MINUTES

Potato Crop Germplasm Committee meeting

Potato Association of American annual meeting 2017 at Fargo ND, --- 6:30 AM, July 25th, 2017

Present: Barkley, Bamberg (Chair), Parsons, Jansky, Endelman, Levy, Shannon, Whitworth, French, Novy, Douches, del Rio.

Agenda (attached) had been distributed in advance.

Introductions: Ron French introduced himself and his new APHIS post managing quarantine for potatoes. As usual, importers are encouraged to plan ahead and communicate so yearly imports fit smoothly into the timing and quota number.

CGC-sponsored grants: Dave Douches reported SNP genotyping 725 samples as part of the 2015 CGC grant. These were from USPG, CIP and Seed Savers. There was high duplication. Noelle Barkley suggested that since CIP organized the larger parent grant, CIP would be willing to take the lead in crunching the data, with help from Dave. Julien Levy reported on the 2016 grant to TAMU for Zebra Chip screening. They found psyllid resistance in four accns, but not much resistance to the bacterium. Rich Novy mentioned evidence of resistance in *chacoense*. Julien has a poster at this PAA meeting (attached). [Bamberg post meeting note: is there promise in the apparently symptomless *microdontum*?]. In 2017 we selected a grant for *Dickeya* screening by Amy Charkowski. Jeff Endelman suggested getting advice from European colleagues who have had longer experience. Rich Novy wondered if introgressed lines involving *etuberosum* or M6 (inbred *chacoense*) would be promising. [Bamberg post-meeting note: We already sent available tubers from >200 lines to Bryan Swingle at Cornell, and got preliminary results indicating *microdontum* has very promising tuber resistance. At this writing we are generating tubers of all members of this species for fine screening.] Bamberg noted that grants in 2017 were double (~$20K) or nothing, so potato CGC needs to do the optimum job of presenting high-quality proposals, as well as have our minutes and Vulnerability Statement up to date.

Big Data: Alfonso del Rio discussed status of GBS data on 700 lines of cultivated species. Jeff Endelman cooperating with Laura Shannon, now at Minnesota. Noelle Barkley noted that data should be accessible on-line, but it is not so useful in raw form. Jeff Endelman said a high value future CGC grant would do the work needed to get these new data accessible to the research community.

Vulnerability Statement update: To keep this current (2014 is our latest version), Sagar Sathuvalli agreed to recruit members and chair a committee to review the document each year, and propose revisions prior to our annual meetings.

New members: Laura Shannon, new breeder at Minnesota, Isabel Vales, new breeder at TAMU, Susie Thompson, breeder at NDSU.

Kenosha Potato Project and SSE—Curzio Caravati: Curzio provided a document (attached). He seeks continued cooperation with PCGC. He can partner with us in generating positive publicity for potato, sharing stocks and technology, exploring ways to raise funding. Curzio has a vision for creating a potato institute at Kenosha.

Adjourned at 8:00 AM.
Respectfully submitted,
John Bamberg

POTATO CGC 2017

Agenda

As is typical, the Potato CGC annual meeting for 2017 will be held during the Potato Association of America (PAA) meeting-- this year at Fargo, ND…

at 6:30 AM breakfast on Tuesday July 25th

PAA program will specify the room.

Contact PCGC chairman Bamberg at John.Bamberg@ars.usda.gov for the latest news on timing and agenda for the CGC meeting.

AGENDA

1. Review of past grants and discussion of priorities

    2015 SNPs of US/CIP/SSE cultivars – Dave D., Dave E., and Noelle
    2016 Zebra Chip – Isabel
    2017 *Dickeya* -- John

2. Discussion of big data management – Alfonso, Laura, Dave E., Noelle

3. Update of Vulnerability report – Sagar and sub-committee

4. Review of CGC members and participation -- John

5. Status report of Kenosha Potato Project/SSE – Curzio (document)

6. Other topics

KENOSHA POTATO PROJECT
Curzio Caravati
403 8th Street
Kenosha, WI 53140

ATTN: Dr. John Bamberg
For Crop Germplasm Committee Meeting July 23, 2017

On May 5th, 2017 KPP celebrated the 10 Year Anniversary. It started in Kenosha, WI as a hobby project by a couple of local seed savers, and it now counts over 2,600 Facebook followers in 90 countries. The Group includes professional breeders and farmers / gardeners who experiment with TPS.

The group vision is to become the Global Platform which promotes Potato Breeding. We believe to be the inspiration, the breeding ground of future potato breeders. Some may one day be working for PAA members.

It appears that the more sophisticated PAA members and professional potato breeders focus on the specific needs of the commercial industry. While many of the KPP members "freely" experiment with different cultivars, without specific objectives in many cases!

Often we start with heirloom varieties kept for years by Seed Savers Exchange members – I'm referring to the well-known organization based in Decorah, IA.

SSE has a substantial capital base built on donations and grants. It has been keeping a large collection of potato plant material in a lab as in-vitro plantlets.

SSE is plagued by three major challenges:

1. Many cultivars kept in the collections are duplicates, lots of misspellings.
2. Lacks a clear vision of what is valuable, and what should be discarded.
3. Needs to find funding to do virus elimination of infected material.

