

ECPGR WG for Forages towards 2020s

(Forages 2020)

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Participants in the Workshop (Photo by P. Marum)

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1. INTRODUCTION

In recent years the work of the ECPGR Forages Working Group (WG) has been focused on the establishment of the European Forage Collection (EFC). Progress has been made on this task resulting in a long list of candidate accessions. In the present Forages 2020 project, the aim was to continue where the previous project carried out under the AEGIS Grant Scheme¹ left off and also to put more focus on characterization and evaluation data and plans for the future. Specifically, the project has three aims: 1) improving the European Forage Collection in accordance with the AEGIS goals; 2) inventory of evaluation and characterization data on European forage accessions; and 3) development of a new workplan for the ECPGR Forages WG.

The project included three phases: A) Preparatory phase, where the activity leaders planned and initiated a participatory process towards the three goals listed above; B) a workshop where the results of the preparatory phase were presented and discussed, future steps evaluated, and specific tasks for the workplan developed; and C) the post-workshop phase documenting decisions and outcomes.

At the start of the project a management group was created consisting of the task leaders and the former Chair who is the main author of the application (Evelin Willner, Susanne Barth, Petter Marum, Merja Veteläinen and Anna Palmé). During the preparatory phase, three Skype meetings were held to discuss the progress of the work and to plan the workshop.

2. TASK 1: AEGIS PROCESS AND PROGRESS

The Forages WG has worked on the establishment of the European Forage Collection for a long time. It has been discussed at several meetings of the WG and at two workshops in 2012 and 2013. This project continues with these tasks and addresses Outcome 1 of the ECPGR objectives (Phase IX), specifically output 1.2: AEGIS collections established.

2.1. Materials and Methods/Approach

To help the members of the ECPGR Forages WG to select AEGIS candidates, the project group developed a list of selection criteria (see Annex 1, page 7). The criteria were in agreement with the criteria described in the [Revised simplified procedure for the selection and flagging of accessions for the European Collection](#) and were adapted from, but not identical to, the criteria used by NordGen for selection of candidates.

A letter was sent to the Forages WG members, with a copy to the National Coordinators, on 9 September 2015. The letter encouraged the genebank managers who had not already done so to go through their forage accessions and flag candidates accessions stored in their genebank, and send the suggestion to their National Coordinator for approval and inclusion in EURISCO. The WG members were asked to give a short progress report from their respective country by 9 October 2015. A report form was included to simplify the reporting. A friendly reminder was sent to the WG members on 19 October 2015.

¹ Establishment of the European Forage Collection (project proposal and reports available [here](#)).

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2.2. Results

The Netherlands and the Czech Republic had flagged forage accessions in EURISCO before the project started. During the preparations for the workshop, Germany, the Nordic Countries and the UK also flagged accessions in EURISCO.

We received progress reports from 17 countries; of these five countries had started the selection process, but had not yet flagged accessions in EURISCO. Four had not yet started the process. No answer was received from 22 countries (seven of these are not yet AEGIS members). Four countries did not have members in the ECPGR Forages WG and therefore did not receive the request for a progress report.

A summary of the status of the European Forage Collection (AEGIS) and the results of the workshop are given in Annex 2 (page 9). By 1 November 2015, 7024 forage accessions were flagged in EURISCO within the most important forage genera. The distributions between some genera are given in Table 1. The genera with the most flagged accessions are *Festuca* and *Lolium*.

