ANALYSIS OF GENETIC DIVERSITY OF SELECTED *RIBES* GENOTYPES IN THEIR RESISTANCE TO BLACKCURRANT GALL MITE USING SSR MARKERS

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RIBES – SCIENTIFIC CLASYFICATION

DOMANIAN: EUKARYA
KINGDOM: PLANTAE

SUPERPHYLUM: SPERMATOPHYTE
PHYLUM: MAGNOLIOPHYTA

FAMILY: GROSSULARIACEAE

GENUS: RIBES

SPECIES:

***Ribes nigrum* (Blackcurrant)**
***Ribes odotatum (*Red Currant)**
Ribes uva-crispa (*Goosberry*)
…….

HEALTH BENEFITS OF *RIBES*

RICH IN

VALUABLE FOR HEALTH PHYTO-NUTRIENTS AND ANTI-OXIDANTS

- **ANTHOCYANINS**
- **VITAMIN-C**
- **VITAMIN-A**
- **B-VITAMINS** (PANTOTHENIC ACID – VITAMIN B5, PYRIDOXINE – VITAMIN B6, THIAMIN – VITAMIN B1)
- **….**

RIBES CULTIVATED FOR:

FRESH FRUITS

AND

PROCESSING INTO

JUICE AND BEVERAGE, JAMS
JELLIES, YOGHURTS, PUREES, TEAS

FUNCTIONAL FOOD PRODUCTS

↓

RIBES PRODUTION IS VERY IMPORTANT

BLACKCURRANT BUD GALL MITE

Cecidophyopsis ribis (Westw.)

ONE OF THE MOST IMPORTANT PEST OF CULTIVATED *RIBES*

- **INFECTS NEW BUDS THROUGHOUT THE BLOSSOM PERIOD**
- **CAUSES BUD DAMAGING (‘BIG BUD’)**

LIVES INSIDE THE DORMANT BUDS SUCK SAP FROM EMBRYONIC LEAVES

CAUSES INFESTED BUDS TO BECOME ABNORMALLY SWOLLEN AND ROUNDED

CECIDOPHYOPSIS RIBIS – VECTOR OF *BRV* (BLACKCURRANT REVERSION VIRUS)

EUROPEAN form (E)

RUSSIAN form (R) (more severe than E)

STERILITY OF FLOWERS

REDUCE YIELD of blackcurrant plants

VARIETIES RESISTANT TO *BRV*

R. nigrum sibiricum, R. bracteosum

R. cereum, R. carrierieriei

R. dikuscha

CULTIVARS WHICH ARE RESISTANT TO *BRV* ARE NOT ALWAYS RESISTANT TO GALL MITE

(e.g *Ribes dikuscha*)

CURENT KNOWLEDGE - GALL MITE RESISTANCE

TWO GENES OF RESISTANCE & THE SOURCE OF THEM:

Ce* – *R. grossularia
P* – *R. nigrum sibiricum
????????

PYRAMIDING OF RESISTANCE

Ce RESISTANCE IS MUCH MORE EFFECTIVE AGAINST GALL MITE INFESTATION THAN P RESISTANCE

TRAITS INTRODUCED BY INTERSPECIFIC HYBRIDIZATION MAY BE LOST (BACKCROSSES WITH *R. nigrum* CULTIVARS)

THERE ARE NOT EFFECTIVE CONTROL OF THE PEST

RESISTANT CULTIVARS ARE DESIRED

IDENTIFICATION OF MITE-RESISTANT PLANTS

PHENOTYPIC DATA

(from field observations or infestation plots)

TIME-CONSUMING!

MOLECULAR METHODS – MARKERS

EARLY DIAGNOSTIC SYSTEM

SELECTION OF RESISTANT GENOTYPES

- **IN ALL PHASES OF PLANT DEVELOPMENT**
- **WITHOUT INFESTATION**

THE AIM OF STUDY

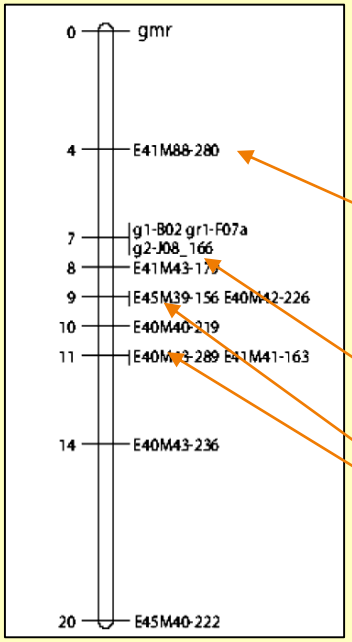
SSR-BASED COMPARISON OF *RIBES* GENOTYPES DIVERSED IN THEIR RESISTANT TO GALL MITE TO SELECT ALL FRAGMENTS LINKED TO ANALYSED TRAIT

