

Nye udfordringer med gulrust – seneste resultater fra GRRC

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Dagens indlæg

- Det globale Rustcenter
- Gulrust 2013/2014
- Varslingssystem for gulrust sorter/racer mm.
- Warrior/Kranich racer; - hvor kommer de fra?
- Sammenfatning



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Det Globale Rustcenter www.wheatrust.org



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THE WARRIOR RACE GROUP SPREADS IN EUROPE

READ MORE

News



2014.06.27 | RESEARCH NEWS

Yellow rust in Europe: The Warrior race group has spread to new areas in 2014

New results from GRRRC show that isolates of the Warrior race group were present in high frequencies at many epidemic sites in Europe in 2014. Isolates of this race group were detected on many varieties of both wheat and triticale, which confirm a high level of aggressiveness of such isolates.

Race analysis of Puccinia striiformis at GRRRC

Please find reports of the non-European Puccinia striiformis race analyses activities at GRRRC 2010 - 2013:

- » [Summary of Puccinia striiformis race analysis 2013 NEW February 2014](#)
- » [Summary of Puccinia striiformis isolate pathotyping 2012](#)
- » [Summary of Puccinia striiformis isolate pathotyping 2011](#)
- » [Summary of Puccinia striiformis isolate pathotyping 2010](#)

Sampling site focus in 2014 will be selected by staff at ICARDA, CIMMYT and NARC in Africa and Asia, with a focus on high risk epidemic areas. Since 2011, GRRRC also accepted samples of stem rust (Puccinia graminis tritici) as agreed upon with the Borlaug Global Rust Initiative and the phase II of the Durable Rust Resistance in Wheat Project (DORRRI). GRRRC can only process samples according to available space and resources at any time, and we cannot guarantee to process all samples received. This report deals only with yellow rust. Submission procedures are enclosed at the end of the report, 2012.

Omfattende internationalt netværk

The Borlaug Global Rust Initiative Network






IC-team













2

Disease epidemiology is changing

Triticale, Denmark, 11th March, 2014



Disease epidemiology is changing

Wheat: The Netherlands, 1st April 2014



Hvede v/ Karise, 20. november 2013

Angreb i den kommende vækstsæson?

Primær infektion af gulrust ("læsion")

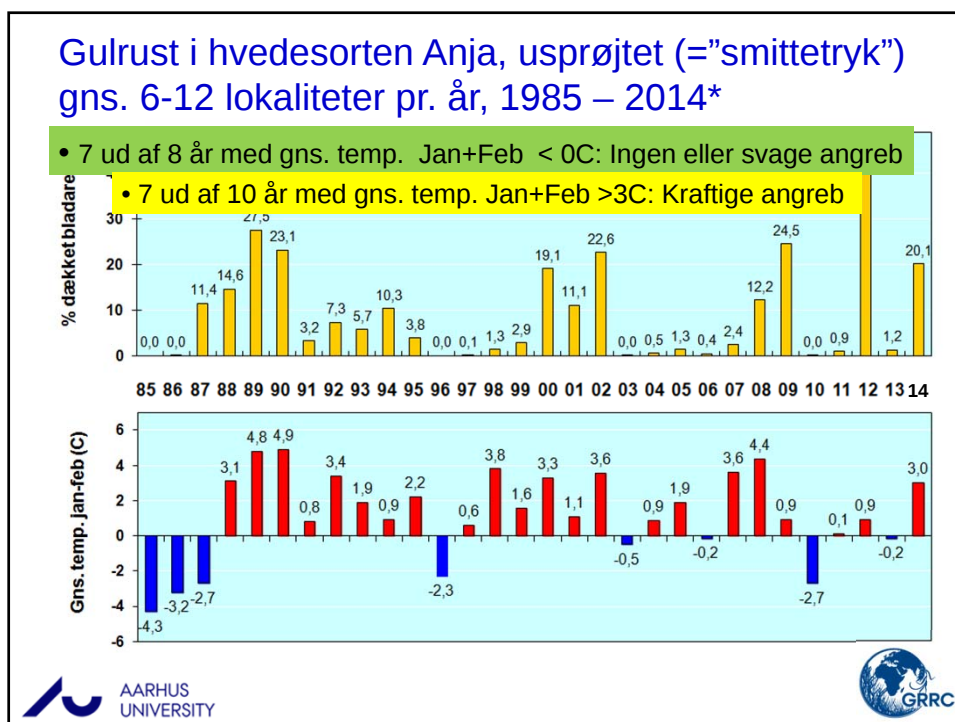
- Vinteroverlevelse: Afhænger af værtplantens 'overlevelse'
- Smitterisiko (sortsniveau): Afhænger af 'smitterace'
- Epidemisk potentiale: Afhænger af svampens 'aggressivitet'
- Afhænger af vækst/vejrforhold og 'management' på markniveau og sortens resistens





