Global Strategy for the *Ex Situ* Conservation of Faba Bean (*Vicia faba* L.)

Source: Prof. Dr. Otto Wilhelm Thomé *Flora von Deutschland, Österreich und der Schweiz* 1885, Gera, Germany

April 2009

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 faba bean.

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 April 2009) 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 *Vicia faba*. Valuable information, ideas and insights source from the many genebank managers, curators and national and international programme scientists (listed in Annexes 2 and 3) who attended the Aleppo Workshop in February 2007 and/or contributed to the surveys. The strategy was reviewed and improved through the contribution of many researchers, including Mike Ambrose, Nigel Maxted, Geoff Hawtin, Manuela Veloso, Gérard Duc, María José Suso, Jan Valkoun, and Ken Street.

Summary

The current status of faba bean *ex situ* genetic resources was assessed via information and database searching, surveys sent to the major identified collections, and a meeting bringing together researchers and curators of *Vicia faba* germplasm. Collection composition, facility status, regeneration needs, safety duplication status, information and documentation status, and status of accessibility of germplasm are presented based upon the compiled information. Gaps in the world collection of faba bean, improved utilization of *Vicia faba* germplasm, training, partnerships, and networks related to the crop are surveyed.

Information is currently insufficient for a number of collections identified in the strategy, and other collections potentially containing faba bean germplasm remain to be verified. From the available information, key collections containing important accessions and meeting international standards for conservation and distribution of germplasm, and identified to play a central role in the global system for faba bean, are highlighted. Collections holding priority germplasm but not yet meeting full international standards with respect to maintenance, documentation, and/or distribution are also identified. Other collections holding unique germplasm of faba bean are also highlighted for further investigation. These collections form the basis for a rational global conservation system for faba bean, and the international plant genetic resources 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 background information important to the evolution of a rational global *ex-situ* conservation system for faba bean (*Vicia faba*).

Vicia is a large genus of 140-190 species, chiefly located in Europe, Asia and North America, extending to temperate South America and tropical East Africa [1]. Primary diversity for the genus is centered in the Near East and Middle East, with a large percentage of the species occurring in the Irano-Tauranian floristic region[2]. The members of this genus are largely adapted to disturbed and agricultural areas. However, a number of perennial species are also found in less disturbed habitats.

Vicia contains approximately 78 utilized taxa (approximately 34 species)[3]. *Vicia faba*, known as faba bean, broad bean, fava bean, horsebean, windsorbean, tickbean (small type), bakela (Ethiopia), boby kurmouvje (former USSR), faveira (Portugal) ful masri (Sudan) feve (French), yeshil bakla (Turkey), and numerous other names is cultivated primarily for its edible seeds, while a number of other species are cultivated as a forage or grain legume for livestock, or for soil improvement[4]. Major forage or green manure species include *Vicia sativa, Vicia ervilia, Vicia articulata, Vicia narbonensis, Vicia villosa, Vicia benghalensis and Vicia pannonica*. Taxa that have a high potential for development as forages in the future include *V. hyaeniscyamus*, *V. noeana*, and *V. sativa* subsp. *amphicarpa*[5]. The genus is also important in ornamental horticulture.

This strategy is confined to an analysis of the major grain species (*Vicia faba)* collections. The genus *Vicia* 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 faba bean (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 survey was distributed to the curators of major *Vicia faba* collections in institutes worldwide (Annex 2) to seek comprehensive information on the status of *Vicia faba* collections. Unfortunately the response to the questionnaire was poor.

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 4 lists the workshop participants and the annotated agenda is given in Annex 5. A simplified questionnaire (Annex 6) was distributed to participants and other concerned

[1] Kupicha (1981); Allkin *et al*. (1986); Maxted (1995), ILDIS (2005).
[2] Maxted and Bennett (2001).
[3] Mansfeld's World Database of Agricultural and Horticultural Crops (2008).
[4] Muehlbauer and Tullu (1997).
[5] Maxted *et al*. (1990).

researchers in advance of the meeting, and the responses were collated and verified at the workshop. Participants addressed a wide range of issues related to increasing the efficiency and effectiveness of *ex situ* conservation and to 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 *Vicia*.

A second survey (Annex 1) was sent in June-July 2008 to 33 institutes in 26 countries (Annex 3) holding *Vicia faba* collections in order to obtain more information on collections identified as possibly containing significant quantities of unique faba bean genetic diversity. Data from the 14 responding institutes was subsequently added to previous data and incorporated into the strategy.

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

- The regional crop conservation strategies for West Asia and North Africa; Americas; Southern Africa; 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.
- 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: http://www.ecpgr.cgiar.org/
    - 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
    - Bioversity Germplasm Collection Directory: http://www.bioversityinternational.org/Information_Sources/Germplasm_Databases/Germplasm_Collection_Directory/index.asp
    - Scientific literature

1.2 The genus *Vicia*

Vicia L. is a member of the family Fabaceae (Leguminosae), subfamily Faboideae, tribe Fabeae. Over 20 major classifications of *Vicia* have been conducted since Linnaeus[6]. Contemporary classification is commonly based on Kupicha (1976); this treatment was revised by Maxted (1991). Following Maxted (1991), the genus is divided into two

[6] Maxted (1995).

subgenera: *Vicia* and *Vicilla*. Subgenus *Vicia* is further divided into nine sections (*Atossa, Bithynicae, Faba, Hypechusa, Microcarinae, Narbonensis, Peregrinae, Vicia*, and *Wiggersia*), nine series, 38 species, 14 subspecies and 22 varieties. Subgenus *Vicilla* is divided into 17 sections (*Americanae, Australes, Cassubicae, Cracca, Ervilia, Ervoides, Ervum, Lentopsis, Mediocinctae, Panduratae, Pedunculatae, Perditae, Subvillosae, Trigonellopsis, Variegatae, Vicilla,* and *Volutae*)[7].

1.3 Faba bean (*Vicia faba* L.)

The wild progenitor and the exact origin of faba bean remain a mystery. In the absence of a clearly defined progenitor, there has been considerable taxonomic controversy over the placement of *V. faba* [2n= 12 (14)] within the genus. *V. faba* is probably most closely related to, but distinct from, section *Narbonensis* species. At various stages the species has been proposed to be in a distinct series, section, subgenus or even genus. Placement of the species in a monotypic section [*Faba* (Miller) Ledeb] follows Maxted (1995).

Based on seed size, Kay (1971) and Bond *et al*. (1985) recognized two subspecies of *Vicia faba* (*paucijuga* and *faba)*. Subspecies *faba* was further subdivided into var. *minor* (small rounded seeds of 1 cm long), var. *equine* (medium sized seeds of 1.5 cm), and var. *major* (large broad flat seeds of 2.5 cm). Alternatively, Cubero (1974) proposed four subspecies (*minor, equina, major, and paucijuga*)[8]. In practice, a continuous variation for most morphological and chemical traits has been observed, making discrete differentiation of varieties challenging[9].

Vicia faba subsp. *faba* is currently cultivated throughout the Northern Temperate zone, in selected Southern Temperate regions, and at higher altitudes in the sub-tropics. *V. faba* was introduced into agriculture in the Near and Middle East either in the Neolithic or the mid to late Bronze Age, then radiated to Europe, North Africa, along the Nile to Ethiopia, from Mesopotamia to India, to China, and later to South America. The earliest forms of *V. faba* were small seeded, and would currently be classified as subsp. *faba* var. *minor* or subsp. *paucijuga*[10]. Many centres of diversity exist for the crop, including the Near East, Mediterranean, Afghanistan, India, and China[11].

Production and Use:

Faba beans, along with lentils, peas, and chickpeas, were among the early domesticates in the Near East, complementing domesticated cereal grains, and these legumes continue to serve an important role in culinary traditions throughout the region. Faba beans are also grown as a cold season cover crop to prevent erosion and fix nitrogen. The crop is widely adapted to diverse soil types, and is more tolerant to acidic soils than most legumes. Cold hardy cultivars tolerate temperatures of -10°C without serious injury[12].

Faba beans are susceptible to a variety of diseases including chocolate spot (*Botrytis fabae* and *B. cinerea*), rust (*Uromyces viciae fabae*), black root rot (*Thielaviopsis basicola*), stem

[7] Maxted (1991).
[8] Muehlbauer and Tullu (1997).
[9] Perrino *et al*. (1991).
[10] Maxted (1991).
[11] Perrino *et al*. (1991).
[12] Duke (1983).

rots (*Sclerotina trifoliorum, S. sclerotiorum*), root rots and damping-off (*Rhizoctonia* spp.), downy mildew (*Pernospora viciae*), pre-emergence damping-off (*Pythium* spp.), leaf and pod spots or blight (*Ascochyta fabae*), foot rots (*Fusarium* spp.), bean yellow mosaic virus, bean true mosaic virus, and bean leaf roll virus. Major pests include ground nut aphid (*Aphis cracivora*), Black bean aphid (*Aphis fabae*), pea aphid (*Acyrthosiphon pisum*), pea thrip (*Kakothrips robustus*), cowpea bean beetle (*Callosobruchus macculatus*), seed weevils (*Apion* spp.), bean weevil (*Sitonia lineatus*), and Egyptian leaf worm (*Spodoptera littoralis*)[13].

Faba bean seeds are consumed from green to dry, and pods are eaten when young. The grain is one of the most important winter crops in the Middle East. Faba bean is a common breakfast food in the Middle East, Mediterranean region, China and Ethiopia. Well-known dishes containing the legume include medamis, falafel, bissara, and nabet soup[14]. Salted, fried broad beans are eaten in China, Peru, Mexico, India and Thailand. In the Sichuan cuisine of China, broad beans are combined with soybeans and chili peppers to produce a spicy fermented bean paste[15]. Faba beans are also used as animal feed, mainly for pigs, horses, poultry and pigeons[16].

World dry faba bean production for 2007 was 4,868,681 tonnes on 2,450,000 hectares. Countries with largest production include China (50%), Ethiopia (12%), Egypt (7%), France (5%), United Kingdom (3%), Sudan (3%), Australia (3%) and Morocco (2%)[17].

Nutritional Factors in Faba Bean

Consumption of raw faba beans can induce hemolytic anemia (favism) for those with the hereditary condition glucose-6-phosphate dehydrogenase deficiency (G6PD). G6PD deficiency is rare, occurring mostly among people of Mediterranean, African, and Southeast Asian descent, and is potentially an adaptive defense against malaria parasites by reducing the amount of oxygen in red blood cells. Faba beans themselves also may reduce susceptibility to malaria by lowering the amount of oxygen in the blood. In about 20 percent of the people with G6PD deficiency, consumption of faba beans (or in severe cases even the inhalation of pollen) causes hemolytic anemia. For those with the deficiency but not suffering from favism, resistance to malaria is potentially elevated from consumption of faba bean[18].

The young pod and the immature beans contain significant amounts of levodopa (84 grams of fresh or canned green faba beans may contain about 50-100 mg of levodopa). Some small studies have shown that the levodopa in faba beans may help control the symptoms of Parkinson's disease[19].

Faba bean contains small amounts of several possible antinutritional factors including haemagglutinins (lectins) (destroyed during cooking process), and oligosaccharides such as stachyose, raffinose and verbascose (which ferment and produce methane and other gases causing discomfort and abdominal pain), cyanogens, favogens, phytic acid, tannins, and tripsin inhibitors[20].

[13] Muehlbauer and Tullu (1997).
[14] Ibid.
[15] Duke (1983), Wikipedia (2008).
[16] Muehlbauer and Tullu (1997).
[17] FAOSTAT (2008).
[18] Parsons R. (1996), Holden K.
[19] Parsons R. (1996), Holden K.
[20] Muehlbauer and Tullu (1997).

1.4 Analysis of information from the regional conservation strategies

From 2005 to 2007 with support from the Global Crop Diversity Trust, regional conservation strategies for the long-term conservation and availability of plant genetic resources were developed for almost all regions worldwide. The regional approach is to bring together regional experts to identify key *ex situ* collections of globally important crops (with emphasis on crops listed in 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 West Asia and North Africa, faba bean has been identified as being of importance and conservation priority. The crop is seventh in the region in terms of accession numbers held in genebanks. The largest national collections are listed as held in AARI Turkey, NGB Egypt, INRA Morocco, CGSAR Syria, NARC Pakistan, and MOA Tunisia. The region also includes the world's largest faba bean collection, held at ICARDA, Syria.

