

**Integration of barley characterization and evaluation
data into EURISCO, and development of
specifications for a barley crop portal,
with a focus to improve the AEGIS collection**

(Barley C&E Data)

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Photograph

Regeneration of conservation varieties at TystofteFonden, Denmark. In the centre is cv. Svanhals from a selection in Swedish Plymage released in 1903, to the left is cv. Åsa from the 1940s (Dore x Wega) and to the right is Gute-barley released in 1901. Gute-barley is a selection from a landrace from Gotland, Sweden. All are two-rowed barleys with the exception of cv. Åsa (six-row). © Jan Svensson

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INTRODUCTION

In 2015, the ECPGR Activity “[Identification and updating of C&E data in EBDB of AEGIS *Hordeum* \(HordEva\)](#)” defined barley AEGIS accessions for Bulgaria, France, Germany, Latvia, Lithuania, Nordic Countries, Poland, Romania, Slovakia and Switzerland. In addition, the participants conducted an inventory of characterization and evaluation (C&E) data available for the AEGIS accessions. The European Barley Database (EBDB) was created at IPK, Germany, in 1983 and contains ca. 156 000 accessions from ECPGR countries in addition to contributions from genebanks in Australia, Japan, Syria (ICARDA) and the International Barley Core Collection. The EBDB contains basic characterization data for 80 000 accessions (seasonality, row number and kernel cover) and 3029 accessions contain evaluation data from an EU GENRES project. The last update of the EBDB was in 2001 and currently the evaluation data are not accessible.

The aims of the Activity “[Barley C&E Data](#)” were to expand the Barley AEGIS collection and to upload and provide access to C&E data on European Barley Genetic Resources.

WORKSHOP

A joint workshop of the ForageDataAccess and Barley C&E Data Activities was held in Malmö, Sweden in 2017. The meeting included joint sessions focusing on general information, EURISCO, scientific talks and crop portals. The workshop developed a list of recommended actions (see Annex 1) and available on both Activities’ webpages. It includes recommendations on AEGIS, characterization and evaluation data in EURISCO, quality of data in EURISCO and visibility of European genetic resources, C&E data, EURISCO and ECPGR. The meeting agenda can be found in Annex 2 and the list of participants in Annex 3.

PROGRESS REPORT

1a. Expand the barley AEGIS collection with accessions from Estonia, United Kingdom, Austria and Italy

Austria: the Activity member left for another position early in the project and no Austrian barley AEGIS accessions were selected.

Estonia: the Estonian Crop Research Institute selected 15 accessions for inclusion as barley AEGIS accessions. The selection was based upon the following criteria: country of origin (Estonia), quality of the material, availability of the material at the genebank and safety duplication. These accessions have been flagged.

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Italy: ITA004 (CNR-IBBR, Bari, Italy) and ITA382 (CREA-GB, Fiorenzuola d'Arda, Italy) selected 198 accessions for inclusion as barley AEGIS accessions. The selection was based upon the following criteria: geo-referenced landraces collected in different missions across the country (95 accessions) and cultivars bred from 1920 to today (103 accessions). The material was multiplied at a single location in 2018 and phenotyped according to the international standards for the species. These accessions will be flagged in 2019.

Nordic countries: NordGen had previously flagged 573 barley accessions. In this Activity 11 additional AEGIS candidates were selected, and the Nordic National Coordinators agreed to flag these accessions for a total of 584 Nordic barley accessions. Selection criteria for Nordic cultivars and landraces are based on Nordic origin and good seed status.

United Kingdom: the Activity member was made redundant and no accessions were selected as AEGIS candidates. It was also indicated that lack of information about germination tests postpone flagging new material at present in the UK. The Activity members agreed that only material with germination test should be included.

1b. Update from previous barley ECPGR activity

Germany: approximately 13 000 AEGIS candidates were reported to meet the AEGIS criteria under the previous ECPGR barley activity HordEva. A total of 12 634 *Hordeum* accessions were flagged in EURISCO in 2018 in the frame of the present Activity.

2a. Transfer C&E data from the old EBDB to EURISCO

The Activity member assigned to this task retired during the Activity and no progress was made. Stephan Weise (EURISCO Coordinator) offered to download the data to Excel files but a careful examination of the data is needed before uploading to EURISCO.

