European Cooperative Programme for Plant Genetic Resources

ECP/GR

Report of a Working Group on Umbellifer Crops

Second Meeting, 26-28 June 2013, St. Petersburg, Russian Federation

L. Maggioni, E. Geoffriau, C. Allender and E. Lipman

Bioversity International

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Bioversity International is the only global non-profit research organization that places the use and conservation of agricultural biodiversity in smallholder farming systems at the centre of its work. Bioversity is a member of the Consultative Group on International Agricultural Research (CGIAR) Consortium, a global association of public and private members to create a food secure future.

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The European Cooperative Programme for Plant Genetic Resources (ECPGR) is a collaborative programme among most European countries aimed at contributing to national, sub-regional and regional programmes in Europe to rationally and effectively conserve *ex situ* and *in situ* Plant Genetic Resources for Food and Agriculture and increase their utilization. The Programme, which is entirely financed by the member countries, is overseen by a Steering Committee composed of National Coordinators nominated by the participating countries and a number of relevant international bodies. The Coordinating Secretariat is hosted by Bioversity International. The Programme operates through nine networks in which activities are carried out through a number of permanent working groups or through ad hoc actions. The ECPGR networks deal with either groups of crops (cereals; forages; fruit; oil and protein crops; sugar, starch and fibre crops; vegetables) or general themes related to plant genetic resources (documentation and information; *in situ* and on-farm conservation; inter-regional cooperation). Members of the working groups and other scientists from participating countries carry out an agreed workplan with their own resources as inputs in kind to the Programme.

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Dill (*Anethum graveolens)* grown at NordGen (Alnarp, Sweden): accession 'NGB20234 Arlöv', a locally collected material of dill that survived from one year to another in an old garden in South Sweden. © ECPGR.

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CONTENTS

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SUMMARY REPORT OF THE MEETING

Introduction

The second meeting of the Working Group on Umbellifer Crops of the European Cooperative Programme for Plant Genetic Resources (ECPGR) was held during 26-28 June 2013 in St. Petersburg, Russian Federation. It was organized in collaboration with the N.I. Vavilov Research Institute of Plant Industry (VIR), St. Petersburg.

Welcome addresses

On behalf of the director, Sergey Filimonenko welcomed all participants to VIR and to St. Petersburg. Anna Artemyeva presented the plant genetic resources activities in the Russian Federation. VIR headquarters are situated in St. Petersburg and the main task of the institute is the conservation and utilization of crop diversity and wild relatives for food and agriculture. VIR was born in 1894 with the name of "Bureau of Applied Botany". Currently, it employs 352 staff, of which 184 are scientists. During its long history, 1842 collecting missions have been carried out in 110 countries, and the genebank now conserves over 323 000 germplasm accessions of 155 botanical families, 376 genera and 2169 species. In the past, breeding was not allowed at VIR and germplasm was only characterized and catalogues were provided to breeders, but now most curators are also breeders and the balance of breeding activity versus characterization depends on the individual curator.

Umbellifer Crops Working Group progress and objectives of the meeting

Emmanuel Geoffriau, Chair of the Umbellifer Crops Working Group (WG), welcomed the members to the second meeting. He was pleased with the number of participants at this second meeting and noted that most of the participants had also been present at the previous meeting, with the exception of members from Belgium, Hungary and Georgia and of new members from Austria, Lithuania, the Russian Federation and Serbia.

E. Geoffriau presented the workplan agreed by the Group at its first meeting in Quedlinburg (2011) and summarized the progress made:

- **AEGIS project**
  - A list of cultivated carrot accessions proposed for inclusion in the European Collection was cross-checked by the members.
  - Lists of wild and landrace accessions were also analysed.
  - Lists of other Apiaceae still need to be analysed.

- **Wild relatives project**
  - A list of wild accessions of *Daucus carota* to be characterized was prepared and taxonomic characterization is in progress.
  - The project organization and an agreement for the use of funds were completed in May 2013.
  - A list of celery accessions was not included in this activity.

- **Characterization of Apiaceae**
  - Minimum descriptor lists were prepared for celeriac (13), celery (12), dill (7) and parsley (15); they need to be validated.
  - An amended list of minimum descriptors for carrot was completed, also to be validated.

- The collection of characterization data of minor Apiaceae still needs to be coordinated, including the need to discuss descriptors for these species.

Objectives of the meeting

- Validation of proposed lists for inclusion of accessions into AEGIS;
- Validation of minimum descriptors and of crop-specific standards for conservation;
- Definition of a strategy on minor Apiaceae;
- Preparation of a time-table for the completion of the wild relatives project;
- Organization of the WG and preparation for Phase IX.

The draft agenda for the meeting was discussed and approved.

C. Allender reminded the Group about the initiative proposed by the Secretariat at the previous meeting on information-sharing on the website and suggested verifying the intention of the Group to follow this up.

Update on ECPGR

ECPGR towards Phase IX

Lorenzo Maggioni, ECPGR Coordinator, updated participants on the status of the ongoing Phase VIII (2009-2013) of the ECPGR Programme. The budget of the Umbellifer Crops WG and its planned use were presented: € 13 520 for the second meeting; € 7840 for the wild relatives projects; an additional € 10 600 obtained through a successful AEGIS grant.

Participants were informed about the steps leading to Phase IX of ECPGR, following the ECPGR Independent External Review of July 2010. Phase IX (2014-2018) will be launched with a total budget of € 2.5 M, new objectives and a new operational structure. As the result of a tendering process, the decision was made to move the Secretariat to Bonn, Germany, where it will be hosted by the Global Crop Diversity Trust, while the European Plant Genetic Resources Catalogue (or European Internet Search Catalogue, EURISCO) will be transferred to the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) in Gatersleben, Germany. [1] The new goal and objectives of the ECPGR, as agreed by the Steering Committee (SC) at its 12th meeting in Bratislava (December 2010), were presented. The main changes to the mode of operation of the ECPGR in the next Phase were also explained to the Group. These include the elimination of Networks, the confirmation of existing Working Groups, but now these are to be formed from pools of experts rather than by country representatives. Proposals for activities in line with ECPGR objectives will be evaluated and approved every 6 months, with each activity typically not exceeding € 15 000 and the participation of a maximum of 12 members. A country quota system will be maintained.

Challenges for the future were identified as the uncertain/reduced financial commitment of a few countries in Phase IX and the need to establish the effective operation of the Secretariat in a new environment, with a new ECPGR mode of operation to be tested and implemented. Opportunities also exist, considering that the European Collection is being established and can become the focus for the regional "state of the art" of *ex situ* conservation (including capacity-building). *In situ* and on-farm conservation "concepts" are being prepared and their endorsement by the National Coordinators will strengthen the possibilities for collaboration in this area. Further development of EURISCO to better serve the needs of all WGs will be an expected output of Phase IX. Plans are being made for a

[1] Update at time of publication: Owing to the decision of the Trust in November 2013 to withdraw its offer, the move of the Secretariat to Bonn is no longer scheduled.

meeting of the Documentation and Information WG[2] (mid-2014) aimed at clarifying the future developments of EURISCO (characterization and evaluation (C&E) data; Central Crop Databases (CCDBs) as crop portals; Global Information Systems). Dialogues and collaboration with the European Commission (EC) and with germplasm users are expected to be strengthened.

Discussion on the evolution of ECPGR and the future of the Umbellifer Crops WG in the new structure

The WG had three expectations for the new Phase: maintenance of WGs, flexibility to carry out activities on a project basis and an adequate level of funding. It was noted with appreciation that the first two expectations were being met in the new Phase, but not the last one. The Group agreed that they were ready to adopt the new system, but were concerned by the prospect of trying to manage with insufficient funding.

Presentation of national programmes and updates on collection status

Albania

(Sokrat Jani)

Carrot is the most important umbellifer crop in Albania, followed by parsley, dill and celery. Most cultivated carrots are hybrids and advanced cultivars, all from imported seed, due to their higher yields and resistance to diseases. However, in some rural areas, away from cities and residential centres, small areas are planted with landraces, mostly for consumption in old peoples' own households. Most of these landraces, especially parsley and dill, are distinguished by special features such as thin and highly flavoured leaves, good taste, high tolerance or resistance to diseases and pests.

A working collection of 13 accessions (2 carrot, 4 parsley, 5 dill and 2 celery) is conserved at the Agricultural Technologies Transfer Center (ATTC), Lushnja. However, ATTC does not have the facilities to properly process and conserve seeds, while the National Gene Bank in Tirana does not have the financial means for regeneration and safety duplication. It might therefore be useful to arrange safety duplication and conservation at the regional level, in cooperation with the ECPGR Umbellifer Crops WG.

In the meantime, ATTC has identified landraces of carrot, celery, dill and parsley in specific households, at which on-farm conservation is being promoted.

Discussion

Regarding the issue of irrigation, given the dry or saline soil conditions in Albania, S. Jani made it clear that some landraces are cultivated for growers' own consumption where salinity problems exist, but that export market varieties are produced under irrigated conditions, using hybrids imported from Italy and the Netherlands.

It was recommended to collect the landraces and conserve them in genebanks before they disappear.

