chips
a look at what's new in potato information and technology
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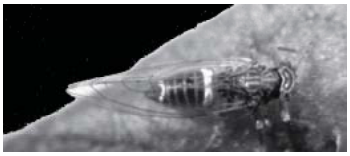
September 2009

Bactericera cockerelli – the tomato-potato psyllid

The recent incursion and establishment of the tomato-potato psyllid in New Zealand is a serious concern for the potato industry. This small insect (less than 3 mm long) will infest most plants in the Solanaceae family and has been associated with outbreaks of the disorder psyllid yellows and zebra chip disease. The insect is also thought to be a vector of the pathogen *Candidatus* Liberibacter solanacearum (which is synonymous with or closely related to *Candidatus* Liberibacter psyllaurous). In this feature article, three papers on the psyllid are profiled, while later in this issue is a section on the liberibacter.



The first (Teulon et al.) is a recent paper in the *New Zealand Plant Protection* journal that describes the incursion, dispersal and current distribution of the insect in New Zealand. It is thought that the insect invaded New Zealand during the summer of 2005-06. By June 2006 it was widely distributed in the Auckland area and had spread throughout much of New Zealand by April 2009, probably through both natural and human-mediated dispersal.

In the second paper (Berry et al.) 13 insecticides were tested for their ability to control the tomato-potato psyllid in laboratory bioassays. Using the equivalent of recommended field rates, six insecticides (dichlorvos, lambda-cyhalothrin, methomyl, taufluvalinate, methamidophos and abamectin) gave 98-100% mortality after 48 hours, while four insecticides (azadirachtin, spiromesifen, spirotetramat and thiacloprid) gave 82-100% mortality after 168 hours. Mortality was less than 53% for the remaining three insecticides (buprofezin, pymetrozine and imidacloprid).

In a greenhouse experiment (Diaz-Valasis et al.) 200 adult psyllids were released on to 2-month-old caged potato plants from 20 cultivars. All cultivars showed typical yellowing symptoms on foliage after 15-20 days. There was a large variation between cultivars in the number of nymphs found on the plants at this time. Four cultivars, Alpha, Gigant, NAU-6 and Lady Rosetta, showed from none to mild internal tuber browning, while remaining cultivars had moderate to strong discoloration in response to the psyllid. The yield and number of tubers were significantly reduced by *B. cockerelli* in all cultivars.

A recent article in the prestigious Science magazine, by a researcher from the Department of Botany, The Natural History Museum, London, investigated the family history of cultivated potatoes. The study reviewed previous classifications of potatoes and found that they have variously been considered as anything from 21 different species to 1 hugely variable species. However, a recent publication suggests that there are four taxa, within which there are different multiples of the chromosome set (ploidy levels).

Celebrating spuds. *Knapp (2008) Science (Washington) 321: 206-207.*

***Bactericera cockerelli*: incursion, dispersal and current distribution on vegetable crops in New Zealand.** *Teulon et al. (2009) New Zealand Plant Protection 62: 136-144.*

Laboratory studies to determine the efficacy of selected insecticides on tomato/potato psyllid. *Berry et al. (2009) New Zealand Plant Protection 62: 145-151.*

Responses of potato cultivars to the psyllid (*Bactericera cockerelli*) under greenhouse conditions. *Diaz-Valasis et al. (2008) Agricultura Tecnica en Mexico 34: 471-479.*

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Candidatus Liberibacter solanacearum/psyllaurous

▶ **First report of the detection of 'Candidatus Liberibacter' species in zebra chip disease-infected potato plants in the United States.** Zebra chip disease is characterised by intermittent dark and light patterns in affected potato tubers, and is particularly noticeable when the tubers are fried. Six Russet Norkota plants exhibiting typical zebra chip symptoms were collected in Texas, USA, in June 2008. DNA was extracted from roots, stems, midribs and petioles of the infected plants and some sequences were determined. These sequences were 99.7% identical to a new species of *Candidatus* Liberibacter identified in New Zealand in potato and tomato. In addition, there was 97% identity with *Candidatus* Liberibacter asiaticus, and 94% with *Candidatus* Liberibacter africanus and *Candidatus* Liberibacter americanus. *Abad et al. (2009) Plant Disease 93: 108-109.*

▶ **Association of '*Candidatus* Liberibacter solanacearum' with zebra chip disease of potato established by graft and psyllid transmission, electron microscopy, and PCR.** Zebra chip disease was first seen in Mexico in 1994 and subsequently found in the southwestern United States in 2000. As described in the previous paper, the disease has been associated with a pathogen that has been given the preliminary name *Candidatus* Liberibacter solanacearum. In this study the transmission of the disease between infected and uninfected potato and tomato plants that had been grafted to each other was demonstrated by electron microscopy. In addition, greenhouse experiments showed that potato psyllid insects collected from potato plants naturally affected with zebra chip disease could transmit the disease to uninfected plants. DNA sequences from the *Candidatus* Liberibacter solanacearum pathogen used in these experiments (from several locations in the United States, Mexico, and Guatemala) was almost identical to a sequence reported from *Candidatus* Liberibacter solanacearum isolated from solanaceous plants in New Zealand and the United States. *Secor et al. (2009) Plant Disease 93: 574-583.*

