EUROPEAN COOPERATIVE PROGRAMME FOR CROP GENETIC RESOURCES NETWORKS (ECP/GR)

Report of a Working Group on *Allium*

Fifth meeting
25-27 May 1995
Skierniewice, Poland

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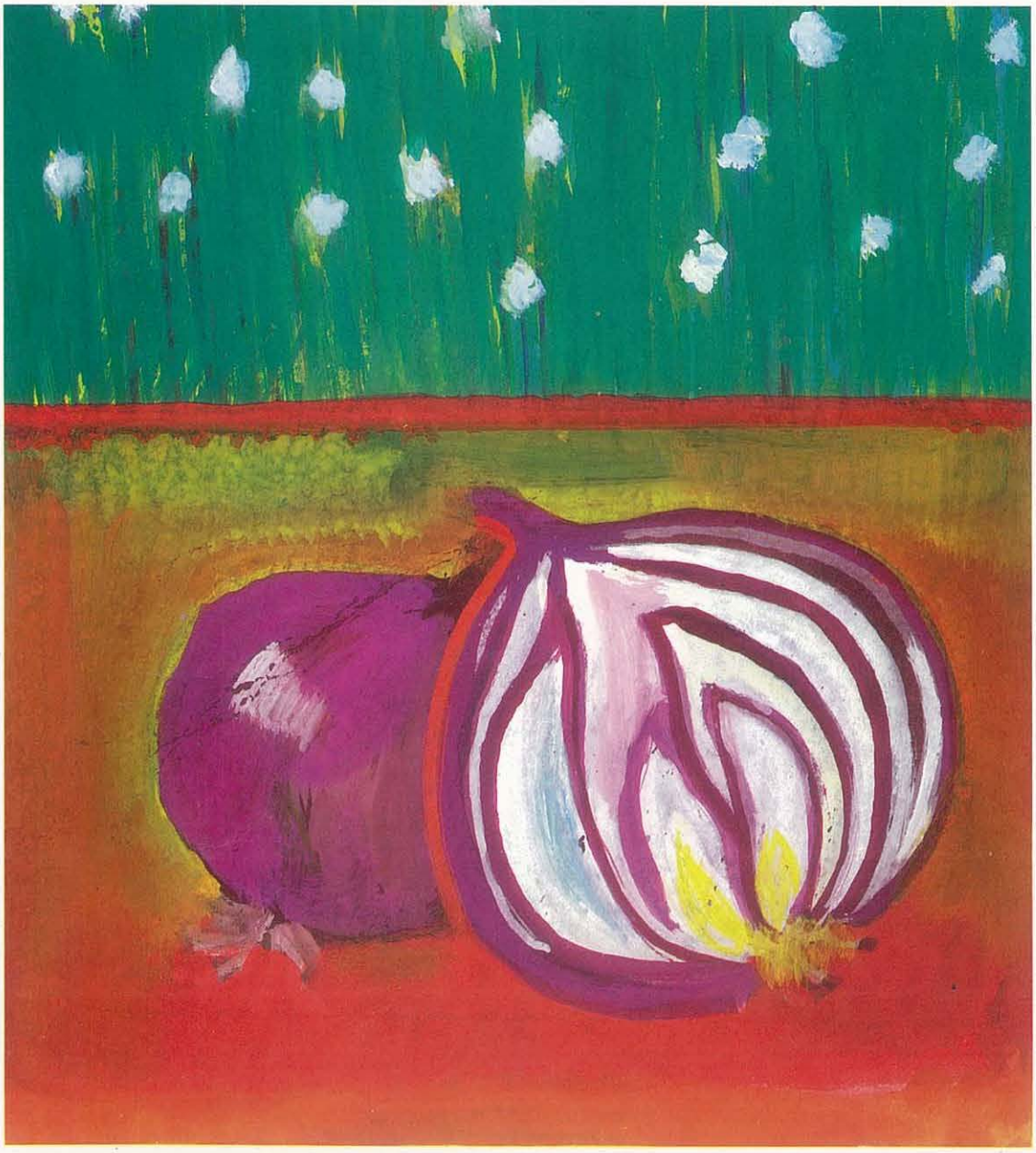

International Plant Genetic Resources Institute
IPGRI

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IPGRI

The International Plant Genetic Resources Institute (IPGRI) is an autonomous international scientific organization operating under the aegis of the Consultative Group on International Agricultural Research (CGIAR). The international status of IPGRI is conferred under an Establishment Agreement which, by December 1995, had been signed by the Governments of Australia, Belgium, Benin, Bolivia, Burkina Faso, Cameroon, China, Chile, Congo, Costa Rica, Côte d'Ivoire, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Greece, Guinea, Hungary, India, Iran, Israel, Italy, Jordan, Kenya, Mauritania, Morocco, Pakistan, Panama, Peru, Poland, Portugal, Romania, Russia, Senegal, Slovak Republic, Sudan, Switzerland, Syria, Tunisia, Turkey, Ukraine and Uganda. IPGRI's mandate is to advance the conservation and use of plant genetic resources for the benefit of present and future generations. IPGRI works in partnership with other organizations, undertaking research, training and the provision of scientific and technical advice and information, and has a particularly strong programme link with the Food and Agriculture Organization of the United Nations. Financial support for the agreed research agenda of IPGRI is provided by the Governments of Australia, Austria, Belgium, Canada, China, Denmark, France, Germany, India, Italy, Japan, the Republic of Korea, Mexico, the Netherlands, Norway, Spain, Sweden, Switzerland, the UK and the USA, and by the Asian Development Bank, IDRC, UNDP and the World Bank.

The European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR) is a collaborative programme among most European countries aimed at ensuring the long-term conservation and facilitating the increased utilization of plant genetic resources in Europe. The Programme, which is entirely financed by the participating countries and is coordinated by IPGRI, is overseen by a Steering Committee (previously Technical Consultative Committee, TCC) composed of National Coordinators nominated by the participating countries and a number of relevant international bodies. The Programme operates through ten broadly focused 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 potato) or general themes related to plant genetic resources (documentation and information, *in situ* and on-farm conservation, technical 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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Introduction

Summary of the introductory session

The fifth meeting of the *Allium* Working Group of ECP/GR was held in Skierniewice, Poland, from 25 to 27 May 1995. The meeting was hosted by the Research Institute of Vegetable Crops and was attended by 16 participants from 13 countries (See list of participants in Appendix II).

Prof. Doruchowski, Head of the Breeding Department, welcomed the participants to Poland on behalf of the Director of the Institute. After a short introduction about the Institute and the importance of vegetable production in Poland, he wished the group a successful meeting.

T. Gass welcomed the participants on behalf of IPGRI and expressed his gratitude to the Host Institute and particularly T. Kotlinska for the excellent preparation of the meeting. E. Frison gave a brief historic overview of ECP/GR, emphasizing the changes which occurred both in Europe and in the world in the area of plant genetic resources since the last meeting of the Working Group in Gatersleben in 1991. Although it was originally planned that ECP/GR would be phased out at the end of Phase IV, there was a strong desire in Europe to continue and strengthen cooperation in the area of plant genetic resources. This led to the launch of Phase V in 1994. Despite the difficult economic situation in many countries, 29 of them are now participating in Phase V of ECP/GR, showing a strong commitment towards cooperation in Europe. Dr Frison stressed that ECP/GR is essentially a coordination mechanism and activities are carried out by individual countries as contributions in kind to the Programme. The success of the Programme will therefore depend on the personal commitment of the participants. The objective of this meeting is the development of a realistic but ambitious workplan by this Working Group, and its implementation after the meeting.

With the recruitment of a full-time ECP/GR coordinator in July 1994, the level of activities in the programme has drastically increased and the production of a Newsletter for Europe provides a convenient mechanism for the exchange of information on plant genetic resources.

E. Frison briefly introduced the process leading to the International Technical Conference on Plant Genetic Resources which will take place in Leipzig in June 1996, stressing that this was an important opportunity to further raise the commitment of decision-makers to the conservation and use of plant genetic resources.

The Chairman of the Working Group, D. Astley, welcomed the participants to the meeting and, following a brief introduction by each of the participants, he wished that the meeting be as informal as possible and that participants express their views and opinions in a very free way. He further highlighted the importance of developing a specific workplan with clear responsibilities and a precise timeframe to allow the monitoring of its implementation.

The Agenda of the meeting was adopted (Appendix I) and the meeting started with the presentation of the Chairman's report.

Chairman's report

David Astley, Horticulture Research International (HRI), Wellesbourne, UK

In the last 4 years the Group has been involved in: a very real threat to the existence of one of the field collections, a rapidly coordinated international action to avert the problem, a significant level of activity within national programmes, coordinated efforts to obtain funds in support of the work, and perhaps rather less direct international collaboration.

The threat to our work came in late 1992 when the future of the Research Institute of Vegetable Growing and Breeding, Olomouc, Czech Republic, was unclear and funding for the *Allium* and other collections could not be guaranteed beyond March 1993. The long-day adapted vegetatively propagated *Allium* collection, which needed to be grown annually, was therefore under imminent threat. The Czech Ministry of Agriculture was concerned for the future of these genetic resources collections, but was not in a position to fund them fully at that time. Under the auspices of the ECP, requests were made for emergency funding to secure the maintenance of collections and to ensure the distribution of safety duplicates.

The international appeal was successful when the UK Overseas Development Administration agreed to provide a grant for US$30 000 in support of this unique collection. Existing scientific and technical staff in Olomouc were thus able to plant and maintain the collections in the field, and protect virus-free accessions using large isolation cages to exclude virus-transmitting insects, such as aphids. Bulbs and cloves produced in this way have been distributed for safety duplication to Germany. The long-term security of the collection is now assured under the Czech Government National Programme on Plant Genetic Resources Maintenance and Utilization. The National Gene Bank at the Research Institute for Crop Production in Prague has executive responsibility for this programme.

The Group has expanded considerably with the informal biannual newsletter, now distributed to colleagues in 27 European countries, plus active links in Asia, Africa, Latin America and the USA. Reports to our newsletter have outlined the broad range of activities taking place at national and international level in Europe and elsewhere.

People: Hervé De Clercq has started a new *Allium* programme at the Rijksstation voor Plantenveredeling in Merelbeke, Belgium. In Israel, Haim Rabinowitch has been elected as the Scientific Head of the Israeli Gene Bank for Agricultural Crops.

Collecting: activities have continued apace, particularly in West and Central Asia; much of the work has been carried out through the collaborations of IPK taxonomists with national experts.

Collections: Joachim Keller at IPK has established an *in vitro* collection of vegetative *Allium* including safety duplicates from Olomouc; similarly Jésus Martín in Cordoba is developing an *in vitro* garlic collection for Spain; Rina Kaminetsky in Israel has moved her research collection to the Department of Ornamental Horticulture, Volcani Institute; the two long-term seed base collections at HRI and CGN continue the coordinated development of these resources.

Research: the main areas of development reported by colleagues are the evaluation of molecular markers for taxonomic evaluation (IPK Gatersleben, Mike Havey, Univ. of Wisconsin); life cycle studies including initiation of flowering and development (Rina Kaminetsky); taxonomic revisions on taxa in sect. Schoenoprasum (Novosibirsk), subgenus *Melanocrommyum* (IPK and Uzbek Academy) and sect. Allium (RBG Kew); seed anatomy (IPK), embryology (IPK and Uzbek Academy);

in vitro culture and embryo rescue techniques (IPK), a pilot study of *in situ* conservation including *Allium* taxa (PGRRI, Turkey).

Global links: members of the Group promoted the concept and value of crop networking for *Allium* through publications and at two international ISHS symposia in Thailand and Argentina. Subsequently, individuals have been involved in discussions to encourage the development of regional cooperation for *Allium.* In southeast Asia, efforts are coordinated by IPGRI, while a preliminary meeting of interested parties in Latin America has been organized by the FAO Regional Office. Lesley Currah has been instrumental in raising the profile of the need for *Allium* work in the tropics through the continuing development of the Onion Network for the Tropics and the network of short-day onion evaluation trials. Collaboration in Africa has developed through links with the FAO Regional Office and Albert Rouamba, Burkina Faso (PhD with Agnes Ricroch in Versailles).

The areas which have not developed so well during the last 4 years are the European *Allium* Database and the characterization and safety duplication of national collections. Each of the following three points are particularly important to the future of the Group:

- the passport database is the window on what is potentially available for their work and we need to be in a position to promote the collections for utilization, hence;
- we recognized the value of minimal characterization to users, but many of us have not fulfilled our obligation in this area;
- it is an agreed principle that genetic resources collections should be safety duplicated to protect against unforeseen disasters. National and international collections must act to safeguard their collections through depositing a "black box" safety duplicate at a genebank with long-term storage facilities.

As Chairman and database holder, I accept that I could have done much more in the development of the database, in safety duplication and in encouraging individuals in national programmes to make a more active contribution to our work. I recognize that we all have wide-ranging responsibilities, not only in our specific *Allium* work, but also in other crops and disciplines. However, a network cannot function without collaboration and communication. If we are to move forward as a network group, we will all have to contribute to the promotion, development and routine inputs of our work.

The European *Allium* Database

Status of the database

D. Astley presented an overview of the status of the European *Allium* Database (EADB). Activities since the last meeting have not been as intensive as they could have been. The EADB has been used to responding to user requests, but this has reduced in the last 2 years. The Group agreed that data quality needs to be high in order to attract interest and utilization.

Since the impetus created by the group meeting in IPK Gatersleben, updates have been received by the EADB from the Czech Republic, Israel and Poland. Minimal characterization descriptors were defined in the last report and these have been used by some national programmes. However, field formats for these descriptors were not standardized and the data have been forwarded to HRI in a very heterogeneous format.

It was agreed that the priority actions for the EADB should be to: update passport data to include new accessions in collections; remove obsolete accessions to a secondary file; store minimal characterization data in three crop-group files linked to the EADB.

The Group reaffirmed the importance of four to five minimal characterization descriptors to potential users and agreed to define high-priority descriptors for each of the three crop groups. The data need to be standardized and forwarded to HRI in an agreed format.

The value of the EADB will be increased if the data are updated on a regular basis. Users have to have confidence in any information received from the EADB, otherwise the credibility of the EADB system and the Group will decrease rapidly. A well-maintained database will allow the members of the Working Group to promptly respond to requests.

The inclusion of a field for availability in the EADB was discussed. AVAILABILITY (Y/N) is used to identify accessions where access is restricted by a finite embargo period due to commercial request, etc., rather than accession status regarding seed quantity or quality. Therefore accession availability will be indicated by two fields, AVAILABILITY (Y/N) and NEED_REG (Y/N), the latter defining the need for regeneration or multiplication.

Working Group members represent the *Allium* activities in their respective countries and have the responsibility to coordinate the collections and to collate and transfer data for the EADB. Delegates reviewed the current status of collection documentation and their national inputs to the EADB, identifying gaps in the current data.

Austria: P. Hanelt reported that the NGO, Arche Noah, maintains collections of onion and garlic. He recommended that the Group try to include data relating to this material in the EADB.

Bulgaria: Collections from Sadovo, Plovdiv and Gorna-Oryahovitsa are included in the EADB. Two collections not yet included are located in Maritsa and the Higher Agricultural Institute, Plovdiv. S. Neykov will ensure that data are forwarded to EADB by February 1996.

Czech Republic: Material is only held at Olomouc and P. Havránek confirmed that all accessions are documented for passport and some characterization. He provided a disk with an update of the passport data for inclusion in the EADB. P. Havránek will request passport data from R. Ferias, Bragha, Portugal for the garlic collection from Portugal.

France: M. Mitteau reported that, in addition to the ENSH data already included in the EADB, there are several collections which are not represented in the EADB. These are INRA Montfavet, INRA Clermont Ferrand, and variety reference collections for statutory tests in GEVES at Cavaillon and Brion. She informed the Group that the collection INRA VAP has been transferred to ENSH and duplicated at HRI, Wellesbourne, UK.

Germany: Information includes the collections maintained in the IPK Gene Bank and Taxonomy Departments and the FAL in Braunschweig. It is planned that, within the context of the reorganization of the genetic resources activities in Germany, the FAL collection will be linked to IPK.

Greece: Data from the collection at the University of Patras will be included in the data from the Greek Gene Bank.

Hungary: There has been a considerable increase in collections. The passport data are currently being processed, but have not yet been transferred to the EADB. Three other working collections (the Vegetable Research Institutes in Makó and Budapest and the University of Agricultural Sciences, Keszthely) have indicated that their material is available for exchange and data will be included in the EADB.

Israel: The collection maintained by Rina Kaminetsky in the Volcani Centre is not included in the EADB. Updated data from the Hebrew University of Jerusalem, Rehovot have been sent to EADB for inclusion.

Italy: P. Perrino agreed to collect and collate information on the content of collections in institutes, botanical gardens and universities in Italy and agreed to forward this to EADB.

The Netherlands: Passport data from the Centre for Genetic Resources, The Netherlands are complete and have been transferred along with some characterization data to the EADB.

Nordic Countries: Updated data from the Nordic Gene Bank have been transferred to the EADB.

Poland: Passport data on the main collection in Skierniewice are included in the EADB, but several small collections at universities and botanical gardens are yet to be included. T. Kotlinska agreed to contact these institutes and report to D. Astley by the end of October 1995.

United Kingdom: A significant collection of wild taxa exists at the Royal Botanic Gardens Kew and the data for this material are not included in the EADB. D. Astley will investigate the possibility of including these important data. Other collections exist for reference in variety testing at the Scottish Agricultural Science Agency, and for ornamental and amateur/organic gardeners in NGOs.

Characterization

The *Allium* descriptor list was defined in Genetic Resources of *Allium* (1982) and updated in subsequent *Allium* Working Group meetings. There was variation among members in the use of descriptors for characterization with combinations of the IPGRI and UPOV descriptors being used. The Group reaffirmed the use of the IPGRI descriptors for data to be incorporated in the EADB.

D. Astley reminded the Group that the minimal characterization descriptors for three crop groups were defined in *Allium* Working Group meetings following an ECP questionnaire distributed to *Allium* scientists worldwide. The crop specialists reviewed the crop group (onion, leek and garlic) minimal characters and identified priority characters for each.

It was agreed that the following descriptors will be given priority for minimal characterization of the three crop groups.

In order to define the variability in some characters more fully existing descriptors were updated or new ones defined.

It is necessary to record data for descriptors 3.1 to 3.5 for the characterization of all accessions.

Onion

4.1.10	Shape of full-grown bulbs (see Figure 1).	
4.1.11	Uniformity of bulb shape	1 homogeneous 2 variable 3 highly variable
4.1.12	Bulb (clove) skin colour	
4.1.13	Uniformity of bulb colour	1 homogeneous 2 variable 3 highly variable
6.1.8	Storage life of storage organs	
6.2.4	Daylength requirement	

Leek

4.1.1	Foliage colour
4.1.3	Leaf erectness
6.1.4	Length of leaf sheath
6.1.5	Median diameter of the leaf-base pseudostem

Garlic

4.1.12.1	Outer skin colour of compound bulb	1 white 2 purple
4.1.12.2	Skin colour of the clove	
4.1.14	Number of cloves/compound bulb	
4.1.15	Number of whorls in bulb	
4.1.16	Bulb shape regularity	1 regular 2 irregular
4.2.7	Ability to produce scape	

Shallots

A subgroup consisting of P. Havránek, H. Rabinowitch, T. Kotlinska and P. Hanelt will suggest a list of minimum descriptors for shallots, in particular an adapted wording of descriptor 4.2.6 (Mode of reproduction).

The Group strongly recommended a full revision of the IPGRI descriptor list for *Allium*.

D. Astley will distribute the field definitions and structure for the minimal descriptors to the national delegates for use in characterization programmes. All curators must use these formats if data are to be included in the database.

A detailed discussion centered on the character for onion, 4.1.10 (Shape of full-grown bulbs) and the pictorial representation of the field states. Experience has shown that the expansion of the number of states for bulb shape from nine to fifteen has caused confusion. Bulb shape is influenced by environmental factors and cultural practice. Delegates agreed that bulb shape should be used as a general indicator of shape in a population and that complex multiple scores were not productive. The Group agreed to reinstate the nine-state scoring system (Fig. 1) and conversion formats were agreed upon unanimously for states 10-15.