2b. Collect C&E data from members of the previous barley Activity (HordEva) and from task 1 for uploading to EURISCO

Italy: the Italian accessions have been phenotyped according to the Protocol for distinctness, uniformity, and stability test, UPOV species code HORDE_VUL. A second trial for characterization and evaluation is running in the 2018-19 growing season and all the collected data will be uploaded to EURISCO.

Estonia: trials for characterization and evaluation of 24 barley accessions of Estonian origin preserved at the genebank of the Estonian Crop Research Institute

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are carried out in 2017-2019. Thereafter the data of all three years will be uploaded to EURISCO.

Nordic countries: NordGen made an inventory of legacy characterization and evaluation data. However, the data were not uploaded to EURISCO.

United Kingdom: C&E data for 472 UK barley accessions from the Biotechnology and Biological Sciences Research Council (BBSRC) barley collection were uploaded to EURISCO, containing information on row number, kernel cover, growth habit, susceptibility to *Puccinia hordei*, *Puccinia striiformis* and *Blumeria graminis f. sp. hordei*.

3. Creation of a “barley view” on EURISCO and development of specifications for a barley crop portal

During a joint meeting of the Barley WG and the Forages WG in Malmö, Sweden, in March 2017, it was decided to postpone the creation of a barley portal. Instead, a forages portal should be created as a proof of concept first. The former ECPGR *Poa* database was thus reengineered and converted into a crop portal (<http://poa.ipk-gatersleben.de>). This portal can be used as a blueprint for the Barley WG. However, it should first be discussed with the Wheat and *Avena* WGs to examine the possibility of creating a joint cereal portal. Necessary Application Programming Interfaces (APIs) can be provided by EURISCO.

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Annex 1. Workshop recommendations

Listed below are recommendations from the ECPGR Forages and Barley workshop, 14-16 March, 2017, Malmö, Sweden. The workshop was a joint activity of the ECPGR projects “ForageDataAccess” and “Barley C&E Data”.

AEGIS

The lack of stable long-term funding for genebank operations is a major problem. A survey among forage collection holders suggests that lack of funding for regeneration is the most important reason why not more forage accessions have been flagged for the European Collection. We suggest the following actions to stimulate progress for AEGIS:

1. Introduce the term “AEGIS candidate”, which would be different from a standard AEGIS accession. AEGIS candidate would signify accessions that are unique and should become AEGIS accessions but need regeneration or other action. It could be introduced as a new state (no. 2) within the current AEGIS MCPD descriptor (no. 35). The aim would be to make the need for action and additional funding more visible.
2. ECPGR should work towards strengthening the basis for funding for genebanks in Europe. Different approaches should be explored, for example cooperation with funding agencies, lobbying for increased funding on the European level and strengthening the status of ECPGR and AEGIS. The latter could be achieved by
 - Exploring options for AEGIS to gain ERIC (European Research Infrastructure Consortium) status to improve long-term funding opportunities and a more integrated system for sharing of responsibilities for regeneration.
3. A system with mentorship could stimulate collection holders to flag accessions. In such a system genebanks with experience of flagging AEGIS accessions could mentor those that have not done so. ECPGR could for example offer travel support within the grant system.
4. The Executive Committee should encourage the National Focal Points (NFPs) to work together with the collection holders and flag accessions for AEGIS.

Characterization and Evaluation data in EURISCO

The first data sets have been uploaded into EURISCO and the system for upload, display and download of C&E data is functioning (though modifications to meet user needs and wishes will be performed later). We recommend:

5. Actions should be initiated to encourage upload of C&E data on a larger scale. The workshop suggests that efforts should be made to involve the National Focal Points. These are people that have the technical expertise to transform the data into the correct format (which can appear daunting for non-experts).
6. Development of a EURISCO feature for downloading of C&E data at experiment level would allow users to perform their own analysis. Ideally, the download options would also append passport data of the accessions included in the experiment.
7. Evaluate the possibility to include C&E data from accessions that are currently not documented in EURISCO, if included in an experiment together with EURISCO accessions.

