Biology and Control of Vine and Root Weevils, Pests of Berry and Nursery Crops in Oregon , USA

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Black Vine Weevil
O. sulcatus

Strawberry Root Weevil
O. ovatus

Damage

Birds nest spruce while in pots
5 years old

Same plants out of pots
with soil washed away

Uninfested field

Infested field

Damaged roots

Brief Biology of Vine and Root Weevils

- Both weevils have similar life cycles – flightless, parthenogenetic, univoltine, feed on many plants, overwinter in the soil as larvae, pupate in the spring, emerge, feed on leaves above ground at night and lay eggs on the soil surface or in the litter in the summer.

- *SRW* is found throughout the northern (40° N) hemisphere, in the USA more into the northern wooded areas, from coast to coast.

- *BVW* is found in the Northern and Southern hemisphere usually more prevalent in areas that have cool to moderate maritime or similar environments; in the US more in the temperate coastal areas (Atlantic and Pacific) and to a lesser degree in CA, and to Virginia.

What have we known about these pests?

- Probable adult host plant range, global occurrence
- Some biology but not much on larval host plants, edaphic relationships, only 8 refereed publications on *O. o*.
- Difficult to find (detect), rear and work with

Current tactics

- For larval prevention, spray chemicals for adults in a window of opportunity (preoviposition period) which is claimed to lie within about 30 d after detection of the first adults, either species, and all crops. Problem – occurs when workers must be in the field.
- For adults that may be contaminants spray pesticide in June. Same problem with workers in the field. Often spray needs to be put on at night, no one likes to spray at 12 AM.
- Efficacy of all present chemicals is questionable.

Filling Knowledge Gaps in the Biology and Control of Black Vine & Strawberry Root Weevils

- Develop rearing methods so as to provide abundant research animals through out the year
- Determine how host plants affect the life history of these species.
- How soil affects efficacy of larval control products.
- Determine if a fungus, *Metarhizium anisopliae* was as efficacious as chemicals for control of these pests.

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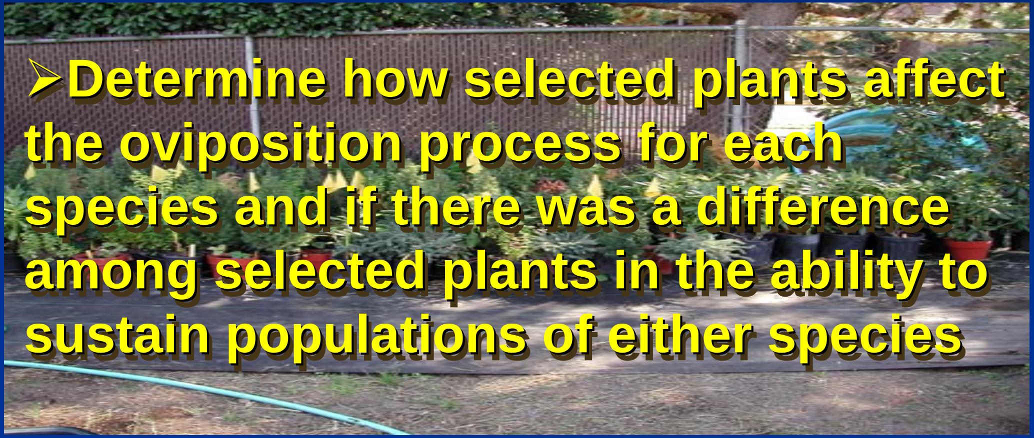
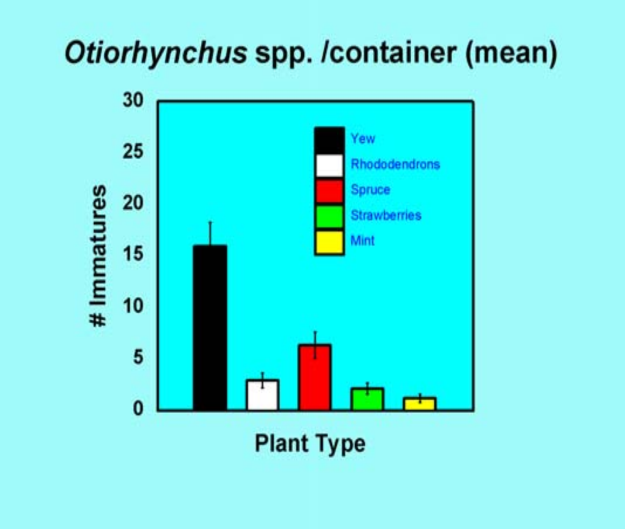
Host-plant studies