The Eastern Africa strategy includes faba bean amongst the region's priority crops, given the 14th ranking out of the 21 crop groups listed. The crop is particularly important in Ethiopia, Eritrea, Madagascar, and Sudan. IBC Ethiopia, ARC Eritrea, and NGBK Kenya are listed as holding the most significant collections of the crop. It is reported in the strategy that high protein content and resistance to chocolate spot have been identified within the Ethiopian collection.

The Americas strategy lists *Vicia* as the 21st most important crop for the Hemisphere. *Vicia* is given low relative priority in the Southern Africa regional strategy. The largest collection (Angola) holds only 7 accessions. The Central Asia and the Caucasus and the South, Southeast and East Asia strategies do not mention *Vicia*.

2. Overview of *Vicia faba* collections

This section provides a brief overview and analysis of the following data:

- total number of *Vicia faba* accessions
- the percentage of landraces, wild relatives, breeding material, etc.
- the percentage of the collection originating in the country concerned, outside of the country, etc.
- the nature of the storage facilities (long- and/or short-term)
- the existence and extent of regeneration requirements
- the percentage of the collection formally safety duplicated, and where
- gaps in collections and the need for further collecting
- whether the data management is computerized, and with or without web access
- whether there are passport, characterization, and/or evaluation data available
- distribution of *Vicia faba* germplasm
- information related to the needs of breeders and researchers.

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.

2.1 Size and composition of collections

Table 1 lists the main collections of *Vicia faba* by number of accessions and accession type, as listed in the surveys, genebank databases, or identified Aleppo meeting.

Table 1: *Vicia faba* collections: Content

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Number of Accessions- Wild Relatives	Landraces *V. faba* (%)	Breeding Material *V. faba* (%)	Improved Varieties *V. faba* (%)	Type of Germplasm - Other or Unknown *V. faba* (%)
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	12015	6148 (also includes other cult species)	24%	35%		29%
China	Institute of Crop Science (CAAS)	5229		64%	Yes		Yes
Australia	Australian Temperate Field Crops Collection, Victoria	2665	2	30%	40%		8%
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	1925	1106	69%; also 787 accessions of other *Vicia* species	13%; also 176 accessions of other *Vicia* species	18%; also 353 accessions of other *Vicia* species	0%
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	1875	69	100%	0%	0%	0%
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	1650					
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	1441		67%	5%		28%
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	1208		55%			45%
Spain	Centro de Recursos Fitogeneticos (CRF), INIA, Madrid	1179	1	87%			1%
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	1098					

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Number of Accessions- Wild Relatives	Landraces *V. faba* (%)	Breeding Material *V. faba* (%)	Improved Varieties *V. faba* (%)	Type of Germplasm - Other or Unknown *V. faba* (%)
France	Station d'Amelioraton des Plantes (INRA)	1057	0	41%	34%	17%	8%
Romania	Banca de Recurse Genetice Vegetale-Suceava (BGRV)	801	0	69%	20%	11%	1%
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	729	60 (*narbonensis)*	2%	29%	0%	69%
Netherlands	Centre for Genetic Resources, the Netherlands (CGN)	728	0	54%	1%	32%	13%
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	589					
India	National Bureau of Plant Genetic Resources (NBPGR)	554	1	10%	Yes		Yes
Turkey	Aegean Agricultural Research Inst. (AARI)	351	33	67%			
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	340	0	99%	0%	1%	0%
Portugal	Estacao Nacional Melhoramento Plantas, Elvas (ENMP)	331		54%	45%		1%
Hungary	Research Centre for Agrobotany (RCA)	328		9%	4%		86%
Canada	Plant Gene Resources of Canada (PGRC)	274	16	84%			
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	267	99	98%	1%	0%	1%

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Number of Accessions- Wild Relatives	Landraces *V. faba* (%)	Breeding Material *V. faba* (%)	Improved Varieties *V. faba* (%)	Type of Germplasm - Other or Unknown *V. faba* (%)
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	262	0	99%	0%	1%	0%
Eritrea	National Agricultural Research Institute (NARI)	200	0	100%	0%	0%	0%
Poland	Research Institute of Vegetable Crops (RIVC), Plant Genetic Resources Laboratory	188	0	50%	<1%	8%	42%
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center (PGRI)	181	40	60%			Yes
Syria	General Commission for Scientific Agricultural Research, Dept of Genetic Resources - DUMA	159		100%			
UK	John Innes Centre (JIC) Norwich	156		5%	Yes		93%
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	125	2		98%		
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	66	38	58%	Yes		Yes
Portugal	Estacao Agronomica Nacional (EAN) (Forages section)	12	11	60%	89%		
Kenya	National Genebank of Kenya (NGBK)	1	5	0% *V. faba*; also 31 accessions of other *Vicia* species	0%	0%	100% *V faba*; also 114 accessions of ofher *Vicia* spp.

Vicia faba is a mandate crop at the International Centre for Agricultural Research in the Dry Areas (ICARDA), in Syria. ICARDA safeguards the largest collection of faba bean

worldwide (32% of total world collection). This global collection conserves material from 71 countries, with a high percentage of unique accessions. 8,628 of these accessions comprise the international collection held in-trust for the global community. The collection held at ICARDA also conserves over 6,000 accessions of other *Vicia* species, including about 3,000 accessions of wild species of *Vicia*.

The accession type and source data in *Table 1* 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 (*Table 2*) 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. The degree of overlap and replication of accessions among these collections is only partially known.

This strategy identified 37,984 accessions of *Vicia faba* held in collections worldwide, gathered from the questionnaire, meetings, and other data sources. The germplasm database of Bioversity International lists 42,122 accessions, FAO's World Information and Early Warning System (WIEWS) database lists 40,871 accessions, and FAO's State of the World (1998) lists 31,831 accessions (Annex 7).

Although the strategy process involved meetings, correspondence, and surveys sent to major genebanks holding *Vicia faba* 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 *Vicia faba* collections, should not be considered a comprehensive listing for collections worldwide. Collections holding accessions of *Vicia faba* identified within the Bioversity International, FAO WIEWS, ECPGR, and/or EURISCO databases, regional conservation strategies, scientific literature, or other means, and not present in *Table 1* are listed in *Annex 7*. As these yet-to-be verified collections together potentially conserve almost 10,000 accessions, further work is warranted to establish the status and contents of these collections, and to incorporate collections holding unique diversity into the Global Strategy.

2.2 Source of collections

Table 2 lists the main collections of *Vicia faba* by collection source, as listed in the surveys, genebank databases, or identified Aleppo meeting.

Table 2: Source of Collections Listed by Responding Institutions

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Collected IN country (%)	Collected OUTSIDE country (%)	Origin - Introduced (%)	Origin - other or unknown (%)
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	12015	NA	NA	NA	NA
China	Institute of Crop Science (CAAS)	5229	65%	0%	35%	0%
Australia	Australian Temperate Field Crops Collection, Victoria	2665	24%	1%	76%	0%

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Collected IN country (%)	Collected OUTSIDE country (%)	Origin - Introduced (%)	Origin - other or unknown (%)
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	1925	5%	32%	62%	0%
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	1875	16%	19%	0%	65%
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	1650				
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	1441	25%	64%	11%	0%
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	1208	94%	0%	2%	4%
Spain	Centro de Recursos Fitogeneticos (CRF), INIA, Madrid	1179	54%			15%
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	1098				
France	Station d'Amelioraton des Plantes (INRA)	1057	28%	15%	30%	27% (breeders)
Romania	Banca de Recurse Genetice Vegetale-Suceava (BGRV)	801	63%	0%	37%	0%
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	729	10%	65%	20%	5%
Netherlands	Centre for Genetic Resources, the Netherlands (CGN)	728	9%	31%	52%	7%
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	589				
India	National Bureau of Plant Genetic Resources (NBPGR)	554	40%	0%	60%	0%
Turkey	Aegean Agricultural Research Inst. (AARI)	351	100%	0%	0%	0%

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Collected IN country (%)	Collected OUTSIDE country (%)	Origin - Introduced (%)	Origin - other or unknown (%)
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	340	99%	1%	0%	0%
Portugal	Estacao Nacional Melhoramento Plantas, Elvas (ENMP)	331	54%	0%	46%	0%
Hungary	Research Centre for Agrobotany (RCA)	328	33%		93%	
Canada	Plant Gene Resources of Canada (PGRC)	274	0%	0%	100%	0%
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	267	100%	0%	0%	0%
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	262	80%	0%	20%	0%
Eritrea	National Agricultural Research Institute (NARI)	200	100%	0%	0%	0%
Poland	Research Institute of Vegetable Crops (RIVC), Plant Genetic Resources Laboratory	188	40%	14%	4%	42%
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center (PGRI)	181	64%	0%	37%	0%
Syria	General Commission for Scientific Agricultural Research, Dept of Genetic Resources - DUMA	159	100%	0%	0%	0%
UK	John Innes Centre (JIC) Norwich	156	70%	30%	0%	0%
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	125	10%			
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	66	70%	0%	30%	0%
Portugal	Estacao Agronomica Nacional (EAN) (Forages section)	12	92%	0%	8%	0%
Kenya	National Genebank of Kenya (NGBK)	1	36%	0%	64%	0%

2.3 Storage facilities

Storage conditions reported by respondents to the survey and questionnaire are listed in *Table 3*. The percent of accessions held in the different facility types is listed where possible. As individual accessions may be held in more than one facility type, the combined percentage for some collections may total greater than 100%.

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[21] the optimum storage temperature for maximum longevity is -18°C or lower and the seed moisture content should be between 3 -7 %. From available data, most *Vicia faba* collections contain long-term storage facilities for the crop, with a number of notable exceptions.

Table 3: Storage Conditions Listed by Responding Institutions

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Facilities-Long-term	Facilities-Medium Term	Facilities-Short-Term
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	12015	Yes	Yes	Yes
China	Institute of Crop Science (CAAS)	5229	Yes (100%)		Yes
Australia	Australian Temperate Field Crops Collection, Victoria	2665	Yes		Yes
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	1925	100%		100%
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	1875	100%	15%	0%
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	1650			
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	1441	Yes		Yes
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	1208	22%		78%
Spain	Centro de Recursos Fitogeneticos (CRF), INIA, Madrid	1179	Yes		Yes
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	1098			

[21] Food and Agriculture Organization (FAO) and International Plant Genetic Resource Institute (IPGRI) (1994).

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Facilities-Long-term	Facilities-Medium Term	Facilities-Short-Term
France	Station d'Amelioraton des Plantes (INRA)	1057		100%	
Romania	Banca de Recurse Genetice Vegetale- Suceava (BGRV)	801	69%	100%	0%
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	729	69%	41%	0%
Netherlands	Centre for Genetic Resources, the Netherlands (CGN)	728	100%	100%	0%
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	589	Yes		
India	National Bureau of Plant Genetic Resources (NBPGR)	554	Yes (100%)		Yes
Turkey	Aegean Agricultural Research Inst. (AARI)	351	Yes		Yes
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	340	Yes (100%)	Yes (100%)	No
Portugal	Estacao Nacional Melhoramento Plantas, Elvas (ENMP)	331	No	Yes	Yes
Hungary	Research Centre for Agrobotany (RCA)	328	Yes		Yes
Canada	Plant Gene Resources of Canada (PGRC)	274	Yes		Yes
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	267	No	Yes (100%)	
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	262	100%		0%
Eritrea	National Agricultural Research Institute (NARI)	200	100%	0%	70%

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Facilities-Long-term	Facilities-Medium Term	Facilities-Short-Term
Poland	Research Institute of Vegetable Crops (RIVC), Plant Genetic Resources Laboratory	188	100%	0%	0%
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center (PGRI)	181	Yes		Yes
Syria	General Commission for Scientific Agricultural Research, Dept of Genetic Resources - DUMA	159			Yes
UK	John Innes Centre (JIC) Norwich	156		Yes (100%)	
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	125	Yes		Yes
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	66	Yes		
Portugal	Estacao Agronomica Nacional (EAN) (Forages section)	12	Yes		Yes
Kenya	National Genebank of Kenya (NGBK)	1	15%	85%	0%

2.4 Regeneration needs

The urgency of regeneration needs given by respondents to the survey and questionnaire listed in *Table 4* depend on individual institution viability testing protocols and standards for regeneration. The general recommendation from the FAO and IPGRI genebank standards dictate that an accession must be regenerated when: (a) seed viability drops to 85% of the initial value or (b) numbers of seeds drops below 1500. Adequate data regarding regeneration backlog is currently lacking for a number of collections. For those responding, significant regeneration needs are present in many collections, including those identified as priority collections (section 6, below). The surveys and results of the Aleppo meeting concur that regeneration and multiplication currently represent major constraints in many genebanks.

