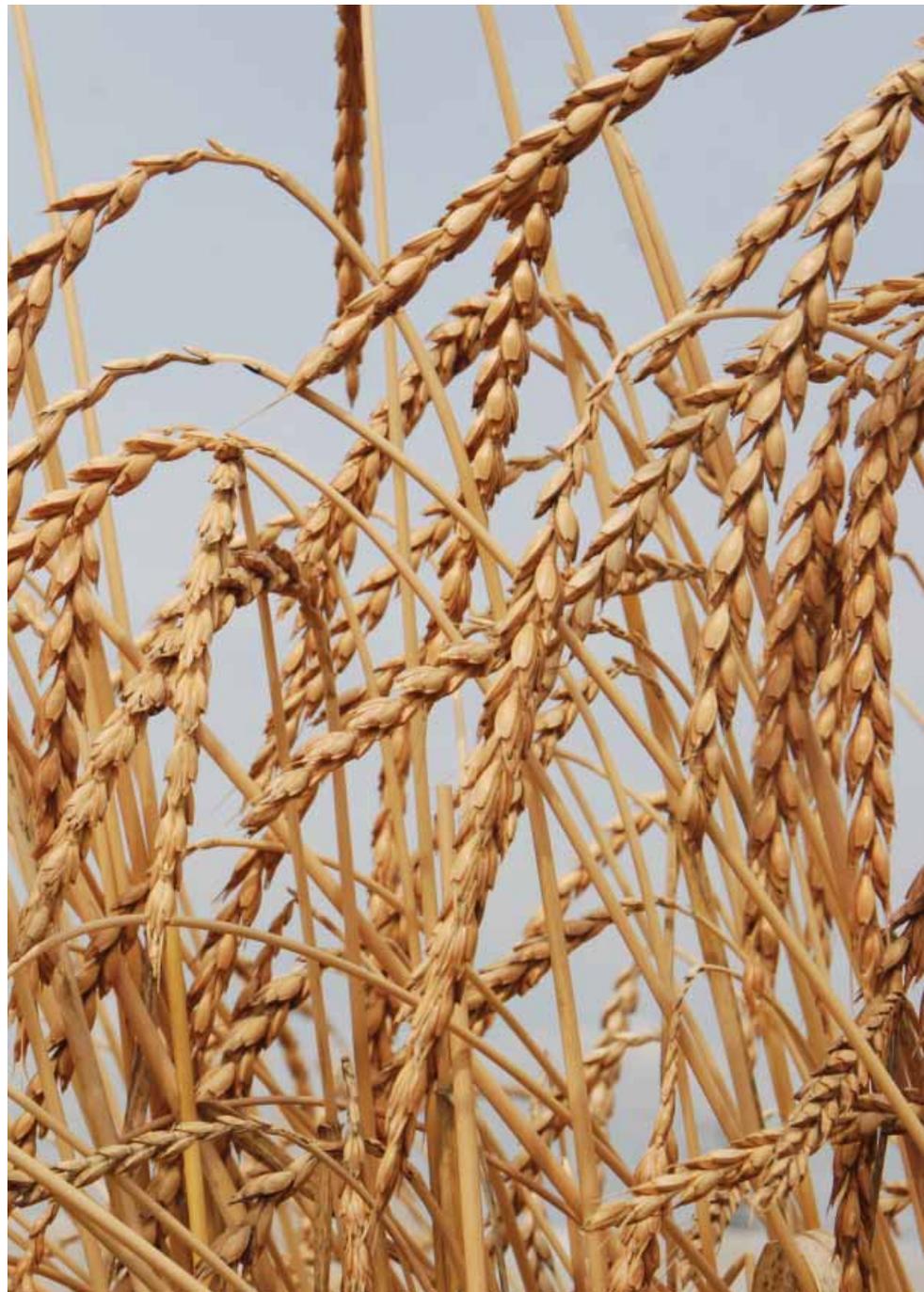


Report of a Working Group on Wheat

Third Meeting, 15-17 May 2012, Piešťany, Slovakia
G. Kleijer, I. Faberová, L. Maggioni and E. Lipman





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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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Spikes of a *Triticum spelta* accession (SVNKOR2006-52) collected in Slovenia, under regeneration at the Genebank of the Plant Production Research Centre Piešťany, Slovakia, July 2010. Courtesy of © P. Hauptvogel, Plant Production Research Centre Piešťany, Slovakia.

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Related presentations can be downloaded from
http://www.ecpgr.cgiar.org/networks/cereals/wheat/wheat_2012/presentations.html

SUMMARY REPORT OF THE MEETING

Introduction

The third meeting of the Working Group on Wheat of the European Cooperative Programme for Plant Genetic Resources (ECPGR) was held from 15 to 17 May 2012 in Piešťany, Slovakia. It was organized in collaboration with the Plant Production Research Center Piešťany (PPRC).

Gert Kleijer, Chair of the Working Group, welcomed all the participants and thanked the host Pavol Hauptvogel for the efficient preparation of the meeting. G. Kleijer welcomed the new members and summarized the history of the Wheat Working Group, which is one of the larger of the ECPGR. The Working Group (WG) was founded following the decision to build the European Wheat Database through a collaboration between representatives from France (Annick Le Blanc, ex-member of the WG) and Czech Republic (Iva Faberová, current Manager of the Database and Vice-Chair of the WG).

The WG was formally established in 1998 and held its first meeting in Prague, Czech Republic. The second meeting took place in 2005 in La Rochelle, France. Specific Wheat WG sessions were held during the meetings of the Cereals Network (first meeting in Yerevan, Armenia, 2003; second meeting in Foça, Turkey, 2008).

The third meeting of the full WG had originally been scheduled for 2011 but it was postponed by one year to allow more progress in the planned activities. This meeting will focus on the implementation of the initiative for “A European Genebank Integrated System” (AEGIS); a full day will be dedicated to AEGIS-related issues.

Pavol Hauptvogel, wheat curator at PPRC and local organizer, welcomed all participants to the town of Piešťany. Organizing this meeting of the Wheat Working Group in cooperation with Bioversity International is a very important milestone for the PPRC.

In the introductory presentation on “Wheat Genetic Resources in the Slovak Republic”, P. Hauptvogel explained that Slovakia is an agricultural country: 70% of the land is arable (1.3 billion ha). Major crops are cereals, followed by oil crops such as oilseed rape. Wheat is the most widely cultivated of cereals (26% of arable land), followed by spring barley (10% of arable land). Although recent market liberalization has reduced agricultural production in Slovakia, plant genetic resources (PGR) remain an essential area of activity. Slovakia has established a PGR National Programme, a genebank and appropriate legislation on genetic resources.

P. Hauptvogel explained that when the Research Institute of Plant Production Piešťany was established in 1951, it focused on the genetic resources of the main crops cultivated in Slovakia. The establishment of the Genebank in 1997 intensified the efforts. Activities in Cereals PGR were linked to breeding programmes and led to the development of several cultivars of wheat, triticale and oat. The Research Institute of Plant Production Piešťany is now an integral part of the Plant Production Research Center Piešťany (PPRC), which was created in 2008 following the merger of several research institutes. The Center operates within the framework of the Ministry of Agriculture and the research programme encompasses all aspects of PGR management. The National Programme for the conservation of plant genetic resources for food and agriculture (PGRFA) was established in 1991. The Center is funded and supported by the Ministry of Agriculture and Rural Development (for 2009-2014), and it cooperates with 23 specialized members.

The Genebank holds 9602 cereal accessions, including 5151 wheat accessions (5079 accessions in the active collection and 72 in the base collection), representing 23 species. Wheat accessions are evaluated for several characters.

P. Hauptvogel thanked the WG for the opportunity to organize the meeting in Piešťany, which is a well-known spa and health resort. He hoped that it would now also be known as an important centre for PGR. He wished the participants a successful and fruitful meeting and a pleasant stay in Piešťany.

Members of the Wheat WG were asked to introduce themselves and to share their perception of the value of the WG and its benefits for them.

A large number of participants expected to gain from the opportunity of meeting more people working in the same area and hoped to establish new collaborations, including the preparation of joint project proposals. They also set high expectations from the exchange of ideas, knowledge and information. A few members hoped it would spawn a common approach to genebank management and stimulate progress in the development of databases and the implementation of AEGIS as an instrument for more efficient conservation and utilization of the collections. The WG was also viewed as a forum for training and research. Countries that had recently launched a PGR conservation system mainly looked to the WG for support in capacity development. The crop-specific approach of the meeting was also considered an important benefit.

G. Kleijer announced his retirement as Chair of the WG, and the election of a new Chair and nomination of a new Vice-Chair at the close of the meeting.

He pointed out that the Wheat Working Group has always associated triticale and rye to its meetings, as these crops do not have specific ECPGR WGs. Rye in particular is a very important crop in Europe, and several Wheat WG members are also involved in rye activities.

He then presented the agenda and called for any changes.

Morten Rasmussen suggested adding a short discussion on the implementation of the EU Directive on conservation varieties, including an exchange of experiences. G. Kleijer agreed to an immediate discussion on the topic.

Discussion on conservation varieties

Mike Ambrose indicated that four crops were currently undergoing registration as conservation varieties in the UK. The selections are old heritage varieties (e.g., thatching wheat) dating back to 1850-1920. A reduced description is the baseline for variety identification. The variety is maintained by the applicant who registers it.

Heinrich Grausgruber informed that several cereal varieties, pre World War II (mainly 50-80 years old), particularly from the Alpine region, are registered as conservation varieties in Austria. A recent variety that failed to meet variety test requirements has also been accepted as it serves a specific purpose. Old descriptions from Austrian trials including official test results are used. Here too, the applicant for registration maintains the conservation variety. Conservation varieties are grown mainly through contract production.