Here is a case study:

For full disclosure, Kenosha Potato Project is part of Kenosha Urban Farm, which is in transition to become a 501 c3 non-profit, educational corporation. I have been receiving donations from SSE members and non-members which I keep in a separate trust account, in addition to my own personal donations to the project. Specifically the assets of KPP are estimated at $20,000 – including a professional grade cooler, mostly used for multiple year seed tubers' storage.

In order to "force the topic" which seems NOT to be a top priority at SSE, I have donated $3000 to Seed Savers Exchange for the very specific use of virus elimination.

SSE has been quoted $1000 for the virus treatment, per cultivar line IF 6 cultivars are sent in at the same time, by the Pathology Department of UW-Madison.

The KPP donation of $3000 is matched by SSE so that we now have funding for 6 lines.
As one of the donors, I got to pick the names of three cultivars. SSE may select the other three. BUT I have a strong suspicion that the SEE Management does not have a clear idea what to select, out of the many "virus loaded plantlets" they are keeping in the lab.

- I'm addressing this letter to this PAA Committee to ask for help.

- Study of the complete list of SSE collection names.
- Identify what is MORE valuable and should be given priority

Perhaps your Association has funds to contribute?

There is no "burning fire emergency". SSE is in the process of having the entire collection genetically fingerprinted to identify duplicates. All decisions are postponed to after that exercise is completed.

Another case study:

SSE is holding material for both heirloom cultivars known as Cowhorn and Seneca Horn. The latter was collected directly from the Native American Tribe – Seneca People.

Some SSE members believe that the cultural value warrants keeping both strains, and not drop one because it may return a genetically similar or possibly identical. It is really hard to pin point somaclonal variants in heirloom varieties.

Thank you very much for your attention and considerations.

Curzio Caravati
Kenosha Potato Project
Founder and Curator

Screening of the US Potato Genebank mini-core collection for psyllid and 'Candidatus Liberibacter solanacearum' resistance

TEXAS A&M UNIVERSITY

TEXAS A&M AGRILIFE RESEARCH

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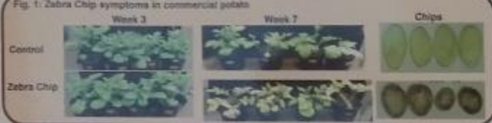
INTRODUCTION

Zebra Chip (ZC) is a vector-borne disease of potato affecting many potato producing regions of the US, Mexico, Central America and New Zealand. The pathogen is a phloem-restricted bacterium '*Candidatus* Liberibacter solanacearum' (Lso) transmitted by the potato psyllid, *Bactericera cockerelli*. Zebra Chip symptoms include stunting, leaf curling, chlorosis and/or purpling, swollen internodes, aerial tubers, and reduced yield. Other symptoms include darkening of the tuber medullary rays, especially during chipping, rendering tubers unsuitable for chip production (Fig. 1).

Fig. 1: Zebra Chip symptoms in commercial potato



Over a thousand selections/named varieties have been evaluated for tolerance/resistance to ZC as part of the Texas Potato Breeding Program. Data from repeated field trials throughout Texas suggest that no high level resistance was present in advanced material. Since no plant resistance against Lso has been found in commercial varieties, crop protection relies on pesticide applications to control the vector populations. Consequently, there is an urgent need to find complementary methods to protect crops; breeding for plant resistance and limiting pathogen transmission are the best long-term solution.

Objectives

Our goal was to identify accessions with enhanced protection against psyllids and/or Lso infection with natural resistance and select for antixenosis or antibiosis, which could lead to a decrease in pathogen transmission.

Materials and Methods

The mini-core collection (80 accessions) was obtained from the US Potato Genebank, Sturgeon Bay, WI. Plants were started from seed. After germination, plantlets were transplanted to small 3.8 l pots (Fig. 2). Experiments were conducted in the greenhouse from March to June 2016 and from September 2016 to February 2017.

Non-choice assay: 8-week-old plants were infested with 3 to 4 psyllids (2 females and 1 or 2 males), placed on a single plant leaf in a mesh bag (Fig. 3). Four plants were infested with Lso-infected psyllids (infected plants) and 2 plants were infested with Lso-free psyllids (control plants). One week after infestation, the infested leaf was cut with the mesh bag to remove the insects.

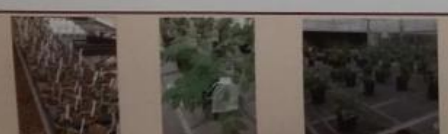
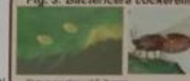


Fig. 2: Plantlets transferred to pots and infested with psyllids in a single leaf mesh bag

Results

Insect resistance: One week after infestation, insect survival and number of eggs were counted from both the control (Lso-) and treatment plants (Lso+).

Fig. 3: *Bactericera cockerelli*



Picture courtesy of F. Ibanez

The vast majority of the accessions did not display insect resistance. On average across the species, Lso-free psyllid survival rate was 85%, and they oviposited 23 eggs per plant, whereas Lso-infected psyllids had a survival rate of 74% and oviposited 16 eggs per leaf.

