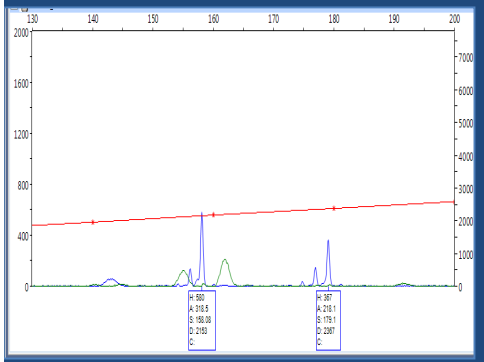
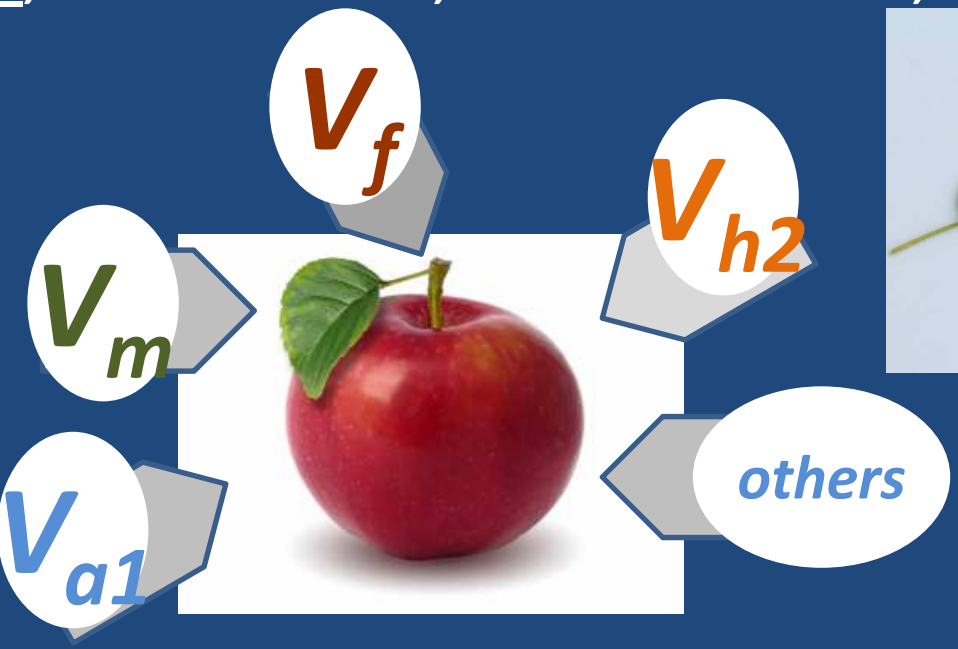
Towards **gene pyramiding** for apple **scab resistance** following the working results at **VNIISPK**

Pikunova A.V., Sedov E.N., Krasova N.G., Serova Z.M.





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Our team


Serova Zoya

Apple breeding,
released
over 70 cultivars


Sedov Evgeny

Krasova Nina

Cultivar evaluation,
apple germplazm
collection
is over 700 cultivars

DNA-markers


Pikunova Anna

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Introduction

Scab disease

- *Venturia inaequalis*
- Evolution
- Overcame resistances

DNA-markers

- Fast identification of genotypes with R genes
- Marker Assisted Breeding

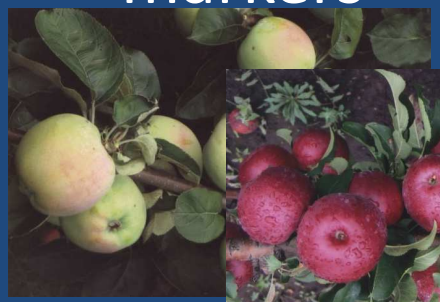
– for effective and accurate breeding

Breeding for Resistance

- Oigogenic + poligenic resistances
- Resistant genes (RG)
- Over 17 RG are known (*Rvi1- Rvi17*)
- Pyramiding of RG for durable resistance

Aims of this study:

- to evaluate important **germplasm** for the presence of scab resistant genes by means of DNA-markers
- to start using of **MAB** for scab resistance



