

Cervantes:

Hello everyone! Welcome to today's episode of Potato-cast. A Potatoes USA podcast, full of all your favorite potato industry content. I'm Natalia Cervantes, Potatoes USA Conversation Architect, and your host.

Today, I have another special guest.

I have Alexander Karasev, the leader of a Tuber Necrotic Viruses Research Project. Alex is a professor in the Department of Entomology, Plant Pathology and Nematology at the University of Idaho. His project was brought to the Potatoes USA Potato Research Advisory Committee in 2019 and received full funding in 2020 from the specialty crop research initiative.

I hope you're just as excited as I am to learn about this project. So, let's get into it.

Cervantes:

Alex, welcome to Potato-Cast!

Karasev:

Thank you, Natalia. It's a pleasure to be here today, with you, in person, and at the new Potatoes USA office.

Cervantes:

Yes, it's always a pleasure to meet with researchers in person to talk about their projects. And I'm grateful we are doing the interview at the new office as well.

Karasev:

There's so much sunlight in the office. It's a great space.

Cervantes:

It really is. Alex, can you tell our listeners a little bit about your scientific background?

Karasev:

For those who do not know me, I am Alex Karasev, Professor of Plant Virology at the University of Idaho. I have a Ph.D. in Virology from Moscow State University in Russia, and for the past 33 years have been involved in research on plant viruses, studying their biology, pathogenesis, evolution, and methods of detection and control. During my career I was involved in viruses affecting various crops, ranging from cereals to perennial fruit crops. Since 2006, I have been involved in potato viruses, primarily those that induce necrotic symptoms in tubers, as the most economically important for potato industry. In 2007-2008, potato industry in the United States experienced an outbreak of recombinant strains of potato virus Y (PVY), and my program was drawn into a prolonged battle to control PVY in seed potato. With a group of scientists from the main potato-producing states we started a research project on development of new methods to detect and differentiate tuber-necrotic strains of the virus, and also find new resistance sources against PVY in potato. Our current project is a direct descendant of those initial attempts to control PVY in seed potato.

Cervantes:

You have quite an interesting history regarding plant virology. Is this a topic you've always been interested in?

Karasev:

Plant virology is my passion, but I do not confine myself to only plant viruses. In 2012, after zebra chip (ZC) disease was found in the State of Idaho, I opened my lab for research to control this devastating bacterial disease transmitted by psyllids. We are still involved in monitoring the psyllid populations and the prevalence of ZC pathogen, although the threat of ZC faded by now, and the disease is effectively controlled.

Cervantes:

Tell me, Alex, how did you get connected with Potatoes USA?

Karasev:

My first contact with Potatoes USA happened in 2008, then the organization had a slightly different name, 'US Potato Board'. At that time USPB helped me to set-up a survey for potato viruses in Mexico. As a direct consequence of that initial support, I ended up with three graduate students from Mexico and multiple publications on the topic. Over the years my connections to Potatoes USA grew stronger, as we proceeded with our various research projects on potato viruses, and in 2019 our proposal was recommended by Potatoes USA for full funding through the Specialty Crops Research Initiative at USDA.

Cervantes:

Great to hear that you have such a long history with the Board. I understand that your research in Mexico was very beneficial to our efforts to open that market to fresh U.S. potatoes.

Let me make sure I understand. The official title of the project is "Development of sustainable system-based management strategies for two vector-borne, tuber necrotic viruses in potato." Did I get that right?

Karasev:

Yes, yes you did.

Cervantes:

And what does that mean in layman's terms?

Karasev:

We are trying to devise a complex of measures that can keep the infection level for potato viruses below the economically significant threshold, in a way that growers would be comfortable to adopt such measures. One of the problems is that often seemingly good solutions cannot be adopted due to the high expense, or inconvenience of the proposed tools.

Cervantes:

Are you leading this?

Karasev:

I am the Project Director of this particular project.

Cervantes:

As Project Director, can you tell me a little more? Maybe about your system-based approach? What does that approach entail?

Karasev:

We are trying to battle tuber necrotic viruses at three different levels. First, we are developing immediate solutions, through improvements in virus detection helpful in potato seed certification. Second, we are developing a series of mid-term measures that can control virus spread, fighting virus vectors, and mitigating tuber symptoms development in the field and in storage. Third, we are working on a long-term strategy of control through breeding for resistance to viruses or to virus vectors. Finally, we have a substantial outreach objective striving to deliver these new approaches and knowledge to growers, for their validation, approval, and application.