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Den danske varslingsystem for gulrust

År 0



Observation af rustangreb i hidtil resistent hvedesort
(OBS-parceller, Registreringsnet, marker, mm.)



GRRC
Opformering af sporeprøver
fra inficerede planter



År 1

År 2 og senere



Den danske varslingsystem for gulrust

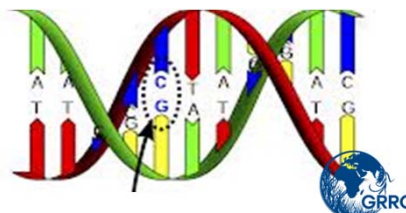
År 0

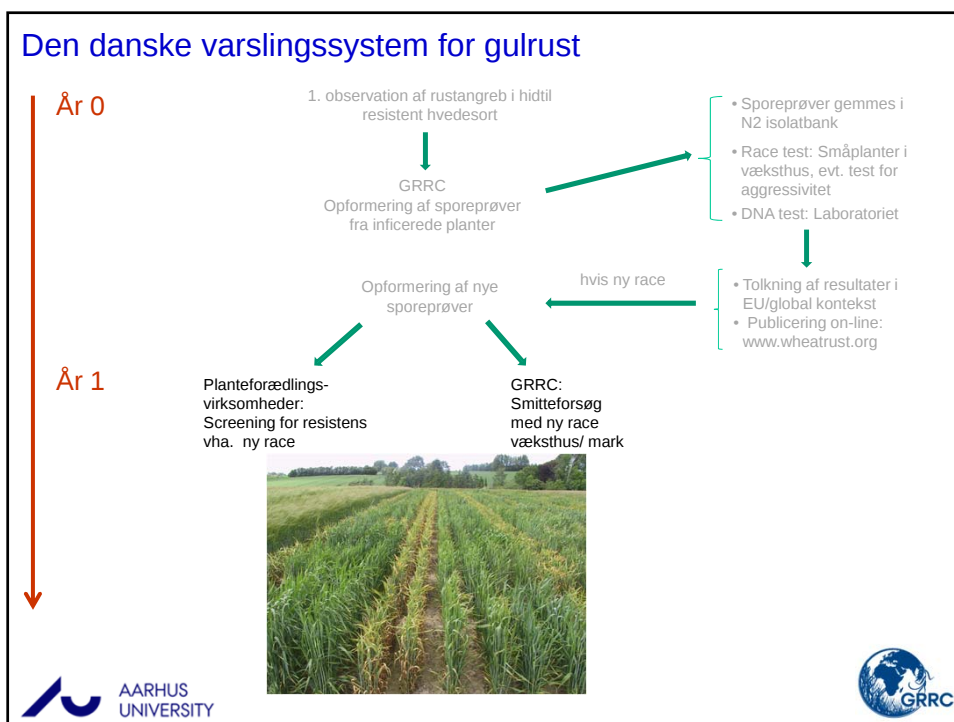
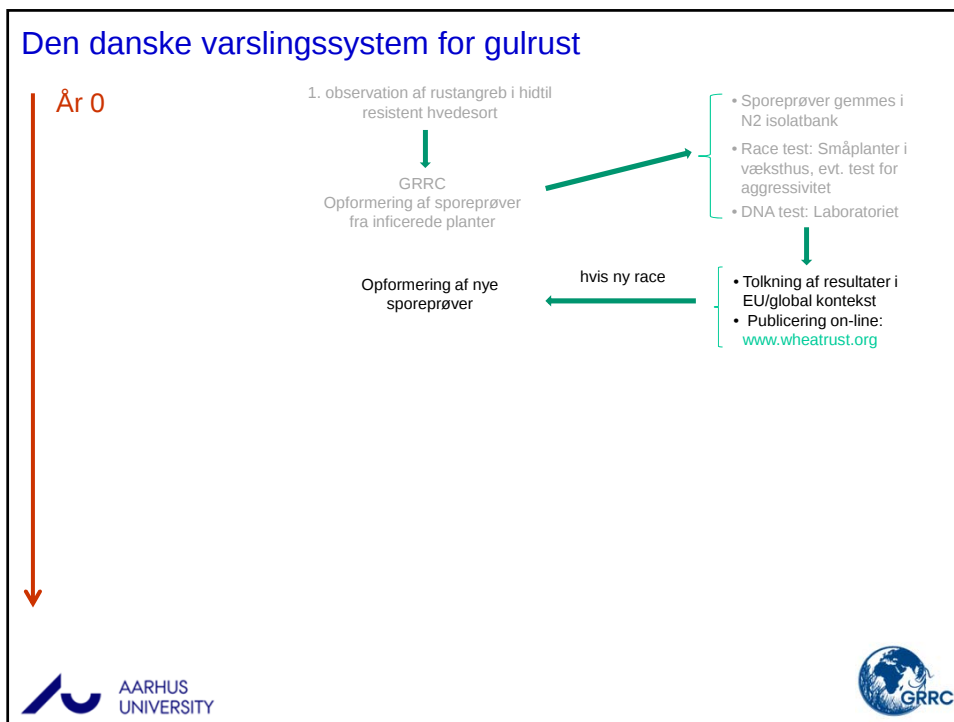
1. observation af rustangreb i hidtil
resistent hvedesort



