



ECPGR Activity Grant Scheme Proposal Form

Second Call – Phase X (2019-2023)

Activity Proposal

Activity	
Full title	Updated MORPHological dEscriptors for Avena Species
Acronym (or short title)	UMORPHEAS
Duration of Activity (in months)	24
Start date – End date Please indicate start date not earlier than 3 months after deadline of Call	March 2020 – February 2022

Applying Working Group(s)

	Working Group	Indicate name and surname of Working Group Chair
1.	Avena	Andreas Katsiotis
2.		
3.		
4.		

Activity Coordinator

Activity Coordinator	
Name and Surname	Andreas Katsiotis
Working Group	Avena
Nationality	Greek
Current position	Professor
Institute	Cyprus University of Technology
Country	Cyprus
Telephone	+357 25002498
Email	andreas.katsiotis@cut.ac.cy

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Activity Partners (ECPGR-funded)

Please note that each partner needs to be a member of an ECPGR Working Group to be eligible for funding. For self-funded partners please use the separate box below.

Partner ID No.	Name and Surname	Institute	Country
1	Dr Tim Langdon	Aberystwyth University Institute of Biological, Environmental and Rural Sciences	United Kingdom
2	Dr Christoph Germeier	Julius Kuehn Institute, Federal Research Centre for Cultivated Plants	Germany
3	Dr Peter Hozlár	National Agricultural and Food Centre Research Institute of Plant Production, Research Breeding Station	Slovakia
4	Dr Angelos Kyrtzis	Agricultural Research Institute Ministry of Agriculture, Natural Resources and Environment	Cyprus
5	Dr Andreas Katsiotis	Cyprus University of Technology, Department of Agricultural Sciences, Biotechnology and Food Science	Cyprus
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Self-funded partners

Partner No.	Name and Surname	Institute	Country
1	Dr Nikolaos Nikoloudakis	Cyprus University of Technology, Department of Agricultural Sciences, Biotechnology and Food Science	Cyprus
2			

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Description of Activity (suggested max. 1000 words)

Please address the following aspects:

– **Background:** Explain the context behind the choice of this Activity, e.g. why this has been prioritized or selected. If this is the continuation of a preceding Activity, please indicate how and why the new Activity will build on previous results/experiences.

It has been almost 35 years since the ‘Oat Descriptors’ were published by the International Board for Plant Genetic Resources, based upon a list of descriptors selected by the Oat Working Group of ECP/GR. Oat was among the first crops for which descriptors were set, helping the whole oat community (from genebank curators to plant breeders and academic researchers) in characterizing the germplasm.

Since the 1985 publication, there has been huge progress in using molecular tools for genetic analyses and trait characterisation of plant species, including oats. In particular the advent of genomics and high throughput genotyping has led to renewed interest in large scale screening of genebank diversity (eg <https://www.nature.com/articles/s41588-018-0266-x>). For oats, new species have been discovered and phylogenies updated, while work in the two RES-GEN EU projects identified constraints and limitations on the use of the published descriptors, mainly deriving from loose interpretations of the categories within each descriptor by users (e.g.. Erectness of panicle: drooping (3), semi-erect (5), erect (7)). Several genome assembly projects for hexaploid oat are underway, including one by the UK partner, (<https://gtr.ukri.org/projects?ref=BB%2FS008195%2F1>), and discussions are now underway to establish a pan-genome consortium which will require a detailed reassessment of germplasm to capture representative diversity for breeding programmes and conservation strategies. As pan-genome projects mature the emphasis shifts to integration of datasets at all scales, from field to metabolite, and reliable ontologies enable comparative studies to be extended even across crops (e.g. Planteome project, <http://planteome.org/>; TAS system, doi.org/10.1186/s12864-019-5812-0). The goal of these efforts is to improve resilience and sustainability of crops, with increasing use of non-elite material in breeding programmes (e.g. <https://gtr.ukri.org/projects?ref=BB%2FJ011827%2F1>).

– **Justification:** Explain why this Activity is justified in terms of making progress towards achieving the ECPGR objectives.

An update of the ‘Oat Descriptors’ would be valuable simply to reflect the better understanding of ECPGR relevant germplasm developed over the last 35 years. However, improvement becomes of critical importance if genetic resources for oats are to be developed in line with other crops, such as wheat and barley, as genomics and high throughput analyses allow characterisation of entire genebank collections. These analyses both promote the efficient use of preserved diversity and point up areas of deficiency where fresh collection and conservation should be directed.

As outlined above, there is an increasing demand for accurate descriptor guides that may be reliably

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used by non-specialists to ensure uniform scoring of phenotypes across a variety of oat research projects. The proposed project will have an impact on the first two objectives set by ECPGR for Phase X. More specifically, the development and updating of the oat descriptors list can provide a precise and concise reference (with photos for category clarification for each descriptor – where applicable) for characterizing an accession. Furthermore, a 'short' list of the most informative and variable descriptors will also be developed. In this way unique germplasm will be better described, helping decision making for entries included in AEGIS. Additionally, the phenotypic information will be precise and will enhance selection. Furthermore, in the era of molecular genetics there is an increased need to develop a more robust and easy to use tool for phenotyping, including passport data, descriptor list and key evaluation traits.

In the proposed project categories within descriptors (where applicable) will be accompanied by digital photos, providing a reference for scoring uniformly characters, minimising bias due to the personal perception of the researcher. Since the same germplasm will be planted in four edaphoclimatic diverse locations (Germany, UK, Slovakia and Cyprus), stable and environmentally influenced descriptors will be identified and mentioned. Furthermore, a core-set of key descriptors will be defined.

– Rationale for the choice of partners: Explain why the selected partners are the most suitable to carry out the proposed Activity and briefly describe their respective roles in the Activity.

All selected partners are most suitable to carry the proposed activity, since they are all active in oat research and have knowledge on phenotyping and genotyping oats.

Andreas Katsiotis is the current chairman of the Avena Working Group, was the coordinator of the Avena landrace characterization project (Council Regulation No 1467/1994) and has experience in phenotyping and genotyping. He works closely with the self-funded partner Nikolaos Nikoloudakis in characterising Avena species..

Angelos Kyratzis is the Genebank Curator at the Agricultural Research Institute, Cyprus and has knowledge on phenotyping and collecting cereals.

Christoph Germeier was the coordinator of the AVEQ project (Council Regulation No 870/2004), a major initiative to promote the use of European oat landraces. AVEQ material still provides the core collection for a number of research programmes.

Peter Hozlar is the Genebank Curator and plant breeder at the National Agricultural and Food Centre Research Institute of Plant Production, Research Breeding Station Viglas Pstrusa, Slovakia.

Tim Langdon is using high throughput genotyping and genomic resources to characterise Avena hexaploid diversity and clarify oat domestication.

– Methodology or Approach: Explain how the partners will operate. Clearly explain who is expected to do what. Also explain the rationale of meeting (or not) as part of the Activity. Include a Gantt Chart, to illustrate the work breakdown structure of the project.

At first all partners involved will have to provide information about accessions under their possession that show variability for the Avena descriptors published in the 1985 publication. Next step is to select which of the above material will be multiplied by the holder and distributed to the other partners. There is available information regarding the variability among the different accessions from the data recorded during the two funded RES-GEN EU projects. All partners should agree in developing a number of descriptors list at different developmental stages according to Zadok's scale. All selected entries will be planted by all partners and data will be recorded according to the agreed descriptors. Comparisons among the recorded data under the different environments will be performed in order to reveal their stability/plasticity. Based on the above information a 'short' list of most appropriate descriptors will also be developed (after consulting with expert oat plant breeders – following an

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equivalent pipeline for wheat descriptors – Bioversity International; survey during the International Oat Conference at Perth 2020). For the agreed descriptors digital photos will be included for each category within each descriptor (where applicable) for easily identifying the category of the trait.

		M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
	Activities (2020-2022)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Seed regeneration																								
2	Descriptor list agreed																								
3	Field																								
4	Short descriptor list																								
5	Development of revised descriptors for oats																								
6	Meeting																								

– Description of genetic material: If your Activity is focusing on genetic material, please describe in detail, as far as possible, who is providing this genetic material, its status and the number of accessions under investigation (for example: *This Activity aims at molecularly analysing / safety-duplicating / evaluating / collecting XY accessions (listed) of “Genus species”, provided by genebank Z/ farmers in country W /to be collected in country P..., etc.*).

The genetic material used in the present project will be contributed by the partners. Previous data available from the two GEN-RES EU projects will be used in order to select entries that cover most categories within each descriptor. We expect to have at least 50 *A. sativa* and *A. byzantina* entries and not more than 100, as well as about 10 *A. strigosa* entries, that will be distributed among all partners to be planted.

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– **Expected impact.** Clearly specify the expected impact from this Activity for the respective ECPGR objective(s), compared to the current state of progress of those same objectives. Explain how the impact will be obtained.

The goal of the present project aims to update and replace the 1985 Oat descriptors IBPGR publication, by delivering a standardized protocol for descriptors included. Also it will be an updated aid in better characterizing the oat accessions proposed to be included in AEGIS. Furthermore, development of such complete descriptors for oats will have an impact also on the ongoing genotyping efforts of the oat community.

The need to develop an accurate and reliable tool for differentiating and describing germplasm is a necessity for molecular genotyping techniques. The deliverable of this project can become an indispensable tool for phenotyping the cultivated oats.

– **Links with other non-ECPGR projects or individuals:** If applicable, clearly explain the objectives of the linked projects and the reasons for complementarity with the ECPGR Activity.

The UK partner's institute is home to the National Plant Phenomics Centre (<https://www.plant-phenomics.ac.uk/>) supported as a national capability by BBSRC and a European research infrastructure centre by the EU (<https://eppn2020.plant-phenotyping.eu/>). Its director, Prof John Doonan, is involved in a variety of initiatives which integrate multi '-omic' data. The most relevant for this Activity is Planteome, a US based project which covers many crops although not currently oats. Prof Doonan will help develop oat community efforts to establish Planteome like resources for oats, and will advise on choice of ontology terms and characters which will allow comparison across databases. Consistency across species will allow much more powerful analyses to be carried out and will add value to community investments in oat genetics and genomics.

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Expected products and related ECPGR Objectives

List concrete products and results that are obtained by the Activity and the corresponding number(s) of the ECPGR Outcome(s) and/or Output(s) and/or Activities to which each product/result will contribute.

	Expected products/results	Corresponding ECPGR output, activity
1	Publication of oat descriptors	1.2 (1.2.1) 1.6 (1.6.2) 1.9 (1.9.1) 2.1 (2.1.2) 2.2 (2.1.3)
2	Publication of key set of characterization	
3		
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Workplan for the proposed period of the Activity

Brief description of meetings and/or main actions of the Activity.

	Type of Action (indicate if “meeting” or “other action”)
1	We anticipate to have two meetings; one at the beginning of the project in order to agree on the format and traits to be included; the second meeting will be scheduled towards the end of the project in order to fine tune the output (publication of descriptors’ list)
2	Regeneration of material selected by the partners and distribution
3	Field data collection and digital photos
4	Development of a key set of characterization and evaluation descriptors
5	Development and publication (on line) of the updated ‘Oat descriptors’

