Section V
Soil Arthropods

DIFFERENTIAL INSECTICIDE EFFICACY FOR CONTROL OF ROOT WEEVILS ON EUONYMUS

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Objective:

The goal of this project was to continue to evaluate the efficacy of new chemical compounds to existing standard pesticides for adult root weevil control.

Methods and Materials:

In May 2001, adult stages of black vine (*Otiorhynchus sulcatus*) or strawberry (*O. ovatus*) root weevils were established in 2.7 liter containers of *Euonymus* 'Emerald Gaity' in a randomized complete block design (n=15). Both species of root weevils were reared to adults and harvested from infested nursery stock from several nurseries. Ten BVW were applied to each container in the trial and five SRW were applied to each container in block one only. On May 23 treatments were applied to the *Euonymus* beginning at 9 PM with a CO_2 sprayer at 52 lbs psi., Treatments were evaluated for percent adult mortality at 7 and 14 days after treatment (DAT) May 30 and June 6 and efficacy was evaluated as percentage of adult mortality and effective kill ratio (EKR) 14 days after treatment. The EKR adjusts the data for the natural mortality of weevils in nontreated pots, assigning an EKR of 0 to nontreated pots.. All treatments were "re-challenged" with additional fresh weevils (5 BVW and 4 SRW) on June 11 and evaluated on June 21. Data was analyzed **at the 5% and 1% level (SAS General Linear Models) ofarcsine-transformed data (data transformed based on analysis of normality and homogeneity)**. Treatments and application rates for this trial were:

Tmt name	Formulation	Rate	type
UTC			
acephate	Orthene 97	0.73 lb ai/100 gall	foliar
bifenthrin	Talstar Flowable	20 oz prod/100 gal)	foliar
azadirachtin	Azatin	2.0 pt/100 gal	foliar
deltamethrin	DeltaGard T&O 8oz	8 oz/100 gal	foliar
	+ Tactic	10 oz/100 gallons	
acetamiprid (high)	70WP	0.15 lb ai/100 gal	foliar
+ Nufilm 17		1 pt/acre	foliar

acetamiprid (low) 70WP		0.1 lb ai/100 gal	foliar	
+ Nufilm 17		1 pt/acre	foliar	
thiamethoxam (low)	Flagship 25 WG	4 oz prod/100 gal	foliar	
thiamethoxam (high)	Flagship 2 5WG	6.3 oz prod/100 gal	soil	
lamda cyhalothrin	Scimitar CS	2.5 oz prod/100 gal	foliar	
thiamethoxam	Flagship 25 WG	4 oz prod/100 gal	foliar	
+ lamda cyhalothrin	Scimitar CS	2.5 oz prod/100 gal	foliar	
lamda cyhalothrin	Scimitar CS	2.5 oz prod/100 gal	foliar	
+ thiamethoxam	Flagship 25WG	6.3 oz prod/100 gal	soil	applied 1 wk later
pyrethrin type	Pyreth-It	16 fl. oz/100 gal	foliar	
protective porous particle film (PPPF)		47.5lb ai/100 gal	foliar	
spreader/sticker	Nufilm 17	1 pt/acre	foliar	
spreader/sticker	Tactic	10 oz/100 gallons	foliar	

Results:

An EKR of at least 21 was needed to be significantly different from nontreated pots. Adult mortality and EKR was higher for black vine (Table 1.) compared to strawberry root weevil (Table 2.) for all insecticides studied. Acephate, acetamiprid, azadiractin, bifenthrin, deltamethrin, kaolin film, lambda cyhalothrin, pyrethrum, and thiamethoxam provided an EKR of 14, 40, 33, 38, 53, 35, 82, 9, and 20, respectively, for black vine root weevil, and 11, 17, 0, 0, 7, 12, 23, 8, and 38, respectively, for strawberry root weevil. Combining lambda cyhalothrin with thiamethoxam provided an EKR of 96, and 49 for black vine and strawberry root weevil, respectively.

Discussion:

This is the third season in which we have found differential efficacy of various insecticides amongst root weevil species. These particular populations of root weevils, both black vine and strawberry, seemed more resistant in general to chemical control than populations with which we have worked previously. Several insecticides which have provided good control of root weevils, particularly black vine root weevil, in previous trials failed to manage this population at acceptable levels. Lambda cyhalothrin alone or in combination with thiamethoxam provided acceptable control of black vine root weevil (EKR>80), while none of the insecticides studied provided acceptable control of strawberry root weevil. Reduced damage from foliar feeding by root weevil adults suggest that mortality from kaolin film application was caused by inhibition of feeding.