Austria

(*Paul Freudenthaler*)

The Austrian Apiaceae collection includes 113 accessions. About half of the accessions are held by a non-governmental organization (NGO), the others by governmental institutions. The accessions were collected from different sources: home gardeners, seed markets, genebanks; there are also some wild accessions. There is often a problem of identity of the

[2] The Documentation and Information Network will be maintained in Phase IX as a Working Group.

accessions and collecting data are often incomplete. Characterization data are available for some of the accessions.

In Austria there are no breeding activities on Apiaceae, but two carrot varieties and one parsley variety are listed under "Amateur variety" in the national catalogue. For home gardening old varieties are more popular, but no support is available from the Government for collecting, description and evaluation of these materials. It is also questioned whether wild relatives should be collected, considering that no breeding programme would use them.

Czech Republic

(*Pavel Kopecký*)

The national programme on conservation and use of plant, animal and microbial genetic resources for food and agriculture, launched by the Ministry of Agriculture, covers the period 2012-2016.

The Department of Genetic Resources for Vegetables, Medicinal and Special Plants, Crop Research Institute (CRI), Olomouc, maintains the vegetables collection, including umbellifers. These consist of medicinal and aromatic plants (127 accessions of caraway, 25 dill, 21 fennel, 25 coriander, 8 anise, etc.) and vegetables (388 accessions of carrot, including 33 wild relatives, breeding lines, old or advanced cultivars; 60 of celery, 40 of parsley and 14 of parsnip). Genotypes for the collection were obtained from seed companies, through exchange or collecting during national or international collecting missions. Accessions are provided to users only for non-commercial breeding, educational or research purposes, based on signature of a Standard Material Transfer Agreement (SMTA). The majority of the collection has already been regenerated and multiplied according to international standards and biological requirements. Apiaceae are regenerated in permanent glass cages with the use of honey bees (*Apis mellifera*) and bumble bees (*Bombus terrestris*). Harvested seeds of the required quality are stored in the genebank of CRI in Prague with seed moisture contents of 5-8%, in hermetically sealed jars conserved at -18°C. The minimum amount per accession is 12 000 seeds. Morphological characterization is based on the IPGRI *Descriptors for wild and cultivated Carrots.*

France

(*Emmanuel Geoffriau*)

There is no national genebank in France. Genetic resources in France are organized around networks of public and private organizations. Collections are often linked to research programmes.

At the Institut de Recherche en Horticulture et Semences (IRHS), Angers, genetic resources are used for research and evaluation of economic and agronomic traits.

Current research on carrots focuses on resistance to *Alternaria*, carotenoid content and the structure of genetic diversity.

The Centre for Biological Resources of Angers is aiming at obtaining an OECD certification. The Apiaceae collection consists of 2731 *Daucus carota* and 706 *Chaerophyllum bulbosum* accessions.

The ISHS *International Symposium on Carrot and other Apiaceae* will be organized in Angers, 17-19 September 2014 and everyone is invited to take part.

Germany

(*Ulrike Lohwasser* and *Thomas Nothnagel*)

U. Lohwasser reported that the German genebank at the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) conserves 2491 Apiaceae, of which 420 were regenerated in 2010. The most frequently represented genera are *Daucus* (497 accessions), *Coriandrum* (492), *Apium* (249), *Petroselinum* (233), *Anethum* (204), *Foeniculum* (190) and *Heracleum* (106). The

Quality Management System of the genebank is certified according to ISO 9001:2008. The whole IPK collection is to be duplicated at Svalbard; one-third is already duplicated.

Research is ongoing on the German Parsley Germplasm Collection, focused on the interaction of morphological, molecular and phytochemical characters. Intraspecific taxonomy of coriander (*Coriandrum sativum* L.) is also being investigated with comparisons of morphological, phytochemical and molecular data.

Thomas Nothnagel informed the Group that the Julius Kühn-Institute (JKI), Institute for Breeding Research on Horticultural and Fruit Crops, Quedlinburg, focuses on breeding. Evaluation of parsley, caraway and fennel is carried out with a focus on volatile oils and some types of resistance. Work is also ongoing on molecular markers for the preparation of the carrot genetic map. A project on organic carrot breeding is also taking place.

Lithuania

(*Rasa Karklelienė*)

The Plant Gene Bank (PGB) is a state-funded subordinate institution of the Ministry of Environment, which was established in 2004 to coordinate the collection, research, conservation and use of national plant genetic resources in Lithuania. Plant genetic material is kept in long-term storage.

Umbellifer genetic resources conservation is coordinated by three centres: the Institute of Botany of the Nature Research Centre (medicinal and aromatic plants), the Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry (horticultural crops), and the Vilnius University Botanical Garden (ornamental crops).

However, work on genetic resources of umbellifers is mainly carried out at three research and educational institutions: Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry (*Daucus*, *Coriandrum*, *Apium*, *Pastinaca*, *Foeniculum* etc.); Aleksandras Stulginskis University (*Carum*); and Kaunas Botanical Garden of Vytautas Magnus University (*Coriandrum*, *Apium*, *Pastinaca*, *Foeniculum* etc.). Some field collections are maintained at the Institute of Botany (*Angelica* and *Myrrhis*).

In total, 170 accessions are conserved, of which 27 are in long-term storage.

Breeding activities have resulted in the recent development of Lithuanian cultivars of caraway, carrot and coriander.

Poland

(*Teresa Kotlińska*)

The Umbellifer crops collection in Poland currently includes a total of 1400 accessions representing 10 genera (153 advanced cultivars, 859 landraces, 93 breeding material and 295 wild accessions). In recent years 91 accessions were characterized, 527 evaluated and 97 regenerated. The most represented genera are carrot and its wild relatives (652), dill (373) and parsley (268). Eight collecting missions were carried out in Poland and two missions in Lithuania in 2011-12, during which 63 accessions were collected from 4 umbellifer crops.

The genebank has also reintroduced landraces into selected farms (organic and traditional) using accessions that originated from the same selected areas in south-eastern Poland. Additional reintroductions are planned in East Poland.

Russian Federation

(*Tatyana Khmelinskaya*)

The Russian Umbelliferae collection was started in 1923 after N.I. Vavilov's visit to West–European countries, USA and Canada (1921-1922), from the seed samples shipped by breeding companies of the USA, United Kingdom, France, Germany and Austria. Russian resources were included in the VIR collection through the All-Russian agricultural exhibition. Local landraces were collected during collecting missions to Afghanistan, Iran,

Armenia, Uzbekistan, Turkey, etc. In 1926 VIR scientists started to study the collection. From 1928 new expeditions were arranged to Mediterranean countries, Ethiopia and Western China by Vavilov, to India by Markovich, to Asia Minor by Zhukovskiy, etc. The collection had also started to expand through exchange of material with various institutes and companies.

The VIR Genebank currently contains genetic resources from more than 90 countries, including wild species, landraces, old and advanced cultivars, F1 hybrids and breeding materials. The Umbelliferae collection is divided into two parts: the permanent (base) catalogue and the temporary catalogue. The permanent catalogue includes landraces and breeding cultivars with sufficient quantity of seeds. Passport data of all accessions are computerized. The temporary catalogue includes F1 hybrids, breeding materials and the samples with insufficient quantities of seed. These latter accessions need to be regenerated and will then be included in the permanent catalogue. Passport data of these accessions are recorded on hard copy. The total number of accessions is 6203, of which nearly half (3067) are *Daucus carota*, 811 *Anethum*, 586 *Coriandrum*, 580 *Apium*, etc. The carrot collection represents all known intraspecific diversity of cultivated carrot, which according to the classification of Sechkarev (1971)[3] and Sazonova (1990)[4] includes three subspecies, four varietal groups and eleven varieties.

At present, the base collection is preserved for long-term storage at –10°C in the VIR Genebank and is duplicated under medium-term storage conditions at +4°C in glass jars in the National Seed Storage at the Kuban experiment station (Krasnodar region). The active working collection is stored at room temperature in St. Petersburg at the Department of Vegetable and Cucurbit crops. The duplicate active collection is placed for short-term storage at +4°C in the VIR-Centre. Seed samples for long-term storage are dried down to a seed moisture content of 2-6%, and packed in laminated aluminium packets. Regeneration is carried out at Pushkin, Majkop and Dagestan Stations.

Between 2002 and 2012 a total of 2728 samples were distributed to users, 40% of which were sent abroad.

Most accessions of the Umbelliferae collection have been characterized and evaluated for 50-54 morphological, biological and agronomic traits at 7 experimental stations in different ecogeographical zones of Russia. The accessions have been studied using the same standardized research methods for three years to test adaptive capacity. Some of the accessions were tested for resistance to diseases and insects and for the biochemical composition of plant parts used for human consumption. Evaluation data are stored in summary journals and in separate computerized files.

Serbia

(*Dejan Cvicik*)

A team of experts is working in Serbia to prepare a national strategy for plant genetic resource conservation for the period 2014-2024.

The national Apiaceae collection currently consists of 47 accessions of carrot, 25 of parsley and 8 of parsnip. These are conserved at +4°C and some of the accessions are endangered due to low germination rates and lack of sufficient seeds. Documentation is stored on hard copy.