- We noticed that larval damage was greater on certain varieties of spruce, yew and strawberries than on other types of small fruits and nursery plants. In a trial to explore using trap crops we found more larvae in pots with yew than any other crop.



- Determine how selected plants affect the oviposition process for each species and if there was a difference among selected plants in the ability to sustain populations of either species



MULTIPLE HOST INFLUENCES

- From a previous study and surveying the literature, we concluded that in Western North America *BVW* appears to favor certain Rosales i.e. strawberry, blackberries and raspberries, Ericales i.e. certain rhododendrons, blueberries and salal, and members of the gymnosperm families, Taxaceae and Pinaceae.
- We then tested the hypothesis that feeding on multiple hosts may promote reproductive success.

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- Plant species-varieties used: 1) Strawberry “Totem’, 2) *birds nest spruce* ‘Nidiformis', and 3) *Rhododendron* ‘Cynthia’.
- Moved to new host at 0, 15, 30, 45, or 60 days.
- Arranged in a permutated array with 26 insects per combination
- Newly emerged adults of each species individually caged with each host.
- Eggs collected weekly for nearly a year to determine fecundity.

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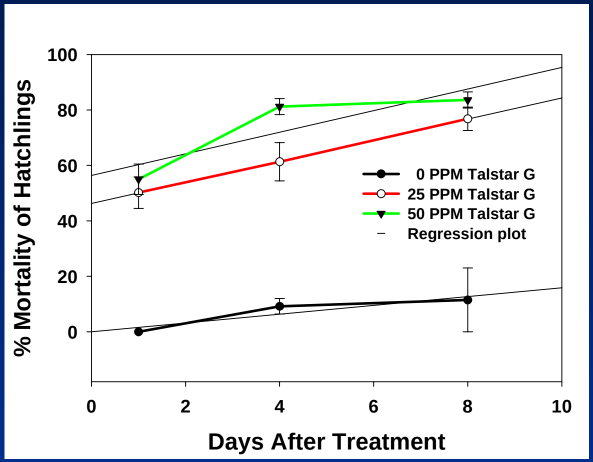
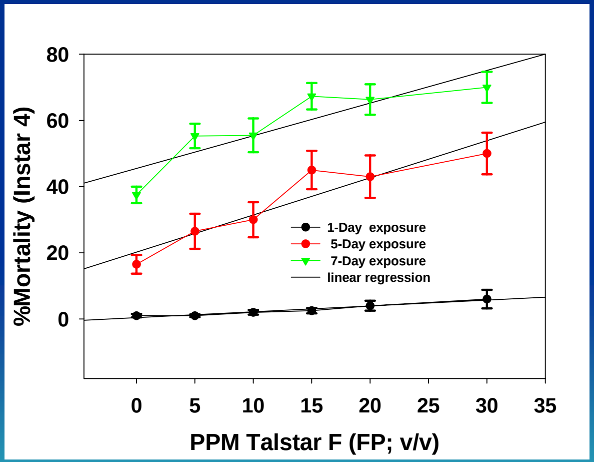
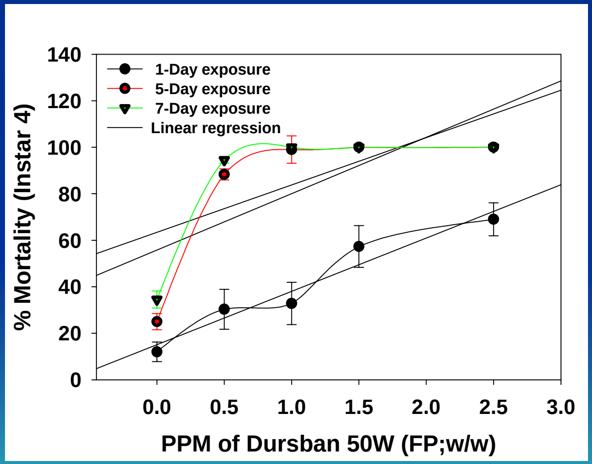
Host 1	Host 2	Days on host 1	Egg/♀ ± 95% CI	Dunnett's test Control host			Longevity (days) ± 95 % CI	Adults ovipositing/26
				F. a.	R. c	P. a.		
