European Cooperative Programme for Crop Genetic Resources Networks
ECP/GR

Report of a Working Group on Grain Legumes

IPGRI

Third Meeting – 5–7 July 2001 – Kraków, Poland

L. Maggioni, M. Ambrose, R. Schachl, G. Duc and E. Lipman, *compilers*

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The **International Plant Genetic Resources Institute (IPGRI)** is an autonomous international scientific organization, supported by the Consultative Group on International Agricultural Research (CGIAR). IPGRI's mandate is to advance the conservation and use of genetic diversity for the well-being of present and future generations. IPGRI has its headquarters in Maccarese, near Rome, Italy, with offices in more than 20 other countries worldwide. The Institute operates through three programmes: (1) the Plant Genetic Resources Programme, (2) the CGIAR Genetic Resources Support Programme and (3) the International Network for the Improvement of Banana and Plantain (INIBAP).

The international status of IPGRI is conferred under an Establishment Agreement which, by January 2002, had been signed and ratified by the Governments of Algeria, Australia, Belgium, Benin, Bolivia, Brazil, Burkina Faso, Cameroon, Chile, China, Congo, Costa Rica, Côte d'Ivoire, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Greece, Guinea, Hungary, India, Indonesia, Iran, Israel, Italy, Jordan, Kenya, Malaysia, Mauritania, Morocco, Norway, Pakistan, Panama, Peru, Poland, Portugal, Romania, Russia, Senegal, Slovakia, Sudan, Switzerland, Syria, Tunisia, Turkey, Uganda and Ukraine.

In 2001 financial support for the Research Agenda of IPGRI was provided by the Governments of Albania, Armenia, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Republic of Korea, Lithuania, Luxembourg, Macedonia (F.Y.R.), Malta, the Netherlands, Norway, Peru, the Philippines, Poland, Portugal, Romania, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Uganda, UK, USA and F.R. Yugoslavia (Serbia and Montenegro), and by the African Development Bank (AfDB), Asian Development Bank (ADB), Center for International Forestry Research (CIFOR), Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Centro Agronómico Tropical de Investigación y Enseñanza, Costa Rica (CATIE), Centro Internacional de Agricultura Tropical (CIAT), Centro Internacional de la Papa (CIP), Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Common Fund for Commodities (CFC), European Commission, European Environmental Agency, European Union, Food and Agriculture Organization of the United Nations (FAO), German Foundation for International Development (DSE), Global Forum on Agricultural Research (GFAR), Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnología (COLCIENCIAS), Inter-American Drug Abuse Control Commission (CICAD), International Center for Agricultural Research in the Dry Areas (ICARDA), International Center for Living Aquatic Resources Management (ICLARM), International Centre for Research in Agroforestry (ICRAF), International Crops Research Institute for the Semi-Arid (ICRISAT), International Development Research Centre (IDRC), International Food Policy Research Institute (IFPRI), International Foundation for Science (IFS), International Fund for Agricultural Development (IFAD), International Institute of Tropical Agriculture (IITA), International Livestock Research Institute (ILRI), International Rice Research Institute (IRRI), International Service for National Agricultural Research (ISNAR), International Water Management Institute (IWMI), Japan International Research Centre for Agricultural Science (JIRCAS), National Geographic Society, National Science Foundation (NSF), Programme on Participatory Research and Gender Analysis for Technology Development and Institutional Innovation (PGRA), Regional Fund for Agricultural Technology (FONTAGRO), Rockefeller Foundation, Taiwan Banana Research Institute (TBRI), Technical Centre for Agricultural and Rural Cooperation (CTA), Technova, United Nations Development Programme (UNDP), UNDP Global Environmental Facility (UNDP-GEF), United Nations Environment Programme (UNEP), UNEP Global Environmental Facility (UNEP-GEF), United States Department of Agriculture (USDA), United States Agency of International Development (USAID), Vlaamse Vereiniging voor Ontwikkelingssamenwerking en Technische Bijstand (VVOB), West Africa Rice Development Association (WARDA) and the World Bank.

The **European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR)** is a collaborative programme involving most European countries aimed at facilitating the long-term conservation and increased utilization of plant genetic resources in Europe. The Programme, which is entirely financed by the member countries and is coordinated by IPGRI, is overseen by a Steering Committee composed of National Coordinators nominated by the participating countries and a number of relevant international bodies. The Programme operates through ten networks in which activities are carried out through a number of permanent working groups or through *ad hoc* actions. The ECP/GR networks deal with either groups of crops (cereals, forages, vegetables, grain legumes, fruit, minor crops, industrial crops and potatoes) or general themes related to plant genetic resources (documentation and information, *in situ* and on-farm conservation, inter-regional cooperation). Members of the working groups and other scientists from participating countries carry out an agreed workplan with their own resources as inputs in kind to the Programme.

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Part I. Discussion and Recommendations

Introduction

M. Ambrose welcomed the participants to the third meeting. He thanked the hosts in Kraków and the ECP/GR Secretariat for organizing the meeting together with the Fourth European Conference on Grain Legumes of the European Association for Grain Legume Research (AEP). He welcomed new members of the Group and stressed the open and participatory nature of the meeting. He asked the Group to think about ideas for *ad hoc* actions over the course of the meeting.

ECP/GR briefing

L. Maggioni, ECP/GR Coordinator, welcomed the participants on behalf of IPGRI. He was pleased that the third meeting of the Working Group on Grain Legumes was being held in conjunction with the AEP Fourth European Conference on Grain Legumes, thereby facilitating collaboration between grain legume scientists from all over the world. He welcomed the presence of new members in the Group and particularly participants from countries represented for the first time in an ECP/GR meeting on grain legumes—Belgium, Bulgaria, Greece, Hungary and Macedonia (FYR). He also welcomed Anne Schneider, Executive Secretary Delegate of AEP, who would join the meeting on the second day, and a few other observers, including some from non-member countries such as Australia, Russia and USA. He explained that ASSINSEL and FAO were invited to attend, but could not send representatives.

The ECP/GR Coordinator briefly summarized activities carried out within Phase VI of ECP/GR (1999-2003), explaining that the current meeting was the only activity planned within the Grain Legumes Network, but the possibility was open for the Network Coordinating Group (made of M. Ambrose, G. Duc and R. Schachl) as well as for all members of the Group to propose *ad hoc* actions, such as small technical meetings, making use of available funds (about US$ 15 000). Finally, he reminded the Group that the ECP/GR Steering Committee would meet in October 2001 in St. Petersburg, Russian Federation and that the progress of the Group would have to be reported for evaluation by the National Coordinators.[1]

L. van Soest informed the Group that he had heard from an EU Commission Officer that a new EC programme for funding genetic resources projects was in preparation, waiting for approval by the general Directorates and by the European Parliament. The first call is expected to be launched by mid-2002. This programme, which is the continuation of programme EC1467/94, is expected to move the focus towards *in situ* (including on-farm) conservation of animal, crop and forest genetic resources. It is expected that there will be opportunities for proposals concerning plant genetic resources. Considering that there were no grain legume projects funded during the previous cycle, this may be a good opportunity for the Working Group on Grain Legumes to prepare collaborative projects for funding.

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1 Relevant recommendations made by the Steering Committee to the Grain Legumes Network were the following: 1) encourage the NCG to submit a proposal for an *Arachis* genetic resources meeting in Bulgaria; 2) encourage submission of a proposal for a small technical meeting on the regeneration of allogamous grain legume species, in collaboration with the AEP. (See: Maggioni, L., J. Turok, M. Smith, J. Weibull, P. Mulvany, I. Batlle and O. Spellman, compilers. [2001]. Report of the Steering Committee. Eighth Meeting, 14-17 October 2001, St. Petersburg, Russian Federation. International Plant Genetic Resources Institute, Rome, Italy).

Chairperson's report

The continuation of ECP/GR and its growing significance as a European platform for germplasm conservation and coordination is of continuing benefit to all participating countries. Considerable changes have taken place over the period since the second meeting. Changes in the political scene are a likely consequence of whatever outcome there is to the negotiations on the International Undertaking.[2] The planned development of a Multilateral System for plant genetic resources for food and agriculture (PGRFA), aimed at covering genera linked to global food security and for which countries are highly interdependent, including all the genera currently covered by the Working Group, is already affecting movement of germplasm material. The use of material transfer agreements (MTAs) for the exchange of germplasm is increasing. The issues of sharing of responsibilities are now being actively implemented by some PGR working groups and this will be an area of active development within the ECP/GR programme and the Working Group on Grain Legumes over the coming period. On the scientific front, developments in molecular marker technology and robotics are already having a major influence in a number of areas of PGR. This is set to expand considerably as the areas of genomics and bioinformatics grow to include work on collections. Both the political and scientific changes provide major challenges to the plant genetic resources community. These challenges emphasize the need for an active forum for the community within the European region to provide the opportunities to meet and discuss common goals in an effort to meet some of these objectives.

M. Ambrose reviewed activities and main accomplishments since the second meeting of the Group held in Norwich in October 1998.[3]

Network Coordinating Group

The Network Coordinating Committee formed at the last meeting has remained unchanged over the intervening period. While there has been no opportunity for all members of the Group to meet together, there has been much exchange of correspondence as issues arose. The Chair has taken the opportunity on a number of occasions when attending meetings to take time for detailed discussions with the other two members independently. M. Ambrose thanked G. Duc and R. Schachl for their contributions over the period.

European Grain Legume Databases

Significant developments on a number of European Central Crop Databases (ECCDBs) have been made since the last Group meeting, and European Central Databases for *Cicer*, *Glycine*, *Lathyrus* and *Phaseolus* are available on-line via the ECP/GR Web site. Work on a European Central Database for *Vicia faba* following the call for information has been progressing well. A MSc. project on the identification of potential duplicates using the European *Pisum* Database was carried out in 1999; this included a summary of the status of the catalogue and revision work required. Following the last Group meeting, IPRG Sadovo, Bulgaria has undertaken the coordination of a European Central Crop Database for *Arachis*.

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[2] On 3 November 2001, the renegotiation of the FAO International Undertaking came to an end. The revised text, adopted through a vote, is called "International Treaty on Plant Genetic Resources for Food and Agriculture" (ftp://ext-ftp.fao.org/waicent/pub/cgrfa8/iu/ITPGRe.pdf). This new legally-binding international agreement will enter into force when ratified by at least 40 states. The Treaty establishes a Multilateral System ensuring facilitated access to plant genetic resources for food and agriculture. The system covers a specific list of crops, also including the following grain legume genera: *Cajanus*, *Cicer*, *Lathyrus*, *Lens*, *Phaseolus* (except *P. polyanthus*), *Pisum*, *Vicia* and *Vigna.*

[3] Maggioni, L., M. Ambrose, R. Schachl and E. Lipman, compilers. 2000. Report of a Working Group on Grain Legumes, Second meeting, 1-3 October 1998, Norwich, United Kingdom. International Plant Genetic Resources Institute, Rome, Italy.

Work on the ECCDBs is currently under discussion following the start of an EU project to establish a European Plant Genetic Resources Information Infrastructure (EPGRIS). The development of EPGRIS and a search engine that would automatically update information is under way under the title EURISCO. The ECCDBs are seen as complementary to these two initiatives and their future role seems to be assured for some time to come.

Presentations about the Working Group

The Group is seen as the platform for grain legume germplasm resources in Europe and has been involved in a number of presentations and has acted as the organizing body for conferences.

Links between the Group and the European Association for Grain Legume Research (AEP) have grown significantly over the past few years. A presentation was planned for an AEP workshop on standardization of screening methods for disease resistance, organized by A. Ramos Monreal in Valladolid, Spain, November 2000. A report of the workshop will be presented during the current meeting and further work will be discussed following the recommendations of the Group.

The Group's activities were presented at a Technology Interaction day at the John Innes Centre in October 1999, which was attended by a cross-section of breeders and industrialists from across Europe. A Web demonstration of the ECCDBs was given by M. Ambrose to a working group at a conference on molecular genetics of model legumes held at the John Innes Centre in June 2000. M. Ambrose was invited to give a presentation on genetic resources at the third LINK (Legume Interactive Network) meeting in Bologna, Italy, in April 2001, as part of a session on European current breeding resources and activities.

The Working Group coordination of ECCDBs was mentioned in the breeding and agronomy section of a recent book resulting from the CABINET programme.[4]

Involvement in EU-funded programmes

The PHASELIEU project (FAIR5-PL97-3463), which was reported on in the second meeting of the Working Group on Grain Legumes has come to an end. One of the outputs of the project is a catalogue of bean genetic resources which acknowledges the work of the ECP/GR Working Group on Grain Legumes and carries a preface by L. Maggioni.[5]

Phaseolus *Cambridge collection*

Emergency measures to regenerate important material from the collection previously maintained at the University of Cambridge, United Kingdom, were coordinated by members of the Group. This has been done with mixed success and the current situation is that Italian institutions have multiplied a first batch of about 400 accessions and the seed obtained was split in two batches which were sent to the Federal Office of Agrobiology, Linz, Austria and to HRI, Wellesbourne, UK for long-term conservation. An additional set of about 1900 probably unique accessions is however still considered at risk, since it was last regenerated in 1993.

Vicia faba *collections*

The situation for *Vicia faba* collections has improved somewhat following an upturn in the agricultural interest in the crop. Funding for new breeding efforts began in France with INRA-Dijon, UNIP (Union nationale interprofessionnelle des plantes riches en protéines), the French Ministry of Agriculture and French breeding companies, and the collection there has

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4 Hedley, C.L., editor. 2001. Carbohydrates in grain legume seeds: Improving nutritional quality and agronomic characteristics. CABI Publishing, Wallingford, UK/New York, USA.

5 Amurrio, J.M., M. Santalla and A.M. De Ron, editors. 2001. Catalogue of bean genetic resources. PHASELIEU-FAIR-MBG-CSIC, Fundación Barrié de la Maza. 106pp.

been reactivated. The INRA French *Pisum* and *Vicia faba* collections will be merged at a single site (probably Dijon) in the next two years.

Core collections
No actions were taken on the plans to develop core collections for *Phaseolus* and *Vicia*.

Sharing of responsibilities for conservation
The Network Coordinating Committee has not managed to carry out the recommendation from the last meeting to analyze the advantages and disadvantages of the three models discussed. Other working groups are addressing the question and over the past year IPGRI has run a questionnaire to seek information and feedback on the three models. The outcome is still not clear but it is evident that unilateral actions are beginning to take place. The merging of the two genebanks in Germany has lead to a survey of their holdings, and other European Genebanks from where material was originally obtained have been approached to see if the material is being well maintained. This has been done with a view to reduce the holdings of foreign accessions that are maintained in their countries of origin.

From the Working Group on Barley and the EU-funded project currently running (EU GENRES PL98-104), there is a suggestion to include an additional field in the database indicating national responsibility. In a parallel effort M. Ambrose has undertaken this exercise for the John Innes *Pisum* collection.

Formal and informal sector interactions
The Working Group on Grain Legumes was one of the first to include a non-governmental representative at one of its meetings. A technical meeting of the UK Plant Genetic Resources Group (UKPGRG) was held in June 1999 at the Henry Doubleday Research Association and was open to NGOs from across Europe. The theme of the meeting was "Linking Resources" and was aimed at bringing the formal and informal sectors together with policy-makers to discuss practical methods of conservation, collaboration and exchange.

A number of new links were formed as a result of the meeting and are still in place today. These include the housing of safety-duplicates, visits to assist in characterization work and support for outreach programmes such as back garden seed saving programmes.[6]

In situ *and on-farm conservation*
The complementarity that exists between the formal and informal sector will become more evident over the coming period. The recently activated ECP/GR *In situ* and On-farm Thematic Network has already shown initiative in proposing a project for funding from the EU Framework V. The project, entitled "*In Situ* Conservation of European Plant Genetic Resources" was intended to collect, for the first time, vital ecogeographic data for the socioeconomically important species native to Europe. This information would be used to predict species composition within protected areas; subsequently actual population composition would be verified. These data would be used to enhance both their preservation *in situ* in established protected areas and in *ex situ* collections, as well as facilitating their sustainable use by industry. The project involved cooperation between 20 countries, including one partner from each country. Interactions between national representatives for grain legumes and this project would be most important over the coming period. Unfortunately the project was not approved after its first submission, but the intention is to resubmit an improved version for the next call.[7]

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6 Stickland, S. 2001. Back garden seed saving: Keeping our vegetable heritage alive. Eco-logic Books, United Kingdom.

7 A second EU proposal developed for Thematic Network grant application was submitted in October 2001 and was approved. The project, titled "European Wild Plant Diversity Assessment

The European Grain Legume Databases

Representatives from the countries hosting the ECP/GR grain legume databases presented an update of the status of these databases and of the respective crop genetic resources in Europe.

Phaseolus *and* Vigna

W. Kainz, database manager of the European *Phaseolus* and *Vigna* Databases at the Federal Office of Agrobiology, Linz, Austria, indicated that the database program used internally is MS-Access97, while that used on the Internet is Oracle 8.1.6. For the establishment of the *Vigna* Database (<http://www.agrobio.bmlf.gv.at/vigna/vigna.htm>) 23 institutes were approached in 18 countries, including Israel and Morocco. Three datasets were received from VIR, Russia (2459 records), the National Botanical Garden of Belgium in Meise (709) and INIA-Madrid, Spain (427), together with two questionnaires without data received from the University of Kassel, Germany (37) and from Castelo Branco, Portugal (104). Regarding the *Phaseolus* Database (<http://www.agrobio.bmlf.gv.at/phaseolus/>), 34 institutes from 27 countries were approached and 31 717 records were received from six taxa. Characterization data for five additional descriptors are included for 1074 records (3%).

R. Schachl stressed that no data had been received from Cyprus, Bulgaria, France, Greece, Morocco, Poland, Romania, Slovenia and Yugoslavia and he made an urgent call for these countries to send the missing data. He also mentioned that the description of characterization data is poor, except from Albania and that the five characterization data agreed at the Copenhagen meeting[8] appear insufficient to identify the accessions properly.

Finally, he underlined the absolute need to standardize characterization descriptors before proceeding further. He quoted for example problems with colours, which are difficult to define and change with time. Descriptors are meant to describe material in the vegetative phase. However he proposed, in addition to the existing descriptors, the introduction of a simple system to describe accessions in storage without growing the plants, e.g. by using photographic charts. He also said that it was very important to receive information on growth habit, which is essential to prepare for seed regeneration. Moreover, genetic characterization by means of molecular markers, which is free from environmental influence, was regarded as the target for the near future, for which some standardization of the system will be needed.

Discussion

In the following discussion, S. Angelova confirmed that the Bulgarian genebank could provide data for 500 *Phaseolus* accessions, but that they would appreciate receiving a format for data input. R. Schachl replied that data would be accepted in any format since the Austrian database manager is committed to convert the data into the central database format. This approach was preferred in order to minimize the effort for the genebanks of providing data to the ECCDB. C. Iliadis promised that the Greek data would be sent for inclusion in the database. G. Duc explained that the French *Phaseolus* collection of INRA had been transferred in part to GEVES and in part to CIAT, Colombia, after the termination of

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and Conservation Forum (PGR Forum)" is expected to start in August 2002. Its objectives are to provide a European forum for the assessment of species diversity of European wild crops relatives genetic resources and the development of appropriate methodologies that can be applied to conserve their genetic diversity. The project coordinator is Nigel Maxted of the University of Birmingham, UK.

[8] Gass, T., M. Ambrose, J. Le Guen, A. Hadjichristodoulou and S. Blixt, compilers. 1996. Report of a Working Group on Grain Legumes. First meeting, 14-16 July 1995, Copenhagen, Denmark. International Plant Genetic Resources Institute, Rome, Italy.

the breeding programme in Versailles. A small part of this collection is still kept at Versailles and he agreed to facilitate contact with the current curator to make sure that available data be sent to the European *Phaseolus* Database.

L. van Soest reminded the Group of the difficulties of establishing central databases containing evaluation data, since the performance of the plants is dependent on the environment and is therefore not comparable when accessions are grown in different countries. W. Kainz replied that the environmental conditions of the evaluation sites are always mentioned in the *Phaseolus* Database and that the description should focus on characters little influenced by the environment.

N. Yonash stressed the importance of molecular characterization. M. Ambrose confirmed that collection holders are increasingly in contact with molecular laboratories and that molecular characterization will inevitably improve in the near future. However, he stressed that the focus of this Working Group should primarily ensure the provision of good quality passport data. M. Ambrose also emphasized that collections will continue to develop, adding or removing accessions, so databases should continue to record the changes. For this reason ECCDBs should never be declared to be complete.

Vicia faba

G. Duc (INRA, Station d'Amélioration des Plantes, Dijon, France) explained that a decline in Europe of private and public programmes on *Vicia faba* breeding and genetics had endangered the existence of the genetic resources collections associated with these programmes. However, since 2000 interest in faba bean has increased in France owing to the demand for organic farming, interest in poultry feeds, demand for food safety and as a replacement for peas in some areas due to the increasing long-term problem of their susceptibility to *Aphanomyces*. As a consequence, maintenance and breeding of faba bean genetic resources restarted at INRA-Dijon, France, with modest support from the French Ministry of Agriculture and UNIP. This activity is carried out by a new GIE (Groupement d'Intérêt Economique) called "Féverole". This is a technical group whose membership includes the seed companies Agri-Obtentions, SERASEM and GAE Semences (Groupement agricole essonnois).

The European *Vicia faba* Database

A first survey was made in 1996, aimed at identifying the existing collections of *Vicia faba* in Europe. This survey allowed the identification of 29 collections containing mostly cultivars and farmers' populations, while apparently very few breeder's working lines are included.

Data were requested from the collection holders in order to establish the European *Vicia faba* Database. Data for a minimum of 8 passport descriptors were requested: 'Holding Country and Institution', 'Species', 'Accession code', 'Botanical name', 'Origin', 'Collection Country', 'Donor' and 'Donor code'. The data obtained, distributed over 28 files, were merged into the resulting 19-column Excel file "eurvicia.xls". Accessions related to different species were not included. The next objective will be the elimination of duplicates, although this will be a long and difficult task, due to many variations in the spelling of cultivars' names, donor codes and even country codes.

From a total of 13 067 accessions, 30% have cultivar names, 17% are of unknown geographic origin and 52% are of European origin. Request was also made for a minimum of 4 important descriptors: 'Flower colour', 'Sowing type', '1000-seed weight' and 'Main outstanding trait' that came out of the Working Group's previous meeting. However, half of the collections include very heterogeneous and incomplete characterization data. A general problem is the heterogeneity within accessions.

An updated survey

A second survey was carried out in 2001 to update available information on the collections and to explore possibilities for collaboration between curators. Answers were received from 12 collection holders, corresponding to 10 022 accessions (i.e. 80% of the accessions in the database). Most curators agreed to make their data available through the IPGRI Web site. The majority declared their collections available for distribution, although sometimes Material Transfer Agreements would be required. Descriptions were received for maintenance and regeneration techniques of 11 collections, 50% of which are multiplied under open-pollination. Long-term maintenance is secured for only six collections. Eight curators said they would consider participating in the establishment of a core collection. The possibility of hosting abandoned collections was said to be limited to a few hundreds of accessions. However, no abandoned or unknown collections were identified in this survey.

Conclusions and perspectives

- Gathering passport data on *Vicia faba* genetic resources was a rather successful exercise, demonstrating the good size of European collections (13 000 accessions) with 52% of European origin. This part of the collections is probably not duplicated in the ICARDA collection.
- Collections are mostly kept by public institutions. It would be of interest to discover what further collections could be accessible from private companies.
- In the last few years, there has been a clear reduction of investment by public and private groups in *Vicia faba* in Europe. After the rebirth of faba bean in 2000, it will take 5 years before this upturn in activity can be confirmed.
- Through studies of regeneration methodology looking at the problem of allogamy, INRA has developed a small number of populations from the large number of working collections of breeder's lines.
- The building of a core collection is considered a high priority but research work and financial resources are required before work can begin.
- A key point is to rapidly identify duplicates in the database. INRA may have very limited possibilities to undertake this difficult task.

Discussion

In the following discussion, N. Açikgöz noted some imprecision in the number of Turkish accessions recorded in the database, which should be corrected before the data are presented on-line.

G. Duc expressed the wish, shared by the faba bean collection holders, that the database be uploaded on the IPGRI Web site.

Workplan

- *After checking whether faba bean data providers agree to have their data published on the IPGRI server, G. Duc will send the European* Vicia faba *Database to the ECP/GR Secretariat for uploading on the IPGRI server. As a result of this collaboration, the database will be made accessible with a specific entry page linked to the ECP/GR Web site (to be completed by* ***December 2001****).*
- *Working Group members, in liaison with G. Duc, will strive to ensure that missing data sets, including passport data and the four agreed minimum characterization data (see paper on* Vicia faba *Database, this volume, p. 35) be sent to the database manager (WG members to report their progress to G. Duc and the ECP/GR Secretariat by* ***December 2002****).*

Cicer

I. Duarte (Estação Nacional de Melhoramento de Plantas, Elvas, Portugal) reported that there had been no significant changes to the European *Cicer* Database in the last few years.

The database currently contains information on 3701 accessions (advanced cultivars, primitive cultivars/landraces, breeding material and wild accessions) representing 14 species of *Cicer*, although 98% of the accessions are *C. arietinum*. I. Duarte mentioned that chickpea is a traditional grain legume crop used for human diet in Portugal, Spain and other Mediterranean countries. In the past, it was also used for feeding pigs, horses and mules. Until the middle of this century the chickpea acreage was considerable (during the 1960s the cultivated area increased to 73 000 ha). In the second half of the century it declined significantly, but grain yield remained very low. During the 1990s, problems were attributable to small or non-existent Common Agricultural Policy's subsidies and to low prices. Moreover, extreme susceptibility of varieties to the main diseases and to drought, a plant habit unsuited to mechanical harvesting and insufficient market organization contributed to the problems.

Discussion

M. Ambrose enquired whether any comparison had been made between the ICARDA and the European Databases. I. Duarte replied that no comparison had been made to date.

Lens

N. Açikgöz (Aegean Agricultural Research Institute, Menemen, Turkey) presented progress with the European *Lens* Database. She informed the Group that a letter requesting data was sent in June 2000; several countries did not reply. At present, the database includes data for 1675 accessions from Cyprus, Germany, Greece, Israel, Sweden, Spain and Turkey. It is planned that the database be made available on-line either on the AARI or the IPGRI server by September 2001.

Discussion

In the following discussion, G. Duc referred to the experience of sending requests through the National Coordinators and suggested that the best approach to obtain data quickly is to contact collection curators directly with a copy to National Coordinators.

Representatives from Hungary, Russia and Israel said that they would make sure that missing data from their collections would be sent to the *Lens* database manager.

R. Schachl mentioned that there were many landraces reported in the south German area at the end of the 19th century which had completely disappeared when collecting began. Today no lentils are grown in this area, although they are still eaten.

A. Ramos Monreal and G. Duc explained that in Spain and France, some landraces obtained an AOC-EU label. In France landraces are kept by GEVES.

M. Ambrose mentioned that lentil is included in the list of crops provisionally accepted for a multilateral system; this underlines its importance for food security and the importance of seeking to ensure that the *Lens* ECCDB is as complete as possible.

L. van Soest stated that for some collections, passport data do not exist. For example, CGN received faba bean from ICARDA over 20 years ago, but only the country of origin was known and no other data were provided. However, once the databases are on the Internet, it becomes possible to derive missing data from accessions described in different collections and bearing the same varietal names.

Recommendation

It was recommended that WG members and other curators state the reason why data are not sent, by indicating whether the data may become available in the future or whether they simply do not exist.

Lupinus

W. Święcicki (Institute of Plant Genetics, Poznań, Poland) described the geographic distribution of *Lupinus* species, in particular the European species *L. angustifolius*, *L. albus* and *L. luteus*. He also showed the altitudes, rainfall and pH conditions of the collecting sites of the accessions maintained in the Australian collection, together with the variability of certain traits of *L. angustifolius*, *L. albus* (including the different races—Iberian, Nile Valley, Turkish and Balkan), *L. luteus* and others.

The European *Lupinus* Database covers data obtained from 16 institutions conserving over 13 000 accessions, of which 5800 are from European collections; the remaining accessions are from Australia and USDA. Ninety percent of accessions are maintained in six institutions; 84% are *L. albus*, *L. angustifolius*, *L. mutabilis* and *L. luteus;* 16% are wild taxa; 80% of lupin crop accessions are wild and landraces. The degree of duplications is still not known. A minimum database structure was prepared for Internet uploading and an entry page is now available at <http://www.ihar.edu.pl/gene_bank/lupinus/>. Suggested tasks for the future were the identification and analysis of duplicates, mapping of collected lupin resources showing the species distribution, and additional collecting missions in the Mediterranean basin, the Azores and Ethiopia.

Discussion

In reply to a question, W. Święcicki remarked that no information is available on collections in South America and that a collecting mission there might be advisable, although perhaps difficult to arrange.

It became clear that data for the Russian collection are already available to the database manager, but it will require some time to include them in the central database.

Workplan

A link to the European Lupinus *Database should be made as soon as possible from the ECP/GR Web pages.*

Pisum

M. Ambrose (John Innes Centre, Norwich, UK) said that a student had undertaken a project at the John Innes Centre on 'Preliminary analysis of the European *Pisum* Database'. The project aims to use the database as a starting point to address the questions of duplication within the collection. The objectives of the project are: to undertake a preliminary investigation into the European *Pisum* collection using the information held in the database; to screen for potential duplicates; to develop strategies for these approaches; to identify shortcomings in the database; and to develop strategies for improving the classification and cross-referencing of material in multiple fields.

The objectives of the EPDB (European *Pisum* Database) remain the following: to establish a catalogue of *Pisum* genetic resources in European collections; to provide information on these resources; to identify duplicates and gaps in the European collection; and to determine strategies for further collection.

Workplan

- *File of the first EPDB to be provided to ECP/GR Webmaster by* ***end of August 2001.***
- *Call for new contributions following multi-crop passport descriptors to be sent to all curators holding* Pisum *germplasm by the* ***end of October 2001.***

Glycine

M. Vishnyakova (Vavilov Institute of Plant Industry, St. Petersburg, Russia) informed the Group that the European *Glycin*e Database is available on the VIR Web site, from where data of the different national collections can also be downloaded. The database contains data from nine institutes. However, several countries (Bulgaria, Poland, Italy, Greece) did not send their data. Data for only 3 accessions were available from Sweden, fewer than expected. The database contains a total of 11 915 accessions, including 11 879 of *G. max* and 36 of *G. soja*. The country of origin is often confused with the donor country. This probably explains why such a large number of accessions are recorded as being of USA origin. An analysis of the database is planned for the future, but has not yet begun. As to the minimum characterization data, maturity groups in particular should be recorded, since several varieties are not suitable for cultivation throughout Europe.

Discussion

R. Schachl mentioned that in the past, in Austria, sowing of soyabean never went beyond an experimental stage due to the photosensitivity of soyabean, so that no landraces exist. There was a promising breeding programme during the Third Empire, which was stopped after World War II, and the material was lost before it could be stored in a genebank; new attempts to adapt soyabeans in the early 1950s did not succeed due to the narrow genetic base. Introduction of soyabean on a larger scale during the last 20 years was based on adapted varieties brought from abroad, mainly from Canada.

W. Święcicki mentioned that data on the Polish collection stored at Radzików should be available and said he would help to ensure that the data are transferred to the European *Glycine* Database.

G. Duc explained that the soyabean breeding programme was terminated at INRA, France, but that one of the breeding companies might still hold some material and he would investigate the possibility of getting data.

S. Angelova indicated that there were 900 accessions maintained in the Sadovo genebank with available passport data. There is no working collection or evaluation work at the moment; activity is restricted to regeneration.

G. Poulsen explained that a unique soyabean breeding programme took place in Sweden and was terminated in the 1980s. Several breeding lines were then deposited at the Nordic Gene Bank, but responsibility for making them available on a long-term basis was not accepted, since it would not be possible to guarantee the seed viability or to regenerate segregating material. Moreover, the best material used during a breeding programme is expected to be included in the released varieties. On the other hand, there is no information on the value of the breeding lines and it is not possible to investigate it.

J. Brouwer commented that breeding lines are stored in Australia with a view to creating useful genotypes, even if they never reach the registration stage.

R. Schachl reported that in Austria, when a line has not been registered for some reason, but could have an interesting gene combination, it is stored in the genebank, but not made available until the breeder agrees to release it.

M. Vishnyakova asked for help to regenerate late-maturing types.

A. Ramos Monreal offered to multiply material in southern Spain.

Arachis

S. Angelova (Institute of Plant Genetic Resources "K. Malkov", Sadovo, Bulgaria) explained the history of the groundnut collection in Bulgaria, where introduction and investigations started in 1902-1907. The development of the European database started in 1998; however there is still little knowledge of which countries are conserving groundnut accessions, apart from germplasm received by Sadovo from Italy, India and USA. Material was also known to exist in Portugal.

She explained that 5% of the Bulgarian working collection has problems with germination. The working collection holds 368 accessions including Valencia (310), Spanish (3) and Virginia types (55). Forty-six percent of the accessions are of Bulgarian origin. The most important traits for breeding are yield, earliness, resistance to various diseases, and adaptability to mechanized cultivation. She said that support is received from North Carolina University and New Mexico University for the development of new varieties.

Recommendation
It was recommended that everybody send information to Sadovo about European Arachis *collections.*

Workplan
- *An IPGRI* Arachis *descriptor list was published in 1984 and will be sent to Bulgaria to help with their work.*
- *I. Duarte will investigate the situation of material in Portuguese collections and try to ensure that data be made available.*
- *Working Group members will strive to ensure that missing data sets be sent to the database managers (WG members to report the progress of their action to the Chairperson and the ECP/GR Secretariat by* ***December 2002****).*
- *The inclusion of the minimum set of characterization descriptors, as agreed in Copenhagen in 1995 and in Norwich in 1998, was confirmed (see Report of the WG first meeting, p. 17). The definition of the states for these descriptors will be determined by the Group, under the coordination of the Network Coordinating Group, before the* ***end of November 2001****.*

Sharing of responsibilities for conservation and documentation

Conservation
M. Ambrose stressed the growing need for European genebanks to work towards a greater sharing of responsibilities. The number of bilateral examples is growing and within other ECP/GR Working Groups further discussions are being conducted. The subject is also on the agenda of the forthcoming mid-term meeting of the ECP/GR Steering Committee.

L. Maggioni outlined the preliminary results of a questionnaire prepared by the ECP/GR Secretariat to survey the opinion of curators of European collections about possible ways of establishing a system of responsibility-sharing for conservation of plant genetic resources. The options considered were to share responsibility on an ‘accession basis’ (decentralized collections: each country to take responsibility for a number of accessions) or on a ‘crop-by-crop basis’ (centralized collections: a few countries to take responsibility for entire crop collections). A third option would be to share responsibility in an integrated way on a 'subregional basis'.[9] The questionnaire, addressed to over 500 collection-holding institutions in 43 countries, was returned by 193 respondents from 34 countries. Substantial support for the concept of sharing responsibilities showed the existence of fertile ground to build a better structured framework for regional collaboration in Europe. The 'decentralized collection' option received the highest support (80% of respondents), followed by the 'subregional collection' option (76%) and the 'centralized collections' option (53%). The main concern for the introduction of centralized systems appeared to be the risk of reducing access to

[9] Gass, T. and F. Begemann. 1999. International efforts to sustain *ex situ* collections: options for a closer cooperation in Europe. Pp. 109-115 *in* Implementation of the Global Plan of Action in Europe—Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. Proceedings of the European Symposium, 30 June-3 July 1998, Braunschweig, Germany (T. Gass, L. Frese, F. Begemann and E. Lipman, compilers). International Plant Genetic Resources Institute, Rome.

germplasm. On the other hand, a decentralized system raised concerns for the uneven quality standards for conservation throughout Europe. These results highlighted the importance of improving the quality standards of all the partners involved, independently of the collaborative approach chosen. It is also important to improve the level of reciprocal trust that material will remain easily accessible in the long term. The adoption of a common model for material transfer agreement is one of the possible steps in this direction. Mechanisms for the establishment of decentralized European collections are being actively pursued by several working groups (*Beta*, Barley, Forages, Potato and *Prunus*).

Discussion

In the following discussion, it was reiterated that sharing responsibilities is essential when genebanks have enlarged beyond their capacity and a shortage of funds requires an effort for rationalization of the collections. Concern was expressed that the establishment of a mechanism for sharing responsibilities would also require additional funds and resources, in order to guarantee high quality standards as well as the permanent availability of material being conserved. It was stressed that in many cases work is carried out with national resources, which are not always secure. At the same time, activities undertaken as 'in kind contributions' are often difficult to maintain.

L. van Soest confirmed that, by signing the CBD, the Netherlands had accepted the responsibility to conserve original Dutch material including varieties.

Also A. Ramos Monreal stated that Spain accepted responsibility over Spanish material.

N. Açikgöz said that Turkey is committed to maintain accessions from Turkey, and that the material is available for scientific use.

M. Ambrose mentioned that he had recently included a field indicating accessions for which the UK should be considered as primary holder/source and for which UK responsibility would be accepted.

G. Duc pointed out that a number of faba bean curators in Europe had expressed their availability to host small collections, should anybody have difficulty in continuing the conservation.

R. Schachl stated that the value of decentralized or subregional genebanks was clear for Austria, since regeneration can often be carried out only in the area where the accession originated.

The question of removal of duplicates was discussed. M. Ambrose reported from work in the Working Group on Barley and its own group that the identification and verification of potential duplicates prior to possible disposal required care.

Regarding the choice of the best approach to improve quality standards, L. van Soest and V. Meglič remarked that such improvement should be self-imposed. However, the importance of gathering literature and undertaking studies on grain legume-specific quality standards for conservation was also acknowledged by the Group.

Documentation

Helped by a presentation prepared by Theo van Hintum (CGN), L. Maggioni informed the Group about an ongoing project for the establishment of a European Plant Genetic Resources Information Infra-Structure (EPGRIS). This three-year project (Dec. 2000 - Dec. 2003), developed within the ECP/GR Documentation and Information Network, was approved for funding within the Fifth Framework Programme of the European Union. The objective is to establish a European Search Catalogue (EURISCO) with passport information of plant genetic resources maintained *ex situ* in Europe. The catalogue will be frequently updated and publicly accessible via the Internet. Initial data sets will be derived from the European Central Crop Databases (ECCDBs): however the project will promote the creation of national inventories, which are intended to become the main source of data. Plant genetic resources National Coordinators of most of European countries have already nominated national inventory focal persons. These people will be invited to attend subregional meetings, to discuss coordination and standardization of the data flow from the national inventories to the central catalogue. The project partners will also provide technical support to the focal persons and a limited number of training visits to the main European documentation support centres will be arranged. EURISCO will carry an important minimum set of passport data, frequently and automatically updated from the national inventories. These data will be based on the FAO/IPGRI *Multi-crop Passport Descriptor List*. A Web-based interface will allow easy searching of the European national inventories, in the same way as it is possible today to use SINGER to search the CGIAR collections and GRIN to search the USDA collections.

EURISCO can be seen as an important European contribution to the Clearing House Mechanism (CHM) of the Convention on Biodiversity and the implementation of the Global Plan of Action.

The European catalogue is not planned to replace the ECCDBs. On the contrary, once fully operational, it is expected to reduce the workload of the database managers, making it possible for them to retrieve from the central catalogue an important set of up-to-date passport data related to the crop of interest. The database managers will then be expected to focus their activity on gathering crop-specific characterization and evaluation data, and to dedicate more time to data analysis. Further information on the project is available at <http://www.ecpgr.cgiar.org/epgris>.

