

Pest Alert

Florida Department of Agriculture and Consumer Services
Division of Plant Industry

Potato Psyllid (*Bactericera cockerelli*) (Hemiptera: Psyllidae) a Pest of Solanceae and Vector of Plant Pathogens Established in the Western USA

Susan Halbert, Susan.Halbert@FreshFromFlorida.com, Entomologist, Florida Department of Agriculture and Consumer Services, Division of Plant Industry

Wayne N. Dixon, Wayne.Dixon@FreshFromFlorida.com, Assistant Director, Florida Department of Agriculture and Consumer Services, Division of Plant Industry

INTRODUCTION: The potato psyllid, *Bactericera cockerelli* (Šulc), is a serious pest of solanaceous crops. It causes direct damage to the plants and also vectors one or more species of '*Candidatus Liberibacter*,' known in the literature as '*Ca. Liberibacter solanacearum*' (Lso) and '*Ca. Liberibacter psyllae*' (Lps). The synonymy relationships among the bacteria are unclear at this time. Potato psyllids have been known for many decades in the Great Plains. They were thought to overwinter in south Texas and northern Mexico and migrate seasonally north into the plains states (Liu *et al.* 2006). Recently, new populations have developed that are able to overwinter in California (Liu *et al.* 2006) and even in the Pacific Northwest (Swisher *et al.* 2014). So far, potato psyllids have not established east of the Mississippi River. All potato psyllids found in Florida have been interceptions from places known to be infested with the pests.

DESCRIPTION: Potato psyllids are in the Psyllid family Triozidae, characterized by wing veins that have three main branches. The North American potato psyllid has clear wings, a white band at the base of the abdomen, and a white polygonal pattern on the head (Fig. 1). Nymphs are green, resembling scales or whiteflies (Fig. 2), but unlike scales and whiteflies, they will move when irritated. Eggs are laid on stalks (Fig. 3). *Bactericera cockerelli* is the only potato psyllid known from North America, but other species of psyllids occur on potatoes in the Palearctic and South America (Halbert and Munyaneza 2012). Any psyllids found colonizing potatoes should be considered serious new pests in Florida.



Fig. 1. Adult potato psyllids.
Photography credit: Joseph E. Munyaneza, USDA-ARS, Wapato, WA.



Fig. 2. Potato psyllid nymph.
Photography credit: Joseph E. Munyaneza, USDA-ARS, Wapato, WA.



Fig. 3. Potato psyllid eggs.
Photography credit: Joseph E. Munyaneza, USDA-ARS, Wapato, WA.



Florida Department of Agriculture and Consumer Services
Adam H. Putnam, Commissioner

BIOLOGY: Potato psyllid females lay eggs on suitable host plants. Numbers of eggs laid seems variable. According to Knowlton and Janes (1931), females usually laid 5-50 eggs in a 24-hour period; however one female was observed to lay 157 eggs in 24 hours. This female laid 865 eggs between 3 and 26 June, after which she escaped from captivity. Eggs hatch in 3-9 days. About 73% of 9,615 observed eggs hatched (Knowlton and Janes 1931). Potato psyllids have five nymphal instars (Knowlton 1933). The timing of the nymphal life cycle is dependent on temperature and host plant (Yang and Liu 2009). Knowlton and Janes (1931) observed a variation between 12 and 21 days on potato in the laboratory. Lehman (1930) observed an average of 24 days.

HOSTS: The North American potato psyllid is polyphagous, with a strong preference for Solanaceae. Plants in other families, such as *Amaranthus* (Amaranthaceae), *Polygonum* (Polygonaceae), *Mentha* (Lamiaceae), *Convolvulus* (Convolvulaceae), *Raphanus* (Brassicaceae), *Atriplex* (Chenopodiaceae), *Avena* (Poaceae), *Malva* (Malvaceae), and *Hibiscus* (Malvaceae) can be colonized (Gall 2009), probably particularly when the psyllids are newly established in the area. Knowlton and Thomas (1934) observed that the complete life cycle occurred mostly on solanaceous plants; however, they also observed reproduction on *Convolvulus* (Convolvulaceae), and *Micromeria* (Lamiaceae). Adults can be found on a very wide assortment of plants.