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[3] Sechkarev BI. 1971. Cultivated Flora of the USSR. Vol. 19. Kolos Publishers, Leningrad. 368 pp.

[4] Sazonova LV. 1990. Root crops: carrot, celery, parsley, parsnip, garden radish and radish. Leningrad. 295 pp.

United Kingdom

(*Charlotte Allender*)

The national umbellifer collection consists of a total of 1995 accessions, located at Warwick Genetic Resources Unit (GRU) (1793), Millennium Seed Bank (185), Heritage Seed Library (16) and the Institute of Biological, Environmental and Rural Sciences (IBERS) (1).

The breakdown by genus is the following: *Apium* 135, *Carum* 8, *Chaerophyllum* 12, *Coriandrum* 17, *Daucus* 1658, *Foeniculum* 25, *Pastinaca* 60 and *Petroselinum* 73. As part of a recent research project, the Vegetable Genetic Improvement Network has set up a Carrot Diversity Set, based on morphological and agronomic traits, which includes 77 genebank accessions plus others.

Development of the European Collection

Update on AEGIS: approaches for the development of the European Collection

L. Maggioni presented an update on the establishment of 'A European Genebank Integrated System' (AEGIS). He reminded the Group that AEGIS aims at conserving the genetically unique and important accessions for Europe and making them available for breeding and research. Such material will be safely conserved under conditions that ensure genetic integrity and viability in the long term. Thirty-three countries have signed the Memorandum of Understanding to be members of AEGIS and 51 genebanks have signed Associate Membership Agreements with their respective National Coordinators.

The European Collection, under development, is made up of dispersed accessions ("unique and/or important") that need to be identified and approved as European Accessions by the holding countries; these accessions are maintained by genebanks as a decentralized collection. At the time of the meeting the Collection included 11 524 accessions, mainly from the Dutch and German genebanks.

Regarding the selection procedure for the European Accessions, so far two complementary approaches have been promoted: 1. Selection of Most Appropriate Accessions (MAAs) by WGs based on their own selection criteria (as done for carrot by the Umbellifer Crops WG); 2. Offers by countries based on country of origin and uniqueness. However, it has become increasingly clear that the proposed steps were heavily leaning on two mistaken assumptions, i.e. (i) the availability of sufficient data in EURISCO and the Central Crop Databases, and (ii) that the various parties involved in the selection (WG members, genebank curators, National Coordinators), would be able to respond quickly and agree on the proposed candidate accessions.

Therefore, the ECPGR Secretariat developed the following more straightforward approach for the selection of European accessions, where the central role would be played by the member countries, while the Working Groups would assume a supervisory and monitoring role:

1. Associate Member institutes/genebanks recommend to National Coordinators a list of accessions they maintain, for inclusion into the European Collection.
2. The National Coordinator considers the recommendations and makes the final decision, ensuring that the established conservation and availability conditions will be met.
3. Accessions are flagged in EURISCO as part of the European Collection.
4. The Working Groups maintain the technical oversight over the comprehensiveness of the European Crop Collection, the existence of possible gaps, monitor the management of the Crop Collection, including adherence to the AEGIS Quality

System (AQUAS) and prepare annual workplans for regeneration and other activities that should be coordinated at the European or sub-regional level.

Criteria for the selection would need to respect the Selection requirements agreed by the SC, consider as a priority those accessions that have originated in the individual country and apply other considerations that would indicate the uniqueness of the accessions. In case of evident duplications that may be noted at any subsequent stage, it is suggested that the two holding genebanks agree on the final status of the duplicates, including the possibility of declaring one accession as the original and the other as a safety duplicate.

Discussion

The proposed approach for the selection of accessions was seen as a positive development towards the establishment of the European Collection. It was thought that this new approach could offer some solutions to existing problems encountered for the selection of carrot accessions.

However the Group wondered how the availability of material in the collection would be checked. Besides, the high level of dependence on the reactivity of the National Coordinators in each country was seen as a weakness in the system.

The Group was referred to the Safety duplication Policy available from the AEGIS website.

Regarding the possibility to de-flag accessions, the expectation would be that accessions can be de-flagged in specific cases, but the ultimate decision would remain at the discretion of the National Coordinators.

In this configuration, an important role of the Umbellifer Crops WG will be to identify gaps and ensure the representativeness of the European Collection.

Update on carrot Most Appropriate Accessions (MAAs); extension to landraces and wild relatives and to other umbellifers

C. Allender presented an account of the activity of selection of carrot accessions for the European Collection. A collaborative effort between six partners consisted in undertaking the project funded by the AEGIS Grant Scheme 'Assessment of Unique Material in European Collections of Umbellifer Crops'. In this project, focused on cultivated *Daucus*, the accession name was used as a proxy for genetic diversity and the country of origin was an important selection criterion.

The project started with the EURISCO dataset of 4671 *Daucus carota* accessions, with an additional 242 accessions from Warwick and 83 from France. For the final analysis, only accessions with data in the field "ACCENAME" were considered. Wild, landrace, F1 hybrids and breeding material were also discounted from the analysis. Overall, 2948 accessions were analysed, of which 1281 (43%) were selected for inclusion in the European Collection

In the meantime, IPK, Germany and the Centre for Genetic Resources, The Netherlands (CGN) provided lists of accessions offered for inclusion in the European Collections, based on criteria decided by the respective genebanks.

Tasks ahead for the WG will require decisions on the remaining *Daucus* material and on other crops that would possibly be less problematic than *Daucus*. Decisions are needed on the accessions with no names and on how to handle wild and landrace material.

Other crops to work on, with the respective approximate number of accessions are listed below:

Anethum	1005	*Coriandrum*	1031
Apium	772	*Foeniculum*	502
Carum	492	*Pastinaca*	295
Chaerophyllum	69	*Petroselinum*	1018

Discussion

C. Allender suggested following the approach proposed by the ECPGR Secretariat for the continuation of the selection of accessions.

Country representatives made the following comments:

- **Austria** (P. Freudenthaler): the collection should be unique as much as possible. An issue will be to raise its quality.
- **Czech Republic** (P. Kopecký): there is agreement with the proposed procedure and national lists of offered accessions can be prepared.
- **France** (E. Geoffriau): the newly suggested approach will be easier for France to implement, i.e. including the national collection in AEGIS, and he would gladly prepare the national list for the carrot collection.
- **Germany** (U. Lohwasser): the selection of German accessions at IPK was arranged in such a way that it could be done by a computer. She acknowledged that passport data were therefore not revised by a human eye and in some cases errors were present. These are corrected whenever identified. She stressed the need to monitor the quality of the material.
- **Germany** (T. Nothnagel): there is support for the idea of a European Collection, since it makes it easier to focus the conservation effort. Wild material and landraces should also be included, since they have a high value.
- **Nordic Genetic Resource Center (NordGen)** (S. Solberg): NordGen is going through the selection process and will soon be ready to offer accessions. He appreciated the new approach, which will be more practical.
- **Poland** (T. Kotlińska): there is agreement on the selected material, but internal difficulties do not allow reaching a final decision at national level about officially flagging these accessions in AEGIS as European Accessions.
- **Russian Federation** (A. Artemyeva on behalf of T. Khmelinskaya): the idea is good and important for research, but it is not certain that this will be a priority for the Russian National Coordinator.

Workplan

1. C. Allender will circulate the list of proposed accessions resulting from the project, with a view to encouraging the associate members to include those accessions in AEGIS (**as soon as possible after the meeting**).
2. Each member should propose a list of accessions to be submitted to the National Coordinator (NC) for flagging in AEGIS. The list will be sent to C. Allender and at the same time to the NC, in case of accessions conserved by institutions that are already Associate Members (**by end February 2014).**

Recommendation

Keeping in mind that accessions selected for AEGIS need to respect the general Selection requirements agreed by the SC, the Group recommends using the following selection criteria, which correspond to those adopted by Germany, as long as minimum passport data are also available:

- Accessions with origin in the country where they are conserved.
- Accessions collected by the genebank conserving them; in the case of collecting missions posterior to 1993 (year of entry into force of the Convention on Biological Diversity, CBD), only those accessions that have been collected under a material transfer agreement.
- Material collected by "foreign missions" and donated to the genebank.
- Other material not conserved in other genebanks.

The agreed fields to be filled in as minimum passport data, i.e. that should always be present when accessions are proposed for AEGIS, are listed below.

Note: descriptors with * = only if applicable to the given accession

	INSTCODE
	ACCENUMB
*	COLLNUM
*	COLLNAME
	GENUS
	SPECIES
*	SUBTAXA
*	CROPNAME
	ACCENAME
	ACQDATE
	ORIGCTY
*	COLLSITE
*	COLLDATE
	SAMPSTAT
*	DONORNAME
*	DONORNUMB

See the FAO/Bioversity Multi-Crop Passport Descriptors V.2 [MCPD V.2] for a full description of the fields.

It is highly recommended to include also SPAUTHOR.

