

## The ECP/GR Cucurbits Working Group

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### Abstract

**Cucurbits include various crops used as food all over the world, the most economically important being melons, cucumbers, watermelons and pumpkins. Cucurbit genetic resources are necessary for breeders, given the high susceptibility shown by these crops to many pathogens. The European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR) is promoting the coordination of cucurbit genetic resources activities in Europe in order to increase and facilitate their conservation and use. The establishment of the Cucurbits Working Group (CWG) was proposed and formally approved by the ECP/GR Steering Committee in October 2003. The first activity of the CWG was the establishment of the European Central Cucurbits Database (ECCUDB), managed by the Polytechnic University of Valencia (Spain). It is known that 28 647 accessions are currently being stored in European institutions, of which 13 641 correspond to *Cucumis* genus, 7546 to *Cucurbita* genus and 6892 to *Citrullus* genus. Completion of the ECCUDB, including characterization and evaluation data, establishment of standard protocols for regeneration, definition of the minimum descriptor list for each crop and the planning of safety-duplication of each collection under long-term conservation conditions were defined as priority tasks for the Group. A project is being submitted to the EU call for proposals AGRI GEN RES 2005 to give impetus to the activities of the Working Group.**

### INTRODUCTION

Cucurbits include many of the world's food crops of great importance. The economically most important crops are melon, cucumber, watermelon and pumpkin. Worldwide, the production of cucurbits reached 140 million tonnes in 2004 (FAOSTAT data, 2005), which is 16.4% of total vegetable production and occupied 2.2% of harvested area. Asia is by far the continent with the greatest production and area dedicated to cucurbit cultivation, Europe ranking as the second greatest. Romania and Spain are the main producers of melons, followed by Italy. For cucumbers, the Russian Federation occupies the first place, followed by The Netherlands, Spain and Ukraine. Greece and Spain are the main producers of watermelon, while for pumpkins, squash and gourds, Ukraine is the country with the highest production, followed by Italy. Overall, the above-mentioned countries produce more than 50 percent of the 13.241 tonnes of cucurbits produced in Europe.

Cucurbits, mainly those belonging to *Cucurbita* genus, show a great diversity of uses. Pumpkins are consumed mainly for their mature flesh, elaborated into sweets made from the boiled or roasted flesh. However, in South America, some cultivars with small fruits are consumed in an immature state (Nee, 1990). Pumpkins are also used for feeding domestic animals. Pumpkin seeds are processed to obtain oil and proteins (Joshi et al., 1993). They are also traditionally employed in medicine. Some cultivars have an ornamental value and

occasionally male flowers and young sprouts may also be consumed. Plants of this genus are used as rootstocks, due to their resistance to certain diseases and abiotic stresses, in the production of watermelon, melon or cucumber seeds (Traka-Mavrona et al., 2000). In some Asian and European countries, the immature fruits of gourds, *Lagenaria siceraria*, are used in different ways. In Japan their flesh is sliced in order to facilitate its conservation and in China young sprouts are consumed. However, the most widespread use of gourds is as recipients. Musical instruments and cages are also made from gourds and they are also used as ornaments. Among the natives of tropical areas they are used for medicinal purposes (Robinson and Decker-Walters, 1997).

The family Cucurbitaceae belongs to the order Cucurbitales, superorder Violanae, class Magnoliopsida and subclass Dilleniidae. It includes the subfamilies Zanonioideae and Cucurbitoideae. The Cucurbitoideae subfamily is composed of seven tribes. Three of them, *Cucurbiteae*, *Molothrieae* and *Benincaseae* include the most economically important species, pumpkins and squashes belonging to the *Cucurbiteae* tribe, melon and cucumber to the *Melothrieae* tribe and watermelons to the *Benincaseae* tribe (Jeffrey, 1990).

Cucurbit genetic resources are necessary for breeders, mainly for melon, cucumber, watermelon and squash and pumpkins. Pests and diseases are the most important factors affecting cucurbit crops around the world. Wild relatives or accessions with specific origins have been exploited extensively as sources of resistance genes. The present and future progress of breeders depends on the effective conservation and use of genetic resources.

