Global Strategy for the *Ex Situ* Conservation of Chickpea (*Cicer* L.)

Source: Taubert P.H.W. 1891. Leguminosae. In Engelmann (ed.): *Natürliche Pflanzenfamilien.* Vol. III, 3.

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Table of contents

Disclaimer

This document, developed with the input of a large number of experts, aims to provide a framework for the efficient and effective *ex situ* conservation of globally important collections of *Cicer* and its wild relatives.

The Global Crop Diversity Trust (the Trust) provided support for this initiative and considers this document to be an important framework for guiding the allocation of its resources. However the Trust does not take responsibility for the relevance, accuracy or completeness of the information in this document and does not commit to funding any of the priorities identified.

This strategy document (dated 1 December 2008) is expected to continue to evolve and be updated as and when circumstances change or new information becomes available.

Acknowledgment

The Strategy outlined here has been developed following extensive consultations with many stakeholders concerned with the conservation and use of the genetic diversity of *Cicer*. Valuable information, ideas and insights source from the many genebank managers and national and international programme scientists (listed in Annexes 2 and 3) who attended the Aleppo Workshop in 2007, the Fourth International Food Legume Research Conference in 2005, and/or contributed via the survey. Pertinent and useful input was also received from the technical reviewers of the draft Strategy.

Summary

The current status of *Cicer ex situ* genetic resources was assessed via a survey sent to the major chickpea collections, meetings bringing together researchers and curators of *Cicer* germplasm, database searching, and communications with relevant scientists and experts. Collection composition, facility status, regeneration needs, safety duplication status, information and documentation status, and status of accessibility of germplasm is presented based upon the gathered information. Gaps in the world collection of chickpea, improved utilization of *Cicer* germplasm, training, partnerships, and networks related to chickpea are surveyed.

Collection information is currently insufficient for many collections identified in the Strategy, and other collections potentially containing chickpea germplasm remain to be verified. From the available information, key collections containing important chickpea accessions and meeting international standards for conservation, information, and availability are highlighted. Collections holding priority germplasm and identified as in need of assistance to come to meet full international standards with respect to maintenance, documentation, and/or distribution are also identified. Other collections holding unique germplasm of *Cicer* are also highlighted for further investigation. These collections form the basis for a rational global conservation system for chickpea and its wild relatives, and the international community should consider supporting the holding institutions in order to ensure the long-term conservation, information availability, and distribution of these globally important resources.

1. Introduction

This Conservation Strategy summarizes information important to the evolution of a rational global *ex-situ* conservation system for chickpea and its wild relatives.

The genus *Cicer* comprises 42 wild species and one cultivated species, chickpea (*Cicer arietinum*). Chickpea, or garbanzo, is a crop of relatively minor importance on the world market, but is extremely important to local trade in numerous regions within the tropics and sub-tropics. Chickpea is grown and consumed in large quantities from South East Asia across the Indian sub-continent, and throughout the Middle East and Mediterranean countries, playing an important cultural as well as nutritional role. More recently chickpea has also grown in popularity in Africa and in Latin America, and by 2005 there was significant production in 54 countries worldwide.

Over 95% of the area, production and consumption of chickpea takes place in developing countries[1]. Chickpea has one of the best nutritional compositions of any dry edible legume and does not contain any specific major anti-nutritional or toxic factors. On average chickpea seed contains about 23% protein. Chickpea production depends on few expensive or environmentally detrimental inputs. The crop meets up to 80% of its nitrogen requirement from symbiotic nitrogen fixation and can fix up to 140 kg nitrogen per hectare per season from the air[2].

In the 1970s a few wild populations of chickpea were found by botanists in southeast Turkey. Botanically they are classified as a separate species (*Cicer reticulatum*), but their cross-fertility and morphological similarity to the domesticated chickpea are so close that it is highly likely these are the modern crop's wild ancestor[3]. This has led to the hypothesis that chickpea was domesticated in present-day Turkey or in the northern parts of Syria or Iraq. Chickpea remains are found in archaeological sites from Syria to Greece dating from the very early days of farming, and the crop clearly had an important role in the dispersal of the farming lifestyle. As with all crops it has been subjected to different selection pressures in different ecological and cultural settings and consequently has diversified into a range of varieties. These may be classified into two very different main forms. The Desi type, which is closer in form to the putative progenitor (*C. reticulatum)*, is found predominantly in India and Ethiopia, and generally has a bushy growth habit, blue-violet flowers and dark colored, angular, ram-head-shaped seeds. The Kabuli type generally has a more erect growth habit, white flowers and rounder, owl-head-shaped seeds and is grown predominantly in the Mediterranean region.

It is likely that Chickpea has a higher yield potential than is widely achieved on farmers' fields. Currently the average yield of dry pea (*Pisum sativum*) is more than the double that of chickpea[4]. Breeding for higher and more stable yields – the latter through enhanced resistance to pests and diseases – are thus major breeding objectives.[5].

[1] ICRISAT, http://www.icrisat.org/ChickPea/Chickpea.htm
[2] Ibid
[3] Ladizinsky G. 1995. Chickpea in *Evolution of Crop Plants* Second ed, Smartt and Simmonds, Longman Group UK Limited.
[4] FAOSTAT 2006.
[5] Ladizinsky G. 1995.

This conservation strategy aims to provide a blueprint for a more efficient and effective conservation of the chickpea genepool throughout the world, including both cultivated and wild species of the genus *Cicer*. Although the holdings of the latter are small compared to the cultivated species *C. arietinum*, they are potentially very important for research and crop improvement. The genus is included within the multilateral system of access and benefit sharing provided for by the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

1.1 The Strategy Development Process

The first consultations on the development of this conservation strategy for *Cicer* (as well as for other food legumes) took place at a special seminar held during the Fourth International Food Legume Research Conference, in New Delhi, India, in October 2005. Eighteen people from eleven institutions participated. Subsequently, in March 2006, a questionnaire (Annex 1) was distributed to the curators of 36 genebanks in 36 countries (Annex 2) to seek comprehensive information on the status of *Cicer* collections. Unfortunately the response to the questionnaire was not comprehensive.

The major event in the development of this strategy was a workshop that took place at ICARDA in Aleppo, Syria from 19 – 22 February, 2007, entitled: "Global Collaborative *Ex Situ* Conservation Strategies for Food Legumes (chickpea, lentil, faba bean and grass pea)". Annex 3 lists the workshop participants and the annotated agenda is given in Annex 4. A simplified questionnaire (Annex 5) was distributed to participants and other concerned researchers in advance of the meeting, and the responses were collated and verified at the workshop. Participants addressed a wide range of issues relating to increasing the efficiency and effectiveness of *ex situ* conservation and for strengthening links to actual and potential users of the germplasm. Following the workshop, further information was received from some genebanks- both those represented at the workshop itself as well as several that had not been present in Aleppo but were identified at the workshop as possibly having significant collections of *Cicer*.

In addition to the process listed above, additional sources of information consulted in drafting this strategy include:

- The regional crop conservation strategies for West Asia and North Africa, Americas, Southern Africa, South, Southeast, and East Asia, West and Central Africa, Central Asia and the Caucasus, and East Africa.
- Central Asia and Caucasus Plant Genetic Resources Inventory and regional Plant Genetic Resource Network.
- Correspondence between the Trust and national collections regarding regeneration backlogs.
- Various databases and information sources available on the internet including:
    - The Consultative Group on International Agricultural Research (CGIAR) System-wide Information Network on Genetic Resources (SINGER) database: http://singer.grinfo.net/
    - USDA – Genetic Resources Information Network (GRIN) database: http://www.ars-grin.gov/npgs/
    - EURISCO: http://eurisco.ecpgr.org/
    - ECPGR *Cicer* database: http://www.ecpgr.cgiar.org/databases/Crops/cicer.htm
    - FAO – World Information and Early Warning System on PGRFA (WIEWS): http://apps3.fao.org/wiews/germplasm_query.htm?i_l=EN

- Information Sharing Mechanism on the Implementation of the Global Plan of Action for the Conservation and Sustainable use of PGRFA: http://kctu048:8080/gpa/selectcountry.jspx
- Global Biodiversity Information Facility (GBIF): http://data.gbif.org/welcome.htm
- International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) website: http://www.planttreaty.org
- Bioversity International Germplasm Collection Directory: http://www.bioversityinternational.org/Information_Sources/Germplasm_Databases/Germplasm_Collection_Directory/index.asp

1.2 The genus *Cicer*

Cicer belongs to the Fabaceae (Leguminosae) family, tribe Cicereae Alef. The genus comprises ~43 species including the cultivated species *Cicer arietinum* L.

Cicer arietinum is diploid (2n = 2x = 16) and predominantly self-pollinated. Thirty-three of chickpea's wild relatives in the genus are perennials and the 9 remaining, including the cultivated species, are annuals. Some of the wild relatives have been utilized in breeding programmes and resistance to abiotic and biotic stresses have been incorporated into the crop from *Cicer reticulatum* and *Cicer echinospermum,*[6] chickpea's closest relatives. Screenings of the other species have uncovered many traits and characteristics that are of potential value to chickpea improvement programmes[7].

2. Overview of *Cicer* collections

This strategy identified 86 499 accessions of *Cicer* held in collections worldwide, gathered from the questionnaire, meetings, and other data sources.

This section provides a brief overview and analysis of the following data:
- total number of *Cicer* accessions
- the percentage of landraces
- the percentage of wild relatives
- the percentage originating in the country concerned
- the percentage originating outside the country
- the percentage of the collection formally duplicated, and where
- the nature of the storage facilities (long- and/or short-term)
- whether the data management is computerized, and with or without web access
- whether there are passport and/or characterization data available
- the existence and extent of regeneration requirements
- gaps in collections
- whether the host country has ratified the ITPGRFA

Note that the information in the tables in this section is in most cases reported by the institutes and genebanks themselves and is in many cases incomplete for some of the categories above.

[6] Iruela *et al*. 2002. *Theor Appl Genet* 104: 643-651.
[7] Croser *et al*. 2003. *Australian Journal of Agricultural Research* 54: 429-444.

2.1 Analysis of information from the regional conservation strategies

From 2005 to 2007 with support from the Global Crop Diversity Trust (Trust), regional conservation strategies for the long-term conservation and availability of plant genetic resources were developed for almost all of regions worldwide. The regional approach is to identify key *ex situ* collections of globally important crops (of Annex 1 of the ITPGRFA) on a region-by-region basis. Regional strategies complement the global crop *ex situ* conservation strategies, which prioritize collections on a crop-by-crop basis at the global level.

In the region in which chickpea has its primary centre of diversity, namely West Asia and North Africa, the crop has been identified as being of key importance and conservation priority. It is third in the region in terms of accession numbers held in genebanks.

The Central Asia and the Caucasus strategy prioritizes the importance of chickpea, especially for food security in Azerbaijan, Georgia, Kyrgyzstan, Tajikistan, and Uzbekistan. Collections are conserved in Armenia, Azerbaijan, Georgia, Kyrgyzstan, and Tajikistan.

The Eastern Africa strategy includes chickpea amongst the region's priority crops, given 17th priority out of the 21 crop groups listed. The crop is particularly important in Sudan, Eritrea, Ethiopia, and Kenya. Ethiopia maintains the only major collection in the region, at the Institute of Biodiversity Conservation (IBC). It is reported in the strategy that initial screenings of this material have identified both disease resistance and drought tolerance traits.

The conservation strategy of South, Southeast and East Asia gives chickpea an overall priority of 14th out of 28 crops. The ranking is higher in the South Asian sub region where the crop is ranked as the ninth most important crop and is assigned the highest priority category in India, Nepal, Sri Lanka, and Bangladesh. This sub-region also reports significant accession numbers and high diversity within *ex-situ* holdings.

The Southern Africa regional strategy does not list chickpea as of priority importance to the region, but does assign the crop high priority in terms of importance to specific countries (these not specifically named).

2.2 Size and composition of collections

Tables 1a and *1b* list the main collections of *Cicer* by number of accessions, accession type, and collection source.