The AEGIS Quality System (AQUAS)

L. Maggioni described the AEGIS Quality System (AQUAS) principles, including the need for consensus, agreement on minimum standards, the acknowledged need for capacity building, minimum bureaucracy and establishment of a monitoring system. AQUAS is composed of a number of elements, some of them already in place and others under development:

1. A template for compilation by each associate member, to be published online, thereby increasing transparency about current genebank operational standards;
2. Generic genebank operational standards to be agreed at the WG level, based on the standards on seed, field and *in vitro*/cryopreservation approved by the FAO Commission in April 2013 (Genebank Standards for Plant Genetic Resources for Food and Agriculture);
3. Minimum crop-specific technical standards (complementing generic standards) to be agreed at the WG level;
4. AEGIS Safety duplication Policy;
5. AEGIS Distribution Guidelines (in preparation);[5]
6. Reporting and monitoring mechanism (in preparation).

Discussion

The Group agreed on the need to develop a monitoring system, otherwise a quality system cannot work.

[5] Update at time of publication: the document, entitled *Guidelines for Distribution of Material from the European Collection*, has been finalized and is available from the AEGIS website (see here).

Presentation of minimum characterization descriptors

Carrot

E. Geoffriau presented the list of minimum characterization descriptors proposed at the previous meeting in Quedlinburg. Two additional descriptors were proposed as important:

- "Leaf dissection"
- "Plant height (cm) at flowering time".

Discussion

These were considered useful descriptors, but not accepted for the minimum list, since they would be problematic to score. In particular, waiting for flowering time would require growth for 2 years in the case of biennial species.

A list of *Minimum characterization descriptors for carrot* had been prepared by E. Geoffriau, with scales and illustrations. The Group agreed that all accessions entering the European Collection should be characterized according to this list, which is included as Appendix II to this report (pp. 25-29) and available online here.

Other umbellifers

H. Declercq provided an Excel table to the meeting, with proposed descriptor scales for celeriac, celery, dill, parsley, and parsnip. This table is available here.

Discussion

It was agreed that the Group needed a minimum list for other Apiaceae. The descriptors proposed by H. De Clercq were considered and the proposed lists were eventually agreed, except "tuber size" for parsnip. It was also pointed out that the UPOV scales were not suitable for germplasm material and they would require a revision of the scales. Ideally, it would be also useful to have reference illustrations.

A proposal made by U. Lohwasser to give up the attempt to standardize descriptors since everyone uses their own system was not approved.

Workplan

The Excel tables provided by H. De Clercq will be revised, including reference illustrations, according to responsibilities and timeframe below. The drafts will then be sent to the Chair for further distribution to the WG and adoption.

Celeriac	P. Kopecký	30 September 2013
Celery	P. Kopecký	30 September 2013
Dill	S. Solberg	31 July 2013
Parsley	U. Lohwasser	31 October 2013
Parsnip	U. Lohwasser	31 October 2013

The final lists will be published online on the same page as the descriptors for carrot.

Presentation of minimum genebank standards

E. Geoffriau recalled that a discussion took place during the First Meeting of the Umbellifer Crops WG in Quedlinburg, 29 March–1 April 2011, where elements for crop-specific genebank standards were proposed.

Based on comments received from the WG and after comparison with the FAO Genebank Standards for Plant Genetic Resources for Food and Agriculture, a revised list of proposed standards was presented and discussed.

Discussion

It was suggested to include a limit of 40% RH of the seed store environment for active collections, but this was not accepted, since some institutes do not control RH for active collections.

Regarding the % of germination, in many countries (e.g. Lithuania, Poland, Russian Federation) it is not possible to reach the FAO suggested level for cultivated species (85%), but in the Czech Republic and France the level is at least 95% in carrot. Different (lower) percentages would be reached in the case of other Apiaceae. It was concluded to suggest not less than 75%.

In the case of collecting missions, it was also agreed to include an "acquisition minimum" of seed taken from 45 plants, with an optimum taken from more than 80 plants, and it was agreed to take note of the number of plants from which seed was collected.

The agreed list of Umbellifer crop-specific standards, based on the FAO standards with some amendments and additions, is included as Appendix IV (pp. 30-32).

ECPGR Umbellifer wild relatives project

Collecting wild relatives, progress and results

Prospection in Albania

(*S. Jani*)

A collecting mission was organized in 2013 thanks to the ECPGR-funded project on umbellifer wild relatives. This mission is focusing on the coastal and western lowland territory.

An exploratory mission carried out between 20 May and 18 June revealed variations in wild carrot types in the Fier, Lushnje, Kavaja and Durres districts, such as thin and thick stems, long and short stems, purple colour, flat and convex umbels. *Anethum graveolens* was found with vigorous plants with long and strong stems, grown in agricultural plots. It is a rare plant, found around the Lushnja and Fieri cities, where it is used as a culinary aromatic herb. *Petroselinum crispum* was found with long and thin stems, small and very aromatic leaves (Lushnje district). *Anthriscus sylvestris* and *Foeniculum vulgare* grow on the sides of roads, in the green hedges and old walls or near canals in a wide territory, from Tirana to Vlora. *Coriandrum sativum* grows in a wide territory, from Shkoder in the north to Vlore district in south Albania. A landrace of *Pimpinella anisum* grows in south-eastern Albania (Permet district) and is used as a kitchen herb. *Ammi visnaga* and *Conium maculatum* grow on roadsides in a wide area, while *Smyrnium olusatrum* is limited to the area around the Bay of Vlora.

Athamanta cretensis is a rare plant found on mountainous areas on limestone rocks, in wet and cool climates. Undetermined umbellifer species were also identified. The project will continue with the estimation of population sizes, geographical referencing, mapping of geographical distribution areas of wild relatives of umbellifer crops and the collecting of seeds which will be prepared for long-term storage.

Diversity of wild carrot in France

(*E. Geoffriau*)

The study of wild carrots in France has the objectives of improving knowledge, including on taxonomic aspects, of analysing the structure of genetic diversity and of carrying out evaluation for carrot breeding. Eighty-five sites were sampled in 2009 and 2010 in France. The geographical distribution of wild carrots is large and the diversity is high. The taxonomy of the species is complex, with two sub-groups (*carota* and *gummifer*), ten subspecies described in France and several botanical varieties.

Morphometric and molecular analyses are carried out to investigate phenotypic plasticity and ecological adaptation. Genetic structure was also studied and evaluation was carried out for resistance to *Alternaria dauci*.

Characterization of wild relatives, progress and results

Wild carrot at the Nordic Genetic Resource Center (NordGen)

(*S. Solberg*)

Carrot germplasm (ca. 60 accessions) was received by NordGen from a breeding company (Svalov Weibull) due to the closing down of the breeding programme. After 5 years it will be possible to distribute them.

Characterization of wild carrot has been carried out on 14 wild carrots from Denmark, Sweden and Norway. These were sown in March 2013 and characterized at 60 days for seedling root length, leaflet length, leaflet growth in spring, number of segment tips, and percentage of early bolting. Differences between accessions were detected.

Characterization by flow cytometry

(*C. Allender*)

Flow cytometry was used to investigate rapid verification methods for taxonomy of wild relatives. This system is for measuring the size of the genome. It is a quick and relatively cheap approach, which does not need a whole flowering plant and requires only leaf tissue. It has some limitations, since it cannot give conclusive confirmation of correctness and it cannot always discriminate species with the same number of chromosomes. The project plan involves the testing of 50 accessions from approximately 12 species with n=9, 10 or 11. A further 50 accessions may also be tested, depending on the first results. Leaf samples are sent to Plant Cytometry Services, The Netherlands and the cost of one sample is € 4.

Characterization of umbellifer wild relatives

(*P. Kopecký*)

Fifteen selected accessions of wild relatives of *Daucus carota* from the southeast of the Czech Republic will be characterized before the end of the year. For each accession 20 plants will be used for characterization and 50 for multiplication.

Taxonomic identification of wild carrot

(*E. Geoffriau*)

The taxonomic identification of two lists of wild carrot accessions from several collections was carried out at the Agrocampus Angers (France), respectively at the flowering stage in July 2012 and at the plantlet stage in April 2013. Controls were compared with samples under scrutiny. Several misattributions of taxonomic names were clearly identified. It was clear that the taxonomy is not straightforward and that comparison of samples with reference controls is very useful.

Evaluation of wild relatives

Resistance to *Alternaria* in wild carrot

(*T. Nothnagel*)

Two species of *Alternaria* affect carrots, causing severe losses in yield, quality and marketability. A third species also seems to be infective. No resistant cultivars exist, only some are tolerant. Carrot is a major cash crop for organic farmers and *Alternaria*, which produces various toxic metabolites, is difficult to control under organic production conditions.

The EC-funded GENRES CT99-105 project tested accessions for resistance to *A. dauci* in 2001-03 and found broad variation among the 200 evaluated genebank accessions, with wild relatives and landraces showing a higher percentage of more tolerant or resistant accessions.

A main problem of disease evaluation in the past was to achieve the objective and reproducible calculation of disease symptoms. Now it is possible to obtain this objectivity by screening with a Digital Image Analysis System (DIAS).