Zofia Bulińska-Radomska said that according to the Directive, conservation varieties can be grown only in the area where they originated. Legislation to implement the Directive is in place, but the actual use of the conservation varieties in Poland has not started. Seed production could pose a problem.

Penelope Bebeli remarked that the Directive cannot be easily applied for all conservation varieties. Historic documentation is a challenge, and the restriction of 10% uniformity may be a limiting factor due to the heterogeneity of the landraces.

Morten Rasmussen confirmed that the Directive is implemented in Sweden, but is not fully effective to facilitate the use of conservation varieties. A specific collaboration on this

topic was established between the Swedish National Programme (POM), the competent authority (Jordbruksverket) and the Nordic Genetic Resource Center (NordGen). It focuses on material prior to 1950. Conservation varieties must be conserved at the genebank. The maintainer is NordGen, but seed production is the responsibility of the users. Registration is done by the National Programme in collaboration with NordGen, keeping seed saver organizations and consumers in the loop to safeguard their interests. The system uses a minimum description; it is developed by NordGen if it does not exist.

Regarding the Directive itself, unrealistic levels of uniformity required in landraces and the rigid approach to variety identification are creating a problem. It therefore needs to be revised.

Sweden is interested in knowing how other countries have implemented the system, what their experiences are regarding the actual use of conservation varieties, and where they encountered the main challenges.

To overcome the bottleneck of seed multiplication, the National Programme of Norway has started multiplication projects of relevant varieties to stimulate use.

As the topic generated many questions and required more time, the Group agreed to continue the discussion by email after the meeting. M. Rasmussen invited interested participants to send him an email, which would be discussed with relevant researchers from the Nordic National Programmes and NordGen.

Recommendation

- Interested members should contact Morten Rasmussen by email (morten.rasmussen@nordgen.org) to subscribe to a discussion list on conservation varieties for a short exchange of experiences.
- M. Rasmussen will report to the WG on the outcome of the discussion.

Update on ECPGR

Lorenzo Maggioni, ECPGR Coordinator, updated participants on the status of the ongoing Phase VIII (2009-2013) of the ECPGR programme. The budget of the Wheat WG and its planned use were presented. He cautioned that unspent funds of the WG would not be immediately available for new activities; the Secretariat would have to seek approval of the Steering Committee (SC) for disbursement. Currently, the SC has frozen unspent funds, given that a few member countries still have outstanding dues. The participants were informed about the outcome of the ECPGR Independent External Review (July 2010) and the process followed by the SC for the decision to be taken in December 2012 on the future of the ECPGR based on the "Options Paper" being prepared by the ECPGR Executive Committee. The new goal and objectives of the ECPGR, as agreed by the SC in Bratislava (2010), were presented.

Discussion

Hanan Sela asked if statistics were available on the use of the European Plant Genetic Resources Catalogue (or European Internet Search Catalogue, EURISCO) by breeders and researchers. L. Maggioni replied that the only indication was the number of hits recorded by the Web site. Ahmed Jahoor pointed out that the information needed by breeders cannot be found in EURISCO. L. Maggioni informed the Group about the plan to include characterization and evaluation (C&E) data in EURISCO.

Stressing the need for practical achievements, M. Ambrose felt that EURISCO should use more community ontologies.

Chair's report

Gert Kleijer presented the WG's progress report based on the replies to the questionnaire sent to the members before the meeting.

Feedback on progress over the period 2008-2011 was received from 23 countries. Eighteen of these countries have a national programme and a national genebank, three more than in 2008. Four countries do not dispose of long-term storage facilities at -18°C. Nearly no progress was made on delivery of data for the 6 descriptors agreed upon in 2001 and the 14 descriptors in 2005. Average distribution of accessions for the 23 countries was 17 350 per year, 7000 more compared with 2005–2008. Twenty countries delivered all or part of their data to the European Wheat Database (EWDB) and to EURISCO. Safety-duplication of accessions progressed further, except in five countries that still do not have any safety-duplication. It was recognized as a specific need for some countries. Other specific needs were equipment, regeneration of accessions, search for potential duplicates, characterization and evaluation, development of a database, and selection of multilateral system (MLS) and AEGIS accessions. Many genebanks have established national and international collaborations. AEGIS accessions were proposed by only seven countries.

Discussion

In reply to a question from Andreas Börner, G. Kleijer clarified that the need for regeneration does not appear to be a major issue for the WG.

M. Ambrose thought that it would be useful to collect information on genebanks that collaborate in funded projects. This information could then be shared with the national programmes to strengthen the perception of the utility of the genebank material.

Along the same lines, F. Balfourier felt it was important to know the proportion of material distributed by genebanks to users. Various colleagues confirmed that the main users were researchers; only a small part of the distributed accessions is taken by breeders. This is not surprising since genebank material, mainly landraces and wild species, needs further research (gene identification or pre-breeding) before it can be of direct use for breeding. Public-private partnerships for pre-breeding, such as they exist in the Nordic countries, are valid enterprises.

Breeders were, however, showing renewed interest in the genetic resources of genebanks, thanks to the availability of new molecular tools to describe them. AEGIS should offer more opportunities in the future for systematic characterization of the European Collection, thus adding value to it. Genebanks would also benefit from feedback on the use of the material that they distribute.

Precise genetic stocks: Update on the project

Gert Kleijer reminded the Group of the importance of conserving precise genetic stocks, which had been discussed during the Cereals Network meeting in Foça, Turkey, in 2008. A subgroup had been created to make an inventory of these stocks and to decide on their conservation, as they need special attention and additional work. The inventory was based on the results of a questionnaire by the Global Crop Diversity Trust for the "Global Strategy for the *ex situ* conservation with enhanced access to wheat genetic resources". Seven countries (France, Germany, Israel, the Netherlands, Romania, Switzerland and UK) reported on their genetics stocks and their capacity to conserve this material and make it available. No information was submitted by Bulgaria, Czech Republic, Hungary, Italy and the Russian Federation.

A complete list of these precise genetic stocks will be posted on the Wheat WG's Web page. Members will be informed by the Secretariat when the list will be uploaded. These

genetic stocks are classified in different categories. The list also indicates if the holding institute is able to maintain and conserve this material, which is generally the case. A list of material for which conservation is not ensured was prepared; in several cases the material is already secured in another institute. The importance of unique material has to be evaluated before deciding on its conservation.

Discussion

A general approach for all genetic stocks of cereals was discussed.

M. Rasmussen informed that NordGen had coordinated the Work Package on precise genetic stocks in the Plant Gene Access proposal and has a special commitment to maintain the barley genetic stocks. The challenge for precise genetic stocks is to keep both the material and the knowledge alive and secure.

G. Kleijer recommended that the large number of publications on the use of wheat genetic stocks should be made available on the Web.

M. Rasmussen mentioned the need to establish criteria for conservation, since all material cannot be maintained for eternity.

M. Ambrose indicated that in the UK, all genetic stocks are considered secure and there is cytological expertise, which is disseminated appropriately. Resources for conservation are stable. Genetic skills need to be complemented with faster molecular techniques. The material is extremely valuable and shared with the rest of the world. The UK, being an active player, is ready to collaborate with the scientific community in any coordination effort and to accept to bear the necessary cost of such coordination.

Z. Bulińska-Radomska said that in Poland rye stocks are also maintained, and they face the same problem of defining the criteria for conserving genetic stocks.

G. Kleijer asked whether the criteria of importance could be identical for the three crops (wheat, rye and triticale).

M. Rasmussen replied that most criteria are identical for mutation groups, but genetic (molecular) knowledge does not exist for all. Genebanks alone cannot undertake this work and need to collaborate with the scientific community. Much knowledge of handcraft (such as temperature needed for flowering of a given mutant) is not published.

G. Kleijer summarized that the Nordic countries have shown interest for barley, John Innes Centre (UK) for wheat, and perhaps Poland for rye (Z. Bulińska-Radomska will talk to those who developed these lines). For *Avena* genetic stocks, A. Jahoor replied that there could be some *Avena* addition lines.

M. Ambrose said that genetic stocks that are stable and true breeding can be multiplied easily; they can be included in the MLS and designated for AEGIS. The WG also works on other types of material that need special attention due to issues of stability and cytological analysis.

F. Balfourier wanted to know how the material should be managed and by whom. Specific competences are needed in cytogenetics but the continuity of these positions is not ensured. Genetic stocks curators need to collaborate with scientists working on genomics.

M. Ambrose agreed but suggested that the way forward is to charge for this type of materials. There is a need to differentiate between the material available in public collections and precise genetic stocks, which require greater effort to maintain.

M. Rasmussen said that there is a need to agree on a precise definition of genetic stocks to resolve the variations in the definitions used.

H. Sela brought up the case of private collections. That of Moshe Feldman, who retired several years ago, will be condemned due to lack of expertise in the future; the collection needs to be regenerated urgently and moved to a more secure place.

G. Kleijer reminded the Group that a remaining amount of € 4000 was available for the precise genetic stocks project, and it had to be used by end 2013.

A discussion followed on how to best use these funds and the following suggestions were made:

- overview of the material (what is held, what is secure, what requires urgent action);
- completion of characterization data of priority sets;
- development of criteria for selection of the most important material;
- expanding of the questionnaire on other crops; and
- clear definition of genetic stocks for an exact identification of the material concerned.

It was agreed that an ad hoc group would carry out the tasks listed below.

Workplan

- Creation of an ad hoc group composed of **Mike Ambrose (leader)**, Morten Rasmussen (on behalf of Agnese Kolodinska), a member from Poland¹ and Elina Kiviharju, Vice-Chair of the *Avena* WG.

The tasks assigned to the ad hoc group are:

- work on the definition of cereal genetic stocks,
- develop criteria to select valuable material,
- complete the inventory of material, and
- develop specific descriptors or fields that indicate their special characteristics.

