

Joanne Russell wanted to know whether the entire BCC had been genotyped. H. Knüpffer responded that no complete overview was available about the utilization of the BCC in research projects. Researchers who requested the BCC or large parts of it could be identified and contacted to obtain their relevant publications. The individual subsets of the BCC (from Europe¹⁹, East Asia, Central and West Asia and North Africa (CWANA) and the Americas) were studied using molecular markers in the 1990s. An overview of utilization of the BCC would be part of the planned review paper.

Ahmed Jahoor informed that he had a collection of Eritrean landraces that is being studied by a project.²⁰ The question of compiling an Ethiopian core subset from the pre-Convention on Biological Diversity material existing in genebank collections outside Ethiopia was discussed. H. Knüpffer replied that the initial intention had been to involve partners from Ethiopia and Eritrea in the selection process and to obtain their official agreement for use of this material for research and breeding. Since the International BCC Committee does not exist any longer (discontinued in 2005), no action could be taken.

Recommendations

1. The Group agreed that EURISCO should be used rather than the EBDB for designating accessions for AEGIS, since all AEGIS accessions must be present in EURISCO.
2. The decision whether to continue developing the EBDB or to use EURISCO alone will be taken at a later stage, when all the AEGIS and C&E functionalities will be available in EURISCO.

Session 6. Plenary discussions

Chair: Külli Annamaa

1. AEGIS – approaches and aims for the European Barley Collection, criteria for Most Appropriate Accessions, steps towards the European Collection, quality standards

(Chair: Helmut Knüpffer, Rapporteur: Lorenzo Maggioni)

Helmut Knüpffer explained to the Group that the definition of the European Barley Collection was not a minor exercise, if the first step of the approach involved an analysis of the EBDB to search for duplicates. He quoted the example of the *Brassica* WG which analysed the *B. rapa* dataset and estimated that eight person-months were required for the additional workload of developing the *B. rapa* AEGIS collection.²¹ Even though the *Brassica rapa* accessions were fewer than 4000 (compared with the nearly 100 000 barley accessions), the effort was time-consuming and yielded partial results due to incomplete data. Several person-months would be necessary to analyse the EBDB, and substantial external funding

¹⁹ Russell JR, Fuller JD, Macaulay M, Hatz BG, Jahoor J, Powell W, Waugh R. 1997. Direct comparison of levels of genetic variation among barley accessions detected by RFLPs, AFLPs, SSRs and RAPDs. *Theoretical and Applied Genetics* 95:714-722.

Backes G, Hatz B, Jahoor A, Fischbeck G. 2003. RFLP diversity within and between major groups. *Plant Breeding* 122:291-299.

²⁰ Orabi J, Backes G, Wolday A, Yahyaoui A, Jahoor A. 2007. The Horn of Africa as a centre of barley diversification and a potential domestication site. *Theoretical and Applied Genetics* 114:1117-1127.

Backes G, Orabi J, Wolday A, Yahyaoui A, Jahoor A. 2009. High genetic diversity revealed in barley (*Hordeum vulgare*) collected from small-scale farmer's fields in Eritrea. *Genetic Resources Crop and Evolution* 56:85-97.

²¹ Meeting of the AEGIS model crops curators and database managers, 1-3 July 2008, Radzików, Poland. Progress report of the AEGIS model crop: *Brassica* (available online from: <http://aegis.cgiar.org/index.php?id=1917>).

would be required. Moreover, in the case of barley, the cost of identifying and confirming the duplicates would be much higher than the benefit from discontinuing the maintenance of duplicates. Lorenzo Maggioni explained that according to the simplified approach, AEGIS accessions could be designated without the quality system being in place.

H. Knüpfner also remarked that the entire barley collection of IPK could be designated as part of AEGIS (a formal offer from IPK is expected to be made soon), since IPK is prepared to guarantee its quality and availability. He proposed a different approach by which entire collections or part of them could be offered as part of AEGIS, without entering into detailed analysis of the presence of unnecessary duplicates.