LINKAGE MAPS IN OUR STUDY…

SCOTTISH

Brennan et al. 2008

(SCRI S36/1/100 × EMRS B1834)

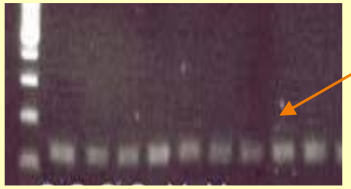


Ce RESISTANCE MAPED TO LG2

AFLP (linked to gall mite resistance)

SSR

EST



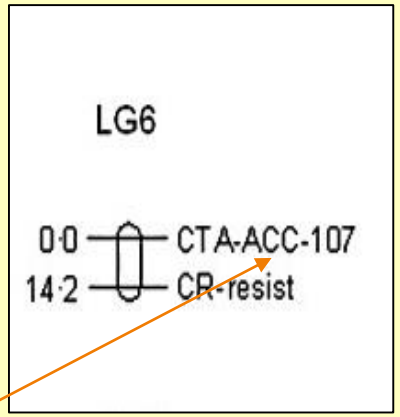
GMresa (130 bp) AMPLIFIED ONLY IN THE RESISTAN PLANTS

LITHUANIAN

Mazeikine et al. 2012

(No 93-169-2 × 'Dainiai')

P RESISTANCE MAPED TO LG6



AFLP (directly used to identify resistance in blackcurrant germplasm)

MATERIAL

15 *RIBES* GENOTYPES (young leaves)

Lp.	VARIETY	PEDIGREE	COUNTRY OF ORIGIN
1.	Tisel	Titania x selfed	Poland
2.	Ruben	Bieloruskaja Słodkaja x Ben Lomond	Poland
3.	Ben Hope	Westra x (SCRI 238/36 x EM 21/15)	Scotland
4.	Ben Gairn	Ben Alder x Gołubka	Scotland
5.	Kroma	unknown	Germany
6.	Gofert	Gołubka x Fertodi 1	Poland
7.	Lentaj	Brodtorp x Minai Shmyrev	Russia
8.	Dlinnokistnaja	Primorsky Champion x Boskoop Giant	Russia
9.	Tihope	Titania x P9/11/14	Poland
10.	Vir	unknown	Russia
11.	Blizgiai	Öjebyn' x 'Minaj Shmyriov	Lithuania
12.	Kerry	Black Naples x selfed	Canada
13.	Ben Sarek	(Goliath x Ojebyn) O.P.	Scotland
14.	Ben Alder	Ben More x Ben Lomond	Scotland
15.	Ben Kilbreck	(Ben More x C2/13/15) X (Ben More x RI-74020-16)	Scotland

METHODS

DNA EXTRACTION

(Doyle & Doyle, 1990)

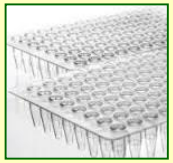



DNA QUANTIFICATION

(Amersham Pharmacia Biotech's Gene Quant pro Spectrofotometer)


PCR AMPLIFICATION (25 SSR PRIMERS)

Datebaze mapping: Brennan *et al*. 2008, Mazaikine et al. 2012)