Germplazm screening

- 91 genotypes (78 bred in Russia, 51 from the VNIISPK breeding program)

V_f
- CH-*Vf1* SSR (Vinatzer et al. 2004)
- amplified with VFC primers (Afunian et al. 2004)
- SNP (for some cultivars, FruitBreedomics)

V_m
-Hio7h02 SSR (Patocchi et al. 2005)
- SNP (for some cultivars, FruitBreedomics)

V_{a1} CH-*Vf1* SSR (Vinatzer et al. 2004)

V_{h2} Ch02B10 SSR and OPL19 SCAR (Bus et al. 2012)

Results

Germplazm screening

Vf (Rvi 6)

- *Vf* (from *M. Floribunda*, 814 and 1924), “immunity” in Russia

- 35 genotypes (31 from VNIISPK breeding programme) with *Vf* from 81 tested:

- selections 27-1-222, 30-33-25, 30-33-81
- **VNIISPK cultivars:** Afrodita, Imrus, Ivanovskoe, Jablochnyj spas, Kandil' Orlovskij, Orlovskoe poles'e, Solnyshko, Start, Stroevskoe, Svezhest, Zdorov'e, Blagaja vest, Maslovskoe, Jubilej Moskvy, Pamjati Blynskogo, Pamjati Hitrovo, Jubiljar, Pervoural'skaja, Pojezija, Priokskoe, Rozhdestvenskoe, Sozvezdie, Spasskoe, Valjuta, Venjaminovskoe, Vostorg, Zeljonyj shum, Zhilinskoe

- Otheres: Priam, Koremodet, Koremolda, M.Floribunda 821

Results

Germplazm screening

Vf (Rvi6) V_f

- newly identified *Vf* cultivars - ‘Pojezija’, ‘Priokskoe’

224_18 V_m x

no *Vf*

? free polination

‘Pojezija’ V_m V_f

V_f

‘Priokskoe’

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Results

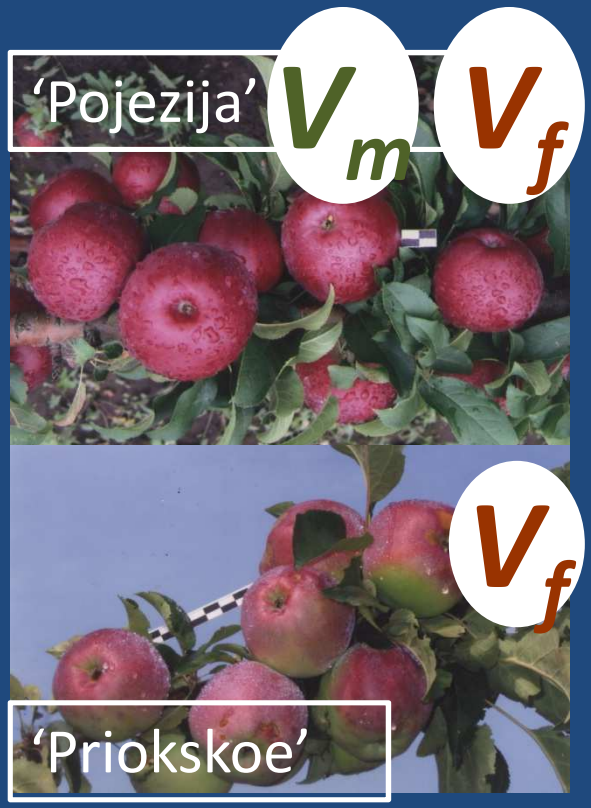
Germplazm screening

Vf (Rvi6)

- ‘Pojezija’, ‘Priokskoe’ – newly identifyed having Vf,

224_18 V_m x ? free polination V_f

no *Vf*



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Germplazm screening

Vf (Rvi6)

V_f

- 6 homozygous *VfVf* fructerious hybrids identified

x

V_fV_f

6 hybrids

x

V_fV_f

1 hybrid

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Results

Germplazm screening

Vm (Rvi5) V_m

- *M. atrosanguinea* 804, SR0523 (F2 *M. atrosanguinea* 804)
- 10 (9 bred at VNIISPK) with *Vm* from 15 tested
- *F3 M. atrosanguinea* 804: Chistotel, Orlovim, Orl. pioner Slavjanin, Sokovinka, Zarjanka
- *F4 M. atrosanguinea* 804: Patriot, Pojezija
- *F5 M. atrosanguinea* 804: Podarok Uchitelju