Table 1. Number of accessions flagged as AEGIS in some important forage genera after the workshop (1 November 2015)

Genera	No. of flagged accessions	% flagged of total in EURISCO
<i>Agrostis</i>	51	2.9
<i>Alopecurus</i>	7	0.8
<i>Arrhenatherum</i>	19	3.4
<i>Bromus</i>	13	1.0
<i>Dactylis</i>	623	4.4
<i>Festuca</i>	1882	12.5
<i>Lolium</i>	1726	12.1
<i>Lotus</i>	20	0.8
<i>Medicago</i>	26	0.2
<i>Phalaris</i>	30	5.4
<i>Phleum</i>	328	4.5
<i>Poa</i>	1154	15.0
<i>Trifolium</i>	1145	4.2
Total	7024	

An issue that was discussed at the workshop was whether AEGIS status should be reserved for the most valuable or genetically different accessions in each species, or whether the aim should be that the majority of the accessions accepted for long-term storage should be flagged as AEGIS. No consensus was reached on this issue.

2.3. Recommendations

The rate of response to the request for information about progress with AEGIS was low. The workshop recommended sending an individual letter to each curator of the European forage collections. This letter should be addressed to the curator but also copied to the National Coordinator of that country. It should include a comment on the current status and progress of AEGIS, mention that no accessions have been flagged from that particular country, and accompanied by the document on selection

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criteria developed within the current project. After the completion of the workshop, an [Information paper: Benefits of establishing and operating a European Collection of unique and important germplasm](#) was published on the ECPGR homepage. This could potentially also be circulated to describe the benefits of AEGIS.

The accessions flagged today represent only a small subset of the variation available in genebanks in Europe. It is clear that actions are needed if more accessions are to be flagged. In the workplan we suggest that we should first conduct studies on the reason why collection holders have not flagged accessions and that we should then plan activities targeted at solving the identified problems. After the workshop discussion, it was clear that one important reason not to flag accessions was uncertainty about funding during the coming years. This is something that is difficult to solve at the ECPGR level but rather a national issue. However, the priority of this task and understanding of its benefits could be addressed by the ECPGR Forages WG. One approach suggested would be to invite representatives from all countries to the upcoming ECPGR meetings related to Forages. This could either be achieved by arranging a series of smaller meetings over several years or a larger meeting with participants from all European countries. Regret was expressed that the latter is no longer possible within the current ECPGR funding scheme.

At the workshop the strict rules concerning un-flagging of AEGIS accessions were discussed. No clear consensus was reached on this issue however. Some participants felt that the strict rules hindered collection holders from flagging accessions. On the other hand, if it was easy to un-flag accessions, collection holders might not trust that AEGIS accessions are conserved in the long-term by the holding genebank, and therefore continue to store duplicates. Clearer rules and practices concerning un-flagging could potentially facilitate this issue.

3. TASK 2: CHARACTERIZATION AND EVALUATION DATA

The aim of this task is to provide user-friendly web access to information about *ex situ* plant collections, and their respective characterization and evaluation (C&E) data. This task addresses Outcome 2 of the ECPGR objectives (Phase IX), specifically output 2.2: C&E data included in EURISCO with high quality and wide coverage.

In the community of plant genetic resources (PGR) stakeholders it is clear that we need user-friendly access to information on PGR (passport and C&E data). The overview about PGR in European genebanks is given through the EURISCO database. There you can find passport data (different degree of completeness) of more than 1.8 million accessions. However, regarding morphological or agronomical traits the EURISCO database provides no information. In order to facilitate the usage of PGR for breeding and/or research purposes, time and experienced search queries are needed to select accessions which are most suitable to achieve the specific aims. Thus, genebank curators and IT members agreed that we need to include C&E data into a powerful database system. Nevertheless, finding a proper solution for all users and genebank members is a difficult task.

The main long-term objective of our work is to include all available forage C&E data into the EURISCO database. But how can we achieve this aim? And what are the requirements to fulfil this task? These different questions require in the first instance a comprehensive overview about data which already exist in European genebanks.