Table 1a: *Cicer* collections: Content

Country	Genebank / institutes	Total number of accessions	Wild relatives	Landraces	Breeding material
GLOBAL	ICRISAT	18963	1%	93%	7%
India	NBPGR	15986	1%	65%	
GLOBAL	ICARDA	13065	2%	68%	23%
Australia	Australian temperate field crops collection	8410	3%	26%	
USA	USDA	6197			
Iran	Seed and Plant Improvement Institute	5600			
Russian Federation	VIR	2643		73%	
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center	2110	4%	95%	
Turkey	Aegean Agricultural Research Institute (AARI)	2063	1%	98%	1%
Ukraine	Institute of Plant Production, Kharkiv	1404	1%	20%	70%
Spain	Centro de Recursos Fitogeneticos, INIA	1389	1%	60%	
Portugal	Estacao Nacional Melhoramento Plantas, Elvas	1283		20%	
Ethiopia	Biodiversity Conservation and Research Institute	1156		75%	
Hungary	Research Centre for Agrobotany	1154	1%	2%	
Uzbekistan	Uzbek Research Institute of Plant Industry (UZRIPI)	726			
Bangladesh	Bangladesh Agricultural Research Institute (BARI)	666			
Canada	Plant Gene Resources of Canada (PGRC)	641	20%	80%	
China	Institute of Crop Germplasm Resources , CAAS, Beijing, China	567		3%	
Nepal	Agricultural Botany Division	424		100%	
Italy	Institute of Plant Genetics (IGV)-Bari	358			
Morocco	National Institute for Agronomic Research (INRA)	332			
Germany	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)-Gatersleben	310			
Mexico	Centro de Investigaciones Forestales y Agropecuarias, INIFAP	299		33%	
Portugal	Banco Portuges de Germoplasma, Braga	253			
Ecuador	Departamento Nacional de Recursos Fitogeneticos y Biotechnologia	150		100%	
Portugal	Banco de germoplasma Genetica, EAN Oieras	115		90%	
Tadjikistan	Makhsumov Scientific Reserch- production Center "Ziroatkor" & Scientific Reserch Institute of Farming & TJK-Genebank (MSRPC)	74			

Country	Genebank / institutes	Total number of accessions	Wild relatives	Landraces	Breeding material
Turkmenistan	Turkmen Scientific Research Institute for Cereals	48			
Azerbadjan	Agricultural Research Institute (ARI)	42			
Azerbadjan	Azerbaijan National Academy of Sciences, Genetic Resources Institute	40			
Armenia	Institute of Botany, Botanical Gardens (IBNAS)	19			
Egypt	Field Crops Research Institute, Agricultural Research Centre	12			

Table 1b: *Cicer* collections: Accession Source

Country	Genebank / institutes	Total number of accessions	Collected IN country %	Collected OUTSIDE country %	Introduced %	Origin-other %
GLOBAL	ICRISAT	18963	36%			
India	NBPGR	15986	89%		11%	
GLOBAL	ICARDA	13065				
Australia	Australian temperate field crops collection	8410			80%	20%
USA	USDA	6197				
Iran	Seed and Plant Improvement Institute	5600				
Russian Federation	VIR	2643	24%	65%	11%	
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center	2110	70%		30%	
Turkey	Aegean Agricultural Research Institute (AARI)	2063	100%			
Ukraine	Institute of Plant Production, Kharkiv	1404	4%		96%	
Spain	Centro de Recursos Fitogeneticos, INIA	1389	58%			
Portugal	Estacao Nacional Melhoramento Plantas, Elvas	1283	20%		80%	
Ethiopia	Biodiversity Conservation and Research Institute	1156	71%		3%	25%
Hungary	Research Centre for Agrobotany	1154	2%		98%	
Uzbekistan	Uzbek Research Institute of Plant Industry (UZRIPI)	726				
Bangladesh	Bangladesh Agricultural Research Institute (BARI)	666				
Canada	Plant Gene Resources of Canada (PGRC)	641			100%	
China	Institute of Crop Germplasm Resources , CAAS, Beijing, China	567	3%		97%	
Nepal	Agricultural Botany Division	424	97%		3%	
Italy	Institute of Plant Genetics (IGV)-Bari	358				
Morocco	National Institute for Agronomic Research (INRA)	332				

Country	Genebank / institutes	Total number of accessions	Collected IN country %	Collected OUTSIDE country %	Introduced %	Origin-other %
Germany	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)-Gatersleben	310				
Mexico	Centro de Investigaciones Forestales y Agropecuarias, INIFAP	299				
Portugal	Banco Portuges de Germoplasma, Braga	253	100%			
Ecuador	Departamento Nacional de Recursos Fitogeneticos y Biotechnologia	150	100%		100%	
Portugal	Banco de germoplasma Genetica, EAN Oieras	115	70%		30%	
Tadjikistan	Makhsumov Scientific Reserch-production Center "Ziroatkor" & Scientific Reserch Institute of Farming & TJK-Genebank (MSRPC)	74				
Turkmenistan	Turkmen Scientific Research Institute for Cereals	48				
Azerbadjan	Agricultural Research Institute (ARI)	42				
Azerbadjan	Azerbaijan National Academy of Sciences, Genetic Resources Institute	40				
Armenia	Institute of Botany, Botanical Gardens (IBNAS)	19				
Egypt	Field Crops Research Institute, Agricultural Research Centre	12				

The collections in *Table 1* together conserve 86 499 accessions. This is more than recorded by any earlier survey of the crop, e.g. the Directory of Germplasm of Bioversity International lists 65 313 accessions, FAO's World Information and Early Warning System (WIEWS) database lists 72 681 accessions, and FAO's State of the World (1998) lists 69 736 accessions (Annex 6).

There are two international *Cicer* collections. *Cicer* is a mandate crop both at the International Crops Research Institute for the Semi Arid Tropics (ICRISAT), located in India and at the International Center for Agricultural Research in the Dry Areas (ICARDA), in Syria. ICRISAT's is the largest collection of *Cicer* worldwide. Although ICARDA's collection is largely duplicated with ICRISAT, it also holds unique germplasm, including a major and important Kabuli collection. Together these two international collections hold 37% of the total number of accessions of *Cicer* germplasm conserved worldwide.

The accession type and source data in *Tables 1a* and *1b* and supplemented by Annex 6 gives an indication of the uniqueness of the collections. Collections with a high percentage of wild relatives, landraces, and material originally collected by the institute are most likely to encompass unique accessions prioritized in a rational global system. Complete data regarding accession type and source is currently lacking for many collections, and the degree of intentional and unintentional duplication of accessions among these collections is only partially known.

Although the strategy process involved meetings, correspondence, and a survey sent to major genebanks holding *Cicer* worldwide, feedback from some potential collections appearing in the database sources listed above was not successfully obtained. Therefore *Table 1,* albeit representing the major and most active *Cicer* collections, should not be considered a comprehensive listing for collections worldwide. Collections holding over 50 accessions of *Cicer* identified within the Bioversity International and/or FAO WIEWS databases, regional conservation strategies, or other means, and not present in *Table 1* are listed in *Annex 6*. As these yet-to-be verified collections together potentially conserve over 9 000 accessions, further work is warranted to establish the status and contents of these *Cicer* collections, and to incorporate collections holding unique diversity into the Global Strategy.

2.3 Storage facilities

Storage conditions declared by respondents to the survey are listed in *Table 2*. The definition of long-term storage is at the discretion of the reporting institute and in some cases the facilities may not be meeting international standards for long-term conservation. According to the Genebank Standards published jointly by FAO and IPGRI[8] in 1994 the optimum storage temperature for maximum longevity is -18°C or lower and the seed moisture content should be between 3 -7 %. Data on storage conditions for numerous collections is currently lacking, but from available data it appears that long-term storage is in place in most major collections.

Table 2: Storage Conditions Listed by Responding Institutions

Country	Genebank / institutes	Total number of accessions	Facilities - long-term	Facilities - medium (MT) or short-term (ST)
GLOBAL	ICRISAT	18963	Yes	Yes
India	NBPGR	15986	Yes (100%)	Yes
GLOBAL	ICARDA	13065	Yes	Yes
Australia	Australian temperate field crops collection	8410	Yes (80%)	Yes (100% MT)
USA	USDA	6197	Yes	
Iran	Seed and Plant Improvement Institute	5600		
Russian Federation	VIR	2643	Yes	Yes
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center	2110	Yes	Yes
Turkey	Aegean Agricultural Research Institute (AARI)	2063	Yes (100%)	Yes (100% MT)
Ukraine	Institute of Plant Production, Kharkiv	1404	Yes (2%)	Yes (98% MT)
Spain	Centro de Recursos Fitogeneticos, INIA	1389	Yes (33.2%)	Yes (99.1% MT)
Portugal	Estacao Nacional Melhoramento Plantas, Elvas	1283		Yes
Ethiopia	Biodiversity Conservation and Research Institute	1156	Yes (59.5%)	Yes (40.5% ST)
Hungary	Research Centre for Agrobotany	1154	Yes	Yes
Uzbekistan	Uzbek Research Institute of Plant Industry (UZRIPI)	726		
Bangladesh	Bangladesh Agricultural Research Institute (BARI)	666		
Canada	Plant Gene Resources of Canada (PGRC)	641	Yes	Yes

[8] Food and Agriculture Organization (FAO) and International Plant Genetic Resource Institute (IPGRI) 1994. Genebank Standards, FAO Rome, Italy and IPGRI. Rome, Italy. 13 pp.

Country	Genebank / institutes	Total number of accessions	Facilities - long-term	Facilities - medium (MT) or short-term (ST)
China	Institute of Crop Germplasm Resources , CAAS, Beijing, China	567	Yes (100%)	
Nepal	Agricultural Botany Division	424		Yes (MT)
Italy	Institute of Plant Genetics (IGV)-Bari	358		
Morocco	National Institute for Agronomic Research (INRA)	332		
Germany	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)-Gatersleben	310		
Mexico	Centro de Investigaciones Forestales y Agropecuarias, INIFAP	299		
Portugal	Banco Portuges de Germoplasma, Braga	253	Yes	Yes
Ecuador	Departamento Nacional de Recursos Fitogeneticos y Biotechnologia	150	Yes (100%)	
Portugal	Banco de germoplasma Genetica, EAN Oieras	115	Yes	
Tadjikistan	Makhsumov Scientific Research- production Center "Ziroatkor" & Scientific Research Institute of Farming & TJK-Genebank (MSRPC)	74		
Turkmenistan	Turkmen Scientific Research Institute for Cereals	48		
Azerbaijan	Agricultural Research Institute (ARI)	42		
Azerbaijan	Azerbaijan National Academy of Sciences, Genetic Resources Institute	40		
Armenia	Institute of Botany, Botanical Gardens (IBNAS)	19		
Egypt	Field Crops Research Institute, Agricultural Research Centre	12	Yes	

2.4 Regeneration needs

The urgency of regeneration needs given by respondents to the survey and/or ascertained through communications with the Trust, listed in *Table 3,* depend on individual institution viability testing protocols and standards for regeneration. The general recommendation from the FAO/IPGRI genebank standards dictate that an accession must be regenerated when: (a) seed viability drops to 85% of the initial value and/or (b) numbers of seeds drops below 1500. Adequate data regarding regeneration backlog is currently lacking for numerous collections. More than one assessment of regeneration needs may be presented for a collection in the table due to differences between data sources. For those responding, significant regeneration needs are present in a number of countries, particularly Pakistan, Ukraine, Hungary, Bangladesh, China, Nepal, Mexico, and Azerbaijan (ARI).

Table 3. Regeneration needs, as of July 2007

Country	Genebank / institutes	Total number of accessions	Accessions for urgent regeneration (within next 5 years)
GLOBAL	ICRISAT	18963	20%
India	NBPGR	15986	1%
GLOBAL	ICARDA	13065	19%
Australia	Australian temperate field crops collection	8410	29%
USA	USDA	6197	10%

Country	Genebank / institutes	Total number of accessions	Accessions for urgent regeneration (within next 5 years)
Iran	Seed and Plant Improvement Institute	5600	36%
Russian Federation	VIR	2643	30%
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center	2110	90%/ 28%
Turkey	Aegean Agricultural Research Institute (AARI)	2063	25%
Ukraine	Institute of Plant Production, Kharkiv	1404	69%/ 20%
Spain	Centro de Recursos Fitogeneticos, INIA	1389	30%
Portugal	Estacao Nacional Melhoramento Plantas, Elvas	1283	15%
Ethiopia	Biodiversity Conservation and Research Institute	1156	3%
Hungary	Research Centre for Agrobotany	1154	85%
Uzbekistan	Uzbek Research Institute of Plant Industry (UZRIPI)	726	
Bangladesh	Bangladesh Agricultural Research Institute (BARI)	666	80%
Canada	Plant Gene Resources of Canada (PGRC)	641	
China	Institute of Crop Germplasm Resources , CAAS, Beijing, China	567	100%
Nepal	Agricultural Botany Division	424	100%
Italy	Institute of Plant Genetics (IGV)-Bari	358	
Morocco	National Institute for Agronomic Research (INRA)	332	
Germany	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)-Gatersleben	310	
Mexico	Centro de Investigaciones Forestales y Agropecuarias, INIFAP	299	100%
Portugal	Banco Portuges de Germoplasma, Braga	253	
Ecuador	Departamento Nacional de Recursos Fitogeneticos y Biotechnologia	150	0%
Portugal	Banco de germoplasma Genetica, EAN Oieras	115	0%
Tadjikistan	Makhsumov Scientific Research-production Center "Ziroatkor" & Scientific Research Institute of Farming & TJK-Genebank (MSRPC)	74	
Turkmenistan	Turkmen Scientific Research Institute for Cereals	48	

Country	Genebank / institutes	Total number of accessions	Accessions for urgent regeneration (within next 5 years)
Azerbaijan	Agricultural Research Institute (ARI)	42	100%
Azerbaijan	Azerbaijan National Academy of Sciences, Genetic Resources Institute	40	
Armenia	Institute of Botany, Botanical Gardens (IBNAS)	19	
Egypt	Field Crops Research Institute, Agricultural Research Centre	12	

Standard regeneration methodologies for many of the wild species have not yet been established. Regeneration of perennial species is especially problematic. The outlining of standard regeneration methodologies for wild species was highlighted in the Aleppo meeting as requiring research attention as a matter of high priority.