Table 4. Regeneration needs

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Accessions for Regeneration within 5 years	Accessions for urgent regeneration
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	12015	20%	15%
China	Institute of Crop Science (CAAS)	5229	60%	
Australia	Australian Temperate Field Crops Collection, Victoria	2665	74%	

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Accessions for Regeneration within 5 years	Accessions for urgent regeneration
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	1925	15%	<5%
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	1875	40%	10%
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	1650		
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	1441	40%	
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	1208	3%	
Spain	Centro de Recursos Fitogeneticos (CRF), INIA, Madrid	1179	31%	
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	1098		
France	Station d'Amelioraton des Plantes (INRA)	1057	55%	10%
Romania	Banca de Recurse Genetice Vegetale- Suceava (BGRV)	801	63%	5%
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	729	8%	5%
Netherlands	Centre for Genetic Resources, the Netherlands (CGN)	728	3%	1%
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	589		
India	National Bureau of Plant Genetic Resources (NBPGR)	554	0%	
Turkey	Aegean Agricultural Research Inst. (AARI)	351		
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	340	50%	20%

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Accessions for Regeneration within 5 years	Accessions for urgent regeneration
Portugal	Estacao Nacional Melhoramento Plantas, Elvas (ENMP)	331	70%	
Hungary	Research Centre for Agrobotany (RCA)	328	38%	
Canada	Plant Gene Resources of Canada (PGRC)	274	50%	
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	267	50%	
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	262	100%	100%
Eritrea	National Agricultural Research Institute (NARI)	200		70%
Poland	Research Institute of Vegetable Crops (RIVC), Plant Genetic Resources Laboratory	188		
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center (PGRI)	181	100%	
Syria	General Commission for Scientific Agricultural Research, Dept of Genetic Resources - DUMA	159	40%	
UK	John Innes Centre (JIC) Norwich	156	low to none	
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	125	10%	
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	66	100%	
Portugal	Estacao Agronomica Nacional (EAN) (Forages section)	12	100%	
Kenya	National Genebank of Kenya (NGBK)	1		

The challenge of keeping accessions isolated during regeneration, while maintaining heterozygosity and minimizing inbreeding depression, is, along with storage space constraints, a central problem in the maintenance of faba bean collections[22]. Regeneration of faba bean at ICARDA is constrained by adequate funding for isolation cages.

[22] Bond *et al*. (1985).

The regeneration of fava bean for conservation of populations (landraces, etc.) is particularly challenging, as the identity of the accession is maintained only if the inbreeding and outcrossing levels in the regeneration reflect the circumstances occurring *in situ*. The level of outcrossing is dependent on genotype and on environmental factors, including available pollinators[23]. Some genebanks have chosen to derive and maintain pure line accessions from the original heterogenous, heterozygous accessions[24]. If, on the other hand, the objective is to maintain co-adapted gene complexes of landraces/populations in order to supply raw material adapted to local environments, the landrace populations must also be maintained[25].

The management of inbred lines by selfing during regeneration by faba bean curators has potentially led to a loss in these varieties' ability to support appropriate pollinators. Decline in outcrossing has a further negative effect on cultivar performance. Balancing breeding techniques with conservation in a larger context, including pollinators, is important to the long-term viability of the crop cultivars and to sustainable production.

Participants of the Aleppo meeting recognized that a survey of regeneration practices across collections would be useful for better understanding existing regeneration protocols, and that further collaboration and research in regeneration is vital in overcoming the significant regeneration constraints. Standards on minimum sample size for regeneration and for storage in order to avoid genetic drift, inbreeding depression, etc., for the species require clarification. The addition of floral traits into the list of standard descriptors documented will aid in creating efficient regeneration protocols for specific genotypes, as these traits impact outcrossing rates, and therefore the specific measures needed to insure isolation[26]. In addition, standard regeneration protocols for wild species in the genus are not well established, and further research is needed to establish successful regeneration practices for wild germplasm.

2.5 Safety duplication

The degree of safety duplication as stated by responding institutions is listed in *Table 5*. 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.

Table 5. Status of Safety Duplication

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Collection Safety Duplicated (%)	Safety Duplication Location
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	12015		Also 2563 accessions in SGSV
China	Institute of Crop Science (CAAS)	5229	100%	100% In country
Australia	Australian Temperate Field Crops Collection, Victoria	2665	3%	3% In process

[23] Suso *et al*. (2001).
[24] Perrino *et al.* (1991).
[25] Nadal *et al*. (2003).
[26] Suso *et. al*. (2007).

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Collection Safety Duplicated (%)	Safety Duplication Location
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	1925	6%	200 accessions in SGSV
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	1875	37%	700 accessions at ICARDA- fully integrated
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	1650		
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	1441	90%	90% In country/ 36% ICARDA
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	1208	0%	N/A
Spain	Centro de Recursos Fitogeneticos (CRF), INIA, Madrid	1179		
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	1098		
France	Station d'Amelioraton des Plantes (INRA)	1057	0%	N/A
Romania	Banca de Recurse Genetice Vegetale- Suceava (BGRV)	801	0%	N/A
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	729	0%	N/A
Netherlands	Centre for Genetic Resources, the Netherlands (CGN)	728	100%	Horticulture Research International, GRU, Wellesbourne UK. Also, 505 accessions (69%) in SGSV)
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	589	44%	44% In country; 19 accessions in SGSV
India	National Bureau of Plant Genetic Resources (NBPGR)	554	0%	N/A
Turkey	Aegean Agricultural Research Inst. (AARI)	351	6%	6% In country/ 1% ICARDA

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Collection Safety Duplicated (%)	Safety Duplication Location
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	340	>50%	51% at ENMP in country; 27% ICARDA; 4% VIR; etc.
Portugal	Estacao Nacional Melhoramento Plantas, Elvas (ENMP)	331	at least 60%	195 Portuguese landrace accessions in country (BPGV)
Hungary	Research Centre for Agrobotany (RCA)	328		
Canada	Plant Gene Resources of Canada (PGRC)	274	100%	Also 9 accessions in SGSV
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	267	0%	N/A
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	262	0%	N/A
Eritrea	National Agricultural Research Institute (NARI)	200	0%	N/A
Poland	Research Institute of Vegetable Crops (RIVC), Plant Genetic Resources Laboratory	188	0%	N/A
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center (PGRI)	181	20%	20% ICRISAT
Syria	General Commission for Scientific Agricultural Research, Dept of Genetic Resources - DUMA	159	100%	100% ICARDA
UK	John Innes Centre (JIC) Norwich	156	70%	
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	125		
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	66	100%	68% CRF Spain (fully integrated), 32% U Southhampton UK)
Portugal	Estacao Agronomica Nacional (EAN) (Forages section)	12	100%	100% Spain/ UK
Kenya	National Genebank of Kenya (NGBK)	1	0%	N/A

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), although the current standard agreed protocol for safety duplication is often as "black box" duplicates. 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. ICARDA expressed a willingness to provide facilities for safety duplication and to aid in the coordination of duplication activities between genebanks 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 28,859 accessions. The majority of these collections are only partially duplicated.

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 an appropriate location for such a second level safety net. To achieve this it was proposed that ICARDA would send safety duplicates of all accessions to Svalbard. Other collections should complement, but not duplicate, this material, with the aim of storing one copy of all genetically unique accessions of *Vicia faba* at Svalbard.

As of March 2009, 3,358 *Vicia faba* accessions (7,261 total *Vicia* accessions) have been deposited at Svalbard Global Seed Vault, the overwhelming majority of which came from ICARDA (2,563 *V. faba* accessions). Five other institutes have safety deposited a percentage of their respective collections- Centre for Genetic Resources (CGN), Netherlands (505 accessions); Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Germany (200 accessions); Nordic Genetic Resource Centre (NordGen), Sweden (62 accessions); National Plant Germplasm System (NPGS), USA (19 accessions), and the Canadian Genetic Resources Program, Saskatoon Research Centre (9 accessions).

Participants in the Aleppo meeting recognized that better collaboration, cohesion, and networking between collections to likely to enhance the willingness of institutes to safety duplicate accessions. Clarification of the terms and conditions of safety duplication is also an important step in enhancing safety duplication coverage of the global genepool. Leadership in promoting an effective global conservation system is vital to the evolution of such a system, with safety duplication as an integral component.

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

The Aleppo meeting recognized the need for further work to identify gaps in the global collection of faba bean. The following geographical areas were identified in the Aleppo meeting as being under-sampled and hence under-represented in germplasm collections with respect to *Vicia faba*:

- North Africa, especially Sudan- there is a need to collect landraces, and to look for heat tolerance traits
- Egypt- oasis populations
- South America
- China

Traits for faba bean in need of further collection include:

- Chocolate spot resistance

- Necrotic yellow virus resistance
- Mosaic virus resistance
- Heat tolerance
- Early flowering
- *Orobanche* spp. resistance
- *Ascochyta* spp. resistance.
- Leaf miner resistance.

Vicia faba subsp. *paucijuga* has been recognized as particularly underrepresented in *ex situ* collections. The taxon was recorded in 1931 as having been cultivated in Afghanistan, Pakistan and India[27]. It is likely that this taxon contains relatively high genetic diversity and the collecting and securing, and evaluation for useful traits, of this diversity is prioritized.

In addition, the microflora associated with different populations of the crop and its wild relatives was noted as in need of collection and conservation.

This global strategy is currently confined to a focus on the major grain crop *Vicia faba*. With no clear wild progenitor, the crop probably represents a distinct grouping in the genus, and is highly related to only a few species (i.e. Narbonensis group). This said, the approximately 30 other utilized species in the genus, and the approximately 110-160 wild species in the genus, represent related germplasm that have the potential to be of use to the improvement of faba bean cultivars. Numerous collections of these utilized taxa (especially *Vicia sativa*) and of the wild species, exist worldwide, and are not treated in this document.

Due to their current value and potential for enhanced future utilisation, *Vicia* species were given high priority by the IBPGR forage working group for collection, conservation and forage development[28]. Extensive genetic erosion of plant genetic resources has occurred within the centre of diversity for *Vicia*, due to changes in agricultural practices and habitat modification. The systematic Vicieae collecting programme, initiated by the IBPGR forage working group and undertaken by members of the Vicieae Database Project, Southampton, U.K. resulted in extensive *ex situ* collections covering the vast majority of species in the genus. This material is duplicated at ICARDA[29].

Maxted (1995) called for the conservation and collection of *Vicia* subgenus *Vicia* germplasm by international and national forage legume conservation programmes in order to supplement previous focused collecting. National plant genetic resource institutes should be encouraged to undertake targeted collecting and to activate conservation programmes for endemic wild species and landrace material of *V. faba* subsp. *paucijuga*, *V. narbonensis* and *V. sativa*. Species identified as in primary need for monitoring and possible future conservation action include *V. galilaea* (Northern Israel and Western Turkey), *V. sativa* subsp. *devia* (endemic of Brazil), and *V. pyrenaica* (French and Spanish alpine regions).

Maxted (1995) also called for the creation of *in situ* conservation measures for members of *Vicia* subgenus *Vicia* in the Eastern Mediterranean region, specifically Turkey, Syria, Lebanon, Israel, Iraq, Iran and the Caucasian Republics, with targeted sites encompassing the distinct ecogeographic preferences of individual taxa. The species within the subgenus most

[27] Maxted and Kell (2009).
[28] IBPGR (1985).
[29] Maxted (1995).

seriously threatened by extinction were shown to be restricted to Syria, Lebanon, Turkey and Israel; the highest concentration of potentially threatened taxa are located in Syria.