Discussion

In the discussion which followed, L. Holly, inventory focal person for Hungary, said that a decentralized system for documentation is in place in his country. It is expected that the process started by the EPGRIS project will help in developing a national database.

Recommendation

M. Ambrose, in agreement with the Group, stressed the importance of continuing the Working Group's activities planned for the development of the Grain Legume Databases, since the EPGRIS project will still need some time before the European catalogue can be used to retrieve all the available European passport data.

Status of National Collections

(Full reports are included in Part II)

Austria

R. Schachl presented a survey of the grain legume collections in Austria, which contain several landraces and varieties from the early days of plant breeding. He said that no more collecting missions are planned, as the chance of finding more material is very low. He explained that the genebank in Rinn had been moved to Innsbruck.

Regarding the possibility of hosting safety-duplicates, he mentioned that there is no longer space at Linz, since the genebank is holding several black-boxes for the Netherlands and ICARDA. However, there is some possibility at the Federal Institute of Forestry.

Storage experiments under long-term conditions (-20°C, relative humidity 60%) show an adverse effect on germination over the last 14 years, when the seed was kept in paper bags.

The Austrian Seed collection is available on the Internet as *Index Seminum Austriae*, at <http://www.agrobio.bmlf.gv.at/genbank>.

Belgium
A. Maquet explained that the base collection of wild Phaseoleae-Phaseolinae species seems to be the only one on grain legumes in Belgium. It is managed by the National Botanical Garden of Belgium. It contains 1567 accessions belonging to 192 taxa, chiefly centred on the Phaseolinae subtribe. It is considered by IPGRI as the base collection for wild *Phaseolus* and *Vigna* species. Seeds are collected from plants cultivated in glasshouses, and are kept in long-term storage.

Research activities are carried out at the Gembloux Agricultural University on *Phaseolus* (study and description of the genetic diversity, *in situ* conservation of spontaneous *P. lunatus* populations, interspecific hybridization, etc.) and on genepool organization of *Vigna unguiculata*. At Ghent University, studies are carried out on *Phaseolus* (genetic transformation, arcelin gene expression) and on *Vicia faba* (breeding for zero tannin, high protein, and disease resistance).

Bulgaria
S. Angelova explained that there had been few changes in the Bulgarian collections in the last few years. *Pisum* and *Phaseolus* remain the largest collections. Priorities are the completion of the databases for *Pisum* and *Vicia faba* and the conservation of old populations of faba bean and chickpea and of wild relatives of grain legumes. She informed the Group about an ongoing project involving NGOs, schools and different research institutes aimed at organizing educational programmes on genetic resources conservation.

Czech Republic
M. Hýbl explained that the national programme on genetic resources ensures funding for long-term storage and basic characterization of the collections. Collections are maintained in three institutes: AGRITEC, Šumperk; RICP-Prague, Olomouc station; and RIFC Troubsko.

The total number of accessions is 4922, the largest collections being those of *Pisum* (2364) and *Phaseolus* (1312). The collection also includes *Vicia*, *Glycine*, *Lupinus*, *Cicer*, *Lens* and *Lathyrus*. Efforts are made to ensure that the whole collection is preserved in long-term storage (currently 54%, hoping for 100% in 2-3 years), to start evaluation according to national descriptors, to complete the safety-duplication in collaboration with Piešťany, Slovak Republic, and to organize collecting missions in Central Europe. Passport data are available at <http://genbank.vurv.cz/genetic/resources>.

France
G. Duc explained that since the reports of the last ECP/GR meetings (Copenhagen, 1995 and Norwich, 1998), little new information was available. Collections in France are held by different institutions (INRA, GEVES, and private companies). Major collections are kept on pea, lupin and faba bean. Under the frame of BRG (Bureau des Ressources Génétiques) a general agreement called *Charte* linking the different institutions has been established, defining the sharing of responsibilities and guidelines for genetic resource maintenance. The next step is for the members of the group (public and private) to sign the statute document of this group. This statute defines internal rules, tasks of each member and a Material Transfer Agreement form. French collections are regenerated in open-field conditions for pea and lupin and under isolation from insects for faba bean. The new GIE “Féverole” is taking care of the maintenance of spring accessions at Dijon. A new subcollection of pea accessions is being developed in insect-proof greenhouses. Seeds are kept in low humidity cold rooms (3°C). There is no safety-duplicate arrangement at -20°C. Characterization of faba bean genetic resources has stopped with the termination of the breeding programmes. Characterization of pea genetic resources is managed by a group of laboratories coordinated by INRA, on the basis of agronomic descriptors and molecular markers. Due to the termination of *Vicia faba* breeding programmes at INRA, a working collection derived from

previous work will soon be added to the current collection of 2000 accessions. In addition, from this breeding work, 23 populations (pools) have been developed at INRA-Rennes on the basis of major criteria (earliness, *Ascochyta* and *Botrytis* resistance, tillering, lodging, stem growth).

The INRA Web site containing information on genetic resources is being created at <http://www.inra.fr/Internet/Produits/legumineuses/accueil.htm>.

Greece

C. Iliadis reported that the Greek grain legume collection is conserved at the Fodder Crops and Pasture Institute (FCPI), Larissa and the Greek Gene Bank, Thessaloniki, under the administration of the National Agricultural Research Foundation (NAGREF), a state-funded legal entity, partner of the Ministry of Agriculture. A total of 958 accessions is conserved in Thessaloniki, mainly *Phaseolus vulgaris* (365 accessions) and *Cicer arietinum* (174), as well as *Lens culinaris* (97), *Vicia faba* (150), *Phaseolus coccineus* (22), *Pisum sativum* (29), *Lupinus* spp. (76), *Lathyrus sativus* (21) and *Vigna unguiculata* (24). The collection is fully documented with passport data in dBase IV. Arrangements for safety-duplication at -20°C have not yet been implemented. FCPI conserves advanced varieties of chickpea, lentil, faba bean, bean, pea, *Lathyrus* and cowpea. The latest collecting missions were undertaken in 1986, since funding was reduced and useful material for breeding was obtained from ICARDA. Priorities for the future remain the completion of safety-duplication of the collections, the evaluation of the accessions and inclusion of evaluation data in a database.

Hungary

L. Holly said that 11 950 accessions are maintained by six institutes in active collections, containing *Phaseolus* beans (5249 accessions), pea (2282), faba bean (417), soyabean (1145), chickpea (836), lentil (866), *Lathyrus* (512), *Lupinus* (432), *Arachis* (85), *Vigna* (110), *Dolichos* (4) and lablab (11), including wild relatives. Subsamples have been deposited in the national base collection at Tápiószele. The genebank is facing the problem of seedborne virus diseases due to a severe aphid infection this year. Ongoing effort is made to multiply accessions to obtain high quality seed for long-term conservation. Since 1980 characterization has been carried out on about 1500 accessions.

Evaluation of selected accessions focused on yield, cold tolerance, Fusarium wilt and Ascochyta blight as well as on suitability for organic farming. Assistance from the Working Group on Grain Legumes for taxonomic identification of *Lupinus* would be welcome.

Discussion

W. Święcicki offered some help for taxonomic identification, although for the American species expertise should be sought elsewhere.

Israel

N. Yonash highlighted the great importance of grain legumes for the Israeli Gene Bank for Agricultural Crops (IGB). The grain legume collection held by IGB contains chickpea (500 accessions), lupin (142), lentil (204), bean (409), pea (288), *Vicia* spp. (838), cowpea (656) and soyabean (93). Data received with donated material and obtained with field observations are computerized and documented in the IGB database.

Most genera collected by IGB are represented by more than one species and originated from both Israel and worldwide. In most cases, the IGB grain legume collection includes landraces and wild types. Most grain legumes have been important in the Mediterranean population diet since ancient times, so this region is a source of many landraces of chickpea, lentil and bean which can be used for crop improvement. Emphasis continues at IGB on collection and regeneration of local landraces and wild relatives of many crops, including the above grain legumes, especially considering that Israel's rich flora is endangered by the increasing disappearance of natural habitats through urbanization, road construction and modern farm practices. The rescue collection activities are carried out in collaboration between the Hebrew University of Jerusalem, Rotem-Israel Plant Information Centre, Tel Aviv University and IGB.

The operating budget for genetic resources provided by the government ensures collecting missions, regeneration of accessions and international collaboration. A new genebank is expected to be built in the near future, with deep-freeze facilities, new equipment for molecular characterization and good germination facilities. This will allow upgrading from short-term (-10°C) to long-term storage and reduce the need for regeneration, which cannot currently be carried out at sufficient speed to ensure optimal conservation of all accessions.

Italy

A. Carboni explained that he would contact the Germplasm Institute of Bari in order to get updated information on the Italian grain legume collections, and would encourage the sending of computerized data on grain legume collections maintained at Bari to database managers. He also offered to carry out some regeneration of *Phaseolus* accessions at ISCI (Istituto Sperimentale per le Colture Industriali), Bologna.

Macedonia (FYR)

J. Petrevska reported on work initiated to restore the lost grain legume collection. Grain legume species have been used in research and breeding at the Institute for Agriculture in Skopje, where some work was done on *Phaseolus vulgaris*, *P. angularis* and *Arachis hypogaea*. It is believed that 40-50 local populations of *Phaseolus* and 10 of *Arachis*, *Pisum* and *Vicia* could offer a significant potential for improvement. Future plans include a survey of *in situ* landraces and wild species and the creation of a genebank. However, owing to the current situation in the country, no funds are available for genetic resources.

The Netherlands

L. van Soest mentioned that as a result of the withdrawal of EU subsidies, the cultivation of *Vicia faba* and *Pisum sativum* was tremendously reduced in the Netherlands. At present there is no lupin breeding, while that of *Pisum* and *Vicia faba* mainly concentrates on their use as vegetables. Two firms are still active in field pea breeding for forage.

The grain legume collection of CGN includes 1781 accessions. This includes varieties and breeding lines from Europe, North America and Australia. The pea and faba bean collections also include a large number of accessions from the centres of diversity (Asia and Ethiopia). For the landraces of *V. faba* from Asia received from ICARDA about 20 years ago, the country of origin is the only passport data available. Evaluation data are available for only three diseases for *P. sativum*, but more are expected in the near future from INRA-Rennes, France.

Between 1988 and 2001, CGN distributed 1146 accessions of pulses, i.e. 3% of the total distribution made during these years.

Discussions had previously taken place about transferring the *V. faba* collection to the BAZ genebank in Braunschweig, Germany. This has not yet taken place. The small *Lupinus* collection (69 accessions) would perhaps be more accessible if it were included in a large lupin collection somewhere in Europe. CGN is willing to consider an exchange with a reliable genebank. A new genebank is planned to be built in Wageningen in the next 2 years. Data of the Dutch collections are available on CGN's Web site: <http://www.cgn.wageningen-ur.nl/pgr/>.

Nordic countries

G. Poulsen explained that a total of 190 grain legume accessions had been accepted for long-term conservation at the NGB. These include soyabean, lentil, yellow lupin, field beans, beans, garden pea, field pea and faba beans. The collection is safety-duplicated at Svaalbard under permanent frost at -4°C. G. Poulsen suggested increasing the exchange of information within the Group regarding the standards for conservation of faba bean.

Poland

W. Święcicki explained that the grain legume genetic resources collections are held in long-term storage at the Plant Breeding and Acclimatization Institute in Radzików; this centre cooperates with other centres holding active collections. A total of 8000 accessions are conserved in Poland, including *Phaseolus*, *Lupinus*, *Pisum*, *Glycine*, *Lens*, *Vicia* and *Lathyrus*.

Portugal

Since the last report presented in 1998, little can be added. The Portuguese collection, excluding advanced breeder's lines and active collections of breeding programmes, consists of 8320 grain legume accessions: *Cicer arietinum* (601), *Lathyrus* spp. (154), *Lens culinaris* (19), *Lupinus* spp. (3291), *Phaseolus* spp. (2442), *Pisum sativum* (398), *Vicia* spp. (1159) and *Vigna* spp. (256). The percentage of characterized material is still low when compared to the number of accessions maintained. The level of safety-duplication of the overall grain legume collection is about 48%.

Russian Federation

M. Vishnyakova reported that the Vavilov Institute´s collection contains 45 690 accessions, of which 35 818 are part of a permanent catalogue and are available. The remaining accessions are in the provisional catalogue and need multiplication; therefore they are not included in the central databases. The collection covers 15 genera and 146 species. During 1998-2000, 1318 new accessions were included. Expeditions were recently organized to the northern Caucasus, Armenia, central Russia, the Leningrad region and Tajikistan.

Regeneration activity is still intense and 26 508 accessions were multiplied during the last 3 years. Nevertheless, the volume of regeneration work has decreased owing to the new facilities that allow for medium- and long-term storage. Evaluation of the accessions is carried out at the eight experimental stations of the Institute as well as abroad, as part of joint international projects.

Regarding the use of the material during 1998-2000, 5489 accessions were sent to breeders within the country, 3423 to foreign genebanks, including trials and joint projects. The main recipient within the former USSR is Ukraine—more than 3000 accessions were sent to the Ukrainian genebank. On the other hand, 3220 accessions were received from abroad, while 12 149 were sent abroad, including 4220 for evaluation as part of joint projects.

Documentation of the collection is ongoing, but a high proportion of characterization data is not yet computerized.

Discussion

A. Ramos Monreal confirmed interest in collaborating in the regeneration of material of Spanish or southern origin, such as chickpea, *Lupinus albus*, lentil and *Vigna*. The Group thanked Spain for their offer of help with this problem.

Slovakia

F. Debre informed the Group that three institutions maintain grain legume collections, with a total of 5554 accessions. The most important genus is *Phaseolus* (2153 accessions), with several landraces of which many are probably duplicates. Of the whole collections, 582 accessions are safety-duplicated in the Prague genebank. Documentation of passport data covers 67% of the collection. The area of peas grown has dramatically decreased over the past 5 years. A number of varieties of Slovak origin have been registered in the last few years, although most of the registered material is foreign. Cooperation with the Slovak Agricultural University is useful for the national programme for PGRFA. The National Council approved a law for the conservation of PGR on 1 July 2001.

Slovenia

V. Meglič explained that the Agricultural Institute of Slovenia is responsible for grain legumes. It was recently possible to reduce the number of accessions of *Phaseolus* by 70 units (duplicates) and therefore the current total number of accessions is 1063.

Due to a severe virus infestation, multiplication is not carried out in the field, but each year 20 accessions are multiplied in the greenhouse; at the same time, morphological characters and disease susceptibility are recorded.

Previous collecting missions made use of the assistance of local elementary and agricultural schools, the Agricultural Advisory Service, newspaper advertisements and farmers; 90% of the accessions were obtained in this way. On the other hand during a repeat exercise, no response was received from farmers. Collecting missions were carried out in collaboration with the Czech Republic. A bilateral project with Croatia has also been proposed.

Documentation of passport data is now complete and *Phaseolus* data will be sent to the Federal Office of Agrobiology, Linz, Austria and *Vicia faba* to INRA, Dijon, France. A relational database is being completed. Research is carried out on the genetic diversity of an old Slovenian bean collection and on *Colletotrichum* resistance.

Spain

A. Ramos Monreal stressed the policy of the Spanish bank to collect only local landraces. The collection of bean and pea landraces contains much variability. There are also collections of *Vicia*, including *V. ervilia*, which has potential as a grain legume and *V. monanthos*, which has disappeared from cultivation.

Turkey

N. Acikgöz presented an account of the grain legume genetic resources conserved at AARI. One of the main changes is the increase in long-term storage capacity. The legume collection includes 5244 accessions, mostly landraces. There is an additional base collection in Ankara, which holds 54 chickpea and 483 lentil accessions. In addition to material obtained through collecting missions, chickpea and bean landraces have also been provided by Provincial Directorates. Some legume material has also been collected as part of the *in situ* projects. Accessions with low germination rate, or with seed stocks reduced to insufficient levels, are subject to multiplication and regeneration. Almost all chickpea accessions are characterized. Some lentil material (330 accessions) collected from central Anatolia was characterized by the Field Crop Improvement Centre. Multiplication and characterization programmes are carried out in collaboration with breeding programmes. Two new *in situ* projects started in 2000.

United Kingdom

M. Ambrose reported that the Vicieae collection previously based at the University of Southampton had moved some 3 years ago to the University of Reading. Prof. Frank Bisby is still maintaining the collection.

The John Innes *Pisum* collection currently comprises 3150 accessions with recently introduced material consisting of genetic stocks and heritage varieties donated by the Heritage Seed Library of the Henry Doubleday Research Association, based at Ryton near Coventry. The remaining public collection of around 300 *Vicia faba* accessions originating from the plant breeding institute was moved to the John Innes Centre in the early 1990s. The collection mainly consists of cultivars of English origin and breeder's lines, together with a few important stocks.

The collection is not very active and a small amount of regeneration of stocks in isolation cages in the field is undertaken each year. Two years ago the germination ability of a number of lines was found to be poor. This summer a project student will undertake a survey of germination capacity of all accessions to assess the situation and to enable appropriate regeneration measures to be taken. Last year the passport data were re-entered from record sheets into an Access database according to multi-crop passport descriptor format. The collection is not considered to be readily available at this moment but the coordinator for *V. faba* will be kept informed.

Discussion

In reply to a question, M. Ambrose confirmed that the pea collection does not require isolation to prevent cross-contamination under UK conditions.

The Australian Temperate Field Crops Collection and work at the Victorian Institute for Dryland Agriculture, Horsham, Australia

J.B. Brouwer thanked the organizers of the meeting for providing the opportunity to attend and to present an overview of grain legume genetic resources and breeding activities in Australia. Grain legumes are a major component of farming systems in a wide range of agroecological environments across Australia from tropical to subtropical and Mediterranean climates with variable soil acidity and rainfall patterns. Virtually all pasture and crop plants in Australia are exotic and there is therefore heavy reliance on genotypes from overseas. Australian activities in the area of genetic resources have evolved into a number of plant genetic resource centres (PGRC). Two of these centres are responsible for pulses: the Australian Temperate Field Crop Collection (ATFCC), (Horsham, Victoria) covers *Pisum*, *Cicer*, *Vicia*, *Lens*, *Lupinus* and *Lathyrus* and the Australian Tropical Field Crops Collection (Biloela, Queensland) covers *Phaseolus*, *Cajanus* and *Vigna*, *Arachis* and *Glycine*.

The PGRC network was very active during the period 1983-1988. Since that time PGRCs have been forced to focus on issues of long-term funding and maintenance.

Intense programmes of plant introduction and joint collecting missions in many areas of Europe mean that one area of priority interest relating to the collections at ATFCC of relevance to the ECP/GR Working Group on Grain Legumes is to establish the level of duplication of material with that held in European collections and to identify the gaps that still exist in the Australian collection compared to the world collection.

The USDA-ARS National Plant Germplasm System – Cool Season Food legumes

C. Coyne thanked M. Ambrose for allowing her to act as observer at this meeting. She introduced the USDA-ARS National Plant Germplasm System at Pullman, WA, where she is the curator for Cool Season Food Legumes, working on *Pisum*, *Vicia*, *Cicer*, *Lathyrus*, *Lens* and *Lupinus* (15 000 accessions in total). Molly Welsh is the curator for the *Phaseolus* collection (20 000 accessions) at Pullman, WA. *Vigna* species are kept by USDA in Georgia and soyabean species in Illinois.

The National Plant Genetic System budget is good due to strong political support of the American Seed Trade Association. The programme for Cool Season Food Legumes focuses on descriptor data and molecular characterization of genetic diversity. USDA breeding activity on *Lens*, *Pisum* and *Cicer* is centred at Pullman. Descriptor data are collected primarily by cooperators. The National Plant Germplasm System (NPGS) database is available on the Internet at <http://www.ars-grin.gov/npgs/searchgrin.html>; this site is being improved to allow Web users to access and sort descriptor data sets for themselves. It will allow users to set up their own spreadsheets and analyze data. Collaborative publications were produced on core collections of *Lens* and *Pisum*, and on *Pisum*'s reaction to Fusarium wilt.

NPGS has funding available for cooperative plant prospecting proposals (including the possibility of cost-sharing on collecting trips). The conditions are:

1. germplasm to be split between cooperators and host country;
2. host country should receive specific extra benefit;
3. bilateral agreement.

Discussion

In reply to questions, C. Coyne confirmed that the definition of "specific extra benefit to host country" in prospecting activities is negotiated by NPGS plant exploitation staff in Beltsville, Maryland. Regarding the regeneration technique of *Vicia faba*, she said it is described at NPGS. Previous curators were using widely separated plantings without barriers, which resulted in outcrossing between accessions. The regeneration from original stocks in long-term storage has now started. Provided funding for a new insect pollinator system at Pullman (such a system exists at Prosser WA site, which is too hot for faba bean), then the development of the collection under the correct pollinating environment will be achieved.

C. Coyne explained that 70% of the Pullman collection (70 000 accessions) is duplicated in long-term storage, located at the Fort Collins, Colorado facility.

Research

Regeneration practices at the Institute for Sustainable Agriculture, Córdoba, Spain

M.J. Suso reported on the collection of faba bean (around 1400 accessions) conserved at Córdoba, which consists mostly of Spanish landraces. Research was carried out on germplasm evaluation and characterization and is now focusing on management, with particular attention to regeneration procedures. The mating system of faba bean was studied, showing an outcrossing rate of 62% in Córdoba and 33% in Rennes, France. The protocol needs to be adapted to the location. The effect of self-pollination was also investigated and it was found to cause radical changes to the accessions. Therefore it was concluded to be impossible to regenerate faba bean through self-pollination. However, multiplication in open-pollinated conditions is unsatisfactory since the rate of gene flow between accessions is not known. Studies revealed the average rate of contamination in the field to be 12%, with a high variability between genotypes (4.5-18.7). Pollen dispersion by bees was also found to be non-random, varying with the genotype. The use of *Brassica napus* and *Vicia narbonensis* as barriers in studies to reduce pollen contamination were found to have a similar effect. These results indicate the need for further research on the issues of genotype, environment and their interaction, since it is important not only to secure isolation but also to maintain the typical mating pattern within an accession. These studies were required to help provide clearer answers for germplasm management, and future revision of regeneration protocols may be needed as a result.

In situ and on-farm conservation

In situ *and on-farm conservation of legume landraces in Turkey*

N. Açikgöz informed the Group about the progress of the *in situ* project under way in Turkey since 1993. Two additional projects have started, under the coordination of AARI and in collaboration with other institutions, including NGOs and farmers.

The first project, funded by the Turkish Scientific and Technical Board together with AARI, is focusing on on-farm conservation of lentil, chickpea and bean landraces grown in northwestern transitional zones. Its objective is to explore the possibilities for on-farm conservation, to conserve and collect landraces *in situ* and to analyze agromorphological, ecogeographical and socioeconomic data to interpret the various aspects of farmers' preferences for landraces and cultivation methods.

The second project, funded by the EU LIFE programme, focuses on ecosystem conservation and management for threatened plant species. The project intends to make surveys and inventories, designate Important Plant Areas, and establish databases and management plans. One particular objective consists in selecting possible *in situ* conservation sites for threatened species included in the list of the Bern convention. These include three legume species: *Thermopsis turcica*, *Sphaerophysa kotschyana* and *Glycyrrhiza iconica*. New sites for these species have already been identified by the project.

In situ *conservation of wild populations of* Phaseolus lunatus *in the Central Valley of Costa Rica*

A. Maquet described the project to establish a conservation strategy using *P. lunatus* as a model. The target zone is the Central Valley of Costa Rica.

Spreading urbanization, severe grazing, seasonal fires and replacement of multicrop coffee plantation with monocrops are the major threats. Different populations (250) were gathered and mapped with GIS to study the correlation between ecogeography and population traits. The genetic variability and structure were assessed and a good balance of the genetic diversity between and within populations was highlighted. Such a result was unexpected in view of the restricted gene flow within populations, their small size, cycles of extinction and expansion and a lack of heterozygosity. The existence of gene flow over large distances was suggested and will be estimated with microsatellites. A study on a sampling design was made which indicated that 10 to 80 plants per population and 4 seeds per plant should be collected to collect all the alleles with a probability of 90%. The unified Life Model using a projection matrix allows the status of a population (extinction or expansion) and its expected life span to be assessed; also which age class contributes most to the maintenance of the population and how it should be managed. Six synthetic populations including individuals from populations showing rare alleles and originating from particular ecological zones were established in protected environments.

Utilization of grain legume genetic resources

Standardization of screening methods for disease resistance

A. Ramos Monreal explained that a number of experts from around the world had been invited to attend the workshop in Valladolid in November 2000 on standardization of screening methodologies for grain legumes. This workshop was funded by INIA, Madrid (National Institute for Agriculture Research), the autonomous government of Castilla and León, and AEP. A report of the meeting has been prepared, which will form a good compendium of methodologies. However, few agreements on standardization were reached. Publication of the report is expected in October 2001 and copies will be sent to AEP for distribution.

Discussion
G. Duc raised the question of distinguishing disease assessments recorded as field resistance or under more controlled conditions where reaction to specific isolates was studied. M. Ambrose commented that adoption of host differentials or minimum sets of common standards could also help improve data quality from field assessments.

EU projects on genomics and bioinformatics
M. Ambrose reported that a number of projects directly or indirectly involving grain legumes have received funding under the EU Framework Programme V for Research and Technical Development. In view of their complementarity, the European Commission arranged that they work together as an informal cluster. The first cluster meeting took place in March 2001 and contact will be maintained throughout their lifetime. Summary details of the three component projects are presented below.

GENE-MINE
This is an EU-funded project, coordinated by Plant Research International B.V. (The Netherlands), addressing two main topics relevant to plant genetic resource management. The first objective is to develop and evaluate an integrative information system with new analysis methods, which reveal the relationships between large-scale molecular marker data, phenotypic traits and environmental data. This is expected to result in the establishment of a necessary, more productive, more informative and cost-effective germplasm management and exploitation system. The second objective is to improve the efficiency of managing wild crop relatives in *ex situ* collections and to optimize the accessibility of the naturally occurring genetic diversity to end-users for exploitation. This part of the project will focus on wild lettuce species and will include the application of AFLPs to determine the extent of redundant germplasm within and between genebank holdings, the use of AFLPs and microsatellites to determine the distribution of the genetic variation across the natural distribution areas, and the development and application of a novel molecular marker assay (NBS-directed profiling) to facilitate the screening of germplasm for resistance to pathogens. This is expected to result in improved conservation practices for wild crop relatives and in promotion of this material for exploitation.

ICONFORS
Another EU-funded project, coordinated by the Institute of Grassland and Environmental Research (United Kingdom) and in which CGN participates. This project aims to draft an optimized regeneration plan for perennial European forage grasses and legumes, taking into account genetic and economic impacts of the available options and the complementarity of cooperating genebanks. CGN's participation includes the application of microsatellite markers to analyze the distribution of paternity in regeneration plots of perennial ryegrass in order to determine how accurately the distribution of paternity can be predicted from data on the spatio-temporal distribution of pollen sources within plots.

TEGERM
The overall goal of the TEGERM Project is to improve the way that major EU germplasm collections are characterized and exploited to the benefit of European agriculture. This goal comprises two major objectives: (i) detailed assessment of the genetic diversity of major EU and international germplasm collections for pea, barley, tomato and pepper, and (ii) to streamline the extraction of useful genetic traits that control crop quality and resistance to pathogens and stresses, into the corresponding EU breeding materials. These objectives will

be addressed by the development and deployment of a new class of high throughput molecular marker systems based on a class of naturally occurring transposable genetic elements called retrotransposons.

The Pisum *gene list*

M. Ambrose said that, as reported at the previous meeting, this activity is undertaken at the John Innes Centre (JIC) on behalf of the *Pisum* Genetics Association. Genetic stocks associated with the gene list form part of the JIC *Pisum* collection. The list currently contains information on 860 published genes with 620 references and 470 genetic studies. Many images have now been linked to the database, a number of which were obtained from Heidi Jaiser from her compendium of *Pisum* genes published in 1989, the genetic information for which had come directly from the gene list. In June 2000 a Web-searchable version was made available on the Web (<http://www.jic.bbsrc.ac.uk/germplas/pisum/>.)

Chickpeas collected from Central, East and South East Anatolia

N. Açikgöz explained that in this study 327 accessions, plus 8 registered varieties, were evaluated for 28 characters including reaction to low temperature, Ascochyta blight and root disease. The material was grouped by using multivariate analysis.

Inter-regional cooperation

Cooperation with China on Vicia faba *genetic resources*

Bilateral cooperation between INRA, France and the Chinese Academy of Agricultural Sciences (CAAS), China has existed since 1997. It promotes reciprocal visits of scientists, exchanges of expertise and of genetic resources. *Vicia faba* genetic resources are one topic of this cooperation. The correspondent at the Institute of Genetic Resources at CAAS is Dr X. Zong, curator of a collection of 4000 accessions of *Vicia faba* multiplied, saved and characterized for several criteria. This work involves a network of provincial academies and city institutes.

G. Duc and J. Le Guen made two successful visits in 1998 and 2000 in order to identify topics and laboratories that could participate in a joint programme on *Vicia faba* genetic resources. China is the main world producer of faba beans (2 million ha, 60% of world production). Spring types are grown in the northern area and winter types in the south, mostly in small plots and involving a lot of manpower. Plots are in valleys or on mountain slopes and the yields vary accordingly. Visits were made to very active laboratories in the main producing provinces (Yangsu, Gansu, Quingai, Guanxi, Yunnan and Sichuan). At least four European groups and three Chinese laboratories that could cooperate in a joint action for the collection, exchange, evaluation and maintenance of *Vicia faba* genetic resources have been identified.

Collaboration with PHASELIEU

R. Schachl reported on the FAIR-Project PHASELIEU, started in 1998. The overall aim of the project was to coordinate research activities on *Phaseolus* and to elaborate an integrated strategy model for the improvement of *Phaseolus* production within Europe for human consumption. The objectives in detail were:

- establishment of an EU-wide network of experts,
- organization of thematic workshop meetings,
- publication of scientific and technical documents, and
- scientific exchange and training.

To meet this target, the project´s activities were focused on:
- analyzing the potential and opportunities of *Phaseolus* beans in European agriculture;
- improving the management of genetic resources at the European level in cooperation with ECP/GR, namely with the European *Phaseolus* Database, in order to widen the genetic base of *Phaseolus* and to introduce new germplasm sources of variation and interspecies hybridization;
- setting up an EU-wide trial system for the multiplication, characterization and evaluation of the different genetic material;
- identifying biotic and abiotic stresses that limit wide distribution of *Phaseolus* beans in some European areas;
- seeking improved non-chemical methods of crop protection related to biotic stress factors, namely bean fly, aphids, mosaic virus, *Pseudomonas* and *Xanthomonas*, as well as abiotic stresses, such as drought and cold tolerance;
- optimizing diversified farming systems incorporating improved *Phaseolus* varieties, monoculture and mixed cropping systems;
- seeking increased nutritional and organoleptic quality and improved cooking characteristics;
- developing a widely applicable transformation and regeneration protocol for *Phaseolus*; and
- developing molecular markers for use in *Phaseolus* breeding.

When PHASELIEU came into operation, the European *Phaseolus* Database was nearly completed, and was made fully available to the partners of PHASELIEU, enabling the results of PHASELIEU's activities to be monitored. This prevented duplication of effort and enabled quick transfer of information in both directions.

Phaseolus bean improvement does not have the problem of a narrow genetic base, as is the case with other major crops. The existing variability, especially in the European collections, offers the promise that in the genus *Phaseolus* more can be achieved than in other crops, provided that the germplasm is efficiently evaluated, possibly using molecular markers. Classical breeding does not provide sufficient scope for further improvements in adaptability and quality; marker-assisted selection and transformation need to be considered for use in conventional breeding programmes.

Though the genepools existing outside Europe will play a role in further work on *Phaseolus*, it was agreed to focus first on the material already existing in Europe. Priority is therefore to be given to characterization and evaluation of this material.

A. Maquet provided information about molecular markers, genome mapping and marker-assisted selection in beans resulting from an information gathering exercise that took place within the PHASELIEU project. He explained that molecular markers could be useful to establish genetic relationships between *Phaseolus* species, to facilitate the tagging of polygenic characters, to speed up the transfer of desirable genes among varieties, and to introgress novel genes from related wild species. Thanks to newly available germplasm and development of molecular markers, a better understanding was achieved of *Phaseolus* phylogenetic relationships and of the genepool organization of *P. vulgaris* and *P. lumatus*. As a result, *P. costaricensis* has been crossed with *P. vulgaris*, confirming its potential as a bridge species in future improvement programmes for common beans.

Interspecific hybridization was shown to present limitations such as post-fertilization events and sterility of the hybrids. Consequently, less than 5% of *Phaseolus* germplasm has been used in hybridization programmes so far. This leaves room for much more improvement, owing to the availability of molecular markers for marker-assisted selection. Several linkage maps were developed with about 550 molecular markers (mainly RFLPs and RAPDs) already mapped. Applications of these linkages were shown to be comparative mapping in the Phaseoleae tribe, mapping genes for phenotypic traits, analysis of the domestication syndrome and gene introgression, dissection of complex traits and marker-assisted selection. Prospects for the future include research on molecular systematics; understanding the mechanisms of genetic incompatibility; introduction of an efficient and reproducible system for regeneration; sequencing of the *Phaseolus* genome; and pursuing the mapping of major genes and QTLs for agronomic traits.

Inter-regional cooperation with AEP

A. Schneider, Executive Secretary delegate of the European Association for Grain Legume Research (AEP), explained that the association seeks to transfer research results to production and to promote multidisciplinary research. AEP is a network of individuals interested in grain legumes, and 40% of its members are geneticists. Objectives are implemented by providing interaction during the AEP conference, offering an expert appraisal on grain legume research, promoting projects such as PHASELIEU and also coordinating the LINK project.

Moreover, economic and scientific networks meet with the intention of linking all ongoing projects. Thematic workshops are organized on specific topics, e.g. disease resistance screening, winter sowing, *Medicago truncatula*. AEP publishes a quarterly magazine, *Grain legumes*, and a Web site is under development. AEP can be used as a platform to enhance the value and use of legume genetic resources. Collaboration with ECP/GR could improve interaction between different disciplines, help to find partners and organize meetings, and offer an additional means of communication, such as links to databases on the Web, providing a dossier on grain legume genetic resources in the next issue of the bulletin, etc.

Discussion

Both A. Ramos Monreal and G. Duc, who are members of the AEP Scientific Committee, endorsed the benefits of integrating genetic resources with other sectors of grain legume research. A genetic resources workshop on the "Management, characterization and utilization of genetic resources" is scheduled for the second day of the conference. For this session, 24 posters were registered. A report of this ECP/GR Working Group meeting will be presented during this session.

G. Duc suggested that the Web pages of the ECP/GR Working Group on Grain Legumes be linked to AEP's Web site.

Recommendations

- *IPGRI's webmaster to contact AEP Secretariat to facilitate reciprocal links to Web sites.*
- *Articles about the meeting of the Working Group on Grain Legumes and its activities to be prepared for the next issue of* Grain legumes.
- *Support from AEP for meetings and possible formulation of an EU project to be explored.*

Ad hoc actions

R. Schachl proposed that the Group could take the initiative in preparing a handbook including a set of guidelines for the regeneration of grain legume accessions. This was seen as an important step towards improving the quality standards of genebank operations. It was noted that the main problems for regeneration are limited to outcrossing species. However, M.J. Suso remarked that faba bean is not strictly outcrossing, since its mating system depends on the variety and the environment. Since the same behaviour could also be true for other grain legume crops, a knowledge base should accompany the definition of the most suitable regeneration procedures.

Workplan

- *The Group agreed to share information about general genebank practices with special emphasis on regeneration procedures currently used. WG members, in liaison with M. Ambrose, will collect information from their countries' genebanks and send the results to M. Ambrose and the ECP/GR Secretariat by **November 2001**. Collated returns will be distributed by **April 2002**.*
- *The possibility of organizing a short workshop on regeneration of allogamic grain legume species will be explored by an Organizing Committee made of M. Ambrose, G. Duc, L. Holly and M. Vishnyakova. As a funding source, AEP should be approached or the ECP/GR Steering Committee could be requested to approve funding of this small technical meeting with the ECP/GR budget (target date for this meeting would be the **second half of 2002**).*

A proposal was made to work for the standardization of descriptors on molecular markers.

M. Ambrose reported that a number of initiatives of this type were already ongoing. He cited the IPGRI report on Molecular Genetic Techniques for PGR.[10]

G. Duc suggested that the Group should promote screening of germplasm for disease resistance. It was remarked that this type of screening needs to involve breeders and plant pathologists and that this kind of collaboration is better implemented in the context of projects such as the EC1467/94 projects. He also suggested that the ECP/GR Secretariat could check with ICARDA whether they might be willing to include accessions from European collections in evaluation trials for disease resistance.

M. Ambrose expressed the view that the report of the expert AEP workshop on standardization of screening for diseases coordinated by A. Ramos Monreal in Valladolid, Spain in October 2000 would contain important information on expert assessment on methods and scoring for these diseases. A. Ramos Monreal said the report was due to be published in October 2001 and would be available through the AEP.

Workplan

- *The Group agreed to use the upcoming AEP Conference to enquire about the currently most important diseases and to locate experts in disease resistance screening (the outcome will be published in the present report).*[11]

The Group considered that on-farm conservation of grain legumes in Europe might become increasingly important in the future, although it is difficult to predict the effectiveness of this methodology. The ECP/GR *In situ* and On-farm conservation Thematic Network would be an important reference for the Group.

Workplan

[10] Ayad, W.G, T. Hodgkin, A. Jaradat and V.R. Rao, editors. 1997. Molecular genetic techniques for plant genetic resources. Report of an IPGRI Workshop, 9-11 October 1995, Rome, Italy. International Plant Genetic Resources Institute, Rome, Italy.

[11] During a workshop held on 10 July 2001, as part of the Fourth European Conference on Grain Legumes, the participants stressed the importance to define screening methodologies, but without losing non-standardized information already gathered in the laboratories. In particular, the importance to standardize methodologies to identify races and pathotypes was emphasized. There was agreement on the need of a stronger collaboration with pathologists. It was remarked that the importance of specific diseases and abiotic stresses varies in the different countries. A number of biotic factors were quoted as relevant for pea (*Aphanomyces*, *Mycosphaerella*, *Pseudomonas*, *Orobanche, Cecidomia*); faba bean (*Botrytys*, *Ascochyta*, *Fusarium*, *Orobanche*, viruses); lupin (anthracnose, viruses); chickpea (*Fusarium*, *Heliotis*); lentil (*Fusarium*, rust, downy mildew); and beans (*Pseudomonas,* anthracnose, bacterial and viral diseases). However, as a general rule, it was felt that collaborative efforts should mainly be focused against those factors that are difficult to control by chemicals, such as viruses or *Orobanche*.

- *The Group members agreed to monitor cases of on-farm conservation of grain legumes in their respective countries and to keep the Chairperson and the ECP/GR Secretariat informed.*

Conclusion

Presentation and adoption of the report

The section *Discussion and Recommendations* of the report was presented to the participants and was approved with minor modifications.

Election of the Chair and Vice-Chair; the Network Coordinating Group

M. Ambrose was re-elected as Chairperson. R. Schachl kindly agreed to take the role of Vice-Chair until his retirement, which is expected in 2 years. Other members selected as part of the Network Coordinating Group were S. Angelova, G. Duc and W. Święcicki.

Closing remarks

M. Ambrose thanked all the participants for their active presence. He underlined the importance of the existence of a Working Group on Grain Legumes and expressed the need for the Group to meet again in the near future. S. Angelova proposed that the next meeting be held in Bulgaria and suggested June or September as the most suitable time. The Group thanked her for the kind offer, which would be considered at the next opportunity.