ECONOMIC IMPORTANCE: Potato psyllid causes direct damage to plants in the form of “psyllid yellows,” which has been known since the 1920s. Perhaps recently, the insects acquired one or more plant pathogens in the genus *Candidatus* Liberibacter. However, there are hints that some pathogen associated with potato psyllids has been around for decades, with sporadic importance. Binkley (1929) observed a destructive syndrome in potatoes in 1926-1928 that was associated with potato psyllid. Damage was most significant in potato and tomato. In 1927, it reduced the early potato crop “from a six hundred to a two carload crop.” Nymphs secured under sterile laboratory conditions did not produce the syndrome when placed on clean plants in the laboratory, suggesting that the syndrome was due to a pathogen, and that the putative pathogen was not transmitted transovarially. The syndrome was characterized by “upward cupping of the leaves and a marked dwarfing of the plant.” Richards (1928) states that the epidemic in 1927 reached southern Idaho, Montana and Wyoming. He mentions brilliant purpling as well as rolling of the leaves. Nymphs confined to a single leaf produced symptoms in other leaves remote from the infested leaf in nine days.

The damage associated with *Ca. Liberibacter* species is more severe than psyllid yellows, and it does not go away when the psyllids are killed with pesticide. The disease is associated with poor growth, purple tip foliage, die-back, and poor yield and quality of potatoes (Munyanza 2012). Affected tubers have internal striping that shows up particularly when the tubers are fried for chips, leading to the name “zebra chip” for the disease (Fig. 4). *Candidatus* Liberibacter spp. also cause general yellowing and decline of tomatoes (Liefting *et al.* 2009; Hansen 2008). Some strains of the pathogen also cause serious damage to *Capsicum* peppers (Liefting *et al.* 2009; Munyanza *et al.* 2009). In Europe and North Africa, Lso has become established and caused major damage in vegetable crops in the family Umbelliferae, associated with at least two other species of psyllids (Alfaro-Fernández *et al.* 2012; Teresani *et al.* 2014; Tahzima *et al.* 2014).



Fig. 4. Striped potato chips made from tubers of potato plants infected with *Ca. Liberibacter solanacearum/psyllaurous*.
Photography credit: Joseph E. Munyanza, USDA-ARS, Wapato, WA.



Fig. 5. Potato psyllid nymphs can be found underneath the calyx on peppers from Western states and Mexico. Sometimes, but not always, there is sooty mold around the calyx that indicates the presence of the insects. Even if it is present, the sooty mold is difficult to see in cultivars like poblano, where the calyx is inside a deep cavity.
Photography credit: Susan Halbert.

DISTRIBUTION: North American potato psyllid: USA west of the Mississippi River, southern Canada in some seasons, Mexico (Liu *et al.* 2006), Central America (Aguilar *et al.* 2013; Munyaneza *et al.* 2013; Bextine *et al.* 2013), and New Zealand (Liefting *et al.* 2009). So far, no potato psyllid has been reported in Costa Rica or Panama.

'*Candidatus* Liberibacter solanacearum/psyllaorous': New Zealand (Liefting *et al.* 2009), western USA (Hansen *et al.* 2008), Mexico (Munyaneza *et al.* 2009), Central America, including at least Honduras (Aguilar *et al.* 2013), Nicaragua (Munyaneza *et al.* 2013), and El Salvador (Bextine *et al.* 2013), Europe (Munyaneza *et al.* 2010), and North Africa (Tahzima *et al.* 2014). Old World records for the pathogens are associated with different psyllids.

REGULATORY ISSUES: Potato psyllids are intercepted with some regularity on vegetables from Western states and Mexico. Most interceptions have been on *Capsicum* peppers. Psyllid nymphs can be found on the calyx of the pepper, sometimes on the underside, between the calyx and the adjacent skin of the fruit. In this case, especially with deep-welled poblano peppers, the insects are nearly impossible to detect without removing the calyx of the pepper to inspect for nymphs (Fig. 5). Occasionally, live colonies of nymphs have been found in the open on the skin of the fruit. Live adult potato psyllids also have been intercepted on leafy vegetables, especially lettuce.

FLORIDA DISTRIBUTION: Not yet known to occur.

REFERENCES:

- Aguilar, E., V.G. Sengoda, B. Bextine, K.F. McCue, and J.E. Munyaneza. 2013. First report of '*Candidatus* Liberibacter solanacearum' on tobacco in Honduras. Plant Disease 97: 1376.
- Alfaro-Fernández, A., F. Siverio, M.C. Cebrián, F.J. Villaescusa, and M.I. Font. '*Candidatus* Liberibacter solanacearum' associated with *Bactericera trigonica*-affected carrots in the Canary Islands. Plant Disease 96: 581.
- Bextine, B., E. Aguilar, A. Rueda, O. Caceres, V.G. Sengoda, K.F. McCue, and J.E. Munyaneza. 2013. First report of '*Candidatus* Liberibacter solanacearum' on tomato in El Salvador. Plant Disease 97: 1245.
- Binkley, A.M. 1929. Transmission studies with the new psyllid-yellows disease of solanaceous plants. Science 70, No. 1825. p. 615.
- Gall, R. 2009. Hosts of the potato psyllid. Potatoes New Zealand. http://www.potatoesnz.co.nz/users/Image/Graphics/PDFS/Psyllid_fact_sheets_-_hosts_lr.pdf [accessed 2014 November 17].
- Halbert, S.E. and J.E. Munyaneza. 2012. Potato psyllids and associated pathogens: a diagnostic aid. http://www.fsca-dpi.org/Homoptera_Hemiptera/Potato_psyllids_and_associated_pathogens.pdf [accessed 2014 November 18].
- Hansen, A.K., J.T. Trumble, R. Stouthamer, and T.D. Paine. 2008. A new huanglongbing species, '*Candidatus* Liberibacter *psyllaorous*' found to infect tomato and potato, is vectored by the psyllid *Bactericera cockerelli* (Šulc). Applied Environmental Microbiology 74: 5862-5865.
- Knowlton, G. F. 1934. Potato psyllid investigations. Proceedings of the Utah Academy of Sciences 11:261-265.
- Knowlton, G. F. and M.J. Janes. 1931. Studies on the biology of *Paratrioza cockerelli* (Šulc). Annals of the Entomological Society of America 24: 283-291.
- Lehman, R.S. 1930. Some observations on the life history of the tomato psyllid (*Paratrioza cockerelli* Šulc) [sic] (Homoptera). Journal of the New York Entomological Society 38: 307-312.
- Liefting, L.W., P.W. Sutherland, L.I. Ward, K.L. Paice, B.S. Weir, and Gerard, R.G. Clover. 2009. A new '*Candidatus* Liberibacter' species associated with diseases of solanaceous crops. Plant Disease 93: 208-214.
- Liu, D.-g., J.T. Trumble, and R. Stouthamer. 2006. Genetic differentiation between eastern populations and recent introductions of potato psyllid (*Bactericera cockerelli*) into western North America. Entomologia Experimentalis et Applicata 118: 177-183.

- Munyanzeza, J.E. 2012.** Zebra chip disease of potato: biology, epidemiology, and management. *American Journal of Potato Research* 89: 329-350.
- Munyanzeza, J.E., T.W. Fisher, V.G. Sengoda, S.F. Garczynski, A. Nissinen, and A. Lemmetty. 2010.** Association of "*Candidatus Liberibacter solanacearum*" with the psyllid, *Trioza apicalis* (Hemiptera: Triozidae) in Europe. *Journal of Economic Entomology* 103: 1060-1070.
- Munyanzeza, J.E., V.G. Sengoda, E. Aguilar, B. Bextine, and K.F. McCue. 2013.** First report of '*Candidatus Liberibacter solanacearum*' associated with psyllid infested tobacco in Nicaragua. *Plant Disease* 97: 1244.
- Munyanzeza, J.E., V.G. Sengoda, J.M. Crosslin, A. Tarzón-Tiznado, and O.G. Cardenas-Valenzuela. 2009.** First report of '*Candidatus Liberibacter solanacearum*' in pepper plants in Mexico. *Plant Disease* 93: 1076.
- Richards, B.L. 1928.** A new and destructive disease of the potato in Utah and its relation to the potato psylla. *Phytopathology* 18: 140-141.
- Swisher, K., V. Sengoda, J. Dixon, J. Munyanzeza, A. Murphy, S. Rondon, B. Thompson, A. Karasev, E. Wenniger, N. Olsen, and J. Crosslin. 2014.** Assessing potato psyllid haplotypes in potato crops in the Pacific Northwestern United States. *American Journal of Potato Research* 91: 485-491.
- Tahzima, R., M. Maes, E. Achbani, K. Swisher, J.E. Munyanzeza, and K. Dejonghe. 2014.** First report of '*Candidatus Liberibacter solanacearum*' on carrot in Africa. *Plant Disease* 98:1426.
- Teresani, G.R., E. Beronlini, A. Alfaro-Fernández, C. Martínez, F.A. Ossamu Tanaka, E.W. Kitajima, M. Roselló, S. Sanjuán, J.D. Ferrándiz, M.M. López, M. Cambra, and M.I. Font. 2014.** Association of '*Candidatus Liberibacter solanacearum*' with a vegetative disorder of celery in Spain and development of a real-time PCR method for its detection. *Phytopathology* 104: 804-811.
- Yang, X.-b. and T.-x. Liu. 2009.** Life history and life tables of *Bactericera cockerelli* (Homoptera: Psyllidae) on eggplant and bell pepper. *Environmental Entomology* 38: 1661-1667.