POLISH ACADEMY OF SCIENCES
Polish Science Contact Agency
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Agricultural genetic resources in rural development

PolSCA Meeting, 8 Dec. 2014, Brussels

The Polish Academy of Sciences Botanical Garden in Warsaw as gene bank for genetic resources conservation of crop plants

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Polish Academy of Sciences Botanical Garden – Center for Biological Diversity Conservation

Departments

I. Department of Plant Diversity Conservation & Evaluation
Head: Prof. Jerzy Puchalski

II. Department of Experimental Plant Biology
Head: Prof. Jan Rybczyński

III. Independent Laboratory of Plant Structure
(Location: Silesian Botanical Garden in Mikołów)
Head: Dr. Paweł Kojs

IV. Department of Botanical and Horticultural Collections
Head: Mr. Wiesław Gawryś

V. Department for Information and Education
Head: Mr. Wiesław Łuczak

Laboratories

1. Seed Bank
Head: Dr. WIesław Podyma

2. Genetics & Crop Genetic Resources
Head: Prof. Helena Kubicka

3. Plant Molecular Biology
Head: Assoc. Prof. Robert Malinowski

1. Plant Biotechnology & Cryobiology
Head: Assoc. Prof. Anna Mikuła

2. Plant Ecology
Head: Assoc. Prof. Wojciech Dmuchowski

Collections

1. **Flora of Poland**
2. **Dendrology (arboretum)**
3. **Ornamental Plants**
4. **Horticultural Crops**
5. **Tropical and subtropical Plants (greenhouses)**

- PAS Botanical Garden

Total area: 40 ha

1. Didactic bed (endangered and protected species)
2. Well-head and marsh plants
3. Graminoids, water and marsh plants
4. Mountain plants
5. Conifers and shrubs
6. Yews
7. Evergreen and azaleas and rhododendrons
8. Junipers, heathers and heats
9. Magnolias
10. Fruit trees and shrubs
11. Old cultivars af apple trees
12. Vegetables
13. Medicinal and aromatic plants
14. Dahlias, gladioluses and lilies
15. Perennials
16. *Liliales*
17. *Paeonias*
18. Bulbs
19. Roses
20. Greenhouses (exotic plants)
21. „Fangorówka” Art Gallery
22. Gene bank and laboratories
23. Nature and Ecology Education Center
24. Horticultural Center
25. Headquarters, administration, laboratory
26. Seasonal fairs

Living planst collections

Collection	Number of taxa
Natural flora of Poland	**812**
Dendrological	**2526**
Ornamental plants	**2951**
Including:	
-Ornamental perennials	*851*
-Bulbs and irises	*1368*
-Roses	*732*
Horticultural crops	**1750**
Including:	
-Vegetables	*205*
-Medicinal plants and spices	*539*
-Pomological	*1006*
Tropical and subtropical plants (greenhouses)	**1898**
Total	**9937**

Living planst collections

Native flora of Poland

Perennial Garden

Mountain Plants

Rose Garden

Bulb Garden

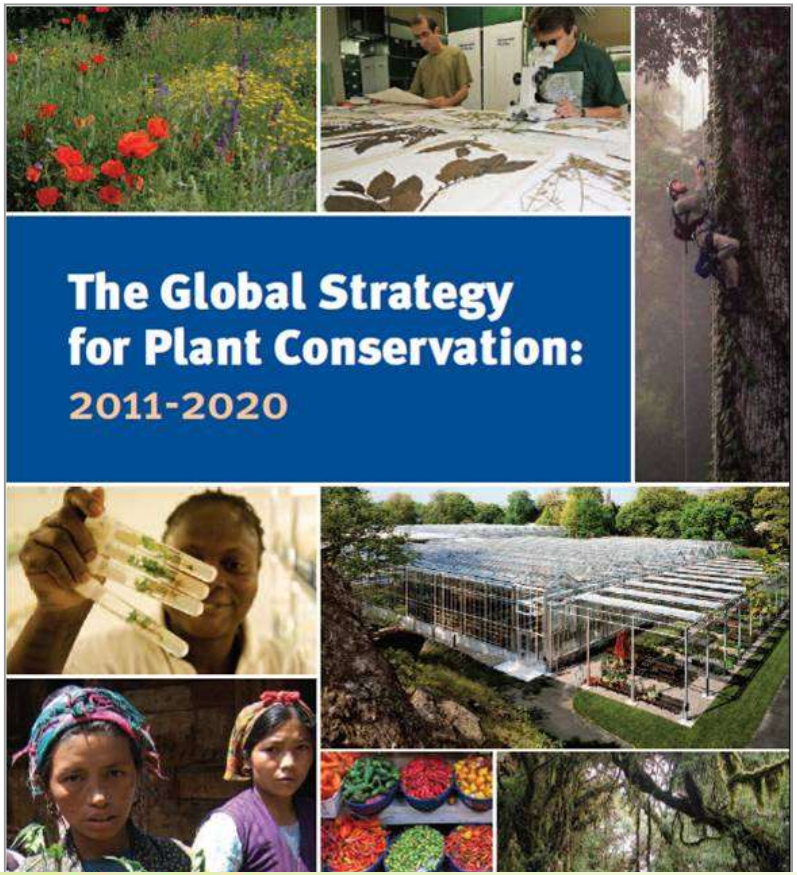
Arboretum – azaleas

Dessert House

Tropical House

Arboretum – conifers

Global Strategy for Plant Conservation 2011-2020



The European Strategy for Plant Conservation 2008 – 2014

ESPC 1.1

A widely accessible dynamic working list of all known plant and fungi species (including bryophytes, lichen, algae and cultivated plants) available by 2010 for vascular plants and bryophytes and 2014 for other groups, as a part of a world list, and including country distributions.