Part II. Presented papers

European Grain Legume Databases

The European Phaseolus *and* Vigna *Databases*

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Technical aspects

- **Software:** the programs currently used are MS-Access97 for the internal database, and Oracle 8.1.6 on the Internet;
- **Format:** most data received were not in the standardized FAO/IPGRI *Multi-crop Passport Descriptors* format, and therefore had to be converted. However it was easier for curators to send their data without having to convert them, and this increased the rate of contribution. All data received were in an easily readable format. The 16-bit standard DBF format was chosen for downloading from the Internet, since this format can be read and processed easily by every common database program.

Vigna Database

Web site: <http://www.agrobio.bmlf.gv.at/vigna/> or <http://www.ipgri.cgiar.org>.

A questionnaire was sent in spring 2001 to 23 institutes in 18 countries, including Israel and Morocco. Only 3 institutes have sent data so far, and 2 institutes returned the questionnaire indicating the number of accessions conserved, but no additional data (they did not work on *Vigna* at the time and do not have data sets of their collections yet). Table 1 lists the data contributions received. The database is expected to contain 4000 records.

Table 1. Contributions to the *Vigna* Database

	No. of records received	
Institute	**with data**	**without data**
VIR, St Petersburg, Russia	2459	
Botanical Garden Meise, Belgium	709	
INIA Madrid, Spain	427	
University Kassel, Germany		36
Castelo Branco, Portugal		104

Phaseolus Database

Web site: <http://www.agrobio.bmlf.gv.at/phaseolus> or <http://www.ipgri.cgiar.org>.

A request for data was sent to 34 institutes in 27 countries, including Israel and Morocco. Passport data were received from 21 institutes, so that the database now contains a total of 31 717 records. Five of these institutes sent additional characterization data for 1074 records (= 3%). Eight institutes from 6 countries returned only information on the number of accessions, but no additional data (Table 2), and some did not reply at all (Bulgaria and Morocco).

Table 2. Missing data in the *Phaseolus* Database

Country	No. of records with no data
Cyprus	29
France	509 + 600
Poland	1241
Romania	1300 + 2037
Slovenia	705
Yugoslavia	290

Contents of the *Phaseolus* Database

Species

Phaseolus species represented in the database are listed in Table 3.

Table 3. Species represented in the *Phaseolus* Database

Species	No. of records
vulgaris	29577
coccineus	1282
lunatus	312
acutifolius	53
x *multigaris*	54
radiatus	16
not defined	423
Total	**31717**

Quality of data

The passport descriptor 'Status of sample' (SAMPSTAT) has been chosen as an example. Only 10 135 records (i.e. 32% of total records in the database) could be analyzed. Results are shown in Table 4.

Table 4. Status of sample (SAMPSTAT) based on 10 135 records (= 32% of total records)

SAMPSTAT	No. records	% of records containing SAMPSTAT information	% of records in the whole database
1. Wild	297	3	0.9
2. Weedy	40	0.4	0.1
3. Landrace	5244	52	17
4. Breeder's line	327	3	1
5. Cultivar	4227	42	13.5

The Cambridge Collection

After Prof. Adrian Shirlin's retirement, emergency measures were taken to save the endangered *Phaseolus* Collection of the University of Cambridge. Regeneration of important material was carried out in Italy by Prof. G.P. Soressi, Viterbo and his collaborators, and by Dr P. Ranalli, Bologna. A representative amount of freshly harvested seed is stored as black-box safety storage in the genebank of the Federal Office of Agrobiology in Linz, Austria.

Characterization and evaluation

Whereas the accessions described in the European *Phaseolus* Database are well documented for passport data, evaluation and characterization data are mostly missing. Except for Israel, Albania and Austria, no characterization data were reported. The excellent documentation of the material from Albania is worthy of mention.

During the Copenhagen meeting (1995) it was agreed to include five characterization descriptors for *Phaseolus*: seed size, seed colour, growth habit, use of the accession, and pod curvature. However, these minimum characterization descriptors are not sufficient to identify the accessions, and even these simple characterization data are often missing. In many cases, e.g. for the English collection, even the growth habit (bushy type or climbing type) is not known.

Standardization of the characterization and evaluation descriptors is essential. Three sets of descriptors are currently in use: IPGRI descriptors, UPOV descriptors, and COMECON descriptors. Many genebanks use their own descriptors, but finally adopt one of the above-mentioned sets of descriptors.

Generally speaking, the descriptors suffer from two problems:

1. in many cases, the extent to which a given character is modified by the environment is not sufficiently known. In the case of wheat for instance, which is one of the best evaluated and described crops, several characters are included which have been shown in the meantime to be largely influenced by environment and are not useful for variety identification; this happens even in relatively recent publications;
2. in many cases the descriptors are much too complicated, e.g. regarding the colours: red, light red, dark red, purple, whitish red, pink, etc. It would be highly confusing for the curator to choose the right term for a certain nuance. We should also be aware that many colours change with time, as is the case of *Phaseolus* beans when they are stored for some time. There is an urgent need to simplify, focusing only on the basic colours and harmonizing among the species and description systems, since colours that are too difficult to identify might create difficulties not only at the description stage, but also for the computerization of evaluation data.

Regarding the three basic description systems set up by IPGRI, UPOV and COMECON, it should also be noted that:

- IPGRI descriptors are very detailed and perfectly appropriate for accessions of wild and weedy types up to landraces, but do not apply well enough to bred material.
- UPOV descriptors, on the other hand, do so but neglect the possible variation found in primitive races.
- Finally, the COMECON descriptors offer a wide range of characterization descriptors, applicable to almost all types of accessions, but they are outdated especially as regards the coding system of the characters.

For the purpose of the European genebanks, comprising in their collections primitive types, landraces and commercial varieties, the only solution would be a synthesis of IPGRI and UPOV descriptors to prevent the use of two different description systems.

But there is still another serious problem: all those descriptors are mainly designed to describe plants during growth, either during collecting or regeneration. Keeping in mind the large number of accessions (31 717 which are reported) included in the European *Phaseolus* Database, such a detailed description system will be applicable for a limited number of accessions only (e.g. for the accessions of a core collection).

Handbook on evaluation of* Phaseolus *germplasm

During the PHASELIEU project, an attempt was made to develop a description system that would be appropriate for the description of a large number of accessions with low input. However this system, as published in the PHASELIEU Handbook[12], still includes some complicated elements and therefore a simplified version, as discussed above, should be developed.

The description system is largely based on tables of photographs. Each photograph is assigned an alphanumeric code. The system also provides highly sophisticated identification methods, and neglects fine nuances of colours. Thus it is kept as simple as possible, but still offers the possibility of a quick description of a large number of accessions so that they can be identified, and possible duplicates revealed. For more detailed information one of the already existing description system might be used, or additional comments might be provided.

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[12] De la Cuadra, C., A.M. de Ron and R. Schachl, editors. 2001. Handbook on evaluation of *Phaseolus* germplasm. PHASELIEU-FAIR-PL97-3463. Misión Biológica de Galicia (CSIC).

The system is based on five main subjects whilst emphasizing the characters of the grain:
- use
- growth habit
- grain colour, shape, and size
- additional botanical characters (e.g. flower; also leaf shape could be included)
- pod shape, size, and colour.

Basic characterization can therefore be made immediately and directly in the store, or from information already recorded during collecting or previous regeneration. Thus further rejuvenation in the field, in order to describe the accession in a more detailed manner if needed, will be required only in exceptional cases.

This system might be found too sketchy, but a sketchy description is better than no description, especially if it allows for sufficient identification of the accession. Furthermore, the possibilities of genetic fingerprinting and the need to include marker genes in the future reduce the need and importance of a far-reaching botanical characterization.

The European Vicia faba *Database*

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Introduction

After our first survey of 1996, which was aimed at identifying the existing collections *of Vicia faba* in Europe, we made a second survey in 2001, in order to update the information on the collections and evaluate the possibilities of collaboration between curators.

Until 2000, European private and public programmes on *Vicia faba* breeding and genetics were in continuous decline. The genetic resource collections associated with these programmes were in a difficult position and were not much used. Since 2001, interest in faba bean is being reinforced owing to several factors (demand for organic farming, interest in poultry feeds, demand for food safety, replacement of pea due to its susceptibility to *Aphanomyces*). In France, this allowed the establishment of a new GIE (Groupement d'Intérêt Economique) "*Féverole*", supported by the French Ministry of Agriculture and UNIP (Union nationale interprofessionnelle des plantes riches en protéines). Members of the GIE are Agri-Obtentions, SERASEM, GAE Semences. The technical platform of this GIE, based at INRA-Dijon, breeds for spring-sown, low tannin and low vicine-convicine genotypes. Its tasks include the maintenance of genetic resources. We do not know if this renewed activity is happening in other European countries.

Updated collection list

We have identified 29 collections. These collections mostly contain cultivars and farmer's populations, obtained by prospecting. Very few breeder's working lines seem to be included. For each of these collections, the current names and addresses of curators are available.

Passport data

We had requested a minimum set of 8 passport descriptors based on the *FAO/IPGRI Multi-crop Passport Descriptor List*: Country and Institution, Species, Accession code, Botanical name, Origin, Country of collecting, Donor, and Donor accession code.

We worked on the collected passport data in order to standardize the columns of parameters. The resulting data file, created in Excel, was made up of 19 columns. Up to now, this work permitted the concatenation of 28 collection files for a total of 13 067 accessions. We eliminated accessions which were not of the right species. The objective is now to work on the elimination of duplicates. We foresee that this elimination will be a long and difficult task, owing to the many variations in the spelling of cultivars' names, donor codes, and even of country codes.

Out of the 13 067 accessions, 30% have cultivar names, 17% are of unknown geographic origin and 52% are of European origin.

Characterization data

For half of the collection, descriptors are very variable and incomplete. We requested a minimum of 4 important characterization descriptors: flower colour, spring or winter sowing type, 1000-seed weight, main outstanding trait. Accessions are often a mixture of different genotypes, which is a general problem. The coding system used for these descriptors is given below (Annex 1).

Results of the 2001 survey

This new survey brought answers from 12 collections corresponding to 10 022 accessions. Most curators agree to load or to connect their database to IPGRI's Web site. Most collections are declared available for distribution (in some cases, MTAs would be requested). The description of maintenance and regeneration techniques is available for 11 collections (50% in open-pollination). Long-term maintenance is secured for only six collections. Eight curators declared that they would consider participating in the development of a core collection. The possibility of hosting abandoned collections is always considered to be limited (a few hundreds of accessions). No abandoned or unknown collections were identified through the survey.

Conclusions and perspectives

- The gathering of passport data on *Vicia faba* genetic resources was rather successful, demonstrating a significant size of European collections (13 000 accessions) with 52% of European origin. This part probably does not duplicate the ICARDA collection.
- The collections are mostly kept by public institutions. Later on, it would be of interest to know which collections are available from private companies.
- In the last few years, there has been a clear reduction of investment by the public and private sectors in *Vicia faba* in Europe. Has there been a rebirth of faba bean in 2001? It will be 5 years before we know.
- The allogamy of the crop makes the maintenance cost heavy. The building of a core collection is a high priority, but research teams need to be supported in this work. INRA is starting to build populations of pooled accessions sharing a common agronomic feature, in order to simplify maintenance.
- A key point is also the quick analysis of the duplicates in the database that has been developed. This will be done in the next phase and will involve a lot of work, for which INRA may have limited resources.

Annex 1. Coding of the minimum characterization descriptors for *Vicia faba*

Column 1. Flower colour

1 White
2 Violet
3 Dark brown
4 Light brown
5 Pink
6 Red
7 Yellow
8 Coloured
9 Other (specify in Notes)

Column 2. Sowing type

1 Spring
2 Winter

Column 3. 1000-seed weight

1 1<30 g
2 30-50 g
3 51-75 g
4 76-130 g
5 >130 g

Column 4. Main outstanding trait

1 Abiotic stress resistance or tolerance

11 Frost resistance or tolerance
12 Drought resistance or tolerance
13 Soil salinity resistance or tolerance

2 Biotic stress resistance or tolerance

21 Botrytis resistance or tolerance
22 Ascochyta resistance or tolerance
23 Rust resistance or tolerance
24 Bruchus resistance or tolerance
25 Aphids resistance or tolerance
26 Sitona resistance or tolerance
27 Orobanche resistance or tolerance

3 Variants for symbiosis

31 Rhizobium
32 Mycorrhizal

4 Variant for plant physiology or architecture

41 Very early flowering
42 Very short internodes
43 Stiff straw
44 Determinate stem growth
45 Leaf shape variant

5 Particular flower trait

51 Nuclear male sterile
52 Cytoplasmic male sterile
53 Independent vascular supply to pods
54 Closed flower
55 Unspotted wings of flowers (diffused pigment)
56 Apetal

6 Particular seed trait

61 Particular seed colour or decoration (different from uniform beige)
62 Green cotyledon
63 Very low content in vicine-convicine
64 Very high content in proteins
65 Very high in lipids

7 Ploidy

71 Tetraploid
72 Aneuploid
99 Other (specify in Notes)

N.B. It is recommended, as far as possible, to provide additional notes in a fifth column named "*Additional notes*" which may define the characteristics, level of homozygosity, possible name of genes, literature references, etc.

Status of the European Cicer *Database*

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Introduction

Portugal is responsible for the European *Cicer* Database. The database was established in 1995 and its structure organized according to the FAO/IPGRI *Multi-crop Passport Descriptors*. Passport data were received from 16 institutions belonging to 10 countries. Unfortunately, since 1995, very few European countries joined the *Cicer* Database and no additional contribution was received. Therefore, since the last meeting of the Working Group on Grain legumes in Norwich (1998) there have been no significant changes in the *Cicer* Database.

Table 1 lists the number of accessions per country and the number of descriptors used.

Table 1. Institutions participating in the *Cicer* Database, number of accessions and number of descriptors

Country	Institution	INSTCODE	Acronym	No. of accessions	No. of descriptors
Cyprus	Agricultural Research Institute – Plant Genetic and Herbarium	CYP004	ARI	36	21
Germany	Institute of Crop Science – Federal Research Centre for Agriculture	DEU001	BGRC	142	12
Germany	Genebank - Institute for Plant Genetics and Crop Plant Research	DEU146	IPK	256	10
Hungary	Institute of Agrobotany	HUN003	RCA	514	11
Israel	Israel Gene Bank for Agricultural Crops			468	7
Poland	Plant Genetic Resources Laboratory – Research Institute of Vegetable Crops	POL030	SKV	4	16
Portugal	Portuguese Plant Germplasm Bank	PRT001	BPGV-DRAEDM	248	18
Portugal	National Plant Breeding Station	PRT083	ENMP	230	12
Portugal	Genebank - Genetics	PRT005	EAN-BANCO	115	16
Portugal	Dept. Genetic Resources and Breeding	PRT014	EAN-FOR	8	
Romania	Genebank of Suceava	ROM007		3	12
Spain	Centro de Recursos Fitogeneticos – Banco de Germoplasma Vegetal	ESP004	CRF	468	9
Spain	Banco de Germoplasma de Horticolas	ESP027	DGABGHZ	11	18
Turkey	Aegean Agricultural Research Institute – Plant Genetic Resources Dept.	TUR001	AARI	1167	6
United Kingdom	*Vicieae* Germplasm Collection and Biology Dept., School of Biological Sciences – University of Southampton	GBR001	SOUTA	31	6

The passport descriptors for *Cicer* are based on the FAO/IPGRI *Multi-crop Passport Descriptors* (Table 2).

Table 2. Passport descriptors adapted for the *Cicer* Database

1. Institute code	INSTCODE	11. Elevation of collecting site	ELEVATION
2. Accession number	ACCENUMB	12. Collecting data of original sample	COLLDATE
3. Collecting number	COLLNUMB	13. Status of sample	SAMPSTAT
4. Genus	GENUS	14. Collecting source	COLLSRC
5. Species	SPECIES	15. Donor institute code	DONORCODE
6. Accession name	ACCNAME	16. Donor number	DONORNUMB
7. Country of origin	ORIGCTY	17. Other number(s) associated with the accession	OTHERNUMB
8. Location of collecting site	COLLSITE	18. Safety-duplication	SAFEDUP
9. Latitude of collecting site	LATITUDE	19. Remarks	REMARKS
10. Longitude of collecting site	LONGITUDE		

The database contains information on 3701 accessions (advanced cultivars, primitive cultivars/landraces, breeding material and wild accessions) representing 14 species (Table 3).

Table 3. Species included in the *Cicer* Database

Species	No. of accessions	%	Country of origin
C. anatolicum	2	0.05	Turkey
C. arietinum	3636	98.24	All countries
C. bijugum	4	0.11	Turkey, Israel
C. pinnatifidum	16	0.43	Turkey, Israel, Germany (IPK), UK
C. cuneatum	2	0.05	Israel
C. echinospermum	5	0.14	Turkey, Israel
C. flexuosum	2	0.05	Germany (IPK)
C. grande	1	0.03	Germany (IPK)
C. judaicum	7	0.19	Turkey, Israel, UK
C. maracanthum	2	0.05	Germany (IPK)
C. montbretii	2	0.05	Turkey
C. reticulatum	11	0.30	Turkey, Israel, UK
C. songaricum	1	0.03	Germany (IPK)
Cicer sp.	10	0.27	Turkey and UK

Cicer arietinum is the most representative species in Europe with 98% of all accessions, and is represented in all countries. Chickpea is a traditional grain legume crop in Portugal (350-600 mm annual rainfall) and is traditionally sown in spring. In Mediterranean countries it is an important constituent of human diet and a valuable source of plant protein. In Portugal, chickpea is produced as a food crop, but in the past, part of the harvested crop was used for feeding pigs, horses and mules, mainly in favourable seasons when a grain surplus was obtained.

Until the middle of the 20th century the chickpea area was considerable. In the 1960s the cultivated area increased to 73 000 ha. In the second half of the century the acreage decreased significantly and the yield remained very low. During the 1990s this problem persisted, mainly owing to the lack of or low CAP subsidies for the crop, and also to the low prices of imported chickpeas. There were also problems related to agronomic characters (varieties extremely susceptible to the main diseases and to drought, plant habit unsuitable for mechanical harvesting), and an inadequate marketing organization at the farm level.

Chickpea yield is usually low, because this crop is currently sown in the spring. Diseases and drought are the most important limiting factors. Ascochyta blight and Fusarium wilt are the two major diseases of chickpea. Leaf miner in the Mediterranean region and pod borer in other regions are the major insect pests. Drought is the major abiotic stress throughout the chickpea-growing areas. The sowing date has a considerable influence on the crop performance since it determines the environmental conditions to which the various phenological stages of the crop will be exposed. In the Mediterranean basin poor yield is due, among other factors, to a low shoot biomass. Yield can be increased substantially by bringing forward the sowing date from spring to autumn, when atmospheric conditions are favourable to the crop. For spring sowings the low soil moisture level in the seedbed leads to poor establishment due to inadequate germination or emergence and high seedling mortality, and plants enter all the flowering and pod-setting stages under humid conditions. On the other hand, for autumn/winter sowings the lack of water associated with high diurnal temperatures hasten plant development and increase flower and pod abortion, even though late rains sometimes occur.

Status of the European Lens *Database*

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After the first meeting of the ECP/GR Working Group on Grain Legumes held in Copenhagen in 1995, the Aegean Agricultural Research Institute took responsibility for the European *Lens* Database. After a first request for data sent to participating countries, very few answers were received. A second call for data was made at the second meeting of the Working Group held in Norwich in 1998, and more countries sent data on their *Lens* accessions. Following another call for data sent in June 2000 to 25 countries, information was received from 6 countries, 5 of which declared they had no *Lens* collection, and 14 did not reply. The database currently contains data on 1675 accessions, including 617 from Turkey (Table 1).

Table 1. Contributions to the European *Lens* Database, tabulated by country

Country	No reply	No data (no *Lens* collection)	Data received (no. of accessions)
Austria		+	
Bulgaria	+		
Croatia	+		
Cyprus			19
Czech Republic		+	
England		+	
Finland		+	
France	+		
Germany			317
Greece			97
Hungary	+		
Ireland	+		
Israel			102
Italy	+		
Lithuania	+		
Malta	+		
The Netherlands		+	
Nordic Countries	+		
Poland	+		
Portugal	+		
Russia	+		
Sweden			1
Slovakia	+		
Slovenia	+		
Spain			522
Turkey			617
Total			**1675**

Another request will be sent to the Working Group members, requesting them to send or update their *Lens* data before September 2001. The database will then be made available on-line either on the AARI or IPGRI server, in the original data format. The following descriptors are requested for the *Lens* Database:

Country	Wild, weed, cultivated
Institution holding the collection (genebank acronym)	Country of origin
Accession number	Donor institute
Other numbers	Donor number
Genus	Province/state of collecting site
Species	Precise locality of collecting site
Local/vernacular name/variety name	Longitude of collecting site
Seed availability	Latitude of collecting site
Accession status	Altitude of collecting site

The European Lupinus *Database*

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Introduction

The protection of lupin genetic resources is justified both by the genetic erosion of the crop and by its characters of agricultural importance: nitrogen fixation, high seed protein content (30-46%), role in protection against soil erosion and in soil improvement, very low soil fertility requirements (e.g. yellow lupin), usefulness of the green mass as fodder and manure. The major steps in lupin domestication and improvement dealt with decreasing the alkaloid content, selection for non–shattering pods, resistance to *Fusarium,* thermoneutrality and self-completing of the vegetation. Identification of anthracnose resistance is currently a crucial problem.

Cooperation between holders of lupin collections was established on the initiative of members of the International Lupin Association. At the 5th International Lupin Conference held in 1988 in Poznań, Poland, managers of specific crop collections were nominated for *L. angustifolius*, *L. albus*, *L. luteus* and *L. mutabilis*. The international database for yellow lupin collections was presented at the 7th International Lupin Conference held in 1993 in Evora, Portugal (Święcicki and Leraczyk 1994). Then, under the patronage of the ECP/GR, at the First Meeting of the Working Group on Grain Legumes in Copenhagen (1995), managers were nominated for European grain legume databases, including one dedicated to the genus *Lupinus*.

At two following conferences (3rd International Food Legumes Research Conference, Adelaide, Australia, 1997, and 9th International Lupin Conference, Klink, Germany, 1999), the *Lupinus* genetic resources held in collections in Europe, USA and Australia (13 056 accessions in total) were presented, with their variation, range of evaluation and characterization (Święcicki *et al.* 2000a, 2000b). The common database was also presented. The Web site of the European *Lupinus* Database (<www.ihar.edu.pl/gene_bank/lupinus/>) was created just before the present meeting of the Working Group on Grain Legumes

Geographical distribution of the genus *Lupinus*

Lupins are distributed in two regions of origin. In the New World, on both American continents—from the Andes to the Arctic—over 200 species were described (annual and perennial, mostly small–seeded, 2n = 48). The only crop among those is *L. mutabilis* Sweet (18-20% fat and 40% protein in big seeds). The Russel lupin, an interspecific hybrid between small–seeded lupins, is an ornamental garden plant.

South America includes two sub-regions of lupin distribution—Andean and Atlantic. There are references indicating evolutionary relationships between the Atlantic sub-region and the Old World lupins (Dunn 1984). Basic constraints to the study of these relationships are the lack of available South American lupin genetic resources and of an updated taxonomy. For example, for about 500 lupin taxa (species and sub-species), 1700 different names are used in the literature (Dunn 1984; Sholars, unpublished).

In the Old World (Mediterranean basin) 12 lupin species were described (Table 1) and divided into smooth- and rough–seeded groups. These species have their own respective areas of distribution, are self- or cross-pollinated and in general do not cross-pollinate with each other (Carstairs *et al.* 1992, Cowling *et al.* 1998, Święcicki *et al.* 1999, Święcicki *et al.* 2000a). Some of them are found on limited, small areas with specific environmental conditions (e.g. *L. princei* on the highlands of Kenya, southern Ethiopia, northern Tanzania), others are present around the whole Mediterranean Sea (e.g. *L. micranthus*) (Gladstones 1974). Lupins grow in a wide range of environmental conditions, from sea level to 2800–3500 m asl, soil pH 4.2–9.5, annual rainfall 100-2000 mm (Cowling *et al.* 1998).

Table 1. Lupin species described in the Mediterranean Basin

Species	Ploidy (2n)
L. angustifolius L.	40
L. albus L.	50
L. luteus L.	52
L. micranthus Guss.	52
L. hispanicus Boiss.et Reut.	52
L. atlanticus Gladst.	8
L. cosentinii Guss.	32
L. digitatus Forsk.	36
L. palaestinus Boiss.	42
L. pilosus Murr.	42
L. princei Harms	38
L. somaliensis Baker	?

Lupin crops (*L. angustifolius, L. albus, L. luteus*) and *L. micranthus* belong to the smooth-seeded group. In the past decade two new species were described: *L. anatolicus* Swiec. et Swiec. (2n = 42), found on a collecting mission, and *L.* x *hispanicoluteus* Swiec. et Swiec. (2n = 52), a stable artificial hybrid (Święcicki *et al.* 1996; Święcicki *et al.* 1999).

European lupin collections

Lupin databases on electronic media were obtained from 14 European institutions (8490 accessions), from Australia (3516 accessions) and from the USA (1050 accessions). The range of passport information and the size of the European lupin collections are presented in Table 2. Their distribution by species and by institute is presented in Table 3. Most institutions are interested in lupins as crops. The dominant species in an institution usually reflects the country's major breeding objective. Six of the biggest collections (BGRC, GAT, INIACRF, RNG, WTD, and Oeiras) hold about 90% of the total number of accessions. The global distribution per species shows that almost 88% of the accessions (80% of which are wild and landrace types) belong to four lupin crops (*L. albus, L. angustifolius, L. luteus* and *L. mutabilis*); 8.33% belong to wild Old World species (L. *anatolicus, L. atlanticus, L. cosentinii, L. digitatus,* L.x *hispanicoluteus, L. hispanicus, L. micranthus, L. palaestinus* and *L. pilosus*); and almost 3% belong to American lupins (excluding *L. mutabilis*). The Atlantic sub-region is not represented. Very few accessions belong to *L. digitatus* and *L. palaestinus.* There is no accession of *L. princei* in the European collections. For *L. somaliensis* only a herbarium specimen is available.

The analysis of data on the country of origin of wild material and breeding lines is interesting (Fig. 1). It shows that most of the 4535 lines described originate from Spain and Portugal (probably wild lines), followed by Poland and Germany (cultivars and breeder's material).

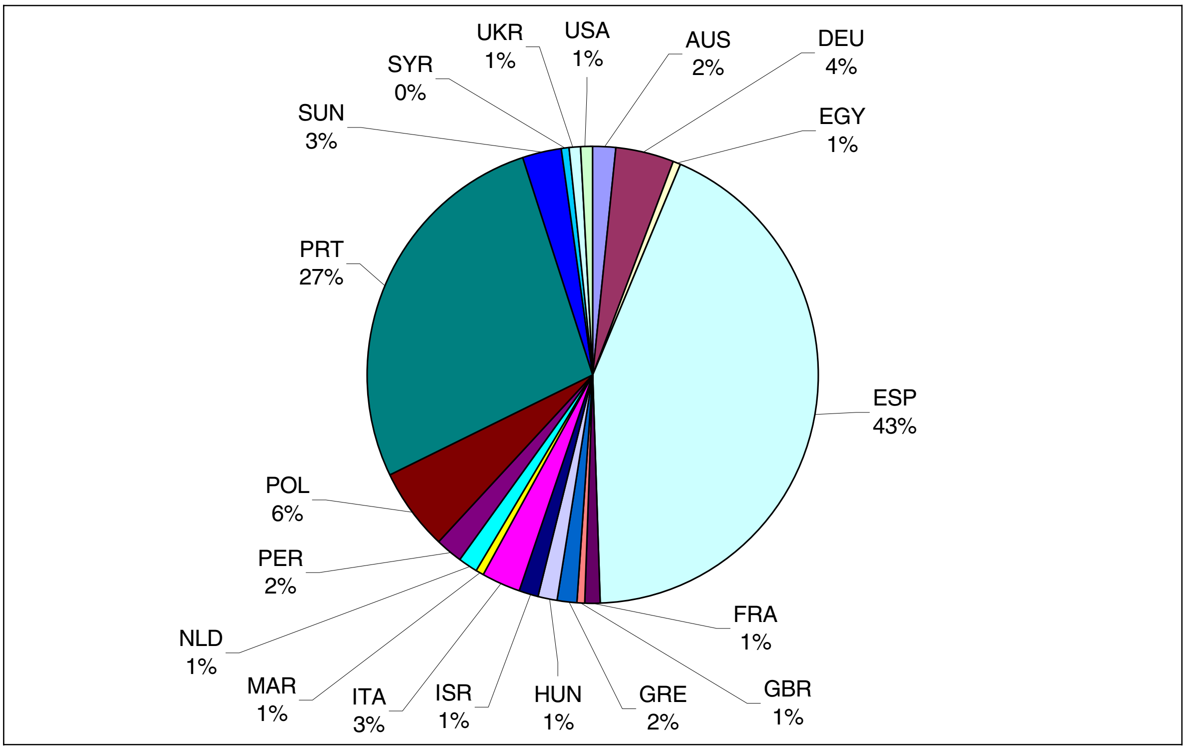

Fig. 1. Countries of origin of collected *Lupinus* genetic resources for 4535 accessions.

Database structure

The information in Table 2 gave rise to a common database format including descriptors from the FAO/IPGRI *Multi-crop Passport Descriptors List* and some additional descriptors: 'Institute code' (INSTCODE), 'Accession number' (ACCENUMB), 'Botanical name' (SPECIES), 'Country of origin' (ORIGCTY), 'Donor institute code' (DONORCODE), 'Collection data' (COLLEC_DATA) and 'Evaluation data' (EVALU-DATA).

Future tasks

Analysis of the European *Lupinus* Database (ELDB) indicates future tasks for individual lupin collections and for the management of the common database. Considering the very wide range of passport data (Table 2), a common database structure should be accepted. The analysis of duplicates is also an important issue.

Since development of the ELDB took place over several years, an update is necessary to include the new accessions collected and to update the data. Moreover, the discussions during this present meeting of the Working Group revealed that some national databases (Russia, France, Turkey and Greece) have not been integrated in the ELBD. These data should be included.

At least half of the national databases maintain information on collecting data. The mapping of this information using GPS on the areas of distribution of a given species (Gladstones 1974) should show gaps and suggest future collecting missions (Święcicki *et al.* 2000b). Taking into account breeders' requirements would increase the value of these missions, which should cover areas where characters that are important for cultivar improvement may be found, e.g.:

- for *L. albus*: alkaline soil tolerance (Corsica, Malta, Sicily);
- for *L. luteus*: frost tolerance at high altitudes, improved yield structure (Sicily, Sardinia), short growing period (Morocco, Israel, Lebanon, Syria);
- for *L. angustifolius*: short growing period;

- for all lupin crops: anthracnose resistance (e.g. Azores Islands and Ethiopia for *L. albus*), reduced flower abortion;
- for *L. pilosus*: smooth seeds (studies on the relationship *L. pilosus - L. anatolicus)*
- for *L. hispanicus:* studies on the relationship *L. hispanicus* subsp. *bicolor* - section *lutei*.

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Table 2. List of acronyms used in Tables 3 and 4

Country	Acronym	Full name
BUL	IPGRSAD	Institute of Plant Genetic Resources, Sadovo
CZE	SUMPERK	Research and Breeding Institute of Technical Crops and Legumes, Šumperk
DEU	BGRC	Institute of Crop Science – Federal Research Centre for Agriculture
DEU	GAT	Zentral Institut für Genetik und Kulturpflanzenforschung, Gatersleben
ESP	INIACRF	Instituto Nacional de Investigaciones Agrarias, Madrid
GBR	RNG	University of Reading, Department of Agricultural Botany, UK
HUN	RCA	Institute for Agrobotany, Tápiószele
ISR	IGB	Israeli Gene Bank for Agricultural Crops, Bet-Dagan
ITA	PLAPORT	University of Napoli
NLD	CGN	Centre for Genetic Resources, The Netherlands
POL	WTD	Plant Breeding Station, Wiatrowo, Poland
PRT	BPGV	Portuguese Plant Germplasm Bank, Braga
PRT	OEIRAS	Dept. Genetic Resources and Breeding, EAN, Oeiras
SLO	PIEST	Research Institute of Plant Production (RIPP), Piešťany

Table 3. Passport data in European *Lupinus* collections

Country	Institution acronym	Accession number	Name	Taxonomy	Origin	Country of origin	Donor	Donor number	Donor country	Breeder	Pedigree	Sample status	Collecting data	Evaluation data	No. of accessions
BUL	IPGRSAD	X	X	X		X			X						221
CZE	SUMPERK	X	X	X		X	X	X		X	X	X			60
DEU	BGRC	X	X	X	X	X	X	X	X	X	X		X	X	1983
DEU	GAT	X	X	X	X	X		X					X		829
ESP	INIACRF	X	X	X	X	X	X	X		X		X	X		1621
GBR	RNG	X	X	X		X									1162
HUN	RCA	X	X	X		X		X	X						255
ISR	IGB	X	X	X		X		X							186
ITA	PLAPORT	X	X	X	X	X	X							X	39
NLD	CGN	X	X	X		X	X					X	X		69
POL	WTD	X	X	X	X	X	X	X		X		X		X	1024
PRT	BPGV	X		X		X						X	X	X	71
PRT	OEIRAS	X	X	X	X	X	X					X	X		951
SLO	PIEST	X	X	X	X	X	X	X				X			19
															8490

Table 4. Species represented in the European *Lupinus* collections and number of accessions per contributing institute

Species	BUL IPGRSAD	CZE SUMPERK	DEU BGRC	DEU GAT	ESP INIACRF	GBR RNG	HUN RCA	ISR IGB	ITA PLA PORT	NLD CGN	POL WTD	PRT BPGV	PRT OEIRAS	SLO PIEST	Total
albus	102	28	137	207	571	736	52	45	27	13	302	62	295	10	2587
angustifolius	17	9	400	275	553	76	44	42	11		299		246	4	1976
luteus	18	22	252	125	255	94	68	59	1	56	345	9	262	5	1571
anatolicus											1				1
atlanticus			18								8				26
cosentinii			32	6	14	2		1			7		23		85
digitatus											2				2
x hispanicoluteus											3				3
hispanicus			90	63	196	5					14		112		480
micranthus			3	19	12	6	7				2		10		59
palaestinus			3					1			4				8
pilosus			6	11		14		6			7				44
princei															-
mutabilis	57		998	26	20	194	7	4			14				1320
New World (other)	27		37	68			76	26			16		2		252
Lupinus sp. (unident.)		1	7	29		35	1	2					1		76
Total	**221**	**60**	**1983**	**829**	**1621**	**1162**	**255**	**186**	**39**	**69**	**1024**	**71**	**951**	**19**	**8490**

Pisum progress report

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During the summer of 1999 a MSc student from the University of Birmingham, Magdelena DuPlessis, undertook her end-of-year project at the John Innes Centre. The title of her project was 'Preliminary analysis of the European *Pisum* Database'. An analysis of contributions represented in the European *Pisum* Database was undertaken and summary findings are presented below. A manuscript is in preparation of her work dealing with the identification of potential duplicates.

Objectives of the project

The project represented the first detailed investigation of the European *Pisum* Database (EPDB). The project aims to use the database as a starting point to address the questions of duplication within the holding represented. The project has five objectives as follows:

- undertake preliminary investigation into the holding of European collection of *Pisum* on the basis of the information held in the database;
- screen for potential duplicates;
- develop strategies for these approaches;
- identify shortcomings in the database; and
- develop strategies for improving the classification and cross-referencing of material in multiple fields.

The European *Pisum* Database (EPDB)

The objectives of the EPDB are to:

1. establish a catalogue of *Pisum* genetic resources in European collections;
2. provide information on these resources;
3. identify duplicates;
4. identify gaps in the European collection; and
5. determine strategies for further collection.

Table 1 lists the institutions participating in the EPDB, Figure 1 shows the percentage data entries in each descriptor field for all institutes, and Table 2 provides the total number of accession information in seven of the descriptors fields for each institute.

Table 1. Institutions holding *Pisum* germplasm that are represented in the EPDB

Acronym*	Institute	Country
ARA	Aegean Agricultural Research Institute	Turkey
BAR	Istituto del Germoplasma	Italy
BRN	Institut für Pflanzenbau und Pflanzenzüchtung	Germany
CGN	Centre for Genetic Resources	Netherlands
ECS	Department of Agriculture and Fisheries for Scotland	United Kingdom
GAT	Zentral Institut für Genetik und Kulturpflanzen-forschung	Germany
GBX	Centre de Recherches Agronomiques de l'Etat	Belgium
ICA	International Centre for Agricultural Research in the Dry areas	Syria
IMD	Instituto Nacional de Investigaciones Agrarias	Spain
JII	John Innes Institute	United Kingdom
JOK	Institute of Plant Breeding	Finland
LIN	Agrobiologische Institute	Austria
NGB	Nordic Gene Bank for Agricultural and Horticultural Plants	Sweden
RAB	Pea and Lentil Breeding Programme	Morocco
SAD	Institute of Plant Genetic Resources	Bulgaria
SUM	Research and Breeding Institute of Technical Crops and Legumes	Czech Republic
TAP	Institute for Plant Production and Qualification	Hungary
UJM	Vegetable Crops Research Institute, Research Station Ujmajor	Hungary
VAL	Servicio de Investigacion Agraria	Spain
VIR	N.I. Vavilov All-Union Scientific Institute of Plant Industry	Russia
VOL	Israel Genebank for Agricultural Crops, Volcani Centre	Israel
WTD	Plant Breeding Station, Wiatrowo	Poland

* 3-letter acronyms of the institutes where collections of the EPDB are maintained.

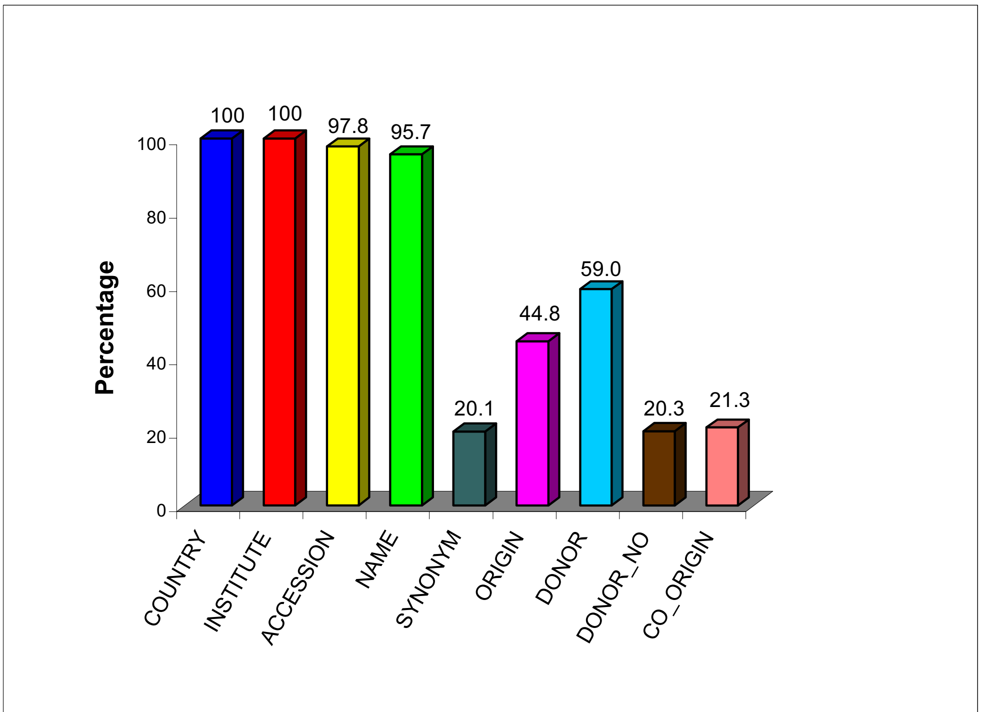

Fig. 1. Percentage data entries in each descriptor field for all institutes.

