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2005 Western Washington Delimiting Survey for *Agriotes obscurus* and *A. lineatus* (Coleoptera: Elateridae), Exotic Wireworm Pests New to the United States

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Background

Wireworms are the juvenile stage (larvae) of click beetles (family Elateridae), a diverse group of beetles that includes beneficial as well as plant-feeding species. Pest species live in soil where the tough, wire-like larvae feed on seeds, plant roots, and underground plant parts.

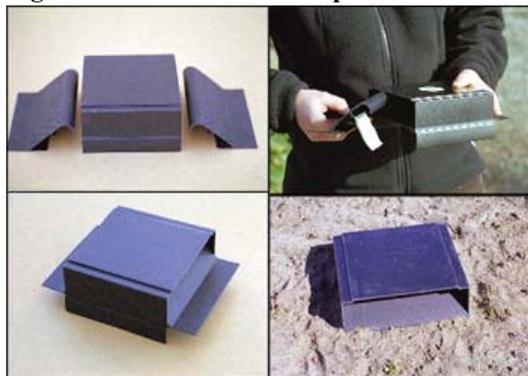
Figure 1. Wireworm Larva



Figure 2. Adult Click Beetles



Figure 3. Vernon Beetle Trap



Two European pest wireworms, *Agriotes obscurus* (L.) and *Agriotes lineatus* (L.) (Figures 1 & 2), were known to be present in British Columbia, Canada, since 1950 and *A. obscurus* was found for the first time in the United States in Washington State in 1997 (Vernon and Päts, 1997). In 2000, a preliminary WSDA/USDA-CAPS detection survey of areas of western Washington found both species in several counties along the east side of Puget Sound (LaGasa et.al. 2000), and a small delimiting survey in 2004 documented the presence of both species in additional areas of Southern Puget Sound, including the Olympia port area (LaGasa et.al. 2004).

Both species are primary economic pests of many plants in Europe and western Asia (USDA APHIS, 1978). In recent years these two introduced species have become the most important pests of many crops in the lower Fraser Valley, causing between \$500,000.00 and \$800,000.00 in crop losses in 1994 (Vernon, 1998). For more information on these pest wireworms, damage, monitoring, and management in the PNW region, a number of links and publications is included at the end of this report.

2005 Project Objectives

1. Delimit *Agriotes lineatus* and *A. obscurus* distribution in the following selected area of western Washington.

- Areas adjacent to known populations (in Pierce/Thurston counties) and in counties to the south.
- Clark and Cowlitz counties, in collaboration with the Oregon Department of Agriculture to survey the greater Vancouver, Washington / Portland, Oregon port area.
- Urban and rural areas of King county, in home garden and other selected environs potentially impacted by larval populations.

Project Methods and Materials

This survey used pheromone-lure-baited ground traps recently developed by Dr. Bob Vernon (Agriculture Canada) and PheroTech Inc. of British Columbia, Canada. A few lures for *Agriotes sputator*, another European pest species established in Eastern Canada, but not B.C., were also provided for this survey by Dr. Vernon.

As in previous surveys, physical criteria for trap sites included proximity to areas of turf, pasture, or other grassy locations, which are considered favored wireworm habitat, and protected situations where traps would be less likely disturbed or damaged.

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Project Methods and Materials (Cont.)

Traps were placed beginning in early March and checked semi-weekly until removal in mid to late-June, to coincide with spring adult beetle activity. Other site selection criteria and trap servicing procedures were similar to previous years. (For details and images of trap servicing procedures see LaGasa et.al. 2004)

In total, 280 sites were trapped in this survey. Trap site numbers and catch status by county are presented in Table 1. Beetles captured were identified in the WSDA Olympia Entomology Lab and new county record collections were sent to Dr. Paul Johnson, a USDA ARS Systematic Entomology Laboratory identification collaborator at the University of South Dakota, for confirmation (received August 23, 2005).