The remaining € 4000 initially earmarked for Wheat Precise Genetic Stocks can be used at Cereals Network level and a proposal is to be submitted by this ad hoc group to the Network Coordinating Group for the use of these funds, keeping in mind that this amount must be spent **by end 2013**.

Adding value to the ECPGR Web site

Elinor Lipman briefly presented a recent initiative of the ECPGR Secretariat. It aims to enrich the information provided on the Web pages of the Working Groups and enhance interactions among members and partners.

The idea is to make available, with the collaboration of WG members, valuable information that is often not easily accessible. This includes many studies and activities at various genebanks and institutes that would be of interest to the WG members and partners; these are at present neither described in reports of meetings, nor published elsewhere or only in a restricted way (posters, grey literature such as internal reports, etc.).

The expected result is an inventory of completed or ongoing studies on genebank material, on topics of interest to the WG (characterization, regeneration, seed physiology, etc.).

Using the Web pages to post this information allows a diversity of sources (such as documents, links to other relevant Web pages) that can be easily updated, provided that those who contribute the information communicate regularly.

A pilot Web page created for the Umbellifers WG was shown to the participants.

The Secretariat's question whether the Wheat WG would be interested in participating in this initiative received a positive response after a quick discussion.

¹ After the meeting, Bogdan Lapinski (b.lapinski@ihar.edu.pl) was nominated for this task.

Recommendations

- The Wheat WG members will participate in the initiative of adding value to the ECPGR Web site by providing data on studies on genebank material and other activities of interest carried out in their institutes.
- E. Lipman will send to all WG members the template table for providing data by email. The first volunteers for this contribution are M. Ambrose (UK) and F. Balfourier (France).

Update on the revised Multi-Crop Passport Descriptors

Lorenzo Maggioni informed the Group that the revision of the FAO/Bioversity *Multi-Crop Passport Descriptors* (MCPDs) has almost reached its final stage. The review process, coordinated by Adriana Alercia and Michael Mackay at Bioversity International and by Stefano Diulgheroff at FAO, was a vast consultation involving 300 people from 187 institutions in 87 countries. The revised version was developed to enhance the applicability of the MCPDs without affecting the previously published version and its use for data exchange. The revision therefore focused mainly on a few additional descriptors related to the Multilateral System of the International Treaty and to the use of spatial information; more flexibility was also added to existing descriptors. The new version, to be online by early June 2012, is expected to reflect the genebank community's expectations.²

The European Wheat Database: Status and progress report

Iva Faberová, EWDB Manager

The current European Wheat Database (EWDB) compiles passport data obtained from 63 contributing institutions in 36 countries. The DB still does not have information from several countries (Albania, Belgium, Bosnia and Herzegovina, Croatia, Malta, Moldova, Montenegro) and from Iceland and Slovenia, which do not have an official wheat collection. The total number of passport records is 168 278, including 160 451 *Triticum* and 7827 *Aegilops* records. Of these records, 165 561 relate to available accessions; 2717 are historical records representing materials that are not available.

The characterization and evaluation part consists of 206 928 records describing 30 384 accessions, representing 18.9% of the total passport with an average 6.8 descriptors per accession. The addition of the disease susceptibility evaluation increased the value of the EWDB to users.

The EWDB Manager suggested that the integration of new descriptors should be harmonized with the Bioversity/CIMMYT document "Key access and utilization descriptors for wheat genetic resources"(2009).³

The EWDB is online at:

http://www.ecpgr.cgiar.org/germplasm_databases/list_of_germplasm_databases/crop_databases/crop_database_windows/wheat_database.html

² The MCPDs were uploaded on 19 June 2012 and are available online at [http://www.bioversityinternational.org/nc/publications/publication.html?user_bioversitypublications_pi1\[showUId\]=6901&cHash=707d08e264e414bbcf9a8a09b55ca694&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+BioversityInternational-LatestPublications+%28Bioversity+International+-+Latest+publications%29](http://www.bioversityinternational.org/nc/publications/publication.html?user_bioversitypublications_pi1[showUId]=6901&cHash=707d08e264e414bbcf9a8a09b55ca694&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+BioversityInternational-LatestPublications+%28Bioversity+International+-+Latest+publications%29)

³ Available online at http://www.bioversityinternational.org/nc/publications/publication/issue/key_access_and_utilization_descriptors_for_wheat_genetic_resources.html

Discussion

Iva Faberová informed that *Aegilops* data from EURISCO had been downloaded onto the EWDB. Hanan Sela added that many missing *Aegilops* data were available in Israel and that he would ensure that these are sent to the EWDB.

Doubts were expressed regarding the usefulness of introducing new descriptors on drought and salt tolerance, since these are complex traits that are expressed at different stages of development and involve different genes. A simple standardized evaluation methodology could therefore not be defined for these traits. Results obtained in different environments could also not be compared easily. On the other hand, precise geographic coordinates provide sufficient information on the ecogeographic conditions to which the accession is adapted and hence indicate which accessions grow well in drought- or salt-affected environments.

Although the “Zeleny sedimentation index” descriptor is said to be influenced by the environment, differences among varieties remain consistent in different environments. This test is the most commonly used for protein quality.

The “Zeleny index/protein content ratio” descriptor was not considered to be very valuable since it can be derived from separate descriptors, and it is not frequently used.

The Group considered it important to add a “Days to flowering” descriptor, but debated whether to use a simple scale of three states or a more detailed 1-9 scale. The use of the actual number of days was also proposed, but it was pointed out that the number would vary widely with the evaluation site, and therefore it would be necessary to include also site information. It was suggested to adopt the UPOV standards, since these are the most useful to breeders. However it turned out that the UPOV Guidelines do not include such descriptor, and therefore the decision was postponed to the next meeting.

F. Balfourier proposed the addition of a descriptor indicating the year of registration/release of varieties, since it is useful for structuring the diversity of the collection. Establishing a link to the databases of those agencies that maintain this information was suggested as a simpler solution than generating a new task for the WG. I. Faberová remarked that this descriptor already exists (passport descriptor number I/18, “Year of registration”) but its definition should be extended to include landraces and obsolete cultivars.

Decisions

- Although drought and salt tolerance are very important characteristics, it is difficult to provide a meaningful scale for these descriptors, hence this information will not be added in the EWDB.
- It was agreed to maintain a descriptor on the Zeleny sedimentation index.
- It was agreed to remove the descriptor “Zeleny index/protein content ratio” from the EWDB.

Workplan

- Switzerland will provide a proposed scale for the Zeleny sedimentation index (**by end July 2012**).
- The new “Zeleny sedimentation index” descriptor will be added to the EWDB C&E Descriptor List as soon as the scales of the descriptor are available.

- F. Balfourier will consult with I. Faberová to propose a definition for “Year of registration” (by end July 2012).⁴
- WG members agreed to update the EWDB each year, on receiving a reminder from the DB Manager, with instructions on what is expected from them (starting March 2013).

I. Faberová informed the Group that the responsibility of the EWDB will be progressively taken over by her colleague Ludmila Papoušková.

The European Secale Database: Status and progress report

Marcin Zaczyński, ESDB Manager

In 2011, the National Centre for Plant Genetic Resources in the Plant Breeding and Acclimatization Institute (IHAR), Poland, implemented the new version of the European Secale Database (ESDB). Passport data are available for 13 187 accessions that are kept in 39 institutions from 28 countries. In addition to passport data, the ESDB contains characterization and evaluation (C&E) data, which include important information such as disease resistance. C&E data are available for accessions stored in Poland and Austria. As each year has separate datasets, an accession can have more than one C&E dataset: 1518 accessions have 7015 C&E datasets (i.e. more than 4 datasets per accession).

The list of C&E descriptors can be found at http://www.ihar.edu.pl/gene_bank/structure_of_european_secale_database.php#ca.

The main site for the ESDB is http://www.ihar.edu.pl/gene_bank/europejska_baza_zyta_en.php.

The direct link to the search form is <http://secale.ihar.edu.pl/>. The search mechanism allows multiple choices of passport and C&E descriptors for finding desired accessions. Query results can be exported to an .xml file, which is compatible with most database or spreadsheet software.

The Group took note of the recommendations made at the meeting of Baltic Sea Countries in 2011 regarding the future development of the ESDB:

- Unification of taxonomy: original and harmonized taxonomy
- Year of release: important for cultivars
- Expansion of the C&E descriptor list/revision of C&E
- C&E data: include a field providing the URL to C&E datasets.

The European Triticale Database: Status and progress report

G. Kleijer, ETDB Manager

The European Triticale Database (ETDB) was augmented from 5203 accessions in 1999 to 15 693 accessions in 2012. It currently contains the data of 18 countries and 23 genebanks. The ETDB was updated in 2011, using mostly EURISCO data. Concerning the origin of the accessions, 47% originate from Europe, but the origin of more than 32% is still unknown. Many passport data are still missing; for instance, “growth class” and “ploidy level” are unknown for 52.9% and 66.6% of the accessions, respectively. The fact that the duplication site is indicated for only 32.2% of the accessions is a greater concern, as it highlights the need

⁴ It was eventually agreed to extend the descriptor, now called “Year of entry into common knowledge” with the following definition: Year of first registration **or** year of release for general use **or** year of creation of material **or** year of first known reference **or** any other initial time information connected to the accession”.

for increased effort to ensure safety-duplication of triticale accessions. Triticale being a fairly new crop, it is not surprising that more than 62% of the accessions are breeding lines. This also explains the much lower proportion of estimated duplicates (20-25%) than the generally estimated percentage. The ETDB is online since 2008 (<http://www.bdn.ch/pages/edtb/>).

Beate Schierscher will succeed Gert Kleijer as ETDB Manager.

Discussion and decision

The descriptors to be used in the ETDB were discussed, and it was agreed that they would be the same as for the EWDB, except for the Zeleny sedimentation index, which is not relevant for triticale.