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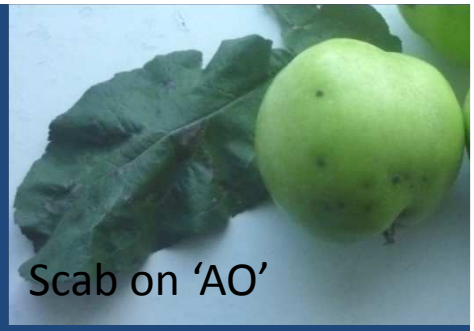
Results

Germplazm screening

Va1 (Rvi17) V_{a1}


Scab on 'AO'

- 'Schmidt's Antonovka' (= 'Antonovka Obyknovennaya', AO)
- AO – source of poligenic resistance and winter hardiness
- Several RG identified in progeny and VA quantitative resistance
- 8 genotypes with *Va1* from 30 tested

Results

Germplazm screening

Va1 (Rvi17) V_{a1}

Old cultivars:

AO

‘Antonovka Krasnobochka’, F1 of AO

‘Bessemyanka Michurinskaya’ (‘Skryzhapel‘ no V_{a1} x ‘Bessemyanka Komsinskaya’ ?V_{a1}

F1: ‘Zaryanka’ (released at), ‘Sokovinka’ ‘Svezhest’

F2: ‘Patriot’

F1:‘Orlik’

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Results

Germplazm screening

Vh2 (Rvi 2)

- from *Malus pumila* Mill, R12740-7A selection, Reca, Remura, OR40T43
- 6 genotypes with *Vh2* from 17 tested

'Reca' V_{h2}

F1: 29-40-186, 31-5-15 , 31-5-42 bred at VNIISPK V_{h2}

OR40T43 (seedlings of *Malus pumila* Mill) not cheked

F1: 27-1-222, bred at VNIISPK V_f V_{h2}

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Di-gene genotypes

$V_m V_f$

Pojezija

$V_f V_{a1}$

Svezhest

$V_{a1} V_m$

Patriot

Zarjanka

Sokovinka

$V_{h2} V_f$ 27-1-222

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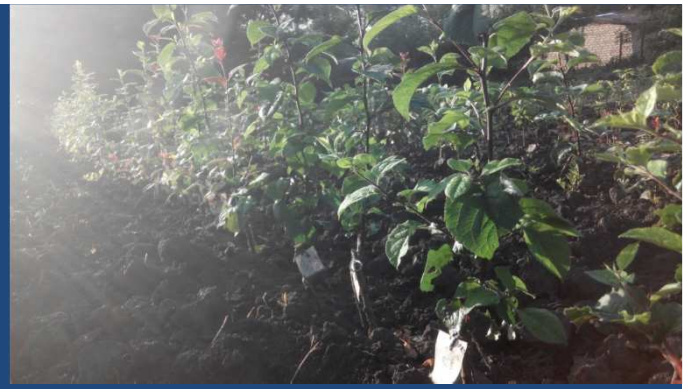
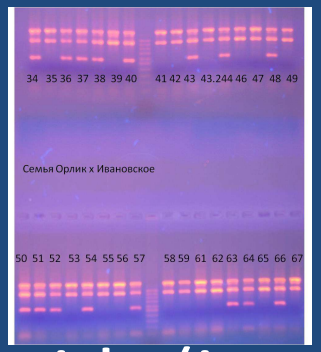
MAS at seedling nursery



- Started at 2012
- For *Vf* mostly
- Over 20 families evaluated (without 2016 data)
- *Vf* hybrids
- *Vf Vm* hybrids
- *Vf* columnar and triploid hybrids (in coloboration with cytoembryology lab)



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Conclusions

- **Di-gene cultivars** for durable resistance and further breeding
- ***Vf Vf* hybrids** for further breeding
- **Newly identified Vf cultivars**
- Knowledge for breeders
- **MAS** in a progress

'Pojezjia' Vm

Svezhest

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Thank you for attention!