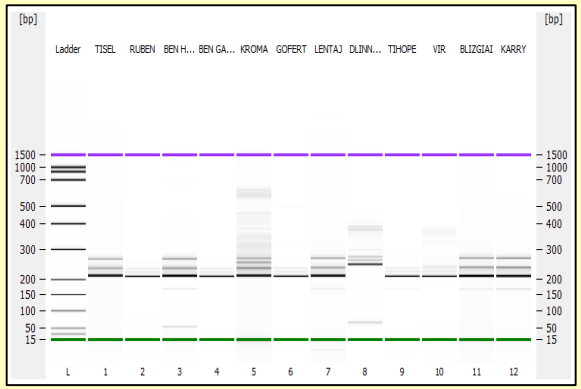



WISUALIZATION OF AMPLIFIED PRODUCTS

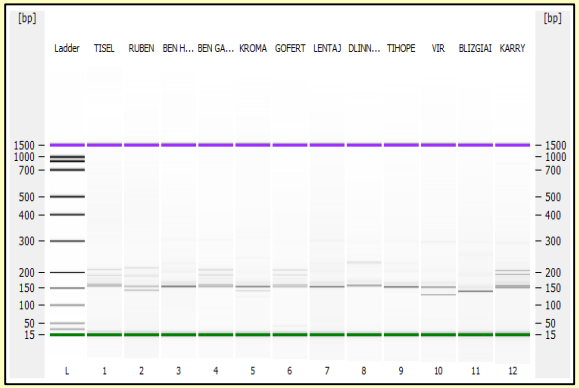
(Bioanalyzer Agilent 2100)


RESULTS

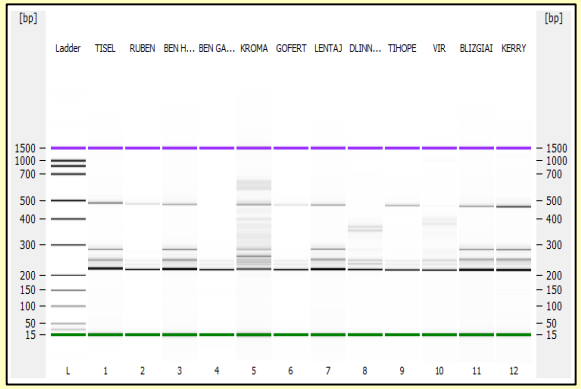
PCR PRODUCTS DIFFERENTIATING THE VARIETIES - examples



