PHREC 2002-05b

NEBRASKA

POTATO EYES

Vol. 14, Issue 2, Summer 2002 ï Alexander D. Pavlista, Professor & Extension Potato Specialist

Potato (Tomato) Psyllids

Range

Outbreaks of potato psyllids (*Paratrioza cockerelli*) are very sporadic but have occurred suddenly and over vast areas. Although most commonly outbreaks occur in Texas, New Mexico, Arizona, Colorado and California, they have been reported as far north as Alberta and Saskatchewan. Potato psyllids overwinter exclusively on winter hosts along the Rio Grande River Valley, on the southern borders of Texas, New Mexico and Arizona. Populations increase from January to May. Peak populations occur at the end of April and early May. They appear north due to migrations of adults. In the last five years, they have appeared consistently in Nebraska and in 1998 were reported in South Dakota. Most of the research and available information on this insect pest comes from Colorado and Texas.

[For a historical perspective, some severe outbreaks in our region are reported; see the citations at the end of this article.]

Potato psyllid can live on or survive on a plethora of hosts. Their main economically important hosts are potato and tomato. However, most members of the Solanaceous family such as pepper, eggplant, and weeds such as nightshades can be hosts. Also, psyllids can survive on many non-Solanaceous weeds such as pigweeds, lambsquarter and bindweed.

Temperature is a critical factor in psyllid outbreaks and range. They do not like very high temperatures, preferring 80 F. Two hours at 100 F is lethal to eggs and nymphs. Temperatures above 90 F will reduce or cease egg laying, hatching and nymph survival. For this reason, psyllids like high altitudes, above 5900 ft. However, their northerly migration seems to be limited by cooler fall temperatures and possibly a reduction in radiance as the autumnal equinox approaches.

Description

Potato psyllids go through three stages in their development - adult, egg and nymph. The nymph is the cause of problems on the plant.

Inside this issue...

Potato Psyllid Mature Adult (courtesy of UNL-Entomology)

Adults, nicknamed ìjumping plant lice,î are not damaging. They look like a tiny cicada for those familiar with this noisy insect and will jump and fly when slightly disturbed. Adults are about a tenth of an inch long with wings held roof-like over the body. Initially light green for their first three days, they turn black with white markings, usually stripes. Their eyes are bulging or prominent and their legs are well developed.

Eggs are orange-yellow and appear at the end of short stalks, similar to but much smaller than the white eggs of lacewings (not a common predator). Eggs appear in clumps and usually, but not exclusively, on the underside of apical leaves.

Potato Psyllid Mature Nymph (courtesy of CSU-Entomology)

Nymphs are the damaging form of this insect. They are tiny (pin-head) and flat. Their most notable appearance is that they look like overlapping scales (reminding me of a tiny trilobite of the Paleozoic Era). This scale-like appearance is ringed with tiny hairs. Young nymphs are pale brown and turning pale green with successive molting. There are four (five instars) molts until adult metamorphosis. Nymphs are mostly found in the upper canopy and on the underside of leaves. Nymphs are quiescent and, unlike aphid nymphs, do not move around much.

Nymphs excrete a waxy salt-like or sugar-like white granular substance. They are sucking-type insects, but their damage is NOT due to feeding but due to the secretion of a toxin into the plant with their saliva. This toxin affects growth of all the plantís parts and causes a symptom called ìpsyllid yellows.î

Continued on page 2

Potato (Tomato) Psyllids

Toxin occurrence in nymphs is irregular as it seems to an inherited trait. So the presence of psyllid nymphs does not necessarily mean that psyllid yellows will occur. Potato psyllids do NOT seem to be vectors of haywire, potato leaf roll nor aster yellow.

Life Cycle

Adults overwinter along the Rio Grande River region and migrate north in the spring. Along the way, they lay eggs. Over 500 eggs may be laid during an average period of 21 days. Eggs hatch within a few days. Nymphs can survive up to 90 days but usually last only two to three weeks before changing to adults. The entire cycle usually is four to five weeks but this varies considerably depending on host and temperature. There are usually three to four generations per season but fewer as insect migrates further north. Generations may overlap. Appearance of psyllids further north depends on winds starting in June and July.

Insect Monitoring

In spring, potato psyllids are first found on perennial weedy hosts such as matrimony vine and on greenhouse Solanaceous plants particularly pepper and tomato. Early sprouting potato cull piles also attract the psyllids and these cull piles can then act as a source for potato field infestations. (Like we donít need another reason why cull piles need to be eliminated such as a livestock feed. See Univ. Nebraska Extension Circular #02-152.) In potato fields, the potato psyllid does not distribute itself uniformly. They typically appear on the edge of the field like Colorado potato beetles, usually the southern rim, and progress toward the center. Yellow pan traps used to monitor green peach aphids will pick up psyllid migrations. Winged black adults can also be picked up using yellow sticky cards hung close to the canopy. Due to the unpredictability of adult migrations and nymphís toxin inheritance, and toxin effects, no population thresholds have been set for economic levels or treatments.

