Molecular marker application in breeding of self- and cross- compatible sweet cherry (*P. avium* L.) varieties

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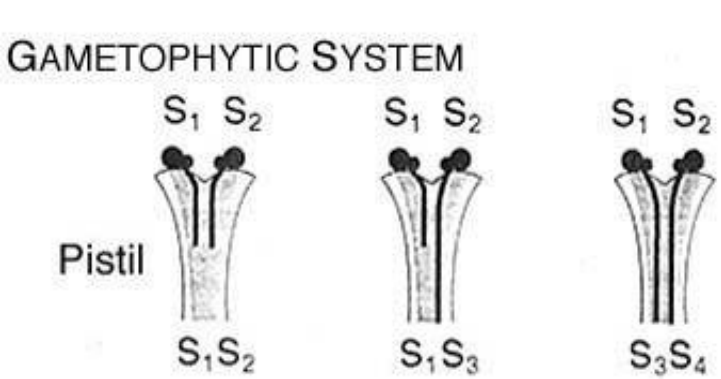
Introduction

- Sweet cherry (*Prunus avium* L.) collection at the Latvia State Institute of Fruit-Growing (135 accessions):
  - advanced cultivars,
  - semi-wild samples,
  - landraces,
  - diverse germplasm from the northern temperate zone.

Introduction

- **Need for self- compatibility information:**
  - All commercial cultivars of sweet cherries grown in Latvia are known to be self-incompatible Commercial sweet cherry orchards needs suitable pollinators to cultivars ensure fertilization and subsequent fruit development
  - Developing of self-fertile cultivars:
    - Winterhardy enough at our country
    - Breeding programme –
      crossing cultivars – *Sf* gene donors with winterhardy local or introduced cultivars.

S (self-incompatibility) gene



- **Gametophytic incompatibility system**
  - mono-factorial, multiallelic (16 alleles (Tobutt et al 2004))
  - governed by a single *S* locus
  - if a pollen S-allele matches the S-alleles of the pistil, the growth of the pollen tube is arrested in the style inhibiting fertilization.

Molecular markers vs. traditional approaches

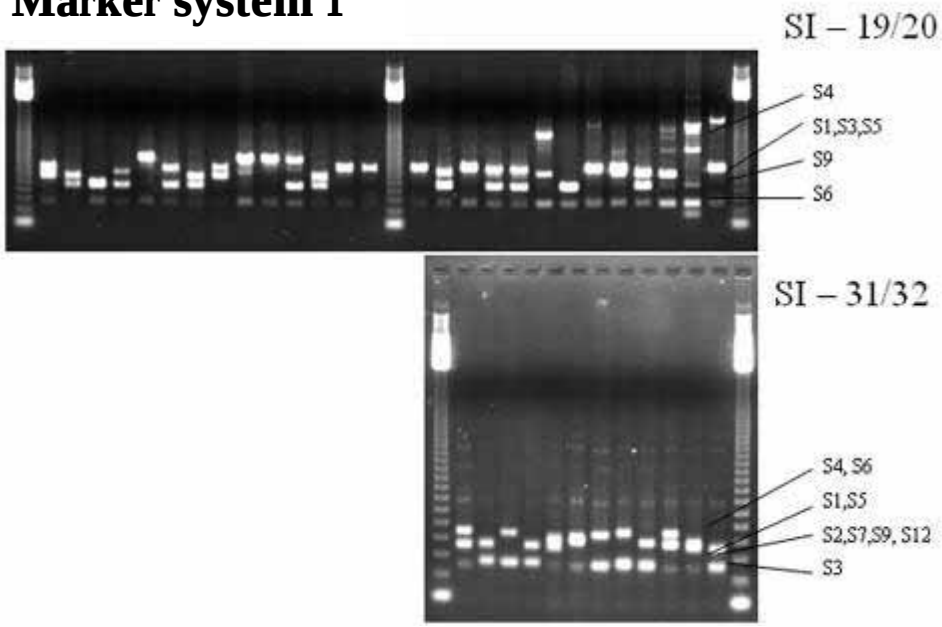
- **Traditional approaches**
  - Crossing experiments with following cytoembryological assessments of the pollen tube growth within the style
  - **Drawbacks:**
    - necessity of flowering plants
    - time consuming
    - depending on weather during blooming

Molecular markers

- Allele specific markers:
  - Detection during juvenile period
  - Independence from weather conditions