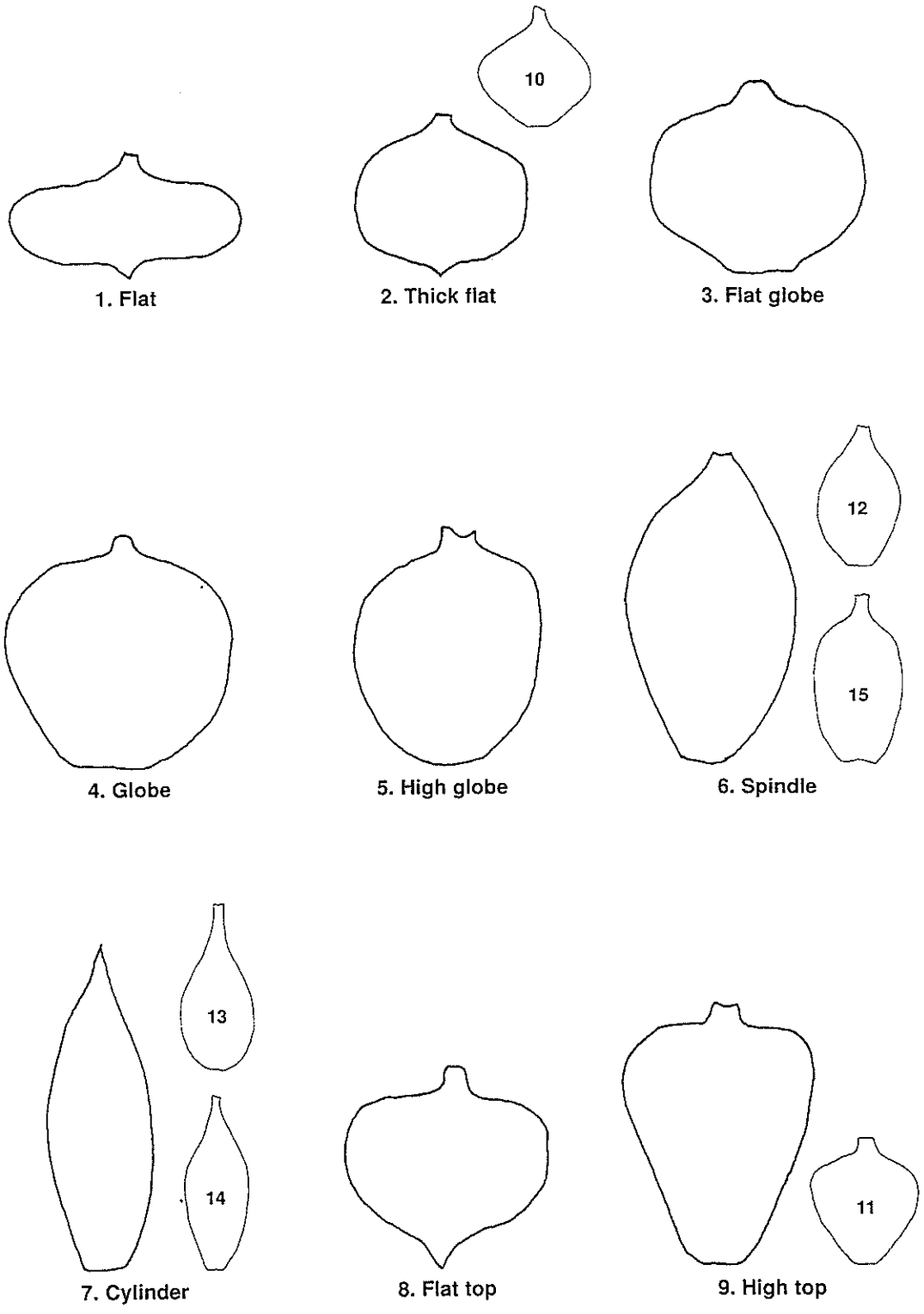

Fig. 1. Shape of full-grown bulbs. Shapes 10-15 are from previous descriptor list and have been replaced by corresponding shapes (i.e., 2, 6, 7, 9).

Action plan

1. Astley will send each *Allium* Working Group member in ECP/GR countries:
   - definitions of minimal characterization field descriptors for three crop groups, by 15 June 1995;
   - the relevant extract of country data from the EADB by disk (dBASE or ASCII) and hard copy by the end of July 1995.

2. Working Group members will consult with all collection curators to review EADB passport data and produce a coordinated response to D. Astley to include:
   - data on collections currently not represented in EADB;
   - data for new accessions added to collections already in EADB;
   - identification of obsolete entries in current EADB file.

The timing for completion of these tasks for countries will vary according to size of collections, current status of resources, etc. The tasks are to be carried out by:

- end of October 1995: Bulgaria, Czech Republic, France, Greece, Hungary, Italy, NGB, Netherlands, UK;
- end of December 1995: Israel;
- end of March 1996: Germany.

3. The EADB will be updated fully by the end of May 1996.

Allium genetic resources in Europe

The European field collection of long-day *Allium*

P. Havránek presented the status of the European collection of vegetatively propagated *Allium* in Olomouc, Czech Republic. He expressed his thanks to IPGRI and ECP/GR for mobilizing international support in a situation in which this collection, the result of 50 years of investment, was threatened by a lack of funds to ensure its continued maintenance. He described how this collection has, since 1994, been included in the Gene Bank Department of RICP, Prague, to ensure the conservation of the vegetable genetic resources collected by the former Vegetable Research Institute, Olomouc (VRI). He explained that the strengthening of links with the Botany Department of Palacký University Olomouc and the continued support by the international community were important to revitalize this collection after the lack of government support for over 5 years.

The collection currently contains 753 accessions of vegetatively propagated garlics (*A. sativum* + *A. longicuspis*), shallots (*A. cepa* var. *aggregatum*) and wild *Allium* species from more than 12 European countries. There is still a need to address phytosanitary problems and to assess whether some of the accessions of shallot and wild taxa could be stored as seed when available. The collection in Olomouc could accommodate more accessions but this would require a rationalization of the collection. Currently the proportion of duplicates is estimated at 30%.

P. Havránek described the ongoing activities and agreed to complete the documentation (including passport data, 25 morphological characters and availability) in electronic format and to forward the data to the EADB by the end of December 1995. He also agreed to send a duplicate of the Nordic shallot collection to NGB by the end of October 1995.

E. Frison informed the Group that IPGRI, in collaboration with FAO, was organizing the establishment and publication of Guidelines for the Safe Movement of *Allium* Germplasm. A meeting to develop these guidelines was planned to be held in Prague in July 1995 and the Guidelines, which will be sent to all the members of the Group, distributed by the end of May 1996.

The rationalization of field collections was discussed (see **Research activities,** below). Regarding the storage of seed of vegetatively propagated *Allium,* refer to **The European field collection of short-day *Allium*.**

The Group expressed its strong appreciation of the fact that the Czech Republic has agreed to continue to maintain this labour-intensive, but important collection on behalf of the countries in Europe.

The European field collection of short-day *Allium*

H. Rabinowitch presented the status of the European collection of vegetatively propagated *Allium* in Rehovot, Israel. Currently the collection contains about 400 entries. The two main crops in this collection are shallot and garlic. In addition, some 10 entries of great-headed garlic (*A. ampeloprasum*), and a smaller collection of *A. proliferum* and *A. grayi,* are also maintained in this field genebank.

For safety reasons, a great part of the collection is grown in other regions of the country. Lack of means prohibits systematic evaluation. However, when grown in the experimental stations, the material is evaluated for economic traits. The level of duplication is difficult to assess owing to high levels of virus infection in the areas of origin, rendering the morphological differentiation difficult. Before being included in the genebank, collected material is put into quarantine for 2-3 years. Following this, some material has to be destroyed to avoid the introduction of new pathogens into the country.

A strongly limiting factor to the maintenance and characterization of the collection is the restricted availability of funds and staff. Experiments have been conducted to develop less labour-intensive conservation methods. Garlic is suffering from genetic instability during *in vitro* culture and aberrations can appear after a few months in culture. The sensitivity of garlic to cryopreservation has not permitted storage in this form for longer than 15-18 months[1]. The storage of seeds of shallots is also considered problematic, because of the risk of losing genetic combinations desired by the breeder (e.g. flavour). It is, however, recognized that storing seed as a safety measure is preferable to no safety duplication at all.

It was noted that, as in the case of the collection in Olomouc, there is a need to raise funds in order to conduct research with a view to rationalizing the collection. The identification of duplicates could, for instance, be done using molecular techniques.

The Group expressed its thanks to H. Rabinowitch and to the Israeli government for assuming the responsibility for this important European collection.

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[1] Recently the Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, reported positive results for *in vitro* storage of 50 clones of garlic and 10 clones of shallot stored without significant losses since 1991. In addition, about 10 clones of onion derived from experiments on *in vitro* haploid induction via gynogenesis have been maintained *in vitro* (Keller, pers. comm.).

Review of national collections

Belgium

A report on the *Allium* collections maintained in Belgium was presented to the Group by D. Astley on behalf of H. De Clercq who was unable to attend the meeting. Besides a collection of 30 leek accessions maintained at RVP, *Allium* collections are also conserved at the National Botanic Garden in Meise and the Conservatoire Botanique de Wallonie in Genappe.

The Group welcomed H. De Clercq and looks forward to the active collaboration with Belgium. It was recommended that H. De Clercq contact the two botanic gardens to assess to what extent provenance data are available from the accessions collected in Belgium.

Bulgaria

S. Neykov presented the four institutions holding *Allium* germplasm in Bulgaria. Of the 250 accessions currently maintained in the base collection at IPGR Sadovo, 18 have been safety duplicated to CGN and 20 to VIR. In its conservation and regeneration strategy, IPGR is giving priority to locally collected material. The garlic accessions have not yet been safety duplicated. S. Neykov agreed to complete duplication there in Sadovo and after multiplication send a safety duplicate to Olomouc by the end of November 1997.

France

M. Mitteau presented the status of *Allium* collections in France. Currently *Allium* germplasm is maintained at INRA, Ploudaniel (81 accessions of shallot), at INRA, Montfavet (51 accessions of garlic), at INRA, Clermont-Ferrand (9 accessions of garlic), at ENSH, Versailles (150 accessions of onion), at GEVES, Cavaillon (720 accessions of onion, garlic and leek) and at GEVES, Brion (66 accessions of bunching onion and shallot).

She explained that several of these collections were not yet safety duplicated. Although the collection in Versailles requires further evaluation, this may not be possible due to the envisaged relocation of the collection to Angers.

The Group recommended that the future of the onion collection be secured at Versailles. M. Mitteau agreed to coordinate the safety duplication of the material stored at Versailles, Cavaillon and Brion. In the case of the collection at Versailles, this should be concluded by the end of August 1995. She will also contact INRA Ploudaniel and Montfavet to promote the evaluation and consequent documentation of these collections in the EADB and report to D. Astley by the end of August 1995.

Germany

P. Hanelt gave an overview of the *Allium* collections maintained in Germany. IPK, Gatersleben maintains a taxonomic collection of 2800 accessions including 320 different taxa and a genebank collection of 1190 accessions. Annually 100 to 150 accessions of the genebank are multiplied. The characterization of this field collection should be fully completed by May 1997. P. Hanelt agreed to send safety duplicates of all the material stored as seeds to HRI or CGN by May 1997.

Referring to a recommendation made at its last meeting in 1991, IPK agreed to establish a reference collection for research purposes. The Group recommends that researchers using wild *Allium* species validate the material they are using against the collection at IPK and provide subsamples to IPK after multiplication for subsequent research activities. D. Astley will contact the Royal Botanic Gardens Kew to inquire

about this institution's willingness to maintain a safety duplicate of this reference collection. He will contact IPK at the end of October 1995 and coordinate the duplicate transfer, if needed.

The Group agreed to publicize the existence and status of this reference collection. P. Hanelt will write a brief article on the objectives of the collection by the end of 1995. This article will be published in the IPGRI Newsletter for Europe (T. Gass), the *Allium* Newsletter for the Tropics, *Allium* Improvement Newsletter and ECP/GR *Allium* Newsletter (D. Astley).

The Group stressed the extreme value of the two collections existing at IPK and strongly recommends that these be maintained in the future. The Group also expressed its appreciation for the significant contribution made by Dr Hanelt in the area of *Allium* genetic resources.

Greece

S. Samaras presented a report on the *Allium* collections currently maintained in Greece. The principal collection is located at the Greek Gene Bank in Thessaloniki. It includes 164 accessions placed in medium-term storage. Except for 22 garlic accessions, all the material is also maintained in various working collections. So far, only passport data have been electronically recorded. Approximately 50% of the collection requires regeneration. This is rendered difficult by a severe lack of funds.

S. Samaras agreed to complete the documentation of the available characterization data in electronic form by the end of December 1995.

The Group recommended that, in accordance with Greece's commitment within the Convention on Biological Diversity, adequate public funding be provided to the Greek Gene Bank for it to fulfill its responsibility in conserving the Greek *Allium* collection (particularly the taxa endemic to Greece).

Hungary

B. Baji informed the Group about the *Allium* collections maintained in Hungary. Besides the base collection at the Institute for Agrobotany in Tápiószele where 341 *Allium* accessions are maintained, the Vegetable Research Institutes in Makó and Budapest and the University of Agricultural Sciences, Keszthely all maintain field collections for breeding and research collections. The material of the latter three institutions is available in small quantities.

The Institute of Agrobotany will regenerate 215 further accessions in 1995 and 201 in 1996. B. Baji will send safety duplicates of all the material to HRI or CGN as the material is regenerated. Objective: Full safety duplication of the *Allium* base collection by May 1997.

The material maintained in the three other institutions listed will be multiplied and duplicated in the base collection at Tápiószele.

Israel

Besides the European Collection of Vegetatively propagated *Allium* taxa, H. Rabinowitch described the collection of over 300 wild accessions from the Israeli *Allium* flora maintained at Rehovot. Due to restricted financial means this collection has not yet been fully evaluated and is still awaiting full safety duplication.

Italy

P. Perrino presented a report on the *Allium* collections in Italy. Currently 112 *Allium* accessions are maintained at the Germplasm Institute in Bari. P. Perrino informed the

Group that all of this material, which has been collected jointly with other institutions, is therefore duplicated in other genebanks.

He agreed to finalize a full inventory of any other *Allium* collections maintained in Italy by the end of 1995.

The Netherlands

I. Boukema presented the status of the *Allium* collection maintained at CGN, Wageningen. She explained that only material with sufficient and viable stocks is considered 'available' and that for onion and leek the low number of accessions was due to a bulking of accessions from the same umbrella varieties. Currently the collection consists of 198 accessions available for distribution and a further 186 awaiting regeneration. The wild material is maintained and seed is continuously harvested until enough is obtained to give the accession a CGN number and declare it available for distribution.

Within the next 2 years, 80 further accessions will be regenerated, safety duplicated and documented in the EADB.

Nordic Countries

G. Synnevag reported on the *Allium* Collection at NGB. Currently 99 accessions are maintained. Of these, 15 need regeneration. These will be regenerated by the end of 1997. Of 121 shallot clones collected in Finland in the 1980s, 10 have been considered for long-term storage by NGB. These are maintained in two field collections in Finland. This material will be evaluated and the documentation sent to EADB by the end of 1996. The bulb-onion material is described to varying degrees and further characterization is needed. This will be done by the end of 1997.

Poland

T. Kotlinska reported on the *Allium* collections in Poland. The main collection is maintained in Skierniewice and currently contains 751 accessions of *A. cepa*, *A. cepa* var. *aggregatum*, *A. ampeloprasum*, *A. sativum* and others. She explained that the collection is used extensively for breeding and in research programmes. Multiplication and regeneration are frequently done in collaboration with breeders. Passport data have been recorded for all the accessions, but evaluation data from the onion and shallot material need to be documented electronically. There is also a need for safety duplication.

The Group recognized the high value of the garlic collection maintained in Skierniewice and recommended that adequate support be given for the continued maintenance of this material. T. Kotlinska agreed to coordinate with P. Havránek by the end of July to identify unduplicated garlic accessions between the two collections. Providing sufficient means are available, these will be multiplied in autumn 1995 and a safety duplicate sent to Olomouc in autumn 1996.

T. Kotlinska also agreed to send safety duplicates of all the seed-propagated material to HRI or CGN by the end of October 1995. She agreed to give priority to the electronic documentation of the evaluation data already obtained and send it to EADB by the end of 1995.

The Group agreed that the wild species collected in Central Asia and maintained in Skierniewice and Olomouc needed to be determined taxonomically. IPK offered to review this collection. It was decided that T. Kotlinska and P. Havránek will collaborate to ensure that in autumn 1995 the material can be planted in Olomouc. In April 1996, P. Havránek will then inform IPK of the best time for a taxonomic review

of the collection (probably in May or June 1996). IPGRI will fund the travel costs of the taxonomist.

Slovakia

The report sent by M. Valšikova was submitted to the Group. Currently 47 accessions including *A. sativum, A. cepa, A porrum* and *A. schoenoprasum* are maintained at the Research and Breeding institute for Vegetable and Special Plants, Nové Zámky.

The Group thanked M. Valšikova for sending the report and looks forward to an active collaboration with Slovakia. The Group recommended that the data related to the collection in Nové Zámky be sent to EADB and that the material be safety duplicated. This could be done at RICP, Olomouc pending the completion of the genebank in Piestany, Slovakia.

United Kingdom

D. Astley informed the Group that significant *Allium* collections were currently maintained by five institutions in the UK. Of these the most comprehensive is located at HRI, Wellesbourne, which contains 1561 accessions of mainly onion (*A. cepa*) and leek (*A. ampeloprasum*). Of these, 448 are awaiting regeneration and 811 require safety duplication. For these crop plants, the objective is to regenerate a further 50 populations in 1995 and 50 in 1996. Besides this, a further 80 accessions will be safety-duplicated by May 1996 and the total of the collection by May 1998.

The Royal Botanic Gardens Kew hold a collection of over 300 accessions of wild taxa for taxonomic study. While this collection has a high value, availability of material is problematic.

The Group recognized the high value of this taxonomic collection. It recommended that the collection be maintained with a stronger genetic resources focus and that information related to it be included in the EADB.

NCCPG Reading, SASA, Edinburgh and HDRA, Ryton on Dunsmore also maintain *Allium* collections. The SASA and HDRA collections are to a large extent duplicated at HRI.

Other countries

The Group expressed its concern that no reports were received from other ECP/GR countries, particularly Russia, Spain and Switzerland.

Core collections

D. Astley gave a brief overview of the objectives of a core collection, namely, to provide a 'window' for breeders to access the collection. He described the activities carried out within the context of an EU AIR Project and the ECP/GR *Brassica* Working Group. He emphasized that the core collection does not replace the base collections and that this concept needs to remain dynamic. He pointed out how important a well-functioning database is to develop a core collection.

In the discussion that followed, it was pointed out that the *Allium* collections are relatively small and that there is not really a need for a core collection. In addition the species are not intercrossable and requests are for specific crops (leek, garlic, onion).

It was agreed that improved characterization and documentation of the existing collections will do more to promote the utilization of the collections than the development of a core collection. Regeneration, according to priorities set through the analysis of the database, was also identified as important.

For vegetatively propagated collections, the risk of losing material is greater and maintenance costs are higher than for seed collections. The Group agreed that it is necessary to find an acceptable way of rationalizing the collections.

D. Astley will advise national collections regarding material of high priority for regeneration based on a review of the EADB by the end of October 1996. Curators of collections will take these recommendations into account for their 1997 regeneration plans.

Section Allium

In the past 4 years there has been an increased interest in close relatives of leek. However, multiplication of this material is difficult. It is necessary to analyze the provenance data to check what is already in collections and to coordinate the multiplication of this material. Multiplication could be carried out in Israel or Greece, provided some limited financial resources are available. There is material maintained at CPRO and Kew and D. Astley will contact the responsible scientists to see whether this material could be sent to Israel by October 1995 for multiplication.

P. Hanelt agreed to prepare a list of taxa within section Allium which are close relatives of *A. ampeloprasum* and send it to D. Astley by the end of June 1995. D. Astley will send the list to all members of the Group by early July with a request to report on the presence of accessions of these taxa within collections in their country and provide data on their provenance. Information should also be provided on the distribution of these taxa in their respective countries with indications as to whether or not they are endangered. This information should be sent by all members to D. Astley by the end of October 1995. D. Astley will then analyze the data received and distribute it to all members of the Group with suggestions for collecting priorities, and when necessary, with suggestions for regeneration in a southern European country such as Israel. E. Thörn will contact Dr Roland von Bothmer regarding the provenance data he has and report back to D. Astley. It was noted that if the EU project was approved, some collecting activities could be funded.

In situ conservation of *Allium*

In order to avoid confusion when talking about *in situ* conservation it was felt important to distinguish between on-farm conservation of landraces and obsolete varieties and *in situ* conservation of wild relatives in protected areas.

B. Baji described the experience in Hungary where two types of activities are carried out. The first one could be called "on-farm regeneration" of landraces. Small farms in isolated sites (hamlets) receive accessions originating from the area concerned for up to 20 different species for regeneration and multiplication. Ms Agnes Bardy is responsible for this activity within the genebank and she visits the reproduction fields two to three times each year.

The second type of activity is the reintroduction of landraces and old varieties in previously abandoned villages which have recently been repopulated. This work is done in collaboration with ecological NGOs working closely with the local communities. It is the intention that this initiative will participate in an IPGRI project to strengthen the scientific basis for on-farm conservation.

S. Samaras reported that similar projects are ongoing in Greece and T. Kotlinska mentioned that a similar project is planned within a protected area in Poland. In Sweden, an agricultural museum is also engaged in such an activity. In Italy, a similar initiative also exists.

The Group recognized that these systems can be useful for the safe reproduction of germplasm. It was, however, important to recognize that genetic drift may occur.

T. Gass informed the Group that at a regional level, several NGOs are interested in collaborating with genebanks, particularly in the area of on-farm conservation.

M. Mitteau reported that 35 wild *Allium* species can be found in France. This material has not been collected, but botanists could provide information on distribution and abundance. T. Kotlinska made a presentation of the wild *Allium* species common in Poland.

All participants from Mediterranean countries agreed to contact botanists to obtain information on the distribution of wild *Allium* in their respective countries and on the level of existing threat to this material. S. Samaras agreed to provide the information to D. Astley by the end of July 1995, M. Mitteau by the end of October and P. Perrino by the end of December 1995. Turkey and Spain were to be contacted by D. Astley by the end of June to request this information for the end of December 1995.

The Group recommends that countries in which wild relatives of cultivated *Allium* occur should give particular attention to the conservation of the environment in which they occur.

Collecting activities

Bulgaria: Several multicrop missions were performed, but there is a need to collect material in some parts of the country (Rhodopi Mountains, Rila, Vitosha, Stara, Planina and villages in S. Bulgaria). During the next 2 years, collaboration with the Turkish Vegetable Institute in Bursa, the genebank in Izmir and NAGREF (Greece) will probably lead to joint missions to Turkey and Greece aiming at the collection of local landraces.

Czech Republic: The genetic variation available in the Czech Republic is already safely stored in the country's genebank. There is a need, however, to continue the collecting activities in Slovakia in the framework of an agreement between the Czech and Slovakian National Programmes.

France: No collection activities were performed in recent years in France, and none are planned for the near future.

Greece: Collection activities during 1991-94 resulted in 51 *Allium* accessions. An additional collecting effort is scheduled for August 1995.

Hungary: In recent years, only a few samples were collected and there seems to be no need for further collecting in Hungary. There is, however, interest in participating in collecting missions in neighbouring countries.