Damage - Psyllid Yellows

Potato psyllid nymphs attach to the underside of leaves and feed by sucking plant juices, sap, through needle-like mouth parts; this in itself doesnít cause enough damage to be the concern. But, many nymphs have inherited a gene that causes them to produce a plant poison (phytotoxin) which is injected into the plant in the nymphís saliva, similar to a mosquito, and drastically reduces or even ceases all plant growth. The degree of damage depends on the amount of toxin, related to insect infestation, and the plantís growth stage. Variability between cultivars with regard to susceptibility and symptom expression has been suggested but it is still unclear and maybe it is more related to seasonal maturity type then actual tolerance.

Leafroll due to Potato Psyllids

Foliar Symptoms (ìPsyllid Yellowsî) -- Toxic symptoms may appear as quick as four to six days after injection in a heavy infestation but usually it takes two to three weeks. When plant are young, still in vine growth, they will be stunted and chlorotic (yellow from lack of chlorophyll). Internodes will be shorter causing a rosette canopy appearance and nodes will thicken. Occasionally, aerial tubers will appear at nodes.

When I do field diagnostics, the first and most easily spotted foliar symptom is a distinctive leaf roll (ìfeathery appearanceî) especially in conjunction with yellowing of the upper leaves (see included photos). From a distance, this leaf roll looks similar to that symptomatic of black leg, leaf roll virus and Eur. corn borer. But, even without finding the nymphs, the others may be eliminated by looking for the black, slimy stem base associated with black leg and for the entry hole and fraas associated with the corn borer. Also, unlike leaf roll virus, the leaves are not brittle and do not produce a soft rattle when shaken. The leaf roll is looser with the leaflets are often slightly jagged from irregular growth and the basal part of leaflets are more curled upward. Leaves, especially the younger leaves may have a purple tinge (anthocyanin pigmentation). In some cases, veins may also develop a slight purple tinge in older leaves.

Besides being affected by nymph density, saliva toxicity and feeding duration, several other factors influence expression of foliar symptoms. Higher intensity and longer duration of sunlight will enhance symptom expression. Therefore, the high light intensity and moderate summer temperatures in high mountain valleys as in Colorado are very conducive to psyllid yellows. Symptom expression is also increased in plants in alkaline soils as in the Nebraska Panhandle and by an abundance of irrigation common under center-pivots. Older plants are more tolerant of psyllid infestation and the phytotoxin has a lesser effect since canopy growth is completed but tubers will still be affected unless fully mature.

Tuber Symptoms -- Potato psyllids have a major (big time) impact on yields, the earlier the infestation with regard to tuber growth the greater the yield reduction. Also the severity of yield loss is proportional to the severity of foliar injury. Total yield losses are due to a reduction in tuber size. When infestation is in early bulking, tuber growth is affected more than when infestation is in late bulking. In addition to smaller tubers, there is an increase in the number of tubers and their set is closer to the plant stem, shorter stolons. Furthermore, tubers tend to be mis-shaped and have a rough skin.

Potato (Tomato) Psyllids

Mis-shaped tubers due to Potato Psyllids (courtesy of CSU-Entomology)

Another important tuber characteristic is a loss of dormancy resulting in premature sprouting. Therefore, tuber chaining and internal sprouting are common. Sprouts are spindly, ìhairî sprouts, and very weak. These tubers are unacceptable for the following yearís planting. Internal necrosis also may occur but, on the other hand, starch and sugar content are not adversely affected by the phytotoxin.

Reversibility -- Removal of nymphs when the first signs of symptoms seems to allow for recovery of plants. From the Univ. Arizona, there is a report (Arslan et al., 1985) that, after a planting application of phorate (Thimet), a foliar application of methomyl (Lannate), shortly after infestation at six to seven weeks after emergence, partially reversed the phytotoxicity caused by the psyllids (Figure 1). Note depicted is total yield; marketable yield will be lower as some tubers will still be mis-shaped and have sprouting defects.

Control

Chemical -- There are many insecticides that will affect potato psyllids. It is best to use a systemic. The main difficulty in treating for them is that the nymphs are on the leafletís underside and donít like to move; therefore, foliar treatments work best when the undersides are exposed. The best foliar applications are low-flying, high-volume aerial spraying and ground spraying using drop nozzles. Common foliar products are Actara, Ambush, Asana, Leverage, Monitor, Phaser, Pounce, Provado and Thiodan. Traditionally, systemic insecticides, Di-Syston and Thimet, were applied at planting but there short residual activity limit their effectiveness. Newer at-planting systemic insecticides, Admire (imidacloprid) and Platinum (thiamethoxam), with their much longer residual, about 13 weeks, have shown to be very effective against psyllids and other insects (Figure 2). Newer still is the use of the active ingredient in these products as seed treatments either as a dust, Tops MZ Gaucho and soon to be released Maxim MZ Cruiser, or as a liquid, Genesis. These treatments seem also to be highly effective against potato psyllids and leafhoppers (Figures 2 and 3).

Biological -- There are a number of natural predators that feed on psyllids. These are the convergent lady beetle, minute pirate bug and damsel bug. But, although they are good eaters and will eat any stage of psyllid development, their effect on populations is modest and far less important than weather conditions. There is also a parasitic wasp that will paralyze nymphs and lay their eggs in them. But, field studies show that they are not well synchronized with the psyllid life cycle and therefore do not show much promise.