2.5 Safety duplication

Degree of safety duplication as stated by responding institutions is listed in *Table 4*. Adequate data regarding safety duplication is currently lacking for numerous collections. While more information is needed on the extent and location of materials duplicated for safety purposes, it is apparent that many important collections are inadequately duplicated and are thus at risk. A large proportion of accessions are not currently reported as safety duplicated in a number of countries, particularly Australia, Pakistan, Turkey, Ukraine, Portugal, Ethiopia, and Nepal.

Table 4. Status of Safety Duplication

Country	Genebank / institutes	Total number of accessions	Safety duplication	Duplication location
GLOBAL	ICRISAT	18963	100%	ICARDA
India	NBPGR	15986		0% (but large proportions acquired from ICARDA/ICRISAT)
GLOBAL	ICARDA	13065	100%	CIMMYT/ICRISAT
Australia	Australian temperate field crops collection	8410	45%	45% In process of shipment
USA	USDA	6197	70%	70% In Country
Iran	Seed and Plant Improvement Institute	5600		
Russian Federation	VIR	2643	85%	85% In country / 40% at ICARDA
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center	2110	58%	ICRISAT/IBPGR
Turkey	Aegean Agricultural Research Institute (AARI)	2063	10%	10% In country / ICARDA
Ukraine	Institute of Plant Production, Kharkiv	1404	61%	61% VIR / ICRISAT / ICARDA / 13% In Country
Spain	Centro de Recursos Fitogeneticos, INIA	1389	100%	Nordic genebank

Country	Genebank / institutes	Total number of accessions	Safety duplication	Duplication location
Portugal	Estacao Nacional Melhoramento Plantas, Elvas	1283	62%	62% Portugal/ICRISAT/ICARDA
Ethiopia	Biodiversity Conservation and Research Institute	1156	0%	
Hungary	Research Centre for Agrobotany	1154	100%	In country (medium term)
Uzbekistan	Uzbek Research Institute of Plant Industry (UZRIPI)	726		
Bangladesh	Bangladesh Agricultural Research Institute (BARI)	666		
Canada	Plant Gene Resources of Canada (PGRC)	641	100%	Duplicated from other sources (USDA, ICARDA, ICRISAT, IPK)
China	Institute of Crop Germplasm Resources , CAAS, Beijing, China	567	100%	In country
Nepal	Agricultural Botany Division	424	0%	No
Italy	Institute of Plant Genetics (IGV)-Bari	358		
Morocco	National Institute for Agronomic Research (INRA)	332		
Germany	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)-Gatersleben	310		
Mexico	Centro de Investigaciones Forestales y Agropecuarias, INIFAP	299		
Portugal	Banco Portuges de Germoplasma, Braga	253		
Ecuador	Departamento Nacional de Recursos Fitogeneticos y Biotechnologia	150		Yes (in original coll. US)
Portugal	Banco de germoplasma Genetica, EAN Oieras	115	100%	100% Spain/ICARDA
Tadjikistan	Makhsumov Scientific Research-production Center "Ziroatkor" & Scientific Research Institute of Farming & TJK-Genebank (MSRPC)	74		
Turkmenistan	Turkmen Scientific Research Institute for Cereals	48		
Azerbaijan	Agricultural Research Institute (ARI)	42		
Azerbaijan	Azerbaijan National Academy of Sciences, Genetic Resources Institute	40		
Armenia	Institute of Botany, Botanical Gardens (IBNAS)	19		
Egypt	Field Crops Research Institute, Agricultural Research Centre	12		

The workshop in Aleppo agreed that all unique materials should be safety duplicated in a genebank meeting international standards for conservation and capable of distribution, ideally in a second country. Ideally, in order to enhance access to plant genetic resources, and under the terms and conditions of the IT, these safety duplication arrangements would be free of constraints (i.e. not black-box). Both ICARDA and NBPGR (India) expressed a willingness

to provide facilities for safety duplication and it is likely that other institutions would also be prepared to offer such facilities if so requested. Amongst the collections tentatively nominated as priority collections (see Section 6 below) there are 73 433 accessions. Out of these less than 60% are reported to be safety duplicated outside the holding country. It is important to note that safety duplication requires a formal arrangement. The fact that an accession is present in another collection does not immediately signify that the accession is safety duplicated in long-term conservation conditions.

It was also agreed that in addition to normal safety duplication in a "conventional" genebank, a second level of safety duplication is highly desirable. The Svalbard Global Seed Vault, Norway, would be a highly appropriate location for such a second level safety net. To achieve this it was proposed that ICRISAT and ICARDA would send safety duplicates of all accessions to Svalbard. Other collections should complement, but not duplicate, this material.

As of July 2008, 3,905 *Cicer* accessions have been deposited at Svalbard Global Seed Vault, the overwhelming majority of which came from ICARDA. IPK Germany, PGRI Pakistan, VIR Russian Federation, and ILRI Ethiopia have safety deposited a limited percentage of their respective collections. ICRISAT has not yet safety duplicated *Cicer* in Svalbard.

2.6 Information and documentation systems

Status of information and documentation systems given by respondents to the survey and questionnaire are listed in *Table 5*. Adequate data regarding information systems is currently lacking for the collections that were not participatory in the survey or planning meetings. In general, responding institutions hold computerized *Cicer* databases containing passport as well as characterization and evaluation data. Degree of each type of data held was not quantified. From available data, internet access to collections databases exists for most collections, with a number of exceptions, including India, Pakistan, Ukraine, Portugal, Hungary, and China. The European and Caucasus countries are included in the EURISCO and in the ECPGR *Cicer* databases, providing some passport, but little or no characterization or evaluation data.

Table 5. *Cicer* collections: Documentation

Country	Genebank / institutes	Total No of acc.	Info computerized	Passport data	Charac / Evaluation data	Web access
GLOBAL	ICRISAT	18963	Yes	Yes	Yes	Yes
India	NBPGR	15986	Yes	Yes	Yes	
GLOBAL	ICARDA	13065	Yes	Yes	Yes	Yes
Australia	Australian temperate field crops collection	8410	Yes	Yes	Yes	Yes
USA	USDA	6197	Yes	Yes	Yes	Yes
Iran	Seed and Plant Improvement Institute	5600				
Russian Federation	VIR	2643	Yes	Yes	Yes	Yes
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center	2110	Yes	Yes		

Country	Genebank / institutes	Total No of acc.	Info computerized	Passport data	Charac / Evaluation data	Web access
Turkey	Aegean Agricultural Research Institute (AARI)	2063	Yes	Yes	Yes	Yes
Ukraine	Institute of Plant Production, Kharkiv	1404	Yes	Yes	Yes	EURISCO/ECPGR
Spain	Centro de Recursos Fitogeneticos, INIA	1389	Yes	Yes	Yes	Yes
Portugal	Estacao Nacional Melhoramento Plantas, Elvas	1283	Yes	Yes	Yes	EURISCO/ECPGR
Ethiopia	Biodiversity Conservation and Research Institute	1156				
Hungary	Research Centre for Agrobotany	1154	Yes	Yes		EURISCO/ECPGR
Uzbekistan	Uzbek Research Institute of Plant Industry (UZRIPI)	726				
Bangladesh	Bangladesh Agricultural Research Institute (BARI)	666				
Canada	Plant Gene Resources of Canada (PGRC)	641	Yes	Yes	Yes	Yes
China	Institute of Crop Germplasm Resources , CAAS, Beijing, China	567	Yes	Yes	Yes	
Nepal	Agricultural Botany Division	424	Yes	100%	Yes	No
Italy	Institute of Plant Genetics (IGV)-Bari	358				EURISCO/ECPGR
Morocco	National Institute for Agronomic Research (INRA)	332				
Germany	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)-Gatersleben	310	Yes	Yes	Yes	Yes
Mexico	Centro de Investigaciones Forestales y Agropecuarias, INIFAP	299				
Portugal	Banco de germoplasma Genetica, EAN Oieras	253	Yes	Yes	Yes	EURISCO/ECPGR
Ecuador	Departamento Nacional de Recursos Fitogeneticos y Biotechnologia	150	Yes	Yes		

Country	Genebank / institutes	Total No of acc.	Info computerized	Passport data	Charac / Evaluation data	Web access
Portugal	Banco Portuges de Germoplasma, Braga	115	Yes	Yes	Yes	EURISCO/ECPGR
Tadjikistan	Makhsumov Scientific Research-production Center "Ziroatkor" & Scientific Research Institute of Farming & TJK-Genebank (MSRPC)	74				
Turkmenistan	Turkmen Scientific Research Institute for Cereals	48				
Azerbaijan	Agricultural Research Institute (ARI)	42				EURISCO/ECPGR
Azerbaijan	Azerbaijan National Academy of Sciences, Genetic Resources Institute	40				EURISCO/ECPGR
Armenia	Institute of Botany, Botanical Gardens (IBNAS)	19				EURISCO/ECPGR
Egypt	Field Crops Research Institute, Agricultural Research Centre	12				

The Aleppo meeting concluded a number of points regarding information systems:

- Descriptors for Chickpea (*Cicer arietinum* L.) (IBPGR/ICRISAT/ICARDA 1993) are adequate and should be adopted as standard by all collection holders. The development of a minimum list of descriptors based upon the 1993 Descriptors is needed.
- Many *Cicer* accessions have yet to be characterized and evaluated. A considerable amount of the data that has been generated is not electronically available.
- Training is needed on recording passport, characterization, evaluation and other related data.
- Standardization of databases is needed, and would be aided by the creation of procedures for information databases.
- Investments are needed for upgrading the information management systems in some priority collections.
- The Global Public Goods 2 project within the CGIAR system contains a project entailing a joint effort between ICARDA and ICRISAT towards the development of a global chickpea registry. The first priority within the project is to link the collection information from ICRISAT and ICARDA, followed by the expansion of the registry to globally important national collections. The IChiS database links ICRISAT, ICARDA, USDA, and Australia collections (41 701 accessions). Further efforts to consolidate *Cicer* collections information should collaborate with, or build off of, these programs, as well as the established functional regional databases (ECPGR, EURISCO), and GRIN.

- Geo-referencing accessions is an important task for the improvement of the Global Strategy. Geo-referencing will identify gaps requiring further collection of existing *in situ* resources, aid in indicating the degree of coverage of the *Cicer* genepool in *ex situ* collections, and may help to clarify accession duplication questions.

2.7 Gaps in the coverage of global genetic diversity in existing collections

The following geographical areas were identified in the Aleppo meeting as being under-sampled and hence under-represented in germplasm collections with respect to landraces of *C. arietinum*:

- Hindhu Kush-Himalayan region (India, Pakistan, Afghanistan and Nepal)
- West and north China
- Ethiopia (Desi chickpea)
- Uzbekistan, Armenia and Georgia

A study by Berger *et al.* (2003) used geo-referencing analysis to determine distribution and gaps in the "world collection" of wild annual *Cicer* species conserved *ex situ*. Only 572 entries of wild *Cicer* species were identified, out of which 124 accessions were collected from distinct wild populations and therefore may be considered *bona fide* unique accessions. Given such a low figure the authors concluded that the world collection covers very little of the total existing wild distribution for the genus, and thus the *ex situ* collection represents only a fraction of the potential diversity available in wild populations. This finding is supported by the data returned in the survey demonstrating a very low percentage of *ex situ* holdings comprised of wild species (*Table 1a*).

The Aleppo meeting identified the need to collect more wild species, especially the putative progenitor (*C. reticulatum),* which together with *C. echinospermum* belongs to the primary genepool of the cultigen[9]. From the secondary genepool *C. bijugum* is recognized as a priority for collection. These species are distributed mainly in west, south and southeastern Turkey, northern Iraq and northeastern Iran. Other priority species include *C. cuneatum* in Ethiopia, and wild species in general in Pakistan.