Table 2. Total number of accession information in seven of the descriptor fields for each institute represented in the EPDB

Institute	Total no. of accessions for each institute	Descriptor fields						
		ACCESSION	NAME	SYNONYM	ORIGIN	DONOR	DONOR_NO	CO_ORIGIN
ARA	88	88	88	0	0	0	0	70
BAR	4297	4297	3850	1980	1478	1462	1692	788
BRN	1009	1009	976	122	0	0	177	521
CGN	1008	1008	1000	464	761	1008	0	0
ECS	1980	1760	1980	658	55	220	258	0
GAT	2478	2478	2478	1	2316	1722	525	820
GBX	348	0	348	0	348	0	0	0
ICA	3318	3318	2973	1780**	0	3318***	3318****	3318*****
IMD	256	256	256	135	0	94	55	230
JII	3008	3008	2991	22	0	2268	0	0
JOK	17	17	17	3	16	0	0	2
LIN	33	33	33	0	33	33	0	0
NGB	3055	3055	3055	313	546	0	96	19
RAB	65	65	65	0	49	10	0	0
SAD	1598	1598	1598	1060	0	1426	661	406
SUM	937	937	937	0	928	0	0	818
TAP	934	934	885	0	848	485	0	0
UJM	748	748	748	0	0	0	0	0
VAL	491	491	491	277	252	0	152	0
VIR	6518	6518*	5886	0	6109	6478	0	0
VOL	690	658	690	24	678	0	0	0
WTD	2899	2899	2896	607	1595	2745	451	1767
Totals	**35775**	**35175**	**34241**	**7446**	**16012**	**21269**	**7385**	**8759**
Actual totals		**34998**	**34241**	**7196**	**16012**	**21091**	**7252**	**7604**

* = No data indicated by "without name": 177
**= No data indicated by " - ": 250
*** = No data indicated by "-": 178
**** = No data indicated by "-": 133
***** = No data indicated by "-": 1155

Status of the European Glycine *Database*

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The European *Glycine* Database was established in 1997. The same year, the database became available on-line through ZADI's Internet server at <http://www.vir.nw.ru> or <http://www.dainet.de/eccdb/glycine/>.

Soyabean is generally regarded as a mainly Asian and American crop and only 2% of the world's soyabean acreage is located in Europe. Nevertheless, successful breeding is being carried out by European breeding companies, the highest yields being obtained in Europe. The European genebanks maintain a rich diversity of the genus *Glycine*. A preliminary estimate gives a total of over 20 000 accessions.

Although all potential holders have been contacted, they have not all sent back their data for entry into the database. Data from Bulgaria, Greece, Belgium, Poland and France are still missing.

The database contains data on two *Glycine* species: *G. max* (L.) Merr. (11 879 accessions) and *G. soja* Siebold et Zucc. (36 accessions). In total 11 915 accessions held in nine institutes are now included in the European *Glycine* Database. Table 1 lists the national centres participating in the *Glycine* Database and the number of accessions received from each.

Table 1. List of institutes contributing to the *Glycine* Database and their numbers of accessions

Country	Contributing institution	No. of accessions
Czech Republic	AGRITEC, Research, Breeding and Services Ltd.	197
Germany	Institute of Crop Science, Federal Research Centre for Agriculture (BAZ)	128
Germany	Institute of Plant Genetics and Crop Plant Research (IPK)	2965
Hungary	Institute for Agrobotany	679
Nordic countries	Nordic Gene Bank	3
Russian Federation	Vavilov Institute of Plant Industry	6126
Slovakia	Research Institute of Plant Production	518
Ukraine	Yur'ev Institute of Plant Breeding (Centre of Plant Genetic Resources of Ukrainian Academy of Sciences)	676
Yugoslavia	Institute of Field and Vegetable Crops	623
Total		**11915**

The structure of the database was organized according to the FAO/IPGRI *Multi-crop Passport Descriptors* (Appendix II, p. 75-78 *in* Lipman *et al.* 1997). The database currently provides a standardized list of passport data recorded in 18 fields. However, these fields are filled very unequally, and some of them are empty (Table 2). Characterization data were lacking in most of the files received. The maturity group is a most important trait, since soyabeans belong to nine different groups according to the period of maturation, and not all of them are suitable for European climatic conditions. Therefore we suggest that the maturity group be included as an additional descriptor.

Data analysis revealed that the 'Country of origin' and 'Donor of the accession' were often missing. For instance, many accessions in the database are marked as originating from the USA: in fact, this number corresponds to the records coming from the USA collection, which includes samples of Chinese, Japanese, Russian and other origins, as well as truly American varieties. This situation was common for many collections.

Future plans for the *Glycine* Database include:

1. updating the requests to institutes and large private enterprises for missing lists; and
2. updating the data already held.

Table 2. Structure of the passport data table and completion of data (%)

	Field name	No. of accessions	%
1	INSTCODE	11915	100
2	ACCENUMB	11915	100
3	GENUS	11915	100
4	SPECIES	11915	100
5	SUBTAXA	784	65.7
6	ACCENAME	10256	86.1
7	ORIGCTY	9211	77.3
8	COLLSITE	329	2.7
9	LATITUDE	0	0
10	LONGITUDE	0	0
11	ELEVATION	518	4.3
12	COLLDATE	8116	68.1
13	SAMPSTAT	3610	3.0
14	COLLSRC	131	1.0
15	DONORCODE	8614	72.3
16	DONORNUMB	856	7.2
117	OTHERNUMB	810	6.8
18	REMARKS	1731	14.5

Reference

Lipman, E., M.W.M. Jongen, Th.J.L. van Hintum, T. Gass and L. Maggioni, compilers. 1997. Central crop databases: Tools for plant genetic resources management. International Plant Genetic Resources Institute, Rome, Italy/CGN, Wageningen, The Netherlands.

Status of National Collections

Status of the Austrian grain legume collections

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The grain legume collections maintained in the Austrian genebanks are presented in Table 1 below.

Table 1. Grain legume collections in Austria

Holding institute	No. of accessions					
	Vigna	*Phaseolus vulgaris*	*Phaseolus coccineus*	*Phaseolus* spp.	*Vicia faba*	*Pisum*
Landesversuchszentrum (LVS), Wies	3	31	3	2	1	
Landesanstalt, Rinn		1			2	1
Federal Office and Research Centre for Agriculture, Vienna					104	
Bundesamt für Agrarbiologie, Linz		522	112	4	39	52
Total	**3**	**554**	**115**	**6**	**146**	**53**

The accessions are listed in Part II of the "*Index Seminum Austriae*" and are available on the Internet at <www.agrobio.bmlf.gv.at/genbank>. CD-ROMs can be obtained upon request.

Status of the collections

The collections consist mostly of commercial varieties, but also include several landraces and varieties dating back to the early days of plant breeding, such as the horse bean (*V. faba*) variety 'Tschermaks Ackerbohne'. Landraces, however, are quite rare, but no new collecting expeditions are planned, since it is unlikely that any new material would be found. The number of landraces is quite limited, even in the Alpine region, and we suggest using the term "groups of landraces", encompassing several local races representing the genepool of the landrace. Thus it makes little sense to "hunt" for a single local race, possibly not yet incorporated, as it would have little impact on the overall genepool.

Research on seed

Since the genebank of the Federal Office of Agrobiology is run by the seed testing station (ISTA Station AUT02), the possibilities offered by the germination laboratory are fully utilized for specific studies. One of these experiments deals with the influence of the type of long-term storage containers (paper bags or sealed glass containers) on seed germination. The experiment was carried out on four species: rye, rape, *Trifolium incarnatum* and *V. faba,* representing cereals, oil crops, small-seeded legumes and grain legumes respectively. The experiment started in 1988. The seeds were kept in cold storage (–20°C) at 60% relative humidity. The following conditions were studied:

- paper bag; seeds stored freshly harvested and dried naturally;
- sealed, moisture-proof glass container; seeds freshly harvested and dried naturally;
- sealed, moisture-proof glass container; seeds dried to a moisture content of 7% after harvest.

The experiment proceeds under the assumptions that (1) the reduction of moisture content in the seed has a bigger effect on seed life span than the reduction of temperature, and (2) seed moisture content will increase due to the relative humidity in the surrounding cold store. The difficulties in controlling and keeping the relative humidity low in a cold store running below the freezing point are well known: when the moisture content in the seed exceeds 14%, ice crystals are formed, damaging the cell membranes.

The test is still ongoing and the results obtained so far for *V. faba* are shown in Table 2.

Table 2. Germination test for controlling the storage conditions. Results for horse bean (*V. faba*) (W. Kainz, Federal Office of Agrobiology)

Container	Moisture (%)	Germination (%)			Moisture (%)
	1988	1988	1993	2001	2001
Paper bag	12.7	86	82	87	14.2
Glass jar	12.7		84	84	12.9
Glass jar	7		84	84	6.9

Germination medium: sand
Germination temperature: 20°C
Counts after: 4/14 days

The intermediate results show little influence of the three different storage conditions; especially the small effect on germination capability and increase of moisture content in the seed when stored in non-moisture-proof paper bags is remarkable. This would allow storing freshly harvested and pre-dried seeds without precautions for a limited time in the cold store before finally packing in moisture-proof containers.

Comments on the Austrian Collection

Lentil

At the end of the 19th century, a large number of lentil landraces were reported in the south German area. The area sown with lentil covered several hundred hectares. In the beginning of the 20th century the importance of lentil, especially as a field crop, decreased. After a short increase during World War I, the area quickly decreased again to less than 100 ha and lentil had almost disappeared by the end of the first half of last century. Though lentils are still a popular dish, and even becoming a delicacy, the crop has not been sown over the last 50 years. Collecting activities were started but no seed was found.

Soyabean

Because of its sensitivity to photoperiod, soyabean has only been grown experimentally in the past, and therefore no real landraces are known. However, soyabean breeding was an important activity during the Third Empire, but the breeding material has probably been lost and it is not to be found in any genebank. Owing to the narrow genetic base of the material, the local breeding activities that had been started in the late 1950s did not succeed. Soyabean production, begun 20 years ago, relies on modern varieties introduced from abroad.

Collaboration with breeders

Plant breeders are invited to hand over their breeding material to one of the genebanks even if it failed to be released as a new variety. This material does not appear in the seed catalogue and is not made freely available without the breeder's agreement. The underlying concept is the preservation of material that might be of value for further breeding.

Review of Belgian grain legume collections

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Introduction

A preliminary inventory of grain legume genetic resources was undertaken among the Agricultural Research Centres, Universities and other institutions in Belgium. The base collection of wild Phaseoleae-Phaseolinae species seems to be the only collection of grain legumes existing in Belgium. The National Botanic Garden of Belgium ensures the management of this base collection, which was started in 1965 by G. Le Marchand and R. Maréchal at Gembloux Agricultural University and transferred to the garden in 1988. It includes principally wild species of the subtribe Phaseolinae and is recognized by IPGRI as a base collection for wild *Phaseolus* and *Vigna* species. The collection currently includes 1567 accessions representing 192 taxa of the Phaseoleae tribe, chiefly centred on the Phaseolinae subtribe. *Phaseolus* and *Vigna* are the most represented genera with 29 species (678 accessions) and 61 species (715 accessions) respectively. Most accessions are wild or weedy material, originating from 87 countries. The seeds are collected from plants cultivated in greenhouses. They are dried at 15°C and 10% relative humidity to equilibrium moisture content (5%), and afterwards stored in hermetically sealed packages at -20°C. The first objective is the conservation of genetic potential in the long term. Small seed samples can be obtained if the proposed use of the material is explained.

No grain legume collection is maintained at the Agricultural Research Centres, either in the Flemish or Walloon Regions, according to the meta-database of "Biodiversity resources in Belgium", which makes no mention of any grain legume collections. This database is an inventory of genetic resources available in Belgium, maintained at the National Botanic Garden in Meise. It contains information concerning both professional and private PGR specialists, research programmes carried out at universities, research institutes and other organisations, collections, botanical gardens, zoos, museums, existing databases, associations and organizations involved in the study and conservation of biodiversity in all its aspects, from the genome to the biome level, on a worldwide scale.

Research activities

The following research activities are being carried out:

Phaseolus

- Gembloux Agricultural University

Research is conducted in collaboration with the Free University of Belgium (ULB) (items i and v below). Studies include a genetic component and an agricultural component. The former focuses on the management and exploitation of plant genetic resources:

i) study of *Phaseolus* genetic diversity by means of DNA molecular markers;
ii) *in situ* conservation of spontaneous populations of Lima bean (*Phaseolus lunatus*): dynamics, demography and gene flow (using microsatellite markers);
iii) genetic improvement using interspecific hybrids and *in vitro* embryo culture;
iv) characterization of pathogen populations (i.e. angular leaf spot of *Phaseolus* spp. caused by *Phaeoisariopsis grisicola*);
v) application of AFLP techniques for genetic resource conservation of a model plant with a mixed mating system (Lima bean) and testing of sampling strategies for the establishment of a core collection.

- Ghent University
  - i) Development of an efficient *Agrobacterium*-based transformation methodology for *Phaseolus vulgaris* and application of the transformation technology already available for *Phaseolus acutifolius* to the improvement of common bean;
  - ii) research on seed-specific gene expression (arcelin genes). The high expression level of arcelin5 genes is being exploited in a project aimed at expressing arcelin5 genes modified to contain extra methionine codons. Legumes are known to contain a low content of the sulphur-containing aminoacids (i.e. methionine). The lack of sufficient amounts of methionine is problematic for people relying on grain legumes as their main source of dietary protein. Methionine is also one of the major additives to animal feed.

Vicia faba

- Ghent University
  Development of *V. faba* varieties containing no tannins, resistant to diseases, with high protein content and moderate seed weight. The working collection is the result of thousands of recombinations between 70 commercial varieties. These accessions are no longer maintained due to lack of funding.

Vigna

- Gembloux Agricultural University
  Study of the genepool organization of wild and cultivated forms of the food legume *Vigna unguiculata*.

Useful contacts

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Maintenance, enrichment and preservation of grain legume collections in Bulgaria

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Introduction

The Bulgarian grain legume collections include diverse genetic materials belonging to nine genera, studied and preserved mainly at the Institute of Plant Genetic Resources (IPGR) in Sadovo.

In the last few years, much emphasis has been placed on the creation of a network for the location and protection of old local varieties, populations and forms. This network involves various structures—research institutes, NGOs, schools, colleges, farmers, etc.—and provides opportunities for the implementation of protective measures for these valuable resources; these activities are supported by official educational programmes delivered at regional level. Collecting old genetic resources of leguminous crops is a priority on the research agenda of specialized scientists. Field expeditions have shown that many legume species (beans, faba bean, lentils, etc.) are still present in mountainous and semi-mountainous regions of Bulgaria.

The newly founded National Advisory Agency for plant genetic resources includes all research units maintaining collections and gathering information. After several years of hard work, a national information system for all field crops will soon be integrated into this structure. This achievement will allow completing and enlarging the collections.

Composition of the Bulgarian grain legume collections

The distribution of accessions per genus is as follows: *Pisum*-32%; *Phaseolus*-24.5%; *Vicia faba*-9.4%; *Lens*–7.4%; *Cicer*–4.8%; *Lathyrus*–4.4%; *Arachis*–9.5%; *Lupinus*–3.9%; and *Vigna*–3.7%. Table 1 provides the number of accessions per genus, and the type of conservation (short-term, long-term, working collection).

Table 1. Status of grain legume collections in Bulgaria (number of accessions)

Genus	Total	Long-term conservation	Short-term conservation	Working collection
Pisum	2300	610	900	1000
Lupinus	284	70	204	10
Lathyrus	320	270	100	40
Phaseolus	1763	777	1151	138
Cicer	348	-	-	348
Lens	532	385	237	94
Vicia faba	682	462	-	220
Vigna	270	117	123	88
Arachis	685	317	368	368
Total	**7184**	**3008**	**3083**	**2306**

Material of Bulgarian origin accounts for only 5% to 21.3% of the collections. The collected material, however, is evaluated and widely used in breeding programmes.

Within foreign material, accessions of European origin predominate, especially from Czech Republic, France (peas and faba beans), Germany, Hungary, Italy (groundnut), Portugal (groundnut), Romania and Russian Federation. Material from Central and South America is significant only in beans and groundnuts.

The distribution of grain legume accessions according to sample type is shown in Table 2. Selected varieties are dominant in all collections. Special attention is given to breeder's lines and old populations of peas, beans and lentils.

Table 2. Distribution of grain legume accessions according to sample type (%)

Genus	Cultivars	Breeder's lines	Old populations	Wild
Pisum	72.7	10.1	17.0	0.2
Lupinus	92.4	7.2	-	0.4
Lathyrus	86.9	-	8.6	4.5
Phaseolus	68.8	16.2	15	-
Cicer	94.5	-	4.8	0.6
Lens	67.5	30.5	1.7	0.3
Vicia faba	67.4	32.3	0.3	-
Vigna	95.5	2.5	2.0	-
Arachis	51.2	48.8	-	-

In situ conservation

Lathyrus is the only genus for which wild relatives are represented in *ex situ* collections. The habitats of wild *Lupinus*, *Cicer*, *Pisum* and *Lens* have been identified and they are protected *in situ:*

- two habitats of *Pisum elatius* have been characterized in northern Bulgaria on the coast of the Black Sea: one on Cape Kaliakra, represented by single plants, and the other in Yailata, with scattered groups of plants.
- *Lens ervoides* and *Cicer* sp. are studied in the region of Strandja Mountain, close to the villages of Kosti and Sinemoretz. These species are found as single plants only. They are not exposed to anthropogenic influence and are not endangered.
- *Lupinus* is located and described in the Eastern Rhodope Mountains, near the town of Krumovgrad. The Forestry Department of this town maintains a collection of *L. albus* for educational purposes.

Evaluation and characterization

Evaluation and characterization are continuously ongoing. The minimum evaluation period for each sample is 2 years, but in case of extreme weather conditions, which are very frequent in Bulgaria, the experimental period can be extended by 1-2 years. All traits are defined according to 48–58 international descriptors (UPOV, IPGRI, Vavilov Institute), which are also used for the production of the national catalogue at IPGR-Sadovo.

The samples are planted on an area of 2 to 4 m^2, depending on the crop. Micro-experiments are conducted later on to determine the individual characteristics. For a more accurate characterization of the plant material, variety trials may be carried out.

Scientists working with the grain legume collections from the Sadovo institute cooperate with breeders from the Dobrudja Agricultural Institute (General Toshevo), the Institute of Fodder Crops (Pleven), the Genetic Institute (Sofia) and the Agricultural University (Plovdiv). The above-mentioned institutes maintain essentially working collections.

Ecological studies are carried out to explore the influence of weather on species' adaptability and growth. The improvement of local and introduced samples is based on the results of these studies. The selected material is evaluated and included in breeding programmes (Angelova and Koeva 1994; Andrejnska *et al.* 1997).

There is only one groundnut collection, maintained at the Institute of Sadovo. All groundnut varieties grown in Bulgaria and its neighbouring countries were bred in this Institute. Breeder's lines are represented in the working collection, either created in the Institute or received from the USA, and account for the genetic diversity of the material.

The major qualitative characters studied in leguminous crops are connected directly with current breeding objectives. They also take into account farmers' requirements regarding winter hardiness, earliness, resistance to stress factors, productivity, resistance to the most commonly occurring diseases in Bulgaria, and grain quality (protein, oils).

There are no breeding programmes on *Lupinus* or *Lathyrus*. Today these crops attract more interest, owing to their potential use in organic agriculture in regions with acidic soils or regions of high altitude. We are looking for partners interested in the elaboration of a programme aimed at exploring the possible cultivation of *Lupinu*s in Bulgaria. *Lupinus* is not a traditional crop in Bulgaria but it has long been used as a green manure source. Similar interest is shown towards V*igna,* in particular in regions with long drought periods and where irrigation is possible. Collections of these species are maintained only in the Institute of Sadovo. They are used for scientific and experimental purposes and their production is very limited.

Research activities

An ecological network has been established to evaluate winter resistance and earliness in leguminous crops. Results show that the species studied fall into three groups (Table 3).

Table 3. Classification of legumes in Bulgaria according to earliness in diverse ecological conditions

Earliness	Genus / species
Ultra early	*Pisum*
Early	*Pisum, Lens, Cicer*
Average early*	*Pisum, Lens, Lupinus,* Faba bean, *Lathyrus, Phaseolus, Cicer*
Late	*Pisum,* Faba bean, *Vigna, Lens*
Very late	*Pisum, Vigna, Lathyrus*

* 20-30 June in Bulgaria

Pea is present in all three groups; this genus has the greatest diversity in the collection. This crop, which has been studied from 1994 to 2000, will be used as an example (Table 4). A total of 437 accessions were studied at 5 sites throughout the country. Data analysis allows the distribution of samples in different earliness groups.

Table 4. Earliness groups of peas

Earliness	Length of growing period (days)	% samples from the collection
Ultra early	60–68	10
Early	68–80	23
Average early	80–92	42
Late	92–104	10
Very late	<104	5

The accessions show different behaviour towards climatic factors according to the region, and they can be classified into three main groups according to their degree of winter hardiness (Table 5). The classification is based on a common methodology (precise determination of the climatic conditions, application of crop-specific cultivation techniques) (Angelova and Koeva 1994; Andrejnska *et al.* 1997). Data collection and analysis are ongoing and will be completed in 2002.

Table 5. Classification of pea accessions according to winter hardiness (number of plants having overwintered successfully)

Winter hardiness (80–100%)	Low sensitivity (70–80%)	High sensitivity (60–70%)
87 samples - old local varieties, populations and forms from Bulgaria and abroad - typical fodder varieties and breeding lines used for production of green mass	250 samples - newly created local and introduced varieties and breeding lines for grain	100 samples - typical vegetable varieties and breeding lines - *afila* type - *progreta* type

This study also included 120 accessions of faba bean. Later on, a smaller number of accessions were also included for *Lupinus, Phaseolus, Vigna, Lens* and *Lathyrus*. A 5-year cooperation project with INRA (France) resulted in the creation of improved peas and faba beans (Decaux 1998). Three breeding lines of peas and two breeding lines of faba beans are currently included in the national variety testing programme (Georgiev 2000).

In conclusion, grain legumes are important crops in Bulgaria and their collections are constantly renewed and enlarged. The development of databases for *Pisum*, *Vicia faba*, *Phaseolus* and *Arachis* will make the collected information more readily available to users.

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Development of the Bulgarian groundnut collection - status 2001

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The Bulgarian groundnut collection is maintained at the Institute for Plant Genetic Resources in Sadovo, which also carries out breeding activities. All the varieties grown in Bulgaria were bred in Sadovo, and the original seed material can be found only there.

The history of groundnuts in Bulgaria dates back over 100 years. The first experiments (1902–1907) were carried out by the former Agricultural Experimental Station in Sadovo, currently IPGR. The crop showed promise in the Plovdiv region. To begin with (1907) the area under groundnut was 0.7 ha. It then increased steadily, reaching 57 ha in 1926, 10 000 ha in 1992, and 15 000 ha in 1999.

Six periods can be distinguished as regards experiments conducted on *Arachis*:

- 1902–1907: introduction and investigation of varieties;
- 1912–1929: introduction and investigation of varieties;
- 1934–1945: creation of a small working collection;
- 1977–1984: enrichment of the collection (199 accessions);
- 1984–1998: enrichment of the collection (317 accessions); and
- 1998–2000: establishment of the database.

In 2000, the collection contained a total of 317 accessions, including 301 in long-term conservation in a working collection. In 2001 the total number of accessions had increased to 685, including 317 in long-term conservation and 368 in the working collection and short-term conservation (Table 1). The collection consists of varieties (51.2%) and breeder's lines (48.8%) (Table 2). Local varieties and breeder's lines constitute 44.5% of the collection and those of foreign origin represent 55.6%. The main part of the groundnut working collection (90.8%) consists of breeder's lines created through hybridization combined with breeding of the hybrid generations. Due to the great biological diversity of the parent genetic material, the breeder's lines have an enormous potential for the inheritance of a complex of valuable characters. This type of germplasm is of great importance for the creation of highly productive, improved new varieties. The last part of the working collection is represented by foreign varieties.

Table 1. Status of the groundnut (*Arachis hypogaea* L.) collection in Bulgaria (number of accessions)

Subspecies	Type	Total	Long-term conservation	Short-term conservation (working collection)
fastigiata	Valencia	411	101	310
	Spanish	127	124	3
hypogaea	Virginia	147	92	55
Total		**685**	**317**	**368**

Table 2. Structure of the groundnut collection

Subspecies	Type	Cultivars		Breeder's lines	
		Foreign	Local	Foreign	Local
fastigiata	Valencia	112	9	-	290
	Spanish	125	2	-	-
hypogaea	Virginia	103		44	-
Total		**340**	**11**	**44**	**290**

The large increase in the number of accessions in the groundnut collection is due to the national breeding programme, which has produced 290 breeding lines. Besides those, 44 other lines from North Carolina State University (NCSU) are included, bringing the total number of lines to 334. They were acquired as part of the free exchange programmes on the basis of international contracts and projects for cooperative scientific research on groundnut breeding. IPGR-Sadovo collaborates with the "Programme for cooperation and support of scientific research on groundnut" elaborated and financed by Georgia Agricultural University (GAU), through North Carolina State University (NCSU) for the period 1997–2001 and New Mexico State University (NMSU) for 2001–2006.

The distribution of accessions according to their country of origin is shown in Table 3.

Table 3. Origin of the groundnut accessions

Country	No. of accessions	Country	No. of accessions
Algeria	1	Japan	7
Argentina	4	Laos	5
Australia	3	Libya	1
Brazil	1	Mexico	1
Bulgaria	305	Morocco	17
China	8	Netherlands	1
Congo	3	Portugal	35
Cuba	2	Former Soviet Union	29
Egypt	8	Senegal	1
Greece	6	Somalia	1
Guinea	1	Syria	2
Hungary	37	Turkey	3
India	22	USA	133
Indonesia	1	Vietnam	7
Iraq	1	Yugoslavia	7
Israel	8	Unknown	4
Italy	20	**Total**	**254**

Bulgarian origin 44.5%
Foreign origin 55.5%

The varieties and the breeder's lines from the working collection (Table 4) are at different stages of research (1, 2, or 3 years). Bulgarian breeder's lines are being studied for a second year, whereas the investigation of breeder's lines from the USA was terminated in 2000. The data related to the latter are being processed and will be computerized. In 2001 the American breeder's lines will be multiplied in order to obtain the required number of seeds for long-term conservation.

Table 4. Structure of the working collection

Subspecies	Type	Total number	Cultivars	Breeder's lines	
			Foreign	Foreign	Local
fastigiata	Valencia	310	20	-	290
	Spanish	3	3	-	-
hypogaea	Virginia	55	11	44	-
Total		**368**	**34**	**44**	**290**

All accessions are studied for a set of 39 characters, including taxonomic identification, length of the growing period, productivity, resistance to diseases, agricultural qualities of the seeds and fruits, chemical contents of the seeds, potential for mechanization of production. During the experiments, all varieties are compared with the Bulgarian variety 'Kalina', a standard for Bulgaria. The results obtained with the American breeder's lines of Virginia type, compared with the Bulgarian variety 'Kalina', lead to the following conclusions:

- In the climatic conditions of Bulgaria, all 44 breeder's lines have a longer growing period (over 150 days). They ripen 15-30 days later than 'Kalina'.
- Regarding fruit and seed yield, no accessions show better results than our control variety, 'Kalina'. Nine breeder's lines approach the yields of our control, while the others have a lower yield. They have a great potential for productivity but under Bulgarian climatic conditions their growing period is longer.
- Most of the varieties are susceptible to *Fusarium* ssp. and *Botrytis cinerea*.
- The seed size of all the breeder's lines exceeds that of 'Kalina' and the most promising can be used as breeding material.
- The fat content in the seeds varies from 47.2% to 53.1%. Five breeder's lines show better results than 'Kalina' (by 1.5% up to 2.7% units) and may be useful for the creation of new varieties with a higher fat content.
- The protein content in the seeds of the breeder's lines varies from 26.0% to 30.4%. There are no samples that exceed the control variety for this character.

It should be emphasized that the results from past experiments confirm that in the period 1930–2000, as indicated by Georgiev (1988, 1994, 2000), no varieties (whatever their taxonomic characteristics) performed better than the Bulgarian varieties. The four Bulgarian varieties created in Sadovo before 1968 ('Sadovski improved', 'No. 1011', 'No. 1717' and 'Velikan') are not currently cultivated. The varieties created during the period 1969–2001 ('Sadovo 2609', 'Kalina' and the new varieties 'Rsositza' and 'Orpheus') are the only ones grown.

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The grain legume collections in the Czech Republic - status 2001

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Introduction

Since the report presented at the last meeting of the Working Group on Grain Legumes in Norwich (Maggioni *et al.* 1998), little new information can be added.

All activities dealing with plant genetic resources (PGR) are carried out within the "National Programme for Plant Genetic Resources Conservation and Utilization" (NP). The Ministry of Agriculture of the Czech Republic financially supports the National Programme (NP) and the NP Council holds annual meetings to coordinate its activities. NP funds can only be used for PGR introduction, documentation, characterization and long-term storage. Passport and description data are fully computerized in the information system EVIGEZ and passport data are also available on the Web site <http://www.genbank.vurv.cz/genetic/resources/>.

The collections

The major grain legume collections are kept at the following institutes: AGRITEC Šumperk, Ltd.; Research Institute of Crop Production (RICP) Prague, station Olomouc; and Research Institute of Fodder Crops (RIFC) Troubsko, Ltd. (Table 1).

Since the 1998 report, a new collection of *Lens* has been included in the grain legume collections. This collection, established after the splitting of Czechoslovakia, is an exact duplication of the Slovak *Lens* collection. For some accessions, seed stocks need to be multiplied.

Table 1. Grain legume accessions maintained in the Czech Republic

Genus	No. of accessions			Total no. of accessions		Accessions in long-term storage	
	AGRITEC	RICP	RIFC	No.	%	No.	%
Pisum	1172	1192	-	2364	48.0	1138	48.1
Vicia faba	335	46	-	381	7.7	289	75.9
Vicia spp. (other than *V. faba*)	351	-	44	395	8.0	162	41.0
Phaseolus	253	1059	-	1312	26.7	776	59.1
Glycine	203	-	-	203	4.1	150	73.9
Lupinus	74	-	12	86	1.7	40	46.5
Lens	80	-	-	80	1.6	80	100.0
Cicer	57	-	13	70	1.4	13	18.6
Lathyrus	-	-	31	31	0.6	25	80.6
Total	**2525**	**2297**	**100**	**4922**	**100.0**	**2673**	**54.3**

Table 1 shows that for some species, the proportion kept in long-term storage is under 60%. These accessions should be stored in controlled conditions as a matter of urgency.

The main priorities of the National Programme were defined as follows:

- To complete long–term storage in the RICP genebank in Prague
- To start evaluation of collections according to national descriptor lists
- To organize safety-duplication in cooperation with the Slovak Genebank, RICP Piešťany
- To organize collecting missions in cooperation with Slovenia.

Characterization and evaluation

Major efforts have been dedicated recently to the establishment of descriptor lists for *Cicer arietinum* L. (Hýbl *et al*. 1998) and *Lupinus* L. (Hýbl and Faberová 2000a). These lists have been published as part of the NP and will be used for recording data in the central documentation system on plant genetic resources EVIGEZ. The lists were established using various descriptor lists available (IBPGR, VIR, COMECON) and the results of our own investigations.

The descriptor lists include characterization and evaluation descriptors, 4 additional descriptors for recording data on the environment of the experiment site, and the National accession number (ECN), which is the unique identifier within the Czech collection. Passport descriptors for EVIGEZ were published separately by Rogalewicz *et al.* (1989) and are therefore not included in these descriptor lists.

Lists of minimum highly discriminating descriptors were established for the genera *Vicia* L. (Hýbl and Faberová 2002b) and *Faba* Adans. (Hýbl and Faberová 2002c). Descriptor lists are already available for the genera *Phaseolus* L. (Horňáková *et al.* 1991a), *Lens* Mill. (Horňáková *et al.* 1991b), *Glycine* Willd. (Pastucha *et al.* 1987) and *Pisum* L. (Pavelková *et al.* 1986). All descriptor lists are developed simultaneously in both Czech and English languages.

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French activities on grain legume collections

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Since the last ECP/GR meeting reports (1995 in Copenhagen and 1998 in Norwich), little information can be added.

Collections in France are held by different institutions (INRA, GEVES and private companies). Major collections are held by:

- INRA-Versailles for pea (curator A. Burghoffer),
- INRA-Lusignan for lupins (curator J. Papineau; material maintained by GIE (Groupement d'Intérêt Economique) Lupin and stored at INRA),
- INRA-Dijon (curator P. Marget) and Rennes (curator R. Esnault) for faba beans,
- INRA-Versailles (curator G. Fouilloux) and GEVES for *Phaseolus*, and
- GEVES for lentils.

Under the auspices of BRG (Bureau des Ressources Génétiques), a general agreement called *Charte* which links the different institutions has been set up. It defines the sharing of responsibilities and guidelines for genetic resource maintenance. The next step will be for members of the group (both public and private) to ratify the statutes of this group. These statutes define internal rules, tasks of each member, and a Material Transfer Agreement form.

Our pea and lupin collections are regenerated in the open field, while faba bean is reproduced in isolation from insects. For *Vicia faba* a new GIE "Féverole" is taking care of the maintenance of spring-sown accessions at Dijon. A new sub-collection of pea accessions is being developed in insect-proof greenhouses. Seeds are kept in low humidity cold rooms (3°C). There is no safety-duplication at –20°C.

Characterization of faba bean genetic resources has stopped with the termination of breeding programmes. Characterization of pea genetic resources is managed by a group of coordinated INRA laboratories, based on agronomic descriptors and molecular markers.

Due to the cessation of the *Vicia faba* breeding programmes at INRA, a working collection derived from this work will soon be added to the current 2000 accessions. This breeding work resulted in the production of 23 populations (pools) developed at INRA-Rennes with various breeding objectives (earliness, Ascochyta and Botrytis resistance, tillering, lodging, stem growth).

The INRA Web site containing information on genetic resources is being developed: <http:/www.inra.fr/legumineuses/accueil>.

Grain legume germplasm collection and improvement in Georgia

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Grain legumes in Georgia, though secondary to cereals in terms of production and consumption, have played an important role throughout the country's history. They are an important component of human diet in the developing countries of the Transcaucasus, where their high nutritive value has long been recognized, both for humans and domestic livestock. They are also used as green manure and straw and for their medicinal properties. Legumes are also important in the development of sustainable cropping systems, as they increase soil fertility.

The Georgian programme on grain legume genetic resources is committed to collect, evaluate, document and renew legume biodiversity for further improvement of the material. This diversity is available both in the cultivated, resistant landraces selected by farmers throughout the centuries, and in their wild relatives. The latter are equally important, since they are constantly adapting to environmental changes (climate, soil, pollution, etc.).

Following resolutions of the Academy of Agricultural Sciences and Ministry of Agriculture and Food of Georgia, the Georgia Agrarian State University (GASU) has been given a mandate to deal with large-scale rehabilitation of legumes. This includes the study, conservation and improvement of local legume germplasm collections. GASU has been involved in the collecting and breeding of food legumes for over 80 years. National agricultural research programmes strive to increase food legume production both in terms of yield per hectare (through high inputs, including irrigation) and by increasing the area grown. Scientists of the national programmes and research administrators have recently realized the need for diversification in a legume-based, sustainable cropping system, and in the last decade, a group of GASU scientists and post-graduate students have carried out studies aimed at large-scale rehabilitation of legumes. These activities have received financial support from international institutions such as GTZ, ACDI-VOCA, ICARDA, the World Bank, etc. This resulted in the collection of 690 samples of legumes for both human and livestock use : soyabean (68); faba bean (24); chickpea (44); lentil (36); *Pisum* (7); haricot bean (83); *Trifolium* (89); *Astragalus* (22); *Medicago* (88); *Onobrychis* (46); *Melilotus* (19); *Lupinus* (16); *Galega* (19); *Vicia* (112); and *Lathyrus* (17). The computer program used to record the data has been supplied by ICARDA.

In situ conservation techniques have been developed for all this material. Simulated *in situ* conservation experiments are under way at our station in Tbilisi. Several high-yielding lines have been developed through hybridization and selection, and released for cultivation in Georgia: in 2000, promising varieties of chickpea, lentil and soyabean (2 of each) have been selected and released at three sites, characterized by different soil and climatic conditions.

Georgian scientists and breeders involved in the collection, identification, improvement and utilization of modern germplasm would benefit from participating in international cooperative activities carried out in the framework of the ECP/GR Working Group on Grain Legumes. This would be an asset to national activities in the fields of breeding and biodiversity protection, and contribute to the development of a sustainable agriculture.

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Status of grain legume collections in Greece

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The most important grain legumes in Greece for human consumption are bean (*Phaseolus vulgaris*), lentil (*Lens culinaris*), chickpea (*Cicer arietinum*), faba bean (*Vicia faba*) and grass pea (*Lathyrus sativus*). Beans are grown under irrigation, the others being rainfed only. These grain legumes have been part of the healthy Mediterranean diet since ancient times.

In Greece grain legume collections are conserved by two national organizations, the Fodder Crops and Pasture Institute (FCPI) in Larissa and the Greek Gene Bank (GGB) in Thessaloniki which are under the administration of the National Agricultural Research Foundation (NAGREF), a primary state-funded body of the Ministry of Agriculture.

FCPI has the national responsibility for improvement of fodder crops, pastures and grain legumes. Breeding grain legumes for the creation of new varieties is one of its main tasks. Collection and maintenance of grain legume genetic material represents a complementary task to support plant breeding projects. Grain legume collections were started by FCPI in 1980 with the aim of saving local populations of the cultivated grain legumes and using them in breeding programmes. Grain legumes had to be collected urgently at the beginning of the 1980s before they were lost following the release of new varieties to farmers. Priority was given to regions of the country with developed agriculture where genetic erosion was expected to be high.

A considerable grain legume germplasm collection including about 608 accessions has been created by FCPI in 1980-1985 with accessions collected throughout the country and donated to GGB (Table 1). The largest FCPI collections are those of bean (219 accessions) and chickpea (133 accessions).

Table 1. Grain legume accessions stored at the Greek Gene Bank (GGB) collections in Thessaloniki

Species	No. of accessions	Landraces	Advanced cultivars	Collecting period	Collected by			No. of acc. from Greece
					GGB	FCPI	Others	
Cicer arietinum	174	161	13	1980-85	18	133	23	all
Lens culinaris	97	90	7	"	4	70	23	all
Vicia faba	150	147	3	"	6	106	39	all
Phaseolus vulgaris	365	359	6	"	73	219	73	all
Phaseolus coccineus	22	22	0	1982	8	14	0	all
Pisum sativum	29	25	4	1980-85	2	24	3	all
Lupinus albus	3	3	0	1980	0	3	0	all
Lupinus angustifolius	72	72	0	1984	0	0	72	-
Lupinus luteus	1	1	0	1984	0	0	1	-
Lathyrus sativus	21	20	1	1980-85	0	21	0	all
Vigna unguiculata	24	21	3	1980-84	3	18	3	all
Total	**958**	**921**	**37**		**114**	**608**	**237**	

Part of these collected accessions were kept in Larissa under ambient room conditions and used for FCPI breeding programmes. New cultivars of lentil, chickpea, bean, faba bean, pea (*Pisum sativum*), grass pea and cowpea (*Vigna unguiculata*) were bred from this material and released to farmers (Table 2). Wild relatives of these grain legume species have not been collected.