Table 1. Efficacy of selected treatments on black vine root weevil adults. Least squares means and standard errors.

Treatment Number	Effective Kill Ratio (X 100) 7 DAT	14 DAT	Percentage Alive 7 DAT	14 DAT
untreated	0.00±5.52	0.00±10.61	91.6±5.3	57.0±7.8
NuFilm-17	4.71±5.58	9.51±10.15	91.4±5.5	66.9±7.5
Tactic	0.03±5.58	9.55±10.15	95.9±5.5	66.8±7.5
acephate (Orthene)	4.80±5.52	13.58±10.15	91.3±5.3	63.9±7.5
bifenthrin (Talstar)	42.99±5.52**	38.27±10.15*	54.7±5.3**	45.6±7.5
deltamethrin (Alta) + Tactic	59.45±5.52**	53.57±10.15**	38.9±5.3**	34.3±7.5*
acetamiprid-Low + NuFilm-17	7.31±5.52	0.76±10.61	88.9±5.3	73.3±7.8
acetamiprid-High + NuFilm-17	11.08±5.52	40.49±10.15*	85.3±5.3	44.0±7.5
thiamethoxam-Low (Flagship)	12.21±5.52	21.57±10.61*	84.2±5.3	58.0±7.8
thiamethoxam-High	14.48±5.52	19.57±10.15	82.0±5.3	59.4±7.5
lambda cyhalothrin (Scimitar)	73.95±5.58**	82.15±10.61**	25.0±5.5**	13.1±7.8**
thiamethoxam-Low + lambda cyhalothrin	82.43±5.52**	99.54±10.61**	16.9±5.3**	0.3±7.8**
thiamethoxam-High + lambda cyhalothrin	82.52±5.52**	95.80±10.15**	16.8±5.3**	3.1±7.5**
azadiractin (Azatin)	4.79±5.52	33.73±10.61*	91.3±5.3	49.0±7.8
kaolin film (Surround)	17.84±5.52*	35.36±10.15*	78.7±5.3	47.8±7.5
pyrethrum (Pyreth-It)	12.62±5.52	9.93±10.15	83.8±5.3	66.6±7.5

*,** signficantly different from the untreated control at the 5% and 1% level, respectively, based on analysis (SAS General Linear Models) of arcsine-transformed data (data transformed based on analysis of normality and homogeneity).

Table 2. Efficacy of selected treatments on strawberry root weevil adults. Least squares means and standard errors.

Treatment Number	Effective Kill Ratio (X 100) 7 DAT	14 DAT	Percentage Alive 7 DAT	14 DAT
untreated	0.00±9.55	0.00±13.03	99.9±9.6	99.9±13.0
NuFilm-17	0.00±9.55	0.73±16.15	99.9±9.6	99.9±13.0
Tactic	0.00±9.55	8.33±13.03	99.9±9.6	91.7±13.0
acephate (Orthene)	0.00±9.55	11.11±13.03	99.9±9.6	88.9±13.0
bifenthrin (Talstar)	0.00±9.55	0.00±13.03	99.9±9.6	99.9±13.0
deltamethrin (Alta) + Tactic	6.67±9.55	6.67±13.03	9.3.±9.6	93.3±13.0
acetamiprid-Low + NuFilm-17	6.67±9.55	8.33±13.03	93.3±9.6	91.7±13.0
acetamiprid-High + NuFilm-17	13.33±9.55	16.67±13.03	86.7±9.6	83.3±13.0
thiamethoxam-Low (Flagship)	0.00±9.55	6.67±13.03	99.9±9.6	93.3±13.0
thiamethoxam-High	6.67±9.55	38.33±13.03*	93.3±9.6	61.7±13.0*
lambda cyhalothrin (Scimitar)	6.67±9.55	23.33±13.03	93.3±9.6	76.7±13.0
thiamethoxam-Low + lambda cyhalothrin	26.67±9.55**	49.09±16.15**	73.3±9.6**	50.9±16.2**
thiamethoxam-High + lambda cyhalothrin	16.67±9.55	33.33±13.03*	83.3±9.6	66.7±13.0*
azadiractin (Azatin)	0.00±9.55	0.00±13.03	99.9±9.6	99.9±13.0
kaolin film (Surround)	0.00±9.55	11.59±13.03	99.9±9.6	88.4±16.2
pyrethrum (Pyreth-It)	6.67±9.55	8.33±13.03	93.3±9.6	91.7±13.0

*,** signficantly different from the control at the 5% and 1% level, respectively, based on analysis (SAS General Linear Models) of arcsine-transformed data (data transformed based on analysis of normality and homogeneity).