THRIPS CONTROL ON DRY BULB ONIONS

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Onion thrips *Thrips tabaci* Lindeman are the key pest for dry bulb onion production in Washington State. Trials were conducted at two different locations during the 2007 growing season each implementing a complete random block design with four replicates. Plots were evaluated for efficacy by counting the number of adult and immature thrips on the central onion leaf.

Broadcast spray plots were two double rows wide and twenty feet long. Applications were made with a $C0_2$ backpack sprayer applying 30 gallons per acre water at 30 psi. The trail was conducted on 18 June 2007 in Othello, Washington State in a yellow onion field grown under rill irrigation. Data were subjected to ANOVA and means were separated from the untreated check using Fisher's PLSD ($p<0.05$). None of the chemistries tested provided thrips control that was significantly different from the untreated check. Thrips abundance was reduced the greatest in the Lannate and Carzol treatments (Figure 1). Trends in the data will be discussed during the oral presentation.

The second trial was conducted three times throughout the growing season in Othello, Washington State in a yellow onion field under drip irrigation. The products were applied through the drip irrigation system using a piston powered pump to inject the pesticide. Applications were made on 14 June, 25 June, and 8 July 2007. Data were subjected to ANOVA and means were separated from the untreated check using Fisher's PLSD ($p<0.05$). In the first and second applications of the treatments, none of the chemistries tested provided thrips control that was significantly different from the untreated check (Figure 2). For the third application, the Lannate treatment provided a level of control that was significantly better than the untreated check (Figure 2). Other trends in the data will be discussed during the oral presentation.

Treatment and Rate	Mean +/- St Dev
Untreated Check	57.00 +/- 27.66
Agrimek 1 pint/A	39.25 +/- 15.80
Assail 30SG 5 oz/A	58.00 +/- 17.09
Aza-DIRECT 1.2 EC 24 oz./A	58.38 +/- 27.80
Carzol 1 lb/ A	36.25 +/- 19.60
Carzol 1.25 lb/ A	37.00 +/- 12.94
Champ 1.5 liters/A	70.50 +/- 46.03
GF 1587 XDE175 12 oz./A	47.00 +/- 17.47
Hachihachi 14 oz/A	65.00 +/- 25.92
Hachihachi 24 oz/A	72.50 +/- 26.08
Lannate LV 3.0 pts/A	26.75 +/- 4.72
Movento 240 SC 5 oz/A MSO	89.75 +/- 22.95
Movento 240 SC 5 oz/A NIS	62.50 +/- 11.56
Movento 240 SC 8 oz/A	77.25 +/- 32.77
QRD 400 25 EC 1 qt/A	70.75 +/- 39.38
QRD 400 25 EC 2 qts/A	62.75 +/- 35.89
QRD 400 25 EC 3 qts/A	42.75 +/- 9.46
Success 6 fl. Oz/A	40.75 +/- 5.19
V-10170 50WG 1 oz/A	112.50+/- 145.46
V-10170 50WG 2 oz/A	45.75 +/- 12.84
V-10170 50WG 3 oz/A	51.75 +/- 33.82
Venom 70SG 4 oz/A	79.75 +/- 36.40

Figure 1. Thrips counts 6 days post treatment. * Denotes treatments with significantly fewer thrips in a pair-wise t-test compared to the untreated check ($p<0.05$).

Treatment and Rate	Application	Days Post treatment	Mean +/- St Dev
Untreated Check	First	8	43.17 +/- 22.17
Aza-Direct 24 oz./A	First	8	42.17 +/- 17.42
Aza-Direct 48 oz./A	First	8	40.17 +/- 22.11
Lannate 3 pints/A	First	8	27.33 +/- 11.72
Vydate 2 qts./A	First	8	35.92 +/- 15.62
Untreated Check	Second	8	116.63 +/- 24.92
Aza-Direct 24 oz./A	Second	8	115.67 +/- 23.28
Aza-Direct 48 oz./A	Second	8	101.00 +/- 24.70
Lannate 3 pints/A	Second	8	69.25 +/- 20.78
Vydate 2 qts./A	Second	8	84.42 +/- 29.27
Untreated Check	Third	10	239.83 +/- 47.13
Aza-Direct 24 oz./A	Third	10	265.83 +/- 34.31
Aza-Direct 48 oz./A	Third	10	229.00 +/- 57.78
Lannate 3 pints/A	Third	10	112.17 +/- 17.26*
Vydate 2 qts./A	Third	10	187.08 +/- 23.32