### **CUCURBIT GENETIC RESOURCES IN EUROPE**

According to the IPGRI Directory of Germplasm Collections in Europe and the European Central Cucurbit Database, the total number of accessions of cucurbits held in European collections is 28 647 (Table 1). Nearly half of these accessions belong to the *Cucumis* genus (13 641 accessions), followed by the *Cucurbita* (7546 accessions) and the *Citrullus* genus (6892 accessions). Other minor cucurbits, including 37 species belonging to 17 genera, add 568 more accessions. The N.I. Vavilov Research Institute of Plant Industry (VIR), St. Petersburg, Russian Federation, holds the largest collection, followed by the Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany and the Vegetable Genebank, Zaragoza, Spain. Five more collections hold more than 1000 accessions. Altogether, these collections hold 81% of the total number of accessions in Europe. The disproportion between the collection of cultivated and wild species is remarkable. Considering only the most economically important crops i.e. melon, cucumber, watermelon and squash, 98% of the taxonomically classified accessions belong to cultivated species. The most important collections holding wild species are the above-mentioned institutions (VIR, St Petersburg, IPK, Gatersleben) and the Research Institute of Crop Production (RICP), Olomouc-Holice, Czech Republic

### **THE COORDINATION OF CUCURBIT GENETIC RESOURCES IN EUROPE: A HISTORICAL PERSPECTIVE**

As a contribution to the activities of the European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR), the Polytechnic University of Valencia (Spain) carried out a survey on the cucurbit genetic resources held in Europe, in order to have a general idea about the status of cucurbit collections. The result of this inquiry was presented in an *ad hoc* meeting of the ECP/GR Network Coordinating Group on Vegetables held in Portugal in May 2000 and published in Nuez and Díez (2001). An updated abstract has been produced and is shown in Table 1. The aim of the Network Coordinating Group was to increase networking activities by increasing the number of Working Groups, consisting until then of the *Allium*, *Brassica* and Umbellifer crops Working Groups. One of the results of this meeting was the establishment of three more Informal Working Groups (IWG) for Solanaceae, Cucurbits and Leafy Vegetables. The tasks to be undertaken by the nominated focal persons of these Informal Working groups were also defined, the most important being:

- The establishment of workplans for the respective IWG;
- The development of Crop Databases;

- Deciding the possible goals in terms of regeneration standards, the establishment of minimum descriptor lists for each crop, safety-duplication and rationalization of the collections.

Future meetings were also planned in order to facilitate contacts and exchange experience between experts from different countries. As a result of the agreements reached at that meeting, a new meeting was held in Adana (Turkey) in 2000, in conjunction with the annual meeting of the EU-funded project RESGEN CT99-108 on *Cucumis melo*. Representatives from Bulgaria, Czech Republic, Hungary, the Netherlands, Russian Federation, Spain and Turkey attended the meeting as well as the EU *Cucumis melo* partners from Portugal, Spain and Turkey. The collections of the participating countries were presented by each attending member and the mode of operation of the Informal Cucurbits Working Group was defined. The proposed workplan consisted of the following tasks:

- Development of the European Central Cucurbit Database;
- Assessment of the safety-duplication status of collections and the planning of the transfer of safety-duplicates to genebanks with long-term conservation facilities;
- The establishment of regeneration guidelines and primary characterization protocols for cucurbitaceous species;
- The preparation of a letter for the next meeting of the Steering Committee, asking for the formal establishment of the Cucurbits Working Group.

First priority was given to the creation of the European Central Cucurbits Database (ECCUDB). The database was established at the Institute for the Conservation and Improvement of Agrodiversity (Polytechnic University of Valencia) (<http://www.comav.upv.es>). At present it holds the passport data of 22 815 accessions of 21 genera conserved in 37 holding institutions (see Díez et al., 2007) and is on-line searchable.

In a subsequent meeting of the Vegetables Network held in Skierniewice (Poland) in May 2003, the Working Group's actions and proposals were reviewed and priorities were set according to the recommendations made by the Steering Committee for Phase VII of ECP/GR. Documentation, task-sharing, characterization and evaluation were prioritized by the Informal Cucurbits Working Group. As a result of this meeting, a workplan was established (Thomas et al., 2005).