F. x ananassa	--------	continuous	745.96 (101.56)		ns	* ^	228.4 (40.0)	26
R. catawbiense	———	“	611.96 (159.45)	ns		* ^	210.6 (45.5)	23
P. abies	———	“	243.36 (62.51)	*	*		191.4 (28.0)	22
F. x ananassa	*R. catawbiense*	15	878.35 (125.57)	ns	* ^	* ^	251.5 (36.3)	26
“	“	30	882.38 (154.56)	ns	* ^	* ^	274.7 (34.3)	26
“	“	45	936.50 (162.60)	ns	* ^	* ^	194.6 (48.8)	20
“	“	60	720.20 (173.64)	ns	ns	* ^	213.6 (47.8)	20
“	*P. abies*	15	210.77 (49.14)	*	*	ns	170.7 (30.7)	26
“	“	30	269.50 (56.35)	*	*	ns	133.1 (39.3)	18
“	“	45	276.16 (54.35)	*	*	ns	112.0 (25.8)	19
“	“	60	152.65 (45.77)	*	*	ns	104.2 (24.8)	20
R. catawbiense	*F. x ananassa*	15	566.72 (185.21)	ns	ns	* ^	187.1 (35.8)	25
“	“	30	157.47 (54.92)	*	*	ns	118.9 (32.0)	19
“	“	45	372.61 (58.47)	*	ns	ns	146.7 (33.6)	18
“	“	60	678.00 (181.40)	ns	ns	* ^	170.1 (42.6)	21
“	*P. abies*	15	153.63 (25.73)	*	*	ns	115.2 (21.5)	22
“	“	30	163.15 (46.15)	*	*	ns	113.8 (22.0)	20
“	“	45	170.70 (40.68)	*	*	ns	135.3 (21.2)	23
“	“	60	146.42 (30.35)	*	*	ns	129.2 (13.9)	26
P. abies	*F. x ananassa*	15	430.58 (124.51)	*	ns	ns	145.6 (38.8)	19
“	“	30	509.05 (156.35)	ns	ns	* ^	159.4 (42.0)	19
“	“	45	388.60 (158.09)	*	ns	ns	144.6 (38.1)	20
“	“	60	493.55 (153.20)	*	ns	ns	170.6 (38.1)	20
“	*R. catawbiense*	15	886.40 (129.73)	ns	ns	* ^	232.6 (38.4)	20
“	“	30	777.80 (105.62)	ns	ns	* ^	224.1 (43.4)	26
“	“	45	606.15 (160.17)	ns	ns	* ^	223.4 (38.1)	26
“	“	60	834.45 (171.04)	ns	ns	* ^	203.9 (41.7)	20

Development of soil bioassays







Bioassay Methods with Biologicals

- **Spore suspensions prepared in 0.01% Tween 80**
- **Fungal suspensions (1.0×10^7, 10^6, 10^5 and 10^4 viable spores/g dry soil)**
- **Assayed at 15% final moisture**