Ahmed Jahoor suggested that each country or genebank propose accessions that they are willing to include in AEGIS, starting with accessions that originate from the country or those that are unique (e.g. pre-World War II Hindu Kush collections at IPK). In a discussion round the table, country delegates expressed their position regarding designation of accessions for AEGIS:

Armenia	Gayane Melyan said that Armenia could offer some original accessions.
Belarus	Alexandre Zoubkovitch said that he did not represent the Belarus genebank and would need to check. Besides cultivars, there were also genetic stock collections. The Belarusian Genebank included 262 cultivars, of which 56 were of Belarus origin.
Cyprus	Dionysia Fasoula said that Cyprus held 30 accessions of barley landraces and <i>H. spontaneum</i> . These were already included in the Multilateral System. They could be included into AEGIS in the future, but no commitment could be made at the moment.
Czech Republic	Marta Balounová said that she did not represent the Czech genebank and would need to check.
Denmark	Ahmed Jahoor said that Denmark relied on the Nordic System for conservation. Some interesting <i>H. spontaneum</i> material would be handed over to NordGen for inclusion in AEGIS.
Estonia	Küllli Annamaa said that Estonia could offer Estonian accessions, but it would not be useful if they were already present at IPK. Discussion: Such duplicates could later be removed through bilateral agreement between the genebanks concerned.
Finland	Finland: Marja Jalli said that Finland relied on the Nordic System for conservation. Only few Finnish landraces had not yet been included in the NordGen bank. A large number of Finnish landraces are held at VIR.
France	Audrey Didier said that France had some unique material in that could be offered for AEGIS, but the appropriate authority to take this decision had not yet been designated.
Georgia	Tamar Jinjikhadze said that a number of unique, recently collected Georgian accessions could be offered. Internal discussion regarding other accessions would be necessary. The historical collections in Georgia (VIR, IPK) had been encouraged to offer their Georgian material for AEGIS.

Germany	Helmut Knüpffer - see previous page, remark about IPK's collection.
Hungary	Lajos Horváth said that the Hungarian genebank held around 4000 barley accessions, of which around 300 were Hungarian.
Ireland	George Garland said that he did not think there would be any problem in offering unique Irish accessions.
Italy	Michele Stanca said that he could speak only on behalf of the Genomics Research Centre in Fiorenzuola, where more than 1000 cultivars, a collection of <i>H. spontaneum</i> and a diverse population of <i>H. bulbosum</i> were maintained in short-term conservation conditions (multiplication every five years). He had no information about the situation of the national genebank in Bari. He remarked that <i>H. bulbosum</i> was one of the best candidates for developing barley as a perennial crop.
Latvia	Isaak Rashal said that the genebank held a number of Latvian accessions that could be offered. Latvia will become a member of AEGIS.
Lithuania	Algė Leistrumaitė said that the genebank held a number of Lithuanian accessions that could be offered.
Macedonia (FYR)	Borche Jonovski said that he had no information about the collection.
Norway	Lars Reitan said that Norway relied on the Nordic System for conservation. A few Norwegian cultivars were not yet included in NordGen but would be handed over after regeneration.
Romania	Domnica Placinta said that a number of Romanian accessions were held in the genebank (about 20% of the collection). She would discuss with the Head of the genebank about AEGIS designation.
Russian Federation	Olga Kovaleva said that the VIR collection included unique barley accessions of Russian and other origins (e.g. historical collections in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan); recently collected samples from Kazakhstan and Tajikistan could be offered.
Slovakia	Michaela Benková would provide Slovakian accessions, but the decision would have to be taken by the National Coordinator of Slovakia.
Spain	José Luis Molina Cano said that the Spanish landraces collection included 2500 accessions. There was also a completely evaluated core collection (the "Spanish Core Collection"), and the data were available online. He could not state the position of the National genebank on contribution to AEGIS and would welcome a request from the Group.
Sweden	Agnese Kolodinska Brantestam said that Sweden had not yet joined AEGIS, but this was expected to happen soon. NordGen would offer primarily material of Nordic origin, or of importance for Nordic barley breeding and research.
United Kingdom	Joanne Russell said that it would not be a problem to offer Scottish and other UK accessions (via John Innes).