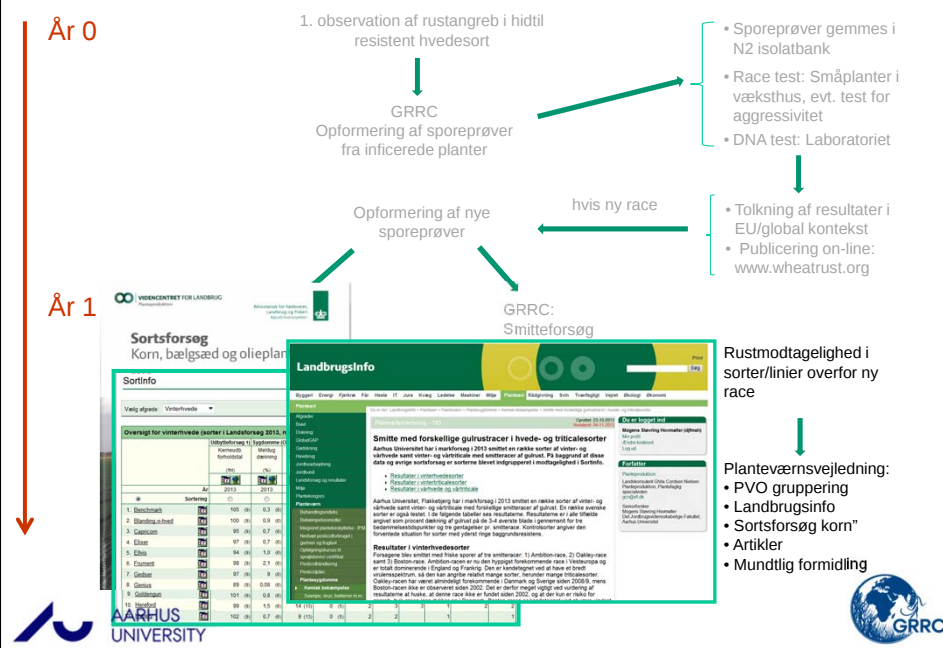
GRRC
Opformering af sporeprøver
fra inficerede planter

- Sporeprøver gemmes i N2 isolatbank
- Race test: Småplanter i væksthuss, evt. test for aggressivitet
- DNA test: Laboratoriet





Den danske varslingsystem for gulrust



Hvilke sorter er mest udsatte for gulrust?



