10th World Potato Congress | CUSCO - PERU | MAY 27 - 31, 2018 | www.worldpotatocongress2018-alap.org
XXVIII CONGRESO DE LA ASOCIACIÓN LATINOAMERICANA DE LA PAPA
WPC | ALAP | CUSCO, PERU | 2018

Seeking host resistance in potato to three *Globodera* species.

Glass house bioassay for *G. rostochiensis* using potato varieties and breeding lines

Introduction

Potato cyst nematodes are present in N. America in limited areas. *G. pallida* and *G. rostochiensis* are both under strict quarantine. A closely related species, *G. ellingtonae* is not regulated, but also exists in limited areas. Extensive surveys have been completed for *G. pallida* and results indicate that it is limited to a very small number of fields in one area of Idaho representing 1% of total potato acreage in Idaho. Eradication is being pursued for *G. pallida* and containment through quarantine for both *G. pallida* and *G. rostochiensis* have been very successful, allowing market access for the U.S. and its trading partners. The objective of this research was to identify varieties and breeding clones with high levels of resistance to all three species of nematodes.

Materials and Methods

- Potato cultivars tested
  - 9 cultivars
  - 13 breeding lines
- Tested in replicated trials in bio-secure facilities:
  - Idaho – *G. pallida*
  - New York – *G. rostochiensis*
  - Oregon – *G. ellingtonae*
- Clay pot tests in greenhouse/screenhouse with 4-6 pots per cultivar/breeding line
- Desiree used as susceptible control
- Results standardized by calculating relative susceptibility to cv. Desiree
- H1 resistance gene marker 57R used to screen *G. rostochiensis*

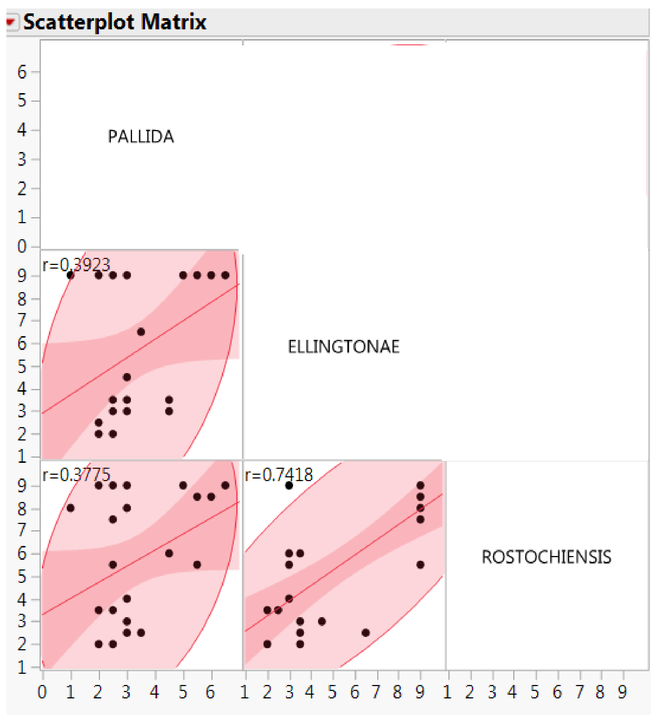

Figure 4. Strong correlation of Globodera species ellingtonae and rostochiensis using EPPO scores, r=0.7418.

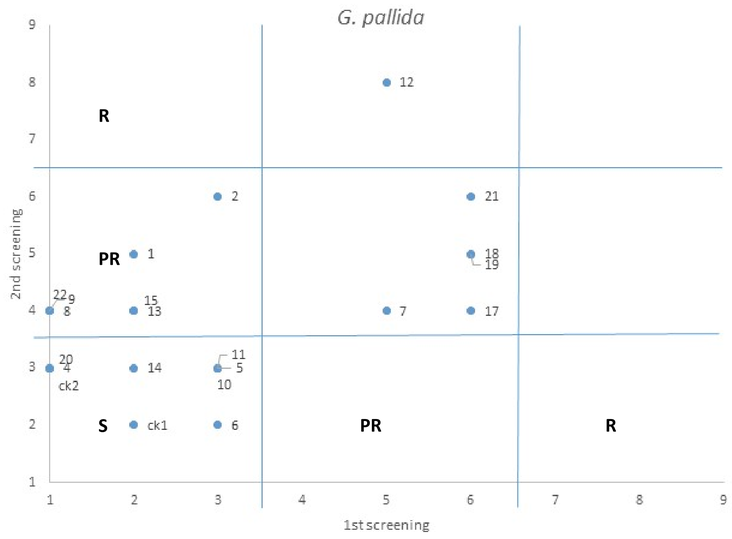

Figure 1. *Globodera pallida* resistance scores (0-9) for screenings conducted in 2013 and 2014. Each data point represents two replications of the screening done for each entry (breeding line/cultivar); data points 3 (score of 3) and 16 (score of 1) not included, due to one screening. Numbers in figure correspond to entries listed in Table 1. R=resistant; PR=partially resistant, S=susceptible.