Israel: Israeli farmers cultivate only modern *Allium* varieties, and landraces are not known. A representative collection of the wild *Allium* flora of Israel and neighbouring areas is maintained by IGB. Collecting missions to remote villages and desert oases in the neighbouring countries may yield highly desired material selected through millennia for adaptation to the local conditions. This material may excel in some important traits such as salt tolerance and resistance to pests. The rapid changes in the Middle East result also in rapid modernization of agriculture with the

consequent replacement of old cultivars with modern high-yielding material. Plans for collecting missions were made, but funding is needed for implementation.

Italy: No collecting activities were performed in the last few years. However, collecting missions are planned for 1995 in Basilicata, Puglia and small islands. Two additional missions to Albania were planned for 1995 and 1996.

The Netherlands: The collection of the leek genepool available in the Netherlands was completed. A proposal for a collecting mission (1996 to 1998) with the Vavilov Institute was submitted to the Dutch Ministry of Education.

Nordic Countries: A number of potato onions from Finland and shallot accessions from Norway were collected. Further collecting of Swedish onions and vegetatively propagated *Allium* spp. is proposed for 1995 and 1996. In Norway, *A. fistulosum* and *A. schoenoprasum* will be collected in 1995/96. Commercial companies in Sweden have agreed to donate their cultivar collections to NGB.

Poland: Since 1991, eight missions collected onion, garlic and shallot landraces, as well as wild *Allium* spp. from various areas in Poland. The longest mission was supported by Japanese researchers interested in the genetic variation existing in old Polish cultivars.

Four or five annual collecting missions (1-week long) are planned for 1996 and 1997, mainly to the eastern provinces, where landraces are still in use.

Portugal: Several multicrop collections were made in the last few years. No such activities are planned for 1995.

Spain: D. Astley informed the Group that local onion cultivars were recently collected by missions from the Servicio Investigacion Agraria, Zaragoza. Garlic has been collected by J. Martín in Cordoba.

Research activities

National research activities related to *Allium* genetic resources

T. Kotlinska described the history of onion breeding in Poland, with special reference to cv. Wolska. In 1911, first crosses were made between a local landrace Wolska and cv. Zittawska. A number of selection cycles and further breeding activities resulted in the release of a modern version of cv. Wolska as well as additional advanced cultivars such as Rawska and more. Polish breeders concentrated their efforts on developing high-quality, open-pollinated varieties. In recent years, high-yielding Dutch hybrids became popular in Poland. Consequently, many efforts were invested in developing local hybrids and newly bred, superior F_1 Polish cultivars are now available to the growers.

P. Hanelt expressed interest in publishing the history of Polish breeding activities. H. Rabinowitch informed the Group that Phil Simon, the editor of the Onion Improvement Newsletter, is also interested in publishing historical notes on *Allium* breeding activities.

S. Neykov described his multicrop cages for controlled pollination, and the adaptations made in beehive construction for easy and safe activities in the screenhouses. Beehives were either placed outside the cages, connected only through

a narrow opening to the cage's space, or a micro-hive, 10x10x10 cm, containing a queen plus ca. 100 workers (honeybees), was introduced into the cages. The two systems work perfectly well and are highly productive. S. Neykov also mentioned that the population per cage does not exceed 20 plants and D. Astley commented that it was previously agreed to use a standard of 100 plants for population regeneration.

P. Perrino informed the Group that in Italy, research work is mainly confined to field trials for growing density of several local types and/or landraces in different environments. In Italy there are no registered varieties of *Allium* crops, although genetic variation of landraces is appreciably large.

According to the report contributed by H. De Clercq, research is carried out at R. V. P. Merelbeke to evaluate 68 accessions of leek for a variety of agronomic characters including resistance to important diseases. The conclusion, so far, is that Belgian landraces have some interesting qualities but that selection is needed to obtain a modern, bluegreen winter type.

Main topics for research

Vegetatively propagated material: The continuous maintenance of field genebanks is expensive and risky. So far, efforts to cryopreserve *Allium* cultures have failed. Successful cold storage of calli, meristem and/or bulbils lasted up to 15-18 months, after which the preserved material quickly deteriorated.

It was agreed that seeds of shallot (and other vegetatively propagated fertile *Allium*) will be stored as a safety backup, to reduce the risk of losing genes of value.

It was agreed to search for possible funding sources within the EU, for the collaborative development of molecular markers as well as of a blueprint for DNA fingerprint work adapted for *Allium*. These tools are expected to facilitate screening for desired traits and for identification of duplicates within the genepool. The Group so far include the following institutions: IPK (Gatersleben), CPRO (Wageningen), ENSH (Versailles), Cordoba, RBG (Kew) and HRI (Wellesbourne). It was agreed to add IGB (Rehovot) and RICP (Olomouc) to the list and D. Astley will disseminate the pertinent information to all interested parties. D. Astley will coordinate the activities of the group of interested members, until a qualified molecular geneticist takes the lead. It was also agreed that this group will respond to the call for proposals due in September aiming at submitting a full proposal to the EC for funding the molecular genetics research related to the *Allium* Group needs and activities.

Positive identification of stored material is of paramount importance. P. Hanelt agreed that due to its expertise, IPK will undertake this task and provide taxonomic service to interested parties.

The importance of collecting exotic material was re-emphasized. D.Astley will investigate the possibilities of obtaining additional material from the foothills of the Himalaya mountains, including *A. cepa* (which may have been cross-pollinated by local wild *Allium* spp. such as *A. roylei*) as well as representative collections of the wild *Allium* flora of the region.

International collaboration

Recent international events

E. Frison briefed the Group on recent international events related to plant genetic resources. He discussed briefly the implication of the Nairobi Final Act and current negotiations at intergovernmental level such as the forthcoming Session of the FAO Commission on Plant Genetic Resources. Participants were informed about the

preparatory process leading to the International Conference on Plant Genetic Resources (Leipzig, June 1996).

The agreement reached between the CGIAR and FAO in autumn 1994 to set the Centres' collections under the auspices of FAO was also presented and its implications discussed.

Finally, the implication of recent negotiations on collecting of genetic resources was discussed. P. Hanelt informed the Group that during the last 2 years payments had been requested by authorities in Uzbekistan and Kasakstan prior to authorizing collecting missions in these countries.

T. Gass agreed to send the International Code of Conduct for Plant Germplasm Collecting and Transfer recently published by FAO to the participants. This code of conduct stipulates that collecting should be implemented according to mutually agreed terms and following prior informed consent of the competent authority of the country where the mission is to be carried out.

Collaboration with other networks, institutions and NGOs

D. Astley re-emphasized the importance of collaborating with other networks and institutions. The presentations made during the meeting showed that several contacts exist. He further remarked that, in other regions, interest for collaboration had been shown from SADC and other groups in Africa and Southeast Asia.

In 1997 an ISHS Symposium on *Allium* is to be held in Australia. It is hoped that the ECP/GR *Allium* Working Group can be represented there.

The Group recognizes the importance of developing links with other institutions and networks and agreed to use the *Allium* Newsletter intensively to inform those groups.

The Group recognizes the importance of collaborating with Non Governmental Organizations (NGOs) and the importance of incorporating them in its activities. Recognizing that, in some cases divergence of opinion had to be surmounted, the members agreed to actively seek to know and establish contact with the informal sector. A directory of NGOs is currently under preparation under contract for IPGRI. This directory will be distributed to the members when published.

Conclusion

The participants reviewed the Discussions and Recommendations section of the meeting's report and approved it. D. Astley was re-elected unanimously to chair the Group until its next meeting which was tentatively planned for spring 1997.

European *Allium* Database

Status of the European *Allium* databases

David Astley
Horticulture Research International (HRI), Wellesbourne, Warwick, CV 35 9EF, UK

Table 1. UK *Allium* Collections: HRI Genetic Resources Unit.

	Total no. accessions	Available accessions	Awaiting regeneration	Safety duplicated
cepa	1127	864	263	674
ampeloprasum	173	134	39	35
fistulosum	72	57	15	17
schoenoprasum	23	6	17	1
Others	166	29	114	23

Table 2. Summary of *Allium* collections registered in the European database.

	A. cepa	*A. ampelo-prasum*	*A. sativum*	*A. fistulosum*	Others	Total
AUTBVAL	3					3
AUTWIEIPP			30			30
BGRIIPR	106	25	7		19	157
BGRGORNA			203			203
BGRPLOVDIV			99			99
CHERAC	15	19				34
CSKOLOMOUC	265	2	433	13	26	739
DDRGAT	178	70	242	57	744	1291
DEUBGRC	11	4			4	19
ESPDGAZARA	78	1				79
ESPPOLVAL	100	7	73			180
FINHELSIGU	99					99
FRAENSHVER	140					140
FRAINRAVAP	96	18			2	116
GBRHRIGRU	1127	173		72	189	1561
GRCGGB	37	59	14			110
HUNRCA	157	9	39	5	6	216
ISRIGB		23			197	220
ITAIDG	78	3	5		9	95
ITAUNIPIAC			2			2
NLDHORWAG	246	96	1		2	345
POLSKV	59		118	1	141	319
PRTEAN	7					7
PRTNUMI	46	1				47
REGNGB	21					21
TURARARI	40	28	1			69
YUGIFVC	8					8
Total	2917	538	1267	148	1339	6209

European Field Collections

European field collections of long-day *Allium*

P. Havránek
Research Institute of Crop Production Prague-Ruzyne (RICP Prague), Division of Genetics and Plant Breeding, Gene Bank Department, Vegetable Section Olomouc, Slechtitelu, 11 783 71 Olomouc, Czech Republic

Current conditions

The vegetable section of the Gene Bank Department RICP Prague was established in 1994 to reclaim the vegetable genetic resources assembled in the abolished Vegetable Research Institute Olomouc (VRI).

After a 5-year government cut-off of support for VRI and the resulting loss of professional continuity, this extensive germplasm collection needs appropriate revision and revitalization. Recently formed links of Olomouc RICP Gene Bank section to the Botany Department of Palackì University, Olomouc (taxonomy, plant tissue culture laboratory, phytotrons, participation of students) as well as international support (*Allium* and *Brassica* Working Groups) seems to be the best preparation to ensure its continued existence.

Curator and university links: Ing. P. Havránek, CSc (Botany Dept., Palacki University Olomouc), Ing. Helena Stavelíkovà.

Collection contents

The accessions comprise (Figs. 1 and 2): 518 garlic *A. sativum* which includes 23 advanced cultivars and 463 landraces with long-day demands from Europe and Central Asia), 32 garlic accessions maintained in isolators as a virus-free (or virus-controlled) collection. There are 140 accessions of shallot *A. cepa* subsp. *ascalonicum* and subsp. *aggregatum* (63 of Scandinavian provenience), 63 accessions (18 species) of wild *Allium* from West Siberia and Central Asia.

Maintenance of collection

The collection is maintained mainly as a living collection under field conditions (replanted yearly). Seeds come from controlled pollination (shallot, wild species) and are stored in glass jars or laminated bags (5% moisture cont.) at –20°C.

Duplication sites

Institute of Genetics and Crop Plant Research, Gatersleben, Germany (63 accessions of garlic, 20 accessions of shallot and 17 accessions of wild species, beginning in 1994), Nordic Genebank, Grimstad, Norway (17 accessions of shallot, transfer was planned for spring 1995 and delayed until autumn 1995 owing to phytosanitary problems).

Availability of material

About 60% of vegetatively propagated accessions are available (under conditions of phytosanitary safety) each year after harvest (from August to September). Some 30% of collection may be temporarily unavailable in 1995 and 1996 owing to multiplication and quarantine measures.

Evaluation status
Twenty-five parameters of 450 garlic accessions and 16 parameters of 120 shallots are available.

Documentation status
Passport data are completely computerized; electronic database of evaluation data continues.

Research work related to evaluation
Occurrence of plant pathogens and pests, resistance against viruses and fungal diseases. Reproduction strategy of wild *Allium* species is followed *in situ* in connection with management of their natural habitats (*A. angulosum, A. carinatum, A. schoenoprasum, A. ursinum*).

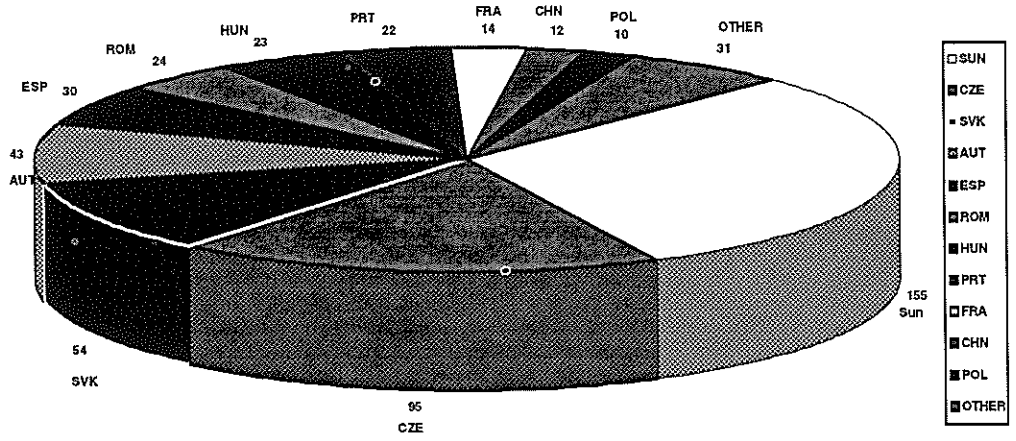

Fig. 1. *Allium* field genebank, Olomouc 1994/1995: garlic (513 accessions).

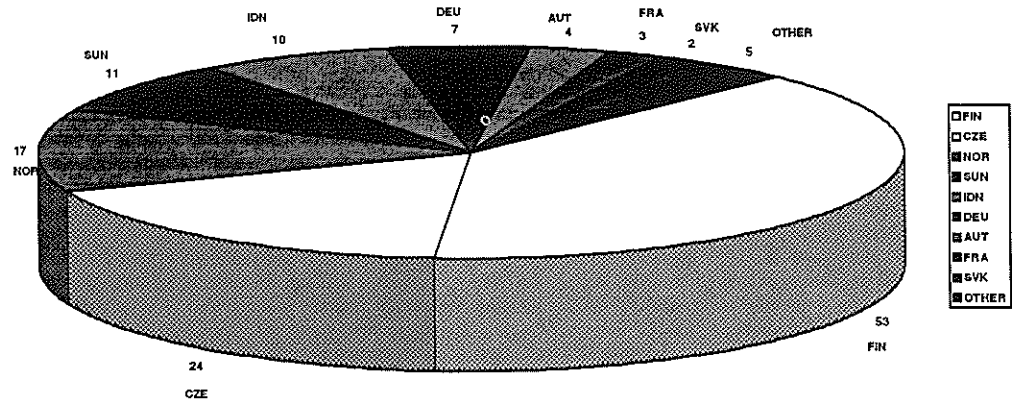

Fig. 2. *Allium* field genebank, Olomouc 1994/95: shallot (*A. c. ascalonicum* and *A. c. aggregatum*, 136 accessions).

Table 1. *Allium*: wild species progenitors (origin: Central Asia, Altaj, Monglia).

Species	No. of accessions	Country of origin	Note
A. nutans	15	Altaj	Dr Grinberg
A. altaicum	26	Altaj	Dr Grinberg
A. altyncolicum	1	Altaj	$2n=4x=32$
A. pskemense	6	CentralAsia	endemic
A. galanthum	3	Central Asia	
A. oschaninii	2	Central Asia	threatened
A. vavilovii	1	Central Asia	threatened
A. obliquum	4	Altaj, Mongolsko	resistance
A. roylei	1	NDL (unknown)	resistance
A. udinicum	2	Altaj	resistance

Table 2. *Allium*: Germplasm of native flora (origin: Czech Republic, Slovak Republic).

Species	No. of accessions	Ploidy	Note
A. scorodoprasum	7	$2n=3x=24$	
A. vineale	17	$2n=4x=32$	Sat.chrs
A. schoenoprasum			
subsp. *sibiricum*	3	$2n=2x=16$	
subsp. *schoenoprasum*	1	$2n=2x=16$	
	3	$2n=5x=16+1$-2B	B chrs
	3	$2n=2x=16+1$-6B	B chrs
A. oleraceum	9	$2n=2x=40$	pentaploid
	1	$2n=4x=32$	tetraploid
	10	$2n=6x=48$	hexaploid
A. angulosum	1	$2n=2x=16$	threatened
A. carinatum	1	$2n=2x=16$	threatened

The European field collection of short-day *Allium*

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The flora of Israel and neighbouring areas, which are part of the secondary centre of evolution, about 40 different *Allium* spp. belonging to four sections: Allium, Codonoprasum, Melanocrommyum, and Kaloprasum. Some species are endemic to narrow geoclimatic zones, others are widespread all over the area.

A representative collection of over 300 entries of the local *Allium* flora is now maintained by the Israeli Gene Bank (IGB), at Rehovot (Table 1). With a few exceptions, lack of means prohibited evaluation and the main effort is invested in guaranteeing the safekeeping of this genepool.

About 10 requests are received annually for material from this collection, mainly for screening for pest and disease resistance (e.g. search for white rot).

The field genebank for short-day, vegetatively propagated alliaceous crops contains about 400 entries and is also located at Rehovot. The two main species in this collection are shallot (*A. cepa* var. *aggregatum*) and garlic (*A. sativum* + *A. longicuspis*). In addition, some 10 entries of great-headed garlic (*A. ampeloprasum* var. *holmense*), and a smaller collection of *A. proliferum* and *A. grayi* are also maintained in the field genebank (Table 2).

For safety reasons, a great part of this collection is grown in other regions of the country (in accordance with their environmental requirements). Lack of means prohibits systematic evaluation. However, when grown in the experimental stations, the material is being evaluated for economical traits. Our observations indicate an extensive variation between accessions regarding those traits.

Table 1. Short-day vegetatively propagated cultivated *Allium* spp. in the *Allium* Gene Bank at Rehovot, Israel (updated 1 May 1995).

Origin	No.
A. sativum	
Egypt	5
Algeria	4
USSR	10
Thailand	2
Indonesia	6
Italy	3
Spain	8
USA	5
France	12
Kenya	4
China	11
Argentina	4
Japan	1
Uganda	3
Zimbabwe	1
Mexico	2
Kazakhstan	34
Syria	1
Brazil	3
Philippines	1
Israel	1
Not known	4
A. bulbiforum	
The Netherlands	1

Origin	No.
A. cepa var. *ascalonicum*	
Thailand	33
Nepal	2
France	5
Indonesia	10
The Netherlands	3
Ethiopia	1
USA	4
China	2
Uganda	4
Argentina	4
Kenya	1
Poland	2
A. longicuspis	
USSR	5
Kazakhstan	3
Not known	3
A. ampeloprasum var. *holmense*	
USA	6
Lebanon	1
Chile	3
A. grayi	
Korea	1

Review of National Collections

The status of the *Allium* collections in Belgium

H. De Clercq
Rijksstation voor Plantenveredeling (RvP), 9820 Merelbeke, Belgium

Le Conservatoire Botanique de Ressources Génétiques de Wallonie

1, rue Fievez, B-1470 Genappe, le conservateur L.A. Dutilleux; Tel: 32 9 252 19 81; Fax: 32 9 252 11 50

This collection contains 55 non-nutritional flowering *Allium* species that are vegetatively propagated (Table 1).

Table 1. Genetic resources of *Allium* at the Conservatoire Botanique de Ressources Génétiques de Wallonie, Belgium.

Allium aflatunense - B. Tedtach
Allium albopilosum - Becker
Allium altaïcum - Pall
Allium atropurpurens - Waldst
Allium baeticum Boiss
Allium bucharicum Regel
Allium carinatum L. subsp. *pulchellum* (Bonn et Lay)
Allium carolinianum D.C.
Allium cepa proleferum -L.
Allium christophii - Trauv
Allium cilicium - Boiss
Allium cyaneum - Regel
Allium cyatophorum - Bur et Franchet
Allium ebusitanum - Sanchez
Allium ericetorum - Corbeld
Allium gultschense - B. Fedtsch
Allium hymenorrhizum - Turkman
Allium iliense - Regel
Allium insubricum - Boiss et Reuter
Allium kansuense - Regel
Allium karataviense - Regel
Allium ledebourianum Schult
Allium lusitanicum Lam.
Allium montanum F.W. Schmidt
Allium narcissiflorum Vill
Allium naepolitanum (Cyr)
Allium nigrum L.
Allium ochotense Prokh
Allium ochroleucum Waldst et Kit
Allium oleraceum L.
Allium oreophilum A. Gray
Allium paezoskianum Fuzs
Allium pskemense B. Fedtsch
Allium pulchellum Meyer
Allium ramosum L.
Allium roseum Favios
Allium rosenbachianum Reg.
Allium sativum ophioscorodon L.
Allium senescens L. subsp. *montanum* Fries
Allium sibiricum L.
Allium scorzonerifolium L.
Allium sphaerocephalon L.
Allium stipitatum Regel
Allium strictum Serach
Allium suaveolens Jaq
Allium textile L.
Allium trecoccum Feldt
Allium triquetrum L.
Allium tuberosum Rottl.
Allium tuberosum odorum L.
Allium ursinum L.
Allium victorialis L.
Allium vineale L.
Allium yunnanense Diek
Allium zehdanense

Table 2. Genetic resources of *Allium* at the National Plantentuin van België, Domein van Bouchout, B-1860 Meise, Seed Bank Manager, T. Vanderborght.

Allium carinatum L.
Allium cernuum Roth
Allium sp. (CAN)
Allium christophii Trautv
Allium cyathophorum Bur. and Franch
Allium fistulosum L.
Allium ramosum L.
Allium sativum L.
Allium scorodorprasum L. (HUN)
Allium senescens L.
Allium sphaerocephalon L. (FRA)
Allium ursinum L.

Rijksstation voor Plantenveredelin (R.v.P.)

Burg. Van Gansberghelaan 109, B-9820 Merelbeke, assistant H. De Clercq

This collection contains about 130 varieties of leek (*Allium ampeloprasum* var. *porrum*). About 20 of them are Belgian landraces of leek.