Hvilke sorter er mest udsatte for gulrust?

Procent dækket bladareal ved fire bedømmelsesdatoer, 2 racer, smitteforsøg Flakkebjerg 2014

Afgrøde	Anm nr.	Sort	Fremavl	PVO	DK02d/12 (Kranich race)				DK09/11Sp (Warrior race)			
					15.05.14	26.05.14	06.06.14	26.06.14	15.05.14	26.05.14	06.06.14	26.06.14
Vinterhvede	20372	Ambition		3	0,3	8,8	17,5	25,0	0,4	7,5	21,3	25,0
Vinterhvede	11281	Anja		3	0,7	11,3	13,8	17,5	0,5	17,5	17,5	19,4
Vinterhvede	15103	Brigadier		3	0,1	6,3	9,4	21,3	0,0	2,0	4,1	8,8
Vinterhvede	18773	Cardos		3	0,3	11,3	21,3	40,6	0,6	6,9	11,3	37,5
Vinterhvede	23127	Mariboss	6.042	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Vinterhvede	25516	KWS Dacanto	3.893	1	0,0	0,4	0,5	0,5	0,0	0,0	0,1	0,1
Vinterhvede	23843	Jensen	2.692	2	0,1	2,4	1,9	1,9	0,2	3,0	2,0	2,0
Vinterhvede	25545	Nakskov	2.452	2	0,0	2,5	6,3	8,1	0,0	1,4	2,5	2,5
Vinterhvede	27329	KWS Cleveland	1.767	1	0,0	1,0	2,4	1,4	0,0	0,1	0,1	0,1
Vinterhvede	22241	Hereford	1.498	1	0,0	1,0	1,4	1,5	0,0	0,6	0,4	0,6
Vinterhvede	27345	Elixer	318	1	0,0	1,4	1,9	1,9	0,0	0,5	0,5	0,5
Vinterhvede	26496	Torp	121	1	0,0	0,0	0,0	0,0	0,0	0,2	0,4	0,5
Vinterhvede	27872	Ohio	97	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Vinterhvede	28655	Landskæct	50	3	0,2	10,6	13,8	23,1	0,4	5,1	7,6	15,6
Vinterhvede	27916	Bergmark		3	0,2	4,5	7,0	11,3	0,3	3,5	4,5	6,9

Specifikt R-gen

"partiel/horisontal/mark" resistens

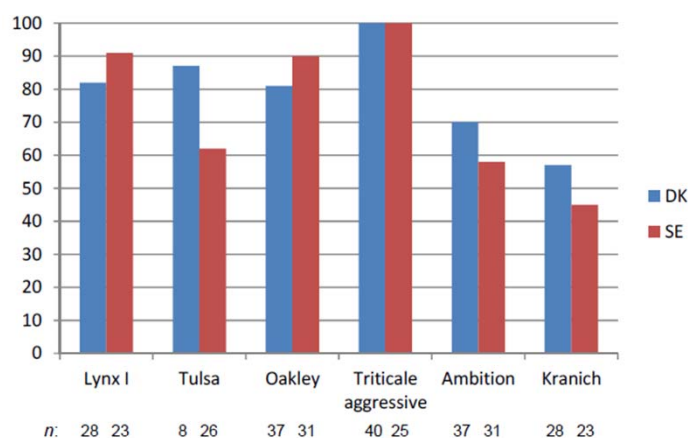


Hvilke sorter er mest udsatte for gulrust?