▶ **First report of '*Candidatus* Liberibacter psyllaurous' in zebra chip symptomatic potatoes from California.** A bacterium, designated '*Candidatus* Liberibacter psyllaurous', has recently been isolated from potato plants with 'psyllid yellows' symptoms, which resemble the foliar symptoms of zebra chip disease. This paper describes how the laboratory received ten tuber samples (cv. Dakota Pearl) from a potato grower in Southern California, five of which had symptoms characteristic of zebra chip disease. These five tubers were shown to contain *Candidatus* Liberibacter psyllaurous, which is the first identification in California, and indicates the continuing spread of the disease. *Crosslin & Bester (2009) Plant Disease 93: 551.*

▶ **First report of '*Candidatus* Liberibacter psyllaurous' in potato tubers with zebra chip disease in Mexico.** Like the previous paper, the research described here took samples of potato tubers (cv. Atlantic) with and without zebra chip symptoms from a commercial field – this time near Saltillo City in Mexico during September 2008. Seven of eleven symptomatic tubers and one of six asymptomatic tubers indicated the presence of *Candidatus* Liberibacter psyllaurous, which is the first positive identification of this bacterium associated with zebra chip disease in Mexico. *Munyaneza et al. (2009) Plant Disease 93: 552.*

Slow- or controlled-release fertilisers

▶ **Release mechanisms for slow- and controlled-release fertilizers and strategies for their use in vegetable production.** This review describes the two groups of slow- or controlled-release fertilisers, and notes that they are particularly important for crops grown on sandy soils with relatively low nutrient and water-holding capacities. The fertilisers in the group that relies on a biochemical reaction for their release may be limited in situations of low soil temperatures where microbial activity is restricted. In addition, soil fumigation may destroy the micro-organisms that enable the release reactions, and the fertilisers are therefore ineffective. The other group of fertilisers has a coating around the fertiliser prill and is not dependent on micro-organisms but will be affected by soil moisture and temperature. In addition, other beneficial leachable materials (e.g. minerals) can be incorporated into the coating, although this will increase the cost. Thus, the growing situation of the crop will have a major influence on the type of slow- or controlled-release fertiliser that is selected. *Morgan et al. (2009) Horttechnology 19: 10-12.*

▶ **Controlled-release fertilizer for vegetable production: the California experience.** In California, despite being available for several decades, controlled-release fertilisers are still considered niche products, and are only used on a small percentage of vegetable crops. Because annual rainfall in California is low and most vegetable crops are grown on relatively fine-textured soils with high water-holding capacity, the nitrogen leaching potential is low. In addition, there is

widespread adoption of drip irrigation, which enables cheap nitrogen sources to be used regularly at low concentrations to match crop growth requirements. Thus, in this situation there is little advantage from using the higher-cost controlled-release fertilisers. *Hartz & Smith (2009) Horttechnology 19: 20-22.*

▶ **Potato response to a polymer-coated urea on an irrigated, coarse-textured soil.** A limitation of slow-release polymer-coated urea (PCU) fertilisers has been the high cost. This research examined a new, lower cost PCU in a 2-year field study on a loamy sand soil using Russet Burbank potatoes. The trial treatments included several rates of the PCU applied at emergence or two split applications of soluble N. Total tuber yields and net monetary returns were similar for PCU and soluble N at equivalent N rates. Petiole nitrate concentrations in PCU treatments were lower early in the season but higher later in the season than with soluble N. It was concluded that an advantage with PCU is that split applications of N could be eliminated. *Wilson et al. (2009) Agronomy Journal 101: 897-905.*

Use of potato by-products

▶ **A review of the potential of bio-ethanol in New Zealand.** This paper investigated the potential of sugarcane, sugar beets, maize, potato waste and spoilt kiwifruit as sources for fermentation to produce ethanol for blending with fossil fuels. To replace all New Zealand gasoline with a 10% blend, 300 Mega-litres (ML)/year are required. Based on laboratory-scale trials, the current maize production (150,000 tonnes/year) would produce 45 ML ethanol/year. There is also potential to utilise 100,000 tonnes/year of potato processing waste and 18,000 tonnes/year of spoilt kiwifruit. Sugarcane and sugar beets are currently not grown on a large-scale in New Zealand, but the former would be useful as it produces high ethanol yields. *Vishesh & Young (2008) Bulletin of Science, Technology and Society 28: 143-148.*

▶ **Anaerobic digestion of by-products of sugar beet and starch potato processing.** This study investigated the levels of starch, sugar or protein that might inhibit anaerobic digestion being used for environmentally friendly recycling of agricultural by-products. Digestion was carried out at 37.5°C for 28-38 days. The by-products tested gave successful digestions. Sugar beet by-products gave higher methane yields than potato by-products, and a steam pre-treatment significantly increased the methane yield from potato pulp. *Kryvoruchko et al. (2009) Biomass & Bioenergy 33: 620-627.*

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▶ **Controlling silver scurf.** *April 2009, p. 26.*

Silver scurf is caused by the fungus *Helminthosporium solani*, which spreads during storage, reducing the quality and weight of tubers. Spores can survive in the soil for up to 2 years and so the easiest method of control is to keep rotation lengths longer than 3 years and ensure that seed is clean when planted. Other recommended methods for control are using smaller seed pieces and planting at a lower density. Some varieties are more susceptible to infection by the fungus than others. Particularly susceptible are short-stolon varieties, as the fungus grows down the stolon from the seed piece. During tuber storage, cooler temperatures are important to minimise growth of the fungus and minimising airflow will help to reduce spread. Postharvest treatments with phosphorus acid, azoxystrobin or fludioxinil have been shown to control the fungus.