Status of *Allium* collections in Bulgaria

Stefan Neykov
IIPGR Sadovo, Plovdiv, Bulgaria

Allium collections in Bulgaria represent 52 wild and cultivated species including 267 accessions at the Institute of Introduction and Plant Genetic Resources, Sadovo. Of these 232 are introduced (130 *Allium cepa*, 11 *Allium porrum*, 91 wild species) and 30 are local wild and cultivated forms.

At the experimental station for vegetable crops, Gorna Orjahovitsa, 203 local accessions of *Allium sativum* are maintained as well as 230 breeding lines and cultivars.

The Institute of Vegetable Crops Maritsa Plovidiv maintains *ex situ* 99 local accessions of *A.llium sativum* and 200 breeding materials and cultivars.

At the High Agriculture Institue, Plovdiv, 30 local wild species of *Allium* are maintained *ex situ*.

At IIPGR, Sadovo 230 accessions were evaluated over the last 3 years, following the International and IBPGR Descriptors.

At ESVC and IVC Maritsa, accessions were explored with limited characterization and evaluation data.

Regeneration activities are ongoing at IIPGR, Sadovo; currently 180 accessions are being reproduced while 105 are kept in storage at the genebank.

At IVC and ESVC, garlic accessions are preserved in the field.

As a result of the collecting missions, 30 wild *Allium* species accessions were collected and a map made of occurrence of *Allium* species in the country.

Workplan

Collecting, evaluation and regeneration of the accessions will continue. Parties from Turkey and Greece are sought for a joint *Allium* collecting mission.

Breeding activities will continue for annual and biannual cultivars to include the following traits: disease resistance, winter storage, chemical structure, dry matter content, bulb size and male sterility.

Table 1. Status of *Allium* species collection.

	Accession status			
Location	**Collected**	**Characterized**	**Stored**	**Regenerated**
IIPGR: *Allium* spp.	250	230	105	180
IVC - Maritsa				
Garlic	99	99	field	field
Other *Allium* material	200	200	5	
ESVCGO - G. Oryahovitsa				
Garlic	203	203	field	field
Other *Allium* material	230	230	4	200
High Agric. Institute, Plovdiv: *Allium* spp.	30	30	*ex situ*	30

Status of *Allium* collections in France

M. Mitteau
Ecole Nationale Superieure d'Horticulture (ENSH), 78009 Versailles-Cedex, France

INRA: Station d'Amélioration de la Pomme de terre et des Plantes à Bulbes

Keraiber, F-29260 Ploudaniel; Tel: 33 98 83 61 76; Fax: 33 98 83 65 59

Staff: James Cohat, chargé de recherches, Curator

Year established: 1984

Conserved species: *Allium cepa* var. *aggregatum* (shallot)

Total number of accessions	81
populations	0
varieties	25 (clones)
wild relatives	6
research genetic material	50

Purpose of the collection: reference and breeding

Availability: restricted; **Available material:** yes; **Form:** bulbs

Maintenance of collection: vegetative propagation bulbs/field

Safety duplication of material: no

Planned activities for the next 2 years: research (see below).

Research and breeding activities (actual and planned):
- Breeding improvement in type "échalote rose" for agronomic characteristics (yield, cultural adaptation, division rate, bolt resistance...) and use value (bulbs aspect, tunica quality, flavour, storage aptitude...).
- Productions of new and innovative genetic material by interspecific crosses.
- Research on seed-propagating varieties by haplodiploidization method.

Published papers on the collection:
Messiaen, C.M., J. Cohat, J.P. Leroux, M. Pichon et A. Beyries. 1993. Les *Allium* alimentaires reproduits par voie végétative. INRA Editions. 228p.

INRA: Station de Pathologie Végétale

Domaine Saint-Maurice, F-84143 Montfavet Cedex; Tel: 33 90 31 63 51; Fax: 33 9031 63 35

Staff:

Actual curators	Véronique Chovelon, ingénieur de recherche
	Jean-Paul Leroux, technicien de recherche
Former curators	Charles-Marie Messiaen
	Maurice Pichon

External collaborators: no

Year collection established: 1958

Holding species: *Allium sativum*

Total number of accessions	51
populations	35
varieties	16 (in official catalogue)

Purpose of the collection:

Maintainance of the populations: Regeneration and plant improvement

Availability: restricted; **Available material:** yes; **Form:** bulbs

Maintenance of collection: vegetative propogation bulbs/field

Safety duplication of material: no

Evaluation and documentation status: none

Planned activities for the next 2 years: no change

Research and breeding activities (actual and planned): Regeneration and plant improvement

Published papers on the collection:
Messiaen, C.M., J. Cohat, J.P. Leroux, M. Pichon et A. Beyries. 1993. Les *Allium* alimentaires reproduits par voie végétative. INRA Editions. 228p.

INRA: Station d'Amélioration des Plantes Agri Obtentions

63, Domaine de Crouelle, F-63039 Clermont-Ferrand; Tel: 33 73 62 43 45; Fax: 33 73 62 44 53

Staff: Bernard Vivier, ingénieur Agri Obtentions, Curator
Patrik Brugiere, technicien de recherche

Former curator: Maurice Pichon

External collaborators: no

Year established: 1958

Conserved species: *Allium sativum*

Total number of accessions: 9 clonal varities

Purpose of the collection: Regeneration by *in vitro* culture of infested clones (Onion Mosaid OYDV) for eventual varietal issue in spring types (regeneration in Montfavet)

Availability: free; **Available material:** yes; **Form:** bulbs

Maintenance of collection: vegetative propagation bulbs/field

Safety duplication of material: yes, most of the accessions

Evaluation and documentation status: none

Planned activities for the next 2 years: Because of the retirement of the engineer in charge of this species, Agri Obtentions will maintain this collection without real enlargement.

Research and breeding activities (actual and planned): no

Published papers on the collection: no

Ecole Nationale Superieure d'horticulture

4 rue Hardy RP 914, F-78009 Versailles Cedex; Tel: 33 39 24 62 00; Fax: 33 39 24 62 01

Staff: Martine Mitteau, professeur, Curator
Agnès Ricroch, assistant, recherche

Former curators: Claude Foury and Henri Cachon

External collaborators: no

Year established: 1958

Conserved species: *Allium cepa* (onion)

Total number of accessions	150
populations	90
varieties	60

Purpose of the collection: Maintenance and evaluation of landraces and cultivars

Availability: free; **Available material:** yes; **Form:** seeds

Maintenance of collection: sexual propagation; seeds; frozen

Safety duplication of material: yes, in two freezers in two different laboratories in the same location (ENSH)

Evaluation and documentation status: yes

Purpose	Stock, descript and passport
Descriptors number	20 to 25
Computerized data	on PC
Type of database	dBASE IV, unavailable on network
Information available	on diskettes and printout

Planned activities for the next 2 years: Pursuit of description and propagation activities

Research and breeding activities (actual and planned): Studies on biochemic and molecular identification (Agnès Ricroch)

Published papers on the collection:

Different activity reports
Derue, C. 1991. Ressources génétiques de l'oignon (*Allium cepa* L.) D.A.A. d'Amélioration des Plantes. ENSH-ENSAR, 50 p.
Ricroch, A. 1992. Un nouvel outil pour l'évaluation des ressources génétiques: l'hybridation *in situ* appliquée au complexe des *Allium*. in complexes d'espèces, flux de gènes et ressources génétiques. Lavoisier. Pp. 193-199
BRG-CTPS. 1992. Oignon in conservation des ressources génétiques en France. Pp. 95-97.

G.E.V.E.S.

B.P. 1, Les Vigneres, 84300, Cavaillon, France; Tel: 33 90 71 26 85; Fax: 33 90 78 01 61

Staff: Richard Brand, responsable de l'unité, Curator

External collaborators: no

Year established: 1970

Conserved species: *Allium cepa* (onion); *Allium sativum* (garlic); *Allium porrum* (leek)

Total number of accessions	720
Allium cepa	263 (mostly varieties)
Allium sativum	40 (idem)
Allium porrum	417 (idem)

Purpose of the collection: Reference collection for official catalogue registration (CTPS) and variety protection (UPOV)

Availability: free; **Available material:** yes (in case of non-protected varieties)

Form: seeds for *A. cepa* and *A. porrum*, bulbs for *A. sativum*

Maintenance of collection: Sexual propagation for *A. cepa* and *A. porrum*; vegetative propagation for *A. sativum* seeds/bulbs, refrigerated/field

Safety duplication of material: no

Evaluation and documentation status:	yes
Descriptors number:	30 to 50
Computerized data:	on PC
Type of database:	logiciel GEVES-BOULINEAU

Possibly accessible in the future on GEVES issue.

Planned activities for the next 2 years: Pursuit of description and propagation activities.

Research and breeding activities (actual and planned): Periodic setting-up with the 15 countries of the European Union with enlargement to USA and Japan.

Published papers on the collection: in project official publication AIL

G.E.V.E.S.
49250 Brion; Tel: 33 41 57 23 22; Fax: 33 41 57 46 19

Staff: François Boulineau, responsable de l'unité, Curator

External collaborators: no

Year established: 1958

Conserved species: *Allium fistulosum* (bunching onion); *Allium cepa* var. *aggregatum* (shallot)

Total number of accessions:	66
Allium fistulosum	36 (varieties)
Allium cepa var. *aggregatum*	30 (populations and varieties)

Purpose of the collection: Reference collection for official catalogue registration (CTPS) and also local population maintenance for shallots.

Availability: free

Available material: Seeds for *A. fistulosum;* Bulbs or seeds for *A. cepa* var. *aggregatum*

Maintenance of collection: sexual propagation for *A. fistulosum;* vegetative propagation for *A. cepa* var. *aggregatum;* seeds/bulbs; refrigerated/field.

Safety duplication of material: no

Evaluation and documentation status:	yes
Descriptors number	20 to 25
Computerized data	on PC
Type of database	logiciel GEVES-BOULINEAU

Research and breeding activities (actual and planned): none

Published papers on the collection: only CEE experiment paper for *A. fistulosum* and for *A. cepa* var. *aggregatum.*

Status of *Allium* collections in Germany

Peter Hanelt
Institut für Pflanzengenetik und Kulturpflanzenforschung (IPK), 06466 Gatersleben, Germany

Table 1. *Allium* collections at IPK Gatersleben.

	No. of accessions	No. of species	Type of collection	Long-term storage
Taxonomic research collection, mainly wild taxa	2800 (1580 taxa examined)	320	permanent field collection	ca. 1200 (open-pollinated, ca. 50 in isolation)
Genebank collection, mainly crop species, including	1190	ca. 15		258
A. cepa s.l.	389		138 permanent vegetative propagation; 251 seed-propagated	175
A. sativum	415		perm. field collection	—
A. proliferum	156		perm. field collection	—
A. ampeloprasum	86		38 perm. vegetative propagation; 48 seed-propagated	39
A. schoenoprasum	20		perm. field collection	14
A. fistulosum	76		perm. field collection	19
Others	124		perm. field collection	11

IPK activities for existing collections

- Continuous field cultivation of the vegetatively reproducing taxa, establishment of a new site for permanent cultivations of the genebank material; annual reproduction of 100-150 accessions of seed reproduced from genebank taxa;
- Continuous evaluation of descriptor characters according to the recommendation of the Working Group; updating of the database.
- Maintenance of the taxonomic field collection; seed production under isolation annually of 10-15 accessions.
- 128 safety duplicates from Olomouc are maintained in the experimental fields, 5 others are maintained *in vitro*; own material not yet systematically duplicated.

Table 2. Collecting missions since 1991, IPK, Gatersleben.

Year	Country/ region	Duration	IPK participant	Number of access.	Number of species	Remarks
1991	Tadzhikistan	3 weeks	Fritsch	32	~20	wild taxa, mainly *Melanocrommyum*
1991	Altai		Pistrick	44	16	wild taxa, *Rhizirideum*
1992	Usbekistan, Kyrgystan	3 weeks	Fritsch	46	~25	wild taxa, mainly *Melanocrommyum, Allium*
1992	(Baikal)	—	Pistrick	15	4	wild taxa, mainly *Rhizirideum*
	(Tunisia)	—	Pistrick	11	6	mainly crops
1993	Kazakhstan, Uzbekistan, Kyrgystan	1 month	Fritsch	117	~50	wild taxa, wild relatives of crops
	(Tunisia)	—	Pistrick	19	4	mainly crops
	(Albania)	—	Pistrick	13	4	mainly crops
1994	Uzbekistan, Kazakhstan, Kyrgystan, Tadzhikistan	1 month	Fritsch, Pistrick	91	~50	wild taxa
1994	Iran	3 weeks	Fritsch	83	~30	wild taxa, wild crop relatives
1994	(Italy)	—	Hanelt	6	3	wild taxa
1995	Turkmenia, Uzbekistan	3 weeks	Fritsch	53	~30	wild taxa, wild crop relatives

Allium genetic resources activities in Greece

S. Samaras
Greek Gene Bank, 570 01 Thessaloniki, Greece

The Greek Gene Bank (GGB) is involved in *Allium* genetic resources as part of its obligation to deal with the genetic resources of all economic plants, particularly of the indigenous plants of the country. However, *Allium* is an important crop for the country. It has particular scientific interest and presents extreme diversity in both wild and cultivated taxa. The GGB includes *Allium* in its priority crops for collecting, conservation both *in situ* and *ex situ*, study and use.

Status of the collection

The GGB conserves in its active collection 164 accessions of *Allium*. The samples were collected by IBPGR, or nationally funded expeditions, from 1981 to date. All germplasm is indigenous. The number of accessions of the various *Allium* species are as follows: *Allium cepa*, 43; *Allium porrum*, 59; *Allium sativum*, 22; *Allium ampeloprassum*, 15; *Allium schoenopassum*, 1; *Allium* spp., 24.

Seed storage facilities

Short- to medium-term storage facilities (active or working collection) have a capacity of 40 m^3 and can hold approximately 10 000 samples. Seed is stored in unsealed packaging (ordinary paper or cloth bags) placed on fixed shelves under 0 to +5°C and 30% relative air humidity. Under these conditions seed moisture is maintained at a very low level (5-6%) in equilibrium with the humidity of the surrounding air which is practically dry (25-30% RH), allowing reliable seed conservation for at least 10 years. With the exception of *Allium sativum* (22 accessions) all accessions are maintained in the active collection.

Field collection

Allium sativum (22 accessions) are maintained in field plots at the GGB.

Table 1. Field collecting expeditions, 1991 to 1994.

		Allium species[1]					
Place	**Year**	*amp.*	*cepa*	*por.*	*sar.*	*Sch.*	**Other**
Peloponnisos	1991	2	1				16
Kefallonia	1992		2	1	5	1	1
Samos	1993	6					
Ikaria	1993	1					
Paros	1993	2					
Naxos	1993	1					
Karpathos	1994	3	3		2		2
Santorini	1994						1
Total		15	6	1	8	1	20

[1] *amp. = ampeloprasum; cepa = cepa; por. = porrum; sar. = sartiuum; sch. = schoenoprosum.*

In situ and on-farm conservation

No funding is available to undertake *in situ* conservation. Promising places have been identified by GGB staff and other scientists (D. Tzanoudakis) but things have not progressed any further. The same applies for on-farm conservation. Recently, however, the EU Directive 2078/92 provides funding for traditional farming and

biodiversity conservation and there are certain opportunities for *in situ* conservation studies in the context of EU Genetic Resources Programme 1467/94.

Documentation

There is no separate database for *Allium*. Owing to the relatively small number of GGB accessions, all germplasm is documented in one database using dBASE 4 under DOS on a 486 DX IBM-compatible computer. The system has 8 MB central memory and 250 MB hard disk. However, data transfer to and from other operating systems (i.e. Windows) and packages (Paradox, SQL, Access) is feasible through various transportable files (ASCII, dif, txt, dbf) available in the modern packages.

Almost all material is currently documented only for passport data using the characters of the standard collection form of FAO/IBPGR. Only a limited number of accessions has undergone regeneration, characterization and some preliminary evaluation, but these data have not been fed to the database. These data will eventually be used to create species-specific characterization and evaluation databases, and as a basis to create the core collection.

Regeneration, characterization and evaluation

Nearly 50% of the accessions have been regenerated for characterization and seed increase. Evaluation has not been undertaken. A limiting factor for multiplication is the lack of adequate reproductive isolation facilities.

Recent collecting expeditions

The GGB makes multicrop collecting expeditions. *Allium* germplasm is occasionally collected as a side activity. *Allium* accessions (=51) have been collected as follows:

1991	Peloponnisos - Zakynthos	19
1992	Kefallonia - Lefkas - Ithaki islands	10
1993	Samos - Ikaria islands	11
1994	Santorini - Karpathos islands	11

Relevant research in the country

Professor Dimitris Tzanoudakis, Botanist at the University of Patras, has surveyed the Greek territory and found 63 wild *Allium* species. He collected seed and vegetative samples and studied their caryotypes.

Perspectives

The GGB expects to activate the National Genetic Resources Programme, which could provide a link to all interested scientific disciplines and the necessary funding. There are good relations with experienced botanists, geneticists and breeders which could help with the study, evaluation and eventual use of the *Allium* germplasm.

At the international level, a programme on *Allium* Genetic Resources has been submitted to the EU by the EU *Allium* Working Group in the framework of the EU Programme 1467/94. Another *Allium* proposal has been submitted to the EU in the framework of the AIR programme jointly with the University of Patras and other EU countries. The programme is to study diversity within the *Allium* genepool.

Progress is also expected in the sector of *in situ* and on-farm conservation through the EU programme 2078/92. The GGB proposes to undertake monitoring responsibilities for this programme, and this may provide the opportunity to initiate parallel activities (collection, etc.).

Allium collections in Hungary

Béla Baji
Institute for Agrobotany, 2766 Tápisózele, Hungary

Institutes maintaining *Allium* collections in Hungary

Vegetable Crops Research Institute Station Budapest
Curator: Dr. Lajos Zatykó
H-1775 Budapest Pf.: 95
Tel: 226 78 32; Fax: 226 78 31

Vegetable Crops Research Institute Station Makó
Curator: Dr. Attila Barnóczki
H-6900 Makó Vásárhelyi u. 89
Tel/Fax: 62 412 455

University of Agricultural Sciences Keszthely
Curator: Dr. József Farkas
H-8361 Keszthely, Ujmajori u. 2
Tel: 83 311 290; Fax: 83 311 233

Regeneration status and availability of the material

At the Research Institute of Agrobotany restricted quantities of seed are available for 294 *Allium cepa*, 16 *Allium fistulosum*, 23 *Allium porrum* and 8 *Allium soechnoprasum* accessions in the active collection; 82 accessions of *Allium cepa*, 3 accessions of *Allium fistulosum*, 7 accessions of *Allium porrum* and 3 accessions of *Allium soechnoprasum* in the base collection (Table 1).

More than 1000 seeds are maintained per accession. These are available for distribution.

The Vegetable Crops Research Institute Station, Makó, the Vegetable Crops Research Institute Station, Budapest and the University of Agricultural Sciences, Keszthely have small botanical seed samples of accessions which are used in the breeding programmes; these are also available.

Table 1. *Allium* collections in Hungary.

Institute	Species	No. of accessions	Active (0-4 °C)	Basic -20°C	Characterization	Duplicate	Activitiies planned[1] 1995	1996
Research Institute of Agrobotany, Tápiószele	**Seed**							
	A. cepa	346	294	82	169	55	81 R	70 R
	A. fistulosum	19	16	3	3	-	as perennial	
	A. porrum	27	23	4	4	1	9 R	5 R
	A. schoenoprasum	11	8	3	3	1	as perennial	
	Allium sp.	6	4	2	-	-	2 R	3 R
	Vegetative							
	A. sativum	102					102 R	102 R
	A. cepa var. *aggregatum*	21					21 R	21 R
Vegetable Crops Research Institute Station Makó	**Seed**							
	A. cepa	427	427		Few characters (3-5) / accession		Continuous field maintenance	
	Vegetative							
	A. sativum	15						
Vegetable Crops Research Institute Station Budapest	**Seed**							
	A. cepa	440	440		Few characters (3-5) / accession		Continuous field maintenance	
University of Agricultural Sciences Keszthely	**Seed**							
	A. cepa	29	29		Few characters (3-5) / accession		Continuous field maintenance	
	Vegetative							
	A. cepa var. *aggregatum*	36						

[1] R = regeneration.

Allium germplasm in Israel

H.D. Rabinowitch
Department of Field Crops Vegetables and Genetics, The Hebrew University of Jerusalem, Faculty of Agriculture, 76100 Rehovot, Israel

Table 1. Wild *Allium* species, from Israel and neighbouring areas, in the *Allium* Gene Bank at Rehovot, Israel (updated 1 May 1995).