In the framework of the ECPGR Umbellifer wild relative project, JKI agreed to evaluate 30 accessions from different European countries for resistance to *Alternaria* species. Two hundred seeds per accession are required. Once the wild carrot accessions are received from UK (carrot diversity set), NordGen (wild carrot from the Nordic collection), Russian Federation (VIR) and France, a pre-evaluation will be made in August-November 2013.

Laboratory tests and DIAS analysis will be made by March 2014 and a publication is also eventually planned. Resulting data are expected to be made available in August 2014.

Discussion

C. Allender informed the Group that most of the GENRES project results (characterization data) are available online in pdf format from the Warwick Genetic Resources Unit website.

E. Geoffriau thought that it would be good to add the evaluation data and encouraged participants to do so.

It was agreed that the evaluation for *Alternaria* resistance should focus on *D. carota* var. *carota* accessions that are well identified and that originate from different geographical areas.

It would be useful to add and re-test some accessions that were evaluated in the GENRES project, as reference material.

Complementary evaluation results on wild carrot

(*E. Geoffriau*)

Evaluation of *Daucus carota* var. *carota* for resistance to *Alternaria dauci* was made together with seed companies. Wild *carota* is generally resistant, more than *gummifer*.

Evaluation for resistance was extended to different pathogens, with some accessions showing good resistance to *Xanthomonas*, much less to *Oidium* and even less to nematodes.

Project assessment and workplan

Discussion

The Group acknowledged the good progress made by the ECPGR-funded wild relative project. The project could only make available very limited funds, but one of the most valuable outcomes is the increased collaboration towards characterization of wild relatives. Therefore, partners in the project were invited to add other data that they might collect, even if this might be outside the specific contracts signed with Bioversity.

It was agreed that the study should focus on "*carota carota*" and should maximize the spread of the geographical origin of the tested samples.

Workplan

- Lists of proposed accessions to be evaluated for *Alternaria* resistance should be sent to E. Geoffriau **immediately after the meeting** by members from Albania, Czech Republic, Lithuania, Poland, Russian Federation and UK.
- E. Geoffriau will make a selection and send instructions to the partners to send seeds for the analysis to T. Nothnagel (**by end July 2013).**

It was confirmed that financial and technical reports should be sent to Bioversity by 30 November 2013.

Database issues

Update on EURISCO and Central Crop Databases

(*L. Maggioni*)

EURISCO currently contains passport data of more than 1.1 million accessions from over 300 collections in Europe. A concept to include C&E data in EURISCO, developed by the ECPGR Documentation and Information Network (Doc&Info Network), is expected to be implemented during the next Phase of ECPGR, following the transfer of EURISCO to IPK, Gatersleben, Germany.

Regarding the relationship between EURISCO and the Central Crop Databases (CCDBs), the WGs are finding it increasingly difficult to sustain the development of CCDBs, but frustration is also building up because of the fact that EURISCO does not contain enough passport and crop-specific data to select AEGIS accessions. At the same time, EURISCO is the official repository of potential AEGIS accessions, while the CCDBs do not contain data verified and cleared by any national authority. Different WGs have expressed apparently contrasting opinions, suggesting in some cases abandoning the CCDBs and investing rather more in EURISCO. In other cases, WGs have confirmed that they would rather rely on the CCDBs, which remain more flexible and suitable for crop-specific needs and can accommodate functions that EURISCO will never have (synonyms, duplicates, photos, geographic information system (GIS), taxonomy standards, molecular, pedigree, *in situ* data, etc.).

A paper by Hintum et al. (2010)[6], written on behalf of the Doc&Info Network, foresees the development of ECCDBs into user-oriented crop portals providing access to information beyond the present C&E data, i.e. all data useful for research and breeding of a particular crop.

Considering the uneasiness of several WGs regarding the respective roles of EURISCO and the CCDBs as well as the need to bring all WGs to the same level of understanding and collaboration about a vision for plant genetic resource (PGR) documentation in Europe, the SC agreed to allocate funds for a meeting of the Doc&Info WG in 2014, specifically dedicated to the above and related issues.

[6] Hintum TJL van, Begemann F, Maggioni L. 2010. The European *ex situ* PGR Information Landscape. In: Maurer L, Tochtermann K, editors. Information and communication Technologies for Biodiversity Conservation and Agriculture. Shaker Verlag, Aachen. pp.155-171.

Evolution of the European Umbellifer Database

(*C. Allender*)

The European Umbellifer Database (EUDB) was updated in April 2013 and it includes 11 915 accessions from 30 National Inventories, mainly *Daucus*, but also other genera (*Anethum*, *Apium*, *Carum*, *Chaerophyllum*, *Coriandrum*, *Foeniculum*, *Pastinaca* and *Petroselinum*).

The status of the largest proportion of samples is "landraces", followed by "advanced cultivars". The April 2013 update allowed inclusion in the database of data from the previously unrepresented national inventories of Belgium, Bosnia and Herzegovina, Croatia, Cyprus, France, Ireland, Macedonia (FYR), Portugal and Spain. Data from Italy were also added in June 2013.

The Group needs to take decisions for the future on how best to manage the Umbellifer Crops WG data, and to decide whether two databases (EURISCO and EUDB) are necessary. Items for discussion are also the treatment of C&E data and the information on the actual availability of the seeds.

Discussion on the database issues

Discussion

U. Lohwasser indicated that the argument to maintain CCDBs was to have the C&E data, but if C&E data can be included in EURISCO, it would be preferable to maintain just one DB.

S. Solberg thought that it would be better to have one DB, if C&E data were also included.

T. Nothnagel stressed the importance of developing a CCDB with data that are of interest for users, unless EURISCO can include such data.

P. Kopecký and P. Freudenthaler would prefer to see a simple system based on EURISCO.

Recommendation

With the understanding that EURISCO will soon include C&E data, the ECPGR European Umbellifer Database should not be further developed as a database for germplasm users, but it should become a tool of the WG. Specifically, the DB Manager should check whether information is available that is not included in EURISCO.

Safety duplication issues

Update from each participant

Each participant provided a brief update of the safety duplication status of the respective national collections of umbellifers.

- Austria: material was partly duplicated in Slovakia and at CGN, The Netherlands. Additional safety duplicates to Svalbard will be arranged, but multiplication needs to be carried out first. There is no information about the part of the collection that belongs to an NGO.
- Czech Republic: about 10% of the accessions are safety-duplicated in Slovakia. Old material that is in the base collection in Prague can only be safety-duplicated as a result of future multiplications.
- France: a very partial duplication (20%) was made locally in a different institute (Groupe d'Etude et de contrôle des Variétés Et des Semences, GEVES). It is understood that the

standard is to safety-duplicate in a different country and this can be organized in the future.
- Germany: duplicates were sent to Svalbard.
- Lithuania: safety-duplicates are deposited at NordGen.
- NordGen: safety duplication in Svalbard is arranged to a large extent – 70% of the umbellifer collection has been duplicated in Svalbard. Backups from the Baltic countries and Israel are maintained.
- Poland: there is no duplication of the Umbelliferae collection so far, but it is planned for the next phase of the genetic resources conservation programme in the Polish Gene Bank (2014-2020).
- Serbia: there are plans to safety-duplicate abroad.
- UK: a good level of safety duplication was achieved by sending samples to CGN, The Netherlands. Warwick can also host safety-duplicates.

Operation of the WG and election of Chair and Vice-Chair

E. Geoffriau wished to step down from his role as Chair. The suggestion that C. Allender replace him in that capacity and that P. Kopecký act as Vice-Chair was accepted by all interested and the Group welcomed this decision.

Assessment of Phase VIII workplan and preparation of next phase; definition of Umbellifer projects in the new organization

The Group discussed its mode of operation and the possibility to make improvements.

C. Allender wondered about the best way to communicate among the members when the Group will become more virtual. Email was still considered preferable, but there is a need to get active reactions from the members.

It should be quite useful to improve the level of information uploaded on the WG's web page.

S. Solberg stressed the need to organize collaborative action, otherwise it would be very difficult to maintain the cohesion of the Group. He was feeling comfortable with collaborative genebank activities and description of material and would also like to continue collaboration with VIR.

L. Maggioni gave some examples of possible activities to be proposed for Phase IX, stressing the point that they would need to be in line with the objectives of ECPGR.

P. Freudenthaler informed the Group that the national priority in Austria will be fulfilling the agreed standards, ensuring safety duplication and characterization of material, and developing niche markets for the utilization of germplasm. *In situ* conservation of crop wild relatives (CWR) is another area of interest.

P. Kopecký stressed the importance of making sure that all accessions are regenerated and not endangered before undertaking characterization. At present there is no project on umbellifer vegetables in the Czech Republic.

E. Geoffriau was in favour of increasing C&E and studies on the differences among accessions in genebanks to assess the amount of variation. He also welcomed the continuation of the wild relatives project. He saw the need to build more expertise in taxonomic identification, geographical distribution and genetic structure. He was also interested to look at the evolution of diversity due to regeneration in genebanks. The research aspect can generate additional funding and feed information to the genebanks. Regeneration is also important and provides an opportunity for comparison of accessions.