PI310927 (*S. berthaultii*) and **PI558050** (*S. commersonii*) exhibited the strongest insect resistance, based both on adult mortality (12.5% survived) and oviposition (0-2 eggs). These were previously identified as insect resistant (Obrycki, 1983).

Potentially interesting accessions for insect resistance identified in this study were :
- **PI473411** (*S. commersonii*) had high insect survival rate but very low reproduction rate (antixenosis).
- Two *S. Jamesii* species (**PI458425** and **PI592422**) had high insect mortality and low oviposition, although not null (antibiosis).

Plant Aerial symptoms / viability (observations)

Symptoms were scored to evaluate resistance to Lso.
- All accessions developed aerial symptoms such as yellowing, purpling, and stunting.
- Some developed aerial tubers.
- Five accessions died prematurely due to small and non-vigorous plants.
- Thirteen accessions, e.g. PI458365, PI243510, PI205407, developed symptoms such as yellowing. They remained alive and had comparable plant height to the uninfected controls (in these accessions the control plants were not vigorous).

Among the accessions that showed insect resistance:
- **PI310927** developed aerial symptoms.
- **PI558050**, **PI458425** and **PI592422** developed delayed symptoms.
- **PI472837**, **PI473411**, **PI265863**, **PI310979**, **PI458355**, and **PI498123** had reduced symptoms.

Tuber production and yield

Resistance to Lso was also evaluated with tuber production:
- Most accessions had reduced yield and tuber counts when infected (**Table 3**) with **65 to 90% reduction.**
- In some accessions the reduction was less.

Chips

Ten accessions treated with Lso+ insects yielded tubers big enough to be chipped, while 26 of the species in the uninfected control treatment produced tubers that could be tested by chipping. This difference is correlated to the loss of yield induced by Lso. However, only 10 accessions in the control treatment produced tubers of adequate chipping quality to evaluate tuber symptoms (other accessions produced tubers that were dark upon frying).

Table 1 : Insects resistance: evaluated by insect survival and oviposition.

Greenhouse test (fall)		Lso- Avg insect survival (%)	Lso- Avg eggs / plant	Lso+ Avg insect survival (%)	Lso+ Avg eggs / plant
S. berthaultii	PI 310927	12.5	0	12.5	0
S. bulbocastanum	PI 243510	87.5	38.75	25	8.5
S. commersonii	PI 473411	87.5	0.75	50	1.75
S. commersonii	PI 558050	25	2.25	0	0
S. jamesii	PI 458425	25	0	12.5	0.25
S. jamesii	PI 592422	12.5	2	16.7	2.67
S. jamesii	PI 605370	37.5	2.75	37.5	4
S. kurtzianum	PI 472923	75	37.75	50	4
S. kurtzianum	PI 472941	87.5	55.75	50	2.75
Average		80.3	23.1	74	16.9

Table 2 : Aerial symptom development: 6 weeks after infestation, viability of the plants was scored. Reported are the difference between the control and treatment. A high score (2 to 5) indicates early death of the plant, whereas a low score (0-1) show a similar death.

Species	Accession	GH Spring Delta Viability	GH FALL Delta Viability
S. berthaultii	PI 310927	2	2.75
S. berthaultii	PI 458365	0.5	0.5
S. berthaultii	PI 498141	2	2.25
S. chacoense	PI 197760	2	3.75
S. chacoense	PI 275139	2	3.5
S. commersonii	PI 472837	0.5	NA
S. commersonii	PI 473411	1	NA
S. commersonii	PI 558050	0	0.25
S. candolleanum	PI 265863	0.5	0.25
S. jamesii	PI 458425	0.5	0.5
S. jamesii	PI 592422	0.5	2
S. microdontum	PI 310979	0	0
S. microdontum	PI 458355	0	0
S. microdontum	PI 498123	1.5	0

Table 3 : Reduction of yield, tuber count, and tuber weight

Inventory	Accession	GH1 Spring		GH2 Fall	
		% reduction in Count	% reduction in yield	% reduction in Count	% reduction in yield
S. bulbocastanum	PI 275188	100	100	34.5	59.5
S. brevicaule	PI 205407	-26.2	18.8	8.3	-49.3
S. berthaultii	PI 310927	19.4	18.7	NA	NA
S. commersonii	PI 473411	100	100	83.8	84.2
S. commersonii	PI 558050	34.7	40	45.6	57.1
S. kurtzianum	PI 472941	62	33.1	57.8	37.9
S. microdontum	PI 498123	100	100	72.3	68.3
S. raphanifolium	PI 310953	100	100	66.7	100
S. raphanifolium	PI 473369	100	100	44.2	75.4
S. stoloniferum	PI 161170	100	100	86.7	64.8
S. tuberosum subsp. andigena	PI 292110	100	100	80.6	83.5

Reference:

- Obrycki et al., 1983 J. econ. Entomol. 76, 456-462

Acknowledgments

- Potato Crop Germplasm Committee Evaluation Grant
- Potatoes USA

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