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8. A study on the feasibility of assigning digital object identifiers (DOIs) to uploaded C&E experiments. The presence of a DOI makes datasets of C&E experiments “citable” for users and it would allow uploaders and EURISCO to track the use of the data by citation count.

Quality of data in EURISCO

The quality, not only the quantity, of data in EURISCO is very important. Errors and inconsistencies in the data hinder users to efficiently search for information.

9. We support the establishment of a quality check system in EURISCO, for example regarding taxonomy and geographic coordinates.
10. We support actions to encourage collection holders to adopt common naming practices and clean their data of errors.
11. Lower quality data, such as poorly documented field observations, can be included but should have a “warning” explaining the limitations.

Visibility of European genetic resources, C&E data, EURISCO and ECPGR

The workshop considers that the awareness of breeders and other users about genetic resources available at European genebanks and about the associated C&E data is too low. Actions should be taken to broaden/spread this knowledge:

12. Crop portals could be a way to not only inform about specific crops but also channel users into relevant parts of EURISCO and the ECPGR homepages. The workshop participants agreed that a European Crop Portal should:
 - a. Aim at increasing the knowledge about the crop, the genetic resources available in Europe, C&E data and at the same time increase the visibility of EURISCO and ECPGR.
 - b. Be hosted under the umbrella of ECPGR.
 - c. Be “owned” by the relevant Working Group (not individual persons).
 - d. Channel users into a relevant view (“subpage”) of EURISCO devoted to the specific crop.
 - e. The Forages WG will set up a simple Forage Crop Portal during 2017 and this can serve as an example of how such a portal can look and function.
 - f. The Barley WG will postpone development of a barley portal until discussions have been held with the Wheat and *Avena* WGs on the possible development of a joint cereal portal and about potential overlap with other similar initiatives.
13. Actions directly targeted towards breeders and pre-breeders should be initiated to inform about the new C&E module in EURISCO and the type of data available. This should include presentations of EURISCO on conferences.
14. The inclusion of EURISCO as data provider for GBIF (the Global Biodiversity Information Facility) should be updated and extended for C&E data. Each holding institution should appear as separate data owner.
15. Explore additional data-publishing pathways from the data publishing genebank to the NFPs and EURISCO utilizing the GBIF data-publishing infrastructure, including support and training from the national GBIF Node helpdesks that are established in GBIF member countries.

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Annex 2. Workshop Agenda

Forages and Barley ECPGR workshop

14-16 March 2017, Malmö, Sweden

A joint meeting of the ECPGR projects “ForageDataAccess” and “Barley C&E Data”

Location: Elite Hotel Savoy, Norra Vallgatan 62, 211 22 Malmö
Rooms “Lilla salen”, “Empiren”, and “JF Horn”

March 14

When	What	Who
13:00 –14:00	Arrival and lunch (at Elite Hotel Savoy)	
Welcome session (Chair: Ian D. Thomas) Room: “Lilla salen”		
14:00	Welcome to the meeting	Anna Palmé and Jan Svensson
14:05	Roundtable introductions of participants	All
14:25	NordGen Welcome	Roland von Bothmer
14:40	Introduction to the project “Forage Data Access”	Anna Palmé
14:50	Introduction to the project “Barley C&E Data”	Jan Svensson
15:00	Information and updates from ECPGR, including their vision of the future for AEGIS	Eva Thörn
15:30	Q&A	Chair
15:40	Coffee/Tea	
Session 1: Characterization and evaluation data in EURISCO (Chair: Külli Annamaa) Room: “Lilla salen”		
16:10	A priority descriptor list for forages	Evelin Willner
16:20	Gaps in EURISCO compared to the ECCDBs	Stephan Weise
16:30	What can a C&E module in EURISCO give us? Presentation of the demo version for C&E data in EURISCO	Stephan Weise
17:10	Q&A on the C&E module	All
17:50 – 18:00	Summing up	Chair

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March 15 (Forage and Barley sessions in parallel in the morning)