Species	Collecting site	No. of accessions
Section: Allium		
A. ampeloprasum	Lebanon	1
	Mt. Hermon	1
	Golan Heights	1
	Upper Galilee	1
	Mt. Carmel	1
	Carmel shore	3
	Sharon Valley	6
	Southern coastal valley	40
	Inner valleys	1
	Judea Mountains	5
	Northern Negev	3
A. truncatum	Mt. Hermon	1
	Golan Heights	1
	Carmel Shore	2
	Um el Fakhem and Menashe Heights	1
	Southern Coastal Valley	1
	Inner Valleys	7
	Northern Negev	2
A. phanerantherum	Mt. Hermon	1
	Golan Heights	1
	Mt. Carmel	4
	Southern Coastal Valley	1
	Inner Valleys	3
	Not recorded	1
A. curtum subsp. *curtum*	Sharon Valley	4
	Southern Coastal Valley	8
	Northern Negev	1
	Mt. Gilboa	1
	Lower Jordan Valley	1
	Samaria Hills	1
	Judea Mountains	2
A. scoradoprasum subsp. *rotundum*	Mt. Hermon	5
	Golan Heights	2
	Not recorded	1
A. artemisietorum	Judea desert	1
	Northern Negev	1
	Southern Negev	3
A. dictyoprasum	Northern Negev	2

Species	Collecting site	No. of accessions
Section: Codonoprasum		
A. stamineum	Mt. Hermon	1
	Golan Heights	3
	Upper Galilee	5
	Lower Galilee	7
	Mt. Carmel	6
	Mt. Gilboa	2
	Samarian Hills	1
	Inner Valleys	3
	Judea Mountains	9
	Judea Desert	1
	Northern Negev	1
	Negev Mountains	1
	Not recorded	3
A. paniculatum subsp. *paniculatum*	Upper Galilee	1
	Mt. Gilboa	2
	Not recorded	1
A. pallens subsp. *pallens*	Golan Heights	2
	Upper Galilee	1
	Inner Valleys	1
	Judea Mountains	2
	Not recorded	2
A. neapolitanum	Golan Heights	1
	Upper Galilee	1
	Lower Galilee	3
	Upper Jordan Valley	1
	Sharon Valley	2
	Inner Valleys	1
	Judea Mountains	1
A. trifoliatum subsp. *hirsutum*	Golan Heights	2 sterile clones
(fertile hairy variety)	Upper Galilee	1
	Lower Galilee	1
	Mt. Carmel	4
	Sharon Valley	1
	Samarian Hills	1
A. erdelii	Sharon Valley	2
A. negevense	Upper Jordan Valley	7
Section: Melanocrommyum		
A. tel-avivense	Sharon Valley	2
	Southern Coastal Valley	10
A. nigrum	Golan Heights	2
A. orientale	Inner Valleys	1
Section: Kaloprasum		
A. schubertii	Golan Heights	1
	Lower Galilee	1

Allium germplasm in Italy

Pietro Perrino
National Research Council, Germplasm Institute (IDG), 165/A70126 Bari, Italy

Status of the *Allium* L. collection at the Germplasm Institute (IDG)

The collection of *Allium* at the IDG is made up of 112 accessions belonging to more than seven species, which have been collected from seven countries (Table 1). Most of the material was collected in Italy, Libya and Japan. Part of the collection was obtained through exchange activity. Most of the accessions belong to *Allium cepa* L. and *A. sativum* L.

Table 1. *Allium* species collected by the CNR Germplasm Institute of Bari, Italy.

	Country[1]							
Species	**ITA**	**DZA**	**EGY**	**ETH**	**LBY**	**ALB**	**JAP**	**Total**
ampeloprasum	2							2
cepa	48	1	4		13	5	7	78
fistulosum							5	5
porrum			1					1
proliferum	2							2
sativum	7				2			9
tuberosum							2	2
Other	7	2	1	2	1			13
Total	66	3	6	2	16	5	14	112

[1] ITA = Italy; DZA = Algeria; EGY = Egypt; ETH = Ethiopia; LBY = Libya; ALB = Albania; JAP = Japan.

The collection is a small one because the IDG was never involved in oriented collecting missions. Samples were collected only by chance, or during missions organized for collecting local varieties of different genera and species, including vegetable crops, in Italy and other Mediterranean countries. Seed samples are stored in aluminium foil bags, under vacuum, at 0°C and 35% RH.

Seed samples of *Allium* have been distributed throughout the world (Table 2). According to information returned, all samples were found to be in good condition and with good viability. Even so there is a strong need for seed regeneration and characterization. This activity will be carried out in collaboration with breeders and seed companies.

Status of the *Allium* L. germplasm in Italy (*ex situ* conservation)

There are several institutions belonging to universities (plant breeding institutes, horticultural institutes and botanic gardens), Ministry of Agricultural, Food and Forestry Resources (Horticultural Institutes, etc.), seed companies, etc. that maintain germplasm collections of *Allium* L. for different purposes, often for breeding activity, experimental trials for yield, nutritional value, industrial processing and trade. Currently the number and status of these collections is unknown. IDG has started to establish an inventory of Italian institutions holding *Allium* germplasm.

Table 2. *Allium* germplasm distributed between 1980 and 1994.

Year	No. of accessions	Institution
1980	1	IPK[1], Gatersleben, Germany
1982	1	IPK, Gatersleben, Germany
1983	17	IPK, Gatersleben, Germany
1984	39	Ministry of Agriculture, Agricultural Research Organization, Israel
1984	5	IPK, Gatersleben, Germany
1985	9	IPK, Gatersleben, Germany
1986	2	IPK, Gatersleben, Germany
1987	2	IPK, Gatersleben, Germany
1988	65	National Vegetable Research Station, Wellesbourne, Warwick, UK
1988	1	Istituto Tecnico Agrario Statale, 'Guiseppe Garibaldi', Cesena, Italy
1988	3	IPK, Gatersleben, Germany
1989	2	IPK, Gatersleben, Germany
1990	1	IPK, Gatersleben, Germany
1991	3	The Asian Vegetable Research and Development Centre (AVRDC), Taiwan, China
1991	4	IPK, Gatersleben, Germany
1992	2	Station Fedèrale de Recherches Agronomiqeus de Changings, Nyon, Switzerland
1993	2	Bejo Zaden B.V. Warmenhuizen, Holland
1993	3	CARDI, Barbados, West Indies
1993	24	IPK, Gatersleben, Germany
1993	15	AVRDC, Taiwan, China
1994	4	Swiss Fedèrale Research Station for Fruit Growing, Viticulture and Horticulture, Wadenswil, Switzerland
Total	205	

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Cultivation, genetic variation and research in Italy

Onion (*Allium cepa* L.) is cultivated all over the territory, but with very big differences among regions. The most important regions are Emilia-Romagna, Campania, Sicily, Puglia, Piemonte, Trento and Calabria. The total area cultivated in 1992 and 1994 was respectively 17 508 and 15 475. Trade figures show Italy among export rather than import countries. From 1986 to 1988, Italy exported more than 47 000 t of bulbs per year and the trend is increasing.

Garlic (*Allium sativum* L.) is less cultivated than onion. In 1992, the total area and production were respectively 4660 ha and 41 390 t. The most productive regions are Campania, Veneto, Emilia-Romagna, Sicily and Abruzzo.

Leek (*Allium ampeloprasum* L.;cultivated form: *A. porrum*) is much less cultivated than onion and garlic. In 1992, total area and production were respectively 1198 ha and 33 143 t. The most productive regions are Abruzzo, Veneto, Puglia, Liguria and Piemonte.

No varieties of *Allium* are registered. This suggests that, in Italy, there are very few breeders interested in *Allium* species. On the contrary, a survey made by the IDG showed that in Italy the number of local cultivated types is quite high. In experimental field trials made by agronomists it was possible to record more than

30 local types collected from different geographical regions. The results of the abovementioned survey will be reported at the next *Allium* meeting.

Although onion, garlic and leek are very important crops, most research in Italy is confined to yield trials with the aim of finding out the best seeding or growing density for each variety or type in different environments. A survey to gather more information on this topic is planned by IDG.

Geographical distribution of *Allium* species in Italy

In Italy, the genus *Allium* includes at least 51 taxonomic species. Excluding *A. cepa*, *A. sativum* and *A. ampeloprasum*, the rest may be considered wild species. Their distribution, status (wild/cultivated) and frequency throughout the peninsula (Table 3) show that many species are related to specific regions and or environments. The next step is to investigate germplasm utilization, both cultivated and wild, and to survey the ecogeographical distribution of wild species of *Allium* in Italy and other Mediterranean countries. This information is essential for estàblishing criteria and strategies for *in situ* and on-farm conservation.

Plans for the future

At the moment no oriented collecting missions have been planned, although new samples of *Allium* species may be collected in Southern Italy and Albania during the multicrop collecting missions organized every year in collaboration with IPGRI, IPK, Basilicata and Puglia regions. No regeneration of the collection at IDG has been planned. However, some regeneration may take place in relation to specific national or international projects.

Table 3. *Allium* species in Italy.

Genus	Cult./Wild	Distr.*	Regions
A. acutiflorum L.	W	RR	Piemonte, Liguria, Corsica
A. amethystinum Tausch	W	R	Liguria, Toscana, Lazio, Campania, Basilicata, Puglia, Sicilia
A. ampeloprasum L.	W	C, R	all over
A. angulosum L.	W	R	North Italy, Toscana, Marche
A. arvense Guss.	W	RR	South Italy, Lazio, Sicilia
A atroviolaceum Boiss	W	R	Puglia
A. carinatum L.	W	C	North Italy, Umbria
A. cepa L.	C	CC	all over
A. chamaemoly L.	W	R	South Italy, Liguria, Toscana, Marche, Lazia, Sicilia, Sardegna, Corsica
A. cirrhosum Vandelli	W	C	North/Central Italy, Calabria
A. commutatum Guss.	W	R	Marche, Campania, Puglia, Calabria, Sicilia, Sardegna, Corsica, small islands
A. cyrilli Ten.	W	RR	Puglia
A. cupanii Rafin	W	R	South Italy (exc. Campania) , Sicilia
A. ericetorum Thore	W	R	Fruili, Veneto, Lombardia, Liguria, Emilia-Romagna, Toscana, Marche, Umbria, Abruzzo
A. flavum L.	W	C	South Italy, Liguria, Abruzzo, Sicilia
A. fuscum W. et K.	W	R	Fruili, Lombardia, Toscana, Marche, Lazio, Abruzzo, Puglia
A. insubricum Boiss et Reuter	W	R	Lombardia
A. lineare L.	W	R	Trentino, Piemonte
A. lusitanicum Lam.	W	C	all over (exc. Puglia, Sardegna, Corsica)

Genus	Cult./Wild	Distr.*	Regions
A. moschatum L.	W	R	Toscana, Abruzzo, Sicilia
A. narcissiflorum Vill.	W	RR	Piemonte, Liguria
A. neapolitanum Cyr.	W	C	all over (exc. Piemonte)
A. nebrodense Guss.	W	R	Sicilia
A. nigrum L.	W	C	South/Central Italy, Emilia-Romagna, Liguria, Sicilia, Sardegna, Corsica
A. obtusiflorum DC.	W	C	Sicilia
A. oleraceum L.	W	R	North Italy, Toscana, Lazio, Abruzzo
A. pallens L.	W	R	South/Central Italy, Fruili, Sicilia, Sardegna, Corsica
A. paniculatum L.	W	C, R	all over
A. parciflorum Viv.	W	R	Sardegna, Corsica
A. pendulunum Ten.	W	R	South/Central Italy, Sicilia, Sardegna, Corsica
A. polyanthum Schultes et Schultes	W	R	Fruili
A. porrum L.	W	C	all over
A. roseum L.	W	C	South/Central Italy, Emilia-Romagna, Liguria, Sicilia, Sardegna, Corsica
A. rotundum L.	W	R	Fruili, Lombardia, Piemonte, Liguria, Emilia-Romagna, Toscana, Umbria
A. sativum L.	W	C	all over
A. sardoum Moris	W	R	South Italy, Lazio, Abruzzo, Sicilia, Sardegna
A. saxatile Bieb	W	R	Fruili, Marche, Umbria, Lazio, Abruzzo
A. schoenoprasum L.	W	R	North Italy, Toscana, Corsica
A. scorodoprasum L.	W	R	Fruili, Veneto, Liguria
A. siculum Ucria	W	R	Toscana, Basilicata, Sicilia, Sardegna, Corsica
A. sphaerocephalon L.	W	C, R	all over
A. suaveolens Jacq.	W	R	Fruili, Veneto, Piemonte, Emilia-Romagna, Toscana
A. subhirsutum L.	W	C	South Italy, Liguria, Toscana, Lazio, Sicilia, Sardegna, Corsica
A. subvillosum Salzm.	W	RR	Sicilia
A. tenuiflorum Ten.	W	R	South/Central Italy (exc. Toscana), Sicilia, Corsica
A. trifoliatum Cyr.	W	R	South Italy, Liguria, Lazio, Sicilia
A. triquetrum L.	W	R	South/Central Italy, Liguria, Sicilia, Sardegna, Corsica
A. ursinum L.	W	C	all over (exc. Sardegna)
A. victorialis L.	W	R	North Italy (exc. Emilia-Romagna)
A. vineale L.	W	C	all over
A. waldsteinii G. Don	W	R, C	Fruili

* R = rare; RR = very rare; C = common; CC = very common.

Conclusions

There is a need to:

- establish an inventory of *Allium* germplasm collections in the country
- study ecogeographical distribution of *Allium* species in Italy, including small islands
- improve the knowledge of the taxonomy of wild *Allium* species in Italy
- list varieties and/or landraces cultivated in the country
- regenerate the IDG and possibly other Italian collections
- select areas for *in situ* and on-farm conservation.

Current status of *Allium* collections at the Centre for Genetic Resources (CGN) in The Netherlands

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The collection

The CGN *Allium* collection consists of 198 accessions (May 1995), available for distribution; 186 additional accessions are not yet included in the collection, but will be after regeneration. An overview of the collection is given in Table 1.

The collection was reduced considerably by bulking near duplicates, from both onion and leek. This reduction of redundancy was reported during the ECP/GR *Allium* Working Group Meeting in 1991. The methods were described in the *Allium* Improvement Newsletter, 1991 (1):25-26. The reduction of duplicates has also been completed for leek now. The total exercise resulted in a reduction of about 50% of the original number of accessions.

Table 1. *Allium* accessions in the CGN collection per species and cultivar group.

Species/group	Accessions available	Accessions to be regenerated
A. altaicum	5	1
A. ampeloprasum		16
A. ampeloprasum group Kurrat	4	12
A. ampeloprasum group Leek	53	25
A. carinatum pulchellum		2
A. cepa		5
A. cepa group Aggregatum		1
A. cepa group Dry Bulb Onion	94	71
A. cepa group Silverskin Onion	4	
A. cepa group Bunching Onion	2	
A. cernuum		1
A. drobovii		1
A. festissourii		1
A. fistulosum	24	10
A. flavum	1	1
A. galanthum		6
A. guttatum	1	2
A. ledebourianum		1
A. oschaninii		2
A. pskemense		3
A. roylei		1
A. scorzonerifolium		1
A. senescens		1
A. senescens montanum		3
A. triquetrum		1
A. tuberosum	3	2
A. vavilovii	1	2
A. vavilovii x *A. cepa*	2	
Allium species unknown	3	15
Total	198	186

The passport data are nearly complete. For three accessions the species name and for 20 accessions the origin country is not known. From the material which needs regeneration the species name of 15 wild accessions is not known. All information on the collection is available in any form, i.e. printed or in computer files. Passport data are included in European *Allium* Database (EADB), but an update is needed because groupings have been made and new material has been added.

Regeneration

All material included in the CGN collection has been regenerated and fulfils our standards regarding quality and quantity (germination over 80%, more than 4500 seeds). Of the material not yet included, about 60 accessions are in the process of regeneration and material will be available soon. The rest of the material will be regenerated in the coming years. Some constraints in regeneration were faced with cultivated material (onion, leek and kurrat) from Egypt and Pakistan, due to possible differences in day length, light intensity and temperature between these countries and the Netherlands and to sensitivity to diseases. Regeneration of the wild material also caused difficulties. It will take several years before enough seed is produced to fulfil our standards.

For regeneration 60-100 plants are used. After onion bulbs have been harvested, dried and potted they are placed in an unheated glasshouse for overwintering. For leek, mature vegetative plants are uprooted in November and overwintered in a glasshouse at 5-10°C. As soon as flowers appear the plants are transferred to isolation rooms and pollinated by blowflies.

Storage

The seeds are dried until a seed moisture content of about 5% is reached. The seed samples are packed in laminated, aluminium foil bags and stored at 20°C for long-term storage. User samples are stored at 4°C.

Safety duplication

All material included in the collection is duplicated at the Genetic Resources Unit of HRI, Wellesbourne, United Kingdom.

Characterization and evaluation

Most of the onion and leek material (including kurrat) has been characterized for, respectively, 19 and 15 different traits, according to CGN descriptor lists (partly derived from UPOV and ECP/GR descriptor lists). This resulted in 2388 observations.

Some of the wild relatives of *Allium cepa* were evaluated by CPRO-DLO for resistance to downy mildew (*Peronospora* destructor), leaf blight (*Botrytis squamosa*), neck rot (*Botrytis aclada*) and white rot (*Sclerotium cepivorum*). Part of the leek material has been screened by CPRO-DLO for resistance to rust (*Puccinia allii*) and thrips (*Thrips tabaci*). The results of the evaluations are not yet included in the CGN information system GENIS, but will be soon.

Utilization

Each year about 50 accessions are distributed to users. The most requested material is the wild species, especially *A. roylei* because of its resistance to diseases. Onion, leek and kurrat accessions from Egypt are also often requested.

Status of the *Allium* collections in the Nordic Gene Bank

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Since 1979, the conservation of plant genetic resources in the Nordic countries has been organized by the Nordic Gene Bank (NGB). NGB is a small central institute within a regional network of institutes and individuals engaged in the conservation and utilization of plant genetic resources. The network consists of members of several inter-Nordic working groups that NGB has established to cover the range of crops grown in the Nordic countries. The Vegetable Working Group collects and evaluates vegetable species, including *Allium*.

The current size and situation of the *Allium* seed collections in the five Nordic countries are shown in Table 1. In total, 99 seed accessions are stored in NGB, 34 *A. cepa* var. *cepa*, 49 *A. cepa* var. *aggregatum*, 13 *A. porrum* and 3 *A. schoenoprasum*. With the exception of the *aggregatum* material all the *Allium* accessions are materials bred and marketed in a Nordic country.

Table 1. *Allium* material in the Nordic Gene Bank.

	Total no. of accessions	**Needs regeneration**	**Needs characterization**	**Dupl. to Svalbard**
Allium cepa L.				
var. *cepa*	34	15	6	10
var. *aggregatum*	49	-		11
Allium porrum L.	13	0	1	-
Allium schoenoprasum L.	3	0	3	

Most of the *A.. cepa* var. *cepa* material consists of varieties that come mainly from Denmark (30). The rest are from Norway (3) and Sweden (1). The germinability is, in many cases, low and some accessions have to be rejuvenated this summer. Most of the varieties are described to a certain extent using UPOV guidelines (Database VG01). The numbers in the Table indicate varieties that are not yet described.

The 49 seed samples of *A. cepa* var. *aggregatum* are seed samples of the collection that are conserved vegetatively in Finland. The entire collection has a temporary status. NGB does not take long-term responsibility for this material.

All but one of the *A. porrum* accessions are from Denmark. Germinability is, in most cases, acceptable. Most of the varieties are described in database VG02.

NGB also takes the responsibility for conservation of the Nordic vegetatively propagated *Allium* base material. The safety material is conserved in the field genebank in Olomouc, Czechoslovakia. Most of the vegetatively propagated *Allium* materials are potato onions, A. *cepa* var. *aggregatum*. Potato onions were imported to Finland from Russia in the 19th century, and were the most important onion type grown in Finland until the 1950s.

In the 1980s, 121 clones were collected. NGB has now taken the long-term responsibility for 10 of these clones. They are grown and stored during winter at two locations in Finland. Duplicate samples have been sent to Olomouc. Collection data exist, but the material has not yet been described and evaluated.

Vegetatively propagated material of shallots was collected in Norway in the early 1980s and 20 clones were sent to Olomouc. Duplicates, however, were not kept in Norway. These clones have now been requested from Olomouc for long-term conservation and for characterization and evaluation.

Future activities

- Description of the Finnish potato onion material, 1996
- Description of the Norwegian shallot material, 1995 and 1996
- Further characterization of the bulb onion material. All accessions shall be described until the end of 1996
- Regeneration of accessions with low germinability, 1995 and 1996
- Collecting of *A. cepa* var. *cepa* and var. *aggregatum* in Sweden, 1995 and 1996
- Collecting of *A. fistulosum*, *A. schoenoprasum* and *A. viviparum* in Norway, 1996 and 1997.

Preservation of *Allium* germplasm in Poland

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The Research Institute of Vegetable Crops in Skierniewice is responsible for the conservation of vegetable crops. It is a part of the National Plant Genetic Resources Conservation Programme which is coordinated by the Plant Breeding and Acclimatization Institute in Radzikow.

The aim of the programme is to collect and protect plant genetic resources endangered by extinction and to stimulate their utilization. The activity covers all aspects of the germplasm collection and preservation.

The most important task is to collect and protect as many landraces, ecotypes, old native cultivars of onion, garlic, shallot and other edible *Allium* as can be found all over Poland. The specific structure of Polish agriculture, where traditional methods have been continued by elderly people, means that very valuable germplasm still exists on small private farms. These old native landraces represent genetic diversity in close connection with the local environment.

The conservation programme of the genus *Allium* covers:

- the main cultivated species of *Allium*: onion, garlic, leek (advanced, obsolete, old cultivars landraces, valuable breeding materials)
- other edible *Allium* species such as shallot, chive, bunching onion, etc.
- wild relatives of cultivated crops
- wild species of *Allium*.

Table 1. Present status of *Allium* germplasm.

Allium	Total	Passport data	Evaluation/ characterization	Seed in long-term storage	Field collection
cepa	153	153	83	153	60
cepa var. *aggregatum*	60	60	39	11	-
ampeloprasum	7	7	-	7	252
sativum	252	252	252	-	-
Other *Allium*	279	279	95	55	279

Characterization and evaluation of the morphological and agronomic characters are made according to IPGRI recommendations and the needs of breeders. These are carried out in collaboration with plant breeders and different institutions. Accessions are evaluated over three growing seasons to provide users with the information necessary to utilize the material

The collected materials are stored at the Central Gene Bank in Radzikow or maintained in field collections and include: onion (*A. cepa*), shallot landraces (*A. cepa* var. *aggregatum*), garlic (*A. sativum*) and edible and wild *Allium* species.

Collection of onion (*Allium cepa* L.)

The collection of *A. cepa*, which is maintained at Skierniewice, covers 153 accessions. Origin and type of materials are given in Table 2.

Table 2. Status of onion collections.

		Type of accessions			
Origin	Number of accessions	Advanced cultivars	Breeding lines	Old cultivars	Landraces
Poland	86	9	57	14	14
Russia	6	-	-	6	6
Tadjikistan	13	1	4	8	8
Kazakhstan	1	-	-	1	1
Kirgistan	2	-	-	2	2
Uzbekistan	20	-	6	14	14
Czech	4	4	-	-	-
Israel	1	1	-	-	-
Japan	19	19	-	-	-
Germany	1	1	-	-	-
Total	153	35	67	-	45

All collected accessions are documented with regard to passport data.