Workplan

- The new ETDB Manager will contact the triticale DB Managers through the Wheat WG members to monitor the update and the inclusion of data for the agreed-upon descriptors (by end July 2013).

The Central Crop Databases and EURISCO

Iva Faberová introduced the topic with a comparison of the wheat information contained in the EWDB and in EURISCO. The numbers of *Triticum* and *Aegilops* accessions are higher in EURISCO than in the EWDB (179 035 vs. 168 278 records), but the completeness of data, measured by the fullness of passport descriptors, was similar in both databases. EURISCO and the EWDB use 26 shared descriptors (MCPD standard) and some additional descriptors specific to each database (8 in EURISCO and 6 in the EWDB).

EURISCO was used several times as a source of information for updating the EWDB (10 158 *Triticum* and 6 805 *Aegilops* records in 2006). The number of records is not the same in the two databases due to differences in the update times and contributing countries. Albania, Bosnia and Herzegovina, and Montenegro contributed to EURISCO but not to the EWDB, whereas Belarus and Serbia (former Yugoslavia) provided data to EWDB but not to EURISCO.

The main difference between both systems is in the implementation of characterization and evaluation (C&E) data. The EWDB has 30 284 C&E datasets representing 18.9% of all *Triticum* accessions and follows one taxonomic system. It is a crop-oriented database that includes historical data, and it will be used as a starting point for the selection of AEGIS accessions. It was emphasized that the two databases did not compete, but were complementary.

Discussion on the transfer of CCDB data into EURISCO and quality of EURISCO data

The issue of the coexistence of EURISCO and the Central Crop Databases (CCDBs) was discussed in detail. I. Faberová thought that the principle of having a reliable central database that included all the passport and C&E data, similar to the Germplasm Resources Information Network of the United States (GRIN, <http://www.ars-grin.gov/>), is an appealing expectation, but at the same time a difficult proposition, especially considering its cost. Moreover, managing a crop-specific database is easier. M. Zaczínský added that a smaller database is more flexible and can be adapted more rapidly to changes.

M. Ambrose pointed out that the main strength of the EWDB is its C&E data. Should the WG decide to continue investing in the EWDB, it should reinforce this element by populating the Database with complete sets of C&E data.

M. Rasmussen and M. Ambrose were in favour of prospecting a timeline for the establishment of a more ambitious EURISCO, which should be able to host all the

standardized C&E data that are currently contained in the EWDB. Such a move does not signify an immediate cessation of the CCDBs, but their continuance until the “new EURISCO” can take over the same functions.

Z. Bulińska-Radomska was also of the opinion that the CCDBs are valuable for their complementarity to EURISCO, providing C&E data and safety-duplication of the information.

F. Balfourier reported about his uneasiness regarding the multiplication of several overlapping databases, a phenomenon that he is experiencing in the French national system and that seems to be mirrored at the regional level.

M. Ambrose thought that CCDB managers could be assigned to curate the crop-specific sets of EURISCO data. L. Maggioni confirmed that the Solanaceae WG had made a similar proposal, whereby the CCDB managers offered to analyse, monitor and promote the development of crop-specific datasets in EURISCO.

Recommendations

- The Group agreed that it would be functional and straightforward if EURISCO could evolve as a reliable unique database that could serve all the current needs of the WGs. This would be a satisfactory scenario if sets of standardized crop-specific descriptors could be hosted in EURISCO under the guidance of the WGs.
- The DB Managers could be assigned the responsibility for C&E data delivery to EURISCO.
- The loss of historical data should be avoided; this risk is inherent in the current EURISCO mechanism for updating entire national datasets of available accessions.
- The Group recommended that, before the end of the current ECPGR Phase, the Documentation and Information Network should propose a scenario whereby EURISCO could become the preferential solution to cover all the requirements of PGR documentation for the WGs.
- The Group recommended that the issue of the role of EURISCO vs. CCDBs, as recommended above, be taken into consideration by the SC at its next meeting

The Group also wished to acknowledge the recent improvements made by EURISCO as well as the immense efforts of the CCDB Managers.

A European Genebank Integrated System: Status, progress, discussion of future work

Update on AEGIS

L. Maggioni explained the history of the establishment of “A European Genebank Integrated System” (AEGIS), its milestones and key components. Thirty countries are now members, and 43 genebanks have signed Associate Membership Agreements with their respective National Coordinators. He described the suggested “simplified procedure” for the selection of candidate European Accessions and outlined the main elements of the AEGIS Quality System (AQUAS). The scope of the European Collection was described. A total of 143 garlic accessions conserved in the Czech Republic and Germany had been flagged in December 2011 as the first official AEGIS accessions. A few points were proposed for action by the WG.

Discussion

The following points were clarified in the discussion:

- The term “genetically unique material” should be used as a general guideline to avoid evident and unnecessary genetic redundancy in the European Collection.
- The accessions in the European Collection can be “of European origin or introduced germplasm that is of actual or potential importance to Europe (for breeding, research, education or for historical and cultural reasons)”.
- While setting the timeframe for implementing AEGIS, the SC should consider the different speeds of the various WGs. These will depend on the respective levels of funding available to the WGs. Concrete progress should be shown after each meeting.
- The benefit of being an Associate Member institution should be evaluated from the point of view of the collective interest. All stand to benefit if the tasks for conservation are shared in Europe. Each institution will be able to focus on its priority crops for conservation and rely on others for the remaining genetic resources.

Update by members on actions related to AEGIS

Gert Kleijer, referring to the list of countries having signed the AEGIS Memorandum of Understanding (MoU) (<http://aegis.cgiar.org/membership.html>), requested the representatives of countries that had not yet signed to update the Group on the current status of the MoU process in their country. The participants gave the following information:

Austria: The issue is currently under discussion at ministerial level in Vienna.

Bosnia and Herzegovina: The MoU has been signed, and the conclusion of Associate Membership Agreements is under way.

France: A new law will facilitate definition of the status of PGR and their conservation. This should accelerate the signing of the MoU.

Greece: The NC is aware of the need to sign the AEGIS MoU, but it has not been signed so far due to shortage of scientific staff and administrative reasons related to the genebank.

Israel: The Head of the genebank has just completed a sabbatical period and will follow up on this issue soon.

Italy: A member of the Ministry of Agriculture discussed this issue at a recent meeting, indicating the intention to sign the MoU in the near future.

Macedonia FYR: The new NC from the Ministry of Agriculture still needs to examine the AEGIS issue.

Identification of Most Appropriate Accessions for the European Collection

Preamble: Definitions

Most Appropriate Accession (MAA): an accession that has been selected from a set of assumed duplicates through the application of the selection criteria, which the Working Group concerned had agreed upon, in a well-defined and transparent selection process. The identified MAAs will be proposed by the WG concerned to the respective National Coordinators for acceptance as a European Accession.

European Accession: a genetically unique and/or important plant genetic resources accession for Europe that fulfils the selection requirements, that has been identified by the respective Working Group after a selection process, and that subsequently has been designated by the National Coordinator of the maintaining country to be conserved for the

long term according to agreed technical standards and to be made available to any *bona fide* user, that will form part of the European Collection. (Synonym: AEGIS Accession).

The example of rye (AEGIS Grant Scheme: Improving the prerequisites for a European rye collection)

M. Rasmussen

The project funded under the AEGIS Grant scheme (project proposal available at http://aegis.cgiar.org/aegis_grant_scheme/second_call.html) has the general objective of initiating closer cooperation on rye germplasm and specifically to update the European *Secale* Database (ESDB), to propose common standards for conservation of *Secale* germplasm, and to clarify requirements and propose guidelines for identification of Most Appropriate Accessions (MAAs) within the *Secale* germplasm preserved in European *ex situ* collections.

Plans were made for completion of the ESDB by including missing data.

Criteria and the procedure for the selection of European rye accessions had already been agreed, starting with landraces, wild *Secale* accessions and cultivars, while genetic stocks and breeder's lines will follow. Duplicate search will be focused on cultivars released after 1950. A proposed list of European rye accessions is expected as a product of this project, which is scheduled to be completed in 2012.

Discussion of preliminary selection criteria proposed by the EWDB Manager and determination of final criteria

Iva Faberová presented the proposed selection mechanism for wheat AEGIS Accessions. The two AEGIS documents "Selection Procedure of the European Accessions" (version November 2010) and "Selection requirements for European Accessions" approved by the Steering Committee during its eleventh meeting (2-5 September 2008, Sarajevo, Bosnia and Herzegovina) were used as a basis for selecting European Accessions in wheat.

Both information and plant material criteria should be considered for the selection procedure. Several criteria could be derived from information recorded in the EWDB: maintenance of accession in country of origin, known information on origin, comprehensiveness of passport information and validated accession name. Whereas recommended criteria such as number of regenerations, health status, presence of C&E data are related to the plant material and genebank standards. The presentation focused mainly on the use of the available information to define selection criteria.

Positive or negative selection and a combination of the two were recommended. Positive criteria such as known and reliable information on origin of the accession, existence of C&E data and safety-duplication could be used for pre-selecting AEGIS candidates. Or an accession could be eliminated from the list of possible candidates due to absence of important information. Sets of probable duplicates implied by the repetition of the accession name should be given special attention. Additional information like known breeding company, country and year of first registration should also be considered. In case of repeated accession names within one national collection, the local collection holder should decide on the selection of the proper candidate accession.

An analysis of the information available in the EWDB revealed the following:

- for *Triticum*, few lists were proposed for confirmation as European accessions: 8 advanced cultivars from the Estonian collection, 19 original cultivars and breeding materials from the Belorussian collection and 80 *T. durum* accessions collected in Cyprus. To increase the number of lists, a simplified procedure was recommended, given the large size of the EWDB: as a first step, the focus should be on the set of original advanced cultivars kept in their countries of origin that have reliable passport information, available C&E data and guaranteed safety-duplication.

