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POTATO EYES

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

IBS Resistance: A Sad Epilogue on Bruising

Spudman 1999

As a follow-up to last year's articles on wound healing and bruising of tubers, the question of resistance to blackspot bruising was mentioned. Several years ago, the biotechnology company NatureMark was disbanded due to pressure against genetically-modified potatoes. Prior to its demise, the company had modified some varieties such as Ranger Russet to be bruise resistant and were in the process of field testing these NewLeaf varieties in 1999.

The following pictures compare tubers from standard Ranger Russet (left) to those of NewLeaf anti-blackspot bruise Ranger Russet (right). Bruising is depicted by the increasing darkening of the tubers starting at one end.

Besides anti-bruising, the most highly farmer-requested genetic-modified trait that growers requested were late blight resistance and increased dry matter content. The company was in the process of fulfilling these, as well, at their forced closure.

Inside this issue...

Alexander D. Pavlista

Potato Tuber Moth -- Tuberworm

The potato tuberworm (PTW) or tuber moth (PTM), most commonly Phthorinaea operculella, is usually found in warm climates for overwinter survival and considered a subtropical pest. It is considered the most serious pest of potato in tropical and subtropical regions. Recently the moth has been found in traps in northern latitudes. Whether this northern migration is due to global warming, mutation, etc., is not known. Since it is not a good flier, its migration is attributed primarily due to movement of tubers carrying the pest into storage facilities further north.

Identification

Description: PTM/PTW has four stages: adult, egg, larva (damaging), pupa.

• Adults have a narrow, silver-gray body with grayish-brown wings patterned with small dark spots. The body length is around ⅓ of an inch and a wing span of an inch. It is mostly nocturnal and attracted to light. They are poor fliers.

• Eggs are oval, smooth and yellow; laid alone or in clusters on leaves or near eyes on infested tubers.

• Larva, caterpillar-like, is gray, cream or pale green with a dark brown head about ½ to ¾ inch long in the final instar.

• Pupa is yellow or rust colored; pupation occurs among dead leaves or debris, in soil, or on stored tubers.

Damage: PTM attacks solanaceous crops with potato being favored.

• Foliage -- Larva (tuberworm) mines into leaflets causing them to form transparent blisters, then move into stem tissue causing death.

• Tubers -- Larva (PTW) reach tubers by two major means. Upon hatching from eggs laid on leaves, the larva can drop to the ground and burrow through cracks in the soil to a tuber, entering it through the eye. This is common after vine desiccation. Another common way is that the female PTM lays its eggs directly on exposed tubers at or near the eye. When the larva hatches, it just enters the tuber through the eye, making a slender tunnel along the surface or deep into the tuber. A tunnel can be detected by mounds of worm excrement (frass) appearing black at the entrance. Tunnels do not heal and are entryways for diseases, most notably soft rot and dry rot.

• Life Cycle: Generation time is 17 to 125 days depending on temperature, commonly one month. Adult = up to 10 days; egg = 2 to 6 days; larva = 13 to 33 days; pupa = 6 to 29 days. Several generation may form per year. Life cycle can continue in storage on tubers.

www.oisat.org

Potato Tuber Moth (adult).

IPM for Potatoes/Jack Kelly Clark

Potato Tuber Worm (larva), showing leaf damage.

Monitoring

The PTM pheromone (male-attracting stimulant) can be used to bait pan-water traps for attracting and monitoring adult male PTM presence. Trapping will give an indication of their presence, population size and distribution, and timing for chemical management. Pan-water traps are recommended due to ease in cleaning between readings. In general, it is suggested to place four traps in each quadrant of a circle, about 50 ft from periphery. Trays should be checked twice per week. Note that economic thresholds have not been determined for potato damage and marketable yield loss. Although there is no threshold determined, a reported guide is 15 to 20 PTMs per trap per night would trigger a spray recommendation. Another guide is if the average PTM/trap/night is 10 during the season to that point then field should be treated. These, however, still may be over- or under-estimates.

Field Management

• Reject seed lots from fields or storage that had been infested with PTM or PTW, or tubers that are infested.

• Avoid letting tubers be exposed outside of hill or be shallow, less than two inches covered by soil. Keep potato

Continued on next page

Potato Tuber Moth - Tuberworm, continued

Continued from previous page

plants well hilled with tubers adequately covered, deeper planting depth and broader hills.

• Avoid late-season washed out areas as this will expose tubers above ground and PTMs can lay their eggs on the exposed tubers.

• Avoid deep soil cracks (2 inches and greater) using cultural practices such as irrigation. This will inhibit female PTM from laying eggs on the tubers and wandering PTW from getting through soil to the tubers.