ESPC 9.1

Establishment of 25 European crop wild relative genetic reserves covering the major hotspots of species and genetic diversity

ESPC 13.1

Projects in place in four European sub regions demonstrating sustainable methods of conserving plant resources (crop wild relatives, land races, medicinal plants, etc) whilst supporting European livelihoods (see also target 9 and associated activities)

ESPC 15.1

A measurable increase in government resourcing of skill training for plant conservation at national and regional level. Priority skill areas must include taxonomy, ecology, policy and advocacy, all-age education, marketing and volunteer development.

Target 9:

70 per cent of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species conserved, while respecting, preserving and maintaining associated indigenous and local knowledge.

The Polish system of plant diversity conservation


The Plant Breeding and Acclimatization Institute - National Research Institute

Genetic resources of agricultural crops


The Forest Gene Bank Kostrzyca

Genetic resources of forest trees and communities



Polish Academy of Sciences Botanical Garden - Center for Biological Diversity Conservation

Rare, threatened and protected species of Polish flora

Polish Academy of Sciences Botanical Garden – Center for Biological Diversity Conservation in Powsin

History of studies on crop genetic resources conservation

1970 Department of Crop Germplasm Conservation at the Institute of Plant Genetics of the Polish Academy of Sciences. Location: Skierniewice

1971 Collection and Seed Bank of *Secale* genetic resources was established

1974 Botanical Garden of the Polish Academy of Sciences. Location: Warsaw – Powsin (The research unit of the Department of Biological Sciences of PAS)

1980-2015 Collaboration with the USDA – ARS institutions on *Secale* germplasm collecting, preservation and evaluation

1983 The collection of *Malus* genetic resources was established (with special emphasis to historical apple cultivars since 1987)

1992 The cryogenic seed bank of rare and threatened species of Polish vascular flora was organized

1997 Botanical Garden – Center for Biological Diversity Conservation of the Polish Academy of Sciences

1997-2013 Participation in Polish national projects on plant genetic resources conservation supported by the Ministry of Agriculture and Rural Development

1999 Collection of *Rosa* cultivars was established (since 2008 as the National Collection of Roses Cultivars)

2009-2012 Cryogenic Gene Bank of Historical Apple Cultivars was organized in the framework of the project of the National Center for Research and Development

Organization of international and national conferences on crop genetic resources conservation

- International Conference "Collection and Utilization of Rye Resources", USDA-ARS and PAS Botanical Garden, Warsaw/Nieborów, 21 June – 5 July 1987.
- International Conference "The Use Plant Genetic Resources and Creation of the Central Collection of Wild Species of Fruit and Shrubs for Eurasia", Botanical Garden AN USRR and PAS Botanical Garden, Warsaw, 7 -12 Sep. 1987
- International Conference "Crop Germplasm Conservation Problems with Special Emphasis on Rye", USDA-ARS, International Plant Genetic Resources Institute, IHAR, PAS Botanical Garden, Warsaw/Konstancin, 2-6 July 1996
- V National Conference of the Polish Plant Genetic Resources „Plant Genetic Resources for Agricultural Development" PAS Botanical Garden, Rogów 12-14 Sep. 2012
- National Conference „Biodiversity of Poland and the Strategic Plan for Biodiversity 2011-2020 - new challenges and tasks for botanical gardens and gene banks" PAS Botanical Garden, Warsaw-Powsin, 30 June-4 July 2014

Rogów

Warszawa-Powsin

Cryogenic seed bank in LN2 (ca. - 160°C) holdings:

- 212 rare and threatened species of Polish flora represented by 683 natural populations

- ca. 150 dormant buds frozen samples of historical apple cultivars

Genetic resources collection of the genus *Secale*

Established: 1971

Secale strictum
Mt.Etna (Italy)

Local landrace of rye
Lungauer Tauern (Austria)

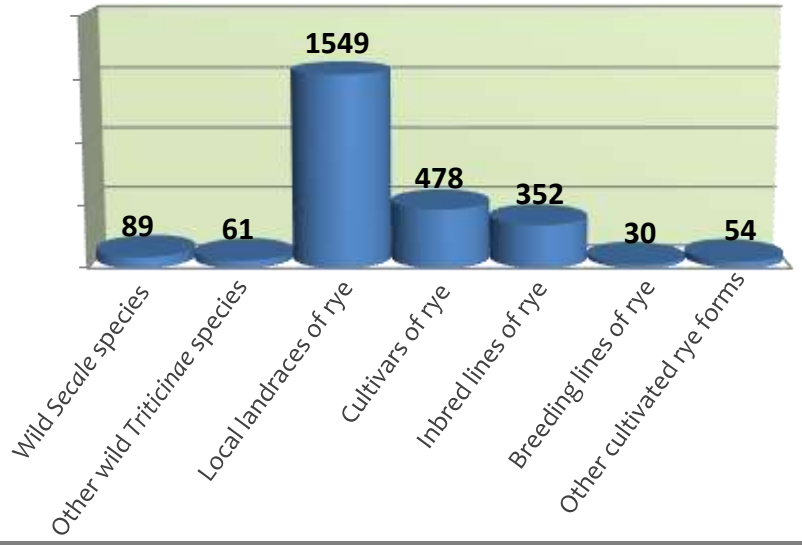
Field multiplication and evaulation

Field multiplication and evaulation (2013)