- for *Aegilops*, it was suggested to start with the 101 accessions of *A. sharonensis* collected in Israel during a rescue expedition.

Table 1. Summary of first candidates proposed as AEGIS accessions

Genus	Country	No. of accessions	Notes
<i>Triticum</i>	Belarus	19	Domestic cultivars and breeding material, full pedigree available, no safety-duplication (SD), no C&E, AEGIS member
	Cyprus	80	<i>T. durum</i> , collecting mission, SD in Bari, no C&E, AEGIS member
	Estonia	8	Exclusively domestic cultivars, full pedigree, SD, C&E, AEGIS member
	Total	107	
<i>Aegilops</i>	Israel	101	Rescue collecting mission of <i>Aegilops sharonensis</i> organized by ECPGR
	Total	101	

Compilation of first lists of possible AEGIS accessions: Wheat

Discussion

Mike Ambrose recommended that the criterion for the designation of unique accessions should be defined, since it will distinguish the European Collection in the eyes of the users.

M. Rasmussen agreed that this was an important point and gave the example of NordGen, which is characterized by its clear mandate of conserving and giving access to all the diversity of Nordic origin.

G. Kleijer asked the Group if anyone could propose a definition of what should be considered "unique" in the European Collection; this concept would then be discussed by the Group. He also requested the genebanks not to discard any material until the selection of AEGIS accessions is completed.

A general discussion on the most effective approach for constituting the European Wheat Collection concluded with the following decisions:

Workplan

- *Triticum*

1. A **first set of 107 *Triticum* accessions** was proposed for flagging as European Accessions. These had been selected by the DB Manager primarily because they are held in the country of origin by AEGIS member countries. Among these accessions, those from Estonia (8) have safety-duplication, pedigree, known breeder and C&E data; those from Cyprus (80) have safety-duplication and those from Belarus (19) have full pedigree and breeder information. **By the end of June 2012**, the respective WG members will notify the DB Manager whether they agree on the proposed selection. As soon as the WG members confirm the lists, the DB Manager will send them to the respective National Coordinators, inviting them to flag these accessions in EURISCO as belonging to the AEGIS European Collection.

2. The separate lists prepared by I. Faberová of *Triticum* accessions conserved in their country of origin will be distributed by the **end of June 2012** to the respective country WG members (irrespective of the MoU signature status). The members will select European Accession candidates according to agreed criteria (see below) and verify whether the holding institutions agree to flag them as part of AEGIS. Only accessions that are already safety-duplicated should be flagged; or those for which safety-duplication by genebanks is under way, in which case the date by which the process will be completed should also be indicated. The DB Manager suggested starting with advanced cultivars. The decision of the country WG member should be communicated to the DB Manager **by the end of October 2012**, after which the DB Manager will send the approved lists to the National Coordinators as per point 1 above (**by end 2012**).
3. WG members are invited to prepare lists of additional accessions that they are conserving as genetically unique (to their best knowledge) and that the holding institutions are prepared to conserve as AEGIS accessions. These lists should be sent to the Wheat DB Manager **by the end of 2012** (extension of the delivery date is exceptionally allowed for the larger collections). The safety-duplication provision as per point 2 above also applies here.

The Wheat DB manager will then screen the lists, mainly to verify that there are no evident duplications of accessions or gaps in the compiled list of proposed accessions. Prior to this screening, all wheat AEGIS candidates should be entered in the EWDB, along with passport and C&E data, if available. The DB Manager will interact with WG members whenever clarifications are needed and will circulate to all the concerned countries for comments a proposed final list of accessions to be flagged as part of AEGIS (**by end 2013**).

- *Aegilops*

1. The EWDB Manager suggested starting with a set of *A. sharonensis* accessions maintained at the Institute for Cereals Crop Improvement (ICCI), Tel Aviv University, which were collected as part of an ECPGR-funded mission. H. Sela clarified that these accessions are not maintained under long-term conditions; moreover, Israel has not yet signed the AEGIS MoU, but he would follow up on the necessary procedure to ensure that these accessions become part of AEGIS (**by end 2012**).
2. I. Faberová prepared separate lists of *Aegilops* accessions conserved in their country of origin, and all the steps as per point 2 of *Triticum* above should be followed, except for the recommendation to start with advanced cultivars.
3. Countries are invited to prepare lists of additional *Aegilops* accessions as per point 3 of *Triticum* above.

Descriptors and criteria for the selection of MAAs

Descriptors

Passport descriptors (following MCPD/EURISCO standards and EWDB descriptors) required for the selection of the MAAs were agreed as listed in Table 2 below; all other passport descriptors should also be entered to the extent possible.

Table 2. Lists of mandatory and highly recommended passport descriptors required for the selection of MAAs

	Mandatory descriptors	Highly recommended descriptors
For all accessions	Accession number (ACCENUM) Institute code (INSTCODE) Genus (GENUS) Species (SPECIES) Country of origin (ORIGCTY) Biological status of accession (SAMPSTAT)	Species author (SPAUTHOR) Other identification (numbers) associated with the accession (OTHERNUMB) Donor accession number (DONORNUMB) and Donor institute code (DONORCODE) or Decoded donor institute (DONORDESCR) C&E data, if available Location of safety-duplicates (DUPLSITE)
Only for cultivars and breeding lines	Accession name (ACCENAME)	Ancestral data (ANCEST) Breeding institute code (BREDCODE) or Decoded breeding institute (BREDESCR) Year of registration (REG_YEAR)
Only for wild species	Collecting number (COLLNUMB) Collecting institute code (COLLCODE) or Decoded collecting institute (COLLDESCR) Collecting date of sample (COLLDATE) Latitude of collecting site (LATITUDE) and Longitude of collecting site (LONGITUDE) and/or Location of collecting site (COLLSITE)	
Only for landraces		Collecting number (COLLNUMB) Collecting institute code (COLLCODE) or Decoded collecting institute (COLLDESCR) Collecting date of sample (COLLDATE) Latitude of collecting site (LATITUDE) and Longitude of collecting site (LONGITUDE) and/or Location of collecting site (COLLSITE) Accession name (ACCENAME), if available

Genebank management criteria

- **Safety-duplication**

It was agreed that if accessions are not already safety-duplicated, safety-duplication by genebanks of the accessions flagged as part of AEGIS should be under way, in which case the date by which the process will be completed should also be indicated. Safety-duplicates should be sent to another Associate Member genebank, possibly in a different country, and/or at the Svalbard Global Seed Vault.

- **Seed quantity**

The appropriate quantity of seed that should be conserved for a typical AEGIS Accession was discussed, but it was concluded that the WG should not be too prescriptive and leave this decision to the genebank managers, as long as the AEGIS Associate Members can make the material available under the conditions of the Treaty.

Compilation of first lists of possible AEGIS accessions: Rye and Triticale

- **Rye**

Morten Rasmussen

The final results of the AEGIS-funded project on rye were expected around the time of this meeting, but will be delayed by six months. M. Rasmussen suggested waiting for the final outcome of the project before proposing a list of rye accessions. Three outcomes are expected: (1) a Task Force coordinated by Külli Annamaa will update standard C&E descriptors; (2) standards required for maintenance will be proposed on the basis of the results of the questionnaire that was sent to holders of rye collections to identify critical aspects of conservation management; and (3) criteria for the selection of MAAs were defined: the process will start with landraces and wild accessions, followed by cultivars and genetic stocks; cultivars produced after 1950 will be screened for duplicates.

- **Triticale**

Gert Kleijer

The development of the first list of possible triticale AEGIS accessions will have to be postponed until the Triticale DB has been updated. It will also be useful to wait for the development of the approach defined for wheat and to learn from it. The scheme proposed for wheat can then be adopted for triticale.

In the meantime, new descriptors can be proposed for inclusion in the ECPGR Triticale DB. This task will be taken up by Beate Schierscher, the new ETDB Manager.

Standard Material Transfer Agreement

Marcin Zacziński described the Polish experience of using the Standard Material Transfer Agreement (SMTA). Seed samples can be ordered and the SMTA signed online. The English version of the SMTA was signed, but users can view the Polish version for information. Requests for accessions are centralized, but collections are decentralized. Once the curators receive an email with the order, they prepare the material, print the SMTA and passport data for delivery to the user. Seed accessions are sent to the users either from the central seed storage or from working collections. Vegetative material is sent directly from the curators of field collections. Heads of genebanks and institutions have delegated the responsibility to sign the SMTA to the curators. If there are several collections in one institute, one person is

given the responsibility of signing the SMTA. If seed is distributed from the main seed storage in Radzików, the SMTA is signed by the Head of the Genebank, currently Z. Bulińska-Radomska. So far, fewer than 100 SMTAs have been issued. All the paper documents and electronic documents are centralized at Radzików.

M. Rasmussen described the Nordic approach: an SMTA is issued for all purposes under the Treaty, regardless of Annex 1 status as agreed by ECPGR. It has to be signed by the legally authorized person of the entity requesting the seed. A NordGen MTA is issued for all other professional uses, including farming. It reflects the SMTA and encourages the requesting entity to respect the conditions of the Treaty. If the recipient then wishes to use the seed material for any of the purposes covered by the Treaty, an SMTA must be issued and signed. For private or hobby purposes, a simple Hobby MTA is issued, explaining that the supplied material cannot be used for other purposes without signing either the NordGen MTA or SMTA, depending on the use. The basic idea is to secure and support the Treaty. The five Nordic countries are currently discussing a coordinated system for the signature of MTAs to cover the distribution of vegetatively propagated material from clonal archives.

G. Kleijer clarified that the Governing Body of the Treaty still needs to take a decision regarding the need to issue an SMTA if the material is requested for repatriation or by farmers for cultivation.

A. Börner indicated that SMTAs are issued also for distribution of material to foreign students or researchers working in a genebank.