Other issues pertaining to further collecting of wild *Cicer* resources include:

- The regeneration of perennials is problematic, and the potential importance of perennials is debatable. However, it is important to collect wild perennial resources before they are extirpated. *In situ* conservation could be the preferable conservation methodology in the long run for these resources. This would necessitate the development of a strategy for *in situ* conservation (target species, site identification – ideally within existing protected areas – appropriate *in situ* management regimes and policies, etc.).
- Rhizobia of perennials are underrepresented in collections and thus soil should be collected along with the target species to ensure availability of effective Rhizobia strains.
- Drought tolerance is in high demand by breeders – and is a trait that might be available for transfer from wild relatives – many of which grow in extremely harsh and dry environments. Although gene transfer from some of these species is currently problematic, further collecting and evaluation should focus on this trait.

[9] Berger *et al.* 2003. *Crop Sci* 43: 1076 – 1090.

2.8 *Cicer* Germplasm Users

Cicer genetic resources are under-utilized due to deficiencies in accession level data; sub-optimal availability and accessibility of that data; lack of pre-breeding, core-collection creation, and other 'value-adding' work in genebanks; and few collaborative relationships with user communities. Use of these resources will be greatly enhanced through generation of accession-level data, and open access to that data. Connections with farmers groups (e.g. via farmer assessment of germplasm), breeders, and other users should be cultivated. In Turkey successful connections have been established via asking breeders to become involved in evaluation for traits of their interests, resulting in more adoption of genetic resources by breeders.

3) Training

During the Aleppo meeting, the working group on *Cicer* and *Lens* identified the following training needs within collections:

- General genebank management.
- Database development/management.
- Characterization and evaluation, including molecular characterization.
- Seed management and technology.
- Seed health.
- Taxonomy.
- Understanding and use of the ITPGRFA- a lack of awareness amongst collection holders regarding the implications of the ITPGRFA for their activities is apparent. Making the content of the Treaty understandable and clarifying the obligations for collection holders within the Treaty is important to creating a global *ex situ* conservation system for this crop. Training regarding the ITPGRFA is considered of high priority.

4) Policy issues

The status of countries hosting collections with respect to the International Treaty on Plant Genetic Resources for Food and Agriculture is given in the *Table 6*. Ten of the total 27 countries have not yet ratified the Treaty[10].

Table 6: Status of Ratification of the ITPGRFA as of July 2008

Country	Genebank / institutes	Total number of accessions	Ratification, Acceptance, Approval or Accession
GLOBAL- ICRISAT	ICRISAT	18963	Yes
India	NBPGR	15986	Yes
GLOBAL- ICARDA	ICARDA	13065	Yes
Australia	Australian temperate field crops collection	8410	Yes
USA	USDA	6197	Signed but not Ratified (NO)

[10] http://www.fao.org/Legal/treaties/033s-e.htm

Country	Genebank / institutes	Total number of accessions	Ratification, Acceptance, Approval or Accession
Iran	Seed and Plant Improvement Institute	5600	Yes
Russian Federation	VIR	2643	NO
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center	2110	Yes
Turkey	Aegean Agricultural Research Institute (AARI)	2063	Yes
Ukraine	Institute of Plant Production, Kharkiv	1404	NO
Spain	Centro de Recursos Fitogeneticos, INIA	1389	Yes
Portugal	Estacao Nacional Melhoramento Plantas, Elvas	1283	Yes
Ethiopia	Biodiversity Conservation and Research Institute	1156	Yes
Hungary	Research Centre for Agrobotany	1154	Yes
Uzbekistan	Uzbek Research Institute of Plant Industry (UZRIPI)	726	NO
Bangladesh	Bangladesh Agricultural Research Institute (BARI)	666	Yes
Canada	Plant Gene Resources of Canada (PGRC)	641	Yes
China	Institute of Crop Germplasm Resources , CAAS, Beijing, China	567	NO
Nepal	Agricultural Botany Division	424	NO
Italy	Institute of Plant Genetics (IGV)-Bari	358	Yes
Morocco	National Institute for Agronomic Research (INRA)	332	Yes
Germany	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)-Gatersleben	310	Yes
Mexico	Centro de Investigaciones Forestales y Agropecuarias, INIFAP	299	NO
Portugal	Banco de germoplasma Genetica, EAN Oieras	253	Yes
Ecuador	Departamento Nacional de Recursos Fitogeneticos y Biotechnologia	150	Yes
Portugal	Banco Portuges de Germoplasma, Braga	115	Yes
Tadjikistan	Makhsumov Scientific Research- production Center "Ziroatkor" & Scientific Research Institute of Farming & TJK-Genebank (MSRPC)	74	NO
Turkmenistan	Turkmen Scientific Research Institute for Cereals	48	NO
Azerbaijan	Agricultural Research Institute (ARI)	42	NO
Azerbaijan	Azerbaijan National Academy of Sciences, Genetic Resources Institute	40	NO
Armenia	Institute of Botany, Botanical Gardens (IBNAS)	19	Yes
Egypt	Field Crops Research Institute, Agricultural Research Centre	12	Yes

As *Cicer* is included within the multilateral system for access and benefit-sharing under the Treaty (i.e. it is a so-called 'Annex 1 crop'), all countries that are party to the Treaty are obliged[11] to make public domain *Cicer* genetic resources available under the terms specified in the Treaty, for the genetic improvement of chickpea[12].

Quarantine regulations

[11] With a few exceptions, such as for material that is under development or that is subject to pre-existing intellectual property protection.

[12] FAO. 2002. The International Treaty on Plant Genetic Resources for Food and Agriculture. FAO Rome, Italy.

There are several pests and diseases of chickpea (such as Aschochyta blight) that have important quarantine implications. Countries vary considerably in the extent to which they operate strict quarantine measures in relation to the movement of chickpea germplasm. To the extent possible it would be preferable to rationalize and harmonize quarantine regulations, at least on a regional basis, but it must be recognized that different countries have different abilities to regulate germplasm flows, have different national requirements, and are subject to different pest threats. At the Aleppo meeting, the representative from Pakistan expressed the need to build its national capacity to handle quarantine matters.

5) Partners in global *Cicer* conservation activities

In order for *ex situ Cicer* collections to be optimally managed, it is important that all key partners involved in the effort work in a coordinated manner. Within the emerging global conservation system for *Cicer,* different collection holders will play differing and complimentary roles, according to their interests and capabilities, including for such activities as regeneration, evaluation, long-term storage, information systems management, pre-breeding, etc. Participants of the Aleppo meeting recognized that international distribution of germplasm is an expensive task that many smaller collections may not be able to undertake. Duplicating the material held in such collections in other larger, better-resourced collections with a strong distribution capacity will help circumvent these constraints and will ensure that the materials in such collections are accessible under the terms of the ITPGRFA.

Characterization and evaluation are areas in which the development of effective partnerships may be particularly valuable. These partnerships could also involve institutions not maintaining chickpea germplasm collections, via facility sharing, technology transfer, etc.

The Aleppo meeting identified the following countries as having particular expertise that could be put to use for the chickpea germplasm community as a whole:

- *Aschochyta* blight (A.B) resistance screening- Canada, Spain, Pakistan (for races prevalent in South Asia), and ICARDA.
- Fusarium wilt resistance screening- ICRISAT
- Molecular screening, including allele-mining and DNA functional diversity profiling- Australia, India.
- Conservation partnering- Spain, ICARDA
- Training (general)- Spain, Turkey, ICARDA, ICRISAT, NBPGR India, and Bioversity International.

5.1 Networks

Several formal and informal international networks and cooperative programmes exist, some of which are dedicated solely to chickpeas while others cover all grain legumes or are geographically focused. These include:

- The European Cooperative Programme for Plant Genetic Resources (ECPGR) established a Grain Legumes Working Group in 1991. A Central *Cicer* germplasm database was established in 1996 and is maintained by the National Plant Breeding Station of Portugal. It is searchable on-line via the Nordic Genetic Resources Center and contains passport data on cultivated material, breeding material and wild *Cicer*

accessions maintained in germplasm collections in European research institutes and genebanks[13].

- West Asia and North Africa, Central Asia and the Caucasus, South Asia, East Asia and South-east Asia all have genetic resources networks that recognize the conservation of *Cicer* as being important to their region. The regional networks vary in funding and extent of work completed thus far to document *Cicer* genetic resources.
- In addition to the above, both ICARDA and ICRISAT have international chickpea programmes that, *inter alia*, distribute germplasm from international screening nurseries and evaluation trials and that manage and make available the data generated.

The Aleppo meeting recognized that crop networks are very important to successful conservation work, are needed for development and the coordination of training, and will require sustainable sources of funding for maximized utility.

6) A strategic approach to conserving the genepool

A conceptual approach to a rational strategy for conserving the genetic diversity of a particular crop *ex situ* is described in the paper "The Role of the Global Crop Diversity Trust in Helping Ensure the Long-term Conservation and Availability of PGRFA"[14]. The concepts presented in this paper were discussed at the Aleppo workshop and it was agreed that they constituted an appropriate strategic approach for conserving the *Cicer* genepool. This approach thus forms the basis of the strategy proposed in the following paragraphs.

The genepool of a crop comprises the genetic diversity contained within all unique accessions that are found within existing *ex situ* collections, together with the related genetic diversity that remains to be collected and that currently remains only under *in situ* conditions (on-farm or in the wild). In terms of the material that already exists within collections, there are clearly some collections that contain within them a larger percentage of the total genetic variation than others and it is on these larger and more diverse collections - especially those that are well maintained and readily available - that, in general, the international community depends for the genetic variation needed for crop improvement. Such collections include the international collections maintained by ICRISAT and ICARDA as well as other major collections maintained in a number of both developing and developed countries. A rational approach to conserving the genepool would see the largest efforts of the international community being devoted to supporting such collections: to ensuring they are able to achieve and maintain international conservation standards and are capable of distributing good quality seed in a timely manner.

However, large, well-maintained and accessible collections are not the only collections that contain important genetic resources. Many smaller collections contain unique material that could be extremely important for the genetic improvement of the crop. Such collections are likely to include those that have a large number or percentage of accessions of local origin (see *Table 1*) and that have not already been extensively duplicated within another collection. However, in cases where only a relatively small number of accessions are involved, it is hard to justify the provision of external financial and other resources for upgrading the collection, and the holding and distribution facilities, to meet international standards. In such cases, in

[13] http://www.nordgen.org/ecpgr/index.php?page=welcome
[14] http://www.croptrust.org/main/role.php

order to ensure the materials are adequately conserved and can be distributed in a safe and timely manner, the collection holders should consider duplicating all unique materials to the international collections maintained by ICRISAT and ICARDA, or other similar large, well-maintained and internationally available collections. As there is a cost associated with any such activity (e.g. for the production of fresh seed, quality control, packaging, shipping, documentation etc.), the international community should be encouraged to consider providing the financial support needed.

In many cases the passport and other data currently available on individual collections is inadequate to gain an accurate picture of the extent of duplication within and among collections and hence to estimate the number and location of those unique accessions that it would be desirable to duplicate within an international collection. The further development of accession level data and subsequent comparison of this data across collections would greatly facilitate the identification of unique accessions.

Results of the Aleppo meeting and subsequent information gathering permits the division of existing *Cicer* collections holding unique germplasm into a number of categories:

Group A
A number of collections have significant coverage (whether national or international), contain large amounts of unique material, are generally maintained according to international standards, and both the information on them, and the materials within them are generally readily available under the terms of the ITPGRFA (or are available without constraint). Such collections are the ones on which chickpea breeders currently depend the most in seeking for suitable traits for genetic improvement purposes. Due to their global importance, the international community should support these collections in addressing any outstanding needs for reaching international standards for conservation and distribution.

- GLOBAL- ICRISAT
- GLOBAL- ICARDA
- India- NBPGR
- United States- USDA
- Russian Federation- VIR

Group B
In addition a number of other collections were identified at the workshop that, while not meeting full international standards with respect to their maintenance, documentation, distribution, or other, nevertheless contain within them important material and with suitable support could, over time, meet such standards. It was recommended that support be provided to enable them to do so. An alternative approach to such collections – particularly in cases when the amount of unique material within them turns out to be less than envisaged, would be for their handling in a similar method to that for collections of group C (below).

- Nepal- NGB
- Pakistan- PGRI
- Ukraine- IPP
- Turkey- AARI
- Ethiopia- BCRI
- Iran- SPII
- Spain- INIA

- Portugal- ENMP
- Hungary- RCA

Together the collections in Groups A-B hold 73 433 accessions (85% of total accessions worldwide).