S (self-incompatibility) gene marker

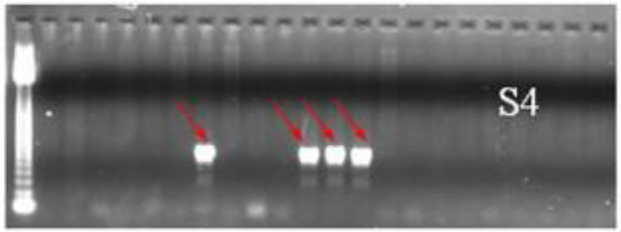
Marker system 1



Degenerate PCR primer pairs developed by Wiersma et al. (2001)

Marker system 2

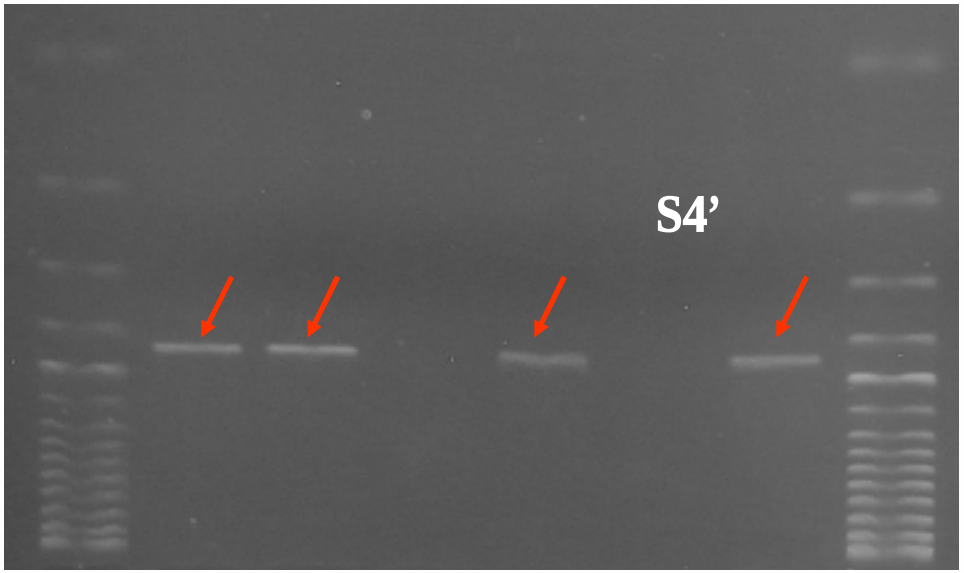
Determination of alleles 1 to 6



S-RNase allele specific PCR primer pairs developed for each allele (S1 to S6) by Sonneveld et al. (2001)

S (self-compatibility) gene marker

Marker system 3



Determination of allele S4’ (self- compatibility)

S-RNase allele specific PCR primer pairs developed for allele (S4’) by Zhu *et al* 2004

Applications

- Screening of genetic resources collection:
  - Detection of compatibility groups
  - Detection of self- compatibility donors

- Introduction of markers in breeding:
  - Testing and selection of potential parents
  - Testing of hybrids

Screening of genetic resources collection

- Results:

  - **56 varieties screened**

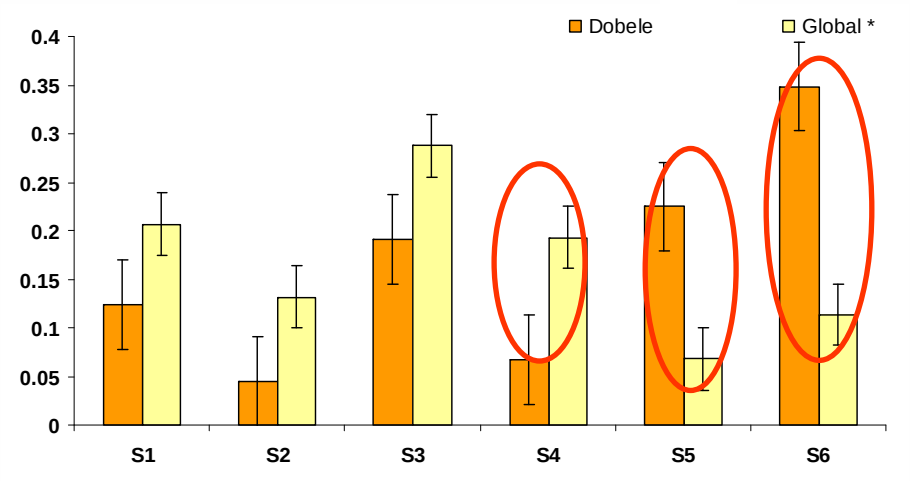
    (Lacis et al 2008)

Table 1 *S*-alleles identified in accessions of the Dobele HPBES sweet cherry collection