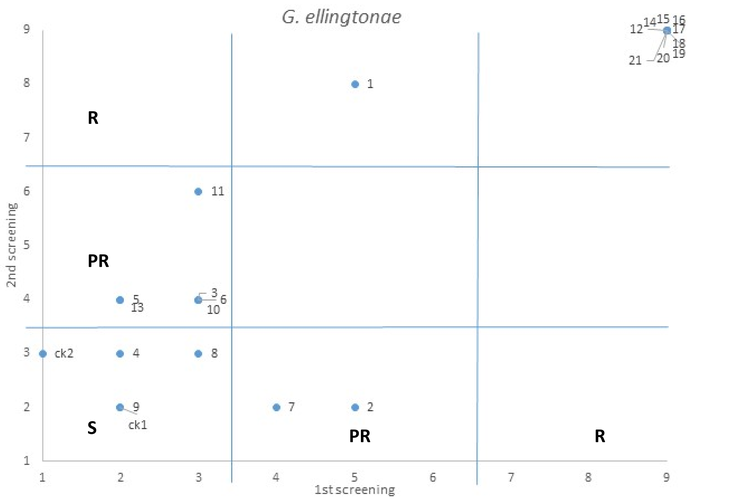

Figure 2. *Globodera ellingtonae* resistance scores (0-9) for screenings conducted from 2012 to 2014. Each data point represents two replications of the screening done for each entry (breeding line/cultivar); data point 22 (score was 9) not included due to one screening. Numbers in figure correspond to entries listed in Table 1. R=resistant; PR=partially resistant, S=susceptible.

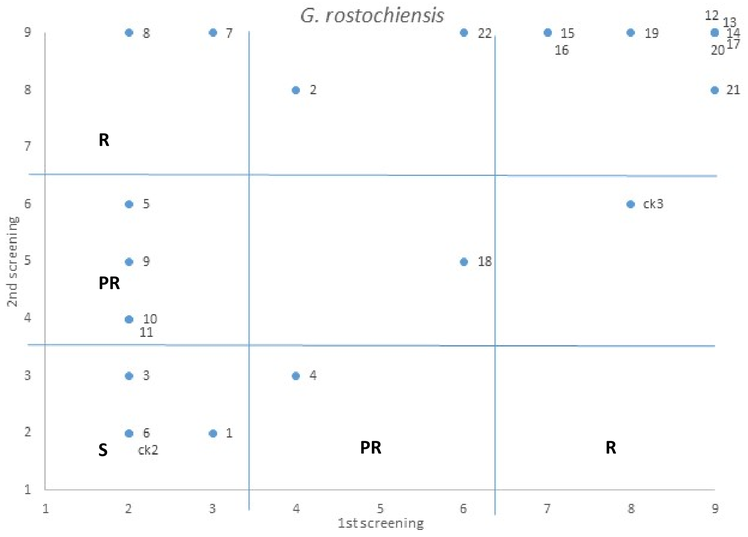

Figure 3. *Globodera rostochiensis* resistance scores (0-9) for screenings conducted in 2014. Each data point represents two replications of the screening done for each entry (breeding line/cultivar). Data point ck1 (score was 2) not included due to one screening. Numbers in figure correspond to entries listed in Table 1. R=resistant; PR=partially resistant, S=susceptible.

Summary and Discussion

- Breeding lines and cultivars are available for developing resistance to three Globodera species. Plant resistance to *G. pallida* is not as high as that to *G. ellingtonae* and *G. rostochiensis*.
- Strong correlation exists between *G. ellingtonae* and *G. rostochiensis* suggesting a common resistance gene H1 or possibly other gene or genes closely linked.
  - H1 R gene marker 57R was present in 8 of 9 entries that were resistant to *G. ellingtonae* and *G. rostochiensis*; however entry V-15-71 with the marker was R to rostochiensis and S to ellingtonae indicating that another gene may be involved in the observed resistance.

Examining cysts found on the roots of potato

Table 1. EPPO resistance scores for cultivars/advanced breeding lines used for screening trials for *Globodera pallida, G. ellingtonae, G. rostochiensis.* Resistance scores are based off of relative susceptibility to Desiree.

#	Cultivar/breeding line	GPA[1]	GEL	GRO	Average
12	NY 121	6.5[2]	9	9*	**8.2**
21	Sante	6.0	9	8.5*	**7.8**
17	Eden	5.0	9	9*	**7.7**
19	Moonlight	5.5	9	8.5*	**7.7**
14	Albatros	2.5	9	9*	**6.8**
15	Avondale	3.0	9	8*	**6.7**
18	Karaka	5.5	9	5.5*	**6.7**
20	Nicola	2.0	9	9*	**6.7**
22	Slaney	2.5	9	7.5	**6.3**
16	Banba	1.0	9	8*	**6.0**
13	V-15-71	3.0	3	9*	**5.0**
2	A03882-10YN	4.5	3.5	6*	**4.7**
7	A08636-7PCN	4.5	3	6	**4.5**
1	A03873-3	3.5	6.5	2.5*	**4.2**
8	A08636-8PCN	2.5	3	5.5*	**3.7**
11	A08640-8	3.0	4.5	3	**3.5**
5	A06968-4	3.0	3	4	**3.3**
10	A08640-2	3.0	3.5	3	**3.2**
3	A061008-4	3.0	3.5	2.5[nt]	**3.0**
4	A06689-2	2.0	2.5	3.5	**2.7**
6	A07934-7	2.5	3.5	2	**2.7**
9	A08636-11PCN	2.5	2	3.5*	**2.7**
ck1	Desiree	2.0	2	2	**2.0**
ck2	Russet Burbank	2.0	2	2	**2.0**

1 GPA, *G. pallida*; GEL, *G. ellingtonae;* GRO, *G. rostochiensis*
2 EPPO scores reported are based on relative susceptibility (%) to susceptible cv. Desiree (9 <1%; 8=1.1-3%; 7=3.1-5%; 6=5.1-10%; 5=10.1-15%; 4=15.1-25%; 3=25.1-50%, 2=50.1-100%; 1>100%). Score of 9 = maximum level of resistance. OEPP/EPPO 2006, Bulletin 36, 419-420.
* indicates presence of H1 marker 57R and/or TG689
nt not tested for markers

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