Regarding characterization and evaluation of accessions (Polish, Russian landraces old cultivars), about 50% of the collections are evaluated for morphological and yield-forming traits, according to IPGRI recommendations, at the Institute of Vegetable Crops.

Materials of the collection are cultivated by direct sowing or seed plants in isolation (20-30 accessions) every year in the field and evaluated during growth and harvest with regard to occurrence of diseases and insect pests (downy mildew, viruses, onion fly, etc.), yield and storage ability.

Dry matter is also examined, as well as the qualitative traits, such as sugar and vitamin C contents. Results for the evaluation of 30 onion landraces are shown in Table 3. These accessions were evaluated under field conditions in two or three places: in Skierniewice and also PlantiCo Breeding Comp, Szymanow and/or Breeding Company PlantiCo Golebiew.

Information related to these 30 accessions is stored as computerized data. The rest of the evaluation data has yet to be computerized.

Landraces of onion originating from Central Asia and Siberia are used as sources of dry matter content, quality of dry skin, source of sterility, earliness and their adaptation to different environmental conditions.

Collection of shallot (*A. cepa* var. *aggregatum*)

The collection of shallot landraces was established at the Research Institute of Vegetable Crops - Plant Genetic Resources Laboratory in 1991, based on landraces collected mainly in Poland. In Poland, shallot is cultivated only in the home garden and not on a large scale. Currently, 60 accessions are maintained in the collection. (Table 4).

All collected accessions are documented with regard to passport data.

Table 3. Garlic accessions having useful economic characters for breeding.

Accession	Origin	Leaf even-ness	Regular head (>90%)	Marketable yield (>90 kg/100 m²)	Weight of head (>30 g)	Dry skin (4 scales or more)
17	Poland	+	+	+	+	+
64	Poland	+	+	+	+	+
67	Poland	+	+	+	+	+
73	Poland	+	+	+	+	+
75	Poland	+	+	+	+	-
103	Poland	+	+	+	+	+
120	Poland	+	+	+	+	+
138	Poland	+	+	+	+	-
53	Romania	+	-	+	+	-
126	Czech Rep.	+	+	+	+	+
178	Czech Rep.	+	+	+	+	-
551	Czech Rep.	+	+	+	+	-
177	Russia	+	+	+	+	-
195	Moldova	+	+	+	+	-
197	Kyrgystan	+	-	+	-	-
46	Kyrgystan	+	+	-	+	+
48	Kyrgystan	+	+	+	+	+
49	Kyrgystan	+	+	+	+	+
26	Uzbekistan	+	+	+	+	+
24	Uzbekistan	-	+	-	+	+
U37	Uzbekistan	+	+	+	+	-
U74	Uzbekistan	+	+	+	+	+
29	Tajikistan	+	+	+	-	-
52	Kazakhstan	+	+	+	+	-
54	Kazakhstan	+	+	+	+	+
LB	Lithuania	+	+	+	+	+
300	USA	+	+	+	+	+

Table 4. Status of the shallot collection.

Origin	Number of accessions
Poland	50
Russia	4
USA	1
Albania	3
Kyrgyzstan	1
Netherlands	1
Total	60

Thirty-nine accessions have been evaluated for morphological and economic character according to IPGRI recomendations and the needs of breeders. The rest of the accessions are in multiplication.

Part of these materials are reproduced every year at the PlantiCo Breeding and Seed Company, where breeding of shallot is carried out.

About 50% of the collected accessions are vegetatively propagated and 50% produce seed. All accessions are reproduced every year in the field in one or in 3-4 replications for evaluation.

Great variability for economic and morphological traits (earliness, dry matter content, size of bulbs, tolerance to downy mildew, stress condition) has been observed in shallot landraces; these provide valuable material for the breeding programme.

Collection of garlic (*A. sativum*)

In Poland garlic is the second species in the group of bulb vegetables, after onion, and is a cultivated and medicinal plant. The total production of garlic amounts to about 10 000 t on a cultivation area of 1500 to 1700 ha. Average annual consumption is 0.25-0.30 kg per person.

Garlic is grown on small areas (0.1 to 0.3 ha), mostly for the home market. The demand for garlic is very changeable, depending on the consumption of other vegetables.

Since 1993 no garlic cultivars have been bred, but various local garlic populations called "types" are grown in Poland. Individual growers select the "types" themselves, abandoning populations with greater genetic variability which are well adapted to the local environment.

The introduction of new Polish or foreign cultivars to cultivation can cause, in a short time, the elimination and loss of the old garlic populations.

The garlic collection was established in 1986 at the Institute of Vegetable Crops to protect natural variations against genetic erosion. The collection is located at the Breeding Company POLAN, Krzczonow, south of Poland (300 km south of Skierniewice) in the old centre of garlic cultivation.

The main task of the collection is to collect and conserve local garlic populations, called "types", which are grown all over the country and to maintain valuable germplasm as research material for breeders and research. The garlic collection contains 252 accessions (Table 5).

Table 5. Origin and type of materials.

	Number of accessions of *A. sativum*	
Origin	var. *sagittatum*	var. *vulgare*
Poland	73	72
Albania	1	2
Argentina	-	7
Czech Republic	7	-
Greece	1	-
Japan	8	-
Kazakhstan	5	-
Kirgistan	14	-
Lithuania	1	-
Moldovia	3	2
The Netherlands	-	1
Russia	29	1
Romania	2	-
Tadjikistan	8	-
Turkmenistan	2	-
Ukraine	1	1
USA	2	-
Uzbekistan	9	-
Total	166	86

All collected accessions are reproduced in the field every year to maintain them live and to obtain sufficient experimental material. Every newly obtained garlic sample receives a number from the Polish Gene Bank in Radzikow, is documented

with regard to passport data and included in the collection. After multiplication the accessions are included in 3-year experiments (3-4 replications) to evaluate economic value. After the 3-year research cycle, the accessions are maintained in field collections in one replication (100 plants for each accession). Evaluation of economic, morphological characteristics and other parameters is conducted according to the file elaborated by IBPGR and the Research Institute of Vegetable Crops. The results of the evaluation are available upon request.

The decisive characters for the economic value of garlic are:

- leaf evenness
- not less than 90% of heads of regular shape
- not less than 80% of heads have non-cracked dry skin
- marketable yield higher than 90 kg/100 m^2
- weight of 1st class quality head not less than 30 g
- at least 4 scales cover the head.

Many collected accessions showed presence of valuable characters when compared with the standards and could be a good source of characters for breeders.

Numerous accessions are used in breeding (the first 6 Polish cultivars of garlic are selected from collection materials) and for biochemical investigations.

Collaboration with breeders is fruitful because it provides a base for initial materials and for the genebank it is a source of new genotypes and suggestions for research useful for practical breeding.

Breeders obtaining materials from the genebank collection evaluate them with regard to many other characters and return the results to the genebank, thereby enriching the information for a given accession.

Ninety-eight percent of the garlic collection has been evaluated over 3 years in accordance with the descriptors list recommended by IBPGR/IPGRI. Passport data and about 20% of the evaluation data are computerized. The data containing the results of the 3-year evaluation are still to be computerized.

In 1992 isozyme analyses began for characterization of genetic variability of *A. sativum*. Up to now 170 accessions have been analyzed. Twenty-two enzyme species were investigated in this material. Polymorphism in phenotype after electrophoresis was observed in four enzyme systems assayed: EST, G6PD, PGM, TPI. The investigations are continuing.

In 1994, in collaboration with the Institute of Herb Plant Processing, the total content of alliine in 23 accessions of garlic was determined and the next 80 accessions were analyzed in April 1995 (Table 6). One of the aims of this study is to choose material with a high content of alliine for pharmaceutic and food-processing needs.

Edible and wild garlic species

The collection is maintained at Skierniewice and covers 279 accessions. Among the materials are accessions collected in Central Asia and Siberia, and wild species occurring in Poland. Some accessions were taken from Botanical Gardens in Poland. Ninety percent of accessions are documented with regard to passport data; about 50 are still unrecognized. Characterization and preliminary evaluation are being done. Data are still not computerized.

Some wild *Allium* species, which show high nutritive and medicinal value (content of vitamin C, B-carotene, Fe, K, amino acids, etc.) and decorative value, are recommended for amateur cultivation and pharmaceutical needs.

Twenty species were used for isozyme analysis including *A. longicuspis*.

Table 6. Contents of alliine in garlic.

No. accessions	Origin	Alliine content (%)
114/103	MDA (Moldova)	1.26
116/120	POL (Poland)	0.59
119/177	RUS (Russia)	1.24
124/300	USA	0.98
170/A 005	RUS	0.79
171/A 006	RUS	0.70
180/A 041	RUS	0.86
189/A 108	RUS	0.79
190/A 109	RUS	0.96
193/Dubkowski	RUS	0.75
199/46	POL	0.52
200/53	ROM (Romania)	0.61
217/G 12	JPN (Japan)	0.57
232/PV 72	POL	0.73
233/PV 83	POL	0.68
236/PV 86	POL	1.01
237/PV 88	POL	0.80
238/PV 98	POL	0.99
240/PV 125	POL	0.70
241/PV 134	POL	0.76
242/PV 135	POL	0.87
244/PV 143	POL	0.93
KRE-192	POL	0.96

Utilization of collected *Allium* germplasm

Allium germplasm from the genebank is utilized mainly by breeders (Breeding Company, Experimental Breeding Station, private breeders), but also Agricultural Universities, Universities, Research Institutes, horticultural schools and gardeners. Distribution of *Allium* accessions from 1991 to spring 1995 is given in Table 7. During this period 946 samples were used.

Safety duplications

Presently there are no registered duplicates of *Allium* accessions at other genebanks. Some accessions of garlic and onion *Allium* species exist in Olomouc, The Czech Republic; Rehovot, Israel; Wisconsin University, Madison, WI, USA and Tsukuba, Japan.

Regeneration

The seeds of eight Polish advanced cultivars of onion were deposited in genebank storage in 1982 and 1983. These were the oldest seeds. These cultivars are still in production. Most of the accessions were stored from 1987 and later. The accessions which are taken from the genebank for evaluation are also regenerated.

Table 7. Number of accessions of *Allium* species distributed since 1991.

Year	Species	Breeding companies	Institutions and Universities	Abroad
1991	onion	40	-	23
	garlic	41	-	25
	shallot	-	-	9
	other *Allium*	-	-	12
	Total	81	-	69
1992	onion	8	23	-
	other *Allium*	11	10	-
	Total	19	33	-
1993	onion	19	16	4
	garlic	236	22	-
	shallot	18	5	-
	other *Allium*	19	8	-
	Total	292	51	4
1994	onion	65	-	1
	garlic	20	-	-
	shallot	-	4	-
	other *Allium*	29	3	-
	Total	114	7	1
1995	onion	7	-	-
	garlic	60	152	-
	shallot	-	32	-
	other *Allium*	10	-	-
	Total	86	184	-

Table 8. List of *Allium* species in the collection.

Species	No. accessions
Subgenus: *Rhizirideum*	
Section: *Cepa* (Mill.) Prokh	
A. cepa L.	153
A. cepa var. *aggregatum* G. Don.	60
A. galanthum Kar. et Kir	9
A. oschanini Fedtsch.	2
A. preamixtum Vved.	1
A. psekemense Fedtsch	4
A. x *proliferum* Scharad	2
Section: *Phyllodolon* (Salisb.) R. Kam.	
A. fistulosum L.	4
A. altaicum Pall.	18
Section: *Schoenoprasum* Dun	
A. altyncolicum Friesen	1
A. ledebourianum Roem. et Schult	2
A. maximiwiczii Rgl.	1
A. ologanthum Kar. et Kir.	2
A. schoenoprasum L.	3
A. sibiricum L.	1
Section: *Rhizirideum* G.Don. ex Koch	
A. albidum Fischer ex Bieb.	1
A. angulosum L.	4
A. glaucum Scharad	1
A. kansuense Rgl.	2
A. montanum Schidt	2
A. nutans L.	15
A. prostratum Trev.	1
A. roylei Stearm	1
A. rubens Schrad. ex. Willd	1
A. senescens L.	1
A. spirale Willd.	1
A. tenuissimum I.	1
A. tuberosum Rotti. ex Spr.	1
Section: *Butomissa* (Salisb)Kamel.	
A. drobovii Vved.	5
A. odorum L.	5
A. ramosum L.	3
A. tuberosum Rottl. ex Spr.	1
Section: *Petroprason* F. Herm.	
A. obliquum L.	5
Section: *Oreiprason* F. Herm	
A. carolinianum DC.	1
A. hymenorhizum Ledeb.	3
A. kokanicum Rgl.	1

Species	No. accessions
A. talassicum Rgl.	1
Section: *Reticulato-bulbosa* Kamel	
A. ericoleum Vved.	1
A. strictum Schrad.	1
Section: *Campanulata* R. Kam.	
A. barszczewski Lipsky	2
A. drapanophyllum Vved.	1
A. jodanthum Vved.	1
Section: *Sacculiferum* P. Gritz.	
A. thunbergii G. Don.	1
Section: *Anquinum* G. Don. ex Koch.	
A. microdictyon Prokh.	1
A. ochotense Prokh.	1
A. tricocum Sol. in Ait	1
A. victorialis L.	1
Section: *Annuloprasum* Egor.	
A. atrosanquineum Schrenk.	1
Subgenus: *Bromatorrhiza* Ekb.	
Section: *Bromatorrhiza* Ekb	
A. macranthum Baker	1
Section: *Cyathophora*	
A. farreri Steam.	1
Subgenus: *Allium*	
Section: *Allium*	
A. ampeloprasum L.	2
A. guttatum Steven	1
A. jajlae Vved.	1
A. longicuspis Rgl.	9
A. pyrenaicum Cos. et Vavr.	1
A. sativum L.	252
A. scorodoprasum L.	2
A. spherocephalon L.	1
A. vineale L.	1
Section: *Codonoprasum* Rchb.	
A. albanum Grossh.	1
A. carinatum L.	1
A. carinatum ssp. *pulchellum* L.	1
A. flavum L.	2
A. oleraceum L.	2

Species	No. accessions
A. turkiestanicum Rgl.	1
Section: Scordon Koch.	
A. caeruleum Pall.	5
A. caeruleum var. *bulbiferum*	2
A. ceasium Schrenk.	9
Subgenus: *Melanocrommyum* (W.B.) Rouy	
Section: *Melanocrommyum* W.B.	
A. aflatunense B. Fedtsch.	6
A. altissimum Rgl.	2
A. vaschkyzyisaicum Krass.	1
A. christophii Trautv.	5
A. collis-magni R. Kam	1
A. elatum Rgl.	1
A. gigantheum Rgl.	2
A. jestidianum Boiss. et Bushe	1
A. karataviense Rgl.	4
A. kastatovaginatum R. Kam. et Levichev	1
A. motor R. Kam. et Levichev	3
A. sarawschanicum Rgl.	1
A. severtzowii Rgl.	2
A. stipitatum Rgl.	11
A. suworowii Rgl.	2
Section: *Verticillata* R. Kam.	
A. verticillatum Rgl.	1
Section: *Porphyroprason* Ekbera.	
A. oreophilum C.A. Mey	2
Subgenus: *Amerallium Traub.*	
Section: *Amerallium* Traub.	
A. canadense L.	2
Section: *Lophioprason* Traub.	
A. cernuum Roth.	3
Subgenus: *Mollium* G. Don ex Koch.	
A. chinense G. Don.	5
A. neapolitanum Cyr.	1
A. molly L.	1
Section: *Caulorhizideum* Traub.	
A. validum S. Wats	1
Section: *Ophioscorodon* (Wallr.)Vved.	
A. ursinum L.	1

Onion production in Poland

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Onion is one of the most important vegetables in Poland. It belongs to the group of six main species consisting of over 80% of the total vegetable crops. For several years onion yearly production was 500 000-600 000 t. In favourable weather conditions, as in 1993, more than 700 000 t were harvested. Poland is the second largest onion producer in Europe, after Spain. In 1994, about 34 000-37 000 ha were under cultivation, which was about 1.8% of the world area or 15% of the European cultivation area.

In 1993, onion was produced on 12.2% of the total vegetable area and consisted of almost the same share (12.3%) of the vegetable crops. Production of onion per capita in 1993 amounted to 18.8 kg with a mean crop of 21.6 t/ha.

Up to 1985 the onion production area was quite stable. Since 1986 production has increased: in 1987 it was 25% more than in 1985, in 1991 15% more than in 1990. Onion yields change yearly. Generally they are very low and unstable; only in 1987 did production surpass 20 t/ha. There are some very productive farms specializing in vegetable crops where sometimes more than 60 t/ha are harvested.

Onion production is concentrated in a few regions. Warsaw and Plock voivodships lead, producing 22% of the total crop. In Plock region this means 156 kg per capita, compared with 87 kg in Skierniewice, 63 kg in Konin, 58 kg in Leszno and 37 kg in Wroclaw voivodships. Production could be higher if the surplus could be sold abroad. Local consumption has been stable for many years and amounts to 6 kg per capita, as in Germany and France.

Export of onion has long been a tradition. In 1938 Poland sold 14 600 t abroad. After the Second World War it was the main export vegetable consisting of sometimes 90% of the share of the total vegetable crop sold on foreign markets. Two decades after the war, in 1964, production reached a peak of 89 000 t. Poland was one of the leading countries in this field with the United Kingdom and Germany being the main importers. Wolska prevailed as the variety that met customers' demands concerning colour, taste, and storage ability. Since 1988 the political situation has greatly limited agricultural trade with Western countries.

Currently, the highest export achieved was in 1987, with similar amounts being achieved in 1993 and 1994, when 152 000 t and 145 000 t respectively were sold abroad. Main importers are the European Union countries including Germany and The Netherlands and Eastern European countries.

In 1992, Germany was the leading importer (23 000 t) followed by the Netherlands (16 900 t). In 1993, this order was reversed: Germany bought 17 700 t (12% of total export) and the Netherlands 26 000 t (17%). Onion trade with Holland deserves attention, as Holland is also a producer and leading exporter of onion. In 1992, the Netherlands produced 573 000 t and exported 523 000 t, partly to Poland.

Over the last 2 years onion imports to Poland, mainly from Holland, grew rapidly. In 1993 they amounted to 11 640 t and in 1994, 16 951 t, representing 80% of all imports. The importation figures for 1994 could be explained by the high export figures from the previous year's crop. In March and April of 1994 onion was a desirable vegetable on the domestic market. In 1993 onion production was profitable and in 1994 even more so, which encouraged growers, in 1995, to increase the area of production.

Traditions of onion breeding in Poland

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Onion has been grown in Poland since the 12th century. The region of Przybyszew on Pilica was established by Benedictine and Cisterian orders of monks. In the 14th century the onion-growing area was increased under King Jagieo. Cultural practices recommended in 17th century do not greatly differ from today's (Brzeziski 1925).

Onion breeding began between the years 1925 and 1935, when the following cultivars were produced: Giant Rocca, Dutch (Flat, Yellow, White and Red), White Queen, Madera globe and Flat, Iron Head, Magnum Bonum, Tripoli Bassano, Italian Great, Kartoflanka and most of all Zytawska.

Between 1926 and 1928 the cv. Wolska was frequently mentioned as being popular on garden farms in the vicinity of Warsaw, where it was produced together with other local cultivars. In other onion-growing regions such as Przybyszew, there was a well-known onion landrace named Przybyszewska, as well as Szczebrzeszyska at Szczebrzeszyn, Topolska at Topola near Skalbmierz, and many others. In 1938/39 a first "List of recommended cultivars" was published, aiming to limit the number. Only two cultivars were included on this list: Wolska and Zytawska.

The first Polish onion cultivar, Wolska, was bred by Józef Zajkowski in the Warsaw district of Wola around 1910. It was a cross between Zytawska and some foreign varieties. Zytawska was commonly grown in the region, but did not store well.

At that time, the private Breeding and Seed Company of Hoser brothers developed onion breeding in the Warsaw district of Rakowiec. At this company Wincenty Hoser and Stanislawa Lenkiewicz bred an original Polish onion cultivar named Wolska. This cultivar originated from a cross (made in 1912) between Zytawska, of German origin, which bears flat-shaped bulbs, and a local cultivar Wolska, which produces elongated bulbs. This was cultivated in the Warsaw region, but was not created by Zajkowski. As a result of this crossing, an onion was bred having large, globe-shaped bulbs with a longer storage life, which soon became popular on the market.

Breeding work continued during the First World War and after. In the process of breeding, the name of the new Wolska cultivar was changed a few times. In 1932-34 it was called Zytawska-Wolska; in 1935-38 Warszawska-Wolska, then Wolska Hosera (Hoser's Wolska). Finally, in 1938, Wolska Hosera was registered as an original Polish cultivar.

After the Second World War all private enterprises were nationalized and breeding was re-established in 1948 at the Breeding Station of Horticultural Plants in Iwiec, where conservation breeding continues. Wolska onion was again placed on the list of original cultivars in 1974 and has remained there up to the present. Wolska has a long vegetation period, is of good quality with globular, rhomboidal shaped bulbs, straw-yellow coloured dry skin and is suitable for long-term storage. It became the main onion cultivar for export. After the Second World War some breeding centres tried to modify some traits of this cultivar. For many years, Wolska was the leading cultivar produced in Poland and had the greatest economic importance; it was also very popular abroad and many Polish and foreign onion cultivars were bred from this base. Other onion cultivars were released in Poland before the Second World War.

Rawska was created by H. Skierkowski in Rawa region in 1938. This cultivar originated from a cross made in 1925 between a local cultivar Rawska and Ziegler's Gelbe Grosse Runde. At first it was called Zytawska Poprawna; since 1938 it has been known as Rawska. This variety was popular in production after the war, but was only introduced to the national register as an original Polish cultivar in 1955. This cultivar is earlier than Wolska, has globular, slightly elongated bulbs with browny-yellow outer skin. It is suitable for storage. At present, conservation breeding is conducted at the Breeding and Seed Enterprise Poznan.

