



Coordinating global research for wheat

ANNEX 7 (June 2016 update)

EXPERT WORKING GROUP MEETING REPORT
--

Please return your completed form to wheat.initiative@versailles.inra.fr

EWG meeting reports, after approval by all participants to the meeting, shall be sent to the Wheat Initiative Secretariat within one month following the meeting. They will be published on the Wheat Initiative website.

NAME OF EXPERT WORKING GROUP	
<i>EWG Durum wheat genomics and breeding</i>	
DATE OF THE MEETING	01-02/10/2016
LOCATION/ONLINE	ICARDA, Rabat (Morocco)

Participants	
A total of 34 members/scientists were present in Rabat, a full list of participants is presented in Annex 1 .	

Apologies and Absentees	

Agenda	
1 October	EWG-DWGB meeting, day 1
9:00	Welcome addresses
9:15	Roberto Tuberosa & Luigi Cattivelli: Introduction to the EWG-DWGB meeting
9:30	Luigi Cattivelli & Roberto Tuberosa: Update on the DWRC proposal and funding perspectives
10:00	Filippo Bassi: DWRC: 1-Diversity for basic phenological traits
10:20	Marco Maccaferri: DWRC: 2-Molecular diversity
10:40	Coffee Break
11:00	Discussion on the composition of the DWRC Collaborative opportunities for the exploitation of the DWRC and future plans
13:00	Lunch
14:30	Karim Ammar: Genomics applications in durum breeding at CIMMYT
14:50	Jacques David: Evolutionary pre-breeding in durum wheat
15:10	Gilberto Igrejas: Phenotyping for quality traits
15:30	Melissa Garcia: Exploring genetic diversity in bread wheat using NAM populations and GWAS
15:50	Steven Xu: Breeding for Fusarium head blight resistance in durum wheat

16:10	Coffee Break
16.40	Ahmed Amri: Presentation of the activities of the EWG on genetic resources and visit to the ICARDA gene bank
17:00	Poster vision
18:00	Return to hotel
2 October	EWG-DWGB meeting, day 2
09:00	Luigi Cattivelli: Current state of the durum wheat genome sequence initiative and proposal for a pangenome project in tetraploid wheat
10:00	Curtis Pozniak: Bread wheat pangenome: The 10 genome sequencing project
10:30	Helene Lucas: Current status and future development of the Wheat Initiative EWGs
11:10	L. Cattivelli & R. Tuberosa: Discussion about the possible interactions with other EWGs (Quality, Genetic resources, Phenotyping) and other topics (see Annex 2)
12:00	L. Cattivelli & R. Tuberosa: Future activities of the EWG-DWGB
12:15	Lunch
14:00	End of meeting and departure to the airport

MEETING REPORT

Progress in the Durum Wheat Reference Collection (DWRC) project. Bassi and Maccaferri presented a summary of the activities for phenotyping (preliminary analysis of phenological traits, one location) and genotyping (96 SNPs), respectively, the DWRC collection. For details, see the presentations available at the Durum Wheat Genomics and Breeding EWG workspace (<http://www.wheatinitiative.org/extranet/workspaces/ewg-durum-wheat-genomics-and-breeding>).

The genotyping of the DWRC accessions has been carried out using the DNA extracted from a single plant/accession; the same plant has been used for increasing the seed lot of the accessions. The DNA of these plants is presently stored at LGC where it will be available for the next 3 years. Molecular data are available to those members that are interest to carry out further analysis.

In summary, the analysis of the molecular and phenological data have been carried out based on the criteria presented below.

In total, 2,503 tetraploid accessions were genotyped with 96 KASP markers, including *RhtB1b* and *Vrn1*. The accessions represented a worldwide collection of elite durum cvs. and advanced lines, durum landraces, tetraploid durum subspecies (*T. dicoccum*, *T. dicoccoides*), durum lines from the INRA evolution population (six main subsets).

The complete genotypic matrix was filtered for uninformative markers and for genotypes with >50% missing data and used to generate a simple matching genetic similarity matrix for each subset. A joint inspection of accession name/pedigree/molecular similarities has identified about 400 duplications and 2,095 non-redundant accessions were retained.

DURUM ELITE	DURUM LANDRACES	TETRAPLOID SUBSPECIES	T. DICOCCUM	T. DICOCCOIDES	INRA EVOL POP
-------------	-----------------	-----------------------	-------------	----------------	---------------

1146	388	79	219	88	175
------	-----	----	-----	----	-----

In order to generate a stratified collection of 960 accessions (the final DWRC composition), the following number of accessions were set.

ELITE DURUM FOR MEDIT-LIKE CLIMATE (semi-dwarf, vernalization insensitive)	288 (3 plates)	1 plate CIMMYT MATERIALS
		1 plate ICARDA MATERIALS
		1 plate MEDITERRANEAN materials (Italy + Spain + north Africa + desert durum + others)
ELITE SEMI-DWARF DURUM PHOTOP-SENSITIVE/VRN SENSITIVE	96 samples (1 plate)	PPD/VRN (French + central Europe + mixed origins)
DURUM VARIETIES NON-SEMIDWARF (TALL)	96 samples (1 plate)	1 plate of tall accessions (Canadian + mixed origins)
DURUM LANDRACES (TALL, GENET DIVERSE)	192 samples (2 plates)	Selected to maximize diversity
T. DICOCCUM	96 samples (1 plate)	Selected to maximize diversity
T DICOCCOIDES + TETRAPLOID RELATIVES	96 samples (1 plate)	Selected to maximize diversity
INRA EVOLUTION_COMPOSITE_CROSS	96 samples (1 plate)	Selected to maximize diversity

In each group the accessions were chosen according to the following criteria:

- Inclusion of important founders/parents of mapping populations and sampling most of the origins and pedigrees within each sub-group.
- considering the information available on heading date, plant height and seed production. Heterogeneous accessions in the field (labeled as MIX under “observations”) were discarded.
- genetic distance; accessions with a low genetic similarity were selected.

A list of selected accessions were presented and discussed considering that the objectives of the DWRC are (i) to use GWAS for the identification of loci controlling the variability of target traits and (ii) to identify novel haplotypes/alleles (allele mining) at known loci of agronomic interest. Given the large variation in the panel for flowering time, plant height and lodging, concern was expressed by some EWG members (particularly the breeders) as to the possibility to properly evaluate the panel for traits influenced by such traits. This notwithstanding, it was underlined that the composition of the panel and its organization in four main subpanels (elite, landraces, durum relatives and INRA evolution population) provides sufficient flexibility to properly manage this problem. The final list of accessions will be released by October 25. Accordingly, EWG members are invited to send suggestions on DWRC composition not later than October 20.

The plants selected for DNA isolation in 2016 will undergo a first round of multiplication in 2017. Bassi at ICARDA will manage the seed increase for all the 960 selected accessions and will make the seed available for the second increase in 2018. Should funds be available to cover the cost of the second increase, Bassi is available to manage this second round of increase in 2018.

From the discussion has emerged that a number of accessions have been already subjected to exome-sequencing. Partners willing to share the exome-sequencing information as an in-kind contribution for the DWRC should inform the chairs of the EWG. The full implementation of the deep genotyping of the DWRC will be possible only if suitable funds will be made available.

As to the phenotyping of the DWRC, the full discussion on this topic was moved to one of the next EWG meetings, since in 2017 seed will undergo multiplication and are not available for phenotypic analysis. Notwithstanding some EGW members have indicated already their interest to phenotype one or more subsets of the collection or even the entire collection as follows: Budak: field evaluation for main phenological traits; Tuberosa: root system architecture at the seedling stage in controlled conditions; Xu: disease resistance (leaf rust, stripe rust, Septoria, Fusarium) under controlled conditions; Igrejas: new nomenclature for seed storage proteins).

Actions:

Marco Maccaferri will finalize the DWRC composition considering all the comments of the EWG member and will release the final DWRC list by October 25 2016.

Filippo Bassi (ICARDA) will manage the multiplication (season 2016/17) of the 960 accessions selected for the DWRC.

Ahmed Amri (ICARDA gene bank) will store all the 2,095 non-redundant accessions collected for the DWRC project.

Update on wheat genomics and breeding. The discussion on the DWRC was followed by 6 presentation addressing issues relevant for the genomics and breeding of durum wheat. The pdf files of the presentations are available at the Durum Wheat Genomics and Breeding EWG workspace. Two presentations were contributed by members of other EWGs invited to promote the interaction between the EWGs of Wheat Initiative. Gilberto Igrejas has given a presentation of the members and subgroups of the EWG on “Improving Wheat Quality for Processing and Health” and has illustrated the possible collaboration of the Quality-EWG to implement the DWRC project. Ahamed Amri has presented the activity of the EWG on “Global Wheat Germplasm Conservation and Use Community” and the interactions with the DWRC activities.

Progress in the durum sequencing project. Cattivelli provided an update of the activities for the assembly of a high-quality sequence. All the details are reported in the file available at the Durum Wheat Genomics and Breeding EWG workspace.

In summary, an international consortium comprised of eight research institution has completed the sequencing and the assembly of the genome of the durum wheat cultivar Svevo. Sequencing was carried out using an Illumina whole shotgun approach assembled with DeNovo MAGIC software (c/o NRGene). The output was ordered along the genome using Chromosome conformation capture (Hi-C) and the annotation of the genome is in progress.

The *de novo* assembly of the genome of cv. Svevo paves the way toward a project aimed at investigating/defining the pangenome of tetraploid wheat and its comparison to the bread wheat pangenome.

Financial support for future research activities. Lucas pointed out that the Wheat Initiative is not a funding agency and does not have funds to support research activities. This notwithstanding, the Wheat Initiative can support meeting and other initiatives

devoted to the organization of new projects whose sustenance needs to be secured otherwise. Therefore, the possibility to move on with the DWRC project, the pangenome project and/or any other project will depend on the resources (either in kind or through dedicated funds) contributed by the partners involved in the project. Accordingly, the relevant partners will contact the funding agencies in their respective countries to verify their willingness to support such activities.

Lucas suggested that a full description of the DWRC project was written so that potential participants identify and share the area/actions to which they could contribute and seek the corresponding funds at national level.

At the EU level, lobbying activities should be undertaken through contacts with different stakeholders (e.g. Ministries, National Technological Platforms, EPSO, ESA, ISF, farmers' associations, seed industry, etc.) to increase the possibility that future calls include durum wheat as such or as a model to identify loci relevant also for gene discovery and/or breeding of bread wheat.

Actions:

All: verify the possibility to attract national funds for the implementation of the DWRC project.

Interactions with other EWGs. In view of the importance of quality in durum wheat, an interaction with the EWG on quality would be very valuable. Gilberto Igrejas was invited for a presentation on how to phenotype wheat seed/flour for quality. Seed of the DWRC will be made available for quality testing.

Once sufficient seed of the 960 DWRC accessions will be available, valuable collaborations can be envisaged with the EWGs on;

- abiotic stress
- biotic stress
- phenotyping
- genetic resources.

Other issues discussed during the meeting were the following:

- Definition of a better acronym for the DWRC project. Several suggestions were made during the meeting: BBDur (Biodiversity for Breeding in Durum wheat), Bio-Dur (Biodiversity for Durum wheat breeding), DNA4Wheat (Durum_iNitiative_Advances_4_Wheat), dw-BRIDGE (durum_wheat-BReeding_Initiative_baseD_on_GEnomics). Those interested in suggesting additional acronyms are kindly requested to send us their suggestions.
- Galeffi suggested to have regular Skype meetings, an option that would allow for a broader participation at no additional cost. Tuberosa asked Lucas if the Wheat Initiative office might be able to manage such meetings. Lucas mentioned that the Wheat Initiative is equipped for Webex meetings with a large number of participants and is willing to provide the required technical support.
- The next EWG-DWGB meeting will be held at the Plant & Animal Genome Congress to be held in San Diego from January 13 to 18, 2017. The suggested date/time for the meeting is Monday, 16 January from 6 to 8 pm. A request has been presented to the PAG organizers for a meeting room.
- A survey will be sent to all EWG leaders to prepare the EWG Jamboree that will be held in Frankfurt, December 6-7. The EWG leaders will be expected to circulate the

survey to all members of the EWG and send a summary of their answers to the Wheat Initiative.

Acknowledgment: The EWG wishes to thank Filippo Bassi and ICARDA for hosting the meeting and for the hospitality and Wheat Initiative for providing travel support to a number of participants. A special thank to Ahamed Amri for the visit to the gemplasm bank at ICARDA.

ATTACHED DOCUMENTS

Please provide a list of the documents attached to the meeting report

- Annex 1: list of participants.
- Annex 2: DWRC list of selected accessions.