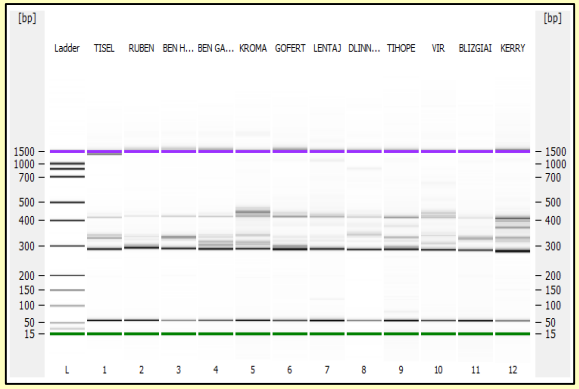
Primer g1-A01



Primer e1-O21



Primer Fa11



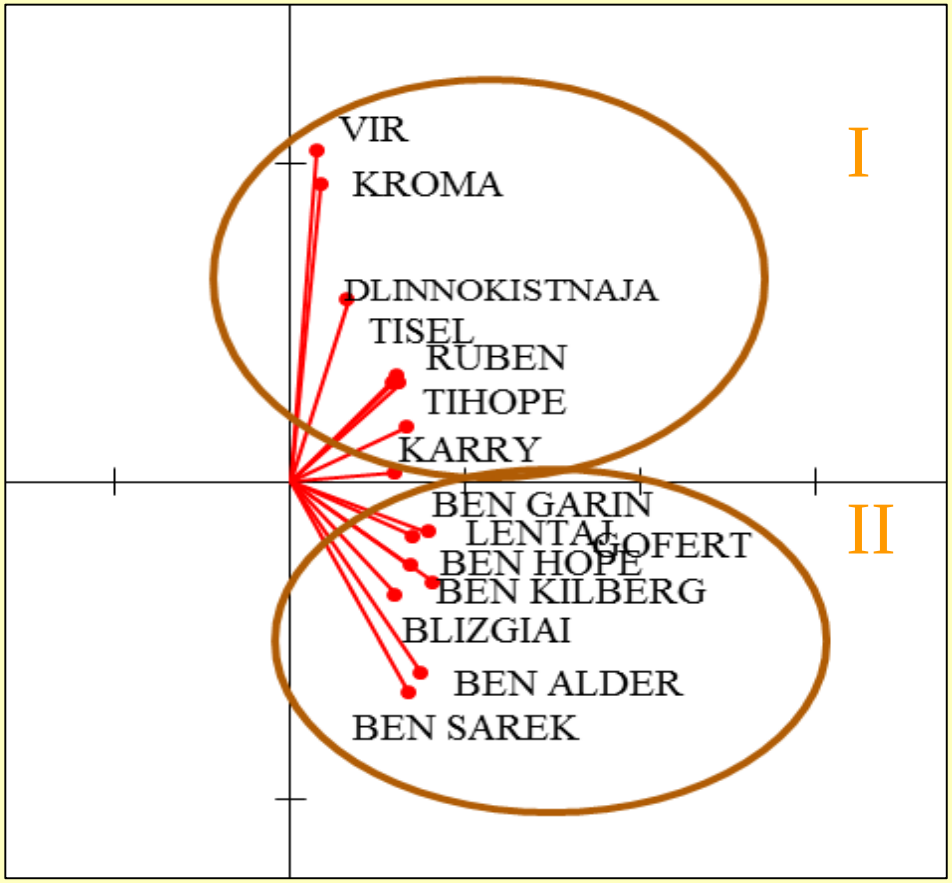
Primer M32

Tested 25 SSR primers

with 13 primers:
93 polymorphic amplikons
(130-820 bp)

RESULTS

MULTIPLE CORRESPONDENCE ANALYZE (MCA)