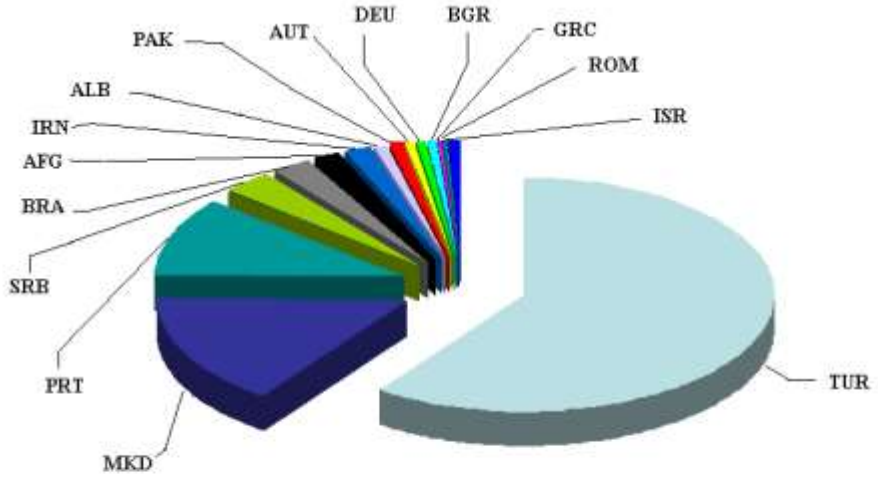
Long-term storage seed bank (-25°C) ca. 2600 accessions (ca. 5.000 seeds samples)

Genetic resources collection of the genus *Secale*
Total number of accessions: 2.613

State and strucure of *Secale* collection



Origin of *rye* local land*races*



The joint collection with USDA-ARS 2.476 accessions

Secale germplasm database

Total: 2.476 accessions

Passport data, 12 morphological, phenological and agronomic characters submitted to:

European Seed Catalogue

European Cooperative Programme for Plant Genetic Resources
ECP/GR

eurisco
Finding seeds for the future

Germplasm Resources Information Network

GRIN-Global

USDA
Agricultural Research Service

Observations for accession PI 535179

Characterization and Evaluation Data

Descriptor	Value	Qualifier	Study Environment
Morphological descriptors			
HABIT	W-S=WINTER TYPE MIXED WITH SOME SPRING TYPES		HABIT ABERDEEN 05
KERNGLSTR	44.0		POLAND 88
KERNELWT	28.4		POLAND 88
GRAINFILL	42		POLAND 88
PROTEIN	15.6		POLAND 88
TILLERS	2.7		POLAND 88

| USDA | ARS | GRIN | NPGS | New Search | View

International *Partnership*

USDA – ARS National Center for Genetic Resources Preservation, Ft. Collins, CO

USDA – ARS National Small Grains Collection, Aberdeen, ID

International Partnership

Leibniz Institute for Plant Genetics and Crop Plant Research, Gatersleben

Participation in international research projects on rye germplasm conservation



1980-1987 „Polymorphism of isoenzymes in selected cultivars of rye and triticale" USDA-ARS

1988-1994 „Rye seed regeneration for the long-term seed storage" USDA-ARS

1989-1996 „Genetic shift in rye accessions in relation to long-term seed storage" USDA-ARS

1997-2003 „Collection, regeneration of rye landraces and wild types" USDA-ARS

2000-2004 „Inheritance of seed longevity in *Secale*, *Triticum* and Triticale" USDA-ARS

2004-2009 „Mechanism of genetic change during *ex situ* conservation of rye germplasm" USDA-ARS

2008-2015 „Kinetics of seed deterioration in diverse lines of rye, wheat and triticale" USDA-ARS



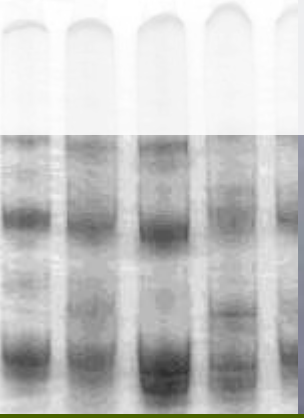
Participation in national research projects on crop germplasm conservation

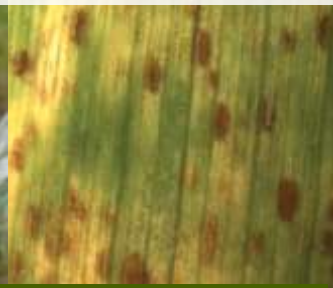
1998 „Protocols for of long-term storage conditions of rye and triticale seeds in relation to conservation of genetic resources of „Danko" varietes" Danko Plant Breeders Ltd.

1997 – 2007 „The conservation of genetic resources of crop wild relatives and rye selected inbred lines. The conservation of genetic resources of wild and old varietes of apple trees" The Ministry of Agriculture and Rural Development

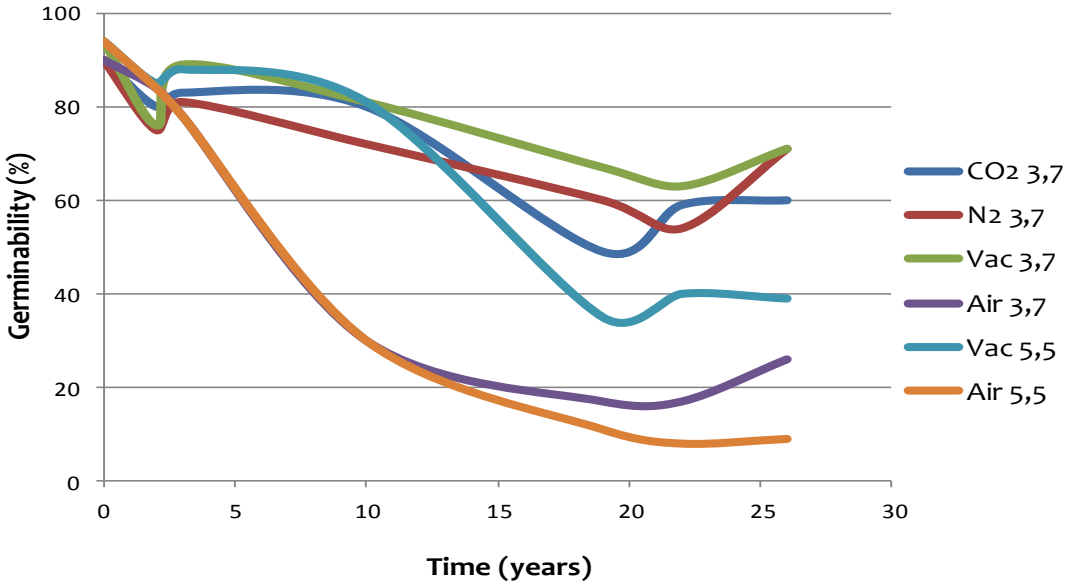
2000 – 2003 „Molecular analysis of genetic variation of rye seeds in relation to long-term storage and field regeneration" The Ministry of Science and Higher Education

2008 – 2013 „The conservation, evaluation and maintenance of genetic resources of crop plants as living plant material and their pathogens for providing access to the national economy" The Ministry of Agriculture and Rural Development

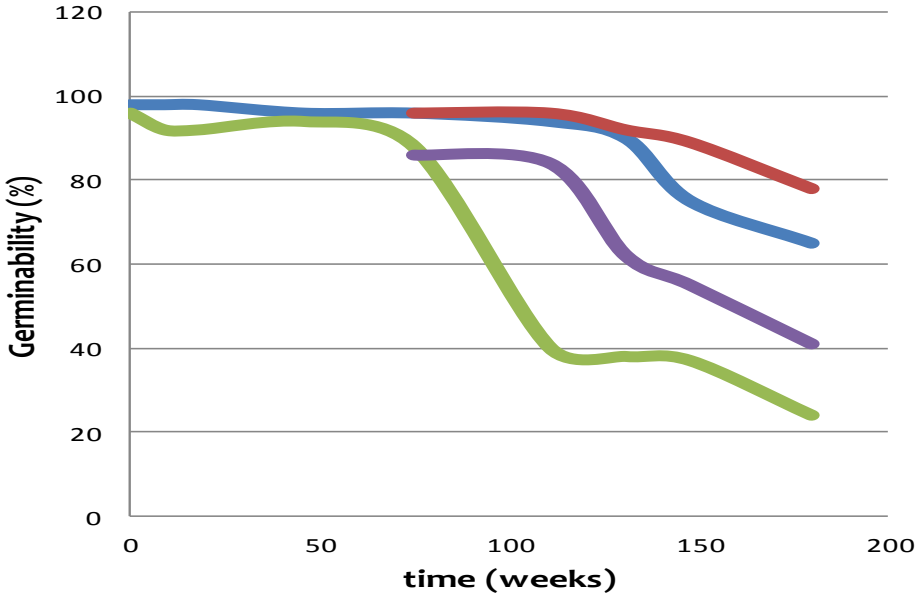




Seed viability of rye after long-term storage



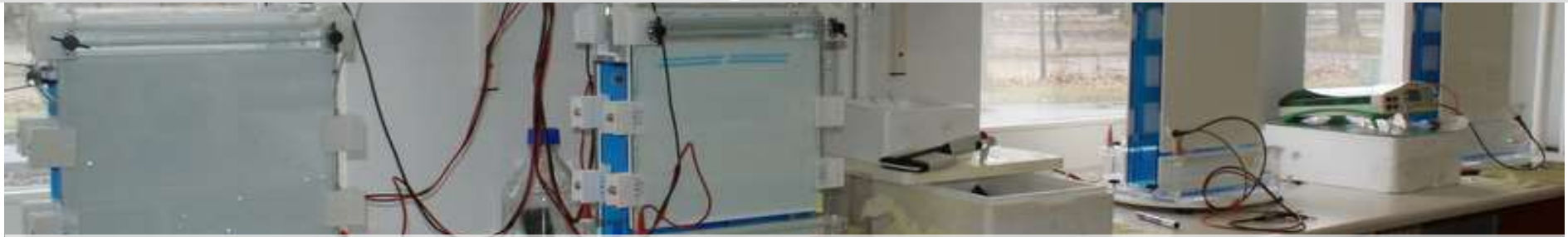
Viability of rye seed samples stored in different atmospheres at ambient temperature for 26 years



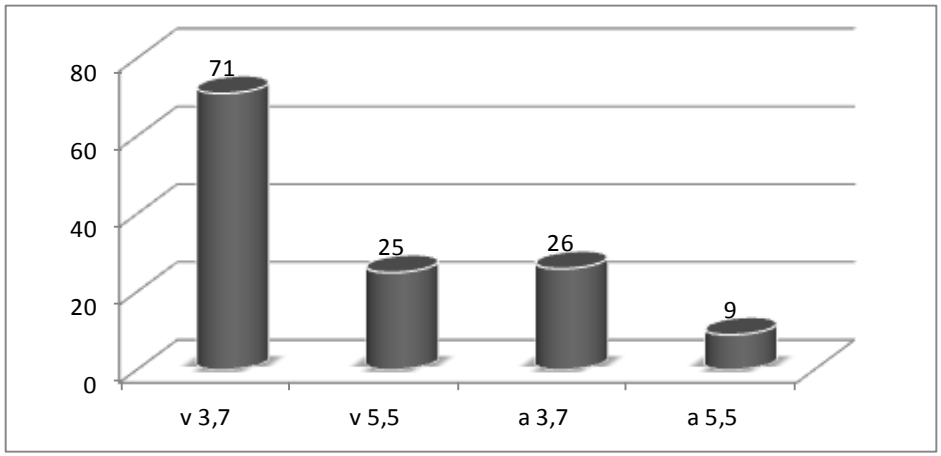
Seed viability of wheat and rye samples stored at different seed MC

Niedzielski *et al.* 2009. Assessment of variation in seed longevity within rye, wheat and the intergeneric hybrid triticale. Seed Science Research 19,213-224

Molecular markers in genetic studies on seeds long-term storage and regeneration effect



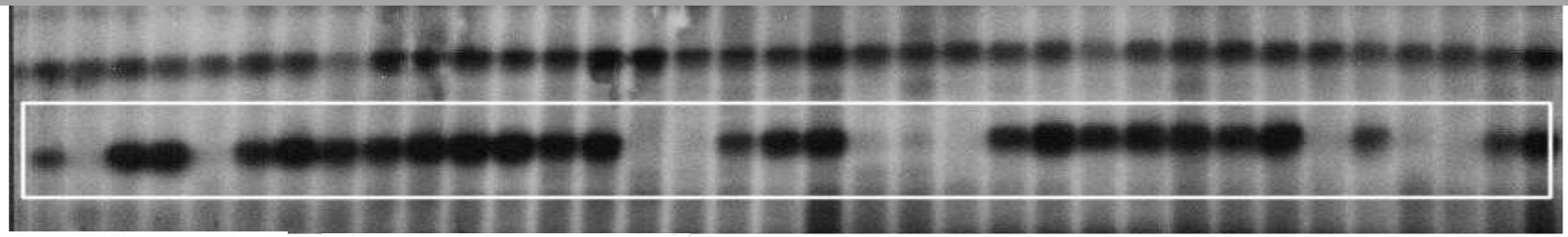
AFLP, Specific PCR and SSR markers in seed samples of rye cv. Dańkowskie Złote – storage and regeneration effects

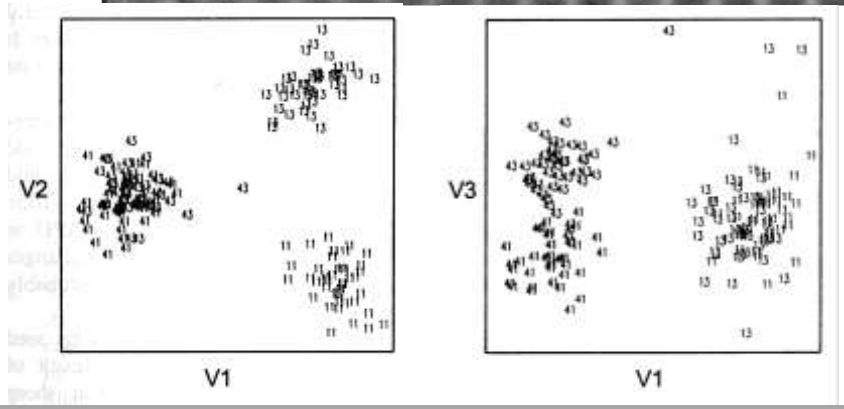


sample	v 3,7	v 5,5	a 3,7	a 5,5
Storage atmosphere	vacum	vacum	air	air
Moisture content	3,7%	5,5%	3,7%	5,5 %
Germinability	71%	25%	26%	9%

Molecular markers in genetic studies on seeds long-term storage and regeneration effect

AFLP markers in seed samples of rye – storage and regeneration effects

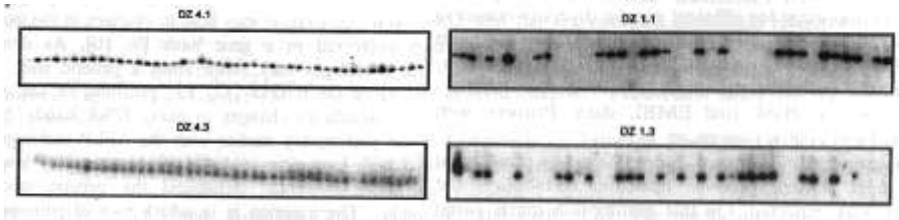




PCA for 231 AFLP markers

Chwedorzewska *et al.* 2002. AFLP Profiling of long-term stored and regenerated rye genebank samples. Cellular and Molecular Biology Letters 7a: 457-463.

Specific PCR markers in seed samples of rye storage and regeneration effects



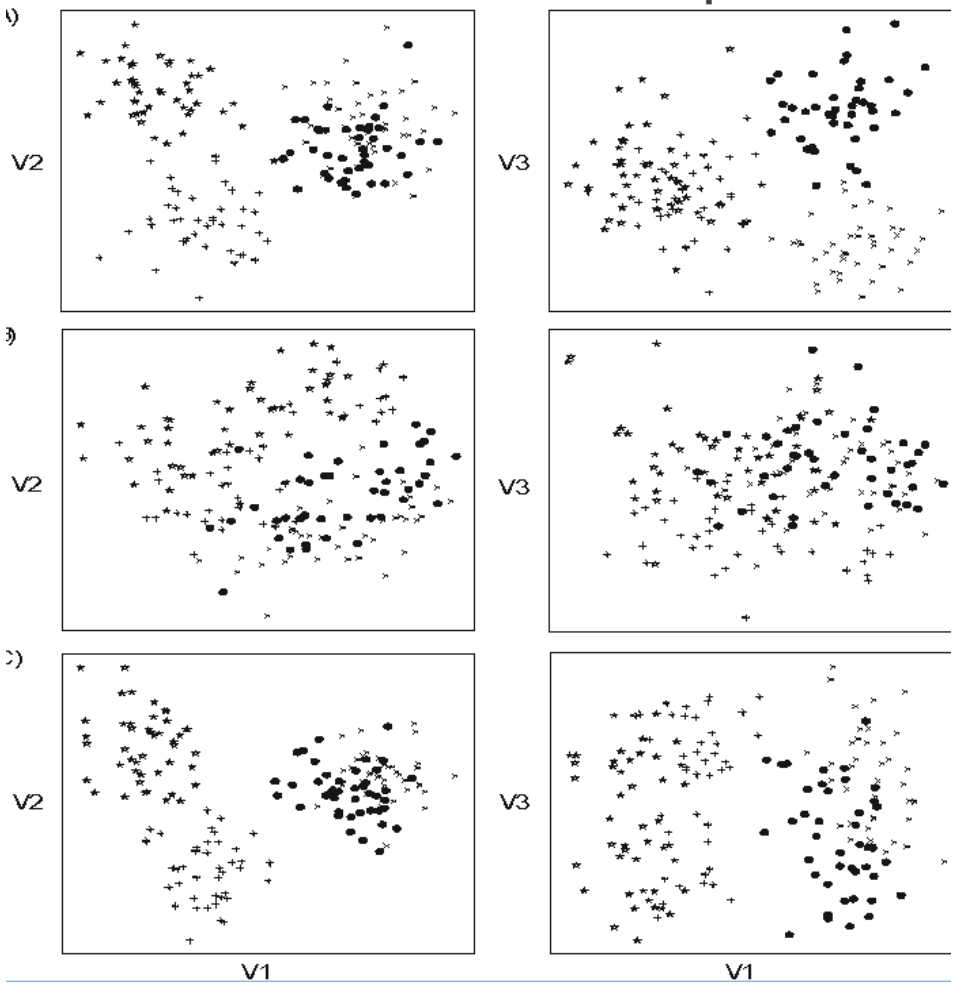
Chwedorzewska *et al.* 2002. Studies on specific rye genome regions due to seed ageing and regeneration. Cellular and Molecular Biology Letters 7b: 569-576

Tab. 2 The data on primer pairs and amplified products

Primer code Fragment type	Total length (bp)	Primer position	Amplification product (bp)	Annealing temp.	Primer sequences 5'→3'
R173.1-L	6676	1022-	987	65	GCAACGGCGCCAGAAATAGC
R173.1-U		1042			ATGCTGGCCGGGTCCGCACT
Macrosatellite		56-76			
R173.3-L	4959	1078-	906	65	TGGGTTCTGACTCGTTATGA
R173.3-U		1098			TGTTTGGTATTTGCTTCTTG
Macrosatellite		193-213			
SCSEC1AB-L	1832	1717-	1640	69	CCAGCAATGTCCTTGTGACA
SCSEC1AB-U		1739			AGATGTAGAGCATCACAAAC
ω-secalin		99-125			TGAATTCC
SCSEC1GR-L	714	685-710	592	67	TTGAAGTAGAACTGGTCTGG
SCSEC1GR-U		118-139			GTCACAACAACCGTCGATTC
γ-secalin					AGCTATC

Molecular markers in genetic studies on seeds long-term storage and regeneration effect

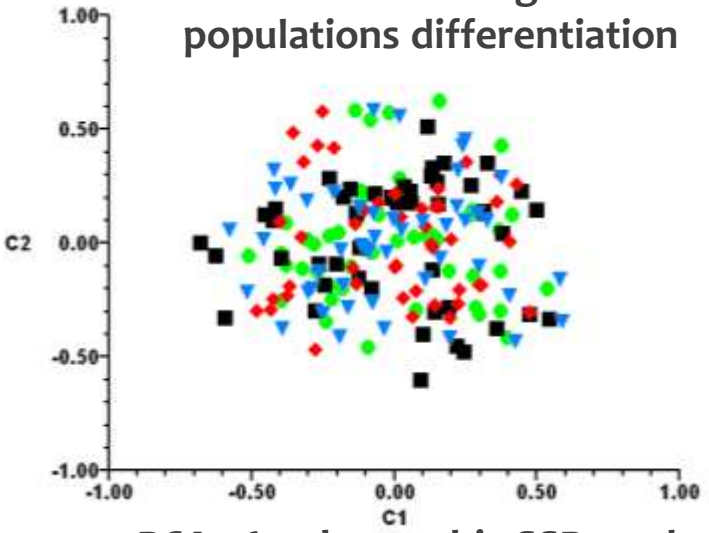
PCA of AFLP markers of rye populations stored in different atmospheres



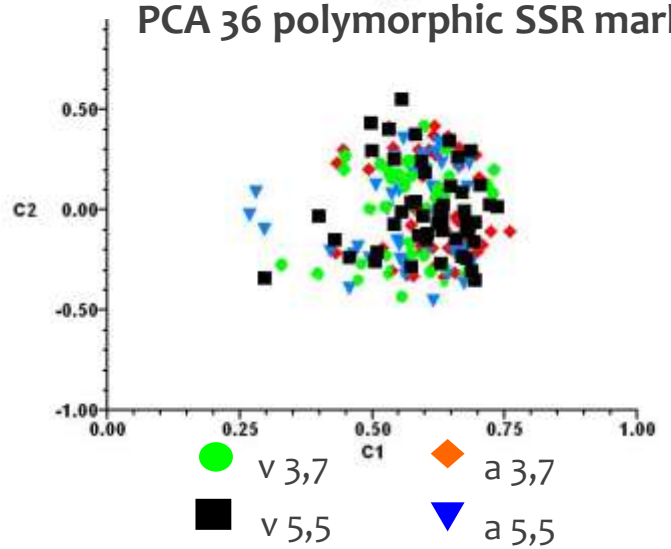
V 37 x A 37 • V 55 + A 55 *

Niedzielski i Puchalski (2005)