U. Lohwasser agreed with the previous speakers and expressed interest in C&E, especially of wild relatives. Considering that ECPGR funding will be very limited, it will be important to identify funding for projects. For example a national project in Germany provides funding from the Ministry of Agriculture for building networks dealing with on-farm management of vegetables, but carrot was excluded. The role of the genebank is to provide seed and to receive characterization data in return. It is also important to look at the genepool species and identify the gaps in the collections.

C. Allender thought that the Group will need to maximize the effect of ECPGR funds. It is correct to say that the basic standards should be ensured, i.e. critical regeneration or safety duplication. She also appreciated the wild relatives project, which should be continued.

The Group needs to become more aware of other projects, such as PGR Secure and the Trust CWR project, of what are they doing and if there is any interest in *Daucus*.

Her personal interest was focused on C&E of parsnip. It would be important to understand what C&E data different institutes have and what they can share. A concern is that to get public funding it is necessary to involve the private sector, which may not be happy to share information. A proposal was submitted to the Department for Environment, Food and Rural Affairs (DEFRA) for collecting the remaining landraces in the UK.

R. Karklelienė indicated her interest in disease resistance donors and suggested that a small panel of organic growers could compare accessions in different countries.

D. Cvikić thought that the priority is the preservation of material in collections. He suggested cooperation between breeders and farmers.

S. Jani indicated that the priority is collecting before loss of genetic resources occurs. In Albania there are no breeding activities and the situation will remain like this for a long time. He was happy to continue cooperation with the Group. He acknowledged that some countries do not have good facilities for conservation and it is better to cooperate and share. C&E are also important.

T. Nothnagel mentioned that in his institute (JKI) many research projects on umbellifers are ongoing, focusing on different traits and funded with the institute's own budget and external sources. JKI can support the activities of the Umbellifer Crops WG with its expertise and facilities. Its main focus is C&E, while T. Nothnagel's main focus is resistance and also molecular characterization to create a genetic map.

T. Kotlińska informed the Group that the genebank in Poland will be supported next year by the EU rural development fund. Projects are oriented towards farmers who would like to develop the use of germplasm on their farms. The genebank will need to multiply seed. Re–introduction of landraces to their original places is also planned and farmers are interested, especially in tourist areas. Another priority will be the maintenance of the collection. The database on vegetables needs to be updated and prepared for providing data

to EURISCO. Another task is the preparation of field tests for registration of varieties. Collaboration exists with breeding companies, but many of them are closing down.

E. Geoffriau summarized the discussion by concluding that cooperation could be promoted at two levels: the first one to improve conservation, including collaboration for regeneration and safety duplication of accessions, and the second to improve the knowledge of the accessions in the collections.

It was also mentioned that a number of countries and geographic areas not represented in the meeting were very important for umbellifers and efforts should be made to involve them in the WG's activities: Bulgaria, the Caucasus, Greece, Turkey and Ukraine.

It was agreed to organize the future activities of the Umbellifer Crops WG in Phase IX around five main tasks and a leader was identified for each task, with the responsibility of promoting and organizing the related activities.

A preparatory task will be carried out by the end of the current Phase VIII.

Workplan

Preparatory task: **List of accessions for the AEGIS European Collection**
(C. Allender)
Lists of accessions that are foreseen to be included in the collection (putative accessions) should be sent to C. Allender by all WG members **by the end of February 2014** to start working on possible plans for the management of the European Collection. This is the starting basis to verify what can be targeted for improvement.

Task 1: Analysis of the AEGIS list (S. Solberg)
- Gap analysis of missing countries and species.

Task 2: **Improvement of collection quality** (**P. Kopecký**)
- Organization and monitoring of the increase in quality, including level of regeneration and safety duplication of the European Collection, with priority on critical material and identified gaps.

It was pointed out that work on **safety duplication** could be organized as an activity of the WG and all the WG members, including those not attending this meeting, are invited to express needs and wishes to be involved.

Similarly, **regeneration** is an activity that can be shared where possible, depending on the gaps and all WG members are invited to express needs and/or opportunities to help.

Task 3: **Characterization and evaluation** (**T. Nothnagel/U. Lohwasser**)
- Inventorying of existing data
- Proceeding with C&E data acquisition
- Definition of joint sub-list of priority accessions to focus characterization on, keeping in mind the genepool concept
- A possible area of interest would be to look at CWR with marker-assisted selection to identify markers for disease resistance as well as for climatic change-related traits (tolerance to abiotic/biotic stress).

Task 4: **Landraces (S. Solberg)**
- Collecting
- Adding value to on-farm initiatives.

Task 5: **Wild relatives** (**E. Geoffriau**)
- Inventory of existing accessions
- Collecting based on identified gaps in the primary genepool (link with other programmes)
- Taxonomic identification
- Phylogenetic study with molecular markers.

Recommendation

All WG members are invited to send information to the Secretariat for uploading on the web page, prepared in draft form by the Secretariat, dedicated to An inventory of activities carried out by our members and partners in Europe on genebank material.

Conclusion

The WG had the opportunity to visit Vavilov's Memorial, the Herbarium and the genebank. Special thanks were given to the VIR's staff who contributed to the success of this meeting, particularly Anna Artemyeva, Irena Chukhina, Sergey Filimonenko, Tatyana Khmelinskaya, Igor Loskutov, Boris Makarov and Oleg Petrov.

APPENDICES

Appendix I. Workplan

(Agreed at the Second Meeting of the Umbellifer Crops Working Group, 26-28 June 2013, St. Petersburg, Russian Federation)

Activities	Responsibility	Deadline
Selection of European Accessions (MAAs)		
1. Circulate the list of proposed accessions of carrot cultivars resulting from the AEGIS–funded project, in view of encouraging the associate members to include those accessions in AEGIS.	C. Allender	As soon as possible after the meeting
2. Propose a list of accessions to be submitted to the National Coordinator (NC) for flagging in AEGIS. The list will be sent to C. Allender and at the same time to the NC, in the case of accessions conserved by institutions that are already Associate Members.	All WG members	End February 2014
Minimum characterization descriptors		
1. Revise the Excel tables provided by H. De Clercq, including reference illustrations.	P. Kopecký (celeriac and celery)	30 September 2013
2. Send the drafts to the Chair for further distribution to the WG and adoption.	S. Solberg (dill)	31 July 2013
	U. Lohwasser (parsley and parsnip)	31 October 2013
Wild relative project		
Send lists of proposed accessions to be evaluated for *Alternaria* resistance to E. Geoffriau.	Members from Albania, Czech Republic, Lithuania, Poland, Russian Federation and UK	Immediately after the meeting
Make a selection and send instructions to the partners to send seeds for analysis to T. Nothnagel.	E. Geoffriau	31 July 2013
Send financial and technical reports to Bioversity.	Partners of the ECPGR-funded wild relative project	30 November 2013
Plan for Next Phase		
Preparatory task: List of accessions for the AEGIS European Collection		
Send lists of accessions that are foreseen to be included in the collection (putative accessions) to C. Allender [this list may be the same as in point 1 of “Selection of European Accessions”, or a larger list].	All WG members	End February 2014
Start working on possible plans for the management of the European Collection.	C. Allender	Pro memoria

Activities	**Responsibility**	**Deadline**
Task 1: Analysis of the AEGIS list - Gap analysis of missing countries and species.	S. Solberg	Phase IX
Task 2: **Improvement of collection quality** - Organization and monitoring of the increase in quality, including level of regeneration and safety duplication of the European Collection, with priorities on critical material and identified gaps.	P. Kopecký	Phase IX
Task 3: **Characterization and evaluation** - Inventorying of existing data - Proceeding with C&E data acquisition - Definition of joint sub-list of priority accessions to focus characterization on, keeping in mind the genepool concept - Possible areas of interest would be looking at CWR with marker-assisted selection to identify markers for disease resistance as well as for climatic change- related traits (tolerance to abiotic/biotic stress).	T. Nothnagel and U. Lohwasser	Phase IX
Task 4: **Landraces** - Collecting - Adding value to on-farm initiatives.	S. Solberg	Phase IX
Task 5: **Wild relatives** - Inventory of existing accessions - Collecting based on identified gaps in the primary genepool (link with other programmes) - Taxonomic identification - Phylogenetic study with molecular markers.	E. Geoffriau	Phase IX

Appendix II. Minimum characterization descriptors for carrot

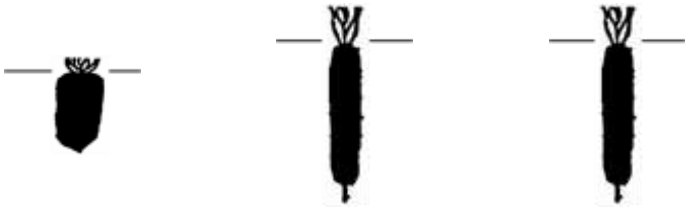
Agreed at the Second Meeting of the Umbellifer Crops Working Group, 26-28 June 2013, St. Petersburg, Russian Federation.

Note: the "IPGRI numbers" refer to the *Descriptors for wild and cultivated Carrots* published by IPGRI (now Bioversity)[7].