Table 2. Grain legume accessions stored at the Fodder Crops and Pasture Institute (FCPI) collections in Larissa

Species	No. of advanced cultivars created by FCPI	No. of advanced cultivars created by FCPI and registered in the National Variety List	Total
Cicer arietinum	25	6	31
Lens culinaris	31	12	43
Vicia faba	4	3	7
Phaseolus vulgaris	8	7	15
Phaseolus coccineus	-	-	-
Pisum sativum	8	4	12
Lupinus albus	-	-	-
Lupinus angustifolius	-	-	-
Lupinus luteus	-	-	-
Lathyrus sativus	7	1	8
Vigna unguiculata	4	2	6

The majority of the collected accessions (1980-1984) was sent to GGB in Thessaloniki and kept under long- and medium-term storage conditions. Since then no serious collecting has been done by FCPI due to lack of funding but also because grain legume germplasm was available to breeding programmes from international centres such as ICARDA, ICRISAT and CIAT. However during the period 1998-2000 a small amount of new grain legume material was obtained from different regions of Greece through collecting missions of GGB and different foreign research institutes from the USA, Canada and Australia. The accessions obtained will be regenerated and subjected to preliminary evaluation by foreign institutes. Samples of the collection will then be returned to GGB.

GGB has the national responsibility for plant genetic resources collection, protection and conservation. Medium-term (0 to +5^{0}C) and long-term (-18 to -21^{0}C) storage facilities have a capacity of 80 m^3 and can hold approximately 10 000 samples. GGB maintains in medium-term conditions 958 accessions of chickpea, bean, lentil, faba bean, grass pea, lupin and cowpea (Table 1). Most of these accessions (608 samples) were collected by FCPI as mentioned before. A database was created to record the germplasm collection in GGB and all the genetic material is documented for passport data and fully computerized in a database using dBaseIV. The database now contains passport and conservation data. The coverage of evaluation data is still incomplete. There is no safety-duplicate at -20^{0}C at present.

Collecting of grain legumes in Greece should not be considered complete for some regions, especially the islands, and additional material can be expected to be found. GGB is organizing collecting missions mainly in cooperation with other institutions.

Future activities

- To complete the formation of the duplicate set of the collection for long-term storage
- To evaluate all accessions
- To create evaluation databases.

Status of grain legume collections in Hungary

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The collections

Among the various Hungarian institutions involved in plant genetic resource conservation, the Institute for Agrobotany in Tápiószele (ABI) not only has a nationwide coordinating responsibility, but is also responsible for the development of genetic resource collections of field and vegetable crops. In order to meet these requirements, the institute performs the whole range of genebank activities, covering all grain legume species cultivated in Hungary and many of their native and foreign relatives.

The development of these collections started in the early 1960s and ABI now has more than 9000 grain legume accessions in its active and base collection chambers at Tápiószele. During the past decades, special emphasis was placed on the collection of the very valuable and diverse resources of Hungarian grain legume landraces and other local materials. This is especially true for beans, but the proportion of accessions of Hungarian origin is also considerable for other species (Table 1).

Table 1. Composition of the grain legume collections held at the Institute for Agrobotany (ABI)

Genus / species	No. of accessions	Hungarian origin
Beans	**4725**	
Phaseolus acutifolius	7	
P. coccineus	202	162
P. lunatus	26	13
P. x *multigaris*	101	
P. vulgaris	4389	2844
Pisum	**1379**	
Pisum abyssinicum	4	
P. elatius	1	1
P. sativum	1373	792
P. syriacum	1	1
Faba bean	**417**	
Vicia faba	417	86
Soyabean	1145	
Glycine max	1144	414
G. soja	1	1
Chickpea	**827**	
Cicer arietinum	815	45
C. cuneatum	1	
C. judaicum	8	
C. pinnatifidum	1	
C. reticulatum	1	
C. yamashitae	1	
Lentil	**864**	
Lens culinaris	857	107
L. nigricans	1	
L. odemensis	4	
L. orientalis	2	
Lathyrus	**509**	
Lathyrus aphaca	11	
L. articulatus	1	
L. cicera	59	3
L. clymenum	3	
L. hirsutus	4	
L. latifolius	2	
L. montanus	1	
L. nissolia	5	
L. ochrus	2	
L. odoratus	2	1
L. pratensis	1	1

L. sativus	414	170
L. tingitanus	2	
L. tuberosus	2	2
Lupin	**432**	
Lupinus albifrons	3	
L. albus	95	63
L. andicola	2	
L. angustifolius	68	33
L. arboreus	2	
L. aridus	22	8
L. benthamii	4	
L. bogotensis	2	
L. cruskshanksii	3	
L. digitatus	2	
L. douglasii	4	
L. elegans	9	
L. hartwegii	4	
L. hirsutissimus	3	
L. luteus	89	47
L. micranthus	16	3
L. mutabilis	13	6
L. nanus	9	2
L. paniculatus	1	
L. perennis	1	
L. polyphyllus	22	5
L. pubescens	3	
L. sparsiflorus	1	
L. subcarnosus	18	
L. succulentus	30	10
L. varius	6	3
Peanut	**83**	
Arachis hypogaea	83	19
Vigna	**104**	
Vigna angularis	7	1
V. mungo	9	2
V. parkeri	1	
V. radiata	5	
V. umbellata	2	
V. unguiculata	80	37
Dolichos	**4**	
Dolichos cebra	2	
D. ornatus	2	
Lablab	**10**	
Lablab purpureus	10	2

Multiplication and characterization

The yearly multiplication and characterization data for the reported period are shown in Table 2. The descriptor lists used for characterization, as all other parameters of the general ABI genebank activities, generally meet international standards.

Table 2. Multiplication and characterization of ABI grain legume collections in 1998-2000

Genus / species	No. of accessions								No. of descriptors
	Multiplication				Characterization				
	1998	1999	2000	Total	1998	1999	2000	Total	
Phaseolus	358	472	493	1323	296	369	253	918	60
Pisum	175	175	105	455	163	162	85	410	61
Cicer	90	10	156	256	0	0	217	217	30
Lens	139	68	133	340	130	16	200	346	28
Lathyrus	33	12	52	97	9	0	16	25	49
Glycine	25	46	36	107	0	0	0	0	-
Vicia faba	22	0	30	52	0	0	0	0	-
Arachis hypogaea	20	19	12	51	11	0	0	11	47
Vigna	19	16	10	45	8	0	22	30	42
Total	**2879**	**2817**	**3027**	**2726**	**2615**	**2546**	**2793**	**1957**	

Evaluation and research

The primary and secondary field evaluations of grain legume accessions have been determined by various research objectives in the last 3 years (Table 3). The seed yield results of a *Vigna* trial show significant differences among the various accessions of this genus held at the genebank (Table 4).

Table 3. Various research directions and number of accessions involved in the evaluation trials of the ABI grain legume collections in the reported period

Genus / species	Trials	No. of accessions
Phaseolus	'Aranyeso' vegetable types, seed yield	3
Vigna	Accessions of various seed types, yield	23
Lathyrus	Accessions of various seed types, yield	16
Lens	Cold tolerance, Fusarium wilt, yield	169
Cicer	Cold tolerance, Fusarium wilt, Ascochyta blight, yield	247
V. narbonensis	Seed yield	15

Table 4. Seed yields (kg/ha) of 23 genebank accessions from ABI's *Vigna* collection in a trial with four replicates

Species	Accession number	Replicate				Average yield
		I	II	III	IV	
V. angularis Wild.	RCAT063323	1250	1094	1156	1094	1148
V. mungo (L.) Hepper	RCAT050827	188	563	250	375	344
	RCAT052235	531	594	594	719	609
	RCAT061844	625	531	500	281	484
	RCAT061878	188	469	344	625	406
	RCAT066840	500	406	563	406	469
	RCAT071724	313	156	156	125	188
	RCAT073429	250	344	531	563	422
V. parkeri B.	RCAT061845	1344	1188	1156	1188	1219
V. radiata (L.) Wilcz.	RCAT050967	375	531	438	219	391
	RCAT061848	188	344	344	188	266
V. unguiculata (L.) Walp.	RCAT024552	1688	1156	1063	1188	1273
	RCAT024556	1094	1031	1281	813	1055
	RCAT024557	1344	1094	1094	1094	1156
	RCAT024558	1313	1406	1500	1938	1539
	RCAT024559	1219	906	1438	1000	1141
	RCAT024562	844	1156	1313	1281	1148
	RCAT024740	281	875	719	406	570
	RCAT024741	969	844	781	563	789
	RCAT050966	1063	1031	1125	1219	1109
	RCAT061770	1188	1063	1500	875	1156
	RCAT070390	313	625	469	313	430
	RCAT070853	1156	813	656	1094	930

Status of grain legume collections in Israel

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Grain legumes are important crops for the Israeli Gene Bank for Agricultural Crops (IGB). The grain legume collection held in the IGB contains representatives of chickpea (*Cicer* spp.), lupin (*Lupinus* spp.), lentil (*Lens* spp.), bean (*Phaseolus* spp.), pea (*Pisum* spp.), bean (*Vicia* spp.), cowpea (*Vigna* spp.) and soyabean (*Glycine* spp.). The information received with the original material and field observations made while propagating the material are computerized and documented in the IGB database.

IGB focuses on collection and regeneration of local landraces and wild relatives of many plants' germplasm including the above grain legumes. The species in the current IGB grain legume collection and the number of accessions are listed in Table 1. Most genera collected by IGB are represented by more than one species and originate from both Israel and the rest of the world. The IGB grain legume collection in most cases includes landraces and wild types. Many grain legumes have been important in the Mediterranean diet since ancient times, so this region is a source of many landraces such as for chickpea, lentil and bean. These can be used for breeding improved crops.

Table 1. Grain legume collections held in the Israeli Gene Bank (IGB)

Genus and species	No. of accessions	Origin
Cicer		
Landraces	40	Israel
C. arietinum	457	Worldwide
Others	3	Israel
Total	**500**	
***Lupinus* (landraces and wild)**		
L. albus	13	Israel
	21	Worldwide
L. angustifolius	16	Israel
	21	Worldwide
L. luteus	10	Israel
	38	Worldwide
Others	7	Israel
	16	Worldwide
Total	**142**	
***Lens* (landraces and wild)**		
Landraces	96	Israel
	62	Worldwide
Wild	3	Israel
	13	Worldwide
Total	**204**	
***Phaseolus* (landraces)**		
P. vulgaris	19	Israel
	242	Worldwide
P. aureus	39	Worldwide
P. coccineus	64	Worldwide
P. lunatus	31	Worldwide
Others	4	Israel
	8	Worldwide
Total	**409**	

Genus and species	No. of accessions	Origin
***Pisum* (landraces and wild)**		
P. sativum	6	Israel
	264	Worldwide
Others	2	Israel
	14	Worldwide
Total	**288**	
***Vicia* (landraces)**		
V. ervilia	47	Israel
	8	Worldwide
V. faba	55	Israel
	252	Worldwide
V. sativa	25	Israel
	186	Worldwide
V.villosa	122	Worldwide
Others	25	Israel
	77	Worldwide
***Vicia* (wild)**		
V. narbonensis	3	Israel
V. palaestina	1	Israel
V. sativa	6	Israel
V. tenuifolia	2	Israel
Total *Vicia*	**838**	
***Vigna* (landraces)**		
V. luteola	3	Israel
V. sinensis	8	Israel
V. radiata	368	Worldwide
V. unguiculata	254	Worldwide
Others	7	Israel
	16	Worldwide
Total	**656**	
Glycine		
	93	Worldwide

Israel's rich flora is endangered by the increasing disappearance of natural habitats through urbanization, road construction, and modern farm practices. Therefore, another important task of the IGB is to rescue the endangered wild plant species and close relatives of local crops still existing in the wild. Emergency collecting is done in collaboration between the Hebrew University of Jerusalem, Rotem-Israel Plant Information Centre, Tel Aviv University and IGB. During the last 4 years several hundreds of accessions have been collected, including about 50 grain legume accessions (Fig. 1). Rescue activities will continue in the future until all high-risk regions are covered.

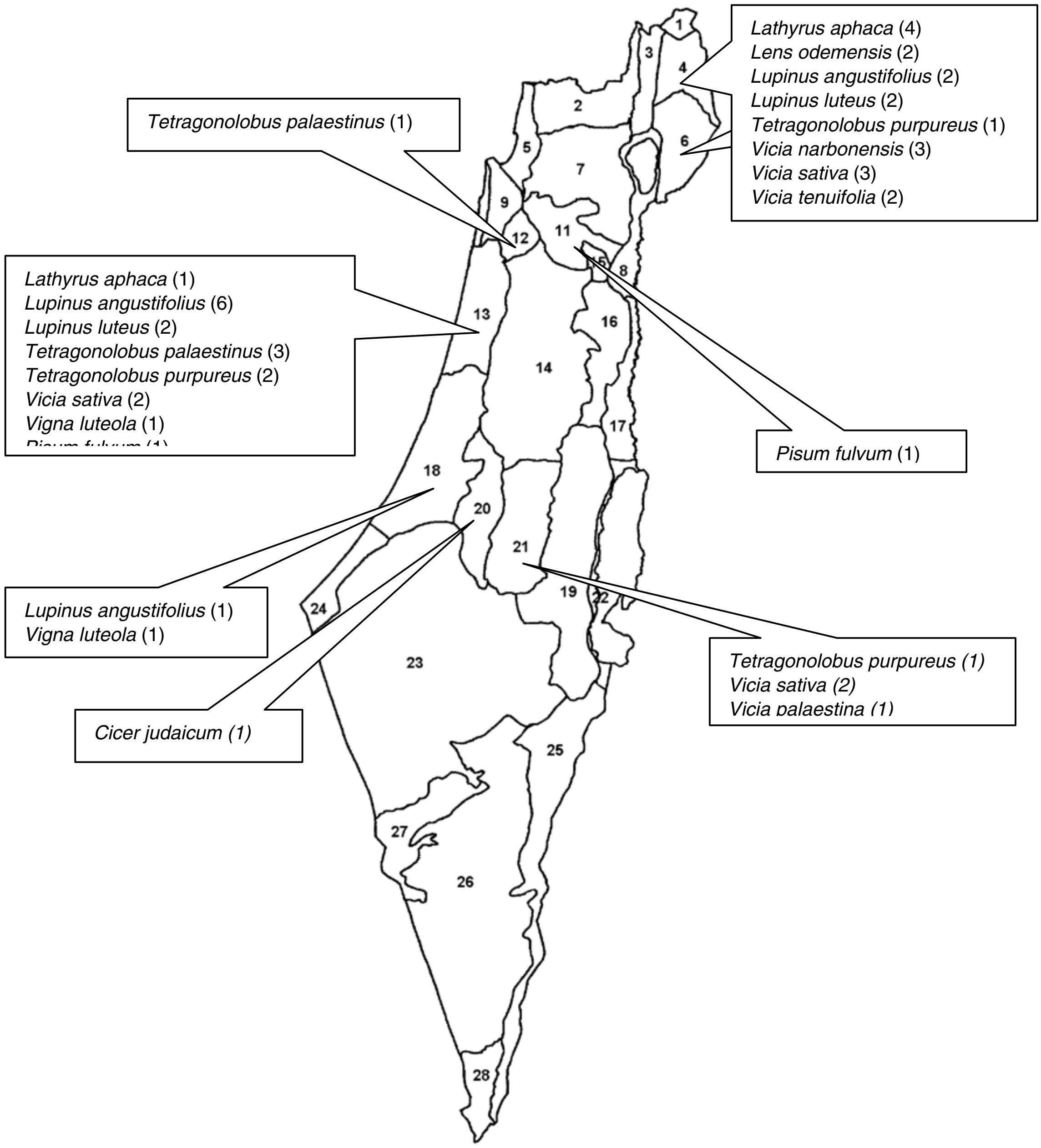

Fig. 1. Grain legume emergency collecting expeditions from different districts in Israel carried out by the Hebrew University of Jerusalem, Rotem, Tel Aviv University and the Israeli Gene Bank (IGB).

The Italian grain legume collection

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The Italian germplasm collection is conserved at the Istituto per il Germoplasma (Germplasm Institute) in Bari. The collection includes 13 127 grain legume accessions belonging to 9 genera, of which 2772 (= 21.12%) are of Italian origin (Table 1). *Vicia* and *Pisum* are the dominant genera, with 5149 and 4559 accessions respectively, while *Phaseolus* is the genus with the largest number of accessions of Italian origin (799).

Table 1. The Italian grain legume collection conserved by the Germplasm Institute in Bari

Genus	No. of species per genus	No. of accessions	No. of accessions not identified at species level	Accessions of Italian origin	
				No.	%
Glycine	1	5	-	1	20.00
Arachis	1	69	6	20	2.90
Lupinus	5	188	48	85	45.21
Lens	5	348	97	58	16.66
Cicer	1	357	-	169	47.34
Vigna	43	944	7	214	22.66
Phaseolus	10	1508	98	799	52.98
*Pisum**	1	4559	-	146	3.20
Vicia	72	5149	301	1298	25.21
Total		**13127**	**3898 (29.69%)**	**2772**	**21.12**

*for *Pisum*, all accessions belong to *P. sativum;* however 1218 accessions are identified down to subspecies level (10 different subspecies), while 3341 accessions are classified only as *P. sativum*

The Institute's Web site (<http://www.ig.ba.cnr.it>) provides access to searchable crop-specific databases, including the grain legume database. Characterization data are limited to the main taxonomic descriptors and the origin, provenance and codes of the accessions.

Reconstituting lost grain legume collections in Macedonia (FYR)

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The preliminary activities for establishing a national programme for crop genetic resources in Macedonia (FYR) started in 1995 with the genebank project financed by the Ministry of Agriculture, Forestry and Water Economy. Four research institutes made a plan whereby they agreed to share responsibility for collecting and conservation of different crops, based on their location and research orientation. During many years of research, the following accessions have been maintained and conserved: about 250 (mainly domestic) cereals, 100 fruit trees and 40 foreign grape varieties in the Institute of Agriculture in Skopje; more than 110 accessions (local and introduced) of vegetable and industrial crops in the Institute of Agriculture in Strumica; 25 domestic cultivars of tobacco in the Institute for Tobacco in Prilep; and 200 rice accessions (37 local) in the Institute for Rice in Kochani.

In 1998, the Institute of Agriculture in Skopje requested assistance from IPGRI for the repatriation of vegetable and fruit accessions duplicated in the USA. These accessions have been collected during foreign missions and joint projects in the period 1970-1980. The survey was undertaken by the US Genetic Resource Information System; as a result, over 1500 vegetable and fruit accessions were identified and collected in the Republic of Macedonia.

Beside this planned and organized research and the initiative from the above-mentioned institutes to develop a national genebank, no further research or other activity is proposed.

Nevertheless, species from the Fabaceae family, especially grain legumes, have been used in the research and breeding process at the Institute for Agriculture in Skopje. Some work has also been done on *Phaseolus angularis* at the Faculty of Agriculture in Skopje (the list of collected species and their main characters are given in Table 1). There is also a collection of local populations of groundnut (*Arachis hypogaea* L.) at the Institute of Agriculture in Strumica. According to the reviewed publications, reports and scientific papers, as well as discussions with researchers, it is clear that there is a significant potential of about 40 to 50 landraces and populations of grain legumes belonging to the genus *Phaseolus*, and about 10 belonging to the genera *Arachis*, *Pisum*, *Vicia*, etc. Some of them can still be collected almost unchanged and at the same locations as when they were evaluated 30 years ago. On the other hand, many of the listed populations have disappeared due to the passage of time and changes in the dietary habits of the local population.

This leaves us with the challenge of undertaking more thorough research on grain legumes and of listing landraces and other populations conserved *in situ*, as well as to create a genebank from collected seeds and store them according to international standards. Considering the current situation and lack of sufficient funds for a national genebank, as well as the unbalanced financial support from the Ministry of Agriculture, Forestry and Water Economy in Macedonia (FYR), it is unlikely that progress will be made in the near future. In spite of this rather pessimistic statement, the involved parties in the country are making stronger demands to governmental bodies for understanding the importance of a national genebank and they are raising hopes and expectations for fruitful international collaboration.

Table 1. Grain legume populations collected and evaluated in Macedonia (FYR) (important note: the species listed below were collected and described 30 years ago. Many of them are still grown and cultivated by the local population although time and uncontrolled selection as well as inappropriate storage conditions must have resulted in significant changes in the plant material).

***Phaseolus vulgaris* Savi. (French bean, green bean, snap bean) - Location: Veles and the vicinity**								
Name	**Origin (*)**	**Plant characteristics**						
		Height (cm)	**Leaves**	**Flowers**	**Fruits**	**Average yield (t/ha)**	**Sowing to harvest (days)**	**Resistance to diseases**
Short green		41-49	Heart-shaped, hairy and slightly wavy surface, dark green	Big and white	6-10/plant, semi-flattened, 5 g dark green bean pods	11.9	77-84 (late)	Medium
Early from Veles	v. Kalaslari	20-60	Heart-shaped, slightly wavy surface, green	Purple	8-24/plant, oval-flattened, 4.7 g slumber yellow bean pods	14.6	72-85 (mid-early)	Low
Kalaslarska	v. Kalaslari	32-35	Oval-shaped, slightly wavy surface, pale green	Pale purple	8/plant, oval-flattened, 4.5 g yellow bean pods	11.8	70-86 (mid-early)	Low
White seed	Veles	36	Oval-shaped, slightly wavy surface, green	White	5/plant, short and flattened, yellow bean pods	9.2	78-88	Medium
Colourful	v. Izvor, Starigrad	40	Symmetric with rough surface, green	Dark violet	5-8/plant, big and flattened, brown bean pods with dots and lines	19.2	81-91	Medium
Broad yellow	v.Chashka, Elovec, Veles	31	Oval-shaped, slightly wavy surface, pale green	White	6.2/plant, flat, tender, yellow bean pods	10.0	79-86	Low
Yellow from Nogaevci	v. Nogaevci	32	Oval-shaped, slightly wavy surface, green	Pale violet	8.3/plant, oval-flattened, yellow bean pods	13.5	77-90	Medium
New seed	Veles	37	Oval-shaped, slightly wavy surface, pale green	Milky white	8.3/plant, oval-flattened, yellow with a green tint bean pods	9.2	83-89	Medium
Early yellow	Veles	33	Small, egg-shaped, slightly wavy surface, pale green	Pale violet	8.3/plant, oval-flattened, yellow bean pods	10.9	70	
Colourful seed	v. Vojnica, Starigrad, Izvor, Chashka	37	Egg-shaped, strongly wavy surface, pale green		4.6/plant, flat, silver-yellow bean pods	11.0	71-92	
Tall green	v. Bogomila	22	Symmetric, smooth surface, dark green	Pale violet	30/plant, flat, light brown bean pods	15.6	102	Medium
Yellow from Starigrad	v. Starigrad, Izvor, Martulci	130-242	Small, egg-shaped, smooth surface, pale green	Pale violet	Tender, yellow to green bean pods	17.2	97	Low
Sharka	Veles	110-230	Small, egg-shaped, slightly wavy surface, dark green	Pale violet	Tender, green to violet bean pods	15.9	96	
Broad yellow	Veles	173	Egg-shaped, wavy surface, dark green	White to pale violet	Flat, tender, yellow to green bean pods	19.9	116	
Green from Elovec	v. Elovec-Melnica	167	Egg-shaped, wavy surface, pale green	White	Flat, tender, green bean pods	14.8	108	Medium
Tall seed	Veles, v. Sojaklari, v. Ivankovci	174	Small and smooth, pale green	White to pale violet	Flat green bean pods	15.9	96	Low
Colourful seed	Veles	176	Medium size, strongly wavy surface, pale green	White	Flat green bean pods	13.1	93	Medium

(*) v. = village

Table 1 (cont.). Grain legume populations collected and evaluated in Macedonia (FYR)

***Phaseolus vulgaris* Savi. (French bean, green bean, snap bean) - Location: Skopje and the vicinity**

Name	Origin (*)	Plant characteristics						
		Height (cm)	**Leaves**	**Flowers**	**Fruits**	**Average yield (t/ha)**	**Sowing to harvest (days)**	**Resistance to diseases**
Old	v. Usje	19-31	Heart-shaped, hairy and slightly wavy surface	White	7-19/plant, semi-flattened, 5-7 g yellow bean pods	14.5	76 (mid-early)	Low
Early	v. Gjorce Petrov	24-38	Elongated heart-shaped	Pink	8-24/plant, cylindrical, 4.6-5.6 g green bean pods	14.4	74 (mid-early)	Medium
Yellow	v. Nerezi	29-49	Heart-shaped	White	5-16/plant, cylindrical, 6.1-7.4 g yellow bean pods	15.4	87	Medium
Butter	v. Nerezi	28-52	Heart-shaped	White	11-21/plant, cylindrical, 2.7-3.9 g yellow bean pods	10.6	83	Good
White	v. Vlae	35-58	Elongated heart-shaped	White	5-15/plant, semi-flattened, 5.2-6.1 g green bean pods	10.5	82	Low
Short	v. Vlae	22-38	Heart-shaped	Pink	Semi-flattened, 5.3-6.2 g yellow tender bean pods	15.8	98	Medium

***Phaseolus angularis* (Adzuki bean) - Locations: Strumica, Skopje, Radovish**

Name	Origin	Plant characteristics						
		Height (cm)	**Leaves**	**Flowers**	**Fruits**	**Average yield (t/ha)**	**Sowing to harvest (days)**	**Resistance to diseases**
Adzuki bean from Strumica	Strumica	40	Heart-shaped, green	Purple	Bean pods	3.6	97	
Adzuki bean from Skopje	Skopje	41	Heart-shaped, green	Purple	Bean pods	3.5	101	
Adzuki bean from Radovish	Radovish	38	Heart-shaped, green	Purple	Bean pods	3.4	101	

(*) v. = village

Description of the CGN grain legume collection - status 2001

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Introduction

Since the last meeting of the Working Group on Grain Legumes the collection has not changed substantially. It consists of 1781 accessions of the three grain legumes *Pisum*, *Vicia faba* and *Lupinus* (Table 1). The collection was originally established in 1985 and started with material previously maintained in working collections of different research institutions in Wageningen. More recently it was expanded with material from Dutch breeding firms and European genebanks (van Soest and Boukema 1995; van Hintum and van Soest 1997; van Soest *et al.* 2000). These grain legume collections have a medium priority in the CGN strategic plan and receive lower attention. The major reason is the decline in the cultivation of these pulses in the Netherlands (Table 2).

Table 1. Grain legume collection of CGN

Species	No. of accessions	Cultivars	Landraces	Breeding material	Unknown including wild
Pisum sativum	966	458	337	84	87
Pisum abyssinicum	1				1
Pisum arvense	1				1
Pisum elatius	3				3
Unknown (wild?)	15				15
Total *Pisum*	**986**	**458**	**337**	**84**	**107**
Vicia faba	726	228	393	10	95
Lupinus albus	13	1	2	10	
Lupinus luteus	56	18		35	3
Total *Lupinus*	**69**	**19**	**2**	**45**	**3**
Grand total	**1781**	**705**	**732**	**139**	**205**

Table 2. Area grown (ha) of the two most important pulses in the Netherlands (data from the recommended lists of varieties (1984 to 2001) of the Netherlands)

Year	Pea	Faba bean
1984	9700	1900
1985	18600	2540
1986	21600	5100
1987	33000	10200
1988	27000	13400
1989	15000	6800
1990	11000	3000
1999	2150	650
2000	1490	700

The collections

Pea (*Pisum*)

Most of the accessions maintained in this collection consist of material of the cultivated pea (*P. sativum*). Since the last meeting the collection was reduced by 22 accessions. Only a few wild species, such as *P. abyssinicum, P. arvense* and *P. elatius* and 15 accessions of undefined wild species are included (Table 2). More details on the composition of this collection are presented in Table 3 and were previously published (van Soest and Boukema 1995; van Soest and Dijkstra 1996; van Soest *et al.* 2000).

The *Pisum* collection includes 46% cultivars, mainly of European origin, and 34% landraces, partly from European countries, but more than 250 originating from the centres of diversity in Asia and Africa. This material is rather primitive and not well adapted to North European conditions. It includes nearly 150 accessions from Pakistan and Ethiopia, collected with Dutch participation (Hashmi *et al*. 1981).

Table 3. Composition of the *Pisum* collection of CGN based on origin and population type

Continent **/ country**	**No. of countries**	**Wild**	**Landraces**	**Research material**	**Cultivars**	**Unknown**	**Total**
Europe	16	2	52	13	296	58	421
The Netherlands		0	3	10	184	20	217
Great Britain		1	0	2	50	8	61
France		0	3	1	24	17	45
Asia	11	4	165	6	0	1	176
Pakistan		0	63	0	0	0	63
India		0	48	1	0	0	49
Africa	2	1	87	0	0	0	88
Ethiopia		1	86	0	0	0	87
North America	3	5	3	33	26	8	75
USA		5	0	33	24	6	68
South America	6	0	6	7	0	0	13
Australia	2	0	1	0	20	5	26
Unknown		15	23	25	116	8	187
Total	**40**	**27**	**337**	**84**	**458**	**80**	**986**

Faba bean (*Vicia faba*)

The composition of the *Vicia* collection has not changed since the last meeting of the Working Group in 1998. The collection consists of 726 accessions of the cultivated species *V. faba.* There are 393 landraces in the collection, largely from Asia (188) and Africa (114). These landraces were collected in the centres of diversity of the faba bean, particularly in a number of countries of the Middle East such as Syria, Afghanistan, Pakistan, Iraq and Turkey. Also present are 78 landraces from the centre of diversity in Ethiopia. Only 54 landraces from Europe are found in the collection, including the old Dutch landrace 'Oldambster'. The 228 cultivars are mainly from Europe (195). These accessions come particularly from the Netherlands (49), Germany (60), United Kingdom (20), France (16) and Russia (11). Some old Dutch cultivars in the collection are 'Mansholt's Wierboon'(1892), 'Adrie' (1919) and 'Wierboon C.B.' (1931). Only a few cultivars from Asia, Africa and America are present in the collection. Ten accessions belong to the population type 'research material'. The country of origin and the population type are not known for 58 and 95 accessions respectively.

Lupin (*Lupinus*)

This small collection includes only 69 accessions of the species *L. albus* and *L. luteus* (Table 2). The collection contains only 2 landraces from Eastern Europe and 19 cultivars from the Netherlands, Germany and Poland. The other material mainly consists of research material from the former Foundation for Plant Breeding (SVP) and Poland (van Soest and Boukema 1995).

Regeneration

Pea is sown directly in the field without isolation of individual accessions as it is treated as a self-pollinating crop. One hundred seeds are sown per accession against a fence approximately 1.50 m high. During the growing season the accessions are monitored visually and when symptoms are detected also serologically for the Pea Seed-borne Mosaic

Virus (PSMV). Plants testing positive for PSMV are removed entirely. Nearly all material listed in Table 1 has been regenerated and is available to *bona fide* users.

Faba beans and lupins are regenerated in plots spatially isolated in *Triticale* fields (previously in rye). The isolation distance between the plots is approximately 50 m. The size of the plots is 8 m^2, and normally 200 seeds are sown directly in the field.

Characterization and evaluation

In combination with the regeneration, accessions of *P. sativum* and *V. faba* are characterized in the field for 14 and 13 morphological traits respectively. CGN developed its own minimal descriptor lists for both species (Dijkstra and van Soest 1986). Both descriptor lists are partly derived from the IPGRI and UPOV lists and were developed after consultation with several grain legume breeders from the Netherlands. As shown in Table 2, large parts of the *Pisum* and *V. faba* accessions are characterized for the descriptors included in the lists. However, only 40% of the *Lupinus* collection are characterized for four descriptors, including plant type and flower colour.

Table 4. Characterization and evaluation data

Crop	Characterization		Evaluation	
	No. of descriptors	Coverage collection	No. of descriptors	Remark
Pisum	14	ca. 89%	3	Diseases*
V. faba	13	ca. 90%	-	-
Lupinus	4	ca. 40%	-	-

* coverage: approximately 20%

Only material from the *Pisum* collection is evaluated for susceptibility to the following diseases:

- *Fusarium solani* f.sp. *pisi*, race 2 (200 accessions)
- *Fusarium oxysporum* f.sp. *pisi* (177 accessions)
- *Aphanomyces euteiches* (181 accessions)

These evaluations were conducted by Prof. J. Kraft (USDA/ARS, Prosser WA, USA), mainly on landraces from Pakistan collected during previous missions (Hashmi *et al*. 1981).

All characterization and evaluation data are included in the information system GENIS (van Soest and Boukema 1995; van Soest *et al.* 2000) and can also be downloaded from CGN's Web site (see below).

Documentation

The 1781 grain legume accessions are all documented for passport data in GENIS, an information system based on the database management system ORACLE (van Hintum 1989). The passport data of some accessions are not complete. There is a lack of data for the landraces of *P. sativum* and *V. faba* collected in the centres of diversity in Asia and Africa (Ethiopia). Further updating of the passport data of the *Pisum* collection started in 1998 and will be completed in the near future.

Data of the CGN collections, including the three collections discussed here can be found on CGN's Web site: <http://www.cgn.wageningen-ur.nl/pgr/>. Since early 2001 passport, characterization and evaluation data are accessible and can be searched on-line or downloaded at <http://www.cgn.wageningen-ur.nl/pgr/collections/dbsearch.htm>.

Utilization

Since 1988 CGN has distributed a total of 1146 accessions of all grain legumes to users in the Netherlands and abroad. More information on the distribution is presented in Table 5. Users are supplied with 50 seeds and passport data on the requested material. Additional data are provided on request.

Table 5. Utilization of CGN grain legume collections

Crop	Period of distribution (years)	No. of requests	Total no. of accessions
Pea	1988-2001 (14 years)	38	914
Faba bean	1990-2000 (9 years)	18	214
Lupin	1993-2000 (3 years)	4	18
Total		**50**	**1146**

Remark: the distribution of material included in the grain legume collections of CGN represents approximately 3% of the total distribution of CGN.

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Grain legume collections in the Nordic Countries

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The Nordic Gene Bank (NGB) is a regional plant germplasm centre for the Nordic Countries (Denmark, Finland, Iceland, Norway and Sweden). The region extends between latitudes 54-72°N where extreme growing conditions have developed highly adapted plants. The NGB headquarters are in southern Sweden.

NGB's mandate is the conservation and utilization of plant genetic resources of Nordic origin or cultural historical value, including the following grain legumes:

Vegetables
Beans: *Phaseolus vulgaris* var. *vulgaris*
Garden peas: *Pisum sativum* subsp. *sativum* L.
Broad bean: *Vicia faba* var. *faba* L.
Tuberous vetch: *Lathyrus tuberosum* L.

Legumes
Soyabean: *Glycine max* (L.) Merrill
Lentil: *Lens culinaris* Medicus
Yellow lupin: *Lupinus luteus* L.
Field peas: *Pisum sativum* L. subsp. *arvense*
Horse bean: *Vicia faba* var. *equina* Pers.

The NGB collection currently holds 190 accepted accessions of grain legumes, 129 commercial varieties, 61 accessions of locally cultivated material and 14 of new material (Table 1). All the accepted material is safety-duplicated.

Table 1. The NGB grain legume collection

	Soyabean	Lentil	Yellow lupin	Field beans	Beans	Garden pea	Field pea	Faba beans	Total
Commercial varieties	3	0	1	40	12	22	42	9	129
Local material	0	1	0	9	5	1	8	37	61
Pending	0	0	0	4	2	2	2	4	14
Total	**3**	**1**	**1**	**53**	**19**	**25**	**52**	**50**	**204**

In addition, NGB holds the Weibullsholm collection of which approximately 450 type lines are maintained in collaboration with the John Innes Centre, Norwich, UK. NGB holds the base collection while JIC is responsible for the active collection and the information. The Weibullsholm collection also comprises 700 accessions of Nordic origin, 500 accessions that are stored for specific purposes and 1200 that are presumed duplicates. A further 200 accessions of soyabean breeding lines are stored.

Storage

Accessions are stored in a base collection and in an active collection at -20°C after drying to 5-7% water content (FAO/IPGRI 1994). The safety storage is subject to natural conditions at -4°C. In general, 4000 viable seeds are stored in the base collection, 10 000 in the active collection and 500 in the safety store.

Reference

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Grain legume collections in Poland

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Grain legume genetic resources in Poland belong to the collection of the National Centre for Plant Genetic Resources (NCPGR) in Radzików, accounting for 15% of all accessions collected. Active collections for particular genus/species are located in different institutions but the database, long-term storage facilities and coordination of the national programme are based in Radzików. The national programme for the protection of plant genetic resources is financed by the Ministry of Agriculture, and an Advisory Board for Plant Genetic Resources has been created.

The present status of grain legume collections in Poland is shown in Table 1. The collections have been increased by 2131 accessions (+31%) since the first meeting of the Working Group in Copenhagen, 1995 (Święcicki 1996). Relatively large active collections exist for faba bean (*Vicia faba* L.), *Lupinus* spp., *Pisum sativum* L. and common bean (*Phaseolus vulgaris* L., grown for dry seeds). These crops have a significant agricultural importance (role in crop rotation/N fixation; protein content of dry seeds; green mass used as forage and manure).

Table 1. Overview of the Polish grain legume collections

Crop	Location of active collection	No. of accessions (1995)	No. of accessions in active collection (2000)	No. of accessions in long-term storage (2000)	Curator
Glycine max	NCPGR	929		1110	
Lens	NCPGR	50		94	
Lupinus spp.	PBS	868	998	958	H. Czerwi□ska
P. vulgaris (pods)	AUP	300	500	1018	M. Fiebig
P. vulgaris (seeds)	NCPGR	626		1002	
Pisum spp.	PBS	2887	3023	2065	W. □wi□cicki
V. faba	NCPGR	802	1258	1258	M. Górski
Vicia (other species)	NCPGR	279		355	
Lathyrus	NCPGR	88		102	
Total		**6829**	**5779**	**7962**	

NCPGR = National Centre for Plant Genetic Resources, Department of the Plant Breeding and Acclimatization Institute, Radzików
PBS = Plant Breeding Station, Wiatrowo
AUP = Agricultural University, Pozna□ (Baranowo)
Note: total number of accessions in active collections and non-active collections in long-term storage: 8442.

A valuable part of the Polish field bean collection is made up of material from companies that have discontinued their breeding activities. This includes lines with the *terminal inflorescence* gene.

The lupin collection covers lines belonging to three lupin crops (*L. angustifolius*, *L. albus* and *L. luteus*) and lines belonging to wild, rough-seeded lupins from the Mediterranean basin. There are only a few lupins from the New World, including *L. mutabilis*.

The *Pisum* collection is characterized according to the gene atlas of the *Pisum* chromosome map. A core collection was selected (Święcicki *et al.* 2000) on the basis of isozymic loci polymorphism.

Much of the common bean collection consists of lines gathered during expeditions in southeast Poland, Ukraine, the Czech Republic and Slovakia.