PCA 21 SSR markers significant for populations differentiation



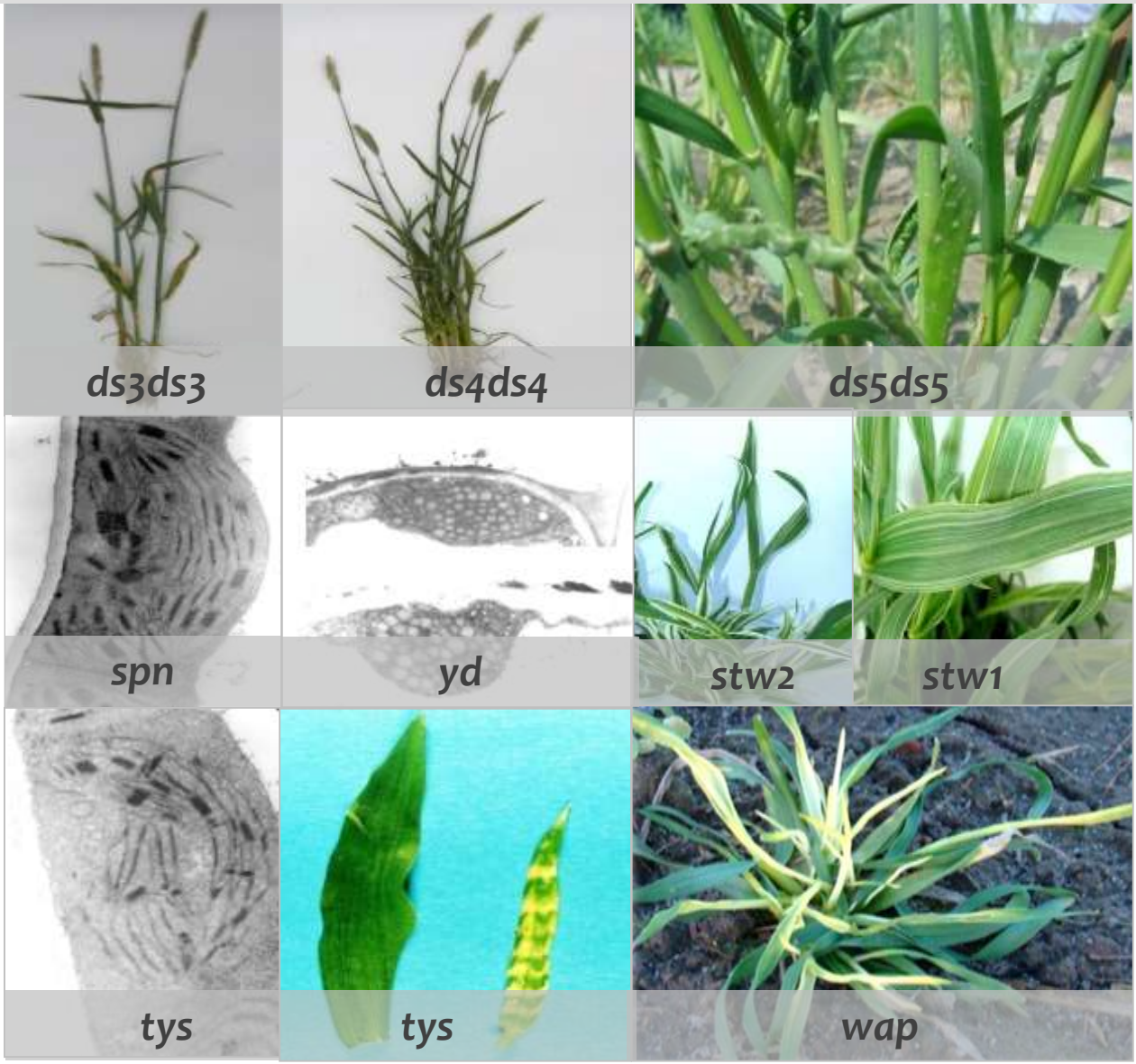
PCA 36 polymorphic SSR markers



Boczkowska i Puchalski (2006)

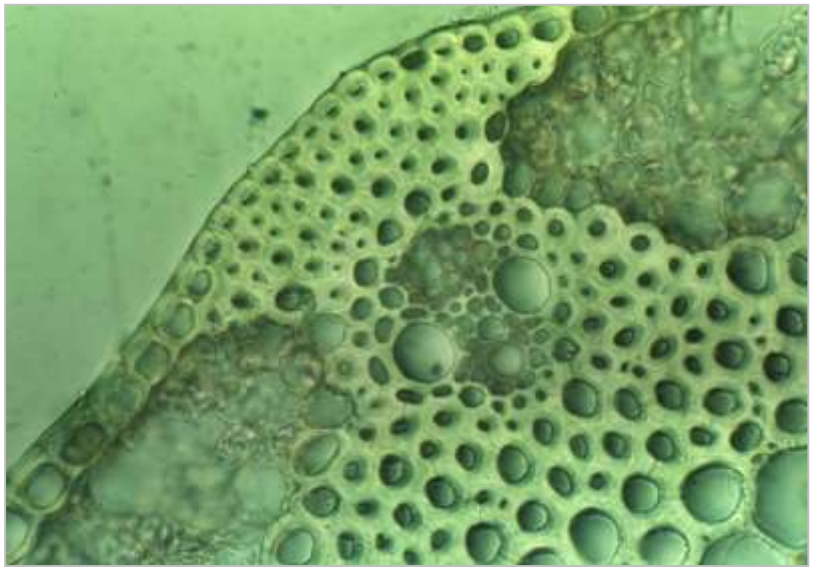
Genotypes selection for breeding programs