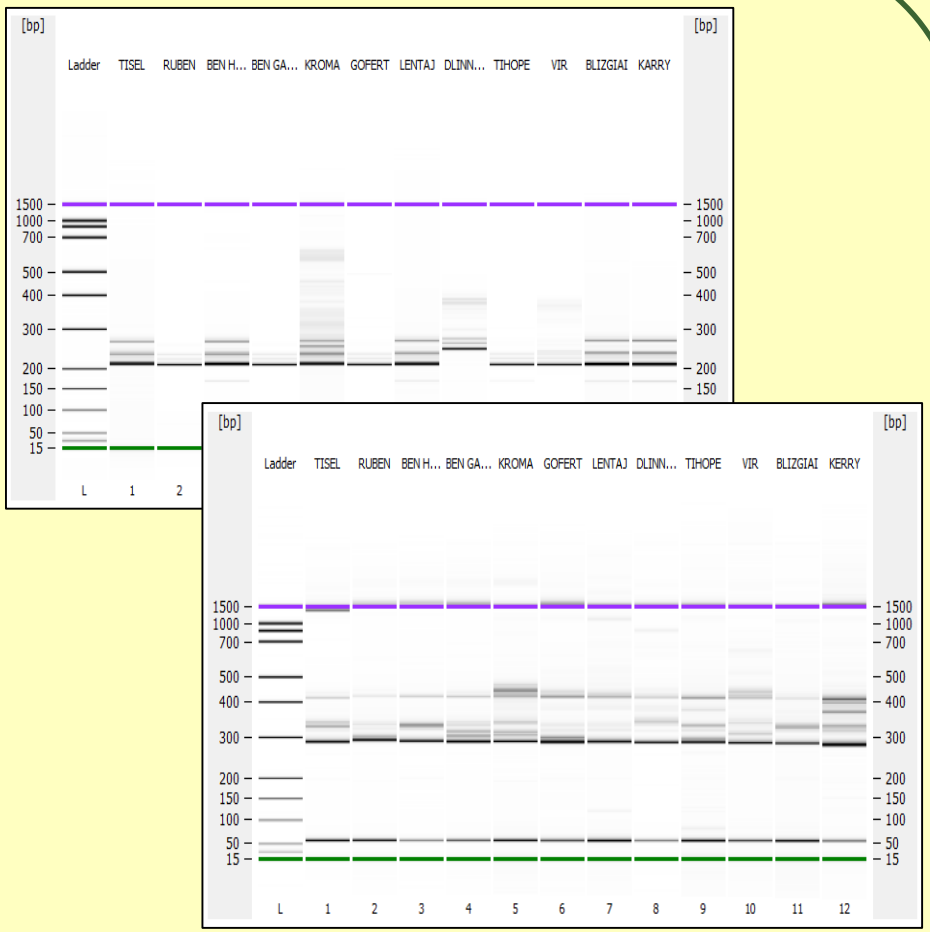


I – RESISTANT GENOTYPES

II – SUSCEPTIBLE GENOTYPES

CORRELATION BETWEEN PHENOTYPING & GENOTYPING RESULTS

Lp.	VARIETY	RESISTANT/ SENSITIVE[1]
1.	Tisel	resistant
2.	Ruben	susceptible
3.	Ben Hope	susceptible
4.	Ben Gairn	susceptible
5.	Kroma	resistant
6.	Gofert	susceptible
7.	Lentaj	susceptible
8.	Dlinnokistnaja	susceptible
9.	Tihope	resistant
10.	Vir	resistant
11.	Blizgiai	resistant
12.	Kerry	resistant
13.	Ben Sarek	susceptible
14.	Ben Alder	susceptible
15.	Ben Kilbreck	susceptible



RESULTS

IDENTYFICATION OF ALLELES POTENTIAALLY LINKED TO GALL MITE RESISTANCE

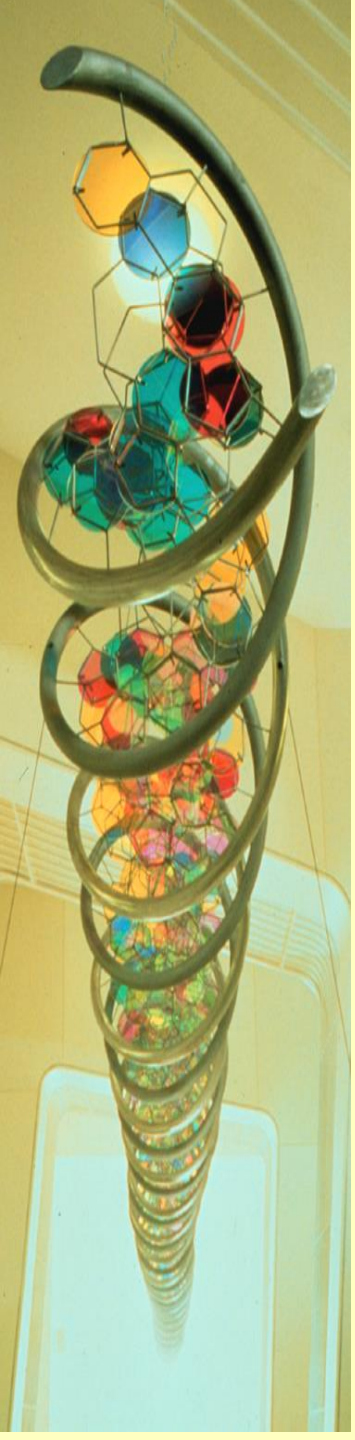
GENOTYPE	ALLEL (bp)/ MARKER/ LG		
	270bp/ g2-j08/LG2*	230bp/ g2-17/ LG4*, LG1**	200bp/ RJL-5/LG2*, LG2**
'Tisel'	+	+	+
'Ruben'	+	+	+
'Kroma'	+	+	+
'Dlinnokistnaja'	+	+	+
'Tihope'	+	-	-
'Vir'	+	+	+
'Karry'	+	-	+

* Scotish map; ** Lithuanina map

SUMMARY

Correlation between the DNA polymorphism and plants resistance to gall mite, evaluated by multiple correspondence analyzes (MCA), allowed to group tested genotypes in two clusters: I) resistant ('Vir', 'Kroma', 'Dlinnokistnaja', 'Tisel', 'Ruben', 'Tihope', 'Karry') and II) susceptible ('Ben Sarek', 'Ben Alder', 'Blizgiai', 'Ben Kilbreg', 'Gofert', 'Ben Hope', 'Lentaj', 'Ben Garin') to gall mite.

In the genomes of tested plants, identified alleles linked to gall mite resistance, derived from LG2 (seven genotypes) and LG4 (five genotypes), corresponding to Scottish map, as well as from LG1 (five genotypes) and LG2 (six genotypes), corresponding to Lithuanian genetic *Ribes* map.



Study are running……

THANK YOU

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