Procent dækket bladareal ved fire bedømmelsesdatoer, 2 racer, smitteforsøg Flakkebjerg 2014

Afgrøde	Anm nr.	Sort	DK02d/12n (Kranich race)					DK09/11Sp (Warrior race)				
			15.05.14	26.05.14	06.06.14	26.06.14	Total mean	15.05.14	26.05.14	06.06.14	26.06.14	Total mean
Vinterhvede	USA MS	514W	0,5	31,3	75,0	100,0	68,8	1,6	34,4	68,8	87,5	63,5
Vinterhvede	20372	Ambition	0,3	8,8	17,5	25,0	17,1	0,4	7,5	21,3	25,0	17,9
Vinterhvede	11281	Anja	0,7	11,3	13,8	17,5	14,2	0,5	17,5	17,5	19,4	18,1
Vinterhvede	15103	Brigadier	0,1	6,3	9,4	21,3	12,3	0,0	2,0	4,1	8,8	5,0
Vinterhvede	18773	Cardos	0,3	11,3	21,3	40,6	24,4	0,6	6,9	11,3	37,5	18,5
Vinterhvede		Cumulus	0,5	18,1	29,4	40,6	29,4	1,3	8,3	22,5	29,4	20,0
Vinterhvede		Audi	0,1	11,3	29,4	40,6	27,1	0,3	10,0	27,5	34,4	24,0
Vinterhvede		SJ 6286003	0,1	4,6	11,9	23,1	13,2	0,0	5,8	17,5	23,1	15,5
Vinterhvede		Af 33768-07 (SW)	0,3	6,5	12,0	19,4	12,6	2,2	11,3	17,5	21,3	16,7
Vinterhvede		Magnifik	0,1	4,8	11,9	13,8	10,1	0,0	4,6	9,4	9,4	7,8
Vinterhvede		Nimbus	0,1	4,5	8,8	12,5	8,6	0,0	1,3	2,4	5,3	3,0
Vinterhvede		Kranich	0,3	7,5	8,1	8,1	7,9	0,4	4,6	4,1	6,4	5,0
Vinterhvede		Memory Sec 175-9c	0,4	6,9	8,1	8,1	7,7	0,1	3,5	3,5	3,5	3,5
Vinterhvede		Olivin	0,0	5,9	7,0	7,0	6,6	0,2	5,3	5,4	4,1	4,9
Vinterhvede		Norin	0,0	5,8	7,5	6,3	6,5	0,1	3,5	4,1	5,9	4,5
Vinterhvede		Beate	0,0	4,0	5,8	7,0	5,6	0,0	3,0	5,3	5,9	4,7
Vinterhvede		Loyal	0,1	4,1	5,9	5,9	5,3	0,0	5,1	7,5	6,3	6,3
Vinterhvede		Frontal	0,1	3,0	4,5	4,5	4,0	0,0	1,1	1,2	0,7	1,0
Vinterhvede		Linus	0,1	1,0	3,5	5,8	3,4	0,0	0,4	0,8	0,8	0,6
Vinterhvede		RGT Reform	0,1	2,5	3,5	3,5	3,2	0,0	0,8	1,4	1,3	1,1
Vinterhvede		Dixie SW 75177	0,1	2,5	3,5	3,5	3,2	0,0	2,0	2,0	3,0	2,3
Vinterhvede		Ceylon, SW 75107	0,1	2,5	2,0	2,0	2,2	0,0	1,4	0,8	1,0	1,1
Vinterhvede		Praktik	0,0	1,5	2,5	2,5	2,2	0,0	1,3	0,8	0,6	0,9
Vinterhvede		Opus	0,0	1,9	1,9	2,4	2,0	0,0	3,0	3,0	3,0	3,0
Vinterhvede		Julius	0,0	1,4	1,9	1,9	1,7	0,0	1,5	1,5	2,5	1,8
Vinterhvede		Stava	0,0	1,0	1,3	2,5	1,6	0,0	1,4	2,2	2,4	2,0
Vinterhvede		Brons	0,0	1,0	1,4	1,4	1,3	0,0	0,4	0,4	0,3	0,4
Vinterhvede		Skagen	0,0	0,6	0,5	0,5	0,5	0,0	0,3	0,2	0,4	0,3
Vinterhvede		Nord 05019/100	0,0	0,4	0,4	0,4	0,4	0,0	0,4	0,4	0,4	0,4
Vinterhvede		SW 85131	0,0	0,4	0,3	0,3	0,3	0,0	0,0	0,0	0,0	0,0
Vinterhvede		Elvis	0,0	0,2	0,1	0,0	0,1	0,0	0,0	0,0	0,0	0,0
Vinterhvede		Cubus	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Vinterhvede		SW 75638	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Vinterhvede		Tobak	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0





Procent resistente danske og svenske vinterhvedesorter (< 5% angreb) efter smitte med 6 gulrust-racer i markforsøg v/ Flakkebjerg. *n* = antal sorter/linier.