#### **CURRENT STATUS OF THE CUCURBITS WORKING GROUP**

The proposal to establish a formal ECP/GR Working Group on Cucurbits as part of the Vegetables, Medicinal and Aromatic Plants Network was approved by the ECP/GR Steering Committee in October 2003. Currently 17 countries (Albania, Bulgaria, Czech Republic, Georgia, Germany, Hungary, Ireland, Italy, Lithuania, the Netherlands, Poland, Portugal, Romania, Serbia and Montenegro, Slovakia, Slovenia and Spain) have nominated their representatives for the Cucurbits Working Group (<http://www.ecpgr.cgiar.org/Workgroups/Cucurbits/Cucurbits.htm>). The first meeting of the formal Working Group was held in Plovdiv, Bulgaria, 1-2 September 2005.

The meeting set the basis for further improvement of the quality and coverage of passport data in the Central Cucurbits Database. Plans were also made to include characterization and evaluation data, starting with a number of descriptors agreed by the Group for melon, cucumber, watermelon and *Cucurbita* species. These minimum lists of descriptors were drafted by the Group members during the meeting. Taxonomy references are also planned to be linked to the database. The safety-duplication status of the cucurbit collections in Europe was revised. Considering that a number of collections are not safety-duplicated, recommendations were made to make sure that all the unique samples are duplicated for safety, under formal bilateral arrangements, possibly in a different country. The Group discussed the importance of having general guidelines for regeneration of genebank accessions in order to secure genetic integrity and high quality of the seed. Guidelines with general practices for good regeneration and some specific examples were drafted as a preliminary document. These include suggestions on the disinfection of seeds, number of plants to use for regeneration, planting and transplanting practices, isolation systems, treatments during vegetation, harvest and processing guidelines. The workplan of the

Cucurbits Working Group established in 2002 was revised and updated. The main points of the workplan are summarized in Table 2. The report of the meeting will be published by IPGRI and will be available upon request to the ECP/GR Secretariat.

One of the points of greatest interest is the proposal that is being prepared for the EU call for proposals AGRI GEN RES 2005. Regeneration, characterization and evaluation activities will be undertaken. The European Central Cucurbits Database will be completed and enhanced using the results obtained in the project. Core collections will also be established in the project and the participation of NGOs will promote the utilization of the materials by organic farmers. The members of the Cucurbits Working Group will take advantage of the results obtained in this project.

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**Tables**

Table 1. Number of cucurbit accessions held in European genebanks.

Institutions (ISO codes <sup>1</sup> )	<i>Citrullus lanatus</i> (4 species)	<i>Citrullus</i> spp.	<i>Cucumis melo</i>	<i>Cucumis sativus</i> (19 species)	<i>Cucumis</i> spp.	<i>Cucurbita maxima</i>	<i>Cucurbita pepo</i>	<i>Cucurbita moschata</i>	<i>Cucurbita ficifolia</i>	<i>Cucurbita</i> wild (11 species)	<i>Cucurbita</i> spp.	Minor cucurbits (37 species of 17 genus)	TOTAL
BGR001	157	8	4	302	976	26	175	26	0	0	66	0	1817
CZE122	8	0	0	100	799	86	381	25	3	22	28	37	1713
DEU146	236	12	20	440	623	68	464	100	9	26	74	157	2560
ESP027	373	0	0	1410	432	0	0	0	0	0	305	0	2520
ESP004	144	0	0	611	26	0	0	0	0	0	0	59	921
ESP058	0	0	0	531	0	29	0	0	0	0	0	0	560
ESP026	246	5	0	563	127	0	270	225	65	0	9	38	1751
FRA215	177	0	0	0	0	0	0	0	0	0	337	0	514
FRA238	0	0	0	600	00	5	0	0	0	0	0	0	605
HUN003	212	9	0	194	191	10	309	479	28	7	1	45	1485
NLD037	0	0	0	0	934	0	0	0	0	0	0	0	934
PRT001	32	0	0	131	53	0	67	224	14	0	0	11	532
RUS001	4735	103	12	1135	1863	0	550	938	405	0	17	217	9975
TUR001	0	0	0	360	217	53	9	138	61	0	425	0	1271
Other	194	0	205	307	321	4	69	298	6	1	96	4	1554
<b>TOTAL</b>	<b>6514</b>	<b>137</b>	<b>241</b>	<b>6684</b>	<b>6562</b>	<b>281</b>	<b>179</b>	<b>1798</b>	<b>876</b>	<b>99</b>	<b>1357</b>	<b>568</b>	<b>28 712</b>

