

MALUS/PYRUS WG REPORT FOR PHASE IX (2014-2018)

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by: Marc Lateur

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1. CONTRIBUTION TO ECPGR OBJECTIVES

1.1. Achievements and success stories

Outcome 1. AEGIS is operational. Accessions in AEGIS are characterized and evaluated.

EcoHisPy

- In the framework of the project, 16 SSR markers data have been produced and analysed for 149 European historical pear accessions from 16 countries. These data have been compared with German and English already published data. Principal results are: (i) it is a very good exercise on the methodological point of view by having clearly demonstrated that SSR data produced by different labs – even with the same markers – may not be compared if no harmonized heavy work is done prior to the analysis for defining for each accession proper pair-bases numbers in line with control cultivars; (ii) original and unique accessions have been identified: out of 142 accessions data that could be analysed (7 were discarded due to missing allele data), 130 were clearly different genotypes which pointed out 11 synonyms mostly within the country but also between countries.
- 116 historical European pear cultivars, which are part of the list of 130 cultivars verified with common phenotypic and genotypic data, have been collected. Procedure to define these cultivars as “EURISCO Candidate” is ongoing prior to their upload to the EURISCO catalogue with the “AEGIS Candidate” flag.

Pomefruit C&E

- “ECPGR Methods and descriptor lists for the Characterization and Evaluation of apple & pear genetic resources” will be finalized, approved and widely disseminated through ECPGR and partners channels. Such common and harmonized protocols and descriptors are a prerequisite for collecting characterization and evaluation data that will be uploaded to EURISCO.
- Common harmonized and standardized SSR data on apple and pear genetic resources accessions is a tremendous and useful tool for helping to track duplicates, homonyms, synonyms and errors inside and between European collections and for pointing out most unique and original material. This is a very important step for helping to define the MAAs to be proposed and flagged as “AEGIS Candidate” accessions.

Outcome 2. Quantity and quality of data in EURISCO, including in situ and on-farm data, have been increased. Functionality of EURISCO meets users' expectations

EcoHisPy

- 116 historical European pear cultivars have been characterized and evaluated with 22 common phenotypic descriptors (2 on phenology – flowering period and period of fruit maturity; 8 on fruit description and agronomic behaviour; 8 on fruit quality parameters and finally, 4 on assessment of disease susceptibility). All data have been encoded - for some traits there are missing data - on standardized templates in preparation for uploading in EURISCO.
- Based on the EcoHisPy SSR data set analysis, 23% of the accessions have been identified as clear triploids. Such information is very important for potential users, especially breeders, because triploid cvs are very poor parents in breeding works.

Outcome 5. Relations with users of germplasm are strengthened

EcoHisPy

- A first draft catalogue in English of 112 European historical pear cultivars with fruit pictures that summarize the main information on their history, main characteristics, qualities and pointing out their different uses was produced. The draft document was transferred to ECPGR and will be sent to their authors for final revision. This document will then be widely disseminated to researchers, the public, nurseries, breeders, through ECPGR channels and national websites. It is a key element for developing an ECPGR Pyrus portal.

Pomefruit C&E

- “ECPGR Methods and descriptor lists for the Characterization and Evaluation of apple & pear genetic resources” will be finalized, approved and widely disseminated through ECPGR and partners channels.
For pear, a total of 12 traits (5 for characterization and 7 for evaluation) and 18 descriptors were agreed to be scored in each collection on a common set of 9 reference cultivars. For apple, the same exercise was agreed to be implemented on 14 traits (5 for characterization and 9 for evaluation) with 20 descriptors on 11 common reference cultivars.
- ECPGR Collaboration agreement for sharing SSR data will be defined and adopted by partners and other European Colleagues – from other continents too.
So far just an informal agreement for sharing SSR data was concluded by the partners via exchange of emails. At the same time, verbal agreements were established between the project and USDA institutions (Geneva for apple and Corvallis for pear) for sharing SSR data. SSR data were received from USDA and preliminary alignment was performed, although the number of common markers is limited. Pear DNA for ca. 600 accessions was also received from Corvallis and some additional genotyping might be performed, based on budget availability.
- The harmonized set of SSR marker data of apple and pear genetic resources will be stored in a database and offered in open access on ECPGR website and encoded in EURISCO.
In the case of pear, for a total of 4766 pear accessions representing 11 collections from 8 countries, SSR data including at least 12 common ECPGR SSR markers are potentially ready to be shared. This high number of already collected data is a good surprise because it is much higher than what was foreseen at the time of project writing. The actual sharing can be completed after data alignment and data harmonization is completed. Analysis of already

harmonized data started for seven collections with the view to track putative synonyms, duplicates and/or errors. In the case of apple, duplicate-tracking work has been completed for the German collection and is still ongoing for two other collections.

- A scientific paper is planned to be published on the results of the study of genetic diversity of European pear genetic resources.

1.2. Gaps or constraints identified

- WG functioning:
 - The new nomination procedure of WG members by NCs is to be re-evaluated; it probably needs a compromise between the old and the new system (e.g. one responsible/country + some complementary experts as 'assistant' depending on specific topics).
 - It is proposed to organize periodically WG meetings for all members in order to achieve sufficient interaction with each country – then asking to each member to produce periodically a short activity report.
 - Difficulty to find out in such transition period the good procedure for choosing Chairs and therefore the evaluation procedure that has been organized was not so appropriate. The nomination of a Vice-Chair is very important for a good functioning of the WG.
- ECPGR public, PGR potential users and decision-makers awareness:
 - Need for a much better communication strategy from ECPGR to enhance (1) its official status, (2) the multiple roles, objectives and strategies; (3) the functioning procedures and tools; (4) its results.
- AEGIS concept:
 - There is a proposal to discuss on the concept to introduce intermediate steps like (1) intra-country sub-regional list of cvs + MAAs flagged as “**AEGIS Candidate**”; (2) National list and proposed MAAs that **get an official status** from regional and national governments as “**AEGIS Candidate**”; (3) Submission of those lists to EURISCO and WGs; (4) Evaluation of the choice of candidate MAAs; (5) Taking the official decision at National level with official engagement signed.
 - In parallel with a pan-European system, ask countries to build smaller networks of trans-borders regions and/or countries that work together for sharing responsibilities and signing protocols of cooperation to share responsibility officially.
 - Big difficulties with perennials and vegetatively propagated PGR with quarantine pest & diseases that reduce drastically the free exchange of material – efforts are needed to tackle this problem encountered by many collection curators. This topic needs to be tackled urgently – link with Bioversity International project on cryoconservation???
- New ECPGR Grant scheme process:
 - It has the advantage to be a bottom-up procedure
 - More partners wanted to get some funds that are very limited
 - Deliverables need to be more focused to enhance public, PGR potential users and decision-makers awareness.
 - There is an important need to point out the importance for curators to implement pre-breeding actions.

2. GRANT SCHEME ACTIVITIES

- **Grant Scheme proposals (submitted: 2; approved: 2)**
 1. [Building and promoting a European *Pyrus* collection - a case study \(ECoHiSPy\)](#) – First Call (2014)
 2. [Common ECPGR protocols and tools available for Characterization & Evaluation of *Malus/Pyrus* genetic resources \(Pomefruit - C&E\)](#) – Fourth Call (2016)
- **Total number of partners involved for both projects: 27 from 21 countries**
 - ECPGR-funded: 18 from 18 countries
 - Self-funded: 13 from 10 countries
- **Meeting held**
 1. Pomefruit C&E project meeting, 26-27 April 2017, Gembloux, Belgium.
- **Reports and related data**
 1. **EcoHisPy**

The Final Report is at final draft stage but still needs to be finalized.
 2. **Pomefruit C&E**
- Lateur M., Ordidge M., Denance D., Durel C.E. (February 2018). Pomefruit – C & E - Progress Activity Report 2017. (internal distribution/under revision)
- **Funds mobilized**
 - ECPGR granted funds: € 30 000
 - Inputs in-kind declared in Grant activities: € 26 250.

3. OTHER ACTIVITIES (CROSS-WORKING GROUP ACTIVITIES, LINKS WITH OTHER NETWORKS, PROJECTS AND INITIATIVES)

- The WG Chair organized a short meeting with 9 attending members during the “EUCARPIA – Fruit Genetics & Breeding” symposium held at Bologna, 15-18 June 2015.
- Generate overviews of the *Malus/Pyrus* Genetic Resources situation.
 - In the framework of the EU FruitBreedomics project, the Chair organized a survey on different topics (Facilities, ranking objectives of collections, C&E current activities, uses of collections, implementation of national/core collection, pre-breeding & breeding activities, use of molecular markers) across the *Malus/Pyrus* Genetic Resources community.
 - Contribution to the survey in 2015 of the Global Crop Diversity Trust to assess the collection status of Apple Collections Worldwide.
 - Active collaboration with the Global Crop Diversity Trust on their project on “**Global Conservation Strategy for Apple Genetic Resources: A framework for ensuring the effective long-term conservation and use of apple genetic resources**” (Paula

Bramel and Gayle Volk) – November 2017 and a meeting has been organized at Gembloux on 20f March 2018.

- **Initiate and coordinate the preparation of project ideas and proposals for funding:**
 - Active contribution to the setting up of projects in response to the EU call topic Research and Innovation actions - SFS-07 a & b 2015-2015: Traditional resources for agricultural diversity//Management and sustainable use of genetic resources:
 - a. **“Local Pome Fruit” – Utilization of local apple and pear varieties for sustainable horticulture and healthy food production.** (Coordinator: Viola HANKE). Seven members of the *Malus/Pyrus* WG were involved, the Chair as co-coordinator of WP1 dealing with C&E of genetic resources collections.

The main objectives were (1) Enhancing characterization and evaluation of local apple and pear cultivars preserved in European *ex situ* collections; (2) Evaluating local apple and pear cultivars for new production systems and markets; (3) Utilizing local apple and pear cultivars in fruit breeding and pre-breeding; (4) Evaluating the socio-economic effects of a diversification of fruit production, and consumers’ perspective on local apples and pears.

Project submitted 1st step, 12/03/2014; second step, 26/06/2014.
Final score: 13/15 – not funded.
 - b. **“Pome Fruit GENRES” - Management and utilization of pome fruit genetic resources for sustainable horticulture and healthy food production.** (Coordinator: Viola HANKE – JKI, Dresden). A huge number of **18 *Malus/Pyrus* WG members** were involved in this project. The Chair was coordinator of WP1 dealing with *ex situ* collections - Networking, harmonizing management and safe conservation.

The main objectives were: (1) Harmonize and enhance management of existing *ex situ* collections and databases and implement conservation systems for pome FGR - contribution to the coordination of the European Genebank Integrated System for apple and pear, building on the AEGIS concept with defined rules for responsibility sharing across European collections. Identification of priority sets of cultivars (Priority European Accessions, PEA) with unique and diverse traits, and nomination of Most Appropriate Accessions (MAAs) for inclusion in the AEGIS European Collection and finally in the EURISCO DB; (2) Enhance acquisition and support conservation of CWR; (3) Enhance characterization and evaluation of pome FGR conserved in *ex situ* collections; (4) Sustainable use of pome FGR in fruit breeding and genetic enhancement; (5) Sustainable use of pome FGR in farming and product development; (6) Consumer acceptance of traditional cultivars; (7) Awareness raising and dialog among actors and target groups.

Project submitted 1st step, 03/02/2015; second step, 11/06/2015.
Final score: 14.5/15 – not funded! Extremely frustrating exercise.
 - c. **“EUFRUNET” - European Fruit Resources Diversity Network** (Coordinator: Jean-Marc AUDERGON – INRA, Avignon.)
SFS-7-2014/2015: Genetic resources and agricultural diversity for food security, productivity and resilience, B. [2015]

Five *Malus/Pyrus* WG members were involved in this project. The Chair was coordinator of WP2 dealing with definition of new evaluation methods fitting with next future fruit growing challenges.

The main objectives were: (1) Progress in the identification and characterization of fruit-tree genetic resources;(2) Progress in the definition of new traits and adapted evaluation methods fitting with next future fruit growing challenges; (3) Progress in the evaluation of the sanitary status of fruit-tree genetic resources; (4) Progress in

optimizing the exploitation of the Fruit GR to increase breeding efficiency; (5) Progress in the coordination of an EU-harmonized evaluation of the Fruit GR.
Project submitted 1st step, 03/02/2015; second step, 11/06/2015.
Final score: 9.5/15 – not funded.

- d. **“SOFIBA”** - Sustainable Organic Fruits through Integrated Evaluation and participatory Breeding Approach. (Coordinator: Jean-Marc AUDERGON – INRA, Avignon.)
Call topic: SFSCall topic: SFS-7-2016 -2017 – Organic Breeding – Increase competitiveness of the Organic Breeding and farming sector.

One of the Work Package was devoted to promote the utilization of local apple and pear genetic resources in breeding, pre-breeding and participative breeding approaches.

Project submitted 1st step, March 2017; second step, September 2017.
Final score: 10/15 – not selected for funding.

- Participation in 2015 to the survey organized by EURISCO DB Manager on the current status of the *Pyrus* Central Crop Database.
- Active participation to the ECPGR Networking Meeting – WGs Chairs’ Meeting - 17-18 October 2017, Ljubljana Slovenia.

4. WORKING GROUP DOCUMENTS AND PUBLICATIONS

- **Working Group documents (internal distribution)**

Lateur M., Bosschaerts J., Houben P. (2016). Work -Document ECPGR - Main synonyms, pomology references and historical country of origin of old pear cultivars.

Lateur *et al.* (2017). ECPGR Methods and descriptor lists for the Characterization and Evaluation of apple genetic resources – Last Draft Document 2017.

Lateur *et al.* (2017). ECPGR Methods and descriptor lists for the Characterization and Evaluation of pear genetic resources – Last Draft Document 2017.

- **Publications**

Lateur, M. (2017). Fruit tree genetic resources PPP projects boosting uses of genetic resources and public awareness. In “Private-Public partnership for the use of Plant Genetic Resources for Food and Agriculture, (Ed. I. Thormann). Report of a Workshop – ECPGR, Bioversity International & German Ministry of Food and Agriculture - 7–9 June 2017, Bonn, Germany.

Lateur, M. (2017). *Malus/Pyrus* Working Group, achievements and perspectives. Lecture presented during the ECPGR WG’s Chairs Meeting - 17-18 October 2017, Ljubljana Slovenia.

Lateur, M., Matthew Ordidge, Monika Höffer & Charles-Eric Durel: Common protocols and tools for characterisation and evaluation of *Malus/ Pyrus* genetic resources – an ECPGR project. Lecture presented during the annual and 25th EUFRIN Board meeting – 15th of November 2017, Brussels.

- **Related posters, lectures and publication on Pome fruit Genetic resources**

- Durel, C., C. Denancé, E. Ravon, L. Feugey, A. Guyader, R. Guisnel, L. Lassois, M. Lateur, S. Tartarini, L. Dondini, F. Paprstein, J. Sedlak, M. Ordidge, F. Fernandez-Fernandez, H. Nybom, L. Gustavsson. (2014). Genetic diversity, structure and parentage analysis within several European apple germplasm collections assessed by microsatellite markers. 7th International Rosaceae Genomics Conference, Seattle, WA. June 24-26, 2014. Oral presentation.
- Lateur, M., Bruneaux G., Rondia, A., Rey, J-B., Poirson, C., Dupont, H., Houben, P., Delahaye, Delpierre, L. et Sievenard, R. (2015). Les Poiriers Palissés – Une tradition du Nord-Pas de Calais et de Wallonie. Ed. INTERREG IV Biodimestica, Gembloux, 126 p.
- Bastiaanse, H., Muhovski, Y., Mingeot, D., Lateur, M. (2015). Candidate defense genes as predictor of partial resistance in old Belgian cultivar ‘Président Roulin’ against apple scab caused by *Venturia inaequalis*. *Tree Genetics & Genomes* 11:125. DOI 10.1007/s11295-015-0948-9.
- Urrestarazu J., Denancé C., Ravon E., Guyader A., Guisnel R., Feugey L., Poncet C., Lateur M., Houben P., Ordidge M., Fernandez-Fernandez F., Evans K. M., Paprstein P., Sedlak S., Nybom N., Garkava-Gustavsson L., Miranda M., Gassmann J., Kellerhals M., Suprun S., Pikunova A.V., Krasova N.G., Torutaeva E., Dondini L., Tartarini S., Laurens F. and Durel C.E. (2016). Analysis of the genetic diversity and structure across a wide range of germplasm reveals prominent gene flow in apple at the European level. *BMC Plant Biology* 6:130. <https://doi.org/10.1186/s12870-016-0818-0>
- Lateur, M., Stiévenard, R., Donis, T., Rey, J-B, Rondia, Filatre, J-Y., Jamar, L., Delebecq, A., Dujardin, D. (2016). Une sélection participative avec les producteurs. Article de Lecore, M. dans la revue *Réussir Fruits & Légumes* **364** :42-43.
- Lateur, M., Stiévenard, R., Donis, T., Rey, J-B, Rondia, Filatre, J-Y., Jamar, L., Delebecq, A., Dujardin, D. (2016). Des variétés créées en bio et bas intrants. Article de Rivry-Fournier, C. *BIOFIL* **106** :40-42.
- Lateur, M. (2017). Fruit tree genetic resources PPP projects boosting uses of genetic resources and public awareness. In “Private-Public partnership for the use of Plant Genetic Resources for Food and Agriculture, (Ed. I. Thormann). Report of a Workshop – ECPGR, Bioversity International & German Ministry of Food and Agriculture - 7–9 June 2017, Bonn, Germany.
- Lateur M., Rey J.B., Oste S., Delebecq A., Jamar L., Tournant L., Rondia A., Houben P., Boucherie R., Bruneaux G., Watteau K., Grogna P., Minet L., Poirson C., Olivier T., Delpierré L., Pennetraux Y., Stiévenard R. (2017). Projets fruitiers transfrontaliers de recherche & développement pour valoriser les anciennes variétés et la production biologique. Poster présenté à la rencontre de partenariat sur les projets européens en agriculture biologique organisée par la DGER le 24 janvier 2017 au MAAF, Paris. <http://agriculture.gouv.fr/projets-de-recherche-innovation-europeens-0>
- Urrestarazu J., Muranty H., Denancé C., Leforestier D., Ravon E., Guyader A., Guisnel R., Feugey L., Aubourg S., Celton JM., Daccord N., Dondini L., Gregori R., Lateur M., Houben P., Ordidge M., Paprstein F., Sedlak J., Nybom H., Garkava-Gustavsson L., Troggio M., Bianco L., Velasco R., Poncet C., Théron A., Moriya S., Bink M., Laurens F., Tartarini S., Durel C.E. (2017). Genome-Wide Association Mapping of Flowering and Ripening Periods in Apple. *Front Plant Sci.* 2017 Nov 10;8:1923. doi: 10.3389/fpls.2017.01923. eCollection 2017.

Garkava-Gustavsson L., Zborowska A. Dörre M., Ghasemkhani M., Wenneker M., Englund J.-E. , Lateur M., van de Weg E. (2017). Phenotyping of resistance to European canker across genetically diverse germplasm. Third International Workshop on Apple Canker and Replant Disease. 1st -3rd November 2017. East Malling Research, United Kingdom.

Sehic S., Gaši F., Benedikova D., Blouin M., Drogoudi P., Giovannini D., Höfer M., Lacis G., Lateur L., Ognjanov V., Nybom H., Hjeltnes S.H. (2017). Genetic diversity of *Prunus domestica* selected from ten countries across Europe. Poster presented at the ISHS IX International Symposium on Plum and Prune Genetics, Breeding and Pomology, Freising - Weihenstephan, Germany.

5. EXPECTED ADDITIONAL ACHIEVEMENTS AND FUTURE ACTIVITIES

The main future activities consist of:

- The finalization and implementation of ‘Grant Scheme’ *Malus/Pyrus* WG projects.
- Publishing adopted ECPGR document as “*ECPGR Methods and descriptor lists for the Characterization and Evaluation of apple & pear genetic resources*”
- An active collaboration with the **Global Crop Diversity Trust** on their project on “Global Conservation Strategy for Apple Genetic Resources: A framework for ensuring the effective long-term conservation and use of apple genetic resources”.