3.1. Materials and Methods/Approach

The ECPGR Documentation and Information WG developed and introduced in several meetings and workshops a EURISCO C&E data model. The data model consists of five templates (Dataset,

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Experiment, Genotype, Trait, Score (see [Data exchange standard for uploading C&E data from National Inventories to EURISCO](#) and Annex 3, page 10), which are linked with each other. Besides the transfer and upload of C&E data to EURISCO, a future EURISCO aim is the implementation of use-cases for visualization and searching/filtering of C&E data. Hence, an overview about existing C&E data in European genebanks makes a valuable contribution to extend the EURISCO germplasm database by inclusion of C&E data. An inquiry letter was sent to all members of our Forages WG, including National Focal Points (NFPs) and other players via the ECPGR list server, in order to receive a good feedback and to create an overview about available C&E data.

3.2. Results

The requests for C&E data were sent to 29 European countries. We received from 7 countries a first overview with C&E data information in shape of templates (more or less). From 6 countries we got an apology with different statements, such as database is under construction or data cannot be provided due to data export difficulties from the current genebank database to the EURISCO templates (lack of time and resources).

The current report/overview (see Annex 3) provides the following information: number of genus/species (1-10), accessions (97-8000), and traits (3-100) which are recorded by seven countries. Results indicated that there is a great differentiation between several forage collections. In particular, the number of scored or measured traits varied greatly: up to 100 possible characteristics depending on the particular trials and crops (e.g. perennial forages, several years, cuts and analyses of contents or forages values).

As a test case for the C&E extension of EURISCO, the first forages C&E data of CGN, IPK, and Agroscope will be imported by the end of 2015, in cooperation with S. Weise, EURISCO Coordinator. The imported data will be made publicly available after a test period and after approval of the respective National Coordinators.

3.3. Recommendations

There are a lot of experiments/data in the European community of forage collections but there is of course a high diversity in the data format and databases. It needs time and personal engagement to fill several templates. The most time-consuming template is by far the SCORE template. If we want to upload C&E data into the EURISCO database we have to get the C&E data in the correct shape (templates 1 to 5) in order to exchange data as easily as possible. We would recommend collection holders and others with C&E data on PGR to use these five data templates for data transfer and upload and encourage them to actively participate in uploading data into EURISCO.

4. TASK 3: WORKPLAN

The aim of this task is to develop a workplan for the ECPGR Phase IX to replace the earlier workplan for Phase VIII. The new workplan is formulated to meet the new objectives specified by the ECPGR under Phase IX, specifically outcomes 1, 2 and 3. The latter will be performed in cooperation with the ECPGR Wild Species Conservation in Genetic Reserves WG.

4.1. Materials and Methods/Approach

In the preparatory phase of the project, a draft workplan was developed by the managing group. Before the workshop, this draft was distributed to all project participants and also other participants of

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the workshop. At the workshop, the development of the workplan was first conducted in smaller groups focusing on particular themes. Group 1 was focusing on AEGIS, database development and quality assurance (chair Ian D. Thomas), group 2 on characterization, evaluation and pre-breeding (chair Beat Boller) and group 3 on *in situ* conservation and crop wild relatives (chair Nigel Maxted). After the work in the groups, the results were presented and discussed in the whole group. In the post-workshop phase the results of the workshop were used as inputs for the new workplan, which was then circulated to all project members and workshop participants for comments. These comments were included in a version of the workplan that was circulated to all members of the WG for final comments.

4.2. Results

The Forages WG's workplan for Phase IX includes activities towards the ECPGR objectives 1, 2 and 3. The WG wanted to work towards establishing the European Forage Collection (EFC) by evaluating the reasons why more forage accessions have not been flagged as AEGIS and, based on this information, develop targeted activities aimed at increasing the number of forage accessions in the EFC. In addition, the quality of genebank management will be addressed by developing crop-specific genebank standards for forages as foreseen by the AEGIS Quality System (AQUAS).

Several actions are also planned to improve the quality and quantity of data in EURISCO. Efforts will be made to identify potential gaps and duplicates in EURISCO, improve the passport data by identifying errors on genus, species, crop name, variety name and latitude and longitude. In addition, the aim is to evaluate how forage-specific data present in the crop-specific databases can be included into EURISCO and to develop a crop portal for forages. The aim is also to facilitate access to evaluation data on forages by surveying data existing in Europe and facilitating the development of the framework for including characterization and evaluation data in EURISCO and to standardize some of the evaluation data by developing recommended characterization protocols.