Group C
A third group of collections is comprised of those that likely only have a relatively limited amount of unique material and for this reason it would be hard to justify the provision of external financial and other resources for upgrading the collection, and the holding and distribution facilities, to meet international standards. Such collections in general warrant duplication within a collection in category A-B above, although further information is necessary for all collections in order to determine the extent of uniqueness of collections. The following list also includes some larger collections but with currently limited assessment of holdings.

- Uzbekistan- UZRIPI
- Bangladesh- BARI
- Morocco - INRA
- Mexico- INIFAP
- Egypt- NGBE/ARC
- Tajikistan - MSRPC
- Turkmenistan- TSRIC
- Azerbaijan- ARI
- Azerbaijan- GRI
- Armenia- IBNAS

Financial and other resources may be needed to enable the holders of these collections to either upgrade to Categories A-B, or to duplicate unique accessions to a Category A-B collection. Such resources might be found nationally or internationally. The Global Crop Diversity Trust is one such source that intends to make resources available for upgrading or duplication based on an analysis of the most efficient and effective use of its funds. The Trust has begun this process for chickpea with the regeneration-characterization-duplication grants initiated in 2007.

Although the strategy process involved meetings, correspondence, and a survey sent to major genebanks holding *Cicer* worldwide, feedback from some potential collections appearing in the database sources listed above was not successfully obtained. Therefore the collections treated in this Strategy, albeit representing the major and most active *Cicer* collections, should not be considered a comprehensive listing for collections worldwide. Collections holding over 50 accessions of *Cicer* identified within the Bioversity International as well as FAO WIEWS databases, regional conservation strategies, or other means, and not treated in this Strategy are listed in *Annex 6*. As these yet-to-be verified collections together potentially conserve over 9 000 accessions, further work is warranted to establish the status and contents of these *Cicer* collections, and to incorporate collections holding unique diversity into this Global Strategy.

Table 7 summarizes potential priority *Cicer* collections and future needs and questions related to those collections.

Table 7. Summary of potential priority collections

Country	Institute	Status	Accessions	Regen. Need (5yr)	Collection comments
Global	ICRISAT	A	18963	20%	
Global	ICARDA	A	13065	19%	
India	NBPGR	A	15982	1%	7488 accessions 'restored' from ICRISAT. 20% duplication within collection. Need to safety duplicate more accessions. Accessibility of information system?
USA	USDA	A	6197	10%	Not Party of ITPGRFA
Russian Federation	VIR	A	2643	30%	Not Party of ITPGRFA
Nepal	NGB	B	424	100%	Need to place accessions into long-term storage. Need to safety duplicate accessions. Not Party of ITPGRFA
Pakistan	PGRI	B	2110	90%/20%	Need to safety duplicate accessions. Accessibility of information system?
Ukraine	IPP	B	1404	69%/20%	96% of the collection is introduced from other institutes, but 853 acc collected by Ukrainian institutes. Need to place accessions into long-term storage. Need to safety duplicate accessions. Accessibility of information system? Not Party of ITPGRFA
Turkey	AARI	B	2063	25%	Need to safety duplicate accessions
Ethiopia	BCRI	B	1156	3%	Need to place into long-term storage. Need to safety duplicate accessions. Status of data and information systems?
Iran	SPII	B	5600	36%	Need to safety duplicate accessions? Status of data and information systems?
Spain	INIA	B	1389	30%	Need to place into long term storage
Portugal	ENMP	B	1283	15%	Need to safety duplicate some accessions. Accessibility of information system? Currently no long term conservation
Hungary	RCA	B	1154	85%	Accessibility of information system?

Table 8 summarizes *Cicer* collections likely to be holding some degree of unique germplasm, and/or in need of further information for an assessment of duplication and/or funding needs.

Table 8. *Cicer* collections containing some unique germplasm, to investigate further

Country	Institute	Status	Accessions	Collection comments
Uzbekistan	UZRIPI	C	726	Accession number from regional (CAC) database
Bangladesh	BARI	C	666	Likely to be reasonably important collection
Morocco	INRA	C	332/294	All accessions in ICARDA. Accession number from regional strategy (WANA)/ Bioversity/WIEWS database
Mexico	INIFAP	C	299	100 Landraces from Mexico. What about Iguala INIA station? 1600 accessions? Accession number from Bioversity/WIEWS databases

Country	Institute	Status	Accessions	Collection comments
Egypt	NGBE/ARC	C	80/12	Accession number from regional strategy (WANA)/ Bioversity database
Tajikistan	MSRCP	C	74	Accession number from regional (CAC) database
Turkmenistan	TSRIC	C	48	Accession number from regional (CAC) database
Azerbaijan	ARI	C	42	Accession number from regional (CAC) database
Azerbaijan	GRI	C	40	Accession number from regional (CAC) database
Armenia	IBNAS	C	19	Very interesting collection (K. Street). Accession number from regional (CAC) database

7) Summary and conclusions: a way forward

Key tasks necessary for the formation of a rational global conservation effort for *Cicer* include the completion of necessary regeneration, safety duplication, and storage in long-term conditions of unique accessions within the collections outlined in the Strategy. In order to accomplish this task, research into the development of successful regeneration and conservation protocols for wild related species is of high priority. Of equal importance is upgrading the documentation on the various collections and to creating an accessible sharing mechanism for this information.

Key collections should be upgraded to meet international standards for conservation and distribution, and the international community should be called upon to support this process where needed. For other collections, the international community should be encouraged to provide assistance with replicating unique materials to the ICRISAT, ICARDA, or other large and secure collections. All unique materials should be duplicated for safety reasons, preferably in a second country, and with a safety backup sent to the Svalbard Global Seed Vault.

Gaps in information regarding *Cicer* collections and the status of germplasm held in these collections currently constrain the comprehensiveness of the Strategy. Missing information on *Cicer* resources should be gathered for all collections listed in the Strategy, and other institutions potentially containing *Cicer* collections (Annex 6) should be verified and incorporated into the Strategy.

Further work is needed on characterizing and evaluating the collections and on making the information openly available. A common platform on information on *Cicer* germplasm is of high priority. Through the generation of accession-level data and by improving the accessibility of information on accessions globally, unique genetic resources will be identified and prioritized for support. Only through such efforts, as well as the formation of stronger collaborative relationships with user communities, is there likely to be a significant increase in the use of collections by plant breeders and others.

Additional collecting should be undertaken, especially for wild species, to fill the gaps identified in Section 2.7. Once more comprehensive accession-level data becomes available it will be possible to carry out further analyses to identify additional gaps in the collections.

Training needs to be organized to meet the needs identified in Section 3. Networks need support regionally and globally. Countries having important collections of *Cicer* that have not yet ratified the ITPGRFA (see *Table 6*) should be encouraged to do so.

The strategy outlined here should evolve as new data and information become available, especially regarding collections not currently included in the strategy, as well as additional accession-level data in general in all collections. Through such efforts it is hoped that genepool of this important crop can be efficiently and effectively conserved for the benefit of current and future generations.

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List of Acronyms

AEGIS- A European Genebank Integrated System
CGIAR- Consultative Group on International Agricultural Research
ECPGR- European Cooperative Programme for Plant Genetic Resources
FAO- Food and Agriculture Organization
GBIF- Global Biodiversity Information Facility

GRIN- Genetic Resources Information Network, USDA
ICARDA- International Center for Agricultural Research in the Dry Areas
ICRISAT- International Crops Research Institute for the Semi-Arid Tropics
IPGRI- International Plant Genetic Resources Institute. Now Bioversity International.
ITPGRFA- International Treaty on Plant Genetic Resources for Food and Agriculture
MCPD- Multi-Crop Passport Descriptors
SINGER- System-wide Information Network on Genetic Resources
USDA- United States Department of Agriculture
WIEWS– World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture, FAO

Annex 1. Survey

Chickpea Conservation Strategy Survey - May 2006

1. Background

The Global Crop Diversity Trust is undertaking a series of studies to support the development of international collaborative conservation strategies for different crops. As such strategies evolve, they will provide a basis for the allocation of resources from the Trust to the most important and needy collections.

This questionnaire has been developed in order to seek the advice and input of representatives of the world's major chickpea collections in the development of the chickpea conservation strategy. In particular the questionnaire aims to assess the status of chickpea conservation throughout the world. As the strategy document is intended to be made available publicly, results of the survey could be included and therefore published.

As curator of a key chickpea collection, we kindly request you to complete the sections 1-17 of the questionnaire. We estimate that his procedure may take approximately 1 hour of your time. We appreciate your patience. If there are no *ex situ* chickpea collections in your institute, please can you complete sections 16-17 only. **Please return the questionnaire no later than Friday 26 May 2006 to:**

Geoff Hawtin PhD, Senior Advisor
Global Crop Diversity Trust
Manor Farm House, 17 Front Street, Portesham, Dorset, DT3 4ET, UK
Phone: +44 (0) 1305 9871043, Email: geoffhawtin@hotmail.com

Please also send a copy to:
Brigitte Laliberté, Scientist
Global Crop Diversity Trust, C/o International Plant Genetic Resources Institute
Via dei Tre Denari 472/a, 00057, Maccarese, Rome, Italy, Tel:+39-06-611-8272, Fax:+39-06-619-79661
Email:b.laliberte@cgiar.org

The Global Crop Diversity Trust is keen to have your active participation in the development of the chickpea conservation strategy and will be pleased to keep your informed on its progress. If have any questions about this questionnaire or about the proposed strategy in general, please contact Geoff Hawtin.

2. Information about your organization

2.1 Name and address of your organisation holding/maintaining the chickpea collection			
Address:			
City:		Postal Code:	
Country:			
Web site:			
2.2 Curator in charge of the chickpea collection			
Name:			

Address:			
City:			
Telephone:		Fax:	
Email:			
2.3 Contact details of respondent to this questionnaire (only if he/she is not the curator of the chickpea collection)			
Name:			
Address:			
City:			
Telephone:		Fax:	
Email:			

2.4 Date of response of this questionnaire: _____

3. Additional key contacts for the chickpea germplasm collection

Name(s)	Title(s)/Function(s)	Email/Address

4. Description of your organization

4.1 Please describe your organization

- ☐ Governmental organization
- ☐ University
- ☐ Private organization
- ☐ Other (please specify): _____

4.2 Is the institution in charge of the chickpea collection the legal owner of the collection?

☐ YES ☐ NO

4.2.1 If NO, who is the owner (including no owner identified)?

_____

4.3 Is the chickpea collection subject to the terms and conditions of the International Treaty on Plant genetic Resources for Food and Agriculture? ☐ YES ☐ NO

4.3.1 If NO, is expected to become under the International Treaty in the near future?

☐ YES ☐ NO

4.3.1.1 If YES, indicate expected date: _____

5. Overview of your chickpea collection

5.1 Please describe the main objectives of the chickpea collection (long-term conservation, working collection, breeding collection etc**.):**

_____

_____

5.2 Indicate the species and the respective number of accessions from the chickpea germplasm types that are included in your collection (Please write the number of accessions in brackets after each species name, e. g. *C.bijugum* (30), *C.reticulatum* (15), etc.)**:**

Type of chickpea germplasm	**Species name (number of accessions per species in brackets)**
Wild related species of chickpea	
Landraces	
Obsolete improved varieties	
Advanced improved varieties	
Breeding/research materials	
Inter-specific derivatives	
Unknown	
Other	

5.3 Please indicate the share (in %) from each specific type of germplasm that is AVAILABLE for distribution:

Type of chickpea germplasm (where known**)**	**% available for distribution**
Wild related species of chickpea	
Landraces	
Obsolete improved varieties	
Advanced improved varieties	
Breeding/research materials	
Inter-specific derivatives	
Unknown	
Other	

5.4 Origin of the chickpea collection: please indicate the proportion (%) of accessions on the total amount that were... *(Note: the sum should be 100 %!)*

Origin	**Proportion %**
...collected originally in your own country (national origin)	
...collected originally in your own region (regional origin)	
...introduced from a collection abroad	
...from other origin (please define the origin):	

5.5 Are there major gaps in your chickpea collection? Please indicate major gaps concerning your chickpea collection:

Species coverage of the crop: ☐ YES ☐ NO

Population (sample) representation per species: ☐ YES ☐ NO

Ecological representation of the species: ☐ YES ☐ NO

Other, please specify the gap concerning your chickpea collection:

_____

5.5.1 If there are major gaps, please provide details on the plans to fill these gaps:

_____
_____
_____

6. Aspects on the potential of the chickpea collection

6.1 What would you consider to be the most interesting aspects of your chickpea collection, making it unique?

_____
_____
_____
_____

6.2 Please describe the main potential/importance of your chickpea collection for use and breeding:

_____
_____
_____
_____

7. Conservation status (germplasm management)

7.1 Please indicate the proportion (in %) of the chickpea accessions maintained under different facilities: *(Note: if the same accessions are maintained under more than one storage condition the sum may exceed 100%)*	**Percentage %**
Short-term storage conditions	
Medium-term storage conditions	
Long-term storage conditions	
Other, please specify:	

7.2 Please indicate the proportion (in %) of the chickpea accessions conserved as: *(Note: if the same accessions are stored as different types of germplasm the sum may exceed 100%)*	**Percentage %**
Seeds	
Field accessions	
In vitro	
Cryopreservation	
Pollen	
DNA	
Other, please specify:	

7.3 Please describe the MAIN storage facility available for your chickpea collection:
*(If you have **more than one** facility, please use the fields for 'additional facilities' too)*

	Main Facility 1	**Additional facility 1**	**Additional facility 2**
Type of facility			
Temperature			
Relative Humidity (%)			

Packing material			
Other, please specify:			

	Additional facility 3	Additional facility 4	Additional facility 5
Type of facility			
Temperature			
Relative Humidity (%)			
Packing material			
Other, please specify:			

7.4 Please mark for which activity you have established a genebank management system and/or have written procedures and protocols:

- ☐ Acquisition (*including collecting, introduction and exchange*)
- ☐ Regeneration
- ☐ Characterisation
- ☐ Storage and maintenance
- ☐ Documentation
- ☐ Health of germplasm
- ☐ Distribution
- ☐ Safety-duplication
- ☐ Other please specify: _____

7.5 In case you have procedures and protocols, are you able to provide the Global Crop Diversity Trust with this information (i.e. provide a copy)? ☐ YES ☐ NO

7.6 Please describe your quality control activities, in terms of frequency, protocols/methods and actions upon results:

Activities	Description of quality control
Germination tests:	
Viability testing:	
Health testing:	
True-to-typeness of *in vitro* plantlets:	
Other, please specify:	

7.7 Is the chickpea collection affected by diseases that can restrict the distribution of the germplasm?

☐ YES ☐

7.7.1 If you indicated YES or slightly above, are knowledge and facilities available at your institution for eradication of these diseases? ☐ YES ☐

7.8 What is the normal regeneration interval to maintain the viability of the chickpea collection?

7.9 Indicate the proportion (%) of each germplasm type that requires urgent regeneration

Type of chickpea germplasm	% of chickpea accessions with urgent regeneration need
Wild related species	
Landraces	
Obsolete improved varieties	
Advanced improved varieties	
Breeding/research materials	
Inter-specific derivatives	
Unknown	
Other, please specify:	

7.10 Please indicate the current situation of the chickpea collection with respect to the following conditions: (*where: 1 = high/good, 2 = adequate/moderate, 3 = not sufficient/bad, NA = not applicable*)

Condition	Current situation	Expected situation in 2010
Funding for routine operations and maintenance		
Retention of trained staff		
Interest for Plant Genetic Resource Conservation by donors		
Genetic variability in the collection as needed by users/breeders		
Access to germplasm information (passport, charact., evaluation)		
Active support/feedback by users		
Level of use by breeders		
Other factors (please specify):		

8. Safety duplications in other institutions

(Safety duplication: defined as the storage of a duplicate/copy of an accession in another location for safety back-up in case of loss of the original accession.)

8.1 Are chickpea accessions safety-duplicated in another genebank? ☐ YES ☐ NO

8.1.1 If YES, please specify in the table (and add lines as necessary):

Name of institute maintaining your safety duplicates:	Number of accessions	Storage conditions (short, medium, long term)	Nature of the storage (e.g. black box, fully integrated in host collection, etc.)
1.			
2.			
3.			
4.			
5.			
Etc.			

9. Institutions storing safety duplicates of chickpea in your genebank

9.1 Is there any chickpea germplasm of other collections safety-duplicated at your facilities?
☐ YES ☐ NO

9.1.1 If YES, please specify in the table (and add lines as necessary):

Name of holder of the original collection:	Number of accessions	Storage conditions (short, medium, long term)	Nature of the storage (e.g. black box, fully integrated in host collection, etc.)
1.			
2.			
3.			
4.			
5.			
Etc.			

10. Further issues on duplication of chickpea collection

10.1 To what extent do you consider the chickpea accessions in your collection to be unique and not duplicated extensively elsewhere (i.e. EXCLUDING safety-duplication)?

☐ Fully unique
☐ Mostly unique
☐ Partially unique
☐ Fully duplicated elsewhere

10.2 Are there any constraints to duplicating the chickpea collection elsewhere outside your country? ☐ YES ☐ NO

10.2.1 If YES, please specify: _____

11. Information management

11.1 Do you use an electronic information system for managing the chickpea collection (data related to storage, germination, distribution, etc.)? ☐ YES ☐ partly ☐ NO

11.1.1 If YES, what software is used? _____

11.2 Please indicate the proportion (%) of the following types of data is: (1) documented and (2) the proportion that is available electronically:

Type of chickpea germplasm	Passport data		Characterization data		Evaluation data	
	Doc.	Electr.	Doc.	Electr.	Doc.	Electr.
Wild related species	%	%	%	%	%	%
Landraces	%	%	%	%	%	%

Obsolete improved varieties	%	%	%	%	%	%
Advanced improved varieties	%	%	%	%	%	%
Breeding/research materials	%	%	%	%	%	%
Inter-specific derivatives	%	%	%	%	%	%
Unknown	%	%	%	%	%	%
Other, specify:	%	%	%	%	%	%

11.3 In case the information on the chickpea collection is not computerised, are there plans to do so in the future?

☐ No plans
☐ Computerisation planned within 3 years
☐ Other

11.4 Is information of the chickpea collection accessible through the Internet?

☐ YES ☐ Partly ☐ NO

If YES, please indicate the address of the website: http://_____

11.4.1 If there is NO data available in the internet, is an electronic catalogue distributed on CD or by Email? ☐ YES ☐ NO

11.4.1.1 If YES, would you be able to provide the Trust with a copy? ☐ YES ☐ NO
If YES, please include a copy to Dr Geoff Hawtin (geoffhawtin@hotmail.com) when returning the completed questionnaire.

11.4.2 If there is NO data available electronically do you produce a printed catalogue?

☐ YES ☐ NO

If YES, please include a copy to Dr Geoff Hawtin (geoffhawtin@hotmail.com) when returning the completed questionnaire.

11.5 Are data of the chickpea collection included in other databases?

National	☐ YES	☐ partly	☐ NO
Regional	☐ YES	☐ partly	☐ NO
International	☐ YES	☐ partly	☐ NO

11.5.1 If YES or partly, indicate the database (e.g. GRIN, SINGER, EURISCO etc.):

_____

11.5.2 Would you consider an international crop specific catalogue for chickpea genetic resources (International Chickpea Database) to be useful? ☐YES ☐partly ☐NO

11.5.3 Would you like to contribute data to an international Chickpea Database?

Passport data	☐ YES	☐ partly	☐ NO
Pedigree data	☐ YES	☐ partly	☐ NO
Characterization and evaluation data	☐ YES	☐ partly	☐ NO
Molecular data (Marker, Genome, Proteome)	☐ YES	☐ partly	☐ NO

Pictures ☐ YES ☐ partly ☐ NO
Other data (please indicate): _____

12. Distribution and use of material

12.1 What proportion (%) of the total chickpea collection is AVAILABLE for the following distributions? Nationally: _____% Regionally: _____% Internationally: _____%

12.2 Please fill in the number of chickpea accessions DISTRIBUTED annually, and indicate the expected change over the next 3-5 years, where: + = increasing, 0 = no change, - = decrease

	Number of accessions distributed annually (average of last 3 years)	**Expected change for the next 3-5 years**
Nationally		
Regionally		
Internationally		

12.3 Do you put specific conditions or requirements for distribution of chickpea accessions?
☐ YES ☐ NO
12.3.1 If YES, please specify: _____

12.4 What is the proportion of chickpea germplasm sufficiently available in terms of QUANTITY for distribution? _____**%** of accessions are sufficiently available

12.5 Is the distribution of chickpea germplasm limited because of its HEALTH status?
☐ YES ☐ partly ☐ NO

12.6 Do you have adequate procedures in place for...
…Phytosanitary certification? ☐ YES ☐ NO
…Packaging? ☐ YES ☐ NO
…Shipping? ☐ YES ☐ NO
…Other, please specify: (_____) ☐ YES ☐ NO

12.7 Do you keep records of the chickpea accession distribution? ☐ YES ☐ NO
(e.g. who received it, quantity, date of shipment, nature of distributed material etc.)

12.8 Please indicate the proportion (in %) of users who received chickpea germplasm from you in the past 3 years:

12.8.1 Provenance of users:	**Proportion of total distribution %**
Domestic users	
Foreign users	
12.8.2 Type of users:	**Proportion of total distribution %**
Farmers and Farmers' organisations	
Other genebank curators	
Academic Researchers and Students	
Plant breeders - public sector	
Plant breeders - private sector	
NGOs	
Others, please specify:	

12.9 Describe briefly how you inform potential users about the availability of chickpea accessions and their respective data in your collection?

_____

_____

_____

12.10 Describe briefly what are the most important factors limiting the use of the chickpea material maintained in your collection?

_____

_____

_____

12.11 Indicate if users have to pay money or not when they request material from you:

for accessions: ☐ free ☐ cost (in US$/accession): _____

for the shipment: ☐ free ☐ cost (in US$/accession): _____

12.12 Do you use a <u>Material Transfer Agreement</u> when distributing material? ☐ YES ☐ NO

12.13 Do you have any restrictions on who can receive chickpea materials? ☐ YES ☐ NO

12.13.1 If YES, please specify: _____

<u>13. Networks of chickpea genetic resources</u>

13.1 Do you collaborate in (a) network(s) as a chickpea collection holder? ☐ YES ☐ NO

13.2 If you collaborate in (a) network(s) please provide the following information of them:

*(**A**) name, (**B**) type (national, regional or worldwide), (**C**) main objectives, and (**D**) a brief description of the main reasons to participate in the network.*

A **Name of network**	**B** **Type of network** National/Regional/Worldwide	**C** **Main objectives of the network**	**D** **Brief description of the main reasons to participate in the network**

<u>14. Additional crop collections maintained in your Institute:</u> please indicate additional crops and number of accessions in the table below:

	Crop or species	**Number of accessions**	**% of wild relative species**
1.			
2.			
3.			
4.			
5.			
6.			
7.			

8.			
9.			
10.			

15. Major constraints: Please list the 5 major limitations you are facing in the management of the chickpea collection:

1. _____
2. _____
3. _____
4. _____
5. _____

16. Question concerning institutes NOT maintaining chickpea *ex situ* collections

16.1 If your institute does not maintain an *ex situ* collection of chickpea, please indicate to the best of your knowledge, the following:

Current chickpea conservation activities:	
Institute focal person to contact for further details:	
Plans for any chickpea *ex situ* conservation:	
Any other information:	

17. Please add any further comments you may have:

_____
_____
_____
_____

Thank you for your important contribution!!!