Helmut Knüpffer suggested to start compiling the offers from different places without regarding their duplicate status and then eventually decide to remove duplicates from the collection following bilateral agreements. This activity would not be urgent. He informed the Group that a small one-year AEGIS project had been approved recently, which would allow the Centre for Genetic Resources, The Netherlands (CGN) to develop a software tool for identifying duplicates in passport data, and that this tool may be explored for removing duplicates from the AEGIS barley collection later.

Agnese Kolodinska Brantestam enquired whether genetic stocks should be included into the European Collection and also informed that duplicates in this case were often outside Europe. H. Knüpffer thought that these could be included, depending on the WG decision, but it would be better to wait for the results of the specific task force on genetic stocks before including them.

Recommendation and workplan

1. *The Group agreed to recommend the establishment of the European Barley Collection as part of AEGIS, starting with a substantial part of the barley collection of IPK, with the addition of accessions that are held in their respective countries of origin and of other evidently unique accessions.*
2. ***By the end of August 2011**, the WG members will prepare lists of accessions suggested for inclusion in AEGIS and send them to the Database Manager, H. Knüpffer. These lists should include accessions that originated in their respective countries and other evidently unique and important accessions. At the discretion of the WG member, the lists could be prepared already at this stage in consultation with the respective National Coordinators, in order to ensure that there is agreement at the national level to designate these accessions as part of AEGIS.*
3. ***By the end of November 2011**, H. Knüpffer will compile the lists received from the WG members into a European list and validate it, checking for obvious inconsistencies or mistakes. A thorough analysis to identify duplicates is not expected.*
4. ***By 15 December 2011**, the Chair of the WG, in consultation with the ECPGR Secretariat, will prepare a message informing the respective National Coordinators of the lists of accessions recommended by the WG for inclusion into AEGIS (for countries where the list of AEGIS accessions was not agreed in advance, cf. step 2. The designated accessions should also be flagged in EURISCO.*

2. Species-specific maintenance protocols for wild *Hordeum* species (as part of AQUAS)

(Chair and Rapporteur: Agnese Kolodinska Brantestam)

The topic was introduced by Helmut Knüpffer. The AEGIS Quality System (AQUAS) prescribes regeneration protocols to ensure that AEGIS accessions are maintained properly in their respective genebanks. It is a prerequisite for establishing AEGIS that AEGIS partners can trust each other in that all are following agreed-upon standards in their genebank operations. The other element of AQUAS is an operational genebank manual that all participating genebanks (Associated Members of AEGIS member countries) will have to develop based on the template mentioned earlier.²²

²² http://aegis.cgiar.org/fileadmin/www.aegis.org/Documents/AQUAS/Template_final240910.pdf

The “Draft FAO Genebank standards” should be used as a starting point for developing species-specific regeneration protocols.²³ These standards provide general guidelines for genebank operations. The species-specific regeneration protocols should, therefore, include only the specific requirements for a particular species.

In his email of 1 February 2011, Jan Engels, AEGIS Coordinator, informed the WG Chairs that the ECPGR Steering Committee was expecting progress and results from the Crop WGs in defining and agreeing upon these protocols and finalizing them so that they could be adopted as part of AQUAS.

The *Avena* WG had discussed this issue during its sixth meeting in Bucharest, Romania (October 2010), and formed a task force made up of curators of collections having wild species (information from Andreas Katsiotis, Chair of the *Avena* WG).

H. Knüpffer then explained the regeneration protocols for *Hordeum* species as applied in the German Genebank (IPK Gatersleben); they are included in the Quality Management System for ISO 9000 certification. A handout with the information was distributed to the participants. IPK also completed its “Operational Genebank Manual”, which is posted on the AEGIS Web site.²⁴

Crop-specific information related to maintenance in genebanks is also available for *Hordeum* species in the Crop Genebank Knowledge Base.²⁵ It includes current practices for management of barley genebanks (conservation, characterization, regeneration and safety-duplication) drawn from various genebanks, the accumulated experience of the ICARDA and CIMMYT genebanks, and literature and Web sites of major small-grain collection genebanks (e.g. USDA-Fort Collins and VIR).