Survey trapping in King county was conducted by volunteer participants in the [Washington State University Cooperative Extension Service / Master Gardener](#) program and members of the Seattle area [Scarabs](#), which was a (highly successful) first collaboration of this kind in USDA APHIS CAPS funded exotic pest surveys in Washington State. A list of volunteer surveyor participants is included at the end of this report.

Project Results and Discussion

Agriotes lineatus and *A. obscurus* were recorded for the first time in King and Lewis Counties in this survey and again neither were collected in Clark County (Table 1.). *Agriotes lineatus* was also recorded for the first time in Cowlitz County, as well as additional sites in (previously positive) Pierce and Thurston Counties. *Agriotes sputator* was not detected in this survey.

Table 1. Total Number of Sites Surveyed and Results by County and Target Pest in 2005.

County and Trap Type	Total Sites Trapped	Positive Sites	Total Beetles*	% Sites Positive	Ave # Beetles @ Positive Sites
King County - Obscurus Sites	35	15	2011	42.9%	134.1
King County - Lineatus Sites	35	17	996	48.6%	58.6
Pierce County - Obscurus Sites	15	0		0.0%	
Pierce County - Lineatus Sites	15	2	5	13.3%	2.5
Pierce County - Sputator Sites	5	0		0.0%	
Thurston County - Obscurus Sites	30	0		0.0%	
Thurston County - Lineatus Sites	30	5	14	16.7%	2.8
Lewis County - Obscurus Sites	15	1	1	6.7%	1.0
Lewis County - Lineatus Sites	15	1	1	6.7%	1.0
Cowlitz County - Obscurus Sites	10	0		0.0%	
Cowlitz County - Lineatus Sites	10	2	2	20.0%	1.0
Clark County - Obscurus Sites	30	0		0.0%	
Clark County - Lineatus Sites	30	0		0.0%	
Clark County - Sputator Sites	5	0		0.0%	

*Data is only target-species catch by lure type (incidental cross attraction catch not included).

Survey results from the King County cooperative survey were surprising, with catch at some locations exceeding 600 beetles over the survey period (a map of survey results is presented in Figure 4.)

Collections of both *A. lineatus* and *A. obscurus* in King, Lewis, and Cowlitz counties (and additional sites in Pierce and Thurston counties) continue to suggest both pests are widely established throughout the Puget Sound area as well as areas of southwestern Washington. However, significantly more survey is needed to confirm and clarify the situation.

Both species have also been detected in adjacent Northwestern Oregon in 2004 and 2005 in *Agriotes spp.* detection surveys by the Oregon Department of Agriculture (ODA, 2005). These detections further expand the known distribution of these pests in the Pacific Northwest and continue to suggest the potential for broader distribution in the region and other areas of North America. Locations of all currently known detection sites in Washington and Oregon is presented in figure 5 (with appreciation for data provided by A. Mudge and J. LaBonte, ODA).

Project Results and Discussion (Cont.)

Figure 4. 2005 *Agriotes lineatus* and *A. obscurus* Collection Sites in King Co., Washington.

