

The architecture of basic entomology: the who, what and where of common insect pests in the 2010 season

Silvia I. Rondon, Extension Entomologist Specialist
Oregon State University, Hermiston Agricultural Research and Extension Center

The purpose of this article is to acquaint people with the incredible biological diversity represented by the largest group of living organisms: insects. We will review most of the common orders and/or insect species found in the 2010 potato growing season in relation to potato crop development. We will focus on general characteristics of potato pests, monitoring and control options.

March-April: Planting Season Begins

Planting season for potatoes in the lower Columbia Basin typically extends from about mid to late March until early June. In some instances, it may start as early as the second week of February. Insects and related pests can cause problems both at pre-planting and planting. Pre-planting general recommendations: control weed hosts, use soil-applied insecticides when necessary. At planting, use systemics properly when appropriate to target pests and to protect non-target organisms.

Wireworm

Wireworms are the larval stage of click beetles and can cause damage to potatoes in two ways: (1) feeding upon potato seed pieces and their emerging sprouts in the spring that can facilitate infection by pathogens or (2) damaging developing tubers by direct-feeding. The latter damage can result in reduction in yield and/or rejection of the entire crop. Wireworms tend to be most damaging in potatoes that follow corn or small grains and on ground just entering cultivation.

Adult click beetles are slender hard-shelled insects. They range in color from tan to dark brown and from about $\frac{1}{8}$ - $\frac{3}{4}$ " long depending on species. Click beetles get their name from their ability to snap a spine on their thorax that produces a clicking sound and allows them to jump in the air when disturbed. All beetles in this family have this ability, which they use to avoid predation or to get back on their feet after falling on their backs. After mating, each female lays an average of 80 eggs singly or in small clusters in the soil. Unlike the soft-skinned immature stages of most insects, wireworms have a hardened and shiny shell and very few hairs. They have three body regions, a distinct head, a thorax with 3 pairs of legs



(Top) Damage caused by wireworm; (bottom) wireworm entering tuber.

and a segmented abdomen with processes at the tail-end. Depending on species and age, wireworm larvae range from about 2 mm after hatching to 4 cm (1/16 - 1½") long or more at maturity. Wireworm pupae are first white, but later change to reddish-brown.



Click beetle. Photo by OSAC

Adult click beetles emerge from pupae in the soil from late spring through late summer. In the Pacific Northwest, wireworms overwinter as larvae or adults. Adults can fly, but usually they prefer to remain in areas where they developed as larvae. Females tend to prefer laying eggs in grassy areas. Larvae can live from 2-5 years in the soil, depending

on species. They require several years to mature and can overwinter at a depth of 12-24" or more in the soil, only to return near the surface in spring to resume feeding in the spring when soil temperatures exceed 50°F.



Wireworm larva. Photo by OSU-Smith



false wireworm - adult and larva

Later in the season when temperatures reach 80°F and above, the larvae tend to move deeper than 6 inches into the soil to escape the "heat". Be careful when you identify wireworm larva because another insect larva of the family Tenebrionidae, usually a saprophagous, resembles wireworm. Wireworm larva can also be confused with crane fly larva.



Crane fly larva. Internet photo

Monitoring.

Wireworm presence or absence in a field should be determined before using control measures. Unfortunately, current monitoring methods are time consuming, laborious and often do not accurately reflect - field populations or this pest's damage potential. Historically, wireworms have been monitored by extracting and sifting through soil cores to locate mainly larvae. Since the distribution of wireworms in a field tends to be patchy and unpredictable, large numbers of samples are required to accurately

estimate population size. Baits have largely replaced random soil sampling, since they are less labor intensive and may detect low wireworm populations.

Control. Economic thresholds vary depending on crop susceptibility, the cost of control measures, market tolerance of pest damage and other factors. Low density but still damaging wireworm populations can be difficult to attract so we recommend trapping from April to May. Dave Horton (2006) modeled the relationship between bait trap counts and crop damage by *Limonius canus* in Wapato, WA. Damage forecast based on bait counts obtained either before or after planting of potatoes –is presented below. Remember that it is difficult to predict crop damage from trap counts so these values should be used with caution.

Wireworms per bait	Pre-planting		Post-planting				
	Predicted % of tubers suffering damage						
	20 April	26 April	3 May	10 May	17 May	24 May	22 June
0	5	2	6	7	8	7	7
0.25	14	24	15	16	16	20	50
0.5	22	40	23	24	23	32	69
1.0	37	62	36	38	35	49	83
1.5	49	74	47	49	45	61	86
2.0	59	81	56	57	52	70	86
2.5	68	85	63	63	59	75	87
3.0	75	88	68	68	65	80	87
4.0	85	90	76	75	72	84	87
5.0	93	90	81	79	77	87	86
10.0	100	91	91	85	84	89	86
15.0	100	91	92	85	85	89	86

Predicted *L. canus* damage incidence to potatoes at various population densities measured with trap counts using rolled oat baits (Horton 2006).

There are no biological control methods for wireworm. If one suspects wireworms are present in a field based on trapping, chemical control is the best management option (<http://potatoes.com/Research-IPM.cfm>). More information regarding wireworm control can be found at: <http://extension.oregonstate.edu/catalog/pdf/pnw/pnw607.pdf>

April-June: Pre-emergence, Emergence through Tuber Growth

After plant emergence, design a monitor program for insects and mites. A well designed Integrated Pest Management program combines the use of several management strategies while maintaining profitability and ecological balance. Before any control measure is taken, one needs basic information regarding the current situation of the crop, history of the crop (record of previous problems), and a register of the presence of pest (s) and natural enemies. This information will be useful in determining whether a control measure is needed or not. It is

essential to obtain at a minimum estimate of these parameters in order to establish an efficient sampling protocol that minimizes costs and time of effort. Several pests affected the potato crop in 2010 during the months of April through June. Among them were Colorado Potato Beetles, aphids, and beet leafhoppers. Few reports were received regarding loopers, cutworms, mites and thrips in the region.