Previously, there has been little focus on *in situ* conservation of forage crops in the WG. The aim is now to increase the effort in this area in cooperation with the Wild Species Conservation in Genetic Reserves WG. Planned activities include a joint application, inventory of different types of grassland in Europe (grassland ecotype reference sites within country and regionally across Europe), forage threat and threat assessment, development of management recommendations for *in situ* conservation of forages and a joint workshop with the Wild Species Conservation in Genetic Reserves WG.

The final version of the workplan will be published on the [Forages Working Group webpage](#).

5. WORKSHOP

The workshop was held 9-11 November 2015 at NordGen in Alnarp, Sweden. In total 18 people took part in the meeting in person and eight people took part in some of the sessions open for online participation. People from the following countries took part: Austria, Bulgaria, Finland, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Norway, Sweden, Switzerland and the United Kingdom. The goal was to report the progress on the three tasks of the project, discuss the results and future steps and to continue the development of the workplan.

The workshop was divided into three specific sessions: 1) AEGIS, 2) Crop wild relatives, 3) Characterization and evaluation and 4) Workplan development. The results of the discussions held at the workshop are described under each task above. The full agenda and PDFs of the presentations are available from the [Forages 2020 webpage](#).

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Annex 1. Suggested selection criteria for AEGIS candidate forage accessions

Below we list the selection criteria that the management group of the ECPGR project “Forages 2020” suggests for the selection of candidates for the European Forage Collection (AEGIS). The criteria are in agreement with the criteria described in the [Revised simplified procedure for the selection and flagging of accessions for the European Collection](#) and are adapted from (but not identical to) the criteria used by NordGen for selection of candidates.

General selection criteria used for all forage accessions

The accessions should be:

1. Under the management and control of the Associate Member/country
2. Plant genetic resource for food and agriculture or medicinal and ornamental species
3. Included in EURISCO
4. Genetically unique within AEGIS and have a European origin or introduced germplasm
5. Viable
 - a. Germination above the minimum standard used by the genebank
6. Duplicated
 - a. Seeds are safety-duplicated at another genebank and/or in the Svalbard Global Seed Vault according to the criteria specified in [The AEGIS Safety duplication Policy](#)
7. Accessible
 - a. Seeds are available for distribution according to the [AEGIS Guidelines for Distribution of Material from the European Collection](#)
8. Assured long-term conservation
 - a. Accepted for long-term conservation (ACC) by the Associate Member
9. Minimum documentation
 - a. Known species
 - b. Accession name assigned
 - c. Known biological status of accession (SAMPSTAT)
 - d. Known origin
 - i. Origin country
 - ii. If wild or semi-wild: minimum collection data includes at least one of the following
 1. Latitude and longitude
 2. Region (higher and/or lower admin level and/or location)
 - iii. Cultivar
 1. Known breeder and/or known donor
 - iv. Landrace, at least one of the following
 1. Latitude and longitude
 2. Region (higher and/or lower admin level and/or location)
 - v. Breeding material
 1. Known donor

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We see the process of selecting accessions for the European Collection as a continuous process. Through the daily work at the genebank, new accessions will reach the minimum criteria specified above, for example because work has been conducted to increase knowledge on seed status, regeneration has increased seed amount or germination or new accessions have been included in the collection.