Nochowska was bred by J. Wachowiak at the Spójnia Breeding Company in Nochowo. It was created in 1938 as a cross between Zytawska Olbrzymia (Mette) and Wolska-Warszawska. This variety bears globular bulbs with straw-yellow outer skin, slightly thicker dry skin and is more pungent than Wolska; it ripens 10 days earlier than Wolska. It has good storage ability.

Besides the above, the following Polish cultivars have been produced since the Second World War.

Koda was bred at the Freege Breeding Company by J. Korohoda in Krakow in 1948. It was a cross between Zytawska and Madera. This is a medium-early cultivar, bearing yellow flattened bulbs, typical for fresh consumption, as it is tasty and very sweet.

Zytawska Plaska was selected from Zittauer Platrund by J. Mazurkiewicz at the Breeding Company, Brothers Kleszczynscy in 1950. Bulbs are flat with straw-yellow outer skin, good for long storage.

Besides these, local cultivars have been grown in many regions. The main regions of onion cultivation have been: central regions, including Warsaw and Lodz voivodships (neighbourhood of Warsaw, Zakroczym. Garwolin, Grodzisk, Przybyszew, Blonie, Sochaczew, Rawa, Kutno, Leczyca, part of Poznan voivodship: Kalisz, Turek, Jarocin, Osrow, Krotoszyn, Sroda, Srem); Kraków region, Kraków-Kielce-Rzeszow including Kraków, Miechow, Pinczow (village Topola), Sandomierz, Opatów, Mielec; Wroclaw-Wroclaw, Legnica region; Lublin-Lublin, Pulawy, Chelm region.

Local cultivars were connected with the region of cultivation and their names derived from the place of growing; for example in Topola near Skalbmierz, cv. Topolska was cultivated. This was an early variety with brown-red skin, excellent for growing from sets (small onion bulbs) for early bunch harvest and it was sold in a bunch with chive.

Legnicka was cultivated in Legnica region; bulbs are slightly flattened with delicate veinlets, they stored well for that time, better than Zytawska but inferior to Wolska.

Some other local varieties are worth mentioning.

Szczebrzeszynska is a landrace for growing from sets and is still cultivated in Zamosc province. It has bulbs which are flat and reddish; the outer skin is bluish in colour. Similar to this is landrace Ropczycka (from Ropczyce region).

Drazgowska (Zytawska z Drzgowa) is cultivated in an old region of onion production near Drazow. This onion has flat, yellow straw bulbs suitable especially for growing from sets.

Krakowska Czerwona is called Zydowka and is cultivated around Krakow. The bulb are flat, pungent, with red-bluish colour of outer and inner skin, early ripening with good storage ability. It was valuable in growing from sets, because this landrace had a small tendency for bolting.

Lubartowska, a Zytawska type, is still in cultivation in Lublin province.

Przybyszewska (Zytawska z Przybyszewa), Cukrowka and Zytawka are landraces derived from Zytawska and Wolska or from crossing between them, growing in the region of Przybyszew.

Ostrowska, Kamienska, Zytawska z Kamienska, and other landraces are known near the river Warta and other areas.

Between 1960 and 1970 rapid progress was made in onion breeding, aimed at releasing original Polish cultivars suitable for local climatic conditions while responding to customers' requirements. Great attention was paid to cultivation methods and adaptation to local soils, for example peat type, as well as to fulfill consumers' needs concerning quality (colour, taste), destination (fresh consumption, storage, drying), planting methods (from seeds, sets or seedlings), hand or mechanical harvest. During this time the list of recommended cultivars included 10 onion cultivars bred in Poland, which are more or less different in morphological and marketable traits. These could be divided into three groups:

1. Medium-early: Dako (previously Koda), Rawska, Zytawska, Wolska sel. Selecta and Wolska sel. Freege
2. Medium-late: Czerniakówska (previously Wolska sel. Czerniaków), Wolska'sel. Ulrich.
3. Late: Wolska sel. Chodów, Sochaczewska (previously Wolska sel. Szepietowski), Wolska (previously Wolska sel. Hoser).

The cultivars in the first group were of low economic value and their share in total production amounted to only 10% of the area under onion cultivation. Only Rawska had some importance due to its good storage ability. The most important in commercial production were five Wolska-type varieties, classified in the second and third groups.

The origin of Wolska-type cultivars deserves an explanation. The mother cultivar was the original Wolska bred by the Hoser brothers. It was the best variety in terms of value and economic importance. Many breeders took it as a source to improve on or to modify some characters. As a result, seven Wolska types were selected, causing misunderstanding and difficulty in distinguishing between them, especially with foreign customers.

However, they differed in morphological, physiological and marketable features. To avoid misunderstanding, the selections fulfilling register requirements were registered as original varieties and put on the list in 1974 under new names: Wolska sel. Hosera (original Wolska) named Wolska; Wolska sel. Czerniaow (derived from landrace Wolska Zatwarnicki's selected at Czerniaków by S. Karpinska) named Czerniakówska; Wolska sel. Szepietowsk (selected from landrace Zajkowski's Wolska on a private farm at Sochaczew) named Sochaczewska; later on Wolska sel. Chodow (selected in Hort. Breeding Station) named Kutnowska; Wolska sel. Chodow (selected in Exp. Breeding Station in Warsaw-Ulrichow, formerly Company C. Ulrich) named Warszawska.

The remaining Wolska selections are as follows: Wolska sel Selekta (selected in SHRO Kazimierza Wielka, formerly Company Selekta); Wolska sel. Freege (selected in SHRO Krakow-Bronowice, formerly Company Freege). They were left under the original names to prove their original character and improved quality.

Individual Wolska selections differ among themselves with the length of vegetation period, shape and size of bulbs, colour, thickness and adherence of outer skin, productivity and keeping ability. This variability of Wolska selections allows them to be cultivated in different regions for the domestic and foreign markets.

During the 1970s the above cultivars as well as landraces of local importance were in use.

Three Polish hybrids based on male sterility (Bona F_1, Warsa F_1, and Diana F_1) were tested. All of them have Wolska type characteristics, but were superior in respect to productivity and quality of usable traits. The F_1 hybrids have not been on the market for long. Our breeding centres were not capable of producing hybrid seed material. Parental lines for these hybrids are preserved in the genebank.

The most important onions in production in Poland are open-pollinated cultivars. Successive changes in the organization of breeding negatively affected the results. This situation continued up to the 1990s. Recently, breeding-seed producing enterprises, companies and corporations have been carrying out creative breeding of open-pollinated and onion hybrids and maintain former bred cultivars.

Alas, valuable populations, most landraces and other breeding materials collected over the past two decades have been lost forever. There are still a few regions in Poland where some landraces exist; these must be preserved. Great efforts are made to collect and to reproduce local forms and old varieties in the genebank. In some cases it is possible to save them on the farms.

Presently breeding work is conducted at the following centres:

- Breeding and Seed Company Spójnia at Nochowo (recently registered onion cultivars Pino and Zorza, includes breeding hybrids too).
- Breeding and Seed Company PlantiCo, Szymanów (recently registered 3 onion cultivars: Kristine, Efekt, Fiesta, preservative breeding of Warszwska cv., breeding of hybrids, resistance to diseases).
- Breeding and Seed Company PlantiCo, Golebiew (creative onion breeding and preservation breeding of Kutnowska cv.)
- Breeding and Seed Company PlantiCo Zielonki (creative onion breeding with red dry skin).
- Breeding and Seed Company POLAN in Krakow (breeding of hybrids, preservaton breeding of Dako cv.)
- Research Institute of Vegetable Crops (breeding of hybrids).

The breeding of onion is conducted by private breeders like The Vegetable Seed Farm of J. Oziemski in Blonie near Warsaw (in register selected cultivar Blonska); the Vegetable Seed Farm of B. Szepietowska in Sochaczew (breeding and preservative breeding of Sochaczewska cv.) and others.

At present there are 23 original onion cultivars registered on the national list. Included are 10 Polish open-pollinated cultivars and 13 foreign (mainly) hybrids and two Polish selected cultivars. There are 24 cultivars under register investigation including one Polish and 23 foreign cultivars.

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Collecting missions, Research Institute of Vegetable Crops, 1991-94

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Plant collecting, systematically performed, is the most important means to broaden the variability of plant collections. Local collecting missions allow the gathering of native germplasm well adapted to the local environment, which might be lost in the course of genetic erosion if not collected. In Poland, a few collecting missions are made every year, mainly in the south, southeastern, eastern and northeastern regions. These regions are traditionally less agriculturally advanced than other parts of Poland, and therefore provide more interesting areas for germplasm collectors.

Table 1. Collecting missions, 1991-94.

Year	Organization	Area	*Allium* germplasm collected
1991 Sept.-Oct.	MAFF-Japan, POLSKV-Poland	southeast, north of Poland	onion 10, shallot 16, garlic 24, chives 2, bunching onion 5
1992 July	POLSKV	Province Skierniewice (Kawêczyn, Radziejowice, Rawka, Mszczonów)	garlic 1, *A. ursinum* 1
1992 August	POLSKV	Province Kraków (Krzeszowice, Nawojowa Góra, Proszowice)	*Allium* sp. 1, shallot 2
1992 October	POLSKV	Province Kielce (Stryczowice, Momina, Garbacz, Wasniów, Slawêcice)	*Allium* sp. 3, *A. fistulosum* 1
1993 August	POLSKV	Province Przemysl (Munina, Jarslaw, Tuczempy, Radymno, Orly, Niziny, Walawa, Bolestraszyce) Province Krosno (Nekrybka, Huwin-ki, Arlamowo, Rybotycze, Dobryñ, Folusz) Province Nowy Sacz (Deno, Pod-rzecze, Dominikowice)	onion 1, garlic 3, shallot 1
1993 Sept.	POLIHAR	Province Gdank (Glusino, Wyczechowo, Poblcie, Backa Huta, Miechucino, Rybaki, Mrozy, Raty)	garlic 3, shallot 23
1993 Nov.	POLSKV	Provine Kielce (Bieliny, S³upia, (£agów, Stryczowice) Province Tarnobrzeg (Opatów, Czerwona Góra) Province Przemycel (Niziny, Walawa)	onion 1
1994 Oct.	POLSKV	Province Suwali (Punk, Szypliszki, Poszeszupie, Rutka Tartak, Szlinokiene, Baranowo Pobazie)	onion 1, chives 1, garlic 6, shallot 10
1994 Sept.	IPGRI, IPK, POLIHAR	Albania	shallot 3, garlic 6, onion 1, *A. ampeloprasum*

Status of all *Allium* collections in Slovakia

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Allium
Allium sativum L.
Status in Slovakia: Total production: 7320 t
Yield: 6.1 t/ha
Total area: 1200 ha
Collection: 10
Accessions in bank: 10

Allium cepa L.
Status in Slovakia: Total production: 53 600 t
Yield: 15.76 t/ha
Total area: 3400 ha
Collection: 25
Accessions in bank: 25

Allium porum L.
Status in Slovakia: Total production: 4000 t
Yield: 20 t/ha
Total area: 200 ha
Collection: 7
Accessions in bank: 7

Allium schoenoprasum L.
Status in Slovakia: Production only in home gardens
Collection: 5
Accessions in bank: 5

No research is conducted in Slovakia which is directly relevant to *Allium* genetic resources conservation.

Allium collections in the United Kingdom

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Status of collections

Collections of *Allium* in the UK are maintained by different organizations for a variety of uses.

HRI Wellesbourne

The collection at HRI Wellesbourne conserves a number of crops and wild taxa as genetic resources for use in pure and applied research, and for educational purposes. Table 1 gives an overview of the collection, regeneration status, the extent of safety duplication and availability. Seeds are stored at 5% moisture content, hermetically sealed in foil laminate pouches at –20°C. A database system is used for documentation. Data in the system are mainly passport, but minimal characterization data are being stored using ECP/IPGRI and UPOV descriptors. We have an agreement with CGN to store mutual safety duplicates. A duplicate seed sample of new accessions is despatched as soon as possible after receipt, but accessions in store are being despatched routinely as and when the time permits. The percentage of accessions which are safety duplicated with CGN varies considerably between crops and wild taxa. The only limitation on distribution is seed availability based on seed quality and quantity.

For crops, up to 50 accessions per year are regenerated under controlled-pollination conditions in isolation cages in glasshouses using flies. The target minimum population for crop (onion, leek, Welsh leek) regeneration is 100 plants. During regeneration the populations are scored for as many ECP minimal characterization descriptors as possible. For the few wild taxa maintained, the population size during regeneration varies considerably. For some wild populations of known origin and collected population size, the regeneration population and isolation standards equate to the crop format described above. Where the collection source or available documentation are dubious only a limited population is pot-grown outside without isolation from pollinators. In this case seeds are collected and the documentation records the link to the maternal population and that seeds are derived from open-pollination. Involvement in field collection has been concentrated in Portugal in collaboration with the National Gene Bank and Universities.

Table 1. UK *Allium* Collections in the HRI Genetic Resources Unit.

Allium species	Total no. accessions	Available accessions	Awaiting regeneration	Safety duplicate
cepa	1127	864	263	674
ampeloprasum	173	134	39	35
fistulosum	72	57	15	17
schoenoprasum	23	6	17	1
Others	166	29	114	23

Royal Botanic Gardens Kew

The Royal Botanic Gardens Kew hold a collection (>300) of wild taxa for taxonomic study. The collection is an amalgamation of material amassed by Brian Mathew for his revision of Section *Allium* and the cytology research collection of the Jodrell Laboratory. The collection is maintained vegetatively, being grown generally in pots in the bulb frame or glasshouses of the research facilities, but also with some material planted in the garden.

The value of the collection lies in its origin and that for the most part it was collected by taxonomists; therefore accessions are of known provenance, generally have taxonomic validation and some material has been studied cytologically. However, the original collections were made for taxonomic purposes during the vegetative stage of the plants and therefore frequently the populations are only represented by very few plants. One of the main problems is the availability of material which is restricted currently to vegetative propagules being surplus to requirements at the time of repotting. RBG Kew is looking to develop their utilization of this collection, the cytological research being one component set to continue in the forseeable future. Also it is an aim to transfer seeds of the collection, albeit initially open-pollinated, to long-term storage either at HRI Wellesbourne or the RBG Kew seed bank at Wakehurst Place.

National Council for the Conservation of Plant and Gardens

The National Council for the Conservation of Plants and Gardens collection of ornamental *Allium* is maintained by Pat Davies in Reading. The NCCPG is an NGO commited to conserving horticultural selections and varieties, particularly ornamentals, which are threatened by the number of new cultivars produced by modern breeding, and by the changes in cultivar popularity and garden style.

Other UK institutes

There are working collections in UK institutes, particularly the Scottish Agricultural Science Agency reference collections of leek and onion used for statutory variety testing, and HRI Breeding and Genetics Department material (onion and leek) used for pest and disease resistance screening.

Henry Doubleday Research Association

The Henry Doubleday Research Association is an NGO which maintains and distributes a vegetable heritage collection for use by their members. The collection includes traditional varieties no longer available commercially in the Common Catalogue, and current cultivars identified as suitable for organic production and amateur gardeners.

Collecting by the Horticultural Research International with colleagues in Portugal

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Horticulture Research International (HRI), Wellesbourne, Warwick, CV35 9EF, UK

All collections between 1990 and 1994 have been carried out in Portugal in collaboration with the National Gene Bank, the Agricultural Advisory Service and Universities. The expeditions were multicrop missions; *Allium* germplasm was collected as indicated in the table below.

Participants/area	Species	Type	No. collected
1990			
Farias, Astley & Varandas in the northwest provinces	*Allium ampeloprasum* *Allium cepa* *Allium sativum*	wild landrace onion garlic	1 25 1
1992			
Two mountainous regions were explored: Basto with Farias & Varandas; Tras-os-Montes with Rosa & Silva-Dias	*Allium cepa*	landrace onion	FAV = 11, RASD = 25
1993			
Farias, Astley & Cheung So Mui in the mountains south of the Douro valley and in the area of Serra da Estrela	*Allium cepa*	landrace onion	4

The participants

- Dr Rena Farias, Head of National Gene Bank at Nucleo de Melhoramento de Milho, Braga (NUMI)
- Eng. E. Varandas, the Direcção Regional de Agricultura de Entre Douro e Minho
- Dr Dave Astley, Genetic Resources Unit, HRI Wellesbourne, UK
- Dr Eduardo Rosa, the Universidade de Tras-os-Montes
- Dr Joao Silva-Dias, the Universidade Tecnica de Lisbao
- Cecilia Cheung So Mui, Parque de Seac Pai Van, Macau
- Also in collaboration with advisors from the Direcção Regional de Agricultura da Beira Litoral.

Rena Farias NUMI has collected additional material during collecting expeditions in other areas of Portugal.

In situ Conservation

In situ conservation of *Allium* in France

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Wild *Allium* species occurring in France

Bureau des Ressources Genetiques

Allium actiflorum Lois
Allium ampeloprasum L. Poireau d'ete, Poireau di Levant, Gros ail, Carambole, Baragane
Allium angulosum L. (A. acutangulum Schrad.)
Allium carinatum L. also cultivated
Allium chamaemoly L.
Allium commutatum Guss.
Allium ericetorum Thore (*A.. ochro-leucum* W. et Kit., *A. suaveolens* Jacq.)
Allium flavum L.
Allium maritimum Rafin. (*A. obtusiflorum* Poiret, *A. pusillum* Cyr.)
Allium moly L. Ail dore
Allium montanum Schmidt (*A. fallax* Roem. et Sch., *A. serotinum* Schl., *A. senescens* L.)
Allium moschatum L.
Allium narcissiflorum Vill.
Allium neapolitanum Cyrillo (*A. album* Santi)
Allium nigrum L. (*A. multibulbosum* Jacq.) Ail des Indes, Ail magique
Allium oleraceum L. (*A. complanatum* Bor.)
Allium paniculatum L. (*A. tenuiflorum* Ten., *A. pallens* L.)
Allium parciflorum Viv. (*A. pauciflorum* G.G.)
Allium pendulinum Ten.
Allium polyanthum Roem.et Sch. (*A. multiflorum* DC.) Poireau des vignes
Allium pulchellum Don
Allium roseum L. (*A. graniticum* Jord., *A. confertum* Jord. et F., *A. corbariense* Timb.)
Allium rotundum L.
Allium scaberrimum Serres
Allium schoenoprasum L. Civette, Ciboulette, Appetits
Allium scorodoprasum L. Rocambole
Allium siculum Ucria (*Nectaroscordum siculum* Lindl.)
Allium sphoerocephalum L. (*A. descendens* L., *A. pygmaeum* Perr.)
Allium strictum Schrader
Allium subhirsutum L. (*A. graminifolium* Lois.)
Allium trifoliatum Cyr.
Allium triquetrum L. also cultivated
Allium ursinum L. Ail des Ours
Allium victorialis L. Ail de Cerf, Herbe à 9 chemises
Allium vineale L. (*A. monspessulanum* Willd., *A. nitens* Sauze et M.)

Location of wild *Allium* in France

Strict Mediterranean region (olive-tree zone)

Allium acutiflorum Lois.
Allium chamaemoly L.
Allium commutatum Guss.
Allium maritimum Rafin. (*A. obtusiflorum* Poiret, *A. pusillum* Cyr.)
Allium moschatum
Allium neapolitanum Cyrillo (*A. album* Santi)
Allium parciflorum Viv. (*A. pauciflorum* G.G.)
Allium pendulinum Ten.
Allium siculum Ucria (*Nectaroscordum siculum* Lindl.)
Allium subhirsutum L. (*A. graminifolium* Lois.)
Allium trifoliatum Cyr.
Allium triquetrum L.

Large Mediterranean region
Allium ampeloprasum L. Poireau d'été. Poireau du Levant, Gros ail, Carambole, Baragane
Allium moly L. Ail doré
Allium nigrum L. (*A. multibulbosum* Jacq.) Ail des Indes, Ail magique

Southeast
Allium pulchellum Don
Allium narcissiflorum Vill.
Allium scaberrimum Serres
Allium strictum Schrader

Half south
Allium flavum L.
Allium montanum Schmidt (A. fallax Roem. et Sch., *A. serotinum*, Schl, *A. senescens* L.)
Allium polyanthum Roem. et Sch. (*A. multiflorum* DC.) Poireau des vignes
Allium roseum L. (*A. graniticum* Jord., *A. confertum* Jord. et F., *A. corbariense* Timb.)
Allium victorialis L. Ail de Cerf, Herbe à 9 chemises

Half west
Allium ericetorum Thore (*A. orhroleucum* W. et Kit., *A. suaveolens* Jacq.)

Half east
Allium angulosum L. (*A. acutangulum* Schrad.)
Allium rotundum L.
Allium scorodoprasum L. Rocambole

All over France
Allium carinatum L. aussi cultivé
Allium oleraceum L. (*A. complanaturm* Bor.)
Allium paniculatum L. (A. tenuiflorum Ten., A. pallens L.)
Allium schoenoprasum L. Civette, Ciboulette, Appétits
Allum sphaerocephalum L. (*A. descendens* L., *A. pygmaemum* Perr.)
Allium ursinum L. Ail des Ours
Allium vineale L. (*A. monspesulanum* Willd., *A. nitens* Sauzé et . M)

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Wild *Allium* species growing in Poland

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In Poland 11 wild species of *Allium* grow under natural conditions. These are:

A. angulosum (czosnek katowy)
A. carinatum
A. oleraceum
A. montanum (czosnek skalny)
A. spherocephalon
A. scorodoprasum
A. strictum
A. sibiricum
A. ursinum (czosnek niedzwiedzi)
A. victorialis (czosnek siatkowaty)
A. vineale (czosnek winnicowy).

The distribution of wild species of *Allium* was worked out at Jagielonian University in Krakowe by Zajac and Zajac. B. Zajac carried out an investigation on *A. ursinum* and *A. victorialis*. On the basis of this study it appears that the most common in Poland are *A. vineale* and *A. oleraceum*. Details of occurrence are contained in a computerized database programme specially created for this. Existing data are updated after each collecting mission.