Every year, part of the active collection is sown, characterized and evaluated, and the respective data entered in the database. The experiments, results, progress and achievements are presented in annual reports. Curators cooperate closely with users. *Lathyrus* and *Lens* are not cultivated in Poland. *Vicia sativa* and *V. villosa* are grown on a limited acreage. The relatively large collections of common bean grown for dry seeds and of soyabean (over 1000 accessions each) have not been active for two years, owing to the rather small acreage of these crops in cultivation.

The table also shows that most legume accessions are preserved in long-term storage.

A database and a Web site have been developed for European *Lupinus* collections. The *Pisum* Database was established in cooperation with the John Innes Centre, UK (see sections on these databases, this volume).

The most important tasks for the near future are to preserve all grain legume genetic resources in long-term storage and to add the national data for all species to the European Grain Legume Databases.

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Grain legume collections in Portugal

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The Portuguese grain legume collections

Since the last report presented in 1998 in Norwich, little information can be added.

The Portuguese collections, excluding advanced breeder's lines and the active collection of breeding programmes, consist of 8320 grain legume accessions (Table 1): *Cicer arietinum* (601), *Lathyrus* spp. (154), *Lens culinaris* (19), *Lupinus* spp. (3291), *Phaseolus* spp. (2442), *Pisum sativum* (398), *Vicia* spp. (1159) and *Vigna* spp. (256).

Table 1. Activity on grain legume collections

Species	Collection	Characterization			Evaluation
		Morphological	Chemical	Molecular	
Portuguese Plant Germplasm Bank (BPGV), Braga (2730 accessions; curator Ana Barata)					
Cicer arietinum L.	248				
Lathyrus sativus L.	29				
Lens culinaris Medikus	4				
Lupinus spp.	88				
Phaseolus coccineus L.	59				
Phaseolus vulgaris L.	1514	125			
Pisum sativum L.	250				
Vicia ervilia (L.) Wild	2				
Vicia faba L.	320				
Vicia sp.	8				
Vicia villosa Roth	2				
Vigna sativa L.	13				
Vigna spp.	3				
Vigna unguiculata L.	184	50			
Vigna unguiculata subsp. *sesquipedales*	6				
National Plant Breeding Station ENMP, Elvas: Sec. Grain Legumes (467 accessions; curator Graça Pereira)					
Cicer arietinum L.	230	230			
Pisum sativum L.	49	49			
Vicia faba L.	188	188			
Plant Biology Lab. ESA, Castelo Branco (112 accessions; curator Carlos Reis)					
Vigna unguiculata L.	104	27	24		
Phaseolus vulgaris L.	8				
Dept. Genetic Resources and Breeding (Ex-Sec. Pastures and Forage) EAN, Oeiras (603 accessions; curator Maria da Paz Andrada)					
Cicer arietinum L.	8	-	-	-	8
Lathyrus spp.	28	28	-	-	28
Lupinus spp.	360	230	60	6	230
Vicia spp.	207	207	-	-	207
National Plant Breeding Station ENMP, Elvas: Sec. Pastures and Forage (187 accessions; curator João Paulo Carneiro)					
Vicia sativa L.	67				
Vicia benghalensis L.	3				
Vicia villosa Roth	40				
Vicia macrocarpa	2				
Vicia ervilia (L.) Wild	16				
Vicia narbonensis L.	3				
Vicia atropurpurea	4				
Lathyrus clymenum L.	3				
Lathyrus cicera L.	6				
Lathyrus arvensis	1				
Lathyrus tingitanus L.	2				
Lathyrus ochus (L.) DC.	11				

			Characterization		
Lathyrus odoratus L.	1				
Lathyrus sativus L.	4				
Lupinus spp.	24				
Dept. Bot. Biol. Engineering ISA, Lisboa (1803 accessions; curator João Neves Martins)					
Lupinus albus L.	732	570	462	40 a	570
Lupinus mutabilis Sweet	674	674	674	10 a	15
Lupinus angustifolius L.	202	100		36 a	100
Lupinus hispanicus Boiss et Reut.	34			4 a	
Lupinus luteus L.	137	20		18 a	20
Lupinus sp.	24			5 a	
Genebank-Genetics EAN, Oeiras (2398 accessions; curator Eliseu Bettencourt)					
Cicer arietinum L.	115	115			
Lathyrus spp.	69				
Lens culinaris Medikus	15				
Pisum sativum L.	99				
Vicia benghalensis	6				
Vicia monanthos Viv.	29				
Vicia sativa L.	41				
Vicia faba L.	66				
Vicia spp.	39				
Vicia villosa Roth	7				
Vicia ervilia L.	5				
Vigna unguiculata	50				
Phaseolus vulgaris L.	809	50		3 (RFLP)	
Phaseolus coccineus L.	32				
Lupinus cosentinii L.	23				
Lupinus albus L.	295				
Lupinus angustifolius L.	272	9			
Lupinus luteus L.	272	11			
Lupinus micranthus L.	10				
Lupinus spp.	144				
Dept. Genetics Biotechnology UTAD, Vila Real (20 accessions; curator Valdemar Carnide)					
Phaseolus vulgaris L.	20	11	11	20 (RAPD)	

a = RAPD + AFLP

Safety-duplication

Table 2 represents the status of the safety–duplication of the Portuguese grain legume collections. Although the proportion of accessions that are safety–duplicated is relatively low (48.1%), it represents an effort over the last 3 years and this work continues in order to duplicate all accessions maintained in all the collections in the country.

Table 2. Status of the safety–duplication of the grain legume collections

Institution	No. of species	Total no. of accessions	No. of accessions duplicated	% of safety-duplication
Portuguese Plant Germplasm Bank, BPGV, Braga	15	2730	2367	86.7
Section Grain Legumes, ENMP, Elvas	3	467	268**	57
Plant Biology Lab., ESA, Castelo Branco	2	112	70*	63
Dept. Genetic Resources and Breeding (ex-Section Pastures and Forage), EAN, Oeiras	22	603	170	26.5
Section Pastures and Forage, ENMP, Elvas	15	187	66***	35
Dept. Bot. Biol. Engineering ISA, Lisboa	15	1803	462	26
Genebank Genetics, EAN, Oeiras	20	2398	600	25
Dept. Genetics Biotechnology, UTAD, Vila Real	1	20	0	0
Total		**8320**	**1062**	**48.1**

* 26 *Vigna unguiculata*: Braga; 44 donor genebanks

** 85 *Cicer arietinum*: Braga; 32 *C. arietinum*: ICARDA; 151 *Vicia faba*: Braga

*** 40 *Lupinus* sp.: Banco de Sementes do ISA; 26 *Lupinus* sp. and *Vicia* sp.: BPGV, Braga

Characterization, regeneration and evaluation

The characterization, regeneration and evaluation status of the grain legume collections maintained in Portugal is summarized in Table 1. The percentage of the studied material is still low when compared to the total number of accessions maintained. The situation is mainly due to the lack of dedicated budgets for such activities which take place, usually, when the material is needed for a breeding programme or in research projects. However, when compared with the situation reported in 1998, a positive trend can be observed.

Germplasm evaluation starts in the field with the evaluation of agronomic traits. For some species (*Cicer arietinum*, *Vicia faba* and *Pisum sativum)*, we evaluate the chemical composition, resistance to some diseases, drought and cold in collaboration with other sections at ENMP.

Conservation

The grain legume collections are maintained in Portugal under good storage conditions and the percentage conservation is the same as 6 years ago (first meeting in Copenhagen, 1995). Seed samples from working collections are dried at 5-10% moisture, put into plastic/nylon bags or glass jars at -15ºC (long-term storage) or 2ºC (medium-term).

The national *Cicer* collection held at ENMP

Since its creation, the National Plant Breeding Station (ENMP) has been dedicated to the production and dissemination of new varieties of cereals, fodder and pulses crops of high economic value. The collection, conservation and evaluation of germplasm, in particular ecotypes of native Portuguese flora, are priorities. Other responsibilities include studies on the adaptation of material from different environmental regions, which could be of national interest.

Research activities (breeding) on *Cicer*

The most important limiting factors for grain legume crop production are severe disease attacks and drought during spring. Ascochyta blight and Fusarium wilt are the two major diseases of chickpea. Drought is the major abiotic stress throughout the chickpea growing areas. Studies are under way at ENMP to understand the physiological and morphological mechanisms to avoid drought. Since the early 1990s we have also undertaken the selection of lines tolerant of Ascochyta blight, starting from local material and combining it with exotic material. Five years ago a study was started to identify lines tolerant of *Fusarium oxysporum* f.sp. *ciceris*. Five highly tolerant lines have been selected.

Characterization

The accessions of the Portuguese collection of *Cicer arietinum* are fully characterized for 20 morphological traits using the ICARDA descriptors, listed below:

1. Days to emergence	11. Number of basal branches
2. Days to 50% flowering	12. Number of apical branches
3. Days to maturity	13. Number of pods per plant
4. Flowering duration	14. Number of seeds per plant
5. Number of leaflets per leaf	15. Pod length
6. Leaflet length	16. Pod width
7. Leaflet width	17. Pod thickness
8. Plant height	18. 100 seeds weight
9. Plant canopy width	19. Seed yield per plant
10. Growth habit	20. Biological yield per plant

Conservation and regeneration of *Cicer arietinum*

The regeneration of *Cicer arietinum* was done every 4 years at ENMP when the material was stored at ambient temperatures. Today, since the whole collection is stored in a cold chamber, regeneration is carried out regularly every 10 years. During the regeneration process, standard plant protection is carried out and a fungicide (Clortalonil) is applied.

Plants infected with anthracnose (*Ascochyta rabiei*) are immediately removed to reduce spread of the fungus.

Documentation of *Cicer arietinum*

The *Cicer* accessions are well documented for FAO/IPGRI minimum passport descriptors.

Status of the grain legume collection of the Vavilov Institute, Russian Federation

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Composition of the collection

The grain legume collection maintained at the Vavilov Institute is the largest in the Russian Federation and in Europe. It contains 45 690 accessions from 15 genera and 145 species from all over the world. The collection contains the main human food and animal feed crops used in the country. The total number of accessions is summarized for the two parts of the collection (Table 1). The first one, called the "permanent" or "basic" catalogue, contains the accessions with sufficient seed for distribution. The second one, called the "introduction" catalogue contains accessions with a small quantity of seed, insufficient for distribution. After multiplication the accessions go from the introduction catalogue to the permanent catalogue.

Table 1. Composition of the grain legume collection (status January 2001)

Crop	No. of accessions		
	Total	**Permanent catalogue**	**Introduction catalogue**
Pea	8789	7034	1755
Lupin	3129	2611	518
Soyabean	6922	6384	538
Common bean	9581	6346	3235
Faba bean	1772	1299	473
Chickpea	2729	2336	393
Lentil	3338	2950	388
Grass pea	1272	901	371
Vetch	3696	3288	408
Vigna sp.	4139	2514	1625
Others	334	155	168
Total	**45701**	**35818**	**9872**

Besides cultivated plants the collection also includes a large number of wild relatives (Table 2).

Table 2. Taxonomic composition of the grain legume collection

Genus / species	No. of species	No. of accessions
Pisum L.	2	8789
Lupinus L.	28	3129
Glycine Willd.	6	6922
Phaseolus L.	5	9581
Vicia faba L.	1	1772
Cicer L.	3	2729
Lens Mill.	2	3338
Lathyrus L.	37	1272
Vicia L. (other than *V. faba*)	48	3696
Vigna Savi.	8	4139
Dolichos L.	1	105
Cajanus DC.	1	54
Cyamopsis DC.	1	147
Canavalia Adans.	1	17
Macroptilium (Benth.) Urban	1	11
Total	**145**	**45701**

Sources of the collection

Over the last 3 years the collection has increased by 1318 accessions (Table 3). These have been obtained through exchange with foreign genebanks, collecting expeditions, and from breeders, botanical gardens and others (Table 4). Genebanks (ICARDA, CLIMA, INRA and others) are the major source of accessions. In 1998-2000 collecting missions were carried out in regions of the Former USSR (Northern Caucasus, Tajikistan, Armenia, Central Russia, Karelia). All these missions were organized as part of international projects. They resulted in the introduction of 143 grain legume accessions in the collection.

Table 3. Number of new accessions included into the collection (1998-2000)

Year	No. of accessions
1998	260
1999	273
2000	785
Total	**1318**

Table 4. Sources of the grain legume collection (1998-2000)

Crop	Expeditions	Genebanks	Breeders	Other
Pea	-	380	120	-
Lupin	25	45	38	30
Soyabean	-	64	82	-
Common bean	51	130	21	52
Faba bean	1	9	-	-
Chickpea	1	22	-	-
Lentil	10	400	-	-
Grass pea	27	368	-	26
Vetch	12	374	10	-
Vigna sp.	16	257	-	5
Total	**143**	**2049**	**271**	**113**

Conservation and maintenance

The collection is regenerated in various agroecological environments at the eight experimental stations of VIR. These stations are located in the Leningrad and Moscow regions, near Tambow city, in Astrakhan, in Volgograd, in Crimea, near Krasnodar city and in the Far East (Vladivostok). Some sets of the collection are regenerated in breeding centres. Part of the collection is maintained at ICARDA.

The number of regenerated accessions decreased in 1998-2000 (Table 5), owing to the enlargement of the mid- and long-term storage volumes. About 90% of the germplasm is now preserved at low temperature. Nevertheless the active collection is regenerated and part of the accessions from the introduction catalogue are multiplied annually in order to obtain a sufficient number of seeds and include the accessions in the permanent (basic) catalogue.

Table 5. Number of accessions regenerated, 1998-2000

Year	No. of accessions
1998	9958
1999	8684
2000	7866
Total	**26508**

Evaluation/characterization

The material introduced in the collection is subjected to preliminary characterization in three quarantine nurseries belonging to the Institute and located in different regions of the country. This is followed by a 3-year evaluation of the accessions at the eight above-mentioned experimental stations. Evaluation covers the following traits:

1. Agronomic traits (period of maturity, yield, productivity, etc.)
2. Disease resistance:
   a. Black spot for pea
   b. Ascochyta blight for chickpea
   c. Bacterial diseases for common bean
   d. Root rot and grey mould for lentil
3. Biochemical characters (protein and oil content, antinutritive substances, etc.)
4. Abiotic stresses (mainly cold and soil acidity)
5. Nitrogen-fixing ability (pea, lupin, soyabean, common bean)
6. Morphological traits.

The overall objective of evaluation is to reveal the genetic diversity of the material preserved. The immediate practical objective is to identify potential breeding material—sources of valuable traits—for diverse areas of the country and different end-use objectives.

Evaluation is done in collaboration with fundamental research laboratories of the Institute and other institutes of the country. Many of the accessions are tested as part of joint projects with foreign genebanks in different regions of the world.

Utilization

The accessions with known traits are sent to users (breeders, scientists) upon request. Each year more than 1500 accessions are distributed to national breeding programmes (Table 6). Most Russian varieties have been bred from the accessions preserved in the collection.

Table 6. Grain legume germplasm distributed (1998-2000)

Crop	Breeders (mainly inside Russian Federation)	Projects/evaluation/trials	Genebanks (including trials in joint projects)
Pea	1080	2458	600
Lupin	259	1500	-
Soyabean	1677	550	322
Common bean	375	552	-
Faba bean	145	604	423
Chickpea	298	1579	1088
Lentil	680	210	109
Grass pea	219	388	-
Vetch	677	1274	761
Vigna sp.	77	91	120
Total	**5487**	**9206**	**3423**

Documentation

Almost all accessions are documented for passport data. Most accessions have preliminary characterization data. Evaluation data are published in "Catalogues" (in Russian). In the last 3 years, five issues of these catalogues have been published. For some crops evaluation data are partly computerized, but much of characterization data are still recorded manually.

Future activities

- To promote long-term conservation of the collection
- To update the passport data of the collection
- To promote documentation of evaluation data
- To contribute to further understanding of genetic variation
- To continue searching for sources of valuable traits for breeding
- To promote the utilization of the collection in worldwide breeding.

Grain legume collections in the Slovak Republic

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This country's report is an update of previous reports presented at the first and second meetings of the ECP/GR Working Group on Grain Legumes (1995 and 1998).

Grain legume collections and holders

Three institutions hold grain legume collections in Slovakia: the Research Institute of Plant Production in Piešťany (2866 accessions), which also coordinates the National Programme; the Breeding station Horná Streda, Joint Stock Company (1758 accessions); and the Slovak Agricultural University in Nitra (930 accessions) with its long-term programme "Conservation of endangered plant genepool in Slovakia".

Table 1. Institutions holding grain legume genetic resources in Slovakia (status December 2000)

Species	No. of accessions
Research Institute of Plant Production, Piešťany	
Phaseolus spp.	1473
Glycine max	592
Lens culinaris	279
Cicer arietinum	399
Lathyrus sativus	48
Lupinus spp.	75
Breeding station, JSC Horná Streda	
Pisum spp.	1481
Vicia faba	140
Vicia L. (other species)	137
Slovak University of Agriculture in Nitra	
Phaseolus spp.	680
Pisum sativum	200
Lathyrus spp.	30
Cicer arietinum	20

The current status of grain legume collections is presented in Table 2. They include a total of 5554 accessions belonging to 9 genera; *Phaseolus* accessions consist mostly of landraces, and include duplicates.

Table 2. Grain legume collections of the National Programme, Slovak Republic (December 2000)

Species	No. of accessions	% of total	Origin*				Type of sample	
			NC	EC	O	UO	C	W
Phaseolus spp.	2153	38.7	1512	455	145	41	2153	0
Glycine max	592	10.7	66	142	243	141	592	0
Lens culinaris	279	5.0	9	157	113	0	279	0
Cicer arietinum	419	7.5	37	66	284	32	419	0
Lathyrus sativus	78	1.5	71	2	5	0	78	0
Lupinus albus	43	0.7	0	41	0	2	43	0
Lupinus luteus	21	0.5	0	20	1	0	21	0
Lupinus angustifolius	11	0.1	0	10	1	0	11	0
Pisum sativum	1458	26.2	430	981	47	0	1458	0
Pisum arvense	223	4.0	44	176	3	0	223	0
Vicia faba	140	2.6	11	101	28	0	128	12
Vicia (other species)	137	2.5	35	101	1	0	137	0
Total	**5554**	**100**	**2215**	**2252**	**871**	**216**	**5542**	**12**

* NC: national collection; EC: European collection (i.e. all European countries except Slovakia); O: other; UO: unknown origin; C: cultivated; W: wild.

Conservation and evaluation

Passport and description data of grain legume collections and their respective storage conditions are given in Table 3. Passport data are documented for 67% of the accessions; approximately half of accessions are stored in controlled conditions.

Table 3. Coverage of passport data and storage conditions of the Slovak grain legume collections

Species	Passport data	Seed data	Plant morphological data	Evaluation data	Storage		
					Ambient t°	-17° C	5° C
Phaseolus spp.	1000	1894	1908	1871	680	274	1199
Glycine max	583	330	192	220	0	57	535
Lens culinaris	236	212	212	279	72	5	102
Cicer arietinum	111	102	102	280	343	0	76
Lathyrus sativus	40	70	70	78	41	2	35
Lupinus spp.	40	35	35	65	55	0	20
Pisum spp.	1481	1681	1681	1681	1327	178	176
Vicia faba	140	129	129	129	68	21	51
Vicia (other species)	135	128	43	43	46	44	47
% of total	**67.80**	**82.48**	**78.18**	**83.65**	**47.38**	**10.46**	**40.34**

Safety-duplication

Safety-duplicates are located in the RICP-Prague genebank, according to a reciprocal cooperation agreement between the Czech and Slovak Republics (Table 4).

Table 4. Safety-duplication of grain legumes in the RICP-Prague genebank

Genus / species	No. of safety-duplicated accessions
Pisum	178
Vicia spp.	44
Vicia faba	21
Phaseolus	274
Glycine max	57
Lens	5
Lathyrus	3
Total	**582**

Utilization and introduction

Nearly 63% of the 559 accessions distributed (Table 5) were introduced from other organizations, except those collected during collecting expeditions in the last three years.

Table 5. Accessions distributed and introduced in 1999-2001

Year	No. of accessions	
	Distributed	Introduced
1999	207	68
2000	91	25
2001	261	258
Total	**559**	**351**

Production data

The growing area of peas fell by half in the last five years. In 2000 the total grain legume harvested area reached 33 780 ha. Peas are the most important grain legume crops in the Slovak Republic (Table 6).

Table 6. Grain legume production data in Slovakia

Crop / Indicator*	Production data		Prediction**	Objectives***
	1998-1999	1999-2000	2000-2001	2001-2002
Peas/1	29938	25043	15573	26000
Peas/2	28532	23435	14701	25000
Peas/3	2.25	2.05	1.24	2.17
Peas/4	79082	58356	18213s	54250
Bean/1	1479	2504	1912	2000
Bean/2	1431	2486	1875	1960
Bean/3	163	1.46	1.2	158
Bean/4	2303	2251	2255	3097
Lentil/1	846	1149	476	600
Lentil/2	855	1059	463	582
Lentil/3	1.2	0.94	0.40	0.91
Lentil/4	1022	991	183	530
Fodder legumes/1	2287	2897	2500	2789
Fodder legumes/2	2199	2635	2020	2610
Fodder legumes/3	147	1.57	1.01	1.53
Fodder legumes/4	3244	4151	2040	3993
Soyabean/1	3556	4197	6141	10000
Soyabean/2	3303	4165	5911	9620
Soyabean/3	1.69	1.46	0.81	1.90
Soyabean/4	5583	6067	4814	19000

* 1: sown area (ha); 2: harvested area (ha); 3: yield/ha (t/ha); 4: production (t)
: actual data; *: author's estimation
(Source: Jamborová, M. 2001. Legumes. Research Institute of Agricultural and Food Economics, Bratislava. 21pp.)

Registered varieties

Most of the 183 registered grain legume varieties are of foreign origin: 54 are Slovakian (Table 7).

Table 7. Number of registered grain legume varieties in the Slovak Republic (2001)

Crop	No. of varieties	
	Total	Slovakian
Pisum sativum L.	31	8
Pisum sativum L. subsp. *sativum*	47	6
Pisum sativum L. subsp. *sativum* convar. *speciosum* (Dierb.)	8	3
Vicia faba L.	10	5
Vicia faba L. subsp. *major*	4	3
Phaseolus vulgaris L.	6	5
Phaseolus vulgaris L. subsp. *vulgaris*	51	11
Phaseolus vulgaris L. subsp. *vulgaris* var. *vulgaris*	2	0
Phaseolus lunatus L.	1	1
Glycine max (L.) Merr.	9	0
Cicer arietinum L.	3	2
Lathyrus sativus L.	1	1
Lens	3	3
Vicia sativa L.	5	5
Vicia pannonica Crantz	1	0
Vicia villosa Roth	1	1
Total	**183**	**54**

Main activities of the PGR National Programme in the future

It is considered very important to implement the law No. 215/2001 "Conservation of Plant Genetic Resources for Food and Agriculture", approved by the National Council of the Slovak Republic in May 2001 and ratified 1 July 2001. The main framework of Slovakian activities in the area of plant genetic resources for food and agriculture (PGRFA) remains the Global Plan of Action for the Conservation and Sustainable Utilization of PGRFA and the Leipzig Declaration adopted by the International Conference on Plant Genetic Resources in Leipzig, Germany, 17-23 June 1996.

The grain legume collection in Slovenia

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Status of the grain legume collection

The germplasm collection at the Agricultural Institute of Slovenia, one of the three working collections within the Slovene genebank system, maintains a fairly large *ex situ* collection of lettuce, onions, cabbage, winter wheat, grasses and clovers, small fruit, grapevine and grain legumes.

The grain legume collection consists of 1063 accessions (Table 1). *Phaseolus* is by far the most represented genus. Common bean (*P. vulgaris*) is represented by 995 accessions, of which 713 (71%) belong to the pole bean group (*P. vulgaris* L. subsp. *vulgaris* var. *vulgaris*), 203 (20%) are bush beans (*P. vulgaris* L. subsp. *vulgaris* var. *nanus* Aschers.) and 27 (3%) are intermediate beans (*P. vulgaris* L. subsp. *vulgaris* var. *intermedius*). The collection also includes 52 accessions of *Phaseolus coccineus* L.

Table 1. Grain legume collection maintained at the Agricultural Institute of Slovenia

Species	No. of accessions
Phaseolus vulgaris	943
Phaseolus coccineus	52
Vicia cracca	19
Vicia sepium	5
Vicia sativa	2
Vicia faba	34
Lathyrus pratensis	8
Total	**1063**

Multiplication

Each year, up to 20 accessions are planted in a field and covered with a screen tent. During the growing period, morphological characteristics and disease susceptibility are recorded. Visual evaluation of 438 accessions showed that 16% of accessions are affected by BCMV, 5% by BYMV and CMV and 9% by BGMV (Černe 1999). When mature, seeds are collected, cleaned, dried and about 1000 seeds per accession are stored in glass jars at +4°C.

Collecting missions

By 1998 the majority of seed samples were obtained with the help of local elementary and agricultural schools, the Agricultural Advisory Service, newspaper ads and farmers (Meglič and Šuštar-Vozlič 2000).

At present, collecting expeditions continue. Accessions are acquired predominantly during national collecting trips; joint missions represent an important part of the collecting missions programme. During the period 1998–2000 two expeditions were carried out in Slovenia through a Slovene–Czech bilateral project, further extended to 2001-2003. A joint Slovene–Croat bilateral project has been submitted to collect in the Mediterranean region of Slovenian and Croatian Istria.

Documentation

All grain legume accessions are documented for IPGRI minimum passport descriptors. The bean database is currently being re-checked since some discrepancies were observed when comparing original datasets. This should also allow a reduction in the number of accessions, with elimination of duplicates.

The development of an Information and database management system for the Slovenian Plant Gene Bank is well under way (Žitnik *et al.* 2000).

Research

Genetic diversity of the Slovenian bean germplasm collection

The Agricultural Institute of Slovenia holds a collection of 995 common bean (*Phaseolus vulgaris* L.) accessions collected from various parts of Slovenia. RAPD and morphological markers are used to assess diversity within the collection. Accessions will be compared with a set of eight previously described control accessions of Mesoamerican and Andean types using RAPDs. Plants are grown, DNA extracted and RAPD reactions run and scored as previously described (Skroch and Nienhuis 1995, 1998).

A set of 40 accessions that were collected in the early 1960s and lost viability because of inappropriate storage conditions will be compared with a recent collection to assess genetic erosion in the collection. The methodology will be the same as above except that DNA will be extracted from seeds. Series of check accessions will be used (i) from the Andean genepool ('Xan 159', 'Eagle', 'Calima', 'Taylor Hort' and 'Swedish Brown') and (ii) from the Mesoamerican genepool ('Michellite', 'Aurora' and 'Ica Pijao').

Disease resistance

A programme was started to improve anthracnose resistance of autochthonous accessions and cultivars. Based on the results of a study on genetic variability of Slovene autochthonous common bean accessions using RAPD markers, a set of accessions was chosen and artificially inoculated with *Colletotrichum lindemuthianum.* The cultivars were used to identify the pathotypes of the fungus present in Slovenia. The same set of accessions was screened with different RAPD markers for anthracnose resistance (*OPZ04, OPZ09, OPD2, OPD3, OPD7, OPD13, OPAL9, OPAS13, OPF10, OPAB3, OPAH1, OPAK20, OPC08, OPI16* and *OPQ4*). The results indicate the potential use of RAPD markers to identify sources of resistance to anthracnose in Slovene genotypes and breeding lines in order to facilitate the breeding process.

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Grain legume genetic resources in Spain

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Status of national grain legume collections

The Spanish genebanks (Table 1) contain 13 400 grain legume accessions, including 7805 accessions of Spanish origin and 6543 landraces (Table 2).

Table 1. Spanish institutes holding grain legume collections

Institute	No. of accessions
CIA de Albaladejito (Cuenca)	55
CIA de Mabegondo (A Coruña)	49
CIFA Alameda del Obispo (Córdoba)	1834
CSIC. EE La Mayora (Málaga)	6
CSIC. Misión Biológica de Galicia (Pontevedra)	1202
INIA. Centro de Recursos Fitogenéticos (Alcalá de Henares)	9431
NEIKER Arkaute (Alava)	19
SERIDA de Villaviciosa (Asturias)	386
SIA. Banco de Germoplasma de Hortícolas (Zaragoza)	587
SIDTA de Zamadueñas (Valladolid)	1636
SIDTA La Orden (Badajoz)	1032
UPV ETSI Agrónomos. Banco de Germoplasma (Valencia)	241

Table 2. Grain legume collections tabulated by species

Species	No. of accessions
Cajanus cajan (L.) Millsp.	6
Cicer arietinum L.	1269
Dolichos lablab L.	9
Glycine max (L.) Merr.	128
Lathyrus amphicarpos L.	2
Lathyrus annuus L.	4
Lathyrus aphaca L.	1
Lathyrus cicera L.	217
Lathyrus clymenum L.	14
Lathyrus hirsutus L.	3
Lathyrus latifolius L.	1
Lathyrus nissolia L.	1
Lathyrus ochrus (L.) DC.	9
Lathyrus pratensis L.	2
Lathyrus sativus L.	151
Lathyrus setifolius L.	1
Lathyrus sp.	2
Lathyrus sphaericus Retz.	2
Lathyrus tingitanus L.	7
Lathyrus tuberosus L.	1
Lens culinaris Medik.	575
Lens ervoides (Brign.) Grande	7
Lens lamottei Czefr.	5
Lens nigricans (M.Bieb.) Godr.	16
Lupinus albus L.	753
Lupinus angustifolius L.	598
Lupinus hispanicus Boiss. & Reut.	199
Lupinus luteus L.	299
Lupinus micranthus Guss.	12
Lupinus mutabilis Sweet	238
Lupinus perennis L.	1
Lupinus polyphyllus Lindl.	1
Lupinus sp.	6
Lupinus varius L.	22

Species	No. of accessions
Phaseolus coccineus L.	99
Phaseolus lunatus L.	15
Phaseolus sp.	5
Phaseolus vulgaris L.	3662
Pisum asiaticum	1
Pisum fulvum	1
Pisum sativum L.	1546
Trigonella foenum-graecum L.	1
Vicia articulata Hornem.	107
Vicia benghalensis L.	4
Vicia bithynica (L.) L.	2
Vicia disperma DC.	1
Vicia ervilia (L.) Willd.	280
Vicia faba L.	1504
Vicia hirsuta (L.) Gray	1
Vicia hybrida L.	1
Vicia lutea L.	17
Vicia narbonensis L.	23
Vicia pannonica Crantz	5
Vicia peregrina L.	17
Vicia sativa L.	957
Vicia sp.	5
Vicia tetrasperma (L.) Schreb.	1
Vicia villosa Roth	146
Vigna adenantha (G.F.Mey) Marechal, Masch. & Stain	1
Vigna mungo (L.) Hepper	1
Vigna sp.	1
Vigna unguiculata (L.) Walp.	434
Total	!Syntax Error, (

Collecting activities

The Centre for Genetic Resources (Centro de Recursos Fitogenéticos, CRF), Alcalá de Henares, Madrid, has collected landraces since 1986. A total of 5022 accessions have been collected so far; these include 1676 legume accessions, covering 24 species belonging to 9 genera. Fig. 1 shows the provinces prospected (shaded).

CRF took part in international expeditions carried out in Spain as part of a bilateral cooperation agreement with Argentina. Drs C. De la Cuadra and A. De Ron also collected *Phaseolus* species in Argentina, Salta region.

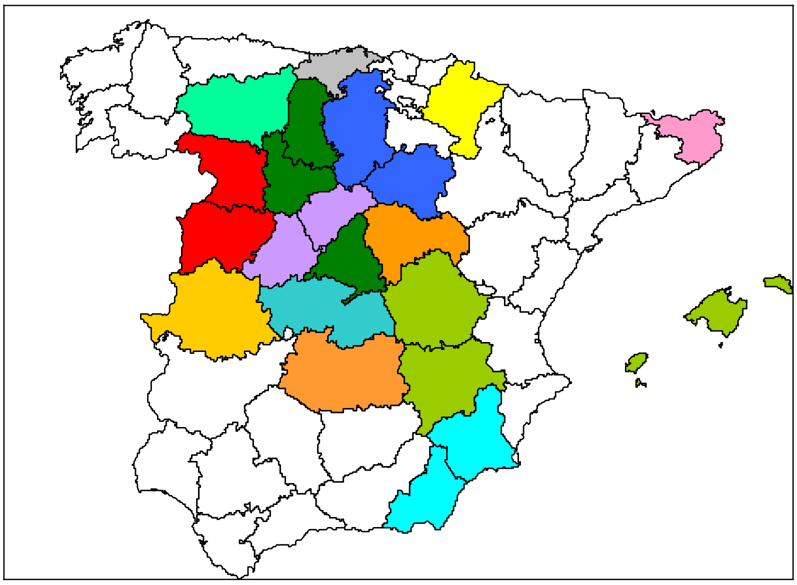

Fig. 1. Provinces prospected during collecting missions in Spain (shaded).

In situ and on-farm conservation

Two projects are currently running, coordinated by Dr C. De la Cuadra, CRF, and in which the Madrid Institute for Agrarian Research (IMIA) and the Association for Rural Development of Aranjuez-Vegas Area (ARACOVE) collaborate. These projects aim at conserving traditional landraces such as the lentil of Colmenar de Oreja, the chickpea of Navalcarnero, and some bean types.

Utilization of grain legume genetic resources

CRF tries to meet requests originating from national and international research centres for grain legume material to be used for breeding purposes. Requests from farmers seeking to recover their landraces or to obtain material for biological agriculture have become more frequent lately.

Collaboration with PHASELIEU

The PHASELIEU project (FAIR programme), coordinated in Spain by Dr A. De Ron, involved the participation of several Spanish institutes: Misión Biológica de Galicia; SERIDA of Villaviciosa; Facultad de Biología, Universidad de Oviedo; NEIKER of Arkaute; SIDTA of Zamadueñas; Escuela de Agrónomos, Universidad Politécnica de Valencia; CRF, Madrid; Departamento de Tecnología de Alimentos, INIA, Madrid; and Escuela de Agrónomos, Universidad de León.

European Grain Legume Databases

Spain has sent passport data to the different European Databases on *Cicer*, *Lathyrus*, *Lens*, *Lupinus*, *Phaseolus*, *Pisum* and *Vigna*. Our country is also a member of the EURISCO project within Region 2 (regional coordinator: Eliseu Bettencourt, INIA, Portugal).

Core collections

The Spanish *Pisum* Core Collection is being developed using molecular markers in a joint project involving three teams: SIDTA of Zamadueñas (Valladolid); CRF (Alcalá de Henares); and UPM-ETS Ingenieros Agrónomos, Biology Department (Madrid).

Sharing of responsibilities for conservation

CRF maintains in its base collection only Spanish materials, but is willing to keep also Iberian or Macaronesian materials, if an agreement is reached. Material from other countries could be kept under a 'black box' status.

Conservation

CRF maintains active and base collections for all grain legume species, except for the *Lupinus* active collection which has been transferred to SIDTA La Orden (Badajoz).

Documentation

CRF is responsible for the development and maintenance of the National Inventory of *ex situ* collections of genetic resources for food and agriculture. The inventory follows IPGRI/FAO's system. Information on the inventory is available from CRF's Web site at <http://www.crf.inia.es>. Management and characterization data are available for those accessions maintained and characterized at CRF. The latter include *Cicer arietinum*, *Lathyrus cicera*, *L. sativus*, *Lens culinaris*, *Phaseolus vulgaris*, *Pisum sativum*, *Vicia articulata*, *V. ervilia*, *V. narbonensis* and *V. sativa*.

Activities related to legume genetic resources in Turkey

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Introduction

Turkey is one of the most important countries in the world for plant genetic resources and plant diversity. Owing to its geographical situation at the intersection of two centres of origin (Near East and Mediterranean Centre), Turkey is the centre of origin and/or centre of diversity for several crops. The Turkish flora is very rich and diverse, species endemism is very high, and the country is a meeting point for three phytogeographical regions (Euro-Siberian, Mediterranean and Irano-Turanian).

Plant genetic resource activities began in 1964 and were reorganized in 1976 within the National Plant Genetic Resources Research Project (NPGRRP). The Aegean Agricultural Research Institute (AARI) has now taken over overall responsibility at the national level, in its capacity as project centre. Cooperation with various institutions is arranged according to the principles set out in the "National Code of Conduct on Collection, Conservation and Utilization" issued by FAO in 1992. All joint programmes are conducted on a project basis within specific agreements.

Systematic collections and surveys are conducted according to various priorities, such as prevalent erosion factors, construction of dams and irrigation canals, grazing, and land development for industry. Herbarium specimens are also collected to facilitate identification and to illustrate the phenotypic variation present in the populations.

Survey and collecting, multiplication and regeneration, and utilization activities are organized around crops or plant groups—cereals, food legumes, forage crops, industrial crops, vegetables, fruit trees and grapes, ornamental plants, medicinal and aromatic plants, and endemic plants.

The collected seed material is preserved in cold storage at the AARI genebank, where the needs for long- and medium-term storage for the base and active collections, as well as short-term storage for working samples, are thoroughly met (Table 1). In addition, base collections are stored at the Field Crops Improvement Centre in Ankara for safety-duplication.

Table 1. Conservation facilities in cold storage at AARI genebank

	Temporary storage	Medium-term storage	Long-term storage
Temperature	+4	0	-20
Seed moisture content (%)	6-8	6-8	6
Storage volume (m^3)	80	240	120
Space availability	yes	yes	yes
Container type*	LAP	SCN	SCN
Viability monitoring	-	5-year interval	10- year interval

* LAP: aluminium laminated foil bags; SCN: sealed can containers

Grain legume genetic resources

Turkey is a centre of origin and/or a centre of diversity for lentil, chickpea, *Pisum* spp., and a micro-centre for faba bean, bean and cowpea.

According to the findings of paleo-ethnobotanical material obtained from excavation of early neolithic village sites, Turkey is possibly one of the first domestication areas of lentil and chickpea.

All species of *Lens* (*L. culinaris* Medik, *L. orientalis* (Boiss), *L. nigricans* (Bieb) Godr., *L. ervoides* (Brign.) Grande and *L. odemensis* Ladiz.) occur in Turkey (Davis 1970; Ladizinsky 1986; Ferguson *et al.* 1996).

Eleven *Cicer* species exist in the country and some of them are endemic (Acikgöz *et al.* 1997). A wide diversity exists of cultivated chickpea in Turkey. Small-seeded chickpeas are common in southeastern parts of the country, while the large-seeded types are found in the Transitional Region and the West.

The wild, weedy and cultivated forms of *Pisum* are found in Turkey where the primary and secondary gene centres of origin overlap. Wild species of *Pisum* have been conserved in isolated areas, primarily in the eastern Mediterranean region.

The close relatives of *Vicia faba* are restricted to the Near East, including Anatolia, a possible gene centre of *V. narbonensis*, presumed wild ancestor of *V. faba*. All three types of *V. faba* (*major*, *minor* and *equina*) are cultivated in Turkey, but most of these have pods capable of shattering and can be assumed to be primitive populations.

Phaseolus bean (*P. vulgaris*) is also cultivated throughout Turkey, owing to its adaptation to the various climatic conditions prevalent in Turkey. Five main seed colour groups have been identified, namely: white, black, red, ocre and brown. There are also various patterns of spots, flecks and stripes on the basic colours.

Primitive populations of cultivated legumes (landraces) maintain a high level of genetic heterogeneity, more frequently than wild populations.

Ex situ conservation

The total number of legume accessions, including wild relatives collected since 1964, exceeds 5200 (Table 2). Between 1998-2001, collecting missions were mostly conducted via the Provincial Directorates. The latter have collected and sent to AARI 451 chickpea and 389 *Phaseolus* landraces. Some additional material was also collected during these collecting missions.