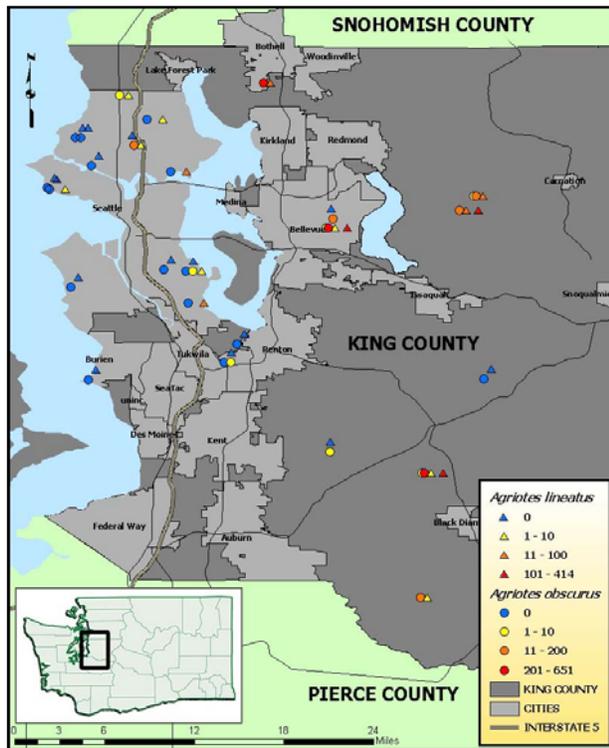
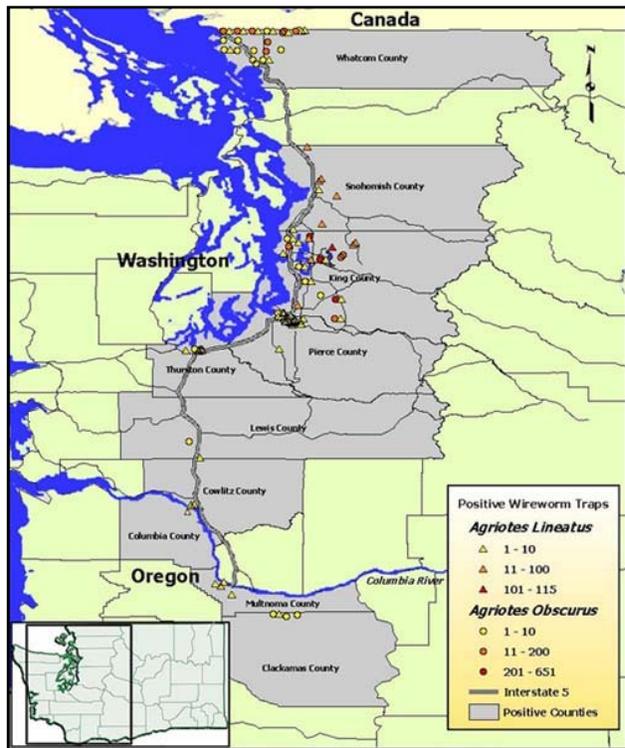


Figure 5. *Agriotes lineatus* and *A. obscurus* Collection Sites in Western Washington and Oregon, 2000 - 2005



(Note - Larger format versions of both maps are presented as attachments at the end of this document)

Agricultural production impacts attributed to these exotic pest species are becoming significant in areas of Northwestern Washington. Certified seed potato growers in Whatcom County (closest to Canada) are now well aware that exotic wireworms are an issue in their area. Some growers survey for wireworms on a limited basis, but all rely on a preventative preplant broadcast soil treatment of "Mocap", which again prevented wireworm damage to their crop this year. Most wireworm damage noted during 2005 certification inspections was minimal and occasional and will not affect quality of grade.

One seed potato grower who had extensive wireworm damage to his crop last year had insignificant tuber damage from wireworms following a preventative "Mocap" treatment this year. Extensive wireworm damage was noted in only two seed lots (Pike variety) during harvest/storage inspections this year, from a site where field corn was grown the previous year, rotated from potatoes the year before that. Both lots failed to make certification grade, and substantial crop loss due to marginal quality is anticipated

Corn producers in Northwestern Washington have recently identified *Agriotes* species as causing significant plant mortality and yield reduction in corn stands. Plant damage from wireworms can range from very little to 50%, with significant yield losses of 25% in the remaining crop. Growers are now adopting pre-plant, seed treatments or tandem seeding applications of organophosphate insecticides to avoid yield loss. Insecticide applications require high rates to experience any efficacy. Low rates do not sufficiently avoid wireworm damage. This is the first time that corn growers in Whatcom County have had to seek pre-plant treatments of insecticides (Midboe, 2006).