• Irrigate slightly after vine desiccation to avoid soil cracking and harvest tubers as soon as skin sets.

• Do not leave potato tubers in containers in the field overnight; likewise do not dig and leave tubers atop of ground to be picked up the next day and stored. At night the female PTM is most active laying eggs.

• Do not use vines as a cover for tubers, as the PTW will move from them to tubers as the vines wilt.

• Bury or feed to cattle cull piles, or in some way destroy them.

• Eliminate volunteer potato plants.

Chemical Management

Insecticides used against leafhoppers and aphids are adequate against PTM during the early part of the season but best applications are toward the end of the season when vines are dying and tubers are maturing.

• Current products active against PTM (adult) and PTW (larvae) even when PTWs are in leaf tissue =

Furadan, Lannate, Monitor, and Penncap M. (source: Alan Schreiber, Eltopia, WA)

• Current products active against PTM and PTW but not when PTWs are in leaf tissue =

Asana, Baythroid, Guthion, Imidan, and Leverage. (source: Alan Schreiber, Eltopia, WA)

• For home gardens, apply Sevin to foliage for general insect control. Treat 10 to three days before harvesting. Bt may also be used if applied at the right timing to kill PTW but note has no effect on PTM.

There are no products registered for storage control of PTM/PTW.

Predation

The only natural predators identified are two wasp species that attack PTW.

Juan Alvarez, U. of Idaho

External tuber damage (frass at tunnel openings).

www.plantdepommedeterre.org

Internal tuber damage (tunnels lined with silk thread).

Storage Management

PTM/PTW damage is year long as the PTM will continue to breed in storage and lay eggs which will hatch into PTW. The length of the life cycle will depend on the storage temperature.

• Sanitize storage facility (walls, floors, ceiling).

• Treat facility with malathione, if PTM or PTW was detected the previous year.

• Keep storage temperatures below 52 deg F.

• Screen storage area from the outside to keep out PTMs.

• If potato sacks, crates or other containers are used, they should be new or thoroughly sanitized.

Varietal Resistance

Varieties that are thought as resistant are those that set tubers deeper in the ground. But, if there are deep cracks through which the PTM or PTW can travel to tubers, the tubers will become infested; likewise, they will infest tubers on the ground. Therefore, there is no real resistance.

References

Insects and Related Pests. 2006. Integrated Pest Management for Potatoes in the Western United States, 2nd Edition, Ed. L.L. Strand, Publ. Univ Calif Agric and Nat Resources, Pub. 3316.

Foot, M. 1998. Potato Tuber Moth Life Cycle. HortFact (on-line), The Horticulture and Food Research Inst of New Zealand.

Sorensen, K.A. 1994. Potato Tuberworm. Vegetable Insect Pest Management: Insect Note, North Carolina State Univ. (online publication)

Spring, A. and E. Day. 2006. Potato Tuberworm. Insect Identification Lab. Virginia Tech. (online publication)

Potato Genetics Newswire

1. The Potato Genome Sequencing Consortium received from the Dutch government this year $3.6 million (U.S.) to sequence the potato's chromosome # 1. The Consortium is led by the Netherlands Genomics Initiative and the Wageningen University and Research Center. Research partners in the consortium have each picked a chromosome of the 12 in potato to sequence. The target completion date for full sequencing is 2010.

2. Scientists at the Wageningen University in the Netherlands identified a gene that confers resistance to late blight (Phytophthera infestans). The gene, located on chromosome # 4, was found in a wild relative (Solanum bulbcastanum) of the commonly-eaten potato (Solanum tuberosum). The DNA sequence seems highly similar to one identified in tomato as conferring late blight resistance. (ref. Molecular Breeding. 2005. 16:33-43)

3. There is a South American tree frog (Phyllomedusa bicolor) that produces an anti-bacterial and anti-fungal substance excreted through the skin. Scientists at the University of Victoria in Australia succeeded in introducing the frog gene that results in the production of this substance into potato. Thereby they produced a genetically-modified potato that seems to be resistant to dry rot (Fusarium spp.), pink rot (Phytophthera erythroseptica) and late blight (Phytophthera infestans).

4. A gene has been transferred from Arabidopsis thaliana (a model plant) to potato via Agrobacterium-transformation that gave potato plants improved salt tolerance. The genetically-modified plants showed tolerance to salinity while maintaining much of the yield. (ref. Plant Science. 2005. 169:746-752)

The Nebraska Potato Eyes

is on the World Wide Web at:

www.panhandle.unl.edu/peyes.htm