No	Accession name	Origin[a]	*S*-allele	Incompatibility group[b]
1	Agris	LC	S_1S_2	I
2	AM-10-12-6	LC	S_3S_5	V
3	AM-10-6-12	LC	S_1S_3	II
4	AM-24-10-22	LC	S_1S_4	IX
5	AM-28-6-7	LC	S_3S_5	V
6	Balzams	LC	S_2S_5	VIII
7	Brjanskaja Rozovaja	RC	S_3S_6	VI
8	Drogan's Gelbe	EO	S_1S_5	XIV
9	Elfrīda	LC	S_5S_6	XV
10	Kati	EC	S_4S_5	VII
11	Meelika	EC	S_4S_6[c]	XVII
12	PU-13629	PU	S_1S_6	XX
13	PU-13802	PU	S_2S_6	XXV
14	PU-14419	PU	S_5S_6[c]	XV
15	PU-14421	PU	S_3S_5	V

Screening of genetic resources collection

- Results:

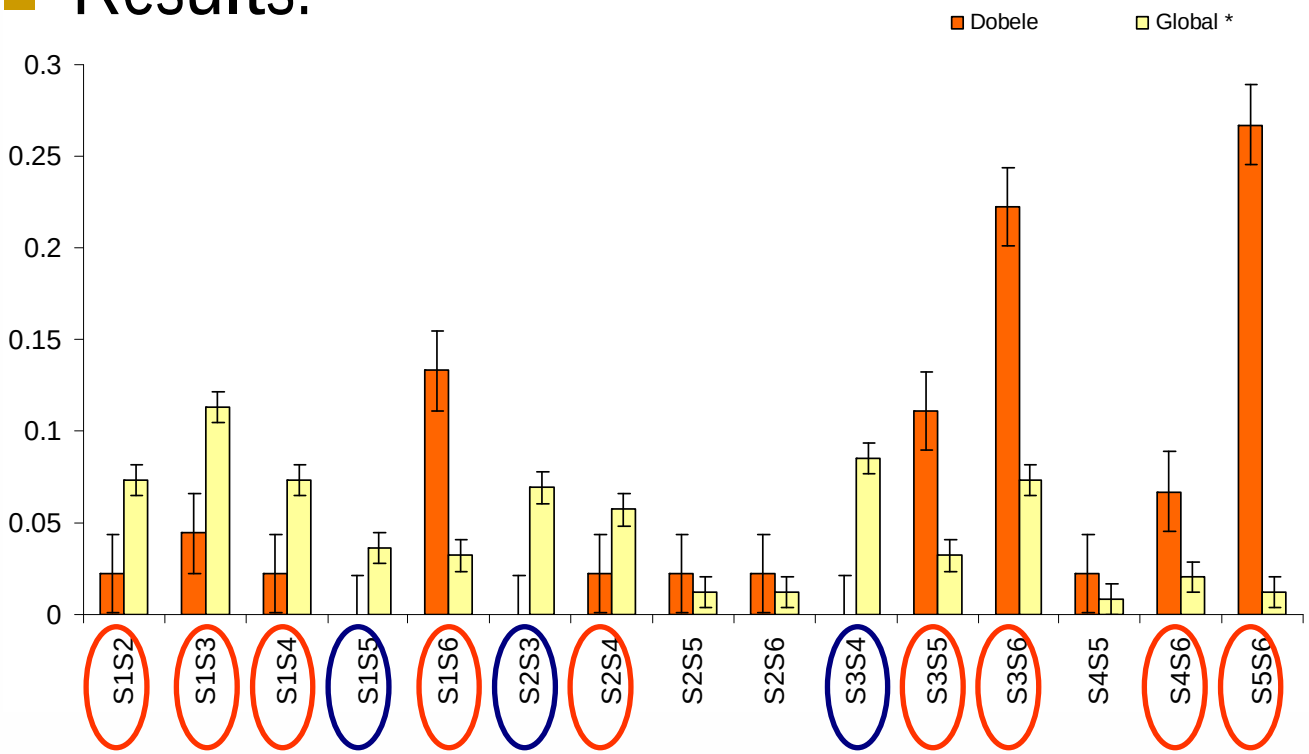


6 incompatibility alleles

*** Allele frequencies calculated from S-allele identification data published by Tobutt et al. (2004) The *S*-allele frequencies published for over 250 sweet cherry cultivars from Western and Southern Europe.**

Screening of genetic resources collection

- Results:

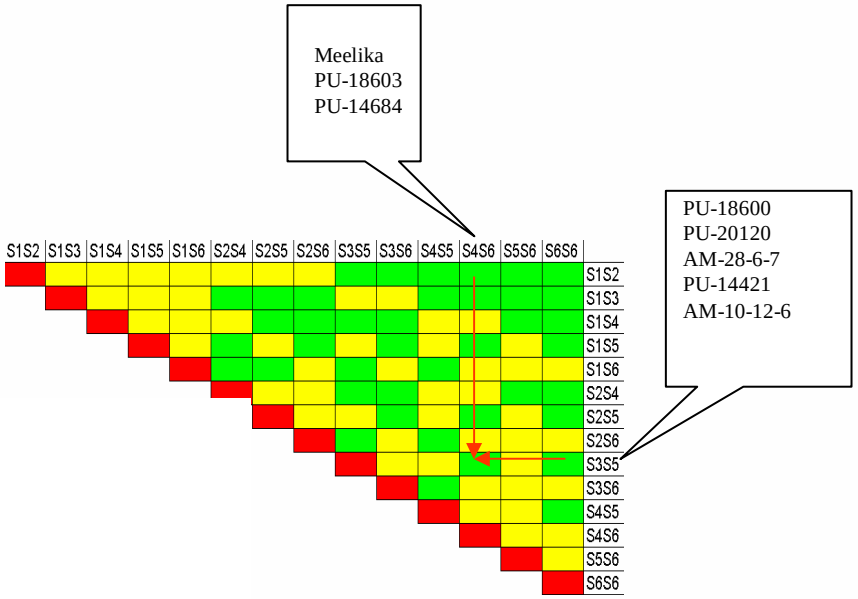


13 incomtatibilty genotypes

*** Allele frequencies calculated from S-allele identification data published by Tobutt et al. (2004) The *S*-allele frequencies published for over 250 sweet cherry cultivars from Western and Southern Europe.**

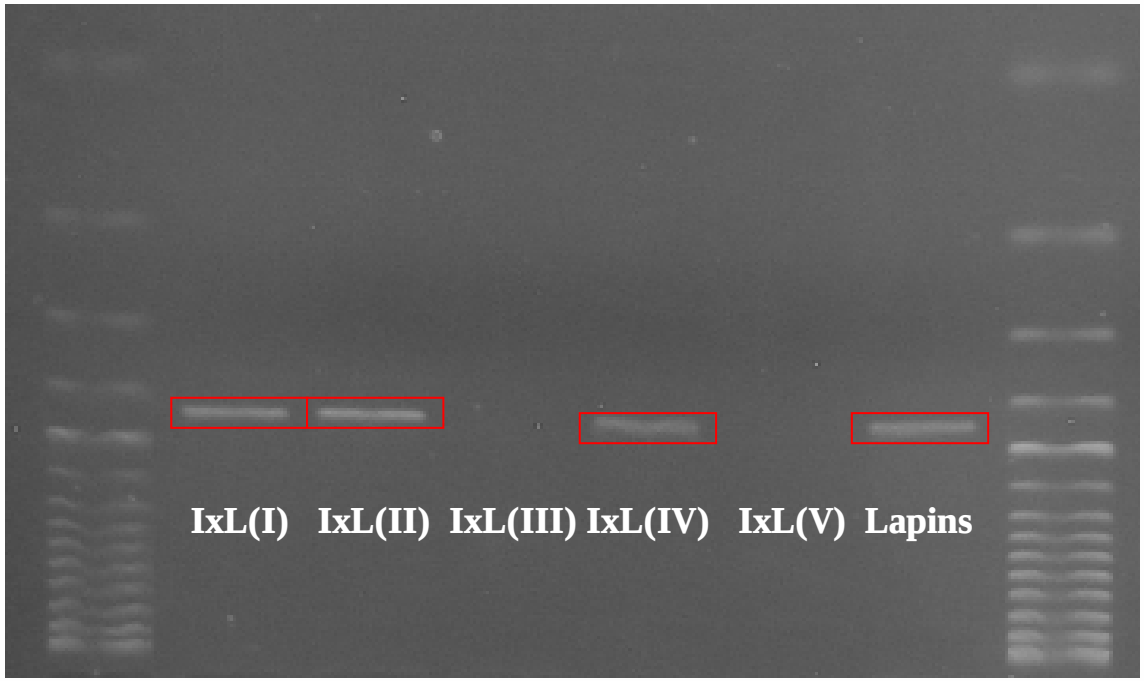
Screening of genetic resources collection

- Further applications:



- as accession descriptor
- planning of crosses
- for conservation of alleles
- population genetics studies
- practical fruit growing

Introduction of markers in breeding



Parents:
‘Lapins’ (self-fertile)
‘Iputj’ (winterhardy)

Progeny:
IxL (I) (S4’)
IxL (II) (S4’)
IxL (III)
IxL (IV) (S4’)
IxL (V)

Thank you for your attention!