Almost all Botanical Gardens in Poland contain collections of *Allium* species originating in Poland or abroad. Such collections are in Krakow, Lublin, Wroclaw, Poznan, Warszawa-Powsin.

Not far (40 km) from Skierniewice, growing wild, are large quantities of *A. ursinum*, which are located in a park surrounding a house for retired people. Finally, more people are interested in this species as medicinal plants. I am afraid that in a short while this population could be endangered.

Research Activities

Research in Belgium on *Allium* genetic resources

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Research into the genetic resources and conservation of *Allium* is very new in Belgium. A breeding programme was started at the R.v.P. station in 1994 with the collection of old Belgian landraces of leek, which were compared with many commercial cultivars of leek.

In a split-plot test, in 1994, we included 68 accessions of leek for three harvest periods: September, November and February. The other accessions were kept in an observation test. The following characters were observed before harvest: leaf colour, erectness, leaf width, uniformity of colour and erectness, sensitivity to Alternaria, Puccinia, Phytophthora, bolting and thrips. At harvest we observed: plant length, shaft length, length of the transition of colour, bulb formation, leaf split and plant weight.

We observed 18 Belgian landraces in the split-plot test. One of the landraces is a green autumn type. The other 17 belong to the blue-green winter type. These 17 landraces were compared with 20 commercial varieties of the winter type.

Table 1 lists the state of the Belgian landraces in the group of 37 winter type leeks.

Table 1. The presence of the 17 Belgian landraces of leek in the top 5-10-17 for some important characters within a group of 37 winter type leeks.

	Presence (in %) in the		
Character	**Top 5**	**Top 10**	**Top 17**
Leaf colour	60	80	59
Erectness	60	40	53
Yield (plant weight): September	60	70	71
November	60	70	77
February	80	90	82
Uniformity of colour and erectness of leaves	60	50	47
Shaft length	10	30	35
Absence of bulb	60	50	47
Short transition of colour	40	70	59
Resistance to: Puccinia (Feb.)	20	30	41
Alternaria (Oct.)	40	60	65
Phytophthora (Feb.)	100	70	65

Table 1 shows that the Belgian landraces of leek produce highest yields, especially at the winter harvest. They are also better than the commercial varieties regarding leaf colour, erectness, short transition of colour and resistance to Alternaria and Phytophthora. For the characters uniformity and absence of bulb, the Belgian landraces are comparable to the commercial varieties. The lowest scores are for the characters of resistance to Puccinia and shaft length.

We may conclude that the Belgian landraces have some good qualities, but further selection is needed to obtain a modern blue-green winter type of leek.

Reproduction methods of *Allium* accessions for conservation and exchange in the Genebank

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Introduction

Allium accessions need to be reproduced for short-term (at +5°C) and long-term (at 18°C) conservation. The requirement for long-term conservation is to lay down a minimum of 5000 seeds per accession. Short-term preserved seeds are used as initial material for improvement through breeding at the institute and for international exchanges.

Materials and methods

For large volumes it is impractical to attempt to meet the abovementioned needs by using traditional methods (hand-isolation and pollination of flowers). New methods are therefore needed to faciliate pollination through bees and flies in suitably isolated cages under field conditions.

To meet seed demand, a minimum of 20 plants is planted. Other entomophilous species can be grown between them.

Twenty-eight metal cages (type Puls, 11.1 x 2.5 x 2.5 m) were used. Plants were covered with plastic nets before flowering in September to protect seeds to maturity. Using methods of the Iowa Research Station, USA, special elongated bee frames of the "Langstrot" RUT type were made. The RUT was improved through the insertion of a feeding trough. A special hole (perla) was made to ensure that if one side was closed the other could remain open.

This method was implemented in 1982 with 20 beehives. One cycle is complete when all the plants have flowered.

Pollination with queen cells located outside the isolation cages

Pollination with queen cells located outside the isolation cages was introduced in 1984. Five frames of queen cells are used. The entrance to the hive is fitted on the front wall of the cage. At the back of the hive is a circular hole (diam.=20 mm) which leads to a wooden device which serves to connect the hive to the isolation cage. Access of the bees is prevented or allowed by the opening and closing of the tightly fitting sheet-metal cover. Technical operations with the bees can be facilitated by a 30-cm long furrow.

Pollination with micro-queen cells

Pollination with micro-queen cells was introduced in 1989. Micro-queen cells in wooden cubes (10 x 10 x 10 cm) are used. A clean area having a width of 1 cm is used, to settle a microfamily of bees with queen in a small amount of honeycomb. To feed this swarm the honeycomb must be full. The box with the bees is placed at 1 m, so as to avoid flooding when the crop is irrigated to provide water for the crop and the bees. The small swarm works for 1 month; if necessary they can be replaced after the first month. *Allium* pollination is carried out by worker bees that instinctively search for pollen and nectar.

Pollination with flies

Pollination with flies is done in the following way: pupae are stored at 4-5°C until they are placed in the cage a few days before flowering of the female flowers. The pupae are kept in plastic bags above the soil, so as to avoid flooding at the time of irrigation of the plants. Hatched flies work 5-7 days; additional replenishment is necessary until the end of flowering.

Results and discussions

The efficiency of the different methods used is reflected in the seeds produced. Yearly data change is significant. Seed quantitites were lower in 1988 and 1989, due to unfavourable climatic conditions, downy mildew and other diseases. The number of seeds from fruit and from plants at harvest was higher in comparison with the control, hand-pollination. Percentages improved from 36.8 to 214.1% for 1988 to 1990, and from 5.8 to 219.1% for 1989 to 1990. A large amount of seed formed in the fruit with free pollination and queen cell pollination, and with queen cell pollination outside the cage. This variant was followed by queen cell and micro-queen cell inside the cage.

There is no significant difference between using flies and hand-pollinating. In the studied cultivars 36.1 to 191.5% more seed formed than in the control in 1988 and 1990 and from 16.4 to 216.7% during 1989 and 1990. No significant differentiation exists in the quality of fruit over the years.

Conclusion

It has been proven that methods of pollination of cultivars in the long and short term using queen cells on the outside of isolation cages with a micro-queen cell, and through the use of flies, are more effective and of lower cost than traditional manual methods.

The quantity of seed obtained, using the three new methods of pollination, satisfied requirements for the necessary quantities of authentic seeds for long-term conservation and for exchange with other institutions.

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Research projects on *Allium* at IPK Gatersleben

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Basic taxonomic analysis of the character relations within the genus and its subdivision, including study of relationships between crop species and relatives, as well as of the infraspecific differentiations of crop taxa (by means of morphological, anatomical, karyological, phenological, serological and geographical studies, of isozyme investigations and by the application of molecular markers), are part of the DFG programme "Molecular basis of plant evolution, speciation and phylogeny" (staff of Department of Taxonomy).

Other activities include:

- studies of seed germination of a broad spectrum of species for the evaluation of optimal conditions for seedling development
- establishment of an *in vitro* culture genebank (635 lines), mainly from the gynogenetical research, from species hybrids and from the vegetatively propagated shallots and garlics
- evaluation of vitality of *in vitro* material and comparison with normally grown plants
- study of the genetical stability of *in vitro* material
- virus tests of plants from meristem culture for establishing a virus-free *in vitro* genebank of garlic
- wide species crosses with A. cepa (up to now, 17 different species combination verified) for further use in research and breeding (by staff of the group for in vitro cultivation and long-term storage at the genebank).

Contributions have been provided for the following project applications which it is hoped will be approved this year:

- project application for the DFG (German Research Assoc.) "Speciation in *Allium* and *in situ* hybridization" (Schubert/Hanelt/Friesen)
- participation in the EU project 'Tailoring the onion crop for the 21st century' in regard to structuring of the genepool, *in vitro* culture, mapping of molecular markers (coordinated by CPRO-DLO, Wageningen) (Keller/Klaas/Hanelt)
- participation in the EU project 'Conservation and Evaluation of *Allium*' in regard to an establishment of *in vitro* genebank and to collecting missions (coordinated by HRI, Wellesbourne) (Keller/Hanelt)
- participation in the EU project 'Viruses of *Allium*' in regard to virus elimination (coordinated by Dr Lesemann, Braunschweig) (Keller).

Variability of some features in shallot landraces (*A. cepa* var. *aggregatum* L.)

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Shallots (*Allium ascalonicum, A. cepa* var. *aggregatum*), also known as ascalonian garlic, like onion were in cultivation at a very early date. The name given by Theophrastus (372-387 BC) derives from Ascalon in Palestine where it was commonly grown (Nowinski 1977). In ancient times shallot was cultivated in the Near East and Greece. In the epoch of Aurelius' conquests (1st century BC), some references were found describing shallot as the favourite food of the Hebrews (Kybla and Kaplicki 1985). According to Calumella (1st century AD) and Plinius (23-79 AD) it was called *ascalonia cepa;* according to Kaspar Bauchin (1550-1624), *cepa fertilis.*

Shallots were propably carried to Europe by Crusaders from Palestine. Charlemagne had shallots in his gardens. In the 13th century they were cultivated together with onion and garlic in Normandy and sold by merchants on the streets of Paris and other towns (Nowinski 1977). Presently they are cultivated in different regions of the world: the Near East Asia, America and Europe. Shallots are very popular in France, occupying 2000-2500 ha (Cohat 1992).

Besides shallots, a similar form called potato-onion (*A. cepa* var. *aggregatum* syn. var. *solaninum*) is also under cultivation.

In Poland, after the First World War, both of these *Allium* species were grown in small plantations, especially where onion failed. In the 1920s two kinds of potato-onion were in cultivation—yellow and red. Shallots were destined mainly for processing. Two kinds were known, common and Jersey (Brzeziñski 1925; Lytynski 1955).

Presently these onions are not grown commercially; only in home gardens can many local populations be found, demonstrating large differentiation of morphological and usable features. They are grown for family use mainly in the foothills, northeast and east regions. From this area landraces were collected and are preserved in the collection at the Research Institute of Vegetable Crops (Kotlinska 1995).

Shallots are highly valued for their delicate, juicy, aromatic flavour and they are rich in vitamins, as well as being small, good-storing bulbs. Shallot is also a very early vegetable. The bulbs reach maturity 70-75 days after planting, but green leaves can be harvested after 30 days. Shallot grows in clusters; one onion can produce as many as 40 bulbs weighing up to 500 g and 15-30 g each. It is possible to harvest up to 50 t/ha of chive and 30 t/ha of onion (Juriewa and Kokoriewa 1992).

Potato-onion forms clusters of onions usually no more than 10 in a cluster. This species has low soil requirements and can be planted in sand and in heavy soils. It is also more resistant to low temperatures than shallot and onion. Its bulbs are more pungent, harder and less juicy than shallot, with yellow or red outer skin. Potato-onion ripens later than shallot, i.e. in the middle of August.

Shallot, like common onion, is rich in nutrient compounds: vitamins C, B1, B2, carotene and mineral salts, which are important in the human diet. They are also rich in aseptic and antibiotic substances such as alliina. The bulbs are highly valuable in the processing industry and can be used earlier than onion.

With all these favourable traits shallot should be grown in both amateur gardens and commercial plantations. Shallot crosses easily with onion. They produce fertile forms that can be employed for breeding purposes and as a source of some features such as high dry-matter content, early maturity, etc.

At the Research Institute of Vegetable Crops evaluation of genetic variability is conducted, taking into account marketable value and suitability for breeding of native and foreign populations in the collection.

Material and methods

The subject of research is shallot landraces which have been collected between 1988 and 1993 in Poland, Siberia and other countries. Sixty accessions exist in the collection, their origins are presented in Table 1. In the field experiments, consisting of 3-year cycles, morphological and marketable traits are evaluated, according to IBPGR/FAO classification (Astley *et al.* 1982) and elaborated at the Research Institute of Vegetable Crops (Kotlinska 1995).

Table 1. List of shallot landraces.

Accession	Local name	Origin
PV 126	Rodzinna	Zastawno, prov. Elblag
PV 110	Siedmiolatka	Bzowo, prov. Torun
PV 108	Kupkowa	Wiag, prov. Bydgoszcz
PV 77		Mszana Górna, prov. Nowy Sacz
PV 87	Rodzinna	Rabka Wyzna, prov. Nowy Sacz
PV 78	Kwoka	Mszana Górna, prov. Nowy Sacz
PV 73	Kwoka	Mszana Górna, prov. Nowy Sacz
PV 193		Jelonka, woj Bialystok
PV 145		Suchowola, prov. Bialystok
PV 151	Gorzka	Kolonia Zabludów, prov. Bialystok
PV 157	Gorzka	Olszanka, prov. Bialystok
PV 171		Nowosady, prov. Bialystok
PV 167	Gorzka	Makówka, prov. Bialystok
PV 160		Trzececianka, prov. Bialystok
PV 112	Gromadkowa	Subkowy, prov. Gdansk
PV 201	Siedmiolatka	Zakowola Radzynska, prov. Biala-Podlaska
PVZ	Zydówka	Krzczonów, woj . Kielce
PVS		Tomaszów Lub., prov. Zamosc
A 001		Altaj, Russia
A 039		Altaj, Russia
A 081		Novosybirsk, Russia
A 082		Novosybirsk, Russia
21/88		Uzbekistan
FRM		France
NL 9		Sument, Indonesia

Results

Shallots, with regard to morphological and marketable features, are close to onion but distinguished by their thinner leaves, more delicate taste and better keeping quality. They are propagated by sets or seeds, but sometimes produce no, or very few, inflorescent stalks.

Our observations showed that out of tested populations eight did not produce flower stalks during the three following years, six produce them every year but some not every season and in limited quantity. Flower stalks are not swollen, 50-100 cm high. Inflorescences and seeds are similar to onion but smaller. Long vegetative propagation leads to bulbs diminishing and increased sensitivity to diseases. Therefore, seed propagation is recommended every few years.

Table 2. Occurrence of flower stalk formation in shallot.

	Flower stalk occurrence[1]		
Accession	**1992**	**1993**	**1994**
21/88	+	+	+
A039	+	+	+
A 001	-	+	+
A 081	+	+	+
A 082	+	+	+
PV 108	-	+	-
PV 193	+	+	+
PV 77	+-	-	-
PV 78	+	-	-
PV 126	-	+	+
PV 73	-	-	-
PV 145	+	+	+
PV 151	+-	-	+
PV 157	+	+	+
PV 171	+	+	+
PV 112	-	-	-
PV 201	-	-	-
PV 87	-	-	-
PV 110	-	-	-
PV - S	-	-	-
PV - Z	-	-	-
NL - 9	-	-	-
FR - M	-	-	-

[1] + = yes, - = no.

Shallot can be planted in early spring. Autumn planting allows a crop harvest of chive and onion about 10-15 days earlier (Juriewa and Kokoriewa 1992; Cohat 1992). Some of the tested accessions planted in spring were very early. The earliest forms (A 081, A 082, PV 77, PV 201) in two recent years bent chives at the end of June. Most of the tested selection were ready to harvest from the beginning to the middle of July.

The resistance to virus diseases, *Peronospora* and onion fly differs greatly. Table 3 contains data on the degree of infection in seasons favourable to infections and onion fly infestation. The most sensitive to onion fly were French populations (PV 201 and A 039), which were heavily infested with the pest every year. Great differences in reaction to *Peronospora destructor* were recorded, which were clearly pronounced in 1992.

Virus diseases were not observed in eight objects, while others were infected to a high percentage (PV 78, PV 201).

Table 3. Infection of shallot by pathogens.

	Infection[1]		
Accession	**Downy mildew (1992)**	**Viruses (1994)**	**Onion fly (1994)**
21/88		-	-
A 001		-	-
A 039		+++	+++
A 081	-	+-	+
A 082	-	-	+
PV 108	-	++	-
PV 193	+	-	-
PV 77	++++	-	-
PV 78	+++	+++	++
PV 126	++	-	-
PV 73	+-	++	++
PV 145	-	-	-
PV 151	-	+	+-
PV 157	+++	-	-
PV 171	-	-	-
PV 112	-	-	+
PV 201	-	++++	+++
PV 87	-	++	+
PV 110	+	+	+
PV - S		-	+
PV - Z		++	++
NL - 9	+	+	++
FR - M	-	-	++++

[1] + = yes, - = no.

The tested populations are primitive and have never been selected to eliminate unfavourable traits. This explains the large variability of marketable features, demonstrated in outer skin colour, bulb size and shape, number of bulbs in cluster, etc. Colour of the skin ranges from white through yellow, violet up to brown of different shades and intensity. They are classified as follows:

straw yellow	A 081
beige dull	FR - M
beige with light red tint	PV - S
yellow with light brown tint	PV 171, 21/88
yellow with dark brown tint	PV 157, PV151, PV193, AO82
light brown with red (claret) tint	PV-Z, PV126, PV78,
light brown with violet tint	PV 87, AOO1
light brown	AO39
red (claret) brown	PV110, PV201, PV112, PV173, PV108,
brown	PV160, NL9, PV 77

Scales are white, creamy or bluish light violet. Forms derived from regions in the north are more often pungent in taste and have yellow brown skin, but southern types are semi-pungent and sweet with violet blue outer skin.

Shallot bulbs are frost resistant; they can be frozen and unfrozen without harming quality and storage ability. Onions are globular, flattened or elongated, small (0.5-2.0 cm or even 4.0 cm in diameter) and weigh 5-50 g (Juriewa and Kokoriewa 1992).

The number of bulbs in a cluster varied from 3 to 33 (Table 4). Mean weight of onion ranged from 0.5 to 52 .0 g but total weight of cluster from 12 to 128 g.

Table 4. Number and weight of bulbs in cluster.

	No. of bulbs in cluster		Weight of 1 cluster (g)		Weight of 1 bulb (g)	
Access.	Range	1993 (avg.)	Range	1993 (avg.)	Range	1993 (avg.)
A 082	10 - 25	14.3	12.2 - 48.8	35.1	0.8 - 20.0	6.7
PV 108	6 - 14	10.2	33.4 - 69.3	52.1	0.9 - 26.3	7.3
PV 77	3 - 6	4.5	30.5 - 86.3	63.3	9.1 - 52.0	22.6
PV 78	3 - 18	8.7	19.2 -128.0	40.4	0.5 - 40.2	8.5
PV 73	7 - 28	12.7	22.5 - 48.5	29.9	0.5 - 18.2	5.8
PV 112	5 - 18	12.1	38.0 - 66.9	51.1	0.6 - 23.4	7.2
PV 110	8 - 22	12.1	27.3 - 52.4	39.5	1.2 - 20.7	6.5
PV-Z	5 - 33	14.5	37.8 - 70.6	45.1	0.4 - 21.0	4.7

Shallot onions are distinguished by their high dry-matter content, up to 28-32% (Cohat 1992). In our tests shallot onions ranged from 19.8 to 21.2%, total sugars 12.2-14.6%, monosacharydes 12.6-4.0% (Tables 5 and 6). For comparison purposes, in Table 5 data compiled by Juriewa are shown.

Table 5. Chemical composition of shallot.

	Juriewa, 1992		Skierniewice, 1993
	leaves	bulbs	bulbs
Dry matter (%)	8.5-10.7	14.2-22.0	19.8-21.2
Total sugars (%)	2.8-4.0	8.1-13.6	12.2-14.6
Monosaccharides (%)	-	-	2.6-4.0
Proteins (%)	2.0-2.8	2.9	-
Vit. C (mg/100 g)	54.9-70.8	5.7-8.3	-
Eteric oils (mg/100 g)	-	28.0-34.0	-

These results show the great genetic variability of shallot populations indicating the possibility of their practical utilization.

Table 6. Dry matter and sugar content in onion and shallot.

Accession	Origin	Dry matter (%)	Sugar	
			monosaccharide	total
Onion				
Czerniakówska	Poland	12.37	3.42	7.08
Wolska	Poland	13.00	3.75	7.97
PV 202	Poland	13.95	4.00	8.23
PV 203	Poland	16.08	3.46	7.08
Ala	Czech	14.74	3.67	8.75
Hanka	Czech	12.92	3.66	8.13
Shemen	Israel	12.39	4.68	6.48
Karatalski	Uzbekhistan	12.89	3.37	7.61
Karatalski "136"	Uzbekhistan	13.13	4.22	8.13
Andizanski U 111	Uzbekhistan	13.91	4.62	9.17
U 030	Uzbekhistan	14.36	4.51	8.90
A 048	Siberia	17.13	4.01	10.73
A 105	Siberia	16.15	4.25	9.95
A 103	Siberia	17.90	3.32	10.57
A 040	Siberia	16.36	4.25	8.23
A 046	Siberia	15.27	3.78	9.74
Shallot				
A 001	Siberia	18.00	3.10	10.52
A 081	Siberia	21.23	2.57	14.62
A 082	Siberia	21.11	3.95	13.09
A 007	Siberia	21.22	3.04	13.54
A 039	Siberia	19.80	3.24	12.17

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Appendix I. Agenda of the meeting

Thursday 25 May 1995
Introduction
- Welcoming Addresses
- ECP/GR Phase V
- The ECP/GR *Allium* Working group: Chairman's Report

The European *Allium* Database
- Status of the Database
- Discussion and recommendations

Allium Genetic Resources Collections in Europe
- The European Field Collection of Long-Day *Allium*
- The European Field Collection of Short-Day *Allium*
- Review of national collections
- Discussions and recommendations

Friday 26 May 1995
Core collections
- Vegetatively propagated *Allium*
- Seed-propagated *Allium*
- Discussion and recommendations

In situ conservation of *Allium* in the Mediterranean Region
- Presentations by members from the Mediterranean countries
- Discussion and recommendations

Collecting activities
- Collecting missions undertaken since 1991
- Collecting missions planned in the future
- Discussion and recommendations

Research activities relating to *Allium* conservation
- Genealogy of open-pollinated cultivars
- Reproduction methods for conservation and exchange
- Discussion and recommendations

Saturday 27 May 1995
Finalizing of the report of the meeting during the morning (no indoor session)

Visit to the Research Institute of Vegetable Crops

International Collaboration
- Recent international events
- Links with other groups and networks
- Links with the non-formal sector

Conclusion
- Presentation of the report
- Election of a new Chairperson
- Closing remarks

Appendix II. List of participants

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