Please return this questionnaire, **no later than Friday 12 May 2006**, to:

Geoff Hawtin, PhD, Senior Advisor
Global Crop Diversity Trust
Manor Farm House, 17 Front Street, Portesham, Dorset, DT3 4ET, UK
Phone: +44 (0) 1305 9871043
Email: geoffhawtin@hotmail.com

Please also send a copy to :

Brigitte Laliberté, Scientist
Global Crop Diversity Trust
C/o International Plant Genetic Resources Institute
Via dei Tre Denari 472/a, 00057, Maccarese, Rome, Italy
Tel:+39-06-611-8272, Fax:+39-06-619-79661
Email: b.laliberte@cgiar.org Web: www.croptrust.org

Annex 2. Institutions contacted through a survey in April 2006

No	Country	Institute's name	Email address	Survey sent 20 April 06
1.	Afghanistan	Plant Genetic Resources Unit Crop Improv. Div., Min. of Agric., Kabul	Sharif_moal_afg@yahoo.com	Yes
2.	Algeria	Institut National Agronomique (INA), Alger	aabdelguerfi@yahoo.fr	Yes
3.	Australia	CSIRO Division of Plant Industry, Institute of Plant Production and Processing, GPO Box 1600, Canberra	enquiries@csiro.au	Yes
4.	Australia	Australian Temperate Field Crops Collection, Private Bag 260, Horsham, Victoria	kevin.a.murray@dpi.vic.gov.au	Yes
5.	Australia	Australian Medicago Genetic Resources Centre, SARDI SARDI, PRC GPO Box 397 Adelaide, South Australia	pirsa.sardi@saugov.sa.gov.au	Yes
6.	Bangladesh	Genetic Resources Centre Bangladesh Agric. Research Inst. GPO Box 2235, Joydebpur Gazipur	baridss@bttb.net.bd	Yes
7.	Bulgaria	Institute for Plant Genetic Resources "K.Malkov" Druzba 2 Sadovo, Plovdiv district	shamov@yahoo.com	Yes
8.	Chile	Centro Regional de Investigación Quilamapu, INIA Avda. Vicente Mandez 515 Chillán	hacuna@quilamapu.inia.cl	Yes
9.	Chile	Inst de Inv. Agropecuarias, Centro Regional de Investigación Carillanca Camino Cajón Vilcun Km 10 Temuco	info@carillanca.inia.cl	Yes
10.	China	Institute of Crop Germplasm Resources (CAAS) 12 Zhongguancun Nandajie Beijing	xxlu@caas.net.cn	Yes
11.	Cyprus	National (CYPARI) Genebank, Agricultural Research Institute, P.O. Box 22016 Nicosia	Athena.Della@arinet.ari.gov.cy	Yes
12.	Ethiopia	Biodiversity Conservation and Research Institute POB 30726 Addis Ababa	aibk2002@yahoo.com	Yes
13.	Ethiopia	International Livestock Research Institute (ILRI) PO Box 5689 Addis Ababa	j.hanson@cgiar.org	Yes
14.	France	IBEAS, Lab. d'Ecologie Moleculaire Universite de Pau Ave. de l'Université, Pau	daniel.combes@univ-pau.fr	Yes
15.	Germany	Genebank, Inst. for Plant Genetics	knupffer@ipk-gatersleben.de	Yes

No	Country	Institute's name	Email address	Survey sent 20 April 06
		and Crop Plant Research (IPK) Corrensstrasse 3 Gatersleben		
16.	Hungary	Institute for Agrobotany Kulsomezo 15, Tápiószele	lhorvath@agrobot.rcat.hu	Yes
17.	India	National Bureau of Plant Genetic Resources, Regional Station, Akola	dikshitn@yahoo.com	Yes
18.	India	Department of Plant Breeding, Indian Institute of Pulses Research, Uttar Pradesh	root@iipr.up.nic.in	Yes
19.	India	Department of Plant Breeding and Genetics, Indira Gandhi Agricultural University, Raipur	sharmarn@yahoo.com	Yes
20.	Israel	Dept. of Botany, Institute of Life Science, Hebrew Univ. of Jerusalem Berman Building, Givat Ram Campus, Jerusalem	ilanahs@vms.huji.ac.il	Yes
21.	Italy	CNR - Istituto di Genetica Vegetale Via G. Amendola 165/A, Bari	galasso@ibba.cnr.it	Yes
22.	Jordan	National Center for Agricultural Research and Technology Transfer Baqa'a	Fardous@ncartt.gov.jo	Yes
23.	Nepal	Central Plant Breeding and Biotec. Nepal Agricultural Research Council P.O. Box 1135, Khumaltar	cpdd@mos.com.np, cpdd@narc.gov.np	Yes
24.	Pakistan	Institute of Agricultural Biotechnology and Genetic Resources G-5/1, P O Box 1031, Islamabad	chair@comsats.net.pk	Yes
25.	Poland	Plant Breeding and Acclimatization Institute (IHAR) Radzikow, Blonie	postbox@ihar.edu.pl	Yes
26.	Portugal	Sector de Pastagens e Forragens Dept Past., Forrag., Proteaginosas Apartado 6, Elvas Codex	enmp.inia@mail.telepac.pt	Yes
27.	Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry 42, B.Morskaya Str., St. Petersburg	vir@vir.nw.ru	Yes
28.	Spain	Servicio de Investigacion Agraria Junta de Castilla y Leon Ctra. de Burgos, km 118, Apdo. 172 Valladolid	ciubaufr@jcyl.es	Yes
29.	Spain	Centro de Recursos Fitogeneticos, INIA Aut. Aragón A-2, km 36 - Apdo 1045 Alcala de Henares, Madrid	cuadra@inia.es	Yes
30.	Spain	Banco de Germoplasma,Centro de Investigacion Agraria de Albaladejito Ctra. Toledo-Cuenca km 174 Cuenca	jcuadrado@jccm.es	Yes
31.	Syria	General Commission for Scientific Agricultural Research P.O. Box 113, Douma Damascus	gcsarpbio@mail.sy	Yes
32.	Syria	Int. Centre for Agricultural Research in Dry Areas (ICARDA)	icarda@cgiar.org	Yes

No	Country	Institute's name	Email address	Survey sent 20 April 06
		PO Box 5466, Aleppo		
33.	Turkey	Plant Genetic Resources Dept. Aegean Agricultural Research Inst. PO Box 9, Menemen, Izmir	AARI@EGENET.COM.TR	Yes
34.	Ukraine	Ustimovskaya Experimental Station for Plant Cultivation Ustimovka, Globino dist., Poltava region	sluds@kot.poltava.ua	Yes
35.	United Kingdom	International Centre for Underutilised Crops University of Southampton, Highfield Southampton	rgs@soton.ac.uk	Yes
36.	USA	Western Regional Plant Introduction Station, USDA-ARS, Washington State Univ. 59 Johnson Hall,P.O.Box 646402 Pullman, WA 99164-6402	mmwelsh@wsu.edu	Yes

Annex 3. Participants List

Global Collaborative *Ex situ* Conservation Strategies for Food Legumes (chickpea, lentils, faba beans and grasspea)

ICARDA, Aleppo, Syria, 19-20-21-22 February 2007

No	Country	Contact information	Emails
1.	Australia	Dr. Maarten van Ginkel Principal Research Scientist, Molecular Plant Breeding, Department of Primary Industries Horsham, Victoria 3400; Australia Tel: +3-5362 0789 Fax: +3-5362 2187	maarten.vanginkel@dpi.vic.gov.au
2.	Canada	Dr. Lone Buchwaldt Plant Pathologist; Plant Gene Resources of Canada Agriculture and Agri-Food Canada 107 Science Place; Saskatoon, SK; S7N 0X2; Canada Tel:+306-956-7641 / 7610 Fax: +306-956-7246	BuchwaldtL@AGR.GC.CA
3.	China	Dr. Zong Xuxiao Institute of Crop Germplasm Resources, CAAS 12 Zhongguancun Nan Dajie, Beijing 100081; P.R. China Tel: +86-10-62186691 Fax:+86-10-62186629	zongxx@mail.caas.net.cn
4.	Egypt	Dr. Mohamed Ibrahim El-Hawary; National Gene Bank of Egypt 9 Gama'a St.; Giza P.O. Box 12629; Egypt Tel: +202-5693241 Fax:+202-5693240	info@ngb.gov.eg
5.	Ethiopia	Dr. Adugna Abdi Crop Genetic resource Conservation and Research Department; Institute of Biodiversity Conservation and Research (IBCR) P.O.Box 30726; Addis Ababa, Ethiopia Tel: +251-11-6612244 Fax:+251-11 6613722	adugnaa@yahoo.com
6.	Hungary	Dr. László Holly National Institute for Agricultural Quality Control Research Centre for Agrobotany Külsömezö 15, 2766, Tápiószele, Hungary Tel: +36-53-380070 Fax: +36-53-380072	lholly@agrobot.rcat.hu
7.	India	Dr SK Sharma ICAR, Krishi Bhawan, New Delhi-110001, India Tel: +91-11-23384773 Fax: +91-011-25842495	director@nbpgr.ernet.in mrai.icar@nic.in
8.	India	Dr. R.L. Pandey Senior Scientist (Pulses) Department of Plant Breeding and Genetics Indira Gandhi Agricultural University; Raipur 492012, Madhya Pradesh, India Tel: + 91 771 2424481/2424315 Fax: +91 771 2424532	lakhanpandey@rediffmail.com
9.	Nepal	Mr. Surendra Srivastava Leader, Grain Legumes, Rampore, Chitwan Nepal Agricultural Research Singha Darbar Plaza, P. O. Box 5459; Kathmandu, Nepal Tel: +977-1-4262663 Fax: +977-1-4262500	narced@mail.com.np

No	Country	Contact information	Emails
10.	Pakistan	Dr. Zahoor Ahmad Deputy Director General, Institute of Agri-biotechnology & Genetic Resources National Agricultural Research Centre Islamabad, Pakistan Fax: +92-51-9255201	zahmad51@hotmail.com
11.	Portugal	Dr. Maria Manuela Veloso Departamento de Recursos Genéticos e Melhoramento Estação Agronómica Nacional Quinta do Marquês; 2784 – 505, Oeiras, Portugal Tel:+351 21 440 3500 Fax: +351 21 441 6011	MM.Veloso@iniap.min-agricultura.pt
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No	Country	Contact information	Emails
21.	ICRISAT	Dr. C.L.L. Gowda Global Theme Leader – Crop Improvement; ICRISAT, Patancheru, Andhra Pradesh 502 324, India Tel: +91 40 30713333 Fax: +91 40 30713074	c.gowda@cgiar.org
22.	Bioversity International	Dr. Prem Mathur Bioversity International Office for South Asia, NASC Complex, Pusa Campus New Delhi 110012, INDIA Tel: +91-11-25847546 Fax:+91-11-25849899	p.mathur@cgiar.org
23.	Global Crop Diversity Trust	Geoff Hawtin, Senior Advisor, Global Crop Diversity Trust Manor Farm House. 17 Front Street, Portesham, Dorset, DT3 4ET, UK Tel: +44 (0)1305 871043	geoffhawtin@hotmail.com
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Annex 4 Annotated Agenda

Global Collaborative *Ex situ* Conservation Strategies for Food Legumes (chickpea, lentil, faba bean and grasspea)
A Workshop at the International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria, 19-22 February 2007

Objective:
To consult representatives of relevant food legumes collections on key elements of global strategies for the efficient and effective *ex situ* conservation of the genetic resources of *Cicer, Lathyrus, Lens* and *Vicia*.

Expected Outcomes:
1. Identification and assessment of key global, regional and national collections of food legumes genetic resources,
2. Identification of critical overlaps and gaps in existing collections
3. Recommendations for increased collaboration and sharing of responsibilities, leading to more effective and efficient conservation and greater utilization
4. Identification of major needs and opportunities for upgrading key collections and building the capacity managers to maintain and distribute them efficiently and effectively over the long term.

Monday 19 February

09:00 – 10:30 Chair: Dr Mahmoud Solh
1) Opening Session:
- Welcome by ICARDA DG , Dr Mahmoud Solh
- Welcome by Global Crop Diversity Trust, Dr Cary Fowler
- Introduction to participants
- Discussion and approval of agenda
- Logistical arrangements, Dr Bonnie Furman

2) Food legume genetic resources conservation in the CGIAR (B. Furman, C.L.L. Gowda, H. Upadhyaya, P. Mathur)
Overview of the work on cool season legume genetic resources conservation at ICARDA, ICRISAT, Bioversity International, and SGRP
3) Global Crop Diversity Trust (C. Fowler)
Overview of the origin and history of the Trust, its vision, goals, major achievements, etc including an introduction to the Svalbard Arctic Seed Vault.

10:30 – 11:00 Coffee

11:00 – 12:30 Chair: G. Hawtin
4) The International Treaty on PGRFA (C. Fowler)
Latest developments in the International Treaty of relevance to the meeting, including an overview of the Standard Material Transfer Agreement (SMTA)
5) Conservation Strategies – general overview (C. Fowler)
Overview of the objectives of the regional and crop strategies being supported by the Trust: the need for them, how the Trust will use them, their main elements and the process followed in their development – based on the paper "The role of the Global Crop Diversity Trust in helping ensure the long-term conservation and availability of PGRFA".

Discussion

12:30 – 13:15 Lunch 13:15 – 14:00 Tour of Genetic Resources Unit of ICARDA

14:00 – 15:30 Chair: B. Furman
6) Outcome of the Regional Strategies (B. Laliberté)
Overview of the rationale and process for developing the regional strategies, some lessons learned and the main findings relating to Cicer, Lathyrus, Lens and Vicia.
7) Food Legume Conservation Strategies (G. Hawtin)

Overview of the nature of the legume strategies, steps taken so far to develop them and the steps still needed to complete them. Note: The data and information brought by participants will be compiled during the first day for presentation on the second day.