Table 2. AARI food legume collections (2001)

Genus / species	No. of accessions
Cicer	1790
Lens	615
Pisum	157
Phaseolus vulgaris	2264
Vicia faba	342
Vigna unguiculata	71
Dolichos spp.	5
Total	**5244**

Multiplication an regeneration

Stored accessions with low germination rates, small amounts in active collections or which are insufficiently represented in the collection are subject to multiplication and regeneration programmes.

Regeneration/multiplication is usually programmed to take place in zones characterized by ecological conditions that are similar to those where the material was collected. For instance, *Lens* material has been multiplied in Central Anatolia or southeastern Anatolia. Regeneration/multiplication programmes are conducted on an *ad hoc* basis—in practice, almost every year.

Evaluation and characterization

The IBPGR/IPGRI descriptor lists are used for characterization and evaluation programmes. These activities are carried out in conjunction with breeding programmes, as is the introduction of the collection to breeders. Some data are also recorded during multiplication, but the material is usually evaluated for a particular character. For instance, most of the chickpea accessions were evaluated for Ascochyta blight, and a few were found to be moderately resistant and tolerant. Primary studies on chickpea characterization were carried out on 30 accessions in 1992 (Açikgöz *et al.* 1994). In 1993, systematic characterization of chickpea accessions was started on the material collected from the Aegean region at AARI (Cinsoy *et al.* 1997a, 1997b). Characterization of chickpea material was nearly complete in 2000. Some of the faba bean material was also characterized in 1992 and some characters were found to be most variable. Characterization of 331 *Lens* accessions collected from Central and North Transitional Anatolia was carried out by the Field Crops Improvement Centre in Ankara in 2000.

Utilization

Material is freely available to breeding programmes and scientists, both at national and international levels. Exchange of plant genetic resources depends on the availability of accessions for distribution. Feedback information is requested for the accessions dispatched from the Turkish genebank or collected jointly with other institutes. Legume genetic resources are used extensively by the breeding programmes at AARI. Some of the registered legume varieties—'Eresen-87' (faba bean); 'Firat-87', 'Sultan-l', 'Emre-l' and 'Kişlik pul-11' (lentil); and 'Canitez-87' (chickpea)—originated from local populations.

In situ conservation

In situ conservation aims to maintain wild crop genetic resources in their natural distribution areas, and to maintain landraces and local varieties in on-farm conditions. It covers different areas of the country. The first project related to *in situ* conservation was initiated in 1993, with the "*In situ* conservation of plant genetic diversity project", which involves the collaboration of the Ministry of Agriculture and Rural Affairs (MARA), the Ministry of Forestry (MOF), and the Ministry of Environment (MOE). MARA and MOF were the project-implementing ministries. The objectives of the project were as follows:

- To identify and establish *in situ* conservation areas in Turkey for the protection of wild genetic resources originated in Turkey.
- To test and develop a new approach for the conservation of genetic diversity.
- To provide sustainable *in situ* conservation of wild genetic resources of field and horticultural plants, and forest trees.

The project components have been determined as:

- site surveys and inventories,
- gene management zones (GMZs),
- data management,
- a National Plan for *in situ* conservation, and
- institutional strengthening.

Site survey and inventory activities included: an ecosystem-based survey to determine suitable habitats; species-specific inventories to describe species' abundance and distribution; and some collecting for *ex situ* conservation, since the *in situ* conservation project is complementary to existing *ex situ* conservation programmes. The following pilot areas have been selected:

- Kazdag, in the Northwest, to represent the Euro-Siberian, Mediterranean and Irano-Turanian regions;
- Ceylanpinar State Farm, in the Southeast, representing the Mediterranean and Irano-Turanian regions; and
- the Anatolian Diagonal, in South and Central Turkey, representing the Mediterranean, Irano-Turanian and Euro-Siberian regions.

AARI had the responsibility of coordinating the MARA studies and undertaking the project in Kazdagg and Anatolian Diagonal, whereas the Field Crop Research Institute is mainly responsible for the studies in Ceylanpinar State Farm.

In Kazdag, indigenous chestnut and plum species have been determined as target species and six gene management zones have been selected—three for plum and three for chestnut. Ceylanpinar State Farm has been selected for wild cereals. The Anatolian Diagonal has been selected for wild relatives of cereals and legumes that originated in those particular areas. Initial surveys were carried out in the Anatolian Diagonal, and candidate GMZs were determined as follows: three for wild lentils (*L. ervoides* and *L. orientalis*), three for *Pisum* spp. and two for *Vicia johannis*.

A National Plan has been prepared and protection work is being undertaken.

In 2000, two additional *in situ* projects were conducted, one on "*In situ* (on-farm) conservation of landraces grown in the northwestern transitional zone of Turkey", and the other on "Ecosystem conservation and management for threatened plant species" (for details see below, section on *in situ* conservation, this volume, p. 117).

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Grain legume species and the Australian Temperate Field Crops Collection

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The pulse industry in Australia

Grain legumes or pulses have become a major component of grain-based farming systems in many parts of Australia over the last two decades. The five major pulses grown in Australia are temperate crop species: chickpeas, faba beans, field peas, lentils and lupins. In addition, there are a number of smaller and/or niche market crops such as peanuts, mung beans, adzuki beans, navy beans, cow peas and pigeon peas, which are classified as summer pulses.

The area currently sown to pulses in Australia is approximately 2.25 million hectares from which around 2.5 million tonnes of grain, with a commodity value of over $A675 million, is produced. Pulses also contribute additional yield and protein benefits to following cereal and oilseed crops where they are included in the farming system. This contribution has been estimated to equate to an additional $A300 million or almost 30% of the total value of the pulse crop.

The pulse crop in Australia has the potential, assuming all constraints are overcome, to increase from its current size to 4.2 million hectares, with an estimated value of $1.5 billion for the grain and of $500 million as additional crop rotation benefits. To enable the Australian pulse industry to reach this potential, numerous issues facing the industry need to be identified and addressed. Many of these are constraints to on-farm productivity and can only be addressed through genetic improvement of the crops concerned. This provides a very valid reason for maintaining a comprehensive and active germplasm collection.

The main driving force in pulse breeding in Australia is the need for improved adaptability to a very wide range of agroecological environments. Pulse growing areas in this country cover a multitude of tropical, subtropical and Mediterranean climates with very variable acid to alkaline soils and very diverse rainfall patterns. Tolerance of numerous biotic (diseases, insect pests) and abiotic stresses (drought, water logging, frost etc.) is an objective of many pulse breeding programmes. In addition, there is interest in turning some of the pulses into higher value products and towards quality markets to improve industry profitability (human food, pharmaceuticals etc.). Again, access to genetic resources is required to make this happen.

The need for genetic resources in Australia

Agriculture in Australia is based almost entirely on exotic plant species. Virtually all pasture and crop plants have been introduced from overseas and because there are no native sources of variation for these species, Australia must rely on germplasm obtained from other countries.

For many years, organized programmes of plant introduction have played a key role in improving productivity of Australian agricultural industries. Large numbers of accessions have been introduced; many have been used directly as cultivars while others have been utilized after local selection or in plant breeding programmes.

Because efforts to preserve germplasm have not always kept pace with plant exploration and collection, many of the earlier introductions have been lost. For this reason and because of the critical importance of plant genetic resources to Australian agriculture, there is a clear need to ensure that adequate supply of germplasm of the most important crop and pasture species is properly maintained.

Australia's activities in the area of genetic resources of agricultural plants have evolved into the formation of plant genetic resource centres (PGRC). By the late 1970s, a network of eight such centres was established. This network includes two centres that have a mandate for pulse species:

- **Australian Temperate Field Crops Collection (ATFCC**, temperate oilseeds and pulses) at Horsham, Victoria which maintains species of *Pisum*, *Cicer*, *Vicia*, *Lens*, *Lupinus* and *Lathyrus*, in addition to oilseed crop species.
- **Australian Tropical Field Crops Collection** (tropical cereal and legume crops) at Biloela, Queensland, which maintains species of *Phaseolus*, *Cajanus*, and *Vigna*, and many other tropical cereal and oilseed crop species such as *Arachis*, *Glycine*, *Gossypium*, *Helianthus*, *Nicotiana*, *Oryza*, *Panicum*, *Pennisetum*, *Setaria*, *Sorghum* and *Zea*.

The PGRCs perform a range of functions:

- Establish comprehensive germplasm collections of each nominated species to meet foreseeable breeding requirements, utilizing material already in Australia as well as new introductions when required from overseas collections and from areas of species diversity.
- Arrange the introduction and quarantine of germplasm. Other Australian organizations can import germplasm into Australia, but there is an obligation to provide subsamples and appropriate documentation to the relevant centre.
- Supply material on request to plant breeders and other researchers both in Australia and overseas.
- Establish close contact with scientists working with individual species, keeping them informed of new accessions to the collections. Close liaison is maintained with IPGRI and national and international collections concerned with the same species.
- Maintain, regenerate and document collections to internationally approved standards. Duplicates, at least of critical and unique material, are stored at a safe distance from the base collection.

The PGRC network was very interactive during the period 1983 to 1988, primarily with issues involving the expansion of existing centres and the establishment of new centres. Since then the PGRCs have been forced to focus on issues of long-term funding and maintenance. These very issues, and the inability to obtain consensus among the key stakeholders in resolving them, still remain of serious concern.

In the meantime, the centres have continued to fulfil their role of servicing user requirements for the introduction, quarantine, multiplication, documentation, characterization, maintenance and storage of germplasm—their original mandate. They have, in practice, been undertaking these activities individually by independently obtaining what funding they can from what sources they can, usually as a combination of funding from the host state agency and from a Research & Development Corporation.

Recent changes

A number of recent developments have been identified as directly influencing the network and how it does or should operate. These include international developments, including the International Undertaking on Plant Genetic Resources and the Convention on Biological Diversity, plant breeders' rights and intellectual property issues, progress in biotechnology and implications such as including GMOs. Plant quarantine is an important consideration for Australia and quarantine regulations can change over time, for example with previously 'Permitted' species now being classified as 'Prohibited'. Public sector (State agencies, Industry, etc.) funding for the operation of PGRCs is declining, while the impact of increasing private sector breeding is also an important factor.

In addition to funding, many other issues need to be resolved such as:

- Linking PGR system activities with all facets of plant improvement, including biotechnology.
- Increasing the efficiency of quarantine through partnership with the Australian Quarantine Inspection Service.
- Management of Material Transfer Agreements (MTAs) for incoming and outgoing germplasm. For example, who signs, etc. for material being imported.
- A standard approach to determine if and when material should be classified as less or more important, and where it should be stored and under what conditions.
- Standard procedures for handling Intellectual Property issues.
- Procedures for storage of samples for plant breeders' rights registration and cultivar certification.
- Samples of new genetic materials (cultivars, parental lines, etc.) bred and released in Australia, should be placed in PGRC.
- Coordinated access to other national collections and collection trips, which were in the past handled by individual institutions in Australia.

The PGR scene in Australia has changed significantly since the network was established. International developments through the Convention on Biological Diversity and the ongoing FAO Undertaking are likely to establish new standards for how countries manage resources received from other countries, involving commitments and conditions. Protocols may be developed for exploration, evaluation, characterization, documentation and conservation of materials and for transfer of material to third parties. They would define allowable uses in plant improvement programmes and subsequent intellectual property and commercialization initiatives, and would specify requirements for reporting and monitoring.

Utilization of Genetic Resource Centres

Underlying the activities in genetic resource management is the recognition that storage of seed in itself is not sufficient and that information on the accessions being held adds value to germplasm.

No one would deny that all stakeholders would like to see plant genetic resources efficiently and effectively utilized. However, the key to efficient utilization is the combination of germplasm plus information. Questions to be asked are: what is the current level of efficiency with which the PGRC is being utilized, and how can it be improved?

In Australia, germplasm is not evaluated by PGRCs as this activity is not considered to be part of their mandate. End-users evaluate some germplasm, but how much of the data collected is linked back to the germplasm database remains unclear. For increased recognition of the role and value of the PGRC and to attract funding, it is important to gather evidence that shows the value of the PGRC to an industry.

The Australian Temperate Field Crops Collection

The Australian Temperate Field Crops Collection (ATFCC) holds 30 000 accessions of temperate pulses and oilseeds, comprising 329 species. National plant breeding programmes are the primary users of the collection. Overseas breeders and researchers are welcome to use the ATFCC services, and seed and information exchange is encouraged. The information recorded about the ATFCC accessions ranges from the basic (accession number, name and source for the smaller and less used collections), to extensive character observations on the larger and regularly used collections such as peas and chickpeas. The information is held on computer, and can be distributed either as a hard copy or on a computer disk or in an e-mailed file.

A significant feature of the ATFCC is its collaboration with other Australian and international institutions. This includes the Centre for Legumes in Mediterranean Agriculture (CLIMA) in Perth, the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India. While the ATFCC is a national institution, it is also very fortunate in being located on the campus of a major plant breeding establishment. The Victorian Institute for Dryland Agriculture (VIDA) is Victoria's major breeding centre for the grains industry. VIDA is located in a major cropping region and has a lead role in a number of national pulse and oilseed breeding programmes and the associated technology that supports them. This co-location of the PRC with a research institute creates opportunities for synergistic relationships in genetic resources activities with breeders, who already collect evaluation data on accessions.

With the increasing pace of technological change within plant breeding, VIDA has established a series of strong affiliations with research organizations and grains companies nationally and internationally. A special feature is its joint arrangement with the University of Melbourne in the Joint Centre for Crop Improvement, which involves some 45 post-graduate research students. Biotechnology, including molecular techniques, are very much part of this joint research approach. The VIDA campus is also seeing a further expansion into a Grains Technology Precinct, which will bring together public, private and academic research organizations, all focused on outcomes for the Australian grains industry. These relationships are giving a wide industry exposure to the ATFCC.

The pulse collection

Pulse accessions held by the ATFCC are listed in Table 1.

Table 1. The ATFCC pulse collection

Genus	No. of accessions
Pisum	4586
Cicer	5960
Vicia	3797
Lupinus	2767
Lens	3841
Lathyrus	1019
Interim*	2419
Total pulse and oilseed species	**30090**

* Undergoing classification in preparation for allocation to crop groups

Storage facilities

The ATFCC drying room operates at 15°C and 15% relative humidity. Total storage space covers 10.2 m^3. The seed is dried to 5% moisture prior to placement in storage.

The working collection store operates at 2°C and has a storage volume of 51.0 m^3, while the long-term storage operates at -18°C and has a storage volume of 10.2 m^3.

Regeneration of accessions

Accessions are regenerated in field, glasshouse and screen-house nurseries. Outcrossing species such as faba beans are regenerated in bee-proof enclosures. The field nurseries are conducted on the VIDA field station at Lower Norton, 5 km west of Horsham.

Characterization and documentation

Upon arrival seed characters are recorded and, more recently, digital images are added to the database. During regeneration observable characters are recorded and added to the database.

Quarantine

The ATFCC is a registered quarantine facility and is the major quarantine introduction centre for temperate pulses in Australia. As part of the quarantine requirements for overseas introductions, virus indexing of pulses is conducted using PCR and ELISA methods developed at the ATFCC. Approximately 1400 new pulse seed lines are processed through quarantine each year.

Roles of ATFCC

As with other centres in the Australian PGRC network, the ATFCC has a function in several areas:

- Seed introduction and quarantine
- Seed distribution
- Information gathering
- Data distribution
- Long-term conservation
- Brokering seed and information exchange.

Information available from the ATFCC

The information from the ATFCC can be accessed in different ways:

- Catalogues, which lists basic accession information
- Character information: information on basic morphological characters of accessions
- *Index Seminum*: a list of the number of each species held
- Species Gazetteer: a list of the number of species held for each country of origin.

Database

All accession information is held on computer-based systems. The passport data and operational procedures are recorded and tracked by in-house developed utilities in MS Access and MS Excel. The ATFCC is collaborating with the other Australian PGRCs to develop a national database gateway and in upgrading and Web-enabling of all the PGRC databases.

Future plans

It is important to ascertain how and to what extent the collections held by ATFCC differ from other large collections overseas. Many accessions may be duplicates of accessions held elsewhere, a common problem among different germplasm collections that each have their own ID numbering system.

Despite general accessibility to passport data, the sheer volume of some germplasm collections tends to deter breeders from using the facility on a frequent basis. If screening techniques for certain desirable traits are cumbersome, it can be a daunting task to wade through so many accessions. The definition of core collections that are representative of the overall collection for a particular species would facilitate a scientific approach to genetic resource management and access to collections by breeders and other users. Diversity analyses need to be conducted, using basic information available such as geographic origin, phenological data and molecular profiles of the accessions. To start that process, a study of the diversity among *Pisum fulvum* accessions held in Australia, as expressed by comparative molecular profiles, has been conducted (Ford *et al.* 2001).

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Research

Strategies and procedures for the regeneration of Vicia faba *L. germplasm: practical considerations*

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Introduction

The purpose of this report is to provide an overview of the activities of the Instituto de Agricultura Sostenible (IAS) and of the Centro de Investigación y Formación Agraria de Córdoba (CIFA) dealing with the regeneration of *Vicia faba* L. germplasm, and to present recommendations to improve the effectiveness of faba bean regeneration.

The CIFA faba bean working collection, located at Córdoba, consists of 1400 accessions. Seeds are kept in a cold room (2-4ºC) at low humidity (41-45%). Most of the accessions are Spanish landraces that have been obtained through direct field collection and germplasm exchange. Landraces of faba bean are genetically heterogeneous populations composed of inbred lines and hybrids produced by various levels of outcrossing.

Activities were previously directed towards germplasm evaluation and characterization. We were mainly interested in extracting specific genetic traits for our breeding programmes. The world germplasm collection was evaluated and has been described in the past (Piqueras 1991). At present, funding is also provided by the Programme for the Conservation and Utilization of Plant Genetic Resources of the Ministry of Agriculture, Fisheries and Food (MAPA). The programme provided financial support to obtain enough material for the distribution of seeds to other institutions or centres, mainly to the Centro de Conservación de Recursos Fitogenéticos (CRF) in Madrid.

The questions currently being addressed are related to the management of germplasm. One of the problems is the need to regenerate the entire collection. Regeneration is difficult because of lack of knowledge about the selection of the optimal regeneration protocol for the species concerned. Besides, the effects of various options are also often unknown. Our main focus at present is the development of protocols for effective regeneration of accessions and the formulation of guidelines in order to maintain the genetic integrity of accessions. The optimal protocol for regeneration depends on numerous factors. One of the main ones is the breeding system.

Mating system of *Vicia faba*

Knowledge of mating patterns is necessary to formulate multiplication strategies. *Vicia faba* is a partially insect-pollinated crop. We will examine the latest relevant knowledge of the mating system of faba bean as an example of the variability in outcrossing rates. Suso *et al.* (2001) compared the outcrossing rate of the same varieties in two locations: Rennes (Brittany, France) and Córdoba (Spain). Both locations have shown that considerable levels of outcrossing can occur. Outcrossing ranged from 0.22 to 0.46 at Rennes with an average of 0.33. However, the average outcrossing rate of cultivars growing at Córdoba was 0.62, ranging from 0.54 to 0.72. Moreover, 62% of the progeny at Córdoba was the result of outcrossing; in contrast 67% of the seeds produced at Rennes were the result of self-fertilization. It should be borne in mind that the degree of outcrossing in the same populations varies with the location. It is therefore not possible to lay down a unique simple optimal protocol.

As a consequence of partial outcrossing there are two main ways of maintaining the germplasm collection: as inbred lines or as populations. It is the responsibility of every curator to adopt appropriate genebank-specific procedures. In IAS-CIFA the original accessions are maintained both as populations and as pure lines through a process of self-pollination. The effect of self-pollination is one of the issues that the faba bean germplasm manager must face when multiplying seeds.

Evaluation of the selfing process

It is thought that the consequences of selfing evolve alongside the level of outcrossing in such a way that a high level of outcrossing would be associated with strong inbreeding depression and high self-fertilization with weak inbreeding depression. Differences in outcrossing among botanical groups have been mentioned (Bond and Poulsen 1983). Taking into account the differences in outcrossing, the consequences of self-fertilization could be different among the different groups; inbreeding effects should be smaller in selfing groups than in outcrossing groups. Moreover, if any of the groups do not show marked inbreeding depression, they could be maintained as inbred lines.

We investigated (Nadal *et al.* 2001) whether there were differences in the consequences of selfing depending on the botanical group. Selfed seed of two levels, S_1 and S_2, were produced. The S_1 level was obtained from the original seed (S_0) in selfed pollination conditions and S_2 were obtained from S_1 seed in selfed conditions. Discriminant analysis was performed on each botanical group (*major*, *equina* and *minor*), to understand the manner in which significant segregation among levels of selfing is achieved and the contribution of different floral, yield and yield distribution traits to the differentiation between levels of selfing. Selfing progressively changes the performance of each botanical group away from the original population and the three levels of selfing are clearly and dramatically different. Besides, such changes can accumulate over successive cycles of selfing and there is no unique directional selection. The main trait affected by selfing depends on the botanical group. In the *major* group the differences among the levels of selfing are due to the number of ovules and seeds per pod, that decreased, and to the number of nodes between the first flower and the first pod, that increased. Self- and open-pollinated plants in the *equina* group differ mainly in the number of seeds per plant, that decrease, and the number of nodes between the first flower and the first pod, that increase. However, in the *minor* group the main difference among the levels of selfing is due to the number of seeds per plant, that decreases. Two features stand out: 1) the highly heterozygous and heterogeneous nature of faba bean populations render them particularly vulnerable to change by selfing; and 2) in contrast to *equina* and *minor* groups there was no significant contribution of the number of seeds per plant to the discrimination among levels of selfing in the *major* group. This is consistent with the idea that *major* accessions are more self-fertile than *equina* and *minor* accessions. Due to the drastic change of accessions we suggest considering more integrated and global strategies.

Much of faba bean pollination depends on wild vectors (Bond and Kirby 1999; Pierre *et al.* 1999). Therefore, an alternative approach to accession multiplication might include the use of open-pollination conditions, wild bees and planting patterns to prevent gene flow among different accessions and to maintain the level of outcrossing within them.

Open-pollination multiplication tactics

Multiplication in open-pollination conditions is difficult because there is limited information on how to maintain genetic integrity. Curators are mainly concerned about genetic erosion due to genetic drift (random loss of alleles) and genetic shift (selective loss of alleles) on one hand, and contamination by foreign pollen on the other. During regeneration, the main risk to the maintenance of genetic integrity of an accession comes from contamination from foreign pollen (Holden *et al.* 1993). Brown *et al.* (1997) also emphasized the threat of contamination during regeneration and the importance of preventing it. A small number of migrants is sufficient to modify the genetic structure of the population. Thus, for outcrossing species, control of pollination is the major issue. Moreover, it is usually preferable to maintain the same proportion of outcrossing in regeneration plots as occurs naturally. Any method of regeneration involves the maintenance of the level of allogamy and prevention of contamination by alien pollen. Most of the data on faba bean gene flow are from the experiments of Bond and Pope (1974), Xanthopoulos *et al.* (1986) and Link and von Kittlitz (1989).

Historically, regeneration takes place in fields where accessions are grown side by side; the accessions are generally planted in plots close enough together so that they can cross-pollinate. Ensuring adequate isolation from pollen exchange between accessions is, therefore, the most important step in maintaining genetic integrity during regeneration. There are several ways to achieve this.

Inter-accession crossing could be decreased by isolation by spatial distance, growing each regeneration plot far away from others. Spatial isolation has been used by many curators because effective pollen flow is leptokurtic, with a rapid decrease in the rate of gene flow over distance. Most of the pollen may travel only a few metres despite the fact that it is capable of movement over long distances. However, regenerating the large number of accessions required by isolation by distance is usually not practicable.

In addition to isolation by spatial distance, other measures of management practices could be used. The pollen flow can be further interrupted and reduced by intervening barriers of other species. Possible partial barriers include tall crops, crops of flowers with similar colour, morphology, scent, etc. Isolation by a combination of distance and pollination barriers was a practice in some genebanks but cannot guarantee sufficient control (Robertson and Cardona 1986). Isolation, discarding outer rows of the plot, since the majority of alien pollen will be in these plants, is another method of preventing gene flow among accessions.

Our objective was to evaluate the relative efficiency of different methods not only in securing isolation between accessions but also in maintaining mating within accessions. Mating patterns may be determined by the genetic background of the pollen receptor, of the pollen donor and/or by specific interactions between these two genotypes.

Biochemical markers, such as isozymes, have been extensively used to assess gene flow during seed multiplication. The use of these markers has enabled breeders not only to estimate the proportion of seed resulting from outcrossing between accessions and outcrossing within the same accession, but also to study how individual genotypes function as both pollen donor and pollen recipient, and the proportion of ovules fertilized by different kinds of pollen.

Estimation of gene flow

Plant material

Gene flow was measured in a multiplication field where different genotypes with contrasting isozyme banding patterns of 'Alameda' cultivar were planted. *6Pgd* and *Sod* isoenzymatic system loci were used as markers of the mating patterns. Mating events have been divided into 1) outcrossing outside the plot; 2) outcrossing among different genotypes within the plot; 3) outcrossing within the same genotypes within the plot and selfing. It was not possible to assess outcrossing within genotypes, therefore selfing and crosses within a genotype were pooled.

Gene flow among plots could be described in terms of the plant's function as maternal parent, i.e. pollen recipient (contamination), and its function as pollen donor, i.e. pollen dispersal. Contamination refers to the proportion of progeny in one plot fertilized by alien pollen from plants from neighbouring plots. Pollen dispersal refers to the successful production of seed on plants of other plots.

The following combination of markers was applied to the study of the mating patterns.

6Pgd locus was used to characterize the mating among plots. Selection within the cultivar 'Alameda' at the *6Pgd* locus resulted in four genotypes, each with a banding pattern. Each plot was homozygous for an allele that was absent in the surrounding three plots. Because the genotypes in each plot were homozygous for the marker allele, all the progeny resulting from selfing or crosses within the plot will also be homozygous for this allele. The presence of individuals that were homozygous for the tester alleles indicated no crossing outside the plot. By contrast, inter-plot crossing progeny will be heterozygous at this locus and their paternity will also be assigned. The amount of contamination was described as the proportion of heterozygous progeny inside the plot. The amount of pollen dispersal per genotype was described in terms of the number of seeds fathered outside the plot, and the quantification was assessed by monitoring the frequency of heterozygotes produced outside the plot.

Sod isozymes were used to identify the crosses inside the plot. In three of the four 6*Pgd* genotypes a *Sod* marker was included. The assessment involved two different *Sod* loci. The different *Sod* genotypes were in 1:1 proportion. Summary of the crossing events and the diagnostic isozyme loci and alleles for every plot is shown in Table 1.

Table 1. Summary of the crossing events, diagnostic loci and marker alleles for the four plots

Plot	Crossing event	Diagnostic locus	Marker allele (proportion in the plot)
1	Inter-plot	*6Pgd*	3
	Intra-plot	Sod_3	1,3 (1:1)
2	Inter-plot	*6Pgd*	1
	Intra-plot	---	---
3	Inter-plot	*6Pgd*	5
	Intra-plot	Sod_3	3,5 (1:1)
4	Inter-plot	*6Pgd*	7
	Intra-plot	Sod_1	1,3 (1:1)

Field experiments

Experiments were conducted at CIFA. The genotypes were planted to simulate a multiplication field allowing naturally occurring pollinators (mainly wild bees, *Eucera numida*) to visit the flowering plant. The experimental design consisted in four plots, each corresponding to one allele of *6Pgd* locus. At the same time, each of the four *6Pgd* genotypes was composed of two genotypes contrasting for one of the *Sod* loci. The ratio of *Sod* markers per plot was 1:1. Pure lines of the different genotypes were produced by controlled self-pollination to provide seeds for the four plots.

Plot size and shape

The level of gene exchange between plots is determined by numerous factors, including their size and shape. Different size and different shape can produce differences in the amount of pollen that it is transferred.

Plot size for regeneration has been considered by most curators in order to balance the risk of gene loss against the added cost of larger plots. Their concern is to keep plot size as small as possible, commensurate with maintaining integrity and producing sufficient quantities of seed to maintain the accession and satisfy the demands for evaluation and use in research and breeding. Genebank standards (FAO/IPGRI 1994) recommended 100 plants; many genebanks use from 30 to 100. We have fixed the size at 120.

Gene flow can also be easily doubled by using long narrow plots instead of square plots. Seeds of the different genotypes were grown in plots of 9 m^2. Each plot was of 5 rows, each row 2.4 m long. Distance between rows was 0.7 m with 0.1 m between plants.

To estimate the efficacy of a barrier to prevent inter-plot crossing, the four plot genotypes were planted in duplicate blocks. Every block of four genotypes was surrounded by 3 m of two types of barrier species: *Brassica napus* and *Vicia narbonensis*. Within the blocks every plot was bordered on all sides by a 2 m strip of *Brassica napus* or *Vicia narbonensis*. The border rows of *Vicia narbonensis* were used because of the species' similarity to *Vicia faba*. The borders of *Brassica napus* were used to provide a place for bees to deposit pollen as they move away from the plot, and as a physical barrier. The *Brassica* was planted about one week earlier than faba beans so that both flowered during the same period.

At harvest 40 plants per plot and 20 seeds per plant were analyzed for *6Pgd* and *Sod* banding patterns. Full details of electrophoretic procedures and the formal genetics of these loci are given in Suso *et al.* (1993).

Data analysis

Variables describing the contamination and pollen dispersion patterns were incidence, rate and total contamination or dispersion. Incidence of contamination was measured by the proportion of plants per plot producing at least one heterozygous seed for the plot marker locus. Rate of contamination was estimated by the proportion of heterozygous seeds per plant in contaminated plants, and total contamination was calculated by multiplying incidence by rate. By analogy with contamination, incidence of dispersion was estimated by the proportion of plants with at least one seed fathered outside the plot per marker locus. The rate of dispersion is the proportion of heterozygous seed fathered outside the plot per plant, and total dispersion was calculated by multiplying incidence by rate of dispersion.

ANOVA was used to study the effects of phenotype and barrier on the incidence, rate and total contamination and dispersion. The variables were arcsin square root transformed to satisfy the assumptions of ANOVA.

The first results referring to inter-plot crossing in the development of our regeneration protocol are presented below.

Pattern of gene flow from outside the plot in a faba bean regeneration field

Pattern of contamination

The incidence, rate and total contamination varied greatly among phenotypes (Table 2). Most of the plants received pollen from outside their plot. Overall, 74% of the plants per plot were contaminated and the mean rate was 15%. The incidence of contamination per plot ranged from 53% to 88%. However, the rate of contamination appeared to be lower and varied from 22% to 8%. Estimated total contamination ranged from 19% to 5%. When calculating the average total contamination it appeared that at least 12% of the seeds in the plots of the multiplication field were fertilized by pollen from the other plots.

Table 2. Gene flow in a faba bean regeneration field: patterns of contamination

Phenotype	Incidence (%)	Rate (%)	Total (%)
1	52.6	8.5	4.5
2	87.9	19.0	16.6
3	85.3	21.8	18.7
4	68.4	13.7	9.4
Average	**73.5**	**15.7**	**12.3**

The amount of contamination that should be considered large or small is debatable. It is not appropriate to specify here a particular target level of contamination. The preferred standard is zero contamination. In some cases genebank policy may accept a low level of contamination but it is not recommended because of the resulting loss of diversity in the collection. However, the ideal target of zero contamination is generally not achievable. Gene flow of the magnitude observed in this study could be considered high or low but is very variable. The main result concerning contamination was the considerable amount of variation among phenotypes: phenotype 3 presented four times more contamination than phenotype 1. The level of contamination might depend on the availability of a key signal that attracts pollinators. Phenotypes that attract more pollinators than others have a higher risk of contamination. The differences among phenotypes may be associated with differences in plant characteristics such as attractiveness and rewards to pollinators. Characteristics of attraction, colours, odours, nectar guides, total numbers of flowers and rewards, pollen and nectar production, should be studied and integrated at the start of the elaboration of a protocol of multiplication.

Pattern of pollen dispersal

Knowledge of pollen dispersal has practical significance where the goal is to minimize crossing among accessions and maximize it within accessions. The ability to donate pollen to plants of other plots varied with the phenotype (Table 3). Estimates of the incidence of pollen dispersion ranged from 61% to 17%. The rate of pollen dispersion varied from 12% to 4%. There were differences among the phenotypes studied in their ability to father seeds outside their plot. Besides, phenotype 1 fathered seeds outside the plot at a rate eight times higher than phenotype 2, four times higher than phenotype 3 and twice that of phenotype 4. Pollen dispersion was not random; most of the available pollen type comes from a single phenotype.

Therefore, pollen dispersion is a major component of gene flow in a faba bean multiplication field. Research is needed in order to know which characteristic is the most important predictor of pollen dispersion ability. Characters that might influence dispersion are pollen morphology, nectar production, inflorescence size, variation in the standard and style length, floral structure. It would be highly desirable to have a key to determine the mating system of accessions.

A primary implication of this study is that the estimation of inter-plot crossing gene flow in a multiplication field by studying only one phenotype and by calculating the contamination may lead to erroneous interpretations. Our analysis of gene flow broadens the usual studies on contamination in faba bean regeneration fields by incorporating the analysis of pollen dispersion and shows that estimation of the contamination on plants functioning as pollen receptors is one of the ways to describe gene flow and must be combined with pollen dispersion in order to design faba bean multiplication fields.

The importance of matching parental genotypes to obtain a low level of inter–plot crossing is emphasized. The characterization of accessions distinguishing those acting as pollen donors, those with a high pollen dispersion ability and those acting as pollen receptors can aid in assembling accessions *ad hoc* and hence decrease the gene flow. Our data suggest that a low capability for receiving pollen from outside the plot is associated with an increased capability to donate pollen outside the plot. Studies investigating the importance of both processes simultaneously and their association with floral characteristics are required.

Table 3. Gene flow in a faba bean regeneration field: patterns of dispersion

Phenotype	Incidence (%)	Rate (%)	Total (%)
1	61.2	12.4	7.6
2	16.5	4.5	0.9
3	29.3	6.6	2.0
4	42.7	8.6	3.7
Average	**37.4**	**8.0**	**3.6**

Evaluation of *Vicia narbonensis* and *Brassica napus* barriers

The planting of multiplication plots as islands in tall surrounding crops acting as barriers to pollen flow is often a feasible and efficient way of achieving reproductive isolation. An unexpected finding was that the amount of contamination in the plots surrounded by *Vicia narbonensis* was not different from the amount of contamination of the plots surrounded by *Brassica napus*. Comparison of the incidence, rate and total contamination and dispersion between the two kinds of barrier revealed no significant differences for either of the variables (Table 4). Robertson and Cardona (1986) suggested that *Brassica napus* reduced bee activity in the faba bean plots; however, the rate of inter-plot crossing was not significantly reduced when compared with bare ground separation. In our conditions, planting a barrier surrounding the plots rather than using a non-cultivated area between them seemed more efficient for restricting inter-plot crossing. Total contamination without barriers in our conditions could be as high as 50% (Lopez *et al.* 1999). Thus, the use of barriers did result in a reduction of between-plot outcrossing rate. However, the fact that *Brassica napus* and *Vicia narbonensis* did not differ in their effectiveness to prevent inter-plot crossing suggests the possibility of looking for other barrier species. Among the legumes, because of their mixed mating system, *Vicia villosa* and species belonging to the genus *Hedysarum* would be candidates.

Table 4. Incidence (I), rate (R) and total contamination (T) in plots surrounded by *Vicia narbonensis* and *Brassica napus*

Phenotype	Barrier					
	V. narbonensis			***B. napus***		
	I	**R**	**T**	**I**	**R**	**T**
1	52.6	9.0	4.7	53.0	8.0	4.2
2	85.8	21.7	18.6	90.0	16.3	14.6
3	81.3	20.7	17.0	89.3	22.7	20.3
4	61.7	13.6	8.4	75.0	13.8	10.4
Average	**70.3**	**16.3**	**12.2**	**76.7**	**15.2**	**12.4**

We are confident that this report will achieve its purpose of extending the debate on faba bean germplasm management, and thereby lead to the development of methodologies for improved germplasm regeneration via new protocols.

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In situ and on-farm conservation

In situ *and on-farm conservation of legume landraces in Turkey*

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Introduction

In situ conservation involves the maintenance of genetic variation at its original location, either in the wild or in traditional farming systems (Maxted *et al.* 1998). In Turkey, activities related to *in situ* conservation were started with an "*In situ* conservation of plant genetic diversity project" as part of GEF in 1993 (Tan 1998; Maxted *et al.* 2001; Tan 2000; Tan and Tan 2000). Details of this project are given above in the section on national collections (this volume, p. 102). In 2000, two more projects were initiated, namely: "*In situ* (on-farm) conservation of landraces grown in the northwestern transitional zone of Turkey" and "Ecosystem conservation and management for threatened plant species".

In situ (on-farm) conservation of landraces grown in the northwestern transitional zone of Turkey

The project is involved in the *in situ* (on-farm) conservation of common bean, lentil, chickpea and hulled wheat landraces grown in the northwestern transitional zone adjacent to the western, northwestern, Black Sea and central Anatolian regions. The project was proposed and carried out on the basis of the "National Plan for *In situ* Conservation of Genetic Diversity in Turkey", according to the priorities of the crop species and regions that are considered to require urgent conservation. Various institutions have cooperated under the coordination of the Aegean Agricultural Research Institute (AARI), namely: the Anadolu Agricultural Research Institute, the Field Crops Central Research Institute and the Aegean University, Faculty of Agriculture, Department of Agricultural Economy. Some local institutions, NGOs, and local farmers have also cooperated in the project, which is fully financed by the Government of Turkey (Turkish Scientific and Technical Board and Ministry of Agriculture and Rural Affairs).

The main objective of the project is to research the possibilities for the on-farm conservation of landraces with the active participation of the farmers. To achieve these general goals, the activities have been programmed as follows:

a) to choose the pilot area using the data and information derived from surveys and collecting missions of AARI in earlier years;
b) to collect the information and build a database of the current state and utilization of landraces by socioeconomic and iconographic surveys of pilot areas;
c) to make an inventory of the landraces still grown in the selected pilot area from the information gathered during the surveys;
d) to collect and evaluate these landraces and to determine agromorphological variation;
e) to conserve the collected landraces in the AARI genebank;
f) to analyze the morphological, ecological and Geographic Information System data obtained in earlier years and during the project;
g) to seek opportunities for *in situ* conservation of the target landraces in the pilot area based on the interpretation of the data from the project; and
h) to show how to protect and conserve landraces grown in the rest of the country based on the experience gained during the project.

Since the two main parts of the project are the inventory of the existing landraces grown in the region and *in situ* conservation of target landraces, which is complementary to *ex situ* conservation, the main components of the project were determined as:

- Ecogeographic surveys and inventory of the landraces
- Socioeconomic surveys
- *Ex situ* seed conservation
- Agromorphological observations
- Genetic analyses
- Establishment of the database and GIS.

The main activities that have been carried out so far within the project are summarized below.

Plant survey and collecting information derived from earlier works was transferred to the database used in the project.

Ecogeographic and socioeconomic surveys for common bean, lentil, chickpea and hulled wheat landraces have been conducted to determine the distribution of landraces and socioeconomic aspects of landrace cultivation. In addition to these selected landraces, other farmers' local varieties (landraces) grown in the transitional zone using traditional agricultural practices were recorded during the surveys to produce the inventory of those aspects. Farm surveys aimed to reveal the socioeconomic profile of the farmers' families, information about the farms or agricultural holdings and the landraces of interest harvested in 1999 and 2000, while inquiries among villagers aimed to collect statistical information on their socioeconomic status and the agricultural activities and marketing of the crops produced on the village lands.