Number	IPGRI number	Descriptor name	Descriptor state	Notes
1	**7.1.12**	**Leaf growth habit (attitude)**	3 Prostrate 5 Semi-erect 7 Erect	See Fig. 1
 3 5 7 **Fig. 1. Leaf growth habit (attitude)**				
2	**7.1.14**	**Leaf type**	1 Celery 2 Normal 3 Parsley or Fern	See Fig. 2
 1 2 3 **Fig. 2. Leaf type**				
3	**7.1.16**	**Leaf colour**	1 Yellow green 2 Green 3 Grey-green 4 Purple green 99 Other	
4	**7.2.1**	**Bolting tendency**	3 Low 5 Intermediate 7 High	

[7] IPGRI. 1998. Descriptors for wild and cultivated Carrots. International Plant Genetic Resources Institute, Rome, Italy.

Number	IPGRI number	Descriptor name	Descriptor state	Notes
5	**7.4.2**	**Root position in soil**	3 Shallow 5 Medium 7 Deep	(at maturity) See Fig. 3



3 5 7

Fig. 3. Root position in soil

6	**7.4.11**	**Root surface**	1 Smooth 2 Coarse 3 Dimpled 4 Ridged 99 Other	See Fig. 4

1 2 3 4

Fig. 4. Root surface

7	**7.4.12**	**Root branching**	0 Absent 3 Sparse 5 Intermediate 7 Dense	See Fig. 5

0 3 5 7

Fig. 5. Root branching

Number	IPGRI number	Descriptor name	Descriptor state	Notes
8	**7.4.14**	**Root shape**	1 Round 2 Obovate 3 Obtriangular 4 Oblong 5 Tapering 99 Other	See Fig. 6

Fig. 6. Root shape

Number	IPGRI number	Descriptor name	Descriptor state	Notes
9	**7.4.16**	**Root shoulder shape**	1 Flat 2 Flat to rounded 3 Rounded 4 Rounded to conical 5 Conical 99 Other	See Fig. 7

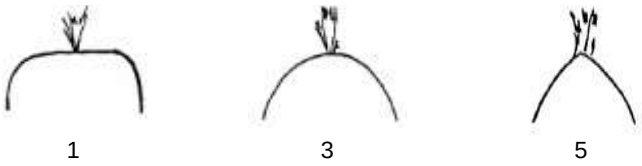


Fig. 7. Root shoulder shape

Number	IPGRI number	Descriptor name	Descriptor state	Notes
10	**7.4.17** (modified)	**Colour of skin on shoulder**	0 No difference 3 Green 5 Violet	See Fig. 8

Fig. 8. Colour of skin on shoulder

Number	IPGRI number	Descriptor name	Descriptor state	Notes
11	**7.4.21**	**Root tip/end shape**	1 Blunt 2 Rounded 3 Pointed	See Fig. 9

1 2 3

Fig. 9. Root tip/end shape

Number	IPGRI number	Descriptor name	Descriptor state	Notes
12	**7.4.22**	**Root skin pigmentation colour**	1 White 2 Yellow 3 Orange 4 Red 5 Purple 99 Other	See Fig. 10

1 2 3 4 5

Fig. 10. Root skin pigmentation colour

Number	IPGRI number	Descriptor name	Descriptor state	Notes
13	**7.5.5**	**Outer core pigmentation/colour**	1 White 2 Yellow 3 Orange 4 Red 5 Purple 99 Other	(Observation at maximum diameter) See Fig. 11

1 2 3 4 5

Fig. 11. Outer core pigmentation/colour

Number	IPGRI number	Descriptor name	Descriptor state	Notes
14	**7.5.7**	**Inner core pigmentation/colour**	1 White 2 Yellow 3 Orange 4 Red 5 Purple 99 Other	(Observation at maximum diameter) See Fig. 12
 1 2 3 4 5 **Fig. 12. Inner core pigmentation/colour**				
15	**7.7.1**	**Accession longevity (lifespan)**	1 Annual 2 Biennial 3 Both	

Appendix III. Umbellifer crop-specific genebank standards

Agreed at the Second Meeting of the Umbellifer Crops Working Group, 26-28 June 2013, St. Petersburg, Russian Federation

Note: The additions and amendments made to the FAO Genebank Standards for Plant Genetic Resources for Food and Agriculture by the Umbellifer Crops WG are listed in the right-side column.

FAO Genebank Standards 2013		Umbellifer crop-specific genebank standards
4.1	**STANDARDS FOR ACQUISITION OF GERMPLASM**	
4.1.1	All seed samples added to the genebank collection have been acquired legally with relevant technical documentation.	
4.1.2	Seed collecting should be made as close as possible to the time of maturation and prior to natural seed dispersal, avoiding potential genetic contamination, to ensure maximum seed quality.	
4.1.3	To maximize seed quality, the period between seed collecting and transfer to a controlled drying environment should be within 3 to 5 days or as short as possible, bearing in mind that seeds should not be exposed to high temperatures and intense light and that some species may have immature seeds that require time after harvest to achieve embryo maturation.	
4.1.4	All seed samples should be accompanied by at least a minimum of associated data as detailed in the FAO/Bioversity multi-crop passport descriptors.	Umbellifer minimum passport data : INSTCODE, ACCENUMB, COLLNUM, COLLNAME, GENUS, SPECIES, SUBTAXA, CROPNAME, ACCENAME, ACQDATE, ORIGCTY, COLLSITE, COLLDATE, SAMPSTAT, DONORNAME, DONORNUMB
4.1.5	The minimum number of plants from which seeds should be collected is between 30-60 plants, depending on the breeding system of the target species	Acquisition minimum of seed from 45 plants, with an optimum taken from more than 80 plants (outcrossing species) Register number of plants
4.2	**STANDARDS FOR DRYING AND STORAGE**	
4.2.1	All seed samples should be dried to equilibrium in a controlled environment of 5-20°C and 10-25 percent of relative humidity, depending upon species.	
4.2.2	After drying, all seed samples need to be sealed in a suitable air-tight container for long term storage; in some instances where collections that need frequent access to seeds or likely to be depleted well before the predicted time for loss in viability, it is then possible to store seeds in non–airtight containers.	
4.2.3	Most-original-samples and safety duplicate samples should be stored under long-term conditions (base collections) at a temperature of -18 ± 3°C and relative humidity of 15 ± 3 percent.	
4.2.4	For medium-term conditions (active collection) samples should be stored under refrigeration at 5-10°C and relative humidity of 15 ± 3 percent.	

FAO Genebank Standards 2013		Umbellifer crop-specific genebank standards
4.3	**STANDARDS FOR SEED VIABILITY MONITORING**	
4.3.1	The initial seed viability test should be conducted after cleaning and drying the accession or at the latest within 12 months after receipt of the sample at the genebank.	
4.3.2	The initial germination value should exceed 85 percent for most seeds of cultivated crop species. For some specific accessions and wild and forest species which do not normally reach high levels of germination, a lower percentage could be accepted.	>75% for cultivated accessions 50% for wild accessions
4.3.3	Viability monitoring test intervals should be set at one-third of the time predicted for viability to fall to 85 percent[8] of initial viability or lower depending on the species or specific accessions, but no longer than 40 years. If this deterioration period cannot be estimated and accessions are being held in long-term storage at -18°C in hermetically closed containers, the interval should be ten years for species expected to be long-lived and five years or less for species expected to be short-lived.	Conditions of long-term storage and safety duplication: in sealed containers (aluminium foil, glass jars), -18°C Monitoring intervals: 5 years for short-term storage, 10 years for long-term storage
4.3.4	The viability threshold for regeneration or other management decision such as recollection should be 85 percent or lower depending on the species or specific accessions of initial viability.	50% for cultivated accessions
4.4	**STANDARDS FOR REGENERATION**	
4.4.1	Regeneration should be carried when the viability drops below 85 percent of the initial viability or when the remaining seed quantity is less than what is required for three sowings of a representative population of the accession. The most-original-sample should be used to regenerate those accessions.	50% for cultivated accessions Regeneration from the original seed lot if possible Minimum of 45 **bolting** plants
4.4.2	The regeneration should be carried out in such a manner that the genetic integrity of a given accession is maintained. Species-specific regeneration measures should be taken to prevent admixtures or genetic contamination arising from pollen geneflow that originated from other accessions of the same species or from other species around the regeneration fields.	Randomly chosen plants for regeneration (no selection, except for obvious off-types) Use of insect-proof isolation cages Harvest in one single seed lot (quite balanced between plants) Regeneration repeated in case of insufficient amount of bolters or harvested seeds Limited number of regeneration cycles (such as every 15 years), to be recorded
4.4.3	If possible at least 50 seeds of the original and the subsequent most-original-samples should be archived in long-term storage for reference purposes.	
4.5	**STANDARDS FOR CHARACTERIZATION**	
4.5.1	Around 60 percent of accessions should be characterized within five to seven years of acquisition or during the first regeneration cycle.	
4.5.2	Characterization should be based on standardized and calibrated measuring formats and characterization data follow internationally agreed descriptor lists and are made publicly available.	Minimum characterization descriptors agreed by the Umbellifer Crops WG

[8] The time for seed viability to fall can be predicted for a range of crop species using an online application based on the Ellis/Roberts viability equations (see http://data.kew.org/sid/viability/).