Race dynamik af gulrust i Europa 2000-2014

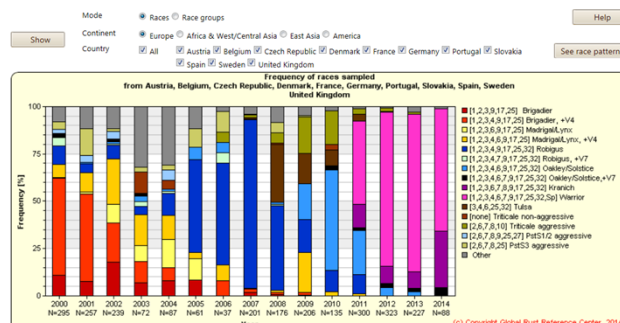


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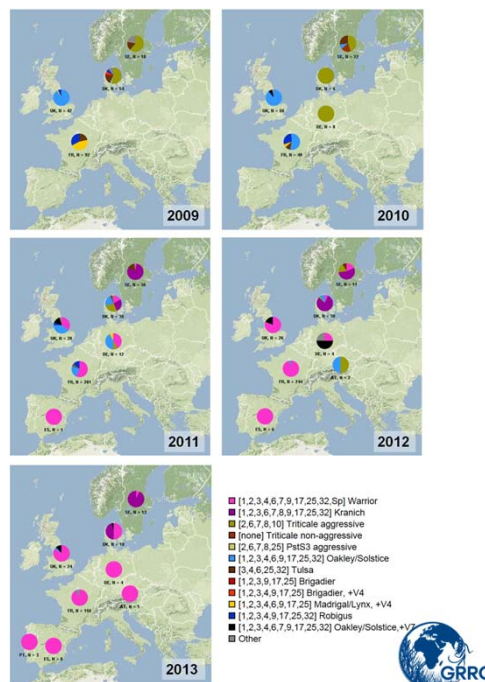
You are here: [wheatrust.org](#) > [Yellow Rust](#) > [Pathotype by country](#)

PATHOTYPE BY COUNTRY



Data provided by: Institut National de la Recherche Agronomique (France), Julius Kühn-Institut, Federal Research Centre for Cultivated Plants (Germany and Austria), National Institute of Agricultural Botany (United Kingdom) and Aarhus University (Denmark and Sweden).

Race dynamik af gulrust i Europa 2009-2014



Racer af gulrust i Europa 2014



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PATHOTYPE BY YEAR MAP - SINGLE LOCATION

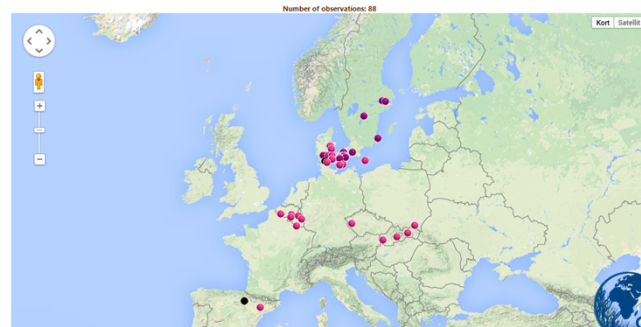
Year: 2014 2013 2012 2011 2010 2009 2008 2007 2006 2005
 2004 2003 2002 2001 2000 1999 1998 1997 1995 1994
 1993

Show

Continent: Europe

Country: ☒ All ☒ Belgium ☒ Czech Republic ☒ Denmark ☒ Slovakia ☒ Spain ☒ Sweden

Races: ☒ All ☒ [1,2,3,4,6,7,9,17,25,32] Oakley/Solstice, +V4 ☒ [1,2,3,6,7,8,9,17,25,32] Kranich ☒ [1,2,3,4,6,7,9,17,25,32,Sp] Warrior ☒ Other





Genetic study: Origin and spread of new *Pst* races in Europe in recent years

Question 1:

Mutation/recombination within the existing European *P. striiformis* population

Question 2:

Does Warrior & Kranich races represent a recent invasion into Europe from the central Asian 2010 and onward epidemics?