Seed samples and herbarium specimens of the landraces were collected during these surveys. Seed samples of the landraces collected during the surveys are maintained *ex situ*, to complement the *in situ* conservation.

A database of the information compiled in the surveys has been established, allowing a comprehensive analysis of both the collections made in earlier years and those made during this project. In order to carry out the agromorphological evaluation of the collected seed samples of the landraces, the collected material was sown at the Anadolu Agricultural Research Institute in Eskişehir province, one of the regions in the northwestern transitional zone. Observations on the plants will be made using IPGRI's descriptor lists. The agromorphological observations were completed in 2001.

As a brief pre-evaluation of results of the project, this region appears to have retained traditional farming methods to a greater degree than the intensively cultivated coastal region or the Anatolian plateau. The farm population in the region is fully integrated into the national economy and culture of Turkey. Agricultural development planners have been providing improved varieties through the seed corporation, causing landrace plantings to decline. Fragmentation of holdings allows farmers to manage several fields and to cultivate landraces in at least one field. Marginal agronomic conditions, especially steep slopes and variable soils of mountainous lands, make landraces competitive with improved varieties. Farmers keep local races in fields that are relatively marginal, with poorer soils, steeper slopes and higher altitudes. Economic isolation in mountainous areas creates marketing problems and lessens the competitive commercial advantage of improved varieties. Cultural and traditional demands and preferences for diversity cause farmers to maintain landraces. A home garden type of production is common and products are sold in front of the gardens.

The main intention of the project is to determine candidate Gene Management Zones (GMZs) for possible *in situ* (on farm) conservation sites of target species. Data compiled from surveys and genetic analysis will be analyzed in Geographical Information Systems (GIS) to better understand the ecogeographic variation of targeted landraces throughout the region for possible *in situ* conservation on farm. The results of socioeconomic surveys will allow the analysis of gender roles in landrace production. A Web site summarizing the project activities is under construction.

Ecosystem conservation and management for threatened plant species
According to the Bern Convention, 22 species are on the "List of endangered herbaceous plant species" and three of them belong to the Leguminosae: *Thermopsis turcica*, *Glycirrhiza iconica* and *Sphaerophysa kotschyna*. This project has been initiated as collaborative work between the Ministry of Environment (MOE) and the Ministry of Agriculture and Rural Affairs (MARA) for conservation and management of steppe ecosystems, which are important plant areas (IPAs) for the endangered herbaceous plant species listed in Appendix I of the Bern Convention.

Goals to achieve the above-mentioned overall objectives are:
- Identification of IPAs in the project area
- Data management
- Raising awareness and public participation
- Managing the designated IPAs for sustainable use
- Monitoring the area.

The overall planned outputs of the project are:
1. Designation of IPAs in the project area for target species listed in the project proposal
2. Establishment of a database for the IPAs
3. Raising awareness of local public about the need to conserve IPAs and achieve their support in conservation efforts
4. Analysis of effects on IPAs
5. Preparation of management plans for IPAs
6. Implementation of a decentralized management system to achieve sustainable use of natural resources in and around the IPAs
7. Establishment of a monitoring system for IPAs.

The planned goals for the first period of the project were the establishment of administrative and institutional procedures for its implementation, initiating the collection of data and information from the literature about the project area and target species, and the preparation of a technical infrastructure for implementing the project .

The overall planned activities of the project are:
a. Survey and inventory
b. Designation of IPAs
c. Community awareness and participation
d. Data management
e. Development of management plan
f. Institutional strengthening within and between formal and informal sectors.

It was decided that field studies would be planned, coordinated and implemented by MARA in collaboration with MOE and the Turkish Association for the Conservation of Nature and Natural Resources, whereas public awareness and participation studies would be planned by MOE and implemented by MOE and the Association.

Project activities carried out in 2000 and 2001

Initial surveys and inventory studies were carried out in the watershed areas, especially in the Lake District and central steppe. The survey was mainly focused on Konya, Aksaray, Karaman, Isparta and Burdur provinces and around 60 sites were visited. Some sites were initially selected as possible *in situ* conservation sites of threatened species included in the project.

Herbarium specimens and seed samples of the threatened and some other wild associated species existing in the natural flora and the ecosystem were collected. Associated species were also recorded.

The collected seed samples were processed for long-term conservation at AARI Gene Bank, and herbarium specimens are conserved in the AARI Herbarium for further identification. The duplicates of the base collection of AARI will be conserved at the Field Crops Central Research Institute storage facilities. Some possible GMZs were initially identified.

Summary of project activities in the coming years

a. Inventory: species-based field survey, socioeconomic survey, evaluation of effects on IPAs
b. Designation of IPAs: description of habitat types, selection of reserves, designation of reserves
c. Community awareness and participation: preparation of audio-visual materials, workshops, dissemination of produced materials
d. Data management: data entry and analysis, establishment of network
e. Development of a management plan: analysis of the information gathered, preparation of a framework management plan, preparation of detailed plans for each IPA
f. Institutional strengthening within and between formal and informal sectors: training.

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In situ *conservation of wild populations of* Phaseolus lunatus *in the Central Valley of Costa Rica*

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In the conservation of plant genetic resources, particular attention is given to wild ancestral populations of cultigens. Such material represents a possible source of much genetic variation, extremely useful for a plant breeding programme.

Wild materials are not easy to maintain *ex situ* for various reasons, such as a lack of information on their ecogeographic distribution, a lack of knowledge of floral biology and mating system, variation in seed ripening and occurrence of seed dormancy. To circumvent these constraints, *in situ* conservation is considered as a dynamic conservation system enabling the continuing evolution of crop genepools, maintaining genetic integrity and adaptation potential of each population.

In an *in situ* conservation programme, the main goal is to preserve as many variants as possible of the target species, which means conserving locally common and rare alleles at as many sites as possible.

Several operations should be carried out when developing *in situ* conservation programmes. Such operations concern not only the target species but also the management of nature reserves where the wild population is scattered.

A key objective is to monitor population dynamics and this will require a full understanding of some major factors, mainly gene flow, breeding system, demography (describing and explaining changes in a number of individuals within a population) and phenology.

The model selected in the project

The plant model is a food legume, *Phaseolus lunatus* or Lima bean, and particularly the wild populations of the cultigen located in one of the major centres of diversity of the species: the Central Valley of Costa Rica.

Lima bean

Lima bean wild populations are made up of short-lived perennial self-compatible plants, with a mixed mating system. In fact the species is regarded as predominantly self-pollinating. Each plant has a climbing indeterminate growth habit; some are very vigorous, bear numerous pods and are characterized not only by perennial or multiannual behaviour but also by a significant soil seed bank.

The Central Valley

In Costa Rica, wild bean populations are mainly distributed in the Central Valley, particularly in zones of premontane and lower montane humid forests, at altitudes varying from 500 to 1800 m. The region is characterized by a mean annual rainfall varying between 1200 and 3000 mm, with wet and dry seasons.

In the Central Valley, Lima beans are grouped into populations of very varying size. More than 70% of these populations contain less than 5 plants and only 15% contain more than 50 plants. In the valley, Lima bean populations are mainly found in habitats disturbed by man: along the roads, in old traditional coffee plantations, in disturbed areas with grasses and scattered trees or bush thickets, or in more woody habitats.

Why an *in situ* conservation programme on Lima bean in the Central Valley?

Wild Lima bean populations in the Central Valley are seriously threatened by several forms of land use including growing urbanization, severe grazing, seasonal fires in pasture lands and sugarcane plantations, and the replacement of traditional small-scale coffee plantations interplanted with leguminous trees by modern high-input plantations. It is therefore urgent to set up an *in situ* conservation programme and in doing so investigate the major components/factors influencing the population dynamics of species having a similar behaviour or mating system.

Lima bean is regarded as a self-pollinated species with facultative allogamy. Pollination is by insects, mainly social and solitary bees visiting flowers for both pollen and nectar.

We conducted some experiments with a view to study gene flow. The movement of genes within and among populations is one of the most important factors that determine the pattern of genetic variation in wild populations. It is also responsible for the genetic structure within populations and its force constitutes an essential parameter for defining optimal sampling strategies for conservation purposes.

Gene flow depends on the efficiency of three types of gene dispersal: dispersal of seeds, pollen and flowers (through vegetative growth).

What are the results of these investigations?

- First we identified a major pollinator among all the insects visiting Lima bean flowers in the valley: this pollinator is the common bee *Apis mellifera,* known to forage on a rather restricted area.
- In all populations investigated, pollen dispersal was limited: most pollen transfers occurred across distances of less than 1 m. Frequencies of pollen transfer falls quickly beyond one metre. The corresponding dispersal variance σ^2_p = 1.7 m^2, a value probably underestimated because we could not measure pollen transfer over distances greater than 6.9 m.
- Measurements of flower dispersal show great variability, mainly explained by the surrounding vegetation used as support. Mean dispersal variance of flowers was 2.7 m^2 (0.35 to 10.96 m^2).
- Mean dispersal variance of seeds varies between 1.34 and 2.46 with estimated mean value σ^2_p = 1. 68 m^2.
- Considering a mean outcrossing rate t = 0.1 (data from electrophoresis) and the mean adult plant density d = 0.235 pl/m^2 $\Rightarrow$ NA = 96 m^2 and Nb = 7.23 individuals (where NA is the genetic neighbourhood area, an area from which the parents of central individuals may be treated as if drawn at random (Wright 1946), and Nb is the effective neighbourhood size, an estimate of the random genetic drift occurring in a single neighbourhood. For more details and references see Hardy *et al.* 1997).

Therefore random local genetic differentiation is expected. As the studied populations were spread over areas ranging from 100 m^2 to more than 1000 m^2, they could include several to many neighbourhood areas. The conclusion is therefore straightforward: allelic distribution within a population is expected to be highly structured.

The evaluation of genetic variability is mainly aimed at evaluating the whole genetic diversity represented by the wild Lima bean populations present in the Central Valley. Such investigations are necessary to identify the genotypes to be conserved but another important objective will be to understand the genetic organization of the wild material at two levels: intra- and interpopulation, and by doing so suggest guidelines for optimum conservation.

The genetic structure was evaluated using several parameters of population genetics:

- We calculated 5 indices characterizing the intrapopulation polymorphism: P (percentage of polymorphic loci), A (average allele number per locus), A_e (distribution of frequency of the different alleles in one locus), H_o (proportion of observed heterozygotes) and H_e (expected proportion of heterozygotes in panmixy conditions). Results showed a low percentage of polymorphic loci (10%), few alleles per locus, less than 1% heterozygotes and a large heterogeneity in the index values. At the intrapopulation level we also calculated the Wright consanguinity coefficient in order to evaluate the possible divergence of the breeding system from the panmixy or Hardy-Weinberg equilibrium. Data showed that in general the populations were not in Hardy-Weinberg equilibrium.
- We also studied the genetic diversity at the interpopulation level using other parameters, in particular the Nei diversity indices and F statistic analysis. If we consider a reference population subdivided into subpopulations, the total genetic diversity (H_t) is composed of two items: the intrapopulation genetic diversity (H_s) and the interpopulation genetic diversity (D_{st}). The genetic differentiation coefficient among the subpopulations (G_{st}) can be deduced from the ratio D_{st}/H_t. H_t and H_s are 0.193 and 0.082 respectively. D_{st} is estimated at 0.111. G_{st} value is around 0.52, as H_s and D_{st} are very similar. We can see therefore that 52% of the total heterozygosity came from genetic diversity between populations while 48% came from genetic diversity within population. Values as high as 52 % for G_{st} are indicative of a high genetic differentiation between populations. In our case several factors could explain such a high value: for example a limited interpopulation gene flow, a genetic drift responsible for marked fluctuations in allelic frequency or a natural selection on some populations (perhaps in relation with environmental data). If we now consider the F statistics, it is interesting to point out the high value of F_{it}, a parameter measuring the divergence of the genotypic frequencies of a population from the Hardy-Weinberg equilibrium. This high value is due to both F_{st} (measuring between population genetic differentiation) and F_{is} (consanguinity coefficient measuring the effect of non-panmixic crosses within subpopulations). Such deviation from the Hardy-Weinberg equilibrium is therefore the consequence of the breeding system, predominantly self-pollinating.

Demography is a discipline which describes and explains changes in the number of individuals within a population over time. Its study is essential for an *in situ* conservation programme because it will allow the evolution of a population to be predicted, together with its persistence and levels of survival or destruction; it will also suggest how to implement field operations or management designed to preserve these populations.

In plant population demography, the most commonly used method is based upon the projection matrix theory. Such a matrix provides a lot of informatic statistics which are useful for monitoring population dynamics.

The first step was to construct a life cycle graph for each population. In such a graph, individuals are classified into developmental stages or age classes. In our case, in the presence of a substantial soil seed bank, we were able to differentiate seed classes according to their age. All other individuals, juvenile or adult, were grouped into classes according to their developmental stage. This model can therefore be defined as a "mixed demographic model".

In the generalized life cycle graph, each node is associated with a particular age class for the seeds or with a developmental stage for the growing plants. In the model, the projection interval is one year, which means that an arrow joining two nodes expresses the possibility for an individual to move from one to the other class or to contribute by its reproduction to increase the individuals of the other class within one year (G_0 G_1 J L_1 L_2 L_3).

Without going into details, the analysis of such population projection matrices provides a range of measures of the population structure and behaviour that are very useful for conservation.

For example the dominant eigen value of matrix A is the asymptotic growth rate of the population when it reaches its stable structure, i.e. stable distribution of stages/ages. The asymptotic growth rate may be used as a measure of fitness for the population in its particular environment.

From the projection matrix we can also define a sensitivity matrix S. The higher the sensitivity value of a matrix element, the greater the importance of the corresponding phase of the life cycle to the population growth rate. Sensitivity analysis may then be used (a) to determine which phase of the life cycle of the individuals is the most critical for population survival, (b) to quantify the contribution of each vital rate to population growth, (c) to evaluate the effects of environmental perturbations on population dynamics, and (d) to propose management strategies.

The projection matrix models were interpreted with the help of the "Unified Life Models" software.

The information gathered by demography allowed the identification of the major determinants of the population dynamics and the response of populations to contrasting environments. Our investigations also demonstrated differences in the demographic patterns of the studied populations. This is well illustrated by the sensitivity values.

In the sensitivity analysis, values of restricted sensitivity are particularly high in the most natural and protected sites. This indicates a high sensitivity of the populations located in this environment to modification of their life cycle due to disturbances, in particular those resulting from human activities.

The information collected from demography was also very useful to develop conservation and management strategies.

For example in disturbed sites, e.g. along trails or at the edges of coffee plantations, conservation of wild Lima beans should favour the growth of young lignified individuals. As a management practice, we suggest maintaining mulch on the soil surface at the end of the dry season or installing a vegetative cover to guarantee both high air and soil humidity. This practice would favour growth of L_1 individuals. We can also promote recruitment of new individuals from seeds by weeding the soil surface just after seed dispersal at the end of the dry season. This practice will allow rapid germination by exposing the seeds to high temperature in order to break the induced seed-coat dormancy.

In the case of decreasing populations, germination delay caused by dormancy and presence of a soil seed bank are particularly important. Weeding will then favour early germination and allow the emergent individuals to reach the L_1 stage within one growing season.

Total seed production in the population located in the most disturbed sites could be favoured by selecting the adult plants yielding a large quantity of seeds. Seed production could also be favoured by weeding during the rainy season. This ensures sufficient regrowth of the cut individuals.

As human pressure is growing in the Central Valley, even the populations located in the most natural sites are endangered. Our studies have shown that management of populations grown in these sites must favour the survival of L_3 individuals that appear to be a key factor in population dynamics. Selective clearing could also be carried out in these sites to maintain a continuous recruitment of new plants that could potentially serve as a reserve of lignified adult plants. Management should also avoid the adverse effects of high plant densities, by removing some individuals. As fecundity does not play any role in the dynamics of populations located in natural sites subjected to low levels of disturbance, an individual plant's seed production must not be taken into account when selective cuttings of *Phaseolus lunatus* are made in these populations.

Results of the demographic study are now being integrated in the *in situ* management of both natural and synthetic populations in the Central Valley of Costa Rica.

The ultimate objective of this project is of course to integrate the various factors studied (phenology, demography, gene flow, genetic structure, ecological distribution of wild lLima bean population) with a view to implement an *in situ* conservation programme in the Central Valley. To do this, we should preserve as many variants as possible, taking into consideration the different populations, distinct ecological habitats, relations between genetic structure, life zones (according to Holdridges's classification), and soil types of the target zone. Another important aspect of the implementation of the *in situ* consideration programme was to decide between two field options to maintain the selected populations: either preserving all wild populations in their natural sites by preserving a core collection in protected sites not yet colonized by *Phaseolus lunatus,* or using the natural resources already present in the Central Valley.

The first investigations on this component were undertaken in 1997 by integrating the Geographic Information System (GIS) as a tool for mapping the Central Valley as well as selecting and managing conservation reserves.

All environmental data available for the Central Valley were fingerprinted to develop different maps, e.g. climates, life zones, soil types, land use, communication, water course network and position of all the Lima bean populations in the target area. This work was carried out with the close collaboration of the CIEDES (Centro de Investigacion en Desarrollo Sostenible) using the GIS/ARCINFO software.

By doing so we first combined life zones and soil maps to identify all possible environmental combinations in which genetic variation could occur. For example 40 out of 72 possible combinations were derived in the Central Valley, with different distributions of wild Lima bean populations. We could identify two major combinations, representing half of the Central Valley area and containing most of the populations (75%).

Each combination was visited with the aim to locate sites likely to be used as conservation areas. The choice of the sites was guided by the need to retain only sites not likely to be disturbed in the coming years. We decided, on the basis of the actual situation of the Central Valley, to implement small conservation areas ("microreserves") not yet colonized by wild Lima bean, relatively protected from any human disturbance, representing the various ecological regions of the Central Valley and having a microenvironment well suited for wild Lima bean populations. We selected some isolated woody sites, remote from cultivated land or human settlements, mainly located along streams and deep slopes, legally protected from cutting and weeding. In these microreserves, the woody species are very useful to support the lignified and climbing *Phaseolus lunatus* individuals.

From this first analysis and from the identification of microreserves, we suggested planning the *in situ* conservation and management as follows:

- the minimal area of patches was calculated according to neighbourhood area determination; the area varied from 56 m^2 to 150 m^2;
- the number of seeds to introduce was estimated to provide a mean density of 0.35 adult individuals per m^2, assuming the mortality and germination rates observed in the demographic study;
- each patch was cleared to facilitate germination;
- supports were provided for the climbing wild beans, either by preserving those already present or by introducing some useful species;
- 2-3 wide corridors were built up and cleared like the patches;
- a buffer zone of about 5 m is present to protect microreserves;

- in each microreserve, management of the protected populations was applied according to the results of both phenological and demographic studies. For example optimum management operations consisted in favouring L_1 stage individuals, that are the most important for population growth rate. Clearing and selective cutting of juvenile individuals were also practised at the beginning of the dry season, to avoid competition for resources.

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Utilization

Characterization and preliminary evaluation of chickpeas collected from East, Southeast and Central Anatolia

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Introduction

According to the findings of palaeo-ethnobotanical material obtained from the excavation of the earliest Neolithic village sites, Turkey is possibly one of the first domestication areas and centres of origin of chickpeas. There is a wide diversity of cultivated chickpeas in Turkey. Small-seeded chickpeas are common in the southeastern parts of the country, whereas the large-seeded type is found in West and Central Turkey. In Turkey chickpeas are grouped into the following types: Spanish type (*C. arietinum* L. subsp. *arieticeps*), with large and ram's head-shaped seeds; *leblebi* type (*C. arietinum* L. subsp. *intermedium*), with medium-sized, owl-shaped seeds; and the ordinary type (*C. arietinum* L. subsp. *pisiioforme),* with pea-shaped or round seeds (Hannan *et al.* 2001).

Although chickpea genetic resources have been collected and preserved at the AARI genebank since 1964, systematic characterization studies started only in 1992. In the study conducted by Açikgöz *et al*. (1994a) five groups were determined within the 20 chickpea populations on the basis of some morphological characters, and variation was observed mostly in pod number, seed number, seed weight per plant and 100-seed weight. Cinsoy *et al.* (1997) found the most variation in 100-seed weight (16.7–48.5 g) and plant height (27–49.2 cm). Most seeds were ram's head-shaped; less variation was observed in the flower colour.

The study presented below is the second part of the systematic characterization work of chickpeas and covers the accessions collected from East, Southeast and Central Anatolia.

Material and methods

In this study, 327 accessions collected from East Anatolia (47 acc.), Central Anatolia (93 acc.) and South East Anatolia (187 acc.), and 8 registered varieties or populations, namely 'ILC 195/2', 'Canitez-87', 'ILC 482', 'Akçin-91', 'Aydin-92', 'Izmir-92', 'Menemen-92' and a Spanish population were evaluated for 28 characters.

In 1999, all accessions were evaluated for morphological and agronomic characters. Sowing was done on 10 March, following an augmented experimental design. Plots consisted of two rows, which were 4 m long and 0.45 m apart. IPGRI's *Descriptors for Chickpea* (IPGRI 1993) were used for the evaluation, i.e. plant pigmentation, plant hairiness, growth habit, number of leaflets per leaf, leaflet size, number of branches, plant canopy height, plant canopy width, days to 50% flowering, days to maturity, flower colour, number of flowers per peduncle, number of pods per peduncle, pod length, pod dehiscence, yield (grain and biological yield per plant and per ha), seed shape, testa texture, seed colour, absence/presence of minute black dots, 100-seed weight and reaction to low temperature.

A Turkish Statistical Program (TARİST) (Açikgöz *et al.* 1994b) was used to calculate minimum, maximum value, coefficient of variation and Principal Component Analysis.

Results

Some of the results obtained are presented below: minimum, maximum, mean, standard deviation values in Table 1, and frequency of the characters in Table 2. Data were also analyzed according to Principal Component Analysis with a Turkish Statistical Program (TARİST) and were grouped on prin1, 2 and 3.

Table 1. Minimum, maximum, mean and standard deviation values of the quantitative characters

Characters	Average	Minimum	Maximum	Standard deviation
Days to 50% flowering	59.6	55	70	3.9
Flowering duration	17.7	12	31	12.9
Days to maturity	103.8	92	116	4.4
Canopy height	29.9	19.4	53	16.8
Canopy width	37.2	16.8	63.4	21.6
Primary branches	2.9	1.6	4.2	18.8
Secondary branches	3.4	0.0	14.2	7.1
Pods per plant	13.9	2.4	44.2	42
Seeds per pod	1.2	1.0	2.2	20.6
Pod length	2.1	1.4	2.9	8.0
100-seed weight	34.1	12	49.5	17.5
Number of leaflets	6.9	5.0	7.0	4.9
Yield per plant	4.9	0.8	16.8	43.5
Biological yield per plant	9.7	2.4	36.6	45.0
Grain yield (kg/ha)	732.8	117	1958	43.5
Biological yield (kg/ha)	1698.9	592	4211	34.9

Table 2. Frequency table of all characters

Character	Class	Class interval	Number	%
Days to 50% flowering	1	55-57.9	32	9.5
	2	58-60.9	245	73.1
	3	61-63.9	29	8.7
	4	64-66.9	21	6.3
	5	67-69.9	8	2.4
Flowering duration	1	12.0-15.7	46	13.7
	2	15.8-19.5	226	67.5
	3	19.6-23.3	59	17.6
	4	23.4-27.1	3	0.9
	5	27.2-30.9	1	0.3
Days to maturity	1	92.0-96.7	16	4.8
	2	96.8-101.5	95	28.3
	3	101.6-106.3	117	34.9
	4	106.4-11.1	87	26.0
	5	111.2-15.9	20	6.0
Plant type	1	Erect	3	0.90
	2	Semi-erect	202	60.30
	3	Semi-spreading	126	37.61
	4	Spreading	4	1.19
	5	Prostrate	-	-
Number of flowers per peduncle	1	Single flower	335	100
Number of pods per peduncle	1	Single pod	335	100
Pigmentation	1	No anthocynanin, stem and leaves pale green	5	1.49
	2	No anthocynanin, stem and leaves green	323	96.42
	3	Light anthocynanin	7	2.09
Flower colour	1	Light pink	2	0.90
	2	Pink	6	1.79
	3	White	327	97.31
Pod length	1	Short (<15 mm)	2	0.6
	2	Medium (15-20 mm)	66	19.7
	3	Long (>20 mm)	267	79.7
Leaflet size	1	Narrow (<10mmlength, <4 mm width)	12	3.6
	2	Medium (10-15mm length, 4-12 mm width)	319	95.2
	3	Large (>15mm length, 12 mm width)	4	1.2
Pod dehiscence	1	No dehiscence	335	100
Hairiness	1	Lightly pubescent	335	100

Table 2 (cont.). Frequency table of all characters

Character	Class	Class interval	Number	%
Canopy height (cm)	1	19.40-26.11	81	24.18
	2	26.12-32.83	172	51.34
	3	32.84-39.55	69	20.59
	4	39.56-46.27	10	2.99
	5	46.28-52.99	3	0.90
Canopy width (cm)	1	16.80-26.11	20	5.97
	2	26.12-35.43	131	39.10
	3	35.44-44.75	126	37.61
	4	44.76-54.07	51	15.22
	5	54.08-63.39	7	2.10
Number of primary branches	1	1.60-2.11	24	7.16
	2	2.12-2.63	94	28.06
	3	2.64-3.15	101	30.15
	4	3.16-3.67	96	28.66
	5	3.68-1.19	20	5.97
Number of secondary branches	1	0.00-2.83	169	50.45
	2	2.84-2.67	115	34.33
	3	5.68-8.51	38	11.34
	4	8.52-11.35	12	3.58
	5	11.36-14.19	1	0.30
Number of pods per plant	1	2.4-10.75	106	31.64
	2	10.76-19.11	170	50.75
	3	19.12-27.47	51	15.22
	4	27.48-35.83	7	2.09
	5	35.84-44.19	1	0.30
Number of seeds per pod	1	10-1.23	225	67.16
	2	1.24-1.47	59	17.61
	3	1.48-1.71	28	8.35
	4	1.72-1.95	16	4.79
	5	1.96-2.19	7	2.09
Number of leaflets per leaf	1	11-13	10	0.03
	2	>13	325	0.97
Minute black dots	1	Present	6	1.79
	2	Absent	329	98.21
	3	27.0-34.4	137	40.90
	4	24.5-41.9	150	44.78
	5	42-49.4	22	6.57
Seed yield per plant (g)	1	0.8-3.9	117	34.93
	2	4.0-7.1	177	52.84
	3	7.2-10.3	34	10.15
	4	10.4-13.5	6	1.79
	5	13.6-16.7	1	0.30
Biological yield per plant (g)	1	2.4-9.23	163	48.66
	2	9.24-16.07	152	45.37
	3	16.08-22.91	16	4.77
	4	22.92-29.75	1	0.30
	5	29.76-36.59	3	0.90
Seed yield (kg/ha)	1	117.0-485.19	83	24.78
	2	485.20-853.39	152	45.37
	3	853.40-1221.59	67	20.0
	4	1221.60-1589.79	28	8.36
	5	1589.80-1957.99	5	1.49
Biological yield (kg/ha)	1	592.0-1315.79	89	26.57
	2	1315.80-2039.59	171	51.04
	3	2039.60-2763.39	54	16.12
	4	2763.40-3487.19	17	5.08
	5	3487.20-4210.99	4	1.19
Testa texture	1	Rough	172	51.34
	2	Smooth	-	-
	3	Tuberculated	163	48.66
Seed colour	1	Black	1	0.30
	2	Brown	5	1.49
	4	Dark brown	3	0.90
	5	Reddish brown	1	0.30
	7	Salmon brown	3	0.90
	9	Greyish brown	24	7.15

	10	Beige	121	36.12
	11	Light yellow	1	0.30
	13	Yellow brown	1	0.30
	16	Yellow beige	22	6.57
	17	Ivory white	153	45.67

Conclusion

As a result of observations and measurements, in terms of days to flowering, 82.6% of materials were early and medium-early, 67.5% completed their flowering earlier than the mean days to flowering (17.7 days). For most of the material (66.9%) the number of days to maturity was shorter than the mean (103.8 days). Eight accessions were determined to belong to the *desi* type and the others to the *kabuli* type of chickpea. Flower colour was light pink for 2 samples and pink for 6 samples for *desi* types. Low anthocyanin was observed for 8 samples; 5 samples were pale green, and the others (96.4%) were green, without anthocyanin. All samples were in the same group for flower number, pod number at flower stalk, hairiness and pod shattering; 45.7% of the material was below average in terms of canopy height and 51.1% was below average for canopy width. The average numbers of primary and secondary branches were 2.6 and 3.4 respectively. Most of the material (66.9%) matured earlier than the average days to maturity (103 days), and 52.8% of the material set fewer pods than the average pod number per plant (13.9). Most of the material (79.9%) was in the large pod group. A small number of accessions (4) were in the narrow leaflet group, 4 accessions were in the large group, the rest of the material was in the medium group. The seeds had two types of testa identified as rough and tuberculated. The rate of rough and tuberculated testa textures were 51.53% and 48.66%, respectively. Black point was observed for 6 samples. The 100-seed weight ranged between 12 and 49.5 g with a mean of 34.1 g. Mean seed yield and biological yield per plant were 4.9 g and 9.7 g respectively while seed yield (kg/ha) and biological yield (kg/ha) were 732.8 kg/ha and 1698.9 kg/ha respectively.

In general, accessions originating from Central Anatolia were the latest and had the large seed type, high pod number, high grain and biological yield.

Accessions originating from Southeast Anatolia were the earliest, had low canopy width and height, pod numbers, grain and biological yield.

Accessions originating from East and Central Anatolia were owl-shaped, with a rough seed surface, beige in colour.

Accessions originating from Southeast Anatolia had pea-shaped, ivory white seeds, with a tuberculated surface.

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Appendices

Appendix I. Abbreviations and acronyms

AARI	Aegean Agricultural Research Institute, Menemen-Izmir, Turkey
ABI	Institute for Agrobotany, Tápiószele, Hungary
ACDI-VOCA	Agricultural Cooperative Development International - Volunteers in Overseas Cooperative Assistance
AEP	European Association for Grain Legume Research
AFLP	Amplified fragment length polymorphism
AIS	Agricultural Institute of Slovenia, Ljubljana, Slovenia
ANOVA	Analysis of variance
ASSINSEL	Association internationale des sélectionneurs (International Association of Plant Breeders)
ATFCC	Australian Temperate Field Crop Collection, Horsham, Victoria, Australia
BAZ	Bundesanstalt für Züchtungsforschung an Kulturpflanzen (Federal Centre for Breeding Research on Cultivated Plants), Quedlinburg, Germany
BCMV	Bean common mosaic virus
BGMV	Bean golden mosaic virus
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economical Cooperation and Development), Germany
BRG	Bureau des ressources génétiques, Paris, France
BYMV	Bean yellow mosaic virus
CABINET	Carbohydrate Biotechnology Network for grain legumes
CBD	Convention on Biological Diversity
CGIAR	Consultative Group for International Agricultural Research
CGN	Centre for Genetic Resources, Wageningen, The Netherlands
CIA	Centro de Investigaciones Agrarias (Agricultural Research Center), Spain
CIAT	Centro Internacional de Agricultura Tropical (International Center of Tropical Agriculture) , Colombia – CGIAR
CIFA	Centro de Investigación y Formación Agraria (Agricultural Research and Training Centre), Córdoba, Spain
CLIMA	Centre for Legumes in Mediterranean Agriculture, Perth, Australia
CMV	Cucumber mosaic virus
COMECON	Council for Mutual Economic Assistance
CRF	Centro de Conservación de Recursos Fitogenéticos (Centre for Plant Genetic Resources Conservation), Spain
CSIC	Consejo Superior de Investigaciones Cientificas (Higher Council of Scientific Research), Spain
EAN	Estação Agronómica Nacional (National Agronomic Station), Portugal
ECCDB	European central crop database
ECP/GR	European Cooperative Programme for Crop Genetic Resources Networks
ELISA	Enzyme linked immunosorbent assay
ENMP	Estação Nacional de Melhoramento de Plantas (National Plant Breeding Station), Portugal
EPGRIS	European Plant Genetic Resources Information Infrastructure
EURISCO	European Search Catalogue (EPGRIS project)
FAO	Food and Agriculture Organization of the United Nations, Rome, Italy
FCPI	Fodder Crops and Pasture Institute, Larissa, Greece
GASU	Georgia Agrarian State University, Tbilisi, Georgia
GEF	Global Environment Facility
GEVES	Groupe d'étude et de contrôle des variétés et des semences (Varieties and Seeds Study and Control Group), France
GGB	Greek Gene Bank, Thessaloniki, Greece
GMO	Genetically modified organism
GRIN	Genetic Resources Information Network, USA

GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation), Germany
HRI	Horticulture Research International, Wellesbourne, UK
IAS	Instituto de Agricultura Sostenible (Institute of Sustainable Agriculture), Córdoba, Spain
ICARDA	International Centre for Agricultural Research in the Dry Areas, Syria – CGIAR
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, India – CGIAR
IGB	Israeli Gene Bank for Agricultural Crops, Bet-Dagan, Israel
INIA	Instituto de Investigación Agraria (Agricultural Research Institute), Spain
INRA	Institut national de la recherche agronomique (National Agronomic Research Institute), France
IPGR	Institute of Plant Genetic Resources, Sadovo, Bulgaria
IPK	Institut für Pflanzengenetik und Kulturpflanzenforschung (Institute for Genetics and Plant Breeding), Germany
ISCI	Istituto Sperimentale per le Colture Industriali (Experimental Institute for Industrial Crops), Bologna, Italy
JIC	John Innes Center, Norwich, UK
LINK	Legume Interactive Network
MAPA	Ministerio de Agricultura Pesca y Alimentación (Ministry of Agriculture, Fisheries and Food), Spain
MTA	Material transfer agreement
NAGREF	National Agricultural Research Foundation, Greece
NCPGR	National Centre for Plant Genetic Resources, Radzików, Poland
NGB	Nordic Gene Bank, Alnarp, Sweden
NGO	Non-governmental organization
PCR	Polymerase chain reaction
PGR	Plant genetic resources
PGRFA	Plant genetic resources for food and agriculture
QTL	Quantitative traits loci
RAPD	Random amplified polymorphic DNA
RICP	Research Institute of Crop Production, Prague, Czech Republic
RIFC	Research Institute of Fodder Crops, Troubsko, Czech Republic
RIPP	Research Institute of Plant Production, Piešťany, Slovakia
SERIDA	Servicio Regional de Investigación y Desarrollo Agroalimentario (Regional Agricultural Research and Development Service), Villaviciosa, Spain
SIA	Servicio de Investigacion Agraria (Agricultural Research Service), Spain
SIDTA	Servicio de Investigación, Desarrollo y Tecnología Agraria (Agricultural Research, Development and Technology Service) , Spain
SINGER	System-wide Information Network on Genetic Resources - CGIAR
UKPGRG	UK Plant Genetic Resources Group
UNIP	Union nationale interprofessionnelle des protéagineux (Protein-crops Industry Organization), France
UPOV	Union internationale pour la protection des obtentions végétales (International Union for the Protection of New Varieties of Plants), Geneva, Switzerland
UPV	Universidad Politécnica de Valencia, Spain
URGAP	Unité de recherche génétique et amélioration des plantes (Genetics and Plant Breeding Research Unit), France
USDA	United States Department of Agriculture
VIDA	Victorian Institute for Dryland Agriculture, Australia
VIR	Vavilov Institute of Plant Industry, St. Petersburg, Russian Federation
ZADI	Zentralstelle für Agrardokumentation und -information (Central Agency for Agricultural Documentation and Information), Germany

Appendix II. Agenda

Third meeting of the Working Group on Grain legumes
Kraków, Poland, 5-7 July 2001

Thursday 5 July 2001

8.30 **Introduction**
- Opening and welcome address (M. Ambrose; W. Święcicki)
- Brief self-introduction of the participants
- Approval of the agenda

9.00 **ECP/GR and the Working Group on Grain legumes**
- ECP/GR briefing (L. Maggioni)
- The Chair's report (M. Ambrose)
- Discussion

10.00 *Coffee break*

10.30 **Crop by crop progress review**
Review of progress made for each grain legume crop in terms of establishment of the central database, inclusion of passport data, definition of characterization descriptors, analysis of the database, level of safety-duplication of the collections, definition of regeneration needs and standards, definition of collecting needs, definition of other priority actions (core collections, pre-breeding, etc.).
- *Phaseolus* and *Vigna* (introduced by R. Schachl)
- *Vicia faba* (introduced by G. Duc)
- *Cicer* (introduced by I. M. Duarte)
- *Lens* (introduced by N. Açikgöz)

12.30 *Lunch*

14.00 **Crop by crop progress review (continued)**
- *Lupinus* (introduced by W. Święcicki)
- *Pisum* (introduced by M. Ambrose)
- *Glycine* (introduced by M. Vishnyakova)
- *Arachis* (introduced by S. Angelova)

15.30 *Coffee break*

16.00 **Sharing of responsibilities for conservation and documentation of PGRFA** (introduced by M. Ambrose and L. Maggioni)

Friday 6 July 2001

8.30 **National collections**
Each country representative to present relevant changes, since the 1998 meeting, of the status of their national collection.

- Austria
- Belgium
- Bulgaria
- Czech Republic
- France
- Greece
- Hungary
- Israel
- Italy
- Macedonia FYR
- The Netherlands
- Nordic Countries
- Poland
- Portugal
- Russia
- Slovakia
- Slovenia
- Spain
- Turkey
- United Kingdom

- Regeneration practices at the Institute for Sustainable Agriculture, Córdoba, Spain (M. Suso)

- The Australian Temperate Field Crops collection and the activity at the Victorian Institute for Dryland Agriculture, Horsham, Australia (J.B. Brouwer)

- The USDA-ARS National Plant Germplasm System – Cool Season Food legumes (C. Coyne)

10.30 *Coffee break*

11.00 ***In situ* and on-farm conservation**
Short presentations based on recent activities
- *In situ* and on-farm conservation of legumes landraces in Turkey (N. Açikgöz)
- *In situ* conservation of wild populations of *Phaseolus lunatus* in the Central Valley of Costa Rica (A. Maquet)

11.30 **Utilization and research activities**
Short presentations based on recent activities
- Standardization of screening methods for disease resistance (A. Ramos Monreal)
- EU projects on genomics and bioinformatics (M. Ambrose)
- The *Pisum* Gene List (M. Ambrose)
- Chickpeas collected from Central, East and South East Anatolia (N. Açikgöz)

12.30 *Lunch*

14.00 **Inter-regional cooperation**
- Cooperation with China on *Vicia faba* genetic resources (G. Duc)
- Collaboration with PHASELIEU (R. Schachl/ A. Maquet)
- Collaboration with AEP (A. Schneider)

15.30 *Coffee break*

16.00 ***Ad hoc* actions**
Proposals for collaborative actions to be initiated by the ECP/GR Working Group

Discussion and recommendations

17.00 **Any other business**

Saturday 7 July 2001

8.30 – 12.00 **Drafting of the report**
(Free time for delegates not involved in the drafting)

14.00 – 17.00 **Conclusion** *(Coffee break at 16.00)*
- Presentation of the draft report and adoption of recommendations
- Election of the Chair and Vice-Chair
- Closing remarks

20.00 *Social dinner in Kraków*

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