In the Netherlands and France, SMTAs are issued even for transfer of material within the same institute.

AEGIS Quality Management System

Generic operational standards (FAO documents): Introduction, comments and possible acceptance

Zofia Bulińska-Radomska briefed the Group about the elements of the AEGIS Quality Management System (AQUAS), focusing on its technical elements. She then presented FAO's *Draft Revised Genebank Standards for the Conservation of Orthodox Seeds*. The standards, which "define the level of performance of a routine genebank operation below which there is a high risk of losing genetic integrity", are detailed in ten sections: acquisition, seed drying and storage, viability monitoring, regeneration, characterization, evaluation, documentation, distribution, safety-duplication and security/personnel. Each section was reviewed in detail. The presentation was followed by a discussion, specifically on the need to elaborate further standards for wild species.

Discussion

The Group commented that some of the guidelines seem too strict, others too lenient. The Group, however, did not see a need to elaborate additional crop-specific standards.

Regarding wild material, the Group thought that it would be useful to develop guidelines and technical protocols.

H. Sela remarked that the existing descriptors for "spike morphology", "yield" and "plant height" were not suitable for *Aegilops* and other wild species, but the decision to prepare new descriptors was postponed.

Recommendation

- The Group concluded that the FAO Genebank Standards could be adopted as they are and that the genebanks should strive to follow them. No need was felt to develop more stringent standards.

Workplan

- A. Börner and H. Sela agreed to prepare together a document summarizing the genebank management knowledge required for breaking dormancy, and for viability testing and multiplication of *Aegilops* and other wild cereals (by **end June 2012**).

Excursion to the Plant Production Research Center Piešťany

On 17 May, the participants visited the Slovak Genebank located at the Plant Production Research Center Piešťany (PPRC). They were welcomed by Dr Ján Kraic, Director PPRC, and Daniela Benediková, Head of the Genebank and National Coordinator for Slovakia. Michaela Benková, researcher at PPRC, guided the Group on a tour of the Genebank's facilities and the PPRC laboratories. This was followed by a visit to field experiments of wheat under the guidance of Pavol Hauptvogel.

Scientific and technical presentations***Diversity of wheat and its improvement for adaptability under climate change and use in agriculture***

Pavol Hauptvogel, Plant Production Research Center Piešťany, Slovakia

The project SARD-0770-07 "Characterization and evaluation diversity of wheat and their wild relatives and their utilization in breeding" includes three Work Packages (WPs) with the following objectives: define the variability of morphological, biological and economic descriptors of wheat genetic resources; identify and characterize wheat storage; evaluate technological quality (WP 01); determine the phylogenetic relations among subspecies of *Triticum turgidum*; determine the regional differences and phylogenetic relations between the *Aegilops cylindrica* accessions; estimate the degree of non-specific resistance against powdery mildew in laboratory and field conditions (WP 02); analyse the growth and production characteristics of genotypes and source-sink relations of assimilates of photosynthetic reactions in conditions of environmental stress; identify stress proteins of chloroplasts and acclimation capacities of genotypes (WP 03).

As part of the project, the variability of genetic resources of wheat from different regions of the world was characterized. Basic statistical characteristics for morphological and agricultural traits, molecular markers and technological quality were described using multivariate data analysis. In its next phase, the project will evaluate DNA polymorphism in different accessions of tetraploid wheats. A new type of DNA polymorphism was developed based on amplification of DNA segments by means of resistance gene analogs (RGA) and retrotransposon primers (TERGAP technique). This technique led to the classification of the 'Kamut' variety into the *turanicum* subspecies. Evolutionary relations among the tetraploid taxa of wheats through the sequencing of the intron 9 of the *SBIIa* gene were estimated. A molecular marker for resistance to powdery mildew was identified; it is located on the short arm of 2A chromosome. A set of 31 wheat genotypes was examined over several testing cycles. A parameter derived from fast chlorophyll fluorescence kinetics was identified, namely relative variable fluorescence at 0.3 ms (WK), which is the quantification of K-step occurrence. The results showed considerable differences in heat sensitivity among

the studied wheat genotypes, offering the potential to identify additional tolerant/susceptible genotypes. The WK parameter was generally more sensitive to heat treatment than the basic chlorophyll fluorescence parameters and therefore found to be the most favourable, because its values before heat treatment were relatively stable. The results stress that chlorophyll fluorescence based on the determination of photosynthetic thermostability represents an expeditive method, useful for identifying heat-tolerant crops or various plant genetic resources including wild relatives.

The project also yielded several other results. For agro-morphological traits, the highest seed yield was found in varieties 'Timber', 'Venistar', 'Bardotka', 'Simila', 'Mulan', 'Gulliver', 'Biscay' and 'Barryton' and the highest values of wheat technological quality were found in species originating from Kl. Escudo, Argentina, and Poshana, Ukraine. Electrophoretic analyses of seed storage proteins proved useful in the identification and characterization of wheat. Results of molecular analyses of *Aegilops* and tetraploid wheats suggest subspecies polymorphism. In emmer, samples with high resistance to fungal pathogens were found in spring types. A complex of physiological, morphological and phenological methods were used to analyse tolerance of vs. sensitivity to drought; results show the role of leaf cuticular resistance and osmotic adjustment of plants under conditions of reduced water availability in improved tolerance of primary photosynthetic reactions to water stress and high temperature.

Phenology, stomatal conductance, fluorescence measurements of "Performance Index" and osmotic adjustment seem to have been potentially useful for assessment of larger collections of wheat genotypes. Parameters based on gasometric measurements – net assimilation rate and water-use efficiency – were also well correlated; they are, however, suitable for use only in a few genotypes.

The project was supported by the Slovak Research and Development Agency under contract No. APVV-0770-07 and is being continued through two further projects: (i) SRDA Project 0197-10 "Biological diversity of wheat, improvement for adaptability under global change and use of organic agriculture" (project coordinator: P. Hauptvogel, project partners: Institute of Plant Genetics and Biotechnology of the Slovak Academy of Sciences in Nitra, Slovak University of Agriculture in Nitra, and Comenius University in Bratislava); (ii) SRDA Project 0661-10 "Divergence of cultivated plants and their ancestors and transfer of characters between the wild species and current varieties of wheat and barley" (partners: PPRC in Piešťany and Slovak University of Agriculture in Nitra).

Agro-morphological and molecular evaluation of the diversity present in the French wheat collection

François Balfourier, INRA-Clermont-Ferrand, France

The French national collection of bread wheat comprises 1783 accessions. This collection was evaluated during three years for ten agro-morphological traits (heading date, plant height, spike density, lodging susceptibility, awnedness and susceptibility to diseases such as yellow rust, brown rust, septoria, fusarium head blight and powdery mildew) in the multisite evaluation network of the French seed association for seed companies and plant breeders (Union Française des Semenciers, UFS). The collection was genotyped for 42 SSR loci (one per chromosome arm).

Agro-morphological data show wide diversity for all observed traits. Analysis of variance (ANOVA) carried out on heading date, plant height, spike density and lodging clearly indicates highly significant genotype and year effects for most of these traits, but their interactions are insignificant. For certain years and locations, some observations were missing due to the absence of selection pressure for some specific pathogens, making it difficult to compare the entire collection of accessions for related diseases. Nevertheless, the

use of an empiric index of selection for these traits allowed the identification of a panel of 190 accessions exhibiting a medium level of resistance to all the studied diseases.

Molecular analysis also indicates wide diversity for neutral polymorphism. The structure of the collection is strongly influenced by the registration date of varieties. Analysis using STRUCTURE software indicates that the current diversity in the French bread wheat collection revolves around at least six founding populations. Taking into account this genetic structure, genetic association was studied by combining both phenotypic and molecular data. Significant associations between traits and markers were observed for heading date and plant height, and to a lesser extent for yellow rust, fusarium head blight and powdery mildew susceptibilities.

The French national collection has been declared to FAO as the country's contribution to the International Treaty on Plant Genetic Resources for Food and Agriculture. The entire collection is now widely distributed as seeds to the international community. The complete set of evaluation data will be progressively available on the Web site of SIREGAL, INRA's genetic information system on PGR, and then included in the ECPGR Wheat DB.

SIREGAL information can be accessed at <http://urgi.versailles.inra.fr/siregal/siregal/welcome.do>.

Genetic diversity of *Aegilops* species grown in Greece

Penelope Bebeli, Agricultural University of Athens, Athens Votanikos, Greece

The presentation was based on the following paper:

Thomas KG, Bebeli PJ. 2010. Genetic diversity of Greek *Aegilops* species using different types of nuclear genome markers. *Molecular Phylogenetics and Evolution* 56(3):951–961.

The abstract is available online (<http://www.sciencedirect.com/science/article/pii/S1055790310002071>).

Baking quality of Swiss wheat landraces

Beate Schierscher, Station de Recherche Agroscope Changins-Wädenswil (ACW), Nyon, Switzerland

Between 2007 and 2011, 162 Swiss wheat landraces were analysed for baking quality, and the high molecular weight (HMW) glutenins of 93 wheat landraces were determined.

Protein content was analysed by a near infrared (NIR) spectroscopy system and the glutenin by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). The results of the rheological (farinograph, extensograph, Zeleny and falling number) and baking tests (rapid mix test) show generally inferior baking quality of the landraces. The Swiss scheme for baking quality index was presented. The composition of the glutenin alleles in landraces was compared with those of modern Swiss varieties. The landraces show a high presence of the GLU-D1 2-12, whereas the modern varieties show a high presence of GLU-D 5-10. The results also show a larger range of different alleles in the landraces than in modern varieties. There is some interest in reviving these landraces.