Figure 2. Thrips counts. * Denotes treatments with significantly fewer thrips in a pair-wise t-test compared to the untreated check ($p<0.05$).

Section VII
Foliage & Seed Feeding Pests

IDENTIFICATION OF CUTWORMS ON GRAPEVINES AND A FIELD TRIAL OF SYNTHETIC *ABAGROTIS ORBIS* PHEROMONE

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Cutworms feed on grape buds at night during the spring causing a reduction in yield. In a previous study, 1% to 5% bud loss resulted in economic damage to Concord grape. The spotted cutworm, *Xestia c-nigrum* (L.), and the redbacked cutworm, *Euxoa ochrogaster* (Guenee) were believed to be the most important cutworms causing damage to grapes. In 2003 and 2004, we sampled vineyard floors to determine the cutworm species present in south central Washington vineyards. We began sampling vines during the night in 2004 to determine the species that were actually on the vines. This work continued through 2007. The results of the nocturnal sampling are reported here.

We identified a pheromone produced by *Abagrotis orbis* (Grote), a cutworm found feeding on grape, and tested the pheromone in a field trial.

Materials and Methods

Cutworm identification. Sampling during the four years of the study started and ended on the following dates: 7 April to 20 April 2004, 7 March to 27 April 2005, 27 March to 3 May 2006, and 13 March to 25 April 2007. The number of vineyard samples (many vineyards were sampled more than once within a year) per year were: 5 in 2004, 51 in 2005, 36 in 2006, and 34 in 2007. Sampling was centered on the Yakima Valley but vineyards were also sampled in the grape-growing regions near Walla Walla in the east, Paterson in the south, and Mattawa to the north. Sampling started about an hour after sundown. Each vineyard was searched for one person-hour using flashlights. Cutworms were collected and taken to the lab for rearing. Cutworms are difficult or impossible to identify as larvae, so they must be reared to adults. They were reared in 135 ml plastic cups with about 2 cm coconut fiber (Coco Life Brik, Coconut Palm Resources, Inc. Hillsboro, Oregon) and a piece of artificial diet (Multiple Species Diet, Southland Products Inc., Lake Village, AR). Nylon screen covered the cups. The temperature was 27°C with 24 h light. The adult moths were pinned and identified using published descriptions and comparisons with identified specimens.

Pheromone trial. Four wine grape vineyards were selected for the study: BD, 2 mi S of Richland; EE, 7 mi NE of Prosser; HQ, 4 mi NE of Prosser; and PA, 3 mi N of Paterson. One Universal Moth Trap (Great

Lakes IPM, Inc. Vestaburg, MI) baited with synthetic *Abagrotis orbis* pheromone and a toxicant strip (Vaportape II, Hercon Laboratories Corp. Emigsville, PA) was hung from the upper trellis wire in each vineyard. The traps were deployed on 13 and 14 April 2006. The trap catches were removed weekly and taken to the lab for counting and identification. The pheromone lures and toxicant strips were replaced monthly. Trapping ended on 29 Oct 2006.

Results and Discussion

Cutworm identification. A total of 563 cutworms were collected in the four years of the study, 444 (78.9%) were reared to adults and identified to species, 56 (9.9%) were parasitized (mostly by Hymenoptera); 50 (8.9%) died as larvae (cause unknown); and 18 (3.2%) died as pupae (cause unknown). Almost 90% of the non-parasitized cutworms were reared to the adult stage. Parasitism per year ranged from 4.2% to 14.7%.