Cervantes:

Why is a project like this important to the potato industry?

Karasev:

Tuber necrotic viruses represent a constant threat to potato production, they affect tuber yield and quality, reducing profit margins, and touch the livelihoods of potato growers across the country.

Cervantes:

Alex, can you break down what PVY and PMTV is, and why this is a disease of particular importance?

Karasev:

I mentioned PVY earlier, this is a virus transmitted by many species of aphids. The transmission of PVY is called non-persistent, it is quick and cannot be controlled by insecticides. This is what makes PVY such a problem. Potato mop-top virus (PMTV) is a relatively new problem in the U.S., it became established in the country only in 2010. This is a virus with a very different biology than PVY. PMTV is transmitted through soil, by a protist, by itself a powdery scab pathogen. For Russeted cultivars of potato, powdery scab was rarely viewed as a problem, hence the powdery scab is common and established in potato fields. If PMTV is brought in, it becomes a serious problem affecting tuber quality.

Cervantes:

Can you break down the importance of virus disease and detection when it comes to potatoes?

Karasev:

In a simple greenhouse experiment we can show that a PVY infection, if happens early in the season, causes up to 70% yield loss and concomitant tuber quality loss in susceptible potato cultivars. The virus reduces the number of tubers per plant, the size of the tubers, and in addition induces nasty necrotic lesions on tuber surface, making it unmarketable. Timely detection of the virus infection during the certification process reduces the level of the virus to economically acceptable levels and prevents yield and quality losses.

Cervantes:

With so many viruses and diseases occurring in plants, how do you determine what to focus on?

Karasev:

Indeed, we always need to realize that disease is only one and quite rare outcome of the interaction between a virus and its plant host. Most of the viruses are harmless to their hosts, due to advantages of this evolutionary scenario. Disease-causing viruses, on the other hand, need to be identified and kept in check using all modern tools of virus control.

Cervantes:

Is the goal of researchers in your department to eliminate all viruses completely?

Karasev:

No, virus disease will never be eliminated completely. It is an ongoing battle because viruses change over time. However, researchers will continue to work toward limiting their presence.

Cervantes:

Sounds like a challenge. How do you start to tackle such a large-scale problem?

Karasev:

Well, our project chose four objectives to help measure success. Our first objective includes training seed certification agencies in detection efforts. That way, when the project is over, there are real, applicable changes made. Our second objective has a similar outcome – We will demonstrate research-based recommendations of virus-vector management at field days and information provided via online media.

The third involves developing molecular markers for resistance genes against PVY and PMTV, and to clone one of these genes. Then, we will provide these markers to potato breeders as soon as they are developed. Our last objective has to do with identifying barriers to effective disease management and working with growers and policymakers on how to implement new approaches.

Cervantes:

Something I have noticed in all four objectives is a component involving educating others and applying the knowledge you have accumulated.

Karasev:

Absolutely. It is really important to myself and my team to make sure our project has a lasting impact on the industry, starting with small adaptations from our research. This topic is complex, and we need to include as many industry members as possible to make lasting change.

Cervantes:

What are your hopes for the outcome of this project? In other words, what real changes do you want to make?

Karasev:

We hope to develop methods for direct tuber testing which may help the certification agencies to control virus spread through seed potato. We also hope to offer some methods to control powdery scab and PMTV by the end of this project.

Cervantes:

Alex, this has been a very special episode. I have enjoyed learning about plant virology, and I'm sure our listeners have, as well.

Karasev:

I hope so!

Cervantes:

One more thing Alex, what would you say is the most misunderstood thing about potato diseases?

Karasev:

Viruses rarely make potatoes really sick, they just re-channel their resources to be used to their advantages. Plants may lose vigor and productivity, but rarely die due to viruses. What we are trying to do, to minimize these subversive effects of viruses on potato.

Karasev:

Well, time to explore around Denver while I'm here. Thank you for hosting me.

Cervantes:

Absolutely, Alex. Enjoy Colorado!

I hope everyone enjoyed listening and learning from Alex Karasev as much as I did. It's exciting to hear about the important research that happens regarding plant virology.

If you're looking for more information about potato research, check out the research section on potatoesusa.com I'm also including a link for resources from Alex Karasev on this episode's page.

That's all for this episode. As always...

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All supporting documents for data provided in this episode can be found on potatoesusa.com.

To see all the great information available about potatoes or new and fun ways to cook with potatoes, visit potatogoodness.com.

I am your host, Natalia Cervantes.

Until next time, take care everyone