FAO Genebank Standards 2013		Umbellifer crop-specific genebank standards
4.6	**STANDARDS FOR EVALUATION**	
4.6.1	Evaluation data on genebank accessions should be obtained for traits that are included in internationally agreed crop descriptor lists. They should conform to standardized and calibrated measuring formats.	
4.6.2	Evaluation data should be obtained for as many accessions as practically possible, through laboratory, greenhouse and/or field analysis as may be applicable.	
4.6.3	Evaluation trials should be carried out in at least three environmentally diverse locations and data collected over at least three years.	
4.7	**STANDARDS FOR DOCUMENTATION**	
4.7.1	Passport data of 100 percent of the accessions should be documented using FAO/Bioversity multi-crop passport descriptors.	INSTCODE, ACCENUMB, COLLNUM, COLLNAME, GENUS, SPECIES, SUBTAXA, CROPNAME, ACCENAME, ACQDATE, ORIGCTY, COLLSITE, COLLDATE, SAMPSTAT, DONORNAME, DONORNUMB
4.7.2	All data and information generated in the genebank relating to all aspects of conservation and use of the material should be recorded in a suitably designed database.	
4.8	**STANDARDS FOR DISTRIBUTION AND EXCHANGE**	
4.8.1	Seeds should be distributed in compliance with national laws and relevant international treaties and conventions.	
4.8.2	Seed samples should be provided with all relevant documents required by recipient country.	
4.8.3	The time span between receipt of a request for seeds and the dispatch of the seeds should be kept to a minimum.	
4.8.4	For most species, a sample of a minimum of 30-50 viable seeds should be supplied for accessions with sufficient seeds in stock. For accessions with too little seed at the time of request and in the absence of a suitable alternative accession, samples should be supplied after regeneration/multiplication, based on a renewed request. For some species and some research uses, smaller numbers of seeds should be an acceptable distribution sample size.	
4.9	**STANDARDS FOR SAFETY DUPLICATION**	See AEGIS Safety duplication Policy
4.9.1	A safety duplicate sample for every original accession should be stored in a geographically distant area, under the same or better conditions than those in the original genebank.	
4.9.2	Each safety duplicate sample should be accompanied by relevant associated information.	
4.10	**STANDARDS FOR SECURITY AND PERSONNEL**	
4.10.1	A genebank should have a risk management strategy in place that includes *inter alia* measures against power cut, fire, flooding and earthquakes.	
4.10.2	A genebank should follow the local Occupational Safety and Health requirements and protocols where applicable.	
4.10.3	A genebank should employ the requisite staff to fulfil all the routine responsibilities to ensure that the genebank can acquire, conserve and distribute germplasm according to the standards.	

Appendix IV. Acronyms and abbreviations

AEGIS	A European Genebank Integrated System
AQUAS	AEGIS Quality System
ATTC	Agricultural Technologies Transfer Center, Lushnja, Albania
C&E	Characterization and evaluation
CBD	Convention on Biological Diversity
CCDB	Central Crop Database
CGN	Centre for Genetic Resources, Wageningen, The Netherlands
CRI	Crop Research Institute, Czech Republic
CWR	Crop wild relatives
DEFRA	Department for Environment, Food and Rural Affairs, United Kingdom
DIAS	Digital Image Analysis System
EC	European Commission
ECPGR	European Cooperative Programme on Plant Genetic Resources
EUDB	European Umbellifer Database
EURISCO	European Internet Search Catalogue
FAO	Food and Agriculture Organization of the United Nations, Rome, Italy
GEVES	Groupe d'Etude et de contrôle des Variétés Et des Semences (Group for the Study and Inspection of Varieties and Seeds), France
GIS	Geographic information system
GRU	Genetic Resources Unit, Warwick Crop Centre, University of Warwick, Wellesbourne, United Kingdom
IBERS	Institute of Biological, Environmental and Rural Sciences, Aberystwyth University, United Kingdom
IPGRI	International Plant Genetic Resources Institute *(now Bioversity International)*
IPK	Leibniz Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany
IRHS	Institut de Recherche en Horticulture et Semences, Angers, France
ISHS	International Society for Horticultural Science
JKI	Julius Kühn-Institut, Quedlinburg, Germany
MAA	Most Appropriate Accession *(for AEGIS)*
NC	National Coordinator
NGO	Non-governmental organization
NordGen	Nordic Genetic Resource Center, Alnarp, Sweden
OECD	Organisation for Economic Co-operation and Development
PGRFA	Plant genetic resources for food and agriculture
SC	Steering Committee
SMTA	Standard Material Transfer Agreement
UPOV	Union internationale pour la protection des obtentions végétales (International Union for the Protection of New Varieties of Plants), Geneva, Switzerland
VIR	N.I. Vavilov Research Institute for Plant Industry, St. Petersburg, Russian Federation
WG	Working Group

Appendix V. Agenda

Second Meeting of the ECPGR Working Group on Umbellifer Crops
26–28 June 2013, St. Petersburg, Russian Federation

Tuesday, 25 June

Arrival in St. Petersburg; check-in at Hotel Petrovskaya Pristan.
No dinner organized.

Wednesday, 26 June

09:00-09:40 **Introduction**

- Welcome address *(Nikolai Dzuybenko and Tatyana Khmelinskaya, 20 min.)*
- Umbellifer Crops WG progress and objectives of the meeting *(E. Geoffriau, 20 min.)*

09:40-10:45 **Update on ECPGR**

- ECPGR towards Phase IX *(L. Maggioni, 20 min.)*
- Discussion on the evolution of ECPGR and the future of the Umbellifer Crops WG in the new structure

10:45-11:00 *Coffee break*

11:00-12:30 **Presentation of national programmes and updates on collection status** *(All participants, 10 min. each)*

12:30-14:00 *Lunch*

14:00-16:30 **Development of the European Collection**

- Update on AEGIS: approaches for the development of the European Collection and the AEGIS Quality System (AQUAS) *(L. Maggioni, 15 min + 15 min discussion)*
- Update on carrot Most Appropriate Accessions (MAAs); extension to landraces and wild relatives and to other umbellifers *(C. Allender, 15 min + 15 min discussion)*
- Presentation of minimum descriptors: carrot *(E. Geoffriau, 10 min)*; other umbellifers *(H. Declercq, 15 min.);* discussion (*10 min.)*
- Presentation of minimum quality standards *(E. Geoffriau, 10 min + 15 min discussion)*
- Validation and conclusions *(30 min.)*

16:30-16:45 *Coffee break*

17:00-19:00 ***Visit to the Vavilov's Memorial*** *(Igor Loskutov)* ***study and Herbarium*** *(Tamara Smekalova)*

19:30 *No dinner organized*

Thursday, 27 June

09:00-10:30 **Umbellifer wild relatives project**

- Collecting wild relatives, progress and results:
  - Prospection in Albania *(S. Jani, 15 min.)*
  - Diversity of wild carrot in France *(E. Geoffriau, 15 min.)*
- Characterization of wild relatives, progress and results
  - Wild carrot at the Nordic Genetic Resource Center *(S. Solberg, 15 min.)*
  - Characterization by flow cytometry *(C. Allender, 15 min.)*
  - Characterization of umbellifer wild relatives *(P. Kopecký, 15 min.)*
  - Taxonomical identification of wild carrot *(E. Geoffriau, 15 min.)*

10:30-10:45 *Coffee break*

10:45-12:30 **Umbellifer wild relatives project**

- Evaluation of wild relatives
  - *Alternaria* evaluation of wild carrot *(T. Nothnagel, 15 min.)*
  - Complementary evaluation results on wild carrot *(E. Geoffriau, 15 min.)*
- Project assessment and workplan

12:30-14:00 *Lunch*

14:00-16:00 ***Visit to VIR's Genebank*** *(Boris Makarov and Oleg Petrov)*

16:00-17:30 **Database issues**

- Update on EURISCO and Central Crop Databases *(L. Maggioni, 20 min.)*
- Evolution of the Umbellifer database *(C. Allender, 20 min.)*
- Discussion on the database issues, conclusions

17:30-18:30 **Safety duplication issues**

- Update from each participant
- Definition of WG actions

19:30 *Social dinner at the restaurant*

Friday, 28 June

09:00-10:00 **Operation of the WG and election of Chair and Vice-Chair**

10:00-10:15 *Coffee break*

10:15-12:00 **Assessment of Phase VIII workplan and preparation of next phase; definition of Umbellifer projects in the new organization**

12:00-12:30 **Meeting assessment and closing remarks**

12:30 *Lunch*

Afternoon Departure of participants; for those staying also the night of 29 June, the local organizers will arrange for an excursion in the afternoon of Friday 29 June to Pushkin (at about 35 km) where it is possible to see some of VIR experimental fields.

Appendix VI. List of participants

Second Meeting of the ECPGR Working Group on Umbellifer Crops
26–28 June 2013, St. Petersburg, Russian Federation

N.B. Contact details of participants updated at the time of publication. The composition of the Working Group is subject to changes. The full list, constantly updated, is available from the Umbellifer Crops WG's Web page (http://www.ecpgr.cgiar.org/networks/vegetables/umbellifer_crops.html).

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