Nine cutworm species were found (Table 1). *Abagrotis orbis* [previously known as *A. barnesi* (Benjamin)] was the most common, accounting for almost three-fourths of the cutworms collected. *Agrotis vetusta* Walker was second, making up almost 20% of the cutworms. All the other species together comprised only 6.6 % of the total. *Abagrotis orbis* ranges over most of North America but it has been reported as a pest only in southeastern Washington, southwestern Idaho, southwestern Michigan, northern Indiana, and New York. It prefers sandy soils. Recorded host plants are apple, peach, cherry, cottonwood, serviceberry, boxelder, and grape. The older larvae have dark elongate spots on each segment, one on either side of the dorsal line. The larvae pupated about two weeks after collection and spent about three weeks in the pupal stage followed by adult emergence from mid-April to early June. The adults live through the summer but do not oviposit until mid-September. There is one generation per year.

Agrotis vetusta occurs across the United States and probably southern Canada and northern Mexico. It apparently has not been reported to be a pest although the moths can be common. The adult has a common name, 'the old man dart', but the caterpillar does not. *Agrotis vetusta* larvae appeared about two weeks later than *Abagrotis orbis* (Table 1). The mature *Agrotis vetusta* larvae go into diapause that lasts about three months. Pupation occurred in the lab in mid-July. The adults fly in late summer and fall, mate, and lay eggs. The eggs soon hatch, the larvae feed for a few weeks, and overwinter. It has one generation per year. The larva doesn't have any prominent markings like the spots on *Abagrotis orbis*, but it does have a series of cream-colored and brownish stripes running from the head to the posterior end. The larvae of the two species easily can be separated by the markings on the head capsules: *Abagrotis orbis* has a network of lines and *Agrotis vetusta* has spots.

Noctua comes Hubner was the third most numerous cutworm in our collection but all specimens came from one vineyard over a span of three years. It is a Eurasian species that was first discovered in North America near Vancouver, BC in 1982. A related species, *Noctua pronuba* (L), apparently was first found in Washington in a light trap near Prosser in 2004. We found it feeding on weeds in a vineyard at night, but have not found it on vines.

Only three spotted cutworms and no redbacked cutworms were found. Possibly these species were more numerous in years past (But see the pheromone trial results for *X. c-nigrum* below.) or they were misidentified by earlier workers.

Pheromone trial. A total of 70 *Abagrotis orbis* males were caught in the synthetic pheromone traps. The flight period of the moths was from early September to mid October. There was one generation per year. The traps also caught 153 *X. c-nigrum* moths, 169 *Mamestra configurata* Walker (bertha armyworm) adults, and 109 *Feltia jaculifera* Guenée (dingy cutworm) moths. All four species have at least one pheromone component in common. Only males were captured in the traps. Recent work indicates that the pheromone has only one component, which was the one tested here. We plan to continue this work with the long-range goal of developing the pheromone for population monitoring and control.

Table 1. Species of cutworms found in on grape vines at night, 2004 to 2007.

Cutworm Species	Reported Food Plants	Number reared to adult	Percent of total	Earliest and latest Collection dates (all years)
Abagrotis orbis (=*A. barnesi*)	Fruit trees, grape	331	74.5	13 March to 26 April
Agrotis vetusta	Unknown	84	18.9	4 to 26 April
Noctua comes (introduced)	Foxglove, strawberry, tobacco, grape, weeds	9	2.0	13 March to 26 April
Abagrotis reedi	Willow, cotton-wood, ocean-spray, boxelder	6	1.4	13 March to 18 April
Spaelotis clandestina, W-marked cutworm	Blueberry, maple, pine, beans, cabbage, corn, apple, strawberry	5	1.1	13 to 21 April
Xestia c-nigrum Spotted cutworm	Apple, barley, corn, clover, maple, tobacco	3	0.7	11 to 17 April
Euxoa atomaris	Unknown	2	0.5	11 to 13 April
Euxoa messoria, Darksided cutworm	Trees, herbs, grasses	2	0.5	17 March to 13 April
Euxoa olivia	Strawberry, corn	2	0.5	13 to 13 April