11th Annