Collaborative action for updating the documentation on berry genetic resources in Europe
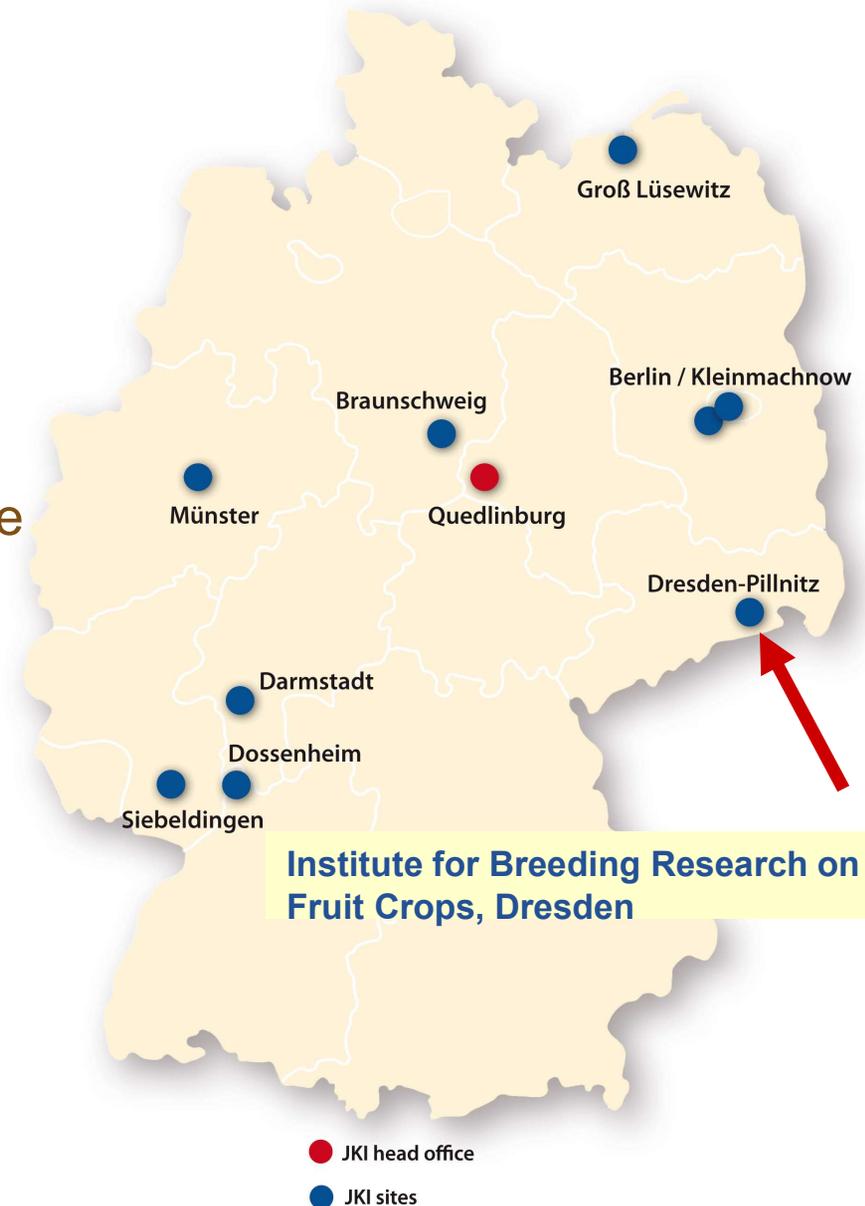
Monika Höfer

Julius Kühn Institute (JKI)

Institute of Breeding Research on Fruit Crops, Dresden-Pillnitz, Germany

Julius Kühn-Institute, Federal Research Centre for Cultivated Plants

➡ **18 Research Institutes**

➡ **Total Staff: 1,180**

➡ Head office in **Quedlinburg**

➡ **Research field area:**
- plant genetics, breeding research
- plant nutrition, agronomy, soil science
- plant protection and plant health

Institute for Breeding Research on Fruit Crops, Dresden

Groß Lüsewitz
Berlin / Kleinmachnow
Braunschweig
Münster
Quedlinburg
Dresden-Pillnitz
Darmstadt
Dossenheim
Siebeldingen

● JKI head office
● JKI sites

Problems

1. only a limited number of partners/countries could be involved
2. the time frame was limited
3. the topic "genetic resources" covers only a very limited part

➢ Strawberry is on the Annex 1 list of the International Treaty on Plant Genetic Resources for Food and Agriculture

➢ ECPGR WGs for *Malus/Pyrus* (1995) and *Prunus* (1983 as one of the original six WGs) with a long active work

December 2018	**Proposal to the ECPGR Executive/Steering Committee for the establishment of a Berries Working Group**
January 2019	Expression of Interest to serve as ECPGR Working Group Chair during Phase X
March 2019	Nomination of the WG Chair
From April 2019	**Nomination of the members of the WG by respective National Coordinators**
January 2020	**1. Meeting of the ECPGR WG Berries in Dresden**

ECP/GR

http://www.ecpgr.cgiar.org/working-groups/berries/

ECPGR Berries Working Group

ECPGR Homepage / ECPGR Working Groups / ECPGR Berries Working Group

51 ECPGR Berries Working Group Members

✉ Email Distribution List

Chair: Monika Höfer ✉ monika.hoefer@julius-kuehn.de

(22 countries)

▤ Full list

| Genebank Curator (14) | Crop specialist (23) | Information/Documentation (8) | Plant breeder (19) |

| Policy and law (3) | Other expertise (8) | Contact Persons (11) |

▾ LIST OF COUNTRIES

Albania	Bosnia and Herzegovina	Czech Republic
Denmark	Estonia	Finland
France	Germany	Greece
Ireland	Italy	Latvia
Lithuania	Norway	Portugal
Romania	Serbia	Slovenia
Sweden	Switzerland	Turkey
United Kingdom		

18 members from 17 countries present

1. Meeting of the ECPGR WG Berries, 14-15 January 2020, Dresden, Germany

It was organized in collaboration with the Julius Kühn-Institut, Institute for Breeding Research on Fruit Crops, Dresden, Germany and financially supported by the German Federal Ministry of Food and Agriculture.

Proposal for a project for the Fourth Call for proposals under the ECPGR Activity Grant Scheme (Phase X).

'Collaborative action for updating the documentation about berries genetic resources in Europe'

Expected impact.

1. With the implementation of the project, the varieties/ cultivars of the **berries genetic resources will be recorded** in the respective countries. The data will be harmonized, qualitatively evaluated and finally **will be available for inclusion to the respective National Focal Points for EURISCO.**

2. **A first draft of crop-specific technical guidelines for genebank management (Manuals) of berries genetic resources** will be elaborated and a related article will possibly be published.

3. Both results provide the basis for the future work of the Berries Working group. With the inventory of which berries genetic resources are conserved under which conditions in the gene banks of the European countries, **further projects on characterisation (phenotypic/molecular) will be derived in order to identify unique accessions for inclusion in AEGIS in the future.**

ECP/GR

What is included in the genetic resources in berries?

In **botanical terminology**, a berry is a simple fruit with seeds and pulp produced from the ovary of a single flower, in which the complete pericarp is still juicy or at least fleshy when ripe (Kiger and Porter, 2001).

Traditionally and in everyday language, the term has different meanings and is usually used for small, sweet fruits, and the berry fruit.

Berries under both definitions include blueberries, cranberries, lingonberries, and the fruits of many other members of the heather family, as well as gooseberries (*Ribes* L.), goji berries (*Lycium* L.) and elderberries (*Sambucus* L.)

The fruits of currants (*Ribes* L.), such as blackcurrants, red currants and white currants, are **botanical berries, even though their most commonly used names do not include the word "berry".**

On the other hand, **several different kinds of fruit commonly called berries are not botanical berries**. Blackberries, raspberries, and strawberries are aggregate fruit; they contain seeds from different ovaries of a single flower.

Because a large number of plant species belongs to berry fruit genetic resources, the activities of the Berry WG will be diverse, and prioritization will take into account the economic importance of the crop.
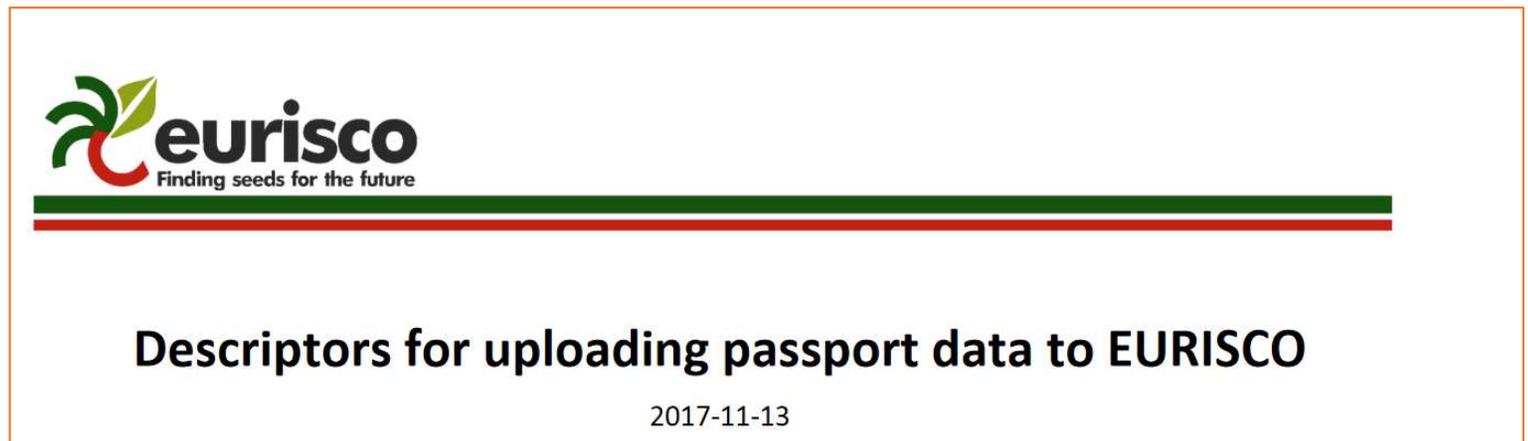

Photo: Luke

Documentation in EURISCO (http://eurisco.ecpgr.org)
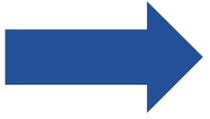
European Search Catalogue for Plant Genetic Resources

For preparation of the inventories

1. **Descriptors for uploading passport data to EURISCO (pdf-file)**

eurisco
Finding seeds for the future

Descriptors for uploading passport data to EURISCO

2017-11-13

2. **Template for the inventory (excel-file) - with some additional descriptors important for our future work**

NICODE	INSTCODE	ACCENUMB	GENUS	SPECIES	SPAUTHOR	CROPNAME	ACCENAME	ACQDATE	ORIGCTY	COLLSITE	BREDCODE
DEU	DEU451	ERB0304	Fragaria	×ananassa	Duchesne ex Rozier	strawberry	Senga Sengana	20050801	DEU		
DEU	DEU451	ERB0304c	Fragaria	×ananassa	Duchesne ex Rozier	strawberry	Senga Sengana	20050801	DEU		
DEU	DEU451	ERB0304vf	Fragaria	×ananassa	Duchesne ex Rozier	strawberry	Senga Sengana	20050801	DEU		

BREDNAME	SAMPSTAT	ANCEST
von Sengbusch, R.	500	Markee/Sieger'
von Sengbusch, R.	500	Markee/Sieger'
von Sengbusch, R.	500	Markee/Sieger'

19. **Biological status of accession** (SAMPSTAT)

The coding scheme proposed can be used at 3 different levels of detail: either by using the general codes (in boldface) such as 100, 200, 300, 400, or by using the more specific codes such as 110, 120, etc.

100) Wild

    110) Natural

    120) Semi-natural/wild

    130) Semi-natural/sown

200) Weedy

300) Traditional cultivar/landrace

400) Breeding/research material

    410) Breeder's line

    411) Synthetic population

    412) H[...]

    413) Fo[...]

    414) In[...]

    415) Se[...]

    416) Cl[...]

    420) Ge[...]

    421) M[...]

    422) Cytogenetic stocks (e.g. chromosome addition/substitution, aneuploids, amphiploids)

    423) Other genetic stocks (e.g. mapping populations)

500) Advanced or improved cultivar (conventional breeding methods)

600) GMO (by genetic engineering)

999) Other (Elaborate in REMARKS field)

20. **Ancestral data** (ANCEST)

Information about either pedigree or other description of ancestral information (e.g. parent variety in case of mutant or selection). For example a pedigree 'Hanna/7*Atlas//Turk/8*Atlas' or a description 'mutation found in Hanna', 'selection from Irene' or 'cross involving amongst others Hanna and Irene'.

DONOR CODE	DONORNAME	DONOR NUMB	DUPLSITE	DUPLINST NAME	STORAGE	MLSSTAT	Virus state	Variety check
							1 = virusfree certified	1 = pomological
							2= virustested	2 = molecular
							3= unknown	3 = pom. + mol.
								4 = not checked
				BSA	20	1		3
					40	1	2	3
					20	1	2	3

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26.   Type of germplasm storage   **(STORAGE)**

If germplasm is maintained under different types of storage, multiple choices are allowed, separated by a semicolon (e.g. 20;30). (Refer to FAO/IPGRI Genebank Standards 1994 for details on storage type.)

   10) Seed collection
       11) Short term
       12) Medium term
       13) Long term
   20) Field collection
   30) *In vitro* collection
   40) Cryopreserved collection
   50) DNA collection
   99) Other (elaborate in REMARKS field)

27.   MLS status of the accession   **(MLSSTAT)**

The status of the PGRFA with regard to the Multilateral System of Access and Benefit-Sharing (MLS) of the International Treaty on Plant Genetic Resources for Food and Agriculture. Leave the value empty if the status is not known.

   0   No (not available under the MLS)
   1   Yes (available under the MLS)

Project partner providing inventories for the genera *Fragaria*, *Rubus*, *Ribes*, *Vaccinium* and other berry species

Partner ID No.	Member project group	Country	Institutsname	Fragaria	Rubus	Ribes	Vaccinium	Other genera
1	x	Lithuania	Lithuanian Research Centre for Agriculture and Forestry	1		1		
2	x	Germany	Federal Plant Variety Office - Testing Station Wurzen	1	1	1		
3	x	Finland	Natural Resources Institute Finland (Luke)	1	1	1	1	1
4	x	Slovenia	Agricultural Institute of Slovenia		1	1	1	1
5	x	Greece	Institute of Plant Breeding and Genetic Resources – HAO Demeter	1	1	1	1	1
6	coordinator	Germany	Julius Kühn Institute, Institute for Breeding Research on Fruit Crops	1	1			1
7		Czech Republic	Research and Breeding Institute of Pomology Holovousy Ltd.	1	1	1	1	1
8		Estonia	Estonian University of Life Science	1	1	1		1
9		France	INRAE	sent passport data				
10		France	INVENIO	1				
11		Italy	CREA Research Centre for Olive, Fruit and Citrus Crops	1				
12		Latvia	Institute of Horticulture LATHORT	1	1	1	1	1
13		Norway	Njøs Fruit and Berry Centre	1	1	1		1
14		Romania	Research Institute for Fruit Growing	1	1	1	1	1
15		Sweden	SLU/ Swedish National Genebank	1	1	1	1	
16		Schweiz	ProSpeciaRara	1	1	1		1
17		Albania	Agricultural University of Tirana		1		1	
18		Turkey	University of Cukurova	1	1	1		1
Total				15	14	13	8	11

Description of the work step	Who is responsible?	Which genus?
Video conference regarding the further verification work	Höfer, Monika	
1 Verification and completion of the inventories for the respective genera according EURISCO by the person responsible		
	Rugienius, Rytis and Sasnauskas, Audrius	*Fragaria*
	Schulte, Erik	*Rubus*
	Karhu, Saila	*Ribes*
	Koron, Darinka	*Vaccinium*
	Maloupa, Eleni	Other genera of berries genetic resources
Transfer of the data to EURISCO via the National Focal point of each country	all partners of the project	
2 Draft of crop-specific technical guidelines for genebank management (Manuals) of berry genetic resources	Höfer, Monika	
3 Select accessions for each genera in berries genetic resources for planning further joint projects	all nominated partners	
Project report	Höfer, Monika	

Methology

3 video conferences with all members of the project-working group

     1st Activity meeting, online, 21 April 2021
     2nd Activity meeting, online, 28 September 2021
     3rd Activity meeting, online, 4 May 2022

1. **Documentation of berries genetic resources in Europe**

the members of the project-group have got the inventories of berries genetic, should ask the partners for the missing data of the template or even for additional accessions and **to create a unified list of the accessions for each genus** with a deadline of September 2021.

ECP/GR

Revision of the list concerning taxonomy (species) and variety names
Integration of passport data

Differing indications of GENUS, SPECIES, and CROPNAME have been adjusted according to GRIN Taxonomy.
The GRIN Taxonomy should be used if possible (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch).

1. **Variety denominations** have been adjusted according to the rule that a variety's name is considered the original one, which is used in the country of its origin,

2. **All other known denominations**, whether submitted by the partners or taken from pomological literature, of a variety have been **listed as known synonyms.**

3. **Passport data have been included**, partly from the individual partners' side (e.g. INSTCODE, ACCENUMB, ACQDATE, ORIGCTY, COLLSITE, SAMPSTAT, DONORNAME, STORAGE, Virus state, and Variety check), or added by the project-group members from the pomological literature (e.g. BREDNAME, ANCEST).

4. Passport data could be used from both the EU GENBERRY project (INRAE, France) project database and the RIBESCO project (Luke, Finland).

Results
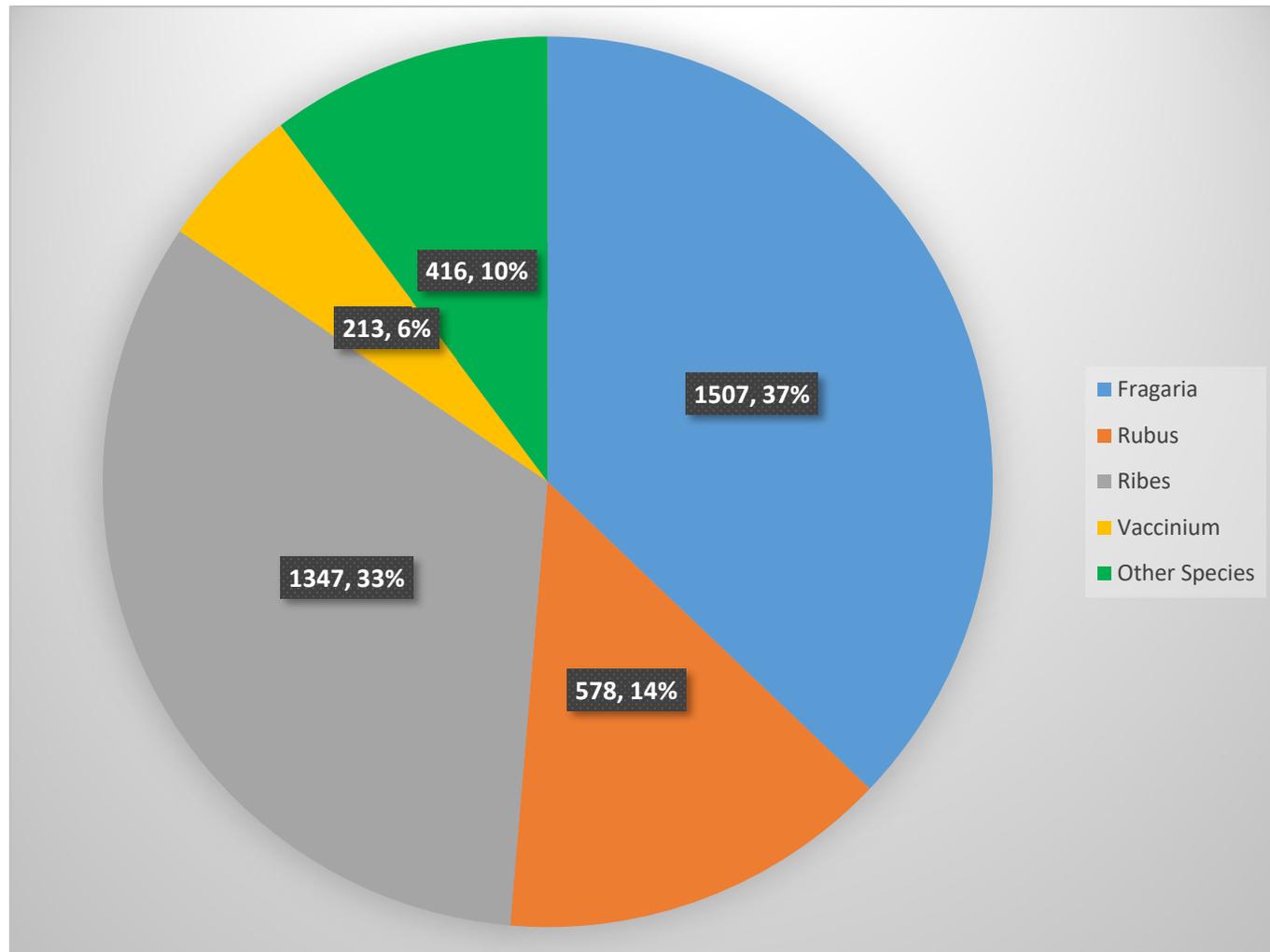
Altogether 4.061 accessions of beery genetic resources were mentioned in the inventories

GENUS	SPECIES	No Acc
Fragaria	chiloensis	11
Fragaria	hybr.	3
Fragaria	*moschata*	69
Fragaria	spp.	1
Fragaria	*vesca*	51
Fragaria	virginiana	4
Fragaria	viridis	1
Fragaria	**x ananassa**	**1355**
Fragaria	x vescana	12

1507 acc.

Fragaria chiloensis   X   *Fragaria virginiana*
(photo: K. Olbricht)

F. vesca ‚Rügen'

F. moschata ‚Bauwens'
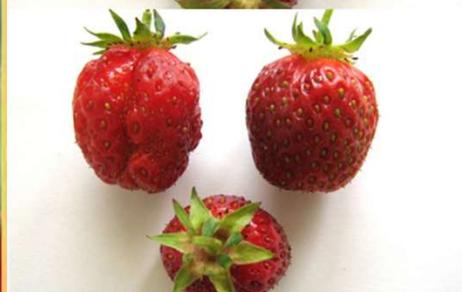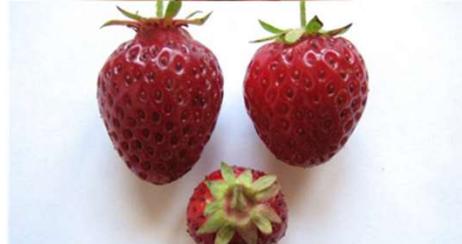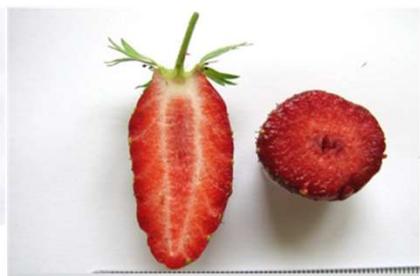
For *Fragaria*, the common list contained 762 different *F. ×ananassa* cultivars.

- Among them 537 were unique accessions, stored in only one of the collections.

- Some cultivars (Honeoye, Senga Sengana) are held in almost all collections.

- **Information on the virus status of strawberry and the method of cultivar identification in various institutions was also collected.** Among accessions 67.1% virus status was unknown, 30.7 % virus tested, 2.2 % virus free certified.

- **Pomological description of accession was most frequent method for variety identification**, but also molecular technology was in use in some institutes: for 67 % of the mentioned accessions, pomological and/or molecular trueness-to-type determination has already been realised.

Rubus	Idaeus - raspberry	439
Rubus	sect. Rubus - blackberry	86
Rubus	occidentalis	14
Rubus	arcticus	10
Rubus	hybr.	16
Rubus	x binatus	4
Rubus	idaeus x allegheniensis	2
Rubus	phoenicolasius	2
Rubus	allegheniensis	2
Rubus	chamaemorus	1
Rubus	nessensis	1
Rubus	ulmifolius	1

578 acc.

cv. Black Juwel (*R. ocidentalis*) (photo Lubera)

cv. Dorman Red (*Rubus parviflorus* x *Rubus idaeus* 'Dorset'),

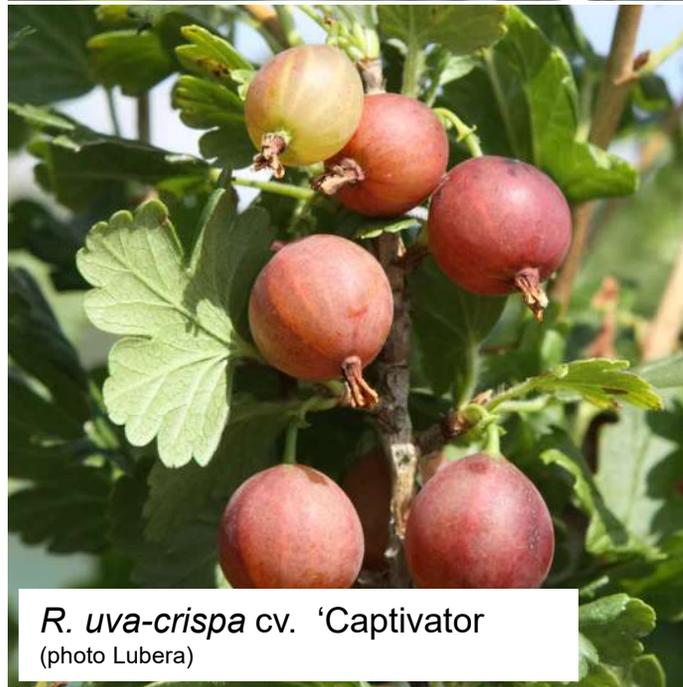|		
Ribes	*aureum*	4
Ribes	*dikusha*	1
Ribes	*nigrum* – black currant	451
Ribes	*Rubrum* – red currant	442
Ribes	*x niveum*	4
Ribes	*spicatum*	12
Ribes	*uva-crispa* - gosseberry	431
Ribes	*x nidigrolaria*	1
Ribes	*spp.*	1
Ribes	*sp.*	2

1347 acc.

R. rubrum (red currant cv. ‚Jonkheer van Tets'
(photo Horstmann)

R. nigrum (black currant) cv. Titania
(photo Lubera)

R. uva-crispa cv. 'Captivator
(photo Lubera)

Vaccinium	*angustifolium*	2
Vaccinium	*corymbosum*	113
Vaccinium	*hybrid*	16
Vaccinium	*macrocarpon*	8
Vaccinium	*myrtillus*	51
Vaccinium	*oxycoccos*	1
Vaccinium	*sp.*	4
Vaccinium	*spp.*	3
Vaccinium	*uliginosum*	1
Vaccinium	*vitis-idaea*	14

213 acc.

Vaccinium myrtillus - blueberry
(photo Horstmann)

Vaccinium corymbosum 'Bluecrop, - American bluebeery
(photo Horstmann)

Vaccinium vitis-idaea - lingonberry
(photo Horstmann)

At the beginning of the project, the project-working group discussed what are genetic resources in berries and what should be included in particular in the **term 'other genera of berries genetic resources'.**

Morus alba

Actinidia	*arguta*	7
Amelanchier	*alnifolia*	5
Amelanchier	*ovalis*	1
Aronia	*× prunifolia*	1
Aronia	*melanocarpa*	4
Cornus	*mas*	17
Hippophae	*rhamnoides*	93
Lonicera	*× caerulea*	2
Lonicera	*caerulea*	27
Mahonia	*aquifolium*	1
Morus	*alba*	112
Morus	*nigra*	25
Morus	*rubra*	2
Morus	*sp.*	22
Rosa	*canina*	9
Rosa	*damascena*	1
Rosa	*dumalis*	1
Sambucus	*nigra*	51
Sorbus	*× hybrida*	1
Sorbus	*× meinichii*	1
Sorbus	*aucuparia*	24
Sorbus	*intermedia*	2
Sorbus	*latifolia*	1
Sorbus	*rupicola*	1
Sorbus	*sp.*	5

Based on the discussion about the definition of berries genetic resources another specific request was sent to the partners for the **'other genera of berries genetic resources'.**

Altogether, 161 acc. of *Morus* (mulberry*),* 51 acc. of *Sambucus nigra* (elderberry), 93 acc. of *Hippophae rhamnoides* (Sea buckthorn) and 35 acc. of *Sorbus aucuparia* (mountain ash) were reported.

Current status of documentation in EURISCO

No.	Country	Contact	INSTCODE	Institutsname	Fragaria	Rubus	Ribes	Vaccinium	other genus	Confirmation	Remarks
1	Lithuania	Rytis.Rugienius@lammc.lt	LTU006	Lithuanian Research Centre for Agriculture and Forestry	1		1			17.10.2023	
2	Germany	Erik.Schulte@bundessortenamt.de	DEU610	Federal Plant Variety Office - Testing Station Wurzen	1	1	1		1	yes	via German Fruit Genebank
3	Finland	saila.karhu@luke.fi	FIN039	Natural Resources Institute Finland (Luke)	1	1	1	1	1	17.10.2023	First via GenBIS and NordGen
4	Slovenia	Nika.CvelbarWeber@kis.si	SVN019	Agricultural Institute of Slovenia		1	1	1	1	07.11.2023	
5	Greece	maloupa@bbgk.gr	GRC044	Institute of Plant Breeding and Genetic Resources – HAO Demeter	1	1	1	1	1	16.10.12023	Position Nationl Focal Point unfilled
6	Germany	monika.hoefer@julius-kuehn.de	DEU451	Julius Kühn Institute, Institute for Breeding Research on Fruit Crops	1	1			1	yes	via German Fruit Genebank
7	Czech Republic	Boris.KRSKA@vsuo.cz	CZE031	Research and Breeding Institute of Pomology Holovousy Ltd.	1	1	1	1	1	19.10.2023	
8	Estonia	Hedi.Kaldmaee@emu.ee	EST012	Estonian University of Life Science	1	1	1		1		
9	France	beatrice.denoyes@inrae.fr		INRAE	sent passport data						
10	France	j.perrotte@invenio-fl.fr	FRA207	INVENIO	1						
11	Italy	gianluca.baruzzi@crea.gov.it	ITA380	CREA Research Centre for Olive, Fruit and Citrus Crops	1					17.10.2023	
12	Latvia	valda.laugale@llu.lv	LVA015	Institute of Horticulture LATHORT	1	1	1	1	1	18.08.2023	
13	Norway	dag.roen@graminor.no	NOR053	Njøs Fruit and Berry Centre	1	1	1		1	24.11.2023	First via GenBIS and NordGen
14	Romania	sturzeanu1980monica@yahoo.it	ROM009	Research Institute for Fruit Growing	1	1	1	1	1	08.05.2023	
15	Sweden	inger@pomologi.nu	SWE089	SLU/ Swedish National Genebank	1	1	1	1		18.10.2023	First via GenBIS and NordGen
16	Schweiz	claudio.niggli@prospecierara.ch	CHE063	ProSpeciaRara	1	1	1		1	17.10.2023	
17	Albania	albanibraliu@ubt.edu.al	ALB026	Agricultural University of Tirana		1		1		19.10.2023	
18	Turkey	ebruyasakafkas@gmail.com	TUR029		1	1	1		1	17.10.2023	Position Nationl Focal Point unfilled

Elaboration of crop-specific technical guidelines for genebank management of berries genetic resources

The first query on the existing accessions also included the descriptor **'Type of germplasm storage' (EURISCO 26 – STORAGE).**

- Most of the temperate fruit species are genetically heterozygous and vegetatively propagated.

- A seed collection will not represent the true genotyp of clonal accessions (cultivars).

- The collections of berries genetic resources are maintained in the field or greenhouses as active plantations where the accessions are available for characterization, evaluation, and distribution.

- Backups for the plant material are needed to provide security in case of a disease or an environmental disaster.

- The duplicate collection could be a second field site, an *in vitro* culture or a cryopreservation.

ECP/GR

JKI: Potted plants of the *ex situ* strawberry collection

JKI: In vitro cold storage

Federal Plant Variety Office: Field collection

JKI: virus-free material maintained in an insect-protected screen house

JKI: Facility for cryopreservation

Federal Plant Variety Office, Germany: Insect-protected screen house for raspberries, photo: BSA

Natural Resources Institute Finland: Field collection of blackcurrant, photo: Luke


Hellenic Agricultural Organization Demeter, Greece: Dog rose collection, photo: Demeter

F Agricultural Institute of Slovenia: Field collection of blueberries, photo: Agricultural Institute of Slovenia

Percentage distribution of accessions in the various methods of preserving genetic resources in berries

Only in the case of *Fragaria* the *in vitro culture* and cryopreservation makes a significant contribution to build up a duplicate.
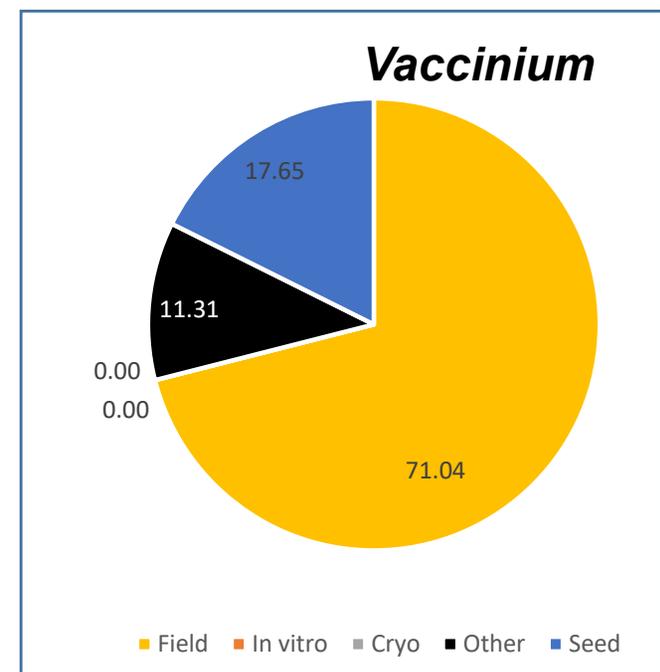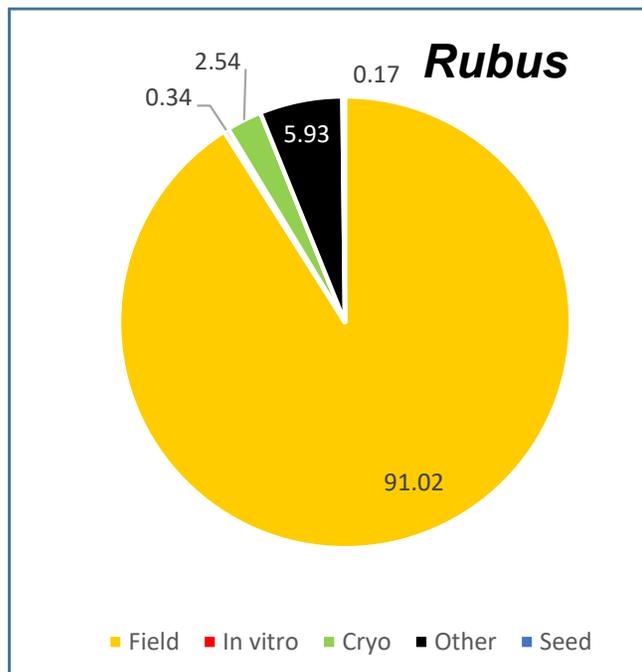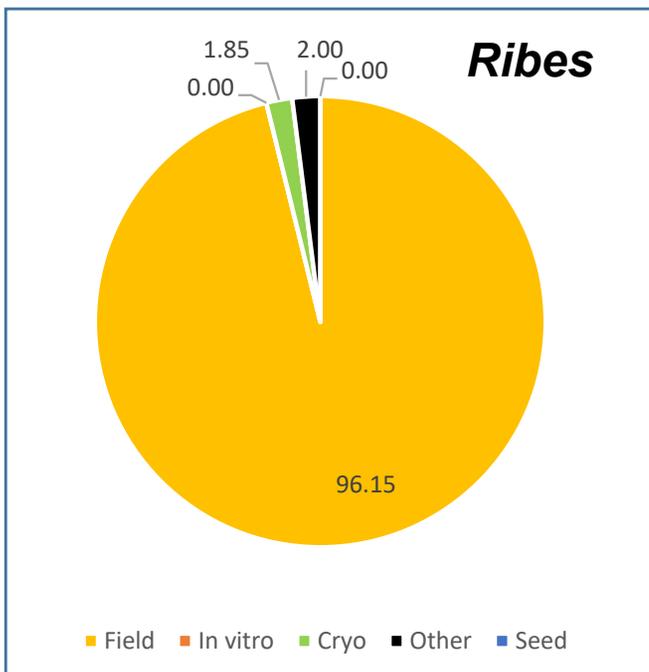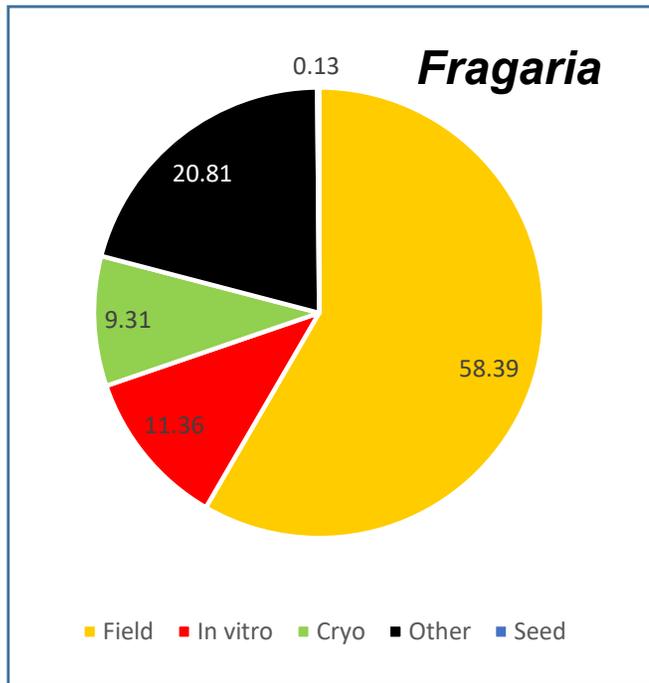
- Based on the results of the first request regarding the forms of preservation a **second template** was developed, which was sent to all project partners, **in order to request the detailed methods of conservation.**
- The template contained exact questions on the cultivation of the plants for the *ex situ* collection in the field or in the greenhouse as well as for the *in vitro* and cryo collection.

For the *ex situ* collections the following points were included:

Location of the genebank	Horticultural work
Soil	How is the phytosanitary control organized? Pest and diseases control
Type of planter containers	Disease prevention / integrated pest management
Type of plants	Replanting time of the plantation
Which plant labels are used?	How is the replantion realized?
How many plants per accession?	Periodically verifying the identity of the accession?
Planting time	Could you realize characterization / evaluation work?
Isolation distance of the plants (cm/ m)	Safety duplication
Field management	

ECP/GR

Contributions to the query were made by all 18 partners by the end of 2022, so that the preparation of the first draft of crop-specific technical guidelines for genebank management of berries genetic resources could be started.

The *Prunus* specific standards for genebank management served as an example (Giovannini et al. 2016).

This first draft will be sent to all members of the Working group for discussion.
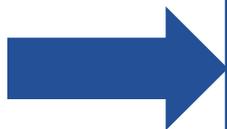
The aim is to establish **quality standards of conservation berries genetic resources (minimal standards)** and to publish these on the webpage of ECPGR.

All objectives of the EUROPE.BERRIES project were achieved.

- An extension to the initially planned time was requested due to different reasons. The main reason was that for the individual partners of the action, working with the EURISCO passport data was new area, so that many explanations were necessary and the work was delayed.

- The situation was the same for the some members of the project-group who had volunteered to revise the inventory / passport data.

RECOMMENDATIONS – PERSPECTIVE

- This action gave the newly established working group the opportunity **to work together for the first time within the framework of the ECPGR** and to make themselves known with its working methods of the ECPGR.

- A grant will be requested for a second group meeting to present the results to a majority of the members and to discuss further projects.

- The results of the project will also be presented at the next Progress Meeting of the EU project 'Breeding value' in order to identify common aims for the further work on genetic resources in berries.

- The project was the basis for establishing the first step towards a long-term work for conservation/ characterisation/ documentation and utilisation of genetic resources in berries.

ECP/GR

THANK YOU