2.7 Information and documentation systems

Status of information and documentation systems given by respondents to the survey and questionnaire are listed in *Table 6*. Adequate data regarding information systems is currently lacking for the collections that did not participate in the surveys or planning meetings. In general, responding institutions hold computerized *Vicia* databases containing passport as well as characterization and evaluation data. Degree of each type of data held was not assessed.

Table 6. *Vicia faba* collections: Documentation

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Data Computerised?	Passport Data?	Characterisation Data?	Evaluation Data?	Internet Access?
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	12015	Yes	Yes	Yes	Partly	Yes
China	Institute of Crop Science (CAAS)	5229	Yes	Yes	Yes		
Australia	Australian Temperate Field Crops Collection, Victoria	2665	Yes	Yes	Yes		Yes
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	1925	Yes	Yes (100%), elec.	Yes (100%), NOT elec	Yes (100%), NOT elec	Yes; and EURISCO, ECPGR DB
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	1875	partly	Yes (100%)	70%	Yes (100%) eval; 70% electronic	Partly on website; partly EURISCO; ECPGR DB
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	1650					
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	1441	Yes	Yes			Yes; and EURISCO, ECPGR DB
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	1208					
Spain	Centro de Recursos Fitogeneticos (CRF), INIA, Madrid	1179	Yes	Yes	Yes		Yes; and EURISCO, ECPGR

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Data Computerised?	Passport Data?	Characterisation Data?	Evaluation Data?	Internet Access?
							DB
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	1098					ECPGR DB
France	Station d'Amelioraton des Plantes (INRA)	1057	Partly	95%; 75% elec.	40%; Not elec.	10%; Not elec.	Partly on website; ECPGR DB
Romania	Banca de Recurse Genetice Vegetale-Suceava (BGRV)	801	Yes (100%)	Yes (100%)	Yes (100%)	Yes (100%)	Yes (passport data), and in EURISCO
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	729	Partly	Yes (100%)	50%, NOT elec	No	EURISCO, ECPGR DB
Netherlands	Centre for Genetic Resources, the Netherlands (CGN)	728	Yes	Yes (100%)	80%	No	Yes; and EURISCO, ECPGR DB
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	589	Yes	Yes	Yes		Yes
India	National Bureau of Plant Genetic Resources (NBPGR)	554	Yes	Yes	Yes		
Turkey	Aegean Agricultural Research Inst. (AARI)	351					ECPGR DB
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	340	Yes	Yes (100%)	40%	40%	
Portugal	Estacao Nacional Melhoramento Plantas, Elvas (ENMP)	331	Yes	Yes	Yes		EURISCO
Hungary	Research Centre for Agrobotany (RCA)	328	Yes	Yes			EURISCO, ECPGR DB
Canada	Plant Gene Resources of	274	Yes	Yes	Yes		Yes

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Data Computerised?	Passport Data?	Characterisation Data?	Evaluation Data?	Internet Access?
	Canada (PGRC)						
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	267		Yes (100%), elec.	50-56%, elec	No	EURISCO, ECPGR DB
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	262	Yes (100%)	Yes (100%)	Yes (100%)	No	WIEWS
Eritrea	National Agricultural Research Institute (NARI)	200	Yes	Yes (100%)	27%, 27% elec		No
Poland	Research Institute of Vegetable Crops (RIVC), Plant Genetic Resources Laboratory	188	Partly	Yes (100%)			EURISCO
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center (PGRI)	181	Yes	Yes			
Syria	General Commission for Scientific Agricultural Research, Dept of Genetic Resources - DUMA	159	Yes	Yes	Yes		
UK	John Innes Centre (JIC) Norwich	156	Yes	Yes			Yes
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	125					
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	66	Yes	Yes			EURISCO, ECPGR DB
Portugal	Estacao Agronomica Nacional (EAN) (Forages section)	12	Yes	Yes	Yes		

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Data Computerised?	Passport Data?	Characterisation Data?	Evaluation Data?	Internet Access?
Kenya	National Genebank of Kenya (NGBK)	1	Yes	Yes (100%), elec.	Yes (100%), elec	Yes (100%), elec	No

Most of the European countries collections are included in the EURISCO and in the ECPGR grain legumes databases, providing some passport, but little or no characterization or evaluation data. Other collections list that some information on accessions is held in the FAO WIEWS or other databases. These databases do not contain accession-specific data such as passport, characterization and evaluation data, and are therefore of limited use to breeders and researchers. For some collections, more data may be available to breeders and researchers in country than the general public/outside country. This data is often distributed through non-electronic means (seedlistings) or meetings and outreach with user communities.

It was agreed at the Aleppo meeting that the Faba Bean Descriptors (IBPGR 1985) were adequate and should be adopted as standard by all collection holders. For improved material, the International Union for the Protection of New Varieties of Plants descriptors may be used.

The Aleppo meeting recognized that the information currently held on accessions in collections is often fragmented and not easily accessible outside of the institution, and genebank information systems generally need strengthening. Technical advice for information systems is needed; ICARDA is willing to play a role in technical backstopping. As different institutes have different data needs, the standardization of genebank management systems across collections, while a worthwhile goal, may have limitations.

Existing regional and global information portals, such as GBIF, EURISCO, SINGER, GRIN, and others, hold some data regarding faba bean. In partnership with ICARDA, ATFCC Australia is developing an online database searchable for descriptor traits for the crop held in a number of collections[30]. The further development of crop group and species level networks, as well as of an integrated global information source that allows visibility of accessions within collections through the internet, is of high priority. Faba bean should be included within collections listed in a global information portal holding data for multiple crops.

The Aleppo meeting participants also recognized that harvesting of evaluation data from users is important and there is a need for further action to develop a community accustomed to sharing such information. The standard material transfer agreement (SMTA) of the ITPGRFA does not contain a strong provision for return of data to germplasm collections, but additional conditions can be placed upon users accessing material via the SMTA.

2.8 Faba bean germplasm distribution and users

Status of distribution of faba bean germplasm as stated by respondents to the surveys and questionnaire are listed in *Table 7*. Availability of germplasm for distribution is listed both

[30] Duc *et al*. (2008).

by percent of collection actually available, and percent of collection available within country (N), regionally (R) or internationally (I). User data shows percent used nationally versus outside country, and user type (researcher, breeder, etc.). Average samples distributed per year are shown, and any constraints on distribution identified. Data regarding distribution and users is currently lacking for many collections in the strategy.

Table 7. *Vicia faba* collections: distribution

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Distribution-Availability (% of collection)	Distribution-Availability in Terms of Quantity (%)	Distribution-Users	Distribution-Quantities (average samples/year)	Distribution-Constraints
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	12015					
China	Institute of Crop Science (CAAS)	5229					
Australia	Australian Temperate Field Crops Collection, Victoria	2665					
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	1925	70% (N, R, and I)	95%	62% domestic, 38% foreign	58	None; SMTA
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	1875	100% (N, I)	70%	100% domestic (50% researchers, 50% public breeders	30 (all nationally)	None; SMTA
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	1650					
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	1441					
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	1208					
Spain	Centro de Recursos Fitogeneticos (CRF), INIA, Madrid	1179					
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	1098					

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Distribution-Availability (% of collection)	Distribution-Availability in Terms of Quantity (%)	Distribution-Users	Distribution-Quantities (average samples/year)	Distribution-Constraints
France	Station d'Amelioraton des Plantes (INRA)	1057	77% (N, R, I)	98%	65% domestic; 35% foreign. 57% breeders, 30% genebanks, 7% researchers, 3% NGOs.	130 nationally; 72 internationally	None; SMTA
Romania	Banca de Recurse Genetice Vegetale-Suceava (BGRV)	801	34% (N, R, I)	37%		0	
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	729	20% (N, R, I)	50%		0	None
Netherlands	Centre for Genetic Resources, the Netherlands (CGN)	728	99% (N, R, and I)	99%	100% domestic	7	None; SMTA
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	589					
India	National Bureau of Plant Genetic Resources (NBPGR)	554					
Turkey	Aegean Agricultural Research Inst. (AARI)	351					
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	340			100% domestic		
Portugal	Estacao Nacional Melhoramento Plantas, Elvas (ENMP)	331					
Hungary	Research Centre for Agrobotany (RCA)	328					
Canada	Plant Gene Resources of Canada (PGRC)	274					

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Distribution-Availability (% of collection)	Distribution-Availability in Terms of Quantity (%)	Distribution-Users	Distribution-Quantities (average samples/year)	Distribution-Constraints
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	267	30% (N, R, I)	10%	100% domestic (80% researchers, 10% breeders, 10% farmers)	50	Limited seed due to regeneration constraints. User must return eval-char data to gene bank
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	262	100% Nationally	10%	Domestic	very limited	out of country, must be ATM or Dec. 391.
Eritrea	National Agricultural Research Institute (NARI)	200		0%(because not regenerated so no quantity)		0	None
Poland	Research Institute of Vegetable Crops (RIVC), Plant Genetic Resources Laboratory	188	100% (N, R, I)		90% domestic, 10% foreign; farmers, breeders, NGOs	11 nationally, 3 internationally	
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center (PGRI)	181					
Syria	General Commission for Scientific Agricultural Research, Dept of Genetic Resources - DUMA	159					
UK	John Innes Centre (JIC) Norwich	156	80% (N, R, I)				
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	125					
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	66					
Portugal	Estacao Agronomica Nacional (EAN) (Forages section)	12					

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Distribution-Availability (% of collection)	Distribution-Availability in Terms of Quantity (%)	Distribution-Users	Distribution-Quantities (average samples/year)	Distribution-Constraints
Kenya	National Genebank of Kenya (NGBK)	1	100% (N, R, I)	80%	100% domestic; researchers, farmers.	91 (all nationally)	Must clarify intended purpose and form benefit sharing agreement

Survey responses indicate that the percent availability of faba bean accessions is inversely correlated with regeneration backlog. Almost all national collections responding to the surveys appear to be distributing almost entirely to domestic users.

The Aleppo meeting suggested that use of *Vicia faba* genetic resources is much less than desired 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. Other specific recommendations from the Aleppo meeting for improved use include:

a. Encouraging better connections or integration of national genebanks and breeding programs
b. Developing demonstration plots with stakeholder participation.
c. Performing more pre-breeding, pre-selection, introgression, and advanced selection, so as to provide more material for the user community.
d. Involve more stakeholders in genebank conservation efforts.
e. Promote farmer participatory breeding, evaluation, and assessment of landraces.
f. Link genebanks to NGOs working with farmers
g. Improve plant genetic resources jargon in outreach so that it is more comprehensible to users.
h. Encourage networks to collaborate with user communities.
i. Develop tighter linkages between *in situ* and *ex situ* conservation.
j. Promote more effective and rapid evaluation techniques to as to provide more information to users.
k. Enhance the utilization of diverse populations and of different breeding systems in order to promote the use of a wider range of diversity in the genepool.
l. Develop standard protocols for faba bean management in order to promote a better flow of germplasm from different institutes.
m. Some institutes have financial constraints currently limiting the ability to distribute germplasm. Unique and important germplasm should be identified and funding for conservation and for distribution of the germplasm secured.

As part of the Generation Challenge Program of the CGIAR, ICARDA in collaboration with INRA-France and IAS-Alameda de Obispo, Spain, have genotyped 1000 accessions chosen as a global composite collection with a set of microsatellite markers. Further ongoing work will lead to the identification of a global reference set for faba bean.

3) Training

During the Aleppo meeting, the working group on faba bean identified the following training needs for collections holders of the crop in general: conservation technology, characterization, regeneration, database and documentation, biotechnology, evaluation, networking and group facilitation, grant application writing for national programs, and terms, conditions, and use of the ITPGRFA. These trainings may be supported through fellowships and through enhancing the capacity of national programs to attract funding and to run in-country training programmes.

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 8*. Three of the total 26 countries have not ratified the Treaty (China, Russian Federation, and USA).