F_2	
Mk x mk 878 : 276 (3:1)	*ds3*
Kn x kn 1477 : 461 (3:1)	*ds4*
L147 x J74 1142 : 357 (3:1)	*ds5*
Jż x L79 1362 : 441 (3:1)	*so*
Jż x L299 1247 : 388 (3:1)	*so*
D855 x L100 760 : 240 (3:1)	*wap*
D855 x chlp 1240 : 399 (3:1)	*stw1*
D855 x L148 1523 : 511 (3:1)	*stw2*
D855 x L419 476 : 120 (3:1)	*spn*
D855 x L18 1103 : 361 (3:1)	*sta*
68 x L71 (3:1)	*lg4*
68 x L103 (3:1)	*yd*
68 x dz 491 : 168 (3:1)	*hys*



Kubicka *et al.* (2013)

Inbred lines selected for breeding



Kubicka *et al.* (2013)

COLLECTION OF HISTORICAL APPLE CULTIVARS AND WILD *MALUS* GERMPLASM

ca.610 accessions (taxa)






Collection of wild *Malus* species
113 taxa

Malus hupehensis

Malus zumi 'Calocarpa'

Malus coronaria

Malus sieversii (fruits)

Collecting expeditions to old apple orchards

Ukraine

Poland - Pomerania

Lithuania

SE Poland

Historical apple cultivars collection
ca. 500 accessions - 338 named cultivars


Rarytas Śląski


Rajewskie


Piękna z Rept


Kosztela

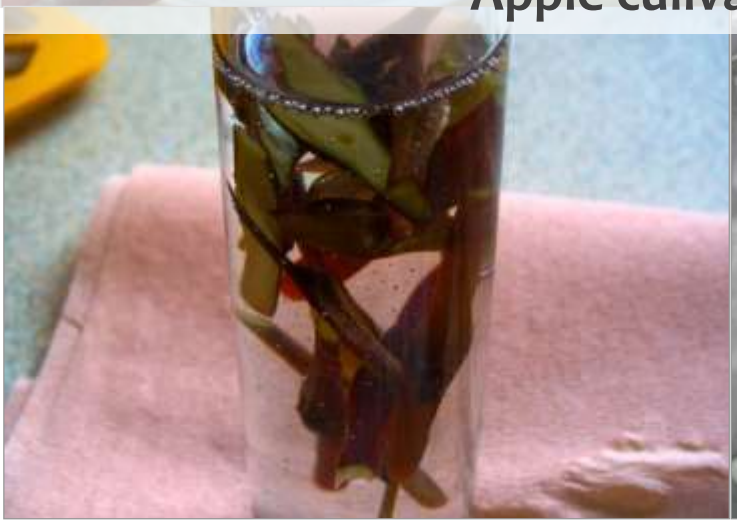

Bursztówka Szlachetna


Kandyl Synap

Cryogenic gene bank of apple buds stored in LN_2



Apple culivars cryogenic gene bank: 150 cv.




http://www.ogrod-powsin.pl/projekt_rozwojowy.pdf

The National Collection of Rose Cultivars and Varietes
1999/2008






The National Collection of Rose Cultivars and Varietes

Total number of taxa: 732 (ca.200 historical cultivars)

OLD ROSES (24 GROUPS):

- wild roses
- Foetida
- Pimpinellifolia
- Damascena
- Damascena Muscosa
- Bifera
- Portland
- Alba
- Centifolia
- Centifolia Muscosa (Moss)
- Francofurtana
- Canina/Dumalis
- Rubiginosa (Sweet Briars)
- Boursault
- Arvensis
- Multiflora (Ramblers)
- Sempervirens (Ramblers)
- Setigera
- Chinensis
- Miniatures
- Noisettes
- Bourbons
- Hybrid Perpetuals
- Odorata (Teas)

MODERN ROSES (17 GROPUS):

- Macrantha
- Davidii
- Moyesii
- Rugosa
- Filipes
- Helenae
- Moschata (Hybrid Musks)
- Modern shrubs
- English Roses
- Polyantha
- Floribunda
- Grandiflora
- Wichuraiana Ramblers
- Kordesii
- Modern climbers and ramblers
- Hybrid Teas
- Ground Cover

The National Collection of Rose Cultivars and Varietes

Total number of taxa: 732 (ca.200 historical cultivars)

R. gallica 'Belle Herminie'

R. foetida 'Persian Yellow'

R.chinensis'Viridiflora'

R. ×centifolia 'Muscosa'

R. ×noisettiana 'Maréchal Niel'

R. ×damascena 'Trigintipetala'

The impact of bio-stimulators on the efficiency of plant rooting stem cuttings of historical roses

Monder *et al.* (2013)

Acknowledgments:

- Prof. Helena Kubicka – Matusiewicz
- Mr. Wiesław Gawryś
- Mr. Wiesław Łuczak
- Dr. Anna Rucińska
- Dr. Marta Joanna Monder
- Mrs. Anna Zaremba
- Mr. Maciej Niedzielski
- Mr. Maciej Niemczyk
- Mr. Konrad Woliński

Thank you for your attention

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