The role of the Germplasm Resources Unit at the John Innes Centre in underpinning public sector wheat research in the UK

Mike Ambrose, John Innes Centre, Norwich, UK

The Germplasm Resources Unit at the John Innes Centre is planning major development of Web and database resources following its recent recognition as a National Facility supported by the Biotechnology and Biological Sciences Research Council (BBSRC). The new status will improve coordination and conservation of key resources and strengthen the Centre's support to UK wheat research and breeders for their germplasm requirements..

Research on seed longevity: The case of wheat

Andreas Börner, Institut für Pflanzengenetik und Kulturpflanzenforschung (IPK), Gatersleben, Germany

Plant genetic resources for food and agriculture (PGRFA) play a major role for global food security. The most significant and widespread way of conserving PGRFA is *ex situ* conservation. Worldwide 7.4 million accessions are stored in about 1500 *ex situ* genebanks. The four largest collections are those of wheat (860 000 accessions), rice (780 000 accessions), barley (470 000 accessions) and maize (330 000 accessions). Most accessions are conserved as seeds. Therefore seed longevity is of particular importance for preserving crop germplasm. The Gatersleben genebank has undertaken research on seed longevity. Variation was detected between and within crop species, and genetic analyses were performed using experimental ageing tests for barley (Nagel et al. 2009)⁵, *Aegilops* (Landjeva et al. 2008)⁶, oilseed rape (Nagel et al. 2011)⁷ and wheat (Rehman Arif et al. 2012).⁸

The results show that:

- A massive number of accessions are “sleeping” in shelves of global *ex situ* collections;
- Storability and longevity of the germplasm in seedbanks being limited, regeneration should be intensified or seed longevity should be improved through genetics and physiology research;
- Association mapping is a feasible strategy to detect genes and gene functions responsible for seed longevity of long-term cold-stored accessions;
- The final aim is the development of rapid non-destructive viability tests.

SEEDNet: A window of biodiversity conservation in South East European countries

Emilija Simeonovska, Institute of Agriculture, Skopje, Macedonia FYR, and Daniela Murariu, Suceava Genebank, Romania

The structure and activities of the South East European Development Network on Plant Genetic Resources (SEEDNet) established in 2004 by a number of national institutions of South Eastern Europe were briefly presented. The objective of SEEDNet (www.seednet.geminova.net) is to strengthen the national efforts of the partner countries for long-term conservation and sustainable utilization of PGR in the region. SEEDNet is formed by partners from 13 South East European countries: Albania, Federation of Bosnia and Herzegovina, Republika Srpska, Bulgaria, Croatia, Hungary, Kosovo, Macedonia, Moldova, Montenegro, Romania, Serbia and Slovenia. SEEDNet operates through regional working groups (six crop-oriented and one thematic). All activities of the network are planned and monitored by the Regional Steering Committee. The network received financial support from the Swedish International Development Agency (Sida) during 2004-2010. The Swedish Biodiversity Centre (CBM), Swedish University of Agricultural Sciences provided the secretariat and coordination for SEEDNet. The members of the SEEDNet Cereals and Maize WG are responsible for issues related to agreed mandate species and priority crops in accordance with the WG strategy. The mandate species list for *Triticum* and *Aegilops* was presented. The SEEDNet Cereals and Maize WG has already held six annual meetings.

⁵ Nagel M, Vogel H, Landjeva S, Buck-Sorlin G, Lohwasser U, Scholz U, Börner A. 2009. Seed conservation in *ex situ* genebanks – genetic studies on longevity in barley. *Euphytica* 170:5-14.

⁶ Landjeva S, Neumann K, Lohwasser U, Börner A. 2008. Molecular mapping of genomic regions associated with wheat seedling growth under osmotic stress. *Biologia Plantarum* 52:259–266.

⁷ Nagel M, Rosenhauer M, Willner E, Snowdon RJ, Friedt W, Börner A. 2011. Seed longevity in oilseed rape (*Brassica napus* L.) – genetic variation and QTL mapping. *Plant Genetic Resources Characterisation and Utilisation* 9:260-263.

⁸ Rehman Arif MA, Nagel M, Neumann K, Kobiljski B, Lohwasser U, Börner A. 2012. Genetic studies of seed longevity in hexaploid wheat using segregation and association mapping approaches. *Euphytica* 186(1):1-13 (DOI 10.1007/s10681).

During the meeting in Sarajevo in 2010, it was agreed to introduce SEEDNet at ECPGR meetings to promote interest for the network's activities and collaboration with ECPGR members. The group members attended a few international conferences and training courses, with SEEDNet financial support. Since 2007 the WG members have collaborated in three regional projects, mainly focused on collecting of local maize and cereal landraces in South Eastern Europe. The collecting projects revealed that South Eastern Europe is still rich in agricultural biodiversity, represented by local landraces. Given the impending danger of their extinction, new collecting expeditions should be carried out in the region. The main achievement of the SEEDNet member countries was the establishment of seed and field genebanks in all partner countries. In total, 29 PGR training courses were carried out, and 22 regional working group projects were completed. SEEDNet obtained permanent observer status in the ECPGR and became a member of the European Association for Plant Breeding Research (EUCARPIA). The future plans of SEEDNet include identification of new modalities for funding, strengthening the relationships between SEEDNet and the ECPGR and disseminating the results of SEEDNet projects through, for example, active participation at international scientific events in Europe. On behalf of the Cereals and Maize working group, E. Simeonovska thanked the SEEDNet Coordinator, Eva Thörn, for her contribution to the progress in PGR activities in South Eastern Europe and expressed the hope for continued collaboration.

Conclusion

Presentation of the report and adoption of recommendations and workplan

The draft report was presented and adopted with some modifications. The workplan for 2012-2013 will be summarized in a table and included in the report as Appendix I (pp. 27-30).

Election of Chair and Vice-Chair

As announced at the opening of the meeting, Gert Kleijer stepped down from his position of Chair following his retirement. His proposal to elect François Balfourier as his successor was approved by the Group. F. Balfourier accepted with thanks and said he would strive to carry on the work accomplished by the Working Group so far and to move forward in the implementation of AEGIS. He thanked Gert Kleijer and Iva Faberová for their excellent chairmanship.

G. Kleijer then proposed Külli Annamaa as Vice-Chair with the consent of the Group, and she kindly accepted.

Closing remarks

Gert Kleijer thanked Iva Faberová for her long-standing work since 1994 for the European Wheat DB and her constructive help to the WG as Vice-Chair since 2005. I. Faberová thanked G. Kleijer in return for his excellent leadership, saying she had been very happy to share the responsibility of the WG with him. She would continue working on the EWDB for the transition period and would ensure a smooth transmission to Ludmila Papoušková, her successor as EWDB Manager.

G. Kleijer extended his thanks for their assistance to the members of the ECPGR Secretariat, including Lidwina Koop who did not attend the meeting but played a key role in its organization, and to the host, Pavol Hauptvogel, for the efficient organization of the meeting. Thanks were also due to Lubomir Mendel for his valuable technical assistance.

G. Kleijer finally thanked the WG members for their constructive participation and commitment towards the completion of the agreed tasks. The meeting had concluded with a clear workplan, including a first step towards the implementation of AEGIS. He urged the

WG members to reply in time to queries from the DB Managers and to keep deadlines to ensure steady progress in feeding data into the EWDB. He wished success to the new Chair and Vice-Chair and to the new DB Managers for their important tasks ahead, and declared the meeting closed.

In the evening, the participants visited a reputed winery in Radošina and enjoyed a traditional Slovak meal accompanied by tasting of the best local wines, in a festive and friendly atmosphere.

APPENDICES

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Appendix I. Workplan of the Wheat Working Group (2012-2013)

Topic	Activities	Responsibility	Deadline
Precise genetic stocks	Work on the definition of cereal genetic stocks	Ad hoc group composed of Mike Ambrose (leader), Morten Rasmussen (Agnese Kolodinska), a member from Poland (Bogdan Lapinski, nominated after the meeting) and Elina Kiviharju, Vice-Chair of the <i>Avena</i> WG	End 2013
	Develop criteria to select valuable material		
	Complete the inventory of material		
	Develop specific descriptors or fields that indicate their special characteristics		
	Submit proposal to the Network Coordinating Group for disbursing within the Cereals Network the remaining € 4000 initially earmarked for Wheat Precise Genetic Stocks		
European Wheat Database (EWDB)	Propose a scale for the “Zeleny sedimentation index” descriptor	Member from Switzerland	End July 2012
	Add the new descriptor “Zeleny sedimentation index” to the EWDB C&E Descriptor List	EWDB Manager	As soon as the scales for the descriptor are available
	Propose a definition for the descriptor “Year of registration”	François Balfourier, in consultation with Iva Faberová	End July 2012
	Send reminder to WG members for updating of the EWDB, with precise instructions about data to be provided	EWDB Manager	Annually, starting in March 2013
	Update the EWDB each year	All WG members	Annually, following the request from the EWDB Manager
European Triticale Database (ETDB)	Contact the triticale DB Managers through the Wheat WG members to monitor the update and inclusion of data for the agreed-upon descriptors	New ETDB Manager	End July 2013

Topic	Activities	Responsibility	Deadline
AEGIS – Compilation of first lists of possible AEGIS accessions			
• <i>Triticum</i>			
First candidate accessions identified at meeting	1. (a) Notify the EWDB Manager about confirmation of the first set of 107 <i>Triticum</i> accessions proposed for flagging as European Accessions (Belarus 19, Cyprus 80 and Estonia 8 - see details pp.14-15 of the meeting report).	WG members from Belarus, Cyprus and Estonia	End June 2012
	(b) Send the agreed lists to the respective National Coordinators, inviting them to flag these accessions in EURISCO as belonging to the AEGIS European Collection.	EWDB Manager	As soon as the lists are confirmed by WG members
Other accessions	2. (a) Distribute the prepared separate lists of <i>Triticum</i> accessions conserved in their country of origin to the respective country WG members (irrespective of the MoU signature status) for selection of European Accessions candidates according to agreed criteria (<i>it was recommended that only accessions that are already safety-duplicated should be flagged; or those for which safety-duplication by genebanks is under way, in which case the date by which the process will be completed should also be indicated. The EWDB Manager suggested starting with advanced cultivars.</i>)	EWDB Manager	End June 2012
	(b) Select European Accessions candidates according to agreed criteria; verify whether the holding institutions agree to flag them as part of AEGIS; and inform EWDB Manager of the outcome of the country member decision.	All WG members	End October 2012
	(c) Send the agreed lists to the National Coordinators, inviting them to flag these accessions in EURISCO as belonging to the AEGIS European Collection.	EWDB Manager	End 2012
	3. (a) Prepare lists of additional accessions that are conserved as genetically unique (to members' best knowledge) and that the holding institutions are prepared to conserve as AEGIS accessions and send the lists to the EWDB Manager. The safety-duplication provision as per point 2(a) above also applies here.	All WG members	End 2012 (extension of the delivery date is exceptionally allowed for the larger collections).