Recommendation -- My recommendation is, if you are in a situation that you may get potato psyllids, to use imidacloprid or thiamethoxam as an in-furrow or seed treatment. If not and your field gets infested, you will be trying to get partial recovery with two or three foliar aerial applications and it will cost much more while still having a marketable yield loss.

Fig. 1. Total yield after psyllid infestation
(source: Aslan et al., 1985)

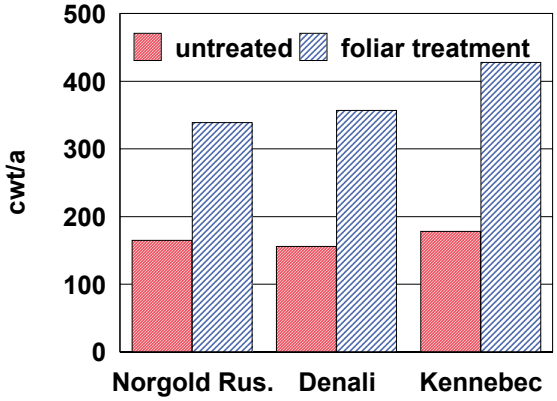
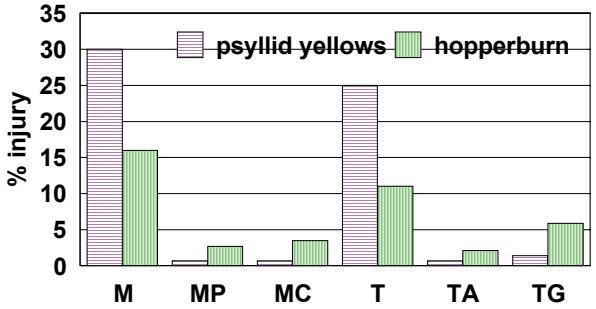
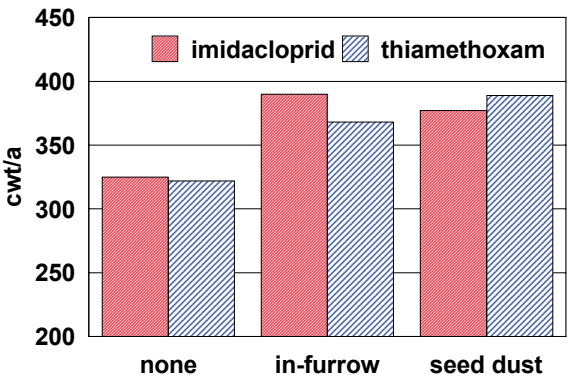


Fig. 2. Potato Psyllid & Leafhopper Injury
(source: Pavlista, Nebr. Research Report. 2001)



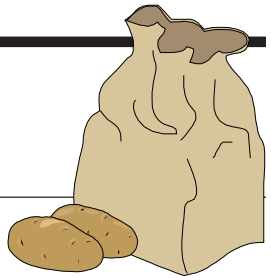
M=Maxim MZ, MP=Maxim MZ & Platinum, MC=Maxim MZ Cruiser
T=Tops MZ, TA=Tops MZ & Admire, TG=Tops MZ Gaucho

Fig. 3. Yield, US-A, Insecticide Placement
(source: Pavlista, Nebr. Research Report. 2001)



University of Nebraska
Panhandle Research and Extension Center
4502 Avenue I
Scottsbluff, NE 69361

NEBRASKA POTATO EYES



Literature Citations

Arslan, A, Bessey, PM, Matsuda, K and Oebker, NF. 1985. Pysiological effect of psyllid on potato. Am Potato J 62:9-22.

Hill, RE. 1947. An unusual weather sequence accompanying the severe potato psyllid outbreak in 1938 in Nebraska. J Kans Entomol Soc 20:88-92.

Starr, LA. 1938. Psyllid yellows unusually severe in Wyoming. Plant Disease Repr 23:2-3.

Wallis, RL 1946. Seasonal occurrence of the potato psyllid in the North Platte Valley. J Econ Entomol 39:689-694.

Check out the Nebraska Potato Eyes on the WWW at:
http://www.panhandle.unl.edu/peyes.htm

For Our Record

-- Mexico has agreed in principle on a protocol to reopen tablestock potatoes to enter Mexico. If you recall, two years ago, there was considerable amount of controversy stemming from potato lots with Columbia root-knot nematode mislabeled as being from Nebraska.

-- Spartan received a ëcrisisí Section 18 label for Nebraska to look for varietal-specific phytotoxicity. The delay was due to EPAís misunderstanding of the phytotoxicity testing. Spartan is labeled for treating ALS- and triazine-resistant pigweed. It should get a full, Section 3, label by next year.

-- A new agricultural book focusing on nitrogen effects and the environment has recently been published by Elsevier. Its title is ì Nitrogen in the Environment: Sources, Problems and Management.ì Chapter 3 on crop quality and health has a section on potatoes that I wrote.