▶ **Zeroing in on zebra chip**. *April 2009, p. 18.*

This article reviews some of the information summarised in previous sections of this newsletter. Zebra chip disease, the potato psyllid and the *Candidatus* Liberibacter spp. bacteria have been found in Mexico, seven states of the USA and New Zealand. However, interestingly there are still states in the USA (e.g. Washington) where psyllids are present but no cases of zebra chip disease have been found. Crop losses from zebra chip disease have been very high in some areas, with total crop failure in some instances. While psyllids appear to be the primary vector of the disease and can infect a plant within one hour of feeding on it, not all psyllids spread the disease even if they are a carrier. Control of psyllids is difficult as they feed at the bottom of the plant and there are few effective chemicals.

▶ **Shareholder demands.** *May 2009, p. 18.*

Shareholders of the McDonald's restaurant chain are demanding that pesticide usage is reduced on the potatoes used for French fry production. With restaurants in over 100 countries, McDonald's is the largest buyer of French fries in the world. The corporation is committed to addressing these concerns and has developed six steps that will be undertaken

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towards reducing pesticide usage. These include a survey of pesticide usage and practices amongst potato suppliers sometime during 2009. In addition, best practice for reducing pesticide usage will be sought and encouraged throughout the global supply chain. The data collected will be shared with all potato growers, and recommendations will include alternative pest control methods and pesticide reduction strategies.

▶ **Copper crimes.** *June 2009, p. 14.*

Starting in April 2007, the Carmichael family from North Carolina, USA, that grows vegetables on 4500 acres, was hit on a regular basis by thieves stealing copper wire from their irrigators and damaging equipment in the process. This was happening on a weekly basis, with one field being struck on consecutive nights! The farmers had no choice but to mend the irrigators so that the crops could continue to be watered. Despite a number of strategies to prevent the attacks, the thieves kept outwitting the farmers, and hiring security guards to patrol the large farm was just too expensive. However, a solution appeared in the form of a device attached to the irrigators that could monitor and control the equipment remotely. This included alerting the operators that wire was being stolen. This proved very successful with three arrests and a number of foiled attempts due to the early alerts from the device. With a minimum price of around $1000 the Carmichael's think it is a much cheaper option than the stolen wire, damaged equipment, fence repairs and security guard costs, which was estimated at about $100,000!

Snippets from www.potatonews.com

Listed below is a small selection of the articles that are posted on the Global Potato News website. Please visit the site for further details or follow the links that are indicated.

▶ **Bacterial biocontrol product improves potato yields.** This article describes a product containing the naturally occurring plant-friendly bacteria *Bacillus amyloliquefaciens*, which appears to help release nutrients from fertilisers, stimulate root development and provide the plant with defence against infection. The product can be applied with fertiliser beside the tuber at planting or sprayed into the furrow. The bacteria appear to colonise the developing roots and provide their beneficial effects in return for some carbon-rich exudates from plant roots. Specific effects have been seen with increased yields in Maris Piper and Fianna cultivars, with reductions in common scab and black scurf blemishes on some tubers. In the UK, potato packers Branston is recommending that growers test the product, particularly if they are aiming for Class one product. *April 2009, News Headlines.*

▶ **China to increase potato output drastically.** China plans to increase its potato production from 70 to 120 million tonnes per annum, and is seeking the assistance of the Lima-based International Potato Centre (CIP). The main gains will come from increasing the per hectare productivity, which currently stands at around 15 tonnes, well below yields in Europe and the USA. To meet this target the focus will be on better seed systems and control of diseases, particularly late blight, bacterial wilt and viruses. *April 2009, News Headlines.*

▶ **Microwaveable packaging growing in popularity.** In the US, the microwaveable packaging market was estimated at $400 million in 2003 and an annual growth rate of 16% to 2013 is forecast. While much of this total market does not directly involve potatoes, there is still growing demand for potatoes that have been cleaned and are packaged so they are ready for immediate microwave cooking. *May 2009, News Headlines.*

▶ **United States: Researchers try to understand why specialty potatoes fade in storage.** Scientists from the University of Idaho are beginning a research programme to understand why the vibrant skin colours, such as red, yellow, purple or blue, of many specialty potatoes don't last. After several months in storage the lustre of the skin is noticeably duller than immediately after harvest. The project will continue over several years, and it is hoped that the outcome will be a comprehensive set of recommendations for maintaining skin quality. *May 2009, News Headlines.*

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