Topic	Activities	Responsibility	Deadline
	3. (a) Prepare lists of additional accessions that are conserved as genetically unique (to members' best knowledge) and that the holding institutions are prepared to conserve as AEGIS accessions, and send the lists to the EWDB Manager. The safety-duplication provision as per point 2(a) in <i>Triticum</i> above also applies here.	All WG members	End 2012 (extension of the delivery date is exceptionally allowed for the larger collections)
	(b) Include all <i>Aegilops</i> AEGIS candidates in the EWDB, along with passport and C&E data when they are available.	WG members, EWDB Manager	Continuously
	(c) Analyse the lists received as per point 3 (a) above, mainly to verify that there are no evident duplications of accessions or gaps in the compiled proposed list of accessions; enter into bilateral communication with WG members whenever clarifications are needed; circulate to all the concerned countries for comments a proposed final list of accessions to be flagged as part of AEGIS.	EWDB Manager in consultation with WG members	End 2013
Genebank standards	Prepare together a document summarizing the necessary genebank management knowledge for breaking dormancy, viability testing and multiplication of <i>Aegilops</i> and other wild cereals.	Andreas Börner (Germany) and Hanan Sela (Israel)	End June 2012

Appendix II. Acronyms and abbreviations

AEGIS	A European Genebank Integrated System
AQUAS	AEGIS Quality System
CBM	Centrum för biologisk mångfald (Swedish Biodiversity Centre), Uppsala, Sweden
CCDB	Central Crop Database
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (International Wheat and Maize Improvement Center), Mexico (CGIAR)
ECPGR	European Cooperative Programme for Plant Genetic Resources
ESDB	European <i>Secale</i> Database
ETDB	European Triticale Database
EU	European Union
EUCARPIA	European Association for Plant Breeding Research
EURISCO	European Internet Search Catalogue
EWDB	European Wheat Database
FAO	Food and Agriculture Organization of the United Nations, Rome, Italy
IHAR	Plant Breeding and Acclimatization Institute, Radzików, Poland
INRA	Institut National de la Recherche Agronomique (National Agronomic Research Institute), France
IPGRI	International Plant Genetic Resources Institute (<i>now Bioversity International</i>)
IPK	Leibniz Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany
JIC	John Innes Institute, Norwich, UK
MAA	Most Appropriate Accession (<i>for AEGIS</i>)
MCPD	Multi-crop Passport Descriptors (FAO/IPGRI)
MLS	Multilateral System
MoU	Memorandum of Understanding
NC	National Coordinator
NordGen	Nordic Genetic Resource Center, Alnarp, Sweden
PGR	Plant genetic resources
PGRFA	Plant genetic resources for food and agriculture
PPRC	Plant Production Research Centre Piešťany, Slovak Republic
SC	Steering Committee
SEEDNet	South East European Development Network on Plant Genetic Resources
SMTA	Standard Material Transfer Agreement
UPOV	Union pour la Protection des Obtentions Végétales (International Union for the Protection of New Varieties of Plants), Geneva, Switzerland.
WG	Working Group

Appendix III. Agenda

Third Meeting of the ECPGR Working Group on Wheat 15-17 May 2012, Piešťany, Slovakia

Monday, 14 May

Arrival of participants
19:00-20:00 Dinner at the hotel

Tuesday, 15 May

- 8:30-9:00 **Introduction**
Welcome by the Chair (*G. Kleijer, 15 min.*)
Welcome by local organizers / Presentation on Wheat Genetic Resources in the Slovak Republic (*P. Hauptvogel*) (*15 min.*)
- 9:00-10:00 Self-introduction by the participants
(*members of the Wheat WG should briefly indicate their perception of the value and expected benefit of the WG - 2 min. per person*)
- 10:00-10:10 Presentation of the agenda and adjustments
- 10:10-10:30 **Update on ECPGR** (*L. Maggioni*)
- 10:30-11:00 *Coffee break*
- 11:00-11:30 **Chair's report** (*G. Kleijer*)
Wheat WG workplan for Phase VIII: Progress report based on the country questionnaire
- 11:30-12:00 Discussion
- 12:00-12:30 **Precise genetic stocks**
Update on the project (*G. Kleijer*) (*15 min.*)
Discussion, recommendations and workplan (*15 min.*)
- 12:30-13:30 *Lunch*
- 13:30-13:40 **Adding value to the ECPGR Web site** (*E. Lipman*)
- 13:40-13:45 **Documentation (general)** - Update on the revised MCPDs (*L. Maggioni*)
- 13:45-14:25 **The European Wheat Database (EWBD), status and progress report**
(*I. Faberová*) (*30 min. + 10 min. discussion*)
- 14:25-14:55 **The European Secale Database (ESDB), status and progress report**
(*M. Zaczyński*) (*20 min. + 10 min. discussion*)
- 14:55-15:25 **The European Triticale Database (ETDB), status and progress report**
(*G. Kleijer*) (*20 min. + 10 min. discussion*)
- 15:25-16:15 **The Central Crop Databases (CCDBs) and EURISCO**
• Discussion on the transfer of CCDB data to EURISCO
• Quality of data in EURISCO
- 16:15-16:45 *Coffee break*

- 16:45-17:15 **Summary of recommendations and workplan for the three DBs**
- 17:15-17:35 **Presentation**
Diversity of wheat and its improvement for adaptability under climate change and use for agriculture (*P. Hauptvogel*)
- Free time for dinner in Piešťany*

Wednesday, 16 May

AEGIS: Status, progress, discussion of future work

- 08:30-08:50 **Update on AEGIS** (*L. Maggioni*)
- 08:50-09:30 Updates from members on actions related to AEGIS (signature of MoU, availability of material, etc.) (*1 minute per person + small margin for discussion*)
- 9:30-10:30 **Identification of MAAs for the European Collection**
- The example of rye (AEGIS Grant Scheme: Improving the prerequisites for a European rye collection) (*M. Rasmussen*) (*20 min.*)
 - Discussion of preliminary selection criteria proposed by the EWDB Manager and determination of final criteria (*I. Faberová*) (*40 min.*)
- 10:30–11:00 *Coffee break*
- 11:00-12:30 **Compilation of first lists of possible AEGIS accessions – Wheat**
(*general discussion – Chair: I. Faberová*)
- 12:30–13:30 *Lunch*
- 13:30-14:30 **Compilation of first lists of possible AEGIS accessions – Wheat (continued)**
(*general discussion – Chair: I. Faberová*)
- 14:30-16:00 **Compilation of first lists of possible AEGIS accessions – Rye and Triticale**
(*general discussion – Chair: M. Rasmussen*)
- 16:00-16:30 *Coffee break*
- 16:00-16:30 **Compilation of first lists of possible AEGIS accessions – Wrap-up session**
(*presented by G. Kleijer*)
What we have achieved, and how to continue (recommendations and workplan)
- 16:30-17:30 **AQUAS**
- Generic operational standards (FAO documents): Introduction, comments and possible acceptance (*Z. Bulířska-Radomska*) (*20 min.*)
 - Elaboration of crop-specific standards (proposal and possible agreement on crop-specific standards if the FAO generic standards are not sufficient) (*40 min.*)
- Free time for dinner in Piešťany*

Thursday, 17 May

- 08:30-10:30 **Visit to Plant Production Research Center Piešťany**
Welcome by J. Kraic, Director
Visit to the Genebank (*D. Benediková*)
- 10:30-11:00 *Coffee break*
- 11:00-13:00 **Scientific and technical presentations**
(each presentation max. 20 minutes including discussion)
- 11:00-11:20 • Agro-morphological and molecular evaluation of the diversity present in the French wheat collection (*F. Balfourier*)
- 11:20-11:40 • Genetic diversity of *Aegilops* species grown in Greece (*P. Bebeli*)
- 11:40-12:00 • Baking quality of Swiss wheat landraces (*B. Schiercher*)
- 12:00-12:20 • The role of the Germplasm Resources Unit at the John Innes Centre in underpinning wheat public sector research in the UK (*M. Ambrose*)
- 12:20-12:40 • Research on seed longevity, the case of wheat (*A. Börner*)
- 12:40-13:00 • SEEDNet (*E. Simeonovska*)
- 13:00-14:00 *Lunch*
- 14:00-16:00 **Presentation of the report and adoption of recommendations and workplan**
- 16:00-16:30 *Coffee break*
- 16:30-17:30 **Conclusions**
Election of Chair and Vice-Chair
Closing remarks
- 19:00 *Transport to venue of social dinner*
19:30 *Social dinner*

Friday, 18 May

Departure of participants

Appendix IV. List of participants

Third Meeting of the ECPGR Working Group on Wheat 15-17 May 2012, Piešťany, Slovakia

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 Wheat WG's Web page (<http://www.ecpgr.cgiar.org/networks/cereals/wheat.html>)

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