Organic vegetable production in the heavily infested areas is particularly vulnerable to economic damage from these exotic wireworms. Row-crop impacts experienced by one organic producer in 2004 and 2005 in Whatcom

Project Results and Discussion (Cont.)

county, near the U.S./Canada border, were severe. Much of the problem resulted from the growers' attempts to plant into newly tilled ground that had been in pasture or lawn for at least ten years, the situation recognized as the most problematic for wireworm damage in Canada (Bob Vernon, personal communication). Nonetheless, plantings of diverse crops were damaged, with up to 100% loss in some cases (corn seeding). Specific impacts and management efforts reported by the organic producer included the following:

- Favored seedling crops (most damaged by wireworm feeding) included; Brussel sprouts, melons, tomatoes, and tomatillo.
- Brussel sprout loss was 75% in 2004 (in a planting of 2,500 plants). Trap-cropping with wheat around Brussel sprouts in 2005 reduced wireworm loss to negligible numbers.
- Tomatillos had over 50% loss in three plantings.
- Watermelons had 50% loss (of 250 plants) in 2004, and trap-cropping with wheat in 2005 did not reduce loss (still 50%).
- Tomato plants experienced a 10% loss in the first 24 hours after plant out.
- Two successive plantings of corn (seed) were 100% losses, and all further corn seedings were cancelled.
- Eggplants planted between trap-crop rows of wheat had no losses.
- In general, mature transplants survived better than young transplants (which can be a total loss).
- Lettuce transplants experience root loss to wireworms, but survive if planted out as large heads.
- Salad greens are not damaged by wireworms.
- Cover crops perpetrate wireworm problems (no cover crop reduces wireworm problems).

(Whatcom county organic farm wireworm impact information provided by [Kristine Schlamp](#), Whatcom County IPM Coordinator – WSU Cooperative Extension Service, which is greatly appreciated.)

Pertinent Literature (and Links to additional wireworm information)

LaGasa, E., B. Vernon, J. Wraspir, P. Hertzog, and H. Kamping 2000. 2000 Western Washington Exotic Wireworm Survey, a Preliminary Detection and Delimiting Survey for *Agriotes obscurus* and *A. lineatus* (Coleoptera: Elateridae), a WSDA 2000 Entomology Project Report – WSDA PUB 047 (N/1/01)

LaGasa, E., J. Loucks, and L. Spurrier 2004. 2004 Western Washington Delimiting Survey for *Agriotes obscurus* and *A. lineatus* (Coleoptera: Elateridae), Exotic Wireworms New to the United States – PUB 805-122 (N/1/01)

Midboe, Steve. 2006. Personal communication. Whatcom Farmers Coop. Lynden, WA.

ODA / Oregon Department of Agriculture 2005, Insect Pest Prevention and Management Report – 2005, Plant Division Report to the Western States and Canada Regulatory Workshop, November 17 – 18, 2005, Portland Oregon.

USDA APHIS 1978. LINED CLICK BEETLE *Agriotes lineatus* (L.) and A WIREWORM *Agriotes obscurus* (L.) in PESTS NOT KNOWN TO OCCUR IN THE UNITED STATES or of Limited Distribution, No..5 in Series, USDA Cooperative Plant Pest Report, 3(48-52):731-734, 1978

Vernon, B. and P. Pats 1997. Distribution of two European wireworms, *Agriotes lineatus* and *A. obscurus* in British Columbia. Journal of the Entomological Society of British Columbia, Vol. 94, December 1997, pp.59-61

Links to additional wireworm information (Internet sites valid as of Jan. 11,2006)

<http://whatcom.wsu.edu/ag/homehort/pest/wireworm.htm>

http://www.pherotech.com/vernon_beetle_trap.html

<http://www.ipm.uiuc.edu/bulletin/article.php?issueNumber=1&issueYear=2004&articleNumber=6>

<http://www.inra.fr/Internet/Produits/HYPPZ/RAVAGEUR/6agrln.htm>

[WSDA Exotic Pest Surveys](#)