Question 3:

What is the likely origin of the Warrior and Kranich races?

Methodology

Selection of isolates

Part A

- Representative isolates of the Warrior race 2011-2013 [Spain, France, Germany, United Kingdom, Denmark, Sweden]
- Representative isolates of non-Warrior races 2000-2010 [European origin]
- Representative isolates from epidemic sites in Central Asia 2010-2012 [Uzbekistan, Tajikistan]

Part B

- Reference isolates from global study representing 6 continents 2005-2010 (Ali et al., 2014) , including recombining populations from the Himalayan region “Center of diversity”



Methodology

Isolate characterization

Part A isolates

- Race phenotyped in national labs: France, Germany, UK
- GRRC: Denmark, Sweden, Spain, Portugal, Uzbekistan, Tajikistan
some overlaps of isolates and differential seeds between national labs and GRRC
- SSR genotyped at GRRC/Uppsala, using 16 of 20 SSR markers from Ali et al., 2014

Part B isolates

- Genotyping results from Ali et al. 2014 (INRA-Grignon, France) aligned with results for Part A isolates

One common dataset developed



Virulence phenotyping (race) results – 34 differentials

- **Warrior:** One dominant race in 2011-2012/ another race increasing in frequency in 2014 (“Warrior non-Ambition”)
- **Kranich:** One dominant race 2011-2014
Both races: Small differences for specific differentials at the quantitative level
- **Triticale aggressive:** one dominant race 2006-2014, - and one virulence mutant detected (Sweden) – highly avirulent on Scandinavian winter wheat
- **Triticale non-aggressive:** One race - highly avirulent on wheat in general



Genetic study: Origin and spread of new *Pst* races in Europe in recent years

Question 1:

Mutation/recombination within the existing European *P. striiformis* population

No! Warrior, Kranich and Triticale races did not emerge from the pre-existing NW European *Pst* population – many alleles exotic to EU population

Question 2:

Does Warrior & Kranich races represent a recent invasion into Europe from the central Asian 2010 and onward epidemics?

No direct link but they share a number of alleles with central Asian population. Warrior & Kranich were not re-sampled in the post 2010 CA population

Question 3:

What is the likely origin of the Warrior & Kranich races?

Most related to near-Himalayan populations (“center of diversity”) but still divergent from these populations (Ali et al. 2014)

Exact origin: Will require much more detailed sampling efforts over huge areas and time points and many more markers representing the pathogen genome



Resume

Landmænd/rådgivning/sortsafprøvning:

- Varsling for ændringer i rustmodtagelighed – vigtigt med tidlig påvisning af nye racer
- Fælles ansvar for detektion af "usædvanlige" observationer, - og indsendelse af planteprov med smitte til GRRC (efter altale)
- Publ. af resultater i SortInfo, Sortsforsøg, Planteavlsoorientering, mm.

Planteforædling:

- Nyt forædlingsmateriale testes mod 'nye' racer hurtigst mulig
- Internationalt overblik via wheatrust.org

Forskning:

- Ny indsigt i rustsvampenes evolution og spredningsmønster på niveauer fra mark til kontinent
- Analyse af resistensegenskaber i korn og græs via adgang til global "isolatbank" (stor genetisk diversitet)

Hvedesortrust igen på vej til Skandinavien?

Lolland, August 2013:

Sortrust i to gl. landracer af hvede

Resultat af race-test
December 2013:

IKKE Ug99* sortrust

* Ug99:

Iflg. CIMMYT virulent på op mod 80% af Verdens hvedesorter



Foto: J Orabi

14th International Cereal Rusts and Powdery Mildews Conference 2015

- *First announcement April 2014*

- *Registration opens November 2014*



EMCRF

The European and Mediterranean Cereal Rusts Foundation



Helsingør (30 km N Copenhagen), Denmark, July 5-8, 2015

<http://emcrf.au.dk/icrPMC2015/welcome-to-the-conference/>