Table 8: Status of Ratification of the ITPGRFA as of November 2008

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Ratification, Acceptance, Approval, or Accession of IT
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	12015	Yes
China	Institute of Crop Science (CAAS)	5229	**NO**
Australia	Australian Temperate Field Crops Collection, Victoria	2665	Yes
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	1925	Yes
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	1875	Yes
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	1650	Yes
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	1441	**NO**
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	1208	Yes
Spain	Centro de Recursos Fitogeneticos (CRF), INIA, Madrid	1179	Yes
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	1098	Yes
France	Station d'Amelioraton des Plantes (INRA)	989	Yes
Romania	Banca de Recurse Genetice Vegetale- Suceava (BGRV)	801	Yes
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	729	Yes

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Ratification, Acceptance, Approval, or Accession of IT
Netherlands	Centre for Genetic Resources, the Netherlands (CGN)	728	Yes
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	589	**Signed but not yet ratified (NO)**
India	National Bureau of Plant Genetic Resources (NBPGR)	554	Yes
Turkey	Aegean Agricultural Research Inst. (AARI)	351	Yes
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	340	Yes
Portugal	Estacao Nacional Melhoramento Plantas, Elvas (ENMP)	331	Yes
Hungary	Research Centre for Agrobotany (RCA)	328	Yes
Canada	Plant Gene Resources of Canada (PGRC)	274	Yes
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	267	Yes
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	262	Yes
Eritrea	National Agricultural Research Institute (NARI)	200	Yes
Poland	Research Institute of Vegetable Crops (RIVC), Plant Genetic Resources Laboratory	188	Yes
Pakistan	Plant Genetic Resources Institute, National Agricultural Research Center (PGRI)	181	Yes
Syria	General Commission for Scientific Agricultural Research, Dept of Genetic Resources - DUMA	159	Yes
UK	John Innes Centre (JIC) Norwich	156	Yes
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	125	Yes
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	66	Yes
Portugal	Estacao Agronomica Nacional (EAN) (Forages section)	12	Yes

Country	Genebank/Institute	Number of Accessions (*V. faba*)	Ratification, Acceptance, Approval, or Accession of IT
Kenya	National Genebank of Kenya (NGBK)	1	Yes

As *Vicia* 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[31] to make public domain *Vicia* genetic resources available under the terms specified in the Treaty, for the genetic improvement of faba bean and other cultivated crops in the genus[32].

The Aleppo meeting acknowledged that there continues to be confusion and differing interpretations of the exact terms and conditions of access to plant genetic resources covered under the ITPGRFA. Leadership in educating collection holders on the Treaty is warranted.

5) Partners in global *Vicia faba* conservation activities

In order for the global faba bean collection to be optimally managed, it is important that all key partners involved in the effort work in a coordinated manner. Within the global conservation system for faba bean, 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 or transferring the material held in such collections to 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.

The Aleppo meeting recognized that there is a need for the development of collaborations between institutes, including for research in identifying key traits for faba bean development and for understanding pollinator-plant traits and interactions and their connection to floral morphology. The meeting and strategy creation process identified the following institutes as having particular expertise that could be put to use for the faba bean germplasm community as a whole:

- United Nations Food and Agriculture Organization (FAO)- information systems
- Bioversity International (formerly IPGRI)- descriptors
- ICARDA:
    - Training on genebank management
    - Disease screening

[31] With a few exceptions, such as for material that is under development or that is subject to pre-existing intellectual property protection.
[32] FAO (2002).

    - Information systems
    - Capacity building and technical backstopping
- China:
    - Black box storage potential
    - Capacity for regeneration
    - Molecular characterization
- European Networks- scientific capacity and coordination
- Spain- regeneration and genetics research
- Canada, European Networks- regeneration
- Australia- applied science in quarantine restrictions, molecular characterization
- USDA- evaluation, molecular work, information systems, training
- Russian Federation- scientific collaborations in research
- University of Birmingham, School of Biosciences, UK- taxonomy, conservation.

5.1 Networks

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

a. The European Cooperative Programme for Plant Genetic Resources (ECPGR) established a Grain Legumes Working Group in 1991. The *V. faba* Central Crop Database is maintained by INRA in Dijon, France (http://www.ecpgr.cgiar.org/databases/Crops/vicia_faba.htm). The *Vicia* spp. (excluding *V. faba* L.) European Crop Database is maintained in Bari, Italy by the Plant Genetic Institute (http://www.ecpgr.cgiar.org/databases/Crops/Vicia.htm). The Aleppo meeting recommended that the ECPGR network work to donate their expertise to a larger faba bean community.
b. West Asia and North Africa, East Africa, and the Americas all have genetic resources networks that recognize the conservation of faba bean as being important to their region. The regional networks vary in funding and extent of work completed thus far to document *Vicia* genetic resources.
c. ICARDA has international faba bean programmes that, *inter alia*, distribute germplasm from international screening nurseries and evaluation trials as well as manage and make available the data generated.
d. The Pulse Crop Genetic Improvement Network (PCGIN) works with faba bean in the UK. Relevant activities include evaluation of accessions for adaptation to UK agriculture, marker survey of UK germplasm, and the development of genetic resources to underpin UK research. These genetic resources will also be available to the global faba bean community.

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. Furthermore the crop specific network for *V. faba* is of particular value in that it focuses on a smaller community with shared interests and common aims more specific than for the genus or grain legumes in general. This is useful in tackling crop specific issues and raising greater awareness in, for example, the problems involved in the maintenance of allogamous germplasm.

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"[33]. 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 *Vicia faba* resources. 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 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 collection maintained at ICARDA as well as other major national collections. 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 collections contain some unique material that could be extremely important for the genetic improvement of the crop. Such collections are likely to include those that have accessions of local origin 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 by the international community for upgrading the collection, and the holding and distribution facilities, to meet international standards. In such cases, in order to ensure the materials are adequately conserved and can be distributed in a safe and timely manner, the collection holders should consider duplicating unique materials to the international collection maintained by ICARDA, or another large, well-maintained and internationally available collection. 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, molecular characterization, 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 replicate within an international collection. The further development of accession level data and subsequent comparison of this data across collections will greatly facilitate the identification of unique accessions and to further the global strategy for faba bean.

[33] http://www.croptrust.org/main/role.php

Results of the Aleppo meeting and subsequent information gathering permits a preliminary division of existing *Vicia faba* collections into a number of priority 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 faba bean 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 and maintaining international standards for conservation and distribution.

- GLOBAL- ICARDA
- China- CAAS
- United States- USDA
- Germany- IPK
- France- INRA

It is recognized that in addition to the five collections above, a number of *Vicia faba* collections maintain international standards and contain some unique germplasm. These collections include ATFC Australia, CGN the Netherlands, PGRC Canada, and NBPGR India. Care should be taken to ensure that these unique accessions are safety duplicated and remain at international standards for conservation and availability.

Group B

In addition a number of other collections were identified at the workshop that likely contain globally important faba bean resources, but may not meet full international standards with respect to their maintenance, documentation, distribution, or other. With suitable support these collections could, over time, meet such standards. It was recommended that assistance be provided to enable them to do so- both through supporting the recognition of the importance of the collections within the nation concerned, and through international collaboration. An alternative approach to such collections – particularly in cases where 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 in group C (below), generally in transferring genetically unique germplasm to a better resourced institute. Further work is needed to assess the uniqueness and quality of some of these collections.

- Spain- CRF, INIA Madrid
- Portugal- BPGV
- Russian Federation- VIR
- Italy- IGV
- Turkey- AARI
- Ecuador- ICN
- Ethiopia- BCRI

Together the collections in Groups A-B hold 28,859 accessions (76% of total identified accessions worldwide).

Group C

A third group of collections are likely to contain genetically unique and important accessions, but have a relatively limited amount of unique material, a small collection of unique material, or for which more information is needed. If the collections contain a limited percentage of genetically unique material or a small collection, it would be hard to justify the provision of external financial and other resources by the international community for upgrading the collection, and the holding and distribution facilities, to meet international standards. If such collections are not supported adequately within nation, they in general warrant duplication within a collection in category A-B above.

- Egypt- NGB
- Romania- BGRV
- Bulgaria- IPGR
- Ecuador- INIAP- DENAREF
- Eritrea- NARI
- Greece- GGB
- Portugal- EAN Oieras
- Morocco- INRA

Financial or other resources may be needed to enable the holders of 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 faba bean with the regeneration-characterization-duplication grants initiated in 2007, and the long-term support grant established for the international faba bean collection safeguarded by ICARDA.

Although the strategy process involved meetings, correspondence, and surveys sent to major genebanks holding *Vicia faba* worldwide, feedback from some potential collections was not successfully obtained. Therefore the collections listed in this strategy, albeit representing the major and most active *Vicia faba* collections, should not be considered a comprehensive listing for collections worldwide. Collections holding accessions of *Vicia faba* identified within the Bioversity International, FAO WIEWS, ECPGR, and/or EURISCO databases, regional conservation strategies, scientific literature, or other means, and not present in the strategy are listed in *Annex 7*. As these yet-to-be verified collections together potentially conserve almost 10,000 accessions, further work is warranted to establish the status and contents of these collections, and to incorporate collections holding unique diversity into the Global Strategy.

The Aleppo meeting and subsequent data analysis identified a number of national collections and regions especially in need of more information on collections, including:

- North Africa, especially the Sudan-Egyptian oasis material
- Arabian peninsula
- The Levant (Syria, Jordan, Lebanon, Israel, and Palestine)
- Central Asia- especially Afghanistan
- South America
- Poland- IHAR
- Israel- ARO, Volcani Center
- Czech Republic- AGRITEC

- Japan
- Bangladesh
- Iran

Table 9 summarizes identified priority faba bean collections and future needs and questions related to those collections.

Table 9. Summary of potential priority collections and further questions

Country	Genebank/Institute	Category	Number of Accessions (*V. faba*)	Accessions for Regeneration within 5 years	Comments
Global	International Centre for Agricultural Research in Dry Areas (ICARDA)	A	12015	20%	Global collection, material from 71 countries, 70% unique
China	Institute of Crop Science (CAAS)	A	5229	60%	Very important Chinese material is not very well represented in other collections
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	A	1925	15%	Very large collection, lots of unique landraces and old varieties. Computerization planned within 5 years. No major limitations stated. Need more safety duplication.
France	Station d'Amelioraton des Plantes (INRA)	A	1057	55%	SGRP 2000 estimated collection to be 70% unique
USA	Western Regional Plant Introduction Station, USDA-ARS, Pullman	A	589		
Italy	Istituto di Genetica Vegetale (IGV), CNR, Bari	B	1875	40%	Many collecting missions carried out in the Mediterranean. Many accessions of *major*, present mostly in Italy. Also high protein *minor* type. Need more cages for regen. Insufficient budget, regen facilities, young researchers, user interest, breeders. Need safety duplication, more work on data availability.
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador (ICN)	B	1650		Important material from Ecuador and is not very well represented in other collections. Safety duplication?
Russian Federation	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR)	B	1441	40%	Needs regeneration
Ethiopia	Biodiversity Conservation and Research Institute (BCRI)	B	1208	3%	Only 22% in long term conditions(-10 degrees). Need safety duplication.
Spain	Centro de Recursos	B	1179	31%	

Country	Genebank/Institute	Category	Number of Accessions (*V. faba*)	Accessions for Regeneration within 5 years	Comments
	Fitogeneticos, INIA, Madrid				
Turkey	Aegean Agricultural Research Inst. (AARI)	B	351		Needs safety duplication
Portugal	Banco Portuges de Germoplasma Vegetal, Braga (BPGV)	B	340	50%	Have space on offer for safety duplication. 416 accessions duplicated at BPGV from ENMP.
Romania	Banca de Recurse Genetice Vegetale- Suceava (BGRV)	C	801	63%	Lack of national breeding program, lack of interest by farmers in *V faba*. Farmers transitioning to other crops. Unique germplasm, high protein content, foliar disease resistance. Only a portion in long-term storage. Need regeneration, safety duplication.
Bulgaria	Institute for Plant Genetic Resources "K.Malkov" (IPGR)	C	729	8%	Active selection for cold and disease resistance, earliness. Lack funding. 73 accessions fully unique. Computerization planned within 3 years. Need support for regeneration. Need safety duplication.
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	C	267	50%	Medium term and working collection gene bank; plans for long-term storage in future. Insufficient # seeds per sample in some cases. Wild species not well known how to curate or regen. Planning more collections, regen will get better with 40 new cages, and planning characterization of wild germplasm. Greek landraces interesting in having large seed size, low glucosinates, and good forage. Planned EU funding recently cut.
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	C	262	100%	Disease resistance found in collection. Financial constraints on regeneration. Need external financial aid. Collection mostly unique. Not distributing many accessions, but no constraints. Need regeneration

Country	Genebank/Institute	Category	Number of Accessions (*V. faba*)	Accessions for Regeneration within 5 years	Comments
Eritrea	National Agricultural Research Institute (NARI)	C	200	70%	Need to do further collecting in country to fill gaps. Have drought tolerance traits in collection. Nothing has been regenerated since establishment in 1992. Need cages, need funding.
Egypt	Field Crops Research Institute, Agricultural Research Center (NGB)	C	125	10%	safety duplication?
Portugal	Banco de germoplasma Genetica, (EAN) Oieras	C	66	100%	68% safety duplicated at CRF Spain; 32% U. Southampton UK.
Morocco	Institut National de la Recherche Agronomique (INRA)	C			

6.1 Maintaining and implementing the *Vicia faba* strategy

The surveys and the Aleppo meeting represent a first step in the creation of a global strategy for the *ex situ* conservation of faba bean. Significant gaps in data regarding collections are outstanding, and must be addressed in order to develop the strategy further. To build upon the achievements of the Aleppo meeting and to advance the global strategy for faba bean for enhanced conservation and use of genetic resources, key steps include:

- Obtaining and incorporating into the strategy data on collections identified in the strategy currently having gaps in information, as well as the collections not included in the strategy (listed in Annex 7).
- Gaining feedback and engagement from major collections and networks, breeders, and stakeholders on the strategy.
- Reinforcing the understanding of interdependence and need for cooperation and collaboration among collections regarding *Vicia* genetic resources.
- Information sharing facilitated by a common information network on *Vicia*.
- More fully utilise the expertise of already integrated systems (e.g. rules and procedures from ECPGR, AEGIS).
- Production and verification of more characterization data on accessible collections.
- Focus research, evaluation, and characterization on a broader range of traits and concerns relating specifically to the maintenance of *V. faba* germplasm during regeneration, including pollination systems, floral biology, spatial isolation and interactions with the environment. Other traits include pests and diseases and climate change.
- Sustainable sources of funding are needed in order to support the works outlined in the strategy and to foster efficient and effective inter-network cooperation.
- Comprehensive support of the strategy by stakeholders worldwide is key to its success and further development.

7) Summary and conclusions

Key tasks necessary for the formation of a rational global conservation effort for *Vicia faba* 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 viable regeneration protocols 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 ICARDA or other large and secure collections. All unique materials should be duplicated for safety reasons so that each genetically unique accession is safeguarded in a facility meeting international standards for conservation and distribution. A further safety duplication should be sent to the Svalbard Global Seed Vault.

Gaps in information regarding *Vicia faba* collections and the status of germplasm held in these collections currently constrain the comprehensiveness of the Strategy. Missing information on *Vicia faba* resources should be gathered for all collections listed in the Strategy, and other institutions potentially containing faba bean collections (Annex 7) 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 faba bean germplasm is of high priority. Through the generation of accession-level data and by improving the accessibility of information on accessions globally, truly genetically unique resources will be identified and prioritized for support. Only through such information-building 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, researchers and others.

Additional collecting should be undertaken to fill the gaps identified in Section 2.6. 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 faba bean that have not yet ratified the ITPGRFA should be encouraged to do so.

This global strategy is currently confined to a focus on the major grain crop *Vicia faba*. The approximately 30 other utilized species in the genus, and the approximately 110-160 wild species in the genus, represent related germplasm that have the potential to be of use to the improvement of faba bean cultivars. Numerous collections of these utilized taxa, especially *Vicia sativa*, and of the wild species, exist worldwide, and are not treated in this document.

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.

Literature Cited:

Allkin R., Goyder D.J., Bisby F.A. and White R.J. 1986. Names and synonyms of species and subspecies in the Vicieae: Issue 3. Vicieae Database Project, Publication No. 7.

Bellido L. L. 1994. Grain legumes for animal feed. In: . J.E. Hernándo Bermejo and J. León (eds.) Neglected Crops: 1492 from a Different Perspective. Plant Production and Protection Series No. 26. FAO, Rome, Italy. p. 273-288.

Bond D.A., Lawes D.A., Hawtin G.C., Saxena M.C., and Stephens J.S. 1985. Faba Bean (*Vicia faba* L.). p. 199-265. In: R.J. Summerfield and E.H. Roberts (eds.), *Grain Legume Crops*. William Collins Sons, London.

van de Wouw M., Enneking D., Maxted N. and Robertson L.D. 2000. Vetches (*Vicia L.*). In: *Plant Genetic Resources of Legumes in the Mediterranean* (Eds. Maxted N. & Bennett S.J.). pp. 132-157. Kluwer, Dordrecht.

Duc G., Bao S., Baum M., Redden B., Sadiki M., Suso M.J., Vishniakova M., and Zong X. 2008. Diversity maintenance and use of *Vicia faba* L. genetic resources. *Field Crops Research* doi: 10.1016/j.fcr.2008.10.003.

Duke J.A. 1983. Handbook of Energy Crops. unpublished.

Ehrman T.A.M. and Maxted N. 1990. Ecogeographic Survey And Collection Of Syrian Vicieae And Cicereae (Leguminosae). *Plant Genetic Resources - Newsletter* 77: 1-8.

European Cooperative Programme for Plant Genetic Resources (ECPGR). Internet page: http://www.ecpgr.cgiar.org/

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

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

FAO STAT 2008. Available online at http://faostat.fao.org/site/291/default.aspx

Global Crop Diversity Trust. 2007. The Role of the Global Crop Diversity Trust in Helping Ensure the Long-term Conservation and Availability of PGRFA. Available online at http://www.croptrust.org/main/role.php

Holden K. Fava Beans, Levodopa, and Parkinson's Disease. Available online at http://www.scienzavegetariana.it/nutrizione/favabeans.html

IBPGR 1985. Forages for Mediterranean and adjacent arid / semi-arid areas: Report of a working group meeting held at Limossal, Cyprus. International Board for Plant Genetic Resources, Rome, Italy.

ILDIS 2005. LegumeWeb. Available online at http://www.ildis.org/LegumeWeb/

Kupicha F.K.1981. Vicieae. In "Advances in Legume Systematics". Eds. R.M. Polhill and P.M. Raven. pp. 377-381. Royal Botanic Gardens, Kew.

Maxted N., Obari H. and Tan A. 1990. New And Interesting Vicieae From The Eastern Mediterranean. *Plant Genetic Resources - Newsletter* 78: 21-26.

Maxted N. 1991. A revision of *Vicia* subgenus *Vicia* using database techniques. Unpublished Ph.D. thesis, University of Southampton.

Maxted N. 1995. An ecogeographical study of *Vicia* subgenus *Vicia.* In: *Systematic and Ecogeographic Studies on Crop Genepools (IPGRI)*, no. 8 / International Plant Genetic Resources Inst., Rome (Italy), 184 p.

Maxted N. and Bennett S., Eds. 2001. *Plant Genetic Resources of Legumes in the Mediterranean.* pp. 1-386. Kluwer, Dordrecht.

Maxted N. and Kell S. 2009. Establishement of a global network for the in situ conservation of crop wild relatives: status and needs. FAO Commission on Genetic Resources for Food and Agriculture. 274 pp. Available online at: http://pgrforum.org/documents/Global_in_situ_CWR_conservation_network.pdf

Muehlbauer F.J. and Tullu A. 1997. *Vicia faba* L. New Crop Factsheet. Purdue University. Available online at http://www.hort.purdue.edu/newcrop/cropfactsheets/fababean.html

Nadal S., Suso M.J. and Moreno M.T. 2003. Management of *Vicia faba* genetic resources: changes associated to the selfing process in the major, equina and minor groups. *Genetic Resources and Crop Evolution* 50: 183-192.

Parsons R. 1996. The Long History of the Mysterious Fava Bean. South Coast Today. Available online at http://archive.southcoasttoday.com/daily/05-96/05-29-96/c01li096.htm

Perrino P., Robertson L.D., and Solh M.B. 1991. Maintenance, evaluation and use of faba bean germplasm collections: problems and prospects. *Options Mediterraneennes*- Serie Seminaires 10: 21-31.

Suso M.J., Nadal S., Roman B. and Gilsanz S. 2007. *Vicia faba* germplasm multiplication-floral traits associated with pollen-mediated gene flow under diverse between-plot isolation strategies. *Ann. Appl. Biol* 152: 201-208.

Suso M.J., Pierre J., Moreno M.T., Esnault R., and Le Guen J. 2001. Variation in outcrossing levels in faba bean cultivars: role of ecological factors. *Journal of Agricultural Science* 136: 399-405.

Undersander D.J., Ehlke N.J., Kaminski1 A.R., Doll J.D., and Kelling K.A. 1990. Hairy Vetch. *Alternative Field Crops Manual*. University of Wisconsin Cooperative Extension Service, Department of Agronomy, Madison. Available online at http://www.hort.purdue.edu/newcrop/afcm/vetch.html

USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/cgi-bin/npgs/html/genus.pl?12701 (25 March 2008)

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
ICARDA- International Center for Agricultural Research in the Dry Areas
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

Annex 1. Fava bean conservation strategy survey

Vicia faba Conservation Strategy Survey – June 2008

1. Background

The Global Crop Diversity Trust is undertaking a series of studies to support the development of global collaborative conservation strategies for different crops. The strategies are intended to serve the plant genetic resources community in understanding the current status of collections as well as identifying needs and challenges in conservation and utilization.

A global conservation strategy for fava bean (*Vicia faba*) has been a number of years in the making. The first consultations on the development of the strategy (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. Subsequently, in March 2006, a survey was distributed to the curators of numerous *Vicia faba* genebanks to seek comprehensive information on the status of *Vicia faba* collections. Unfortunately the response to the questionnaire was limited. A second meeting took place at ICARDA in Aleppo, Syria from 19 – 22 February, 2007, entitled: "Global Collaborative *Ex Situ* Conservation Strategies for Food Legumes (chickpea, lentil, fava bean and grass pea)", attended by 27 scientists from 18 countries. This group furthered the process of developing the strategy given the limited available information.

This questionnaire has been developed in order to seek the advice and input of representatives of the world's major *Vicia faba* collections toward the goal of filling outstanding gaps in the development of the *Vicia faba* conservation strategy. The finished strategy will serve as an important reference document, informing decision- making and priority assessments at the global and regional levels in the coming years. As the strategy document will be made publicly available, results of the survey will be included and therefore published.

As curator of a fava bean collection, we kindly request you to complete all of the sections of the questionnaire. We estimate that this procedure may take approximately 1 hour of your time. We appreciate your patience. If there are no *ex situ Vicia faba* collections in your institute, please can you complete sections 16-17 only. **Please return the questionnaire no later than 18 July 2008 to:**

Colin Khoury
Global Crop Diversity Trust
c/o FAO
Viale delle Terme di Caracalla
00153 Rome
Italy

The survey can also be returned by email to **colin.khoury@croptrust.org**

The Global Crop Diversity Trust is keen to have your active participation in the development of the 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 Colin Khoury at the address listed above, or at +39 06 570 53353.

2. Information about your organization

2.1 Name and address of your organisation holding/maintaining the *Vicia faba* collection			
Address:			
City:		Postal Code:	
Country:			
Web site:	www.		
2.2 Curator in charge of the *Vicia faba* 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 *Vicia faba* collection)			
Name:			
Address:			
City:			
Telephone:		Fax:	
Email:			

2.4 Date of response of this questionnaire: _____

2.5. Additional key contacts for the *Vicia faba* germplasm collection

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

3. Other institutions in your country holding *Vicia faba* germplasm- please list contact details of other fava bean collections in your country.

Name of Institute	Contact Person	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 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 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 it expected to come under the International Treaty in the near future?
☐ YES ☐ NO

4.3.1.1 If YES, indicate expected date: _____

5. Overview of your *Vicia faba* collection

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

_____

_____

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

Type of fava bean germplasm	**number of accessions**
Wild related species	
Landraces	
Obsolete improved varieties	
Advanced improved varieties	
Breeding/research materials	
Inter-specific derivatives	
Unknown	
Other	

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

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

5.4 Are there major gaps in your *Vicia faba* collection? Please indicate major gaps concerning your fava bean collection:

Population (sample) representation per species: ☐ YES ☐ NO
Ecological representation of the species: ☐ YES ☐ NO
Other, please specify the gap concerning your fava bean collection:

_____

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

_____
_____
_____

6. Aspects on the potential of the *Vicia faba* collection

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

_____
_____
_____
_____

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

_____
_____
_____
_____

7. Conservation status (germplasm management)

7.1 Please indicate the proportion (in %) of the *Vicia faba* 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 describe the MAIN storage facility available for your *Vicia faba* 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:			

7.3 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: _____

7.4 Is the *Vicia faba* collection affected by diseases that can restrict the distribution of the germplasm? ☐ YES ☐ slightly, only few accessions ☐ NO ☐ (do not know)

7.4.1 If you indicated YES or slightly above, are knowledge and facilities available at your institution for eradication of these diseases? ☐ YES ☐ limited ☐ NO

7.5 Regeneration

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

_____

7.5.2 Indicate the proportion (%) of the collection that requires regeneration within the next 5 years

_____

7.5.3 Indicate the proportion (%) of the collection that requires urgent regeneration

_____

7.5.4 Indicate issues, constraints, etc. regarding regeneration of fava bean

_____
_____
_____
_____

7.6 Please indicate the current situation of the *Vicia faba* 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 2012
Funding for routine operations and maintenance		
Retention of trained staff		
Interest for Plant Genetic Resource Conservation by donors		

Condition	Current situation	Expected situation in 2012
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 *Vicia faba* 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 *Vicia faba* in your genebank

9.1 Is there any *Vicia faba* 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 *Vicia faba* collection

10.1 To what extent do you consider the *Vicia faba* 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 *Vicia faba* 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 *Vicia faba* 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 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 *Vicia faba* collection is not computerised, are there plans to do so in the future?

☐ No plans
☐ Computerisation planned within 3 years
☐ Other

11.4 Is the information 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 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 when returning the completed questionnaire.

11.5 Is data on the 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 *Vicia faba* genetic resources (International *Vicia faba* Database) to be useful? ☐ YES ☐ partly ☐ NO

11.5.3 Would you like to contribute data to an international *Vicia faba* 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 collection is AVAILABLE for the following distributions?

Nationally: _____% Regionally: _____% Internationally: _____%

12.2 Please fill in the number of *Vicia faba* 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 accessions?

☐ YES ☐ NO

12.3.1 If YES, please specify: _____

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

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 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 *Vicia faba* 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 *Vicia faba* accessions and their respective data in your collection?

_____

_____

_____

12.10 Describe briefly what are the most important factors limiting the use of the *Vicia faba* 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 materials? ☐ YES ☐ NO

12.13.1 If YES, please specify: _____

<u>13. Networks of *Vicia faba* genetic resources</u>

13.1 Do you collaborate in (a) network(s) as a *Vicia faba* 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**

14. Additional crop collections maintained in your Institute: 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 *Vicia faba* collection:

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

16. Question concerning institutes NOT maintaining *Vicia faba ex situ* collections

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

Any current *Vicia faba* conservation activities:	

Institute focal person to contact for further details:	
Plans for any *Vicia faba ex situ* conservation:	
Any other information:	

17. Please add any further comments you may have:

_____
_____
_____
_____

Thank you for your important contribution!!!

Please return the questionnaire no later than 18 July 2008 to:

Colin Khoury
Global Crop Diversity Trust
c/o FAO
Viale delle Terme di Caracalla
00153 Rome
Italy

The survey can also be returned by email to **colin.khoury@croptrust.org**.

Annex 2. Institutions contacted through survey in 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	daniel.combes@univ-pau.fr	Yes

No	Country	Institute's name	Email address	Survey sent 20 April 06
		Universite de Pau Ave. de l'Université, Pau		
15.	Germany	Genebank, Inst. for Plant Genetics and Crop Plant Research (IPK) Corrensstrasse 3 Gatersleben	knupffer@ipk-gatersleben.de	Yes
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	gcsarpbio@mail.sy	Yes

No	Country	Institute's name	Email address	Survey sent 20 April 06
		Damascus		
32.	Syria	Int. Centre for Agricultural Research in Dry Areas (ICARDA) PO Box 5466, Aleppo	icarda@cgiar.org	Yes
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	John Innes Centre, Norwich Research Park, Colney, Norwich, NR4 7UH	mike.ambrose@bbsrc.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. Institutions contacted through survey in 2008

Country	Genebank/institute	Address	email	phone
Armenia	Institute of Botany, Botanical Gardens (IBNAS)	1 Acharyan str. Yerevan 375063 Armenia	Institute botany <botanyinst@sci.am>; nagb@links.am	(+374 10) 61-4440
Australia	Australian Medicago Genetic Resources Centre, South Australian Research and Development Institute	SARDI, PRC GPO Box 397 Adelaide, South Australia 5001 Australia	pirsa.sardi@saugov.sa.gov.au	61 8 83039400
Bolivia	Centro de Investigaciones Fitoecogenéticas de Pairumani	Pairumani s/n, CC 128 Cochabamba Bolivia	fitogen@fundacionpatino.org	(591-42) 60083
Brazil	Embrapa Recursos Genéticos e Biotecnologia	PqEB s/n, Av. W/5 Norte Final, CP 02372 Brasilia, DF 70770-900 Brazil	mlopes@cenargen.embrapa.br	(55-61)4484607
Bulgaria	Institute for Plant Genetic Resources "K.Malkov"	Druzba 2 Sadovo, Plovdiv district 4122	shamov@yahoo.com	(359-32)629026

Country	Genebank/institute	Address	email	phone
		Bulgaria		
Chile	Instituto de Investigaciones Agropecuarias, Centro Regional de Investigación Carillanca	Camino Cajón Vilcun Km 10 Temuco 58-D Chile	iseguel@carillanca.inia.cl; info@carillanca.inia.cl; iseguel@inia.cl	(56-45) 215706
Chile	Instituto de Investigaciones Agropecuarias, Centro Regional de Investigación La Platina	Santa Rosa 11610, La Pintana Santiago Casilla 439-3 Chile	esalazar@platina.inia.cl; iseguel@inia.cl	(56-2)5417223
Colombia	Centro de Investigación La Selva, Corporación Colombiana de Investigación Agropecuaria	Km. 7 vía Llanogrande, A. A. 100 ó 470 Rionegro, Antioquia Colombia	pnegv@epm.net.co	(57-4)5371133
Cyprus	National (CYPARI) Genebank, Agricultural Research Institute, Ministry of Agriculture, Natural Resources and Environment	P.O. Box 22016 Nicosia Cyprus	Athena.Della@arinet.ari.gov.cy	357-22403219
Ecuador	Instituto de Ciencias Naturales Universidad Central del Ecuador	Casilla Postal 633 Quito Ecuador		(593-2)523710
Ecuador	Departamento Nacional de Recursos Fitogenéticos y Biotecnología- Sta Catalina; estacion experimental Santa Catalina DENAREF, INIAP	Panamericana Sur Km 14, C.P. 17-01-340 Quito, Pichincha Ecuador	iniap@iniap-ecuador.gov.ec; eescdir@ecnet.ec	(593-22)693359, 690692, 690693
Eritrea	National Agricultural Research Institute (NARI)	P.O. Box 4627 Asmara Eritrea	amanuelmaz@yahoo.com	000291-1-159801 or 159841
France	Station d'Amelioraton des Plantes (INRA)	Domaine de La Motte, BP 29 Le Rheu 35653 France (now NRA-UMR LEG, BP 86510, 21065 DIJON cédex, France)	divaret@inra.rennes.fr (now duc@epoisses.inra.fr)	(33)234 85144 (now 33 (0)3 80 69 31 48; secretary 33 (0)3 80 69 30 45; standard 33 (0)3 80 69 30 00)
Germany	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben	Corrensstrasse 3 Gatersleben D-06466 Germany	graner@ipk-gatersleben.de	(49-39)482-5521
Germany	Federal Centre for Breeding Research on Cultivated Plants (BAZ), Research and	Bundesallee 50 Braunschweig 38116 Germany	l.frese@bafz.de	(49-531)5962451 / 596307/5961

Country	Genebank/institute	Address	email	phone
	Coordination Centre for Plant Genetic Resources (FKZPGR)- Quedlinburg			
Germany	State Seed Breeding Centre, University Hohenheim (State Plant Breeding Institute)	P.O. Box 700652 Stuttgart 70593 Germany	LSA@uni-hohenheim.de; jochreif@uni-hohenheim.de	
Greece	National Agricultural Research Foundation, Agricultural Research Centre of Northern Greece, Greek Gene Bank	PO Box 312 Thermi, Thessaloniki 570 01Greece Greece	kgeggb@otenet.gr	(30-31)471544/439
Israel	Israel Gene Bank for Agricultural Crops, Agricultural Research Organisation, Volcani Center	Volcani Center, PO Box 6 Bet Dagan 50250 Israel	vcarie@volcani.agri.gov.il	(972-3)9683896
Italy	CNR - Istituto di Genetica Vegetale (IGV)- Bari	Via G. Amendola 165/A Bari 70126 Italy	germplasm@area.ba.cnr.it; galasso@ibba.cnr.it; <germplasm@igv.cnr.it>, <domenico.pignone@igv.cnr.it>, <giambattista.polignano@igv.cnr.it>	(39-80)55.83.463 / 400
Kenya	National Genebank of Kenya (NGBK)	P.O. Box 781, Kikuyu Muguga Kenya	ngbk@wananchi.com	(254-154)32587
Libya	Agricultural Research Centre	Sid Mesri, PO Box 2480 Tripoli Libyan Arab Jamahiriya		(218-21) 603865 / 604865 / 605840 / 605723
Morocco	Institut National de la Recherche Agronomique	Avenue de la Victoire, B.P. 415 Rabat 10101 Morocco	narjisse@awamia.inra.org.ma; contact@inra.org.ma	(212)37770955/37772639
Netherlands	Centre for Genetic Resources, the Netherlands Plant Research International (CGN)	PO Box 16 Wageningen 6700 AA Netherlands	cgn@wur.nl	(31–317)477045
Peru	Facultad de Agronomía, Universidad Nacional del Centro- Junin	Casilla Postal 138 Huancayo, Junin Peru	dorismg83@hotmail.com	64-218233
Peru	Estación Experimental Agropecuaria Illpa-Puno, INIA	Km. 22, Carretera Puno-Juliaca, Apdo 468 Puno Peru	illpa@lanet.com.pe	(51-54)622779, 363812
Peru	Estación Experimental Canaan-Huamanga, INIA	Av. Abancay, Apartado 195 Correo Central Ayacucho, Huamanga Peru	inia.ayacucho@chankas.com	(51-64)813041, 812271

Country	Genebank/institute	Address	email	phone
Poland	Plant Breeding and Acclimatization Institute (IHAR)	Radzikow, Blonie 05-870 Poland	postbox@ihar.edu.pl	(48-22) 725 3611
Poland	Plant Genetic Resources Laboratory, Research Institute of Vegetable Crops (SKV)	Konstytucji 3 Maja 1/3, POB 110 Skierniewice 96-100 Poland	tkotlin@inwarz.skierniewice.pl	(48-46)8332947
Portugal	Banco Portuges de Germoplasma, Braga (BPGV)	Quinta de S. José- S. Pedro de Merelim Braga 4700 Portugal	bpgv@draedm.min-agricultura.pt	(351)253-621711 / 622203
Romania	Banca de Recurse Genetice Vegetale-Suceava (BGRV)	str. 1 Decembrie 1918 nr.17 Suceava 5800 Romania	genebank@assist.ro; genebank@suceava.astral.ro	0040-230-521016
Spain	Centro de Investigacion y Desarrollo Agrario Alameda del Obispo	Av. Menendez Pidal - Apdo. 4240 Cordoba 14080 Spain		(34-5)7293833
Tajikistan	Makhsumov Scientific Reserch- production Center "Ziroatkor" & Scientific Reserch Institute of Farming & TJK-Genebank (MSRPC)	Sharora village Gissar Region 735022 Tajikistan	Dr. Zebuniso Muminshoeva; zebuniso@rs.tj	
Tunisia	Ministry of Agriculture (MOA)	INRAT 43 Av. Charles Nicolle Tunis 1082 Tunisia	salahrezgui08@yahoo.fr	216-96-51398

Annex 4. 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
12.	Russian Federation	Dr. Margarita Vishnakovaya N.I. Vavilov Institute of Plant Industry (VIR) Bolshaya Morskaya Street 42-44; 190000, St. Petersburg. Russian Federation Tel: +7-812-3144732 Fax: +7-812-1178762	m.vishnyakova@vir.nw.ru; ssvvss61@mail.ru
13.	Spain	Dr. Álvaro Ramos Monreal; Jefe de Medios de Producción Agrícola; Consejeria de Agricultura Ganadería; Rigoberto Cortejoso 14, 2ª planta; VALLADOLID 47014, Spain Tel: +983-418935; Fax: +983-419853	rammonal@jcyl.es
14.	Spain	Dr. María José Suso Instituto de Agricultura Sostenible (CSIC) Alameda del Obispo s/n Apartado 4084; 14080 Córdoba, Spain Tel: +34 957 499 237 Fax: +34 957 499 252	ge1susom@uco.es
15.	Turkey	Dr. Ayfer Tan Head, Department of Plant Genetic Resources Aegean Agricultural Research Institute (AARI); PO Box 9 Menemen, Izmir 35661; Turkey Tel: +90-232-8461107 Fax: +90-232-8461331	pgr@aari.gov.tr
16.	Ukraine	Dr. Victor K. Ryabchoun Yurjev Plant Production Inst. of UAAS National Centre for PGR of Ukraine; Moskovs'kyi pr. 142; Ukraine Tel: +38 -57-7797763 Fax: +38-57-7797763	bogus@is.kh.ua; leader@kharkov.ukrtel.net
17.	United Kingdom	Mr. Mike Ambrose Department of Applied Genetics John Innes Centre; Norwich Research Park, Colney Lane, Norwich NR4 7UH; United Kingdom Tel: +44-1603-450630 Fax: +44-1603 -450045	mike.ambrose@bbsrc.ac.uk
18.	ICARDA	Dr. Bonnie J. Furman Interim Unit Head Legume Germplasm Curator Genetic Resource Unit, ICARDA P.O. Box 5466, Aleppo, Syrian Arab Republic Tel: (963-21) 2225012 ext. 699 Fax: (963-21) 2213490	b.furman@cgiar.org
19.	ICARDA	Dr. Ken Street CAC PGR projects coordinator, ICARDA P.O. Box 5466, Aleppo, Syria Tel: 963 221 4434 Fax: 963 21-221-3490	k.street@cgiar.org
20.	ICARDA	Dr. Jan Valkoun Unit Head Emeritus ICARDA, P.O. Box 5466, Aleppo, Syria Tel: 963 221 4434 Fax: 963 21-221-3490	j.valkoun@iol.cz

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
24.	Global Crop Diversity Trust	Cary Fowler Executive Director, Global Crop Diversity Trust C/o FAO, Via delle Terme di Caracalla, 00100, Rome, Italy Tel: +39 06570 53841 Fax: +39 06570 55609	cary.fowler@fao.org
25.	Global Crop Diversity Trust	Brigitte Laliberté Scientist, Global Crop Diversity Trust C/o Bioversity International Via dei Tre Denari 472/a, 00057 Maccarese, Rome, Italy Tel:+39-06-611-8272 Fax:+39-06-619-79661	brigitte.laliberte@croptrust.org
26.	Global Crop Diversity Trust	Ola Westengen Associate Professional Officer Global Crop Diversity Trust C/o FAO, Via delle Terme di Caracalla, 00100, Rome, Italy Tel: +39 06570 54119 Fax: +39 06570 55609	ola.westengen@fao.org
27.	Syria	Dr Majd Jamal Director General, GCSAR Ministry of Agric & Agrarian Reform P. O. Box 113-Douma Damascus, Syria Tel. +963-11 574 1940 Fax: +963-11 575 7992	majdjamal@scs-net.org

Annex 5 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 6. 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 7: Other Potential *Vicia faba* 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	%
Faba bean	Vicia	ICARDA	CGIAR	●	9,703	30	40	60	0	0	0	98	2	0	35
Faba bean	Vicia	IDG	Italy	○	3,671	12	0	0	0	100	0	0	0	100	-
Faba bean	Vicia	IPK	Germany	○	2,946	9	74	26	0	0	0	0	0	100	-
Faba bean	Vicia	ATFGRC	Australia		2,500	8	100	0	0	0	0	0	0	100	-
Faba bean	Vicia	BGRC	Germany	○	2,287	7	0	88	0	12	2	32	62	4	-
Faba bean	Vicia	CIDACOR	Spain	○	1,900	6	0	100	0	0	0	0	63	37	-
Faba bean	Vicia	VIR	Russia	◑	1,707	5	0	0	0	100	0	0	0	100	-
Faba bean	Vicia	INRA-Rennes	France	○	1,700	5	0	0	0	100	0	59	41	0	-
Faba bean	Vicia	UC-ICN	Ecuador		1,650	5	0	0	0	100	0	0	0	100	-
Faba bean	Vicia	AARI	Turkey		1,495	5	0	100	0	0	0	0	0	100	-
Faba bean	Vicia	PGRC-E	Ethiopia	◑	1,208	4	0	0	0	100	0	100	0	0	-
Faba bean	Vicia	SUMPERK	Czech Rep.	○	1,064	3	0	0	100	0	0	0	0	100	-
Faba bean	Vicia	Total			31,831	100	19	38	3	32	0	39	11	42	-

Vicia faba collections identified in databases, strategies, and scientific literature, not contained within *Table 1.*

Country	Genebank/institute	Number of Accessions	Source	Year
Poland	IOPG-PAS, Poznan	1258	Duc *et al.* 2008	
Spain	Junta de Andalucía. Instituto Andaluz de Investigación Agroalimentaria y Pesquera. Centro de Investigación y Formación Agroalimentaria Córdoba	1200	WIEWS	
Poland	Plant Breeding and Acclimatization Institute (IHAR)	856	ECPGR db/ EURISCO/ WIEWS/ Bioversity / Duc *et al.* 2008	2001/ 1995
Peru	Facultad de Agronomía, Universidad Nacional del Centro-Junin	560	WIEWS/ Bioversity	1999
Bolivia	Centro de Investigaciones Fitoecogenéticas de Pairumani	480	WIEWS/ Bioversity	1998
Peru	Estación Experimental Agropecuaria Illpa-Puno, INIA	380	WIEWS/ Bioversity	1999
Israel	Israel Gene Bank for Agricultural Crops, Agricultural Research Organisation, Volcani Center	341	ECPGR db/WIEWS/ Bioversity/EURISCO	1995
Czech Rep.	AGRITEC, Research, Breeding & Services, Ltd. Zemedelska 16, 78701, Sumperk, Czech Republic	330	ECPGR Vfaba database	2001
Morocco	Institut National de la Recherche Agronomique	309	WIEWS/ Bioversity	1988
Belgium	Department of Plant Production, University of Gent	301	WIEWS	
Chile	Instituto de Investigaciones Agropecuarias, Centro Regional de Investigación Carillanca	271	WIEWS/ Bioversity	2003
Spain	Compania Espanola de Cultivos Oleaginosos, S.A. (CECOSA)	255	Bioversity Directory	1988
Chile	Instituto de Investigaciones Agropecuarias, Centro Regional de Investigación La Platina	215	WIEWS/ Bioversity	2003
Libya	Agricultural Research Centre	200	WIEWS/ Bioversity	1998
Italy	Institute of Agronomy and Field Crops	190	WIEWS/ Bioversity	1995

Country	Genebank/institute	Number of Accessions	Source	Year
United Kingdom	NIAB, Huntington road, Cambridge CB3 OLE, UK	180	ECPGR Vfaba database	2001
Tunisia	Ministry of Agriculture (MOA)	158	WANA Strategy	2006
Peru	Estación Experimental Canaan-Huamanga, INIA	150	WIEWS/ Bioversity	1999
Brazil	Embrapa Recursos Genéticos e Biotecnologia	149	WIEWS/ Bioversity	2001
Colombia	Centro de Investigación La Selva, Corporación Colombiana de Investigación Agropecuaria	139	WIEWS/ Bioversity	1999
France	Collection Nationale Céréales à Paille, Unité expérimentale du Magneraud, Groupe d'Étude et de contrôle des Variétés et des Semences	130	WIEWS/ Bioversity	1994
Australia	Australian Medicago Genetic Resources Centre, South Australian Research and Development Institute	116	WIEWS/ Bioversity	2002
Tajikistan	Makhsumov Scientific Reserch- production Center "Ziroatkor" & Scientific Reserch Institute of Farming & TJK-Genebank (MSRPC)	114	CAC database	
Ukrania	Yurjev Institute of Plant Breeding, 61060 Moskovsky prospect, 142 Kharkiv, Ukrania	114	ECPGR Vfaba database	2001
Austria	Institut für Pflanzenbau, BFL,Spargelfeldstrasse 191, PO Box 400 A-1226, Vienne;Autriche	110	ECPGR Vfaba database	2001
Cyprus	National (CYPARI) Genebank, Agricultural Research Institute, Ministry of Agriculture, Natural Resources and Environment	101	EURISCO WIEWS/ Bioversity / ECPGR db	
Peru	Universidad Nacional Hermilio Abad del Cusco, Centro K'Ayra	100	WIEWS/ Bioversity	1999
Spain	Ramon Batlle Vernis, S.A.	89	WIEWS/ Bioversity	1988
Guatemala	Instituto de Ciencia y Technología Agrícolas	87	WIEWS	
Austria	AGES Linz - Austrian Agency for Health and Food Safety / Seed Collection	86	EURISCO	
Azerbaijan	Azerbaijan National Academy of Sciences, Genetic Resources Institute	74	CAC database	
Nordic Countries	Nordic Genetic Resource Center	71	EURISCO/ WIEWS/ Bioversity/ ECPGR	
Slovakia	Slovak Agricultural Research Insititute (SCPV-RIPP), Piestany	60	Duc *et al.* 2008	
Czech Republic	Plant Science Institute of Swiss Federal Institute of Technology, Zurich	55	WIEWS/ Bioversity	1994
Greece	Agricultural University, Athens	55	Duc *et al*. 2008	
United Kingdom	School of Biological Sciences, University of Southampton	55	WIEWS/ Bioversity	1995
Iran	National Plant Gene Bank of Iran, Seed and Plant Improvement Institute	51	WIEWS	
Peru	Universidad Nacional Agraria La Molina	50	WIEWS	
Slovenia	Crops and Seed Production Department, Agricultural Institute of Slovenia	48	EURISCO	
Czech Rep.	Research Institute of Crop Production, Genebank Working Place Olomouc, 783 71 Slechtitelu 11, Olomouc-Holice	46	ECPGR Vfaba database	2001
Spain	Banco de Germoplasma de Horticultura, 50080 Zaragoza, Spain	43	ECPGR Vfaba database	2001
Austria	Arche Noah Association	20	EURISCO	
Azerbaijan	Research Institute of Agriculture	10	EURISCO	
United Kingdom	Welsh Plant Breeding Station, Genetic Resources Unit, Institute of Grassland and Environmental Research	10	EURISCO	
Latvia	Plant Genetics Laboratory Institute of Biology	9	EURISCO	
Azerbaijan	Genetic Resources Institute	7	EURISCO	

Country	Genebank/institute	Number of Accessions	Source	Year
Swizerland	Prospecie Rara, Sortenzetrale, Postfach 95, 5742 Kölliken, Suisse	7	ECPGR Vfaba database	2001
Lithuania	Lithuanian Institute of Agriculture	4	EURISCO	
Georgia	N.Ketskhoveli Institute of Botany	3	EURISCO	
Swizerland	Safeguard for Agricultural Varieties in Europe, Schneebergstrasse 17, CH 9000, St Gallen, Suisse	3	ECPGR Vfaba database	2001
Austria	Genebank Tyrol / Tyrolean Government	2	EURISCO	
Romania	Research Institute for Vegetables and Flower Gardening Vidra-Ilfov	2	EURISCO	
United Kingdom	Warwick HRI Genetic Resources Unit	2	EURISCO	
Austria	Institute of Special Crops, Agricultural Research Center Styria	1	EURISCO	
Azerbaijan	Azerbaijan Agricultural Academy	1	EURISCO	
Estonia	Jõgeva Plant Breeding Institute	1	EURISCO	