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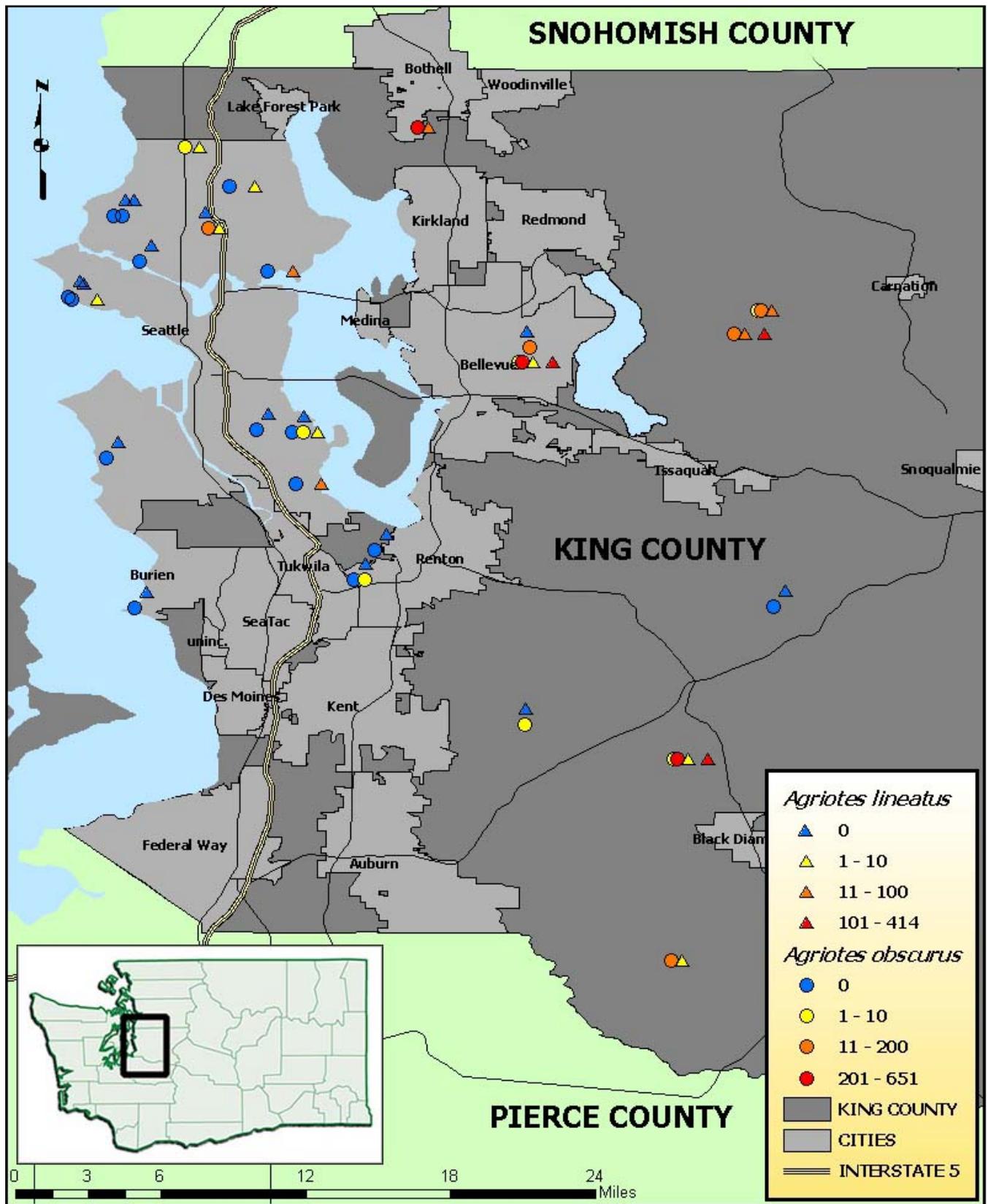
Master Gardeners (and other Friends) with the WSU Cooperative Extension Service in King County, who provided invaluable help with the King County portions of this survey, included the following volunteer wireworm surveyors. Their help contributed significantly to this survey and was very much appreciated.

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Attachment 1. 2005 *Agriotes lineatus* and *A. obscurus* Collection Sites in King Co., Washington.



Attachment 2. *Agriotes lineatus* and *A. obscurus* Collection Sites in Western Washington and Oregon, 2000 – 2005