The establishment of a task force was proposed; its members would include those of the Barley WG who deal with the maintenance of wild species. Its aim would be to:

- collect information about the regeneration procedures from curators of genebanks and research collections having wild species;
- compare the different approaches, compile an overview of species-specific regeneration methods, and recommend “minimum” and “optimum” standards for regeneration.

The protocols for regenerating cultivated barley (*Hordeum vulgare sensu stricto*) should also be taken into consideration.

In the discussion, Agnese Kolodinska Brantestam informed that multiplication of wild *Hordeum* material taken over from the Swedish Agricultural University (Roland von Bothmer) had started recently. She recommended that specific tests with wild species, especially with small-grained wild species, should be developed. For this purpose, it would be useful to know also the specific requirements in other steps of plant genetic resources (PGR) maintenance, such as procedures for viability testing. In the discussion that followed, it was suggested that the protocols should cover all aspects of PGR maintenance that are species-specific. The Group agreed that the protocols be named “species-specific maintenance protocols” instead of “regeneration protocols”. Information from the Knowledge Base and other relevant sources should also be considered.

²³ <http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/itwg/5th/en/> (document “CGRFA/WG-PGR-5/11/Inf.3”, especially p. 17 ff. “Standards for regeneration”)

²⁴ <http://aegis.cgiar.org/index.php?id=4493>

²⁵ http://cropgenebank.sgrp.cgiar.org/index.php?option=com_content&view=article&id=145&Itemid=250&lang=english

Workplan

The task group has the following members: Agnese Kolodinska Brantestam (coordinator), Dionysia Fasoula, Helmut Knüppfer, Olga Kovaleva and Gayane Melyan.

*The agreed-upon protocols for wild (and cultivated) barley species should be available **by end May 2012**, but the initial collection of information via email should start **before mid-June 2011**.*

3. In situ and on-farm activities in barley

(Chair and Rapporteur: Dionysia Fasoula)

Dionysia Fasoula explained that very few farmers still use barley landraces. Not all landraces compare well with modern elite cultivars, but the few that have desirable traits are still sought after by farmers. They demand permission from the government to use them, which shows that improvement or development of new cultivars from landraces meets a need. In Cyprus, barley landraces no longer in cultivation are evaluated using modern methods, as part of a programme which also involves participatory breeding.

George Garland remarked that on-farm projects are important, because they concern production of the object of the Group's work, which would otherwise remain theoretical. In Ireland, trials are sown and harvested, and data are collected all by government staff, but the farmers follow their own husbandry protocols. Two years of evaluation are required for National Listing and a minimum of three years for Recommended Listing. The result is a "National List of Recommended Varieties"²⁶, which is compiled with the help of farmers, who therefore trust it. This is seen from the high uptake by farmers of cultivars that are on the Recommended List.

Olga Kovaleva said that tests are undertaken each year at four barley stations around Russia. After three years of tests, the best material is sent to breeding stations in various parts of Russia. Farmers can then buy seed at breeders' stations.

The new EU directive on "conservation varieties" was adopted in some countries, including Cyprus.

Recommendation

A short summary of the Group's work, aims and directions should be made available to breeders and National Coordinators. It should be distributed during on-farm trial visits and inspections by other farmers. The summary should include maps showing member countries to illustrate the European context and indicate Web addresses and similar information.

4. Pre-breeding and joint research proposals

(Chair: Michele Stanca, Rapporteur: Marja Jalli)

These topics were combined into one session.

To introduce the topic, Michele Stanca summarized the events occurring during the process of domestication of barley, which gradually accumulated traits that facilitated agricultural production. Through a combination of natural and human selection, genetically variable landraces were developed, leading to a broad adaptation. Barley is one of the crops best adapted to very different conditions; crop duration of its cultivars ranges from 70 days to as long as 220 days (these must be very strong to survive all kind of stress such as pests, cold, etc.). The genetic basis of new cultivars was narrowed by the use of closely related parents in cross-breeding. However, the concept of "cross the best to get the best" is scientifically supported by the dynamism of the genome, due to the presence of transposons and *de novo*

²⁶ The term "variety" in the meaning of "cultivar" should be avoided, except in the case where it forms part of an official designation, as in the present case. HK.