and spectroscopic (IR, Raman, UV-Vis etc] techniques; metabolic profiling
   v. Molecular: AFLPs, SNPs, SSRs, etc.
   vi. Abiotic stresses and pathogen responses

OBJECTIVES

3. Application of the Crocus germplasm information and banked accessions
   i. Rationalization of collections, identifying duplicates in order to optimise the management of the bank
   ii. Definition of valuable germplasm for saffron breeding
   iii. Identification of ecologically rare and important species/genotypes in the natural environment
   iv. Identification of valuable species, cultivars and hybrids for the horticultural industry
   v. Comparative genomics with model and crop species to identify universal features and valuable genes for agronomy

THE CONSORTIUM

0: University of Castilla-La Mancha (UCLM, Spain)
1: Junta de Comunidades de Castilla-La Mancha (JCCM, Spain)
2: Agricultural University of Athens (AUA, Greece)
3: Aristotle University of Thessaloniki (AUTH, Greece)
4: Polytechnic University of Valencia (UPVLC, Spain)
5: Tradimpex JM Thiercelin (TJMT, France)
6: University of Catania (DOFATA-UNICT, Italy)
7: University of Debrecen (UD; Hungary)
8: National Polytechnic Institute of Toulouse (INPT, France)
9: University of Leicester (ULEIC, UK)
10: National Agricultural Research Foundation (Greece) (NAGREF, Greece)
11: University of Kastamonu (formerly part of Gazi U.) (KU, Turkey)
12: Azerbaijan National Academy of Sciences (ANAS, Azerbaijan)
13: National Research Institute (Egypt) (NRC, Egypt)

WP01. Saffron Collection

To collect saffron corms in geographical zones of saffron commercial cultivation (EU and abroad) and in zones of remaining minimal or relictic productions

Expected: 160 accessions

Obtained: 220 accessions

WP02. *Crocus* spp. Collection

To collect seeds and/or corms of Crocus taxa from public and private collections, nurseries, botanic gardens and wild populations in the geographical areas of distribution of the genus

Expected: 200 accessions

Obtained: 352 accesions

WP03. Elaboration of a list of descriptors

To elaborate a list of descriptors for the characterisation of the genus Crocus (including saffron) and morphological, phenological and physio-agronomical characterisation of the collected material

WP03. Elaboration of a list of descriptors

Expected: 20 morphological descriptors

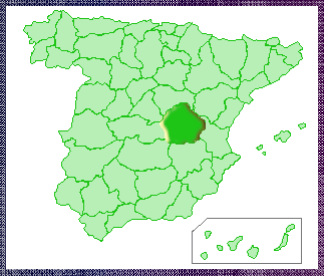
Obtained: 111

WP04. Multiplication, conservation and documentation

-The multiplication of the collected plant material for its conservation and management in the Bank of Plant Germplasm of Cuenca (Spain)

-To guaranty an appropriate management of the Crocus germplasm collection and to make available this material to potential users

The Germplasm Bank of Cuenca, Spain



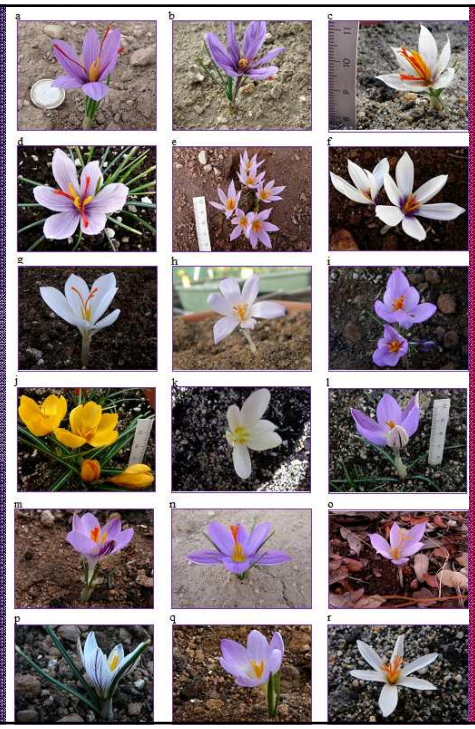
WP04: Results

On farm conservation of the collections

- Reserve Vegetative Collection
- Exchange Vegetative Collection
- Rest Vegetative Collection
- Seed Collection