Colorado Potato Beetle

The Colorado Potato Beetle (CPB) is a yellow and black striped beetle, about 0.5 inch long and 0.25 inch wide. They can be found in almost all US potato regions. Larvae are reddish orange, with two rows of black spots on each side. Yellow egg clusters are found mainly on the undersides of leaves in the top third of the plant. This beetle can cause complete defoliation and nearly complete crop loss if allowed to reproduce unchecked. Both larvae and adults feed on potato foliage throughout the season. Pupation and overwintering occurs in the soil. Adults emerge from soil to lay eggs in the spring. In the southern Columbia Basin, – this beetle may have three generations in a season.



Eggs



Larva



Adult



Pupae

Control. Crop rotations may help in delaying or reducing CPB pressure. Adult beetles spend the winter buried 4 -10 inches in the soil and emerge in the spring just as the first volunteer potatoes appear. Recently emerged beetles either mate close to the overwintering sites or fly to new potato fields to find a mate. Colonizing beetles need to feed before starting to lay eggs, thus controlling volunteer potatoes and weeds is important. This practice will reduce the number of migrating overwintering beetles into the new field. The use of “at planting” and systemic insecticides in early potatoes will contribute to the control of early-season CPB populations. Spinosad, apply by air; ground or chemigation is a good pesticide that targets eggs and young larvae.

Green peach aphids and potato aphids

Aphids on potato are serious pests because of their ability to transmit several plant diseases such as potato leaf roll virus (PLRV) (transmitted mainly by green peach aphid) and potato virus Y (PVY) (transmitted by several species of aphids). PLRV causes necrosis while strains of PVY can cause internal brown lesions in the tubers.

Green peach aphid (*Myzus persicae*) arrives on potatoes in the spring from weeds and various crops where it has overwintered as nymphs and adults, or from



Potato aphid (top, wingless form; below, winged form). Photo by A. Jensen

peaches and related trees where it overwinters as eggs. Potato aphids (*Macrosiphum euphorbiae*) also overwinter as active nymphs, adults or eggs; eggs are laid on roses and sometimes other plants. Throughout the growing season aphids produce live young, all of which are female and can be either winged or wingless. In the fall, winged males are produced which fly to overwintering hosts and mate with egg-laying females produced on that host. Aphids found in the region undergo multiple overlapping generations per year.



Monitoring. Fields should be checked for aphids at least once a week starting after emergence. The most effective

scouting method is beating sheets, trays, buckets or white paper. There are no well-established treatment thresholds for aphids in potatoes in the PNW.

Control. Weed control and elimination of secondary hosts are critical. Early aphid infestations commonly occur on a number of weeds including species of mustards and nightshade. Therefore, those weeds should be kept under control, especially in seed-growing areas where disease prevention is essential. If aphids are present, use of insecticides should occur as soon as non-winged aphids are detected.



Green peach aphid, the most serious aphid in the region. Top, wingless form, bottom, alatae. Photo by A. Jensen

Beet Leafhopper

The beet leafhopper (BLH) is approximately 0.125 inches long, wedge shaped, and pale green to gray or brown in color. It may have dark markings on the upper surface of the body early and late in the season ("darker form"). BLH overwinters on rangeland weeds and migrates to potatoes as early as May. Direct feeding can cause relatively minor damage; however, BLH is able to transmit BLTVA (beet leafhopper transmitted virescence agent), a very destructive and detrimental disease affecting potatoes. Among the favorite hosts of BLH, Kochia, Russian thistle, and various weedy mustard species such as tumble mustard, especially if they are young-marginal-irrigated and small.

Control. Weed control in areas surrounding the potato field can help reduce initial sources of BLTVA inoculum. Foliar insecticides can reduce BLH populations and ergo, the incidence of the disease.

More information at <http://potatoes.com> and <http://uspest.org/pnw/insects?23POTA04.dat>.



July-October: Maturation and Harvest

Potato Tuberworm

The potato tuberworm (PTW) is one of the most economically significant insect pests of cultivated potatoes. A recent study suggests that locations with higher spring, summer, or fall temperatures are associated with increased trapping rates in most seasons. Moreover, elevation and latitude appears to play a constraining role as low densities of PTW are associated with higher elevations and latitudes. It remains unclear how severe of a pest PTW will be in the Columbia Basin in the following years, but it is highly likely that the species will be with us for the near future. Although the PTW's host range includes a wide array of Solanaceous crops such as tomatoes, peppers, eggplants, tobacco, and weeds such as nightshade, it has only been found on potatoes in the region.

PTW adults emerge as early as April in the Columbia Basin, and continue to threaten



Potato tuberworm adult (top; photo by ODA) and larva (bottom; photo by OSU L. Ketchum).

the crop through November. Populations build sharply later in the growing season (September and October) and can potentially cause tuber damage. Control efforts should be directed toward populations during this time. If PTW populations appear to be building prior to late season, additional control measures may be necessary.

Other means of control- include the elimination of cull potatoes and piles, and the control of volunteer potatoes. Daily irrigation that keeps the soil surface moist can also aid in the control of PTW. - Consider control - close to harvest, since PTW females prefer to lay eggs on potato foliage. When potato foliage starts to degrade and turn color, the risk of tuber infestation increases greatly. THE PERIOD BETWEEN DESICCATION AND HARVEST IS A TIME OF INCREASED RISK OF TUBER INFESTATION.