<sup>1</sup> BGR001: Institute for Plant Genetic Resources 'K. Malkov', Sadovo, Bulgaria; CZE122: Research Institute of Crop Production, Prague-Ruzyně (RIPC), Olomouc-Holice, Czech Republic; DEU146: Genebank, Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany; ESP027: Vegetable Genebank, Servicio de Investigación Agroalimentaria, Zaragoza, Spain; ESP004: Centro de Recursos Fitogenéticos, Madrid, Spain; ESP058: Consejo Superior de Investigaciones Científicas. Experimental Station "La Mayora", Málaga, Spain; ESP026: Institute for the Conservation and Improvement of the Agrobiodiversity, Polytechnic University of Valencia, Valencia, Spain; FRA215: Unité Expérimentale d'Angers, Groupe d'Etude et de contrôle des Variétés et des Semences, Angers, France; FRA238: Laboratoire d'Amélioration des Plantes Maraîchères, INRA, Montfavet, France; HUN003: Institute for Agrobotany, Tápíószéle, Hungary; NLD037: Centre for Genetic Resources, Wageningen (CGN), The Netherlands; PRT001: Banco Português de Germoplasma Vegetal, Braga, Portugal; RUS001: N.I. Vavilov Research Institute of Plant Industry (VIR), St. Petersburg, Russian Federation; TUR001: Aegean Agricultural Research Institute (AARI), Izmir, Turkey; Other: Twenty-eight small collections from seventeen countries.

Table 2. Main points of the Cucurbits Working Group workplan.

Action	Carried out by	Date by when action should be completed
Prepare a proposal of a Cucurbits project to be presented to the next EU Genetic Resources Programme	Chair and Vice-Chair	Ongoing
<u>Improve the ECCUDB</u>		
- Modify the structure of the ECCUDB for inclusion of primary characterization data	- Database manager and Chair	- Four months after the first meeting of the CWG (by January 2006)
- Send missing passport data to the DB manager	- WG members of countries not yet included in the DB	- March 2006
- Enter passport data into the DB	- DB manager	- March 2006
- Keep the database updated with new passport data	- All and DB manager	- Ongoing
- Add to the database a taxonomy information module	- DB manager and Chair	- January 2006
- Send available characterization data to DB manager (see minimum descriptors agreed by the Group in Plovdiv)	- All WG members	- When/if possible
- Send new characterization data to DB manager (see minimum descriptors agreed by the Group in Plovdiv)	- All WG members	- As soon as accession are regenerated and characterized
- Link the WG web page to Cucurbit information pages	- ECP/GR Secretariat	- November 2005
- Circulate the draft guidelines for regeneration and the draft minimum descriptor lists for characterization for approval by the WG members	- Chair	- October 2005
- Seek IPGRI's comments on the above minimum descriptor lists	- Vice-Chair	- As soon as descriptors are approved by the WG
- Make available on the web page the guidelines for regeneration of all cucurbit crops	- ECP/GR Secretariat	- One month after approval of the guidelines by the WG
- Make available on the web page the minimum descriptor lists for characterization of melon, cucumber, watermelon and <i>Cucurbita</i> spp.	- ECP/GR Secretariat	- One month after approval of the descriptors by the WG
- Identify experts on minor cucurbits in order to develop the respective minimum descriptor lists	- L. Horvat	- Before the next meeting of the WG
- Complete the draft table of safety-duplication status with information from members who did not attend the Plovdiv meeting	- Vice-Chair	- December 2005
- Promoting safety-duplication of each collection under long-term conservation conditions	- All WG members	- Ongoing