572 accessions covering 47 species are being preserved

Documentation system working



WP05. Characterisation and evaluation

-*To characterise and evaluate genetic resources of C. sativus and allies take into consideration phenotypic characters with good heredability at different structural and physiological levels*

62 *C. sativus* plus 68 non-saffron accessions have been evaluated at morphological, phenological and agronomical level

54 accessions were tested for susceptibility to salt stress

Large genetic variability in saffron has been detected

Some details of morphological characterisation

Fotos 8 y 9.- Detalle de tépalos de *C. nevadensis* (BCU002359 y BCU002380)

Fotos 10 y 11.- Detalle de tépalos en distintas entradas de *C. serotinus* (BCU001657, BCU002618 y BCU002367)

Fotos 10, 11, 12, 13, 14 y 15.- Variabilidad morfológica observada en estilos de *C. serotinus* (BCU001657, BCU002367, BCU002550, BCU002618 y BCU002743)

Figura 36. Aspecto de las semillas de las distintas especies españolas del género Crocus.

Phytochemical characterisation

38 Saffron accessions and 31 other crocuses have been studied:

- FR-IR analysis
- Raman analysis
- Non-polar extracts from styles
  - Volatile compounds
  - GS-MS
- Response Surface Methodology (RSM)
- Colouring strength, bitterness & safranal content
- HPLC-DAD apocarotenoid analysis
- HPLC-DAD analysis of other metabolites

Data under analysis

Molecular and Cytological characterisation

1. Cytological analysis of somatic metaphase chromosomes (different crocus spp.)
2. Cytological analysis of meiosis
3. AFLP markers (high variation)
4. SNPs markers (high variation)
5. IRAP & EST-ISSRs markers (no variation)

Data under analysis

WP06. Application of the Crocus germplasm information and banked accessions

To initiate exploitation of accessions of Crocus and morphological, agronomic and marker data

-Identification of accessions of Saffron within the collection that are genetically identical

-Quantification of diversity in Saffron and Crocus

-Genomics in Saffron. The origin of saffron

-Identification of germplasm for exploitation by breeders and growers

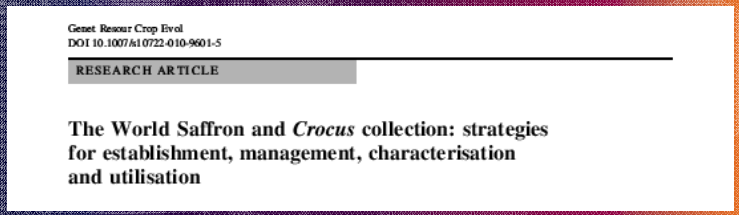
WP07. Project Management and Coordination

-To co-ordinate and administrate the project

-To monitor project's progresses

-To evaluate project's results

-To foster exploitation and dissemination of the results

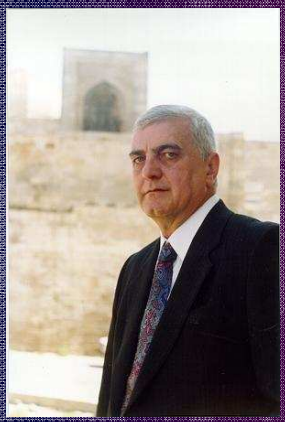

Genet Resour Crop Evol
DOI 10.1007/s10722-010-9601-5

RESEARCH ARTICLE

The World Saffron and *Crocus* collection: strategies for establishment, management, characterisation and utilisation

The Consortium

In memoriam



Fikrat Abdullaev
1943-2006

José Luís Guardiola
1943-2009

Thank you for your attention