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Annex 2. Status of the European Forage Collection (AEGIS) and the results of the workshop (at 1 November 2015)

Country (AEGIS member countries are marked in yellow)	Members of ECPGR Forages Working Group who received request on AEGIS process	Response to request on AEGIS process	Initiated selection process	Total number of accessions of important genera in EURISCO	No. of AEGIS accessions suggested by Genebank manager	No. of AEGIS accessions approved by National Coordinator	No. of AEGIS accessions flagged in EURISCO
Albania	1	No		81			
Armenia	1	No		266			
Austria	4	No		305			
Azerbaijan	1	No		462			
Belarus	4	No		0			
Belgium	1	Yes	Yes	244	56	0	0
Bosnia & Herzegovina	5	No		92			
Bulgaria	1	Yes	No	2828			
Croatia	3	No		137			
Cyprus	2	No		60			
Czech Rep. (Grasses)	2	Yes	Yes	2215	349	236	236
Estonia	2	Yes	yes	147	57	57	0
France	2	No		513			
Georgia				0			
Germany	4	Yes	Yes	13164	6276	2203	2203
Greece	1	Yes	Yes	785	100	0	0
Hungary	1	Yes	No	3941			
Ireland	1	No		712			
Israel				548			
Italy	1	No		5783			
Latvia	4	Yes	Yes	559	26	16	0
Lithuania	3	Yes	Yes	875	875	875	0
Macedonia (FYR)	1	No		129			
Malta	1	No					
Montenegro				0			
Netherlands			Yes	1032			851
Nordic countries	7	Yes	Yes	4415			1303
Poland	4	No		18317			
Portugal	5	Yes	No	703			
Romania	5	No		1994			
Russian Federation	1	No		17438			
Serbia	6	No					
Slovakia	2	No		856			
Slovenia	2	No		245			
Spain	1	No		6762			
Switzerland	5	Yes	No	313			
Turkey	1	No					
Ukraine	1	No		2526			
UK	3	Yes	Yes	16435			2431
TOTAL				104882			7024

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Annex 3. A survey of forages C&E data in Europe. State-of-the-art

A survey of forages C&E data in Europe
State-of-the-art

Evelin Willner
IPK – Dept. Genebank, Satellite Collections North
11 November 2015

Background

- User-friendly access to all information concerning PGR
- Search and selection of valuable accessions for special purposes in breeding and research
- ...

Overall, there is a long discussion process to find the right solution for a suitable database system.

Aims

Enlarge EURISCO with C&E data!!!

For User's	For Genebank's
<ul style="list-style-type: none"> Overview about C&E data Availability of C&E in different Genebank's Which C&E data? Which genus/species? Which quality? 	<ul style="list-style-type: none"> Management priority in maintenance AEGIS and EFC accessions (unique and valuable)

Data model for C&E data II

Survey results I

Request of C&E data – ECPGR Listserv

■ No reply (15)

■ Reply to query - fill out templates (8)

- SWE
- DEU
- CHE
- EST
- LTV
- GBR
- FRA
- NLD

■ Reply to query - diffus statements (8)

Statements

- Databases under construction
- Data can't be provided because it is too difficult to export data from the current Genebank database to the EURISCO template.

→ Lack of time and resources

Survey results II

Country	Genus
EST	4
GBR	1
DEU	10
SWE	8
CHE	5
LTV	3
FRA	7

Country	Traits
EST	70
GBR	13
DEU	297
SWE	81
CHE	322
LTV	29
FRA	19

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Prototype of C&E data in EURISCO

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Prototype of C&E data in EURISCO

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Prototype of C&E data in EURISCO

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Conclusion and suggestions

- There are a lot of experiments/ data in the European community of PGR!
- **But** there is of course a high diversity in the data !!!
- We have to get the C&E data in the correct shape in order to exchange data
 - as easy as possible
 - and to provide data for EURISCO in developed data model
- **Outlook:**
Use these 5 data templates and we would like to encourage you to actively participate.

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Questions, remarks and wishes

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Outline

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Survey results - CHE



<http://www.bdn.ch/>

- **Genus:** Lolium multiflorum – Italian ryegrass
- **No. of accessions:** 55
- **No. of scored traits:** 86
- **Sum data points:** 2.681

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