Forage sessions

Session 2a: AEGIS Forages - establishment of the European Forage Collection (Chair: Evelin Wilner). Room: "Empiren"		
9:00	General progress on the European Forage Collection (EFC) and results from the questionnaire	Petter Marum
9:30	Why are not more forage accessions in the EFC (AEGIS)? The French perspective	Aurélia Priet
9:40	Why are not more forage accessions in the EFC (AEGIS)? The Bulgarian perspective	Maria Stamatova
9:50	Why are not more forage accessions in the EFC (AEGIS)? The Austrian perspective	Wilhelm Graiss
10:00	Discussion	Chair
10:30	Coffee/Tea	
Session 3a: Forage data in EURISCO and WG plans (Chair: Maria Stamatova) Room: "Empiren"		
11:00	Error and duplicate identification in forage accessions in EURISCO	Ian D. Thomas
11:30	What forage-specific descriptors are missing from EURISCO?	Ian D. Thomas
11:50	Workplan for the ECPGR WG on Forages – progress and future plans	Anna Palmé
12:05	Discussion	Chair
12:30	Lunch	
13:30	Guided tour in Malmö	All
15:30 – 16:50	Discussion (including Coffee/Tea)	All

Discussion questions forages

- What tasks from the Forages workplan would be most important to prioritise 2018?
- What would be needed to increase the number of accessions in the EFC (AEGIS)? (WG tasks and recommendations to the ECPGR)
- Crop-specific standards for forages (discuss the draft commented by the ECPGR secretariat, see separate document)
 - Optimal/minimum number of plants to sample when collecting (4.1.5)
 - Number of seeds used for germination testing (4.3.2)
 - Proportion of the collection that should be characterized (4.5.1)
 - Other issues
- What forage-specific descriptors should be included in EURISCO (if any)??
- Are new features needed in EURISCO to facilitate the AEGIS process?
- How can the process of entering C&E data into EURISCO be facilitated?

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Barley sessions

Session 2b: AEGIS Barley - establishment of the European Barley Collection (Chair: Helmut Knüpfper). Room: "JF Horn"		
9:00	Update on previous activities	Jan Svensson
9:10	Current status of the European Barley Collection (AEGIS)	Jan Svensson
9:30	New AEGIS collections from Estonia	Küllli Annamaa
9:40	New AEGIS collections from Italy	Alessandro Tondelli
9:50	New AEGIS collections from Austria	Wolfgang Kainz
10:00	New AEGIS collections from UK	Adrian Turner
10:10	Discussion	Chair
10:30	Coffee/Tea	
Session 3b: Barley WG plans (Chair: Adrian Turner). Room: "JF Horn"		
11:00	Workplan for the ECPGR Barley WG – future plans	Jan Svensson
11:10	Crop-specific genebank standards - AQUAS for Barley	Jan Svensson
11:20 – 12:30	Discussion	Chair
12:30	Lunch	
13:30	Guided tour in Malmö	All
15:30 – 16:50	Discussion sessions (including Coffee/Tea)	All

Discussion questions Barley

- Workplan for the ECPGR Barley WG – future plans
- Crop-specific genebank standards - AQUAS for Barley

Both Forages and Barley groups:

Discussion session (Chair: Ahmed Jahoor) Room: "Lilla salen"		
17:00	Reporting from the group discussions	Chairs of each discussion group
17:50 – 18:00	Summing up	Chair

Common dinner in Malmö 19:00

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March 16

Scientific talks (Chair: Anna Palmé) Room: "Lilla salen"		
9:00	Conservation of regional genetic resources from semi-natural grassland (G-Zert)	Wilhelm Graiss
9:30	Genomic selection in barley	Ahmed Jahoor
10:00	Coffee/Tea	
Session 4: European Crop Portals for forages and barley (Chair: Petter Marum) Room: "Lilla salen"		
10:20	GBIF data portal	Dag Endresen
11:20	A European Crop Portal for Forages	Ian D. Thomas
11:35	Discussion on the Crop Portal for Forages (What should be included in the portal?)	All
12:05	A European Crop Portal for Barley	Jan Svensson
12:20	Discussion on the Crop Portal for Barley (What should be included in the portal?)	All
12:50	Summing up	Anna Palmé and Jan Svensson
13:00 – 14:00	Lunch	

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Annex 3. Workshop Participant list

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