Discussion

15:30 – 16:00 Coffee

16:00 – 17:30 Chair: C.L.L. Gowda
8) Information Systems for Food Legume Genetic Resources
- Overview of international information sources (J. Konopka)
Overview of international and internationally available national databases (including e.g. SINGER, ECP/GR, EURISCO, GRIN, ILDIS, WIEWS, CGN database, etc…) covering such aspects as the availability of accession level data on food legumes, the range of data and their suitability as a tool to help identify duplicates.
9) Focused Identification of Germplasm Strategy - FIGS (K. Street)
Overview of a project to assemble passport data on major pulse collections worldwide into a single database linked with GIS data. The primary aim is to identify subsets of the material likely to include variation for a particular constraint.

Discussion on information needs to promote effective and efficient collaborative conservation activities as well as the use of pulse genetic resources.

Dinner Reception invitation from Dr Mahmoud Solh, Qaser El Wali restaurant, hotel pick up at 19:45

Tuesday 20 February

08:30 – 09:30 Chair: B. Laliberte
10) Overview of the task to be undertaken for the next two days (G. Hawtin)
A list of topics to be addressed by each group is appended to this agenda
11) Overview presentation of the data provided by participants and other data sources (O. Westengen)

Discussion to clarify the assignments, allocation of participants to working groups on a) *Cicer* and *Lens* b) *Lathyrus* and c) *Vicia,* and appointment/approval of chairs and rapporteurs for each group

09:30 – 16:00
Working groups meet in parallel sessions to consider items 1 – 5 in the Appendix to this agenda. Coffee/lunch breaks at 10:30, 12:30 and 15:30.

16:00 – 17:30 Chair: Geoff Hawtin
12) Plenary session for working groups to report back and raise any issues and concerns

Wednesday 21 February

08:30 – 12:00
Continue working group sessions, to consider items 6 – 12 in the Appendix to this Agenda. Coffee break at 10:30

12:00 – 12:30 Chair: Geoff Hawtin
13) Plenary session (if needed) to take stock and raise any further issues and concerns

12:30 – 14:00 Lunch and tour of ICARDA laboratory facilities

14:00 – 17:30
Continue working group sessions, with a coffee break at 15:30. Sufficient time should be left at the end of the day for the Chairs/Rapporteurs to prepare their reports and recommendations.

Thursday 22 February

08:30 – 10:30 Chair: Cary Fowler
14) Report of the working group on *Cicer* and *Lens* and discussion on the proposed strategies (Chair/rapporteur of the working group) – 40 minutes
15) Report of the working group on *Lathyrus* and discussion on the proposed strategy (Chair/rapporteur of the working group) – 40 minutes
16) Report of the working group on *Vicia* and discussion on the proposed strategy (Chair/rapporteur of the working group) – 40 minutes

10:30 – 11:00 Coffee

11:00 – 12:30 Chair: Cary Fowler
General discussion of conservation strategies

12:30 – 14:00 Lunch and field tour

14:00 – 15:30 Chair: Cary Fowler
17) Continue discussion
18) Conclusions of the meeting and next steps
19) Closure (ICARDA and Trust representatives)

Appendix: Topics to be discussed in parallel sessions on days 2 and 3
With reference to *Cicer*/*Lens*, *Lathyrus* or *Vicia*:

1. Review and verify the data presented on the various collections.
   Identify:
   a. any additional collections to be included
   b. any collections that should be dropped from the table
   c. major items of missing data and how they can be filled

2. Consider the proposed criteria for a reference collection, i.e.:
   a. collections on which the world depends:
   b. substantial size and diversity
   c. generally international or regional in coverage
   d. secure - managed to international standards - and in general adequately funded
   e. readily available on request under terms of International Treaty on PGRFA
   Identify the main collections that meet these criteria.

3. Identify other significant collections, and sets of accessions within collections, taking into account criteria such as:
   a. collection size and diversity (number and origin of accessions)
   b. uniqueness of the material
   c. type of material (landraces, released cvs., wild spp. genetic stocks, etc)
   Where possible, indicate the major support needs of any such collections identified

4. Identify potential partners who are able to provide conservation services such as: characterizing or evaluating material for key characters, indexing for diseases, providing specialized assistance with regeneration or storage, providing information or germplasm distribution services, etc.
5. Identify major gaps in the total genetic diversity coverage of existing collections
6. Assess the current status of data and information systems and indicate how they could be strengthened and the data made more accessible.
7. To what extent are collections already duplicated for safety and how can the situation be improved? What standards/guidelines should apply (consider both second-country safety duplication and duplication at the Svalbard International Seed Vault
8. What are the major policy and technical impediments to a greater distribution of materials (e.g. with respect to seed quantity, seed quality, quarantine/phytosanitary arrangements, a clear policy on distribution, agreed MTA etc.) and how can they best be overcome?
9. Identify and assess the effectiveness of any networks and international cooperative programmes that exist for the crop in question. How can collaboration best be strengthened?
10. Assess the effectiveness of links to users (plant breeders and farmers). How can a greater use of the genetic materials best be promoted?

11. What are the most important training needs and how might they best be addressed?
12. Identify key next steps in further development of the strategy and its implementation.

Annex 5. Simplified survey in January 2007

Global Collaborative *Ex situ* Conservation Strategies for Food Legumes (chickpea, lentils, faba beans and grasspea)
ICARDA, Aleppo, Syria, 19-20-21-22 February 2007

Information request in preparation of the consultation meeting

Participants to the meeting should send in advance, or bring with them to Aleppo, information on the following issues relating to the collections of Cicer, Lathyrus, Lens and Vicia held in their institute and, if possible, at other institutions in their country. Ideally the data and information should be provided in electronic form.

1. The size and composition (landraces, current and obsolete cultivars, wild species, genetic stocks, etc.) of the collections.
2. The proportion of the collections that originated in a) their own country and b) their region. For material not originating nationally, which are the main countries and collections from which it originated?
3. The proportion of the collections that has been collected by the institute concerned *vs.* that obtained from other sources nationally and internationally.
4. The current status of the collections with respect to regeneration (e.g. % in need of urgent regeneration now, % in need of regeneration within the next 5 years etc...).
5. The extent to which the collections have been duplicated a) in their own country and b) abroad, and willingness to duplicate internationally (e.g. under black box arrangements including in the global arctic seed vault in Svalbard).
6. The extent (numbers of samples per year) to which the collections are distributed a) nationally and b) internationally.
7. The storage facilities available and conditions (temperature, humidity) under which the collections are held.
8. The main management practices followed in conserving and distributing the materials.
9. The documentation and information systems followed, and the availability of data and information nationally and internationally.
10. The major constraints (financial, staffing, facilities, policies, pests/diseases, etc.) to conservation, documentation and distribution (national and international), and ideas on how these constraints can be overcome - including, where possible, indicative costing.
11. Participation in relevant networking and other international activities.
12. Any other information relevant to the development of international collaborative conservation strategies.

Annex 6: Other Potential *Cicer* Collections and Additional Data

Adopted from FAO's State of the World's Plant Genetic Resources for Food and Agriculture, 1998:

Crop		Genebank			Accessions		Storage facilities (%)				Type of accession (%)				Dupl.
Grouping	Genus	Institute	Country		No.	%	LT	MT	ST	Others	ws	lr/oc	ac/bl	Oth	%
Chickpea	*Cicer*	ICRISAT	CGIAR	●	17,244	25	20	80	0	0	1	93	4	2	98
Chickpea	*Cicer*	ICARDA	CGIAR	●	9,974	14	40	60	0	0	3	72	25	0	51
Chickpea	*Cicer*	SPII	Iran		4,925	7	0	100	0	0	0	0	0	100	-
Chickpea	*Cicer*	W-6	USA		3,806	5	0	100	0	0	0	0	0	100	-
Chickpea	*Cicer*	PGRI-NARC	Pakistan	○	2,912	4	0	100	0	0	1	0	0	99	-
Chickpea	*Cicer*	NARC-Paki	Pakistan	○	2,584	4	0	0	0	100	0	0	0	100	-
Chickpea	*Cicer*	ATFGRC	Australia		2,500	4	100	0	0	0	0	0	0	100	-
Chickpea	*Cicer*	VIR	Russia	◑	2,293	3	0	99	0	1	0	0	0	100	-
Chickpea	*Cicer*	NSSL	USA	◑	2,031	3	0	0	0	100	0	0	0	100	-
Chickpea	*Cicer*	IARI	India	○	2,000	3	0	0	0	100	0	100	0	0	-
Chickpea	*Cicer*	INIA-Iguala	Mexico	◑	1,600	2	0	100	0	0	0	0	0	100	-
Chickpea	*Cicer*	CIDACOR	Spain	○	1,500	2	0	100	0	0	0	0	100	0	-
Chickpea	*Cicer*	ENMP-Past	Portugal		1,500	2	0	0	100	0	0	0	0	100	-
Chickpea	*Cicer*	Univ-Tehran	Iran		1,200	2	0	0	0	100	0	100	0	0	-
Chickpea	*Cicer*	Others			13,667	20				100				100	-
Chickpea	***Cicer***	**Total**			**69,736**	**100**	**11**	**53**	**2**	**31**	**1**	**38**	**7**	**51**	

Cicer Collections Identified in Bioversity International, FAO's World Information and Early Warning System (WIEWS) database, or other means, holding over 50 accessions, not contained within *Table 1.*

Country	Collection	Source	Date recorded	Accessions
Mexico	Estación de Iguala, Instituto Nacional de Investigaciones Agrícolas	Bioversity/ WIEWS	01/01/1984	1600
Spain	Centro de Investig. y Desarrollo Agrario Alameda del Obispo	Bioversity	29/07/1994	1500
Iran	College of Agriculture, Tehran University	WIEWS		1200
Greece	Fodder Crops and Pastures Institute (FCPI)	Bioversity/ WIEWS	24/02/1995	445
Philippines	Institute of Plant Breeding, College of Agriculture UPLB	Bioversity/ WIEWS	08/09/1988	404
Ukraine	Luganskaya Experimental Station	WIEWS		396
Romania	Agricultural Research Station Teleorman	Bioversity	26/06/1995	364
Afghanistan	Plant Genetic Resources Unit, Crop Improvement Division, Ministry of Agriculture	WIEWS		312
Syrian Arab Republic	General Commission for Scientific Agricultural Research	Bioversity/ WIEWS	03/06/1998	257
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	Direct communication with institution	20/10/08	223
Philippines	National Plant Genetic Resources Laboratory, IPB/UPLB	Bioversity/ WIEWS	14/09/1994	207
Brazil	Centro Nacional de Pesquisa de Hortaliças (CNPH), EMBRAPA	Bioversity/ WIEWS	16/08/1994	203/ 115

Country	Collection	Source	Date recorded	Accessions
Bulgaria	Institute for Plant Genetic Resources "K.Malkov"	Direct Communication with Institution	2008	200
Italy	CR Casaccia INN-Bioag-Prove	Bioversity	09/08/1988	200
Italy	Experimental Institute for Vegetable Crops	Bioversity/ WIEWS	09/08/1988	200
Libyan Arab Jamahiriya	Agricultural Research Centre (ARC)	Bioversity/ WIEWS	02/06/1998	200
Chile	Inst de Inv. Agropecuarias, Centro Regional de Investigación Carillanca	Bioversity/ WIEWS	03/01/2003	192
Australia	Australian Medicago Genetic Resources Centre, South Australian Research and Development Institute	WIEWS		190
Spain	Servicio de Investigacion Agraria Junta de Castilla y Leon	Bioversity/ WIEWS	02/08/1994	190/ 50
Greece	Greek Genebank, Ag0ric. Res. Center of Makedonia and Thraki, NAGREF	Bioversity/ WIEWS	08/02/1993	179
GLOBAL	Asian Vegetable Research and Development Centre (AVRDC)	Bioversity/ WIEWS	02/08/1989	158
Slovakia	Research Institute of Plant Production Piestany	Bioversity/ WIEWS	28/05/2002	125/ 111
Tanzania	National Plant Genetic Resources Centre (TPRI)	Southern Africa Strategy	29/06/1905	97
Brazil	EMBRAPA, Recursos Geneticos e Biotecnologia (CENARGEN), EMBRAPA, Recursos Geneti	Bioversity	26/10/2001	72
Eritrea	National Agricultural Research Institute (NARI)	Direct Communication with Institution	2008	71
Peru	Estacion Experimental Canaan-Ayacucho, INIEA	Bioversity/ WIEWS	21/05/1999	66
Cuba	Banco de Germoplasma, Instituto de Investigaciones Fundamentales en Agricultura	Bioversity/ WIEWS	19/07/2002	63
Italy	Institute of Agronomy and Field Crops	Bioversity/ WIEWS	31/05/1995	61
Czech Republic	AGRITEC, Research, Breeding and Services Ltd.	Bioversity/ WIEWS	05/03/2002	57