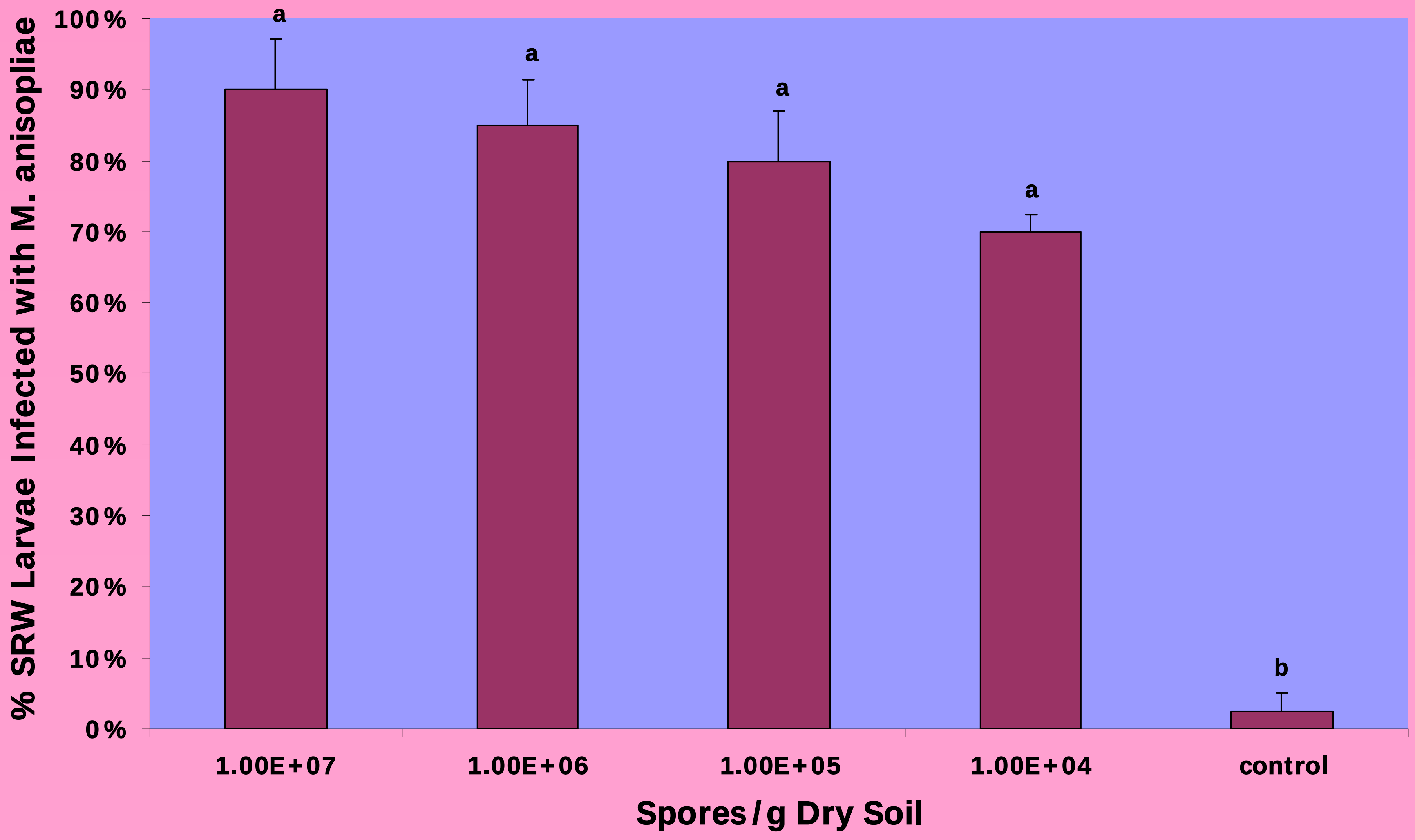
•Added to 20 grams sterilized field soil

•Four replications of 10 last instar SRW per dose

SRW infected with *M. anisopliae*

BVW larva infected with *M. anisopliae*

BVW infected with *M. anisopliae*



% SRW Larvae Infected with M. anisopliae
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
a
a
a
a
b
1.00E+07
1.00E+06
1.00E+05
1.00E+04
control
Spores/g Dry Soil

Biology and Control of Insect Pests of Horticultural Crops

People that do the work:

------David Edwards, Lab.Tech. nursery, small fruit insects

-----Molly Albrecht, Lab.Tech. grape, other small fruit insects

-----Karan Fairchild, Part-time lab tech. small fruit& nursery pests

-----Kelly Donahue, Lab Tech., Biological control of nursery pests

------Amanda Griffiths, Lab Tech, Rearing of vine and root weevils

-----Bev Thomas, Student helper

-----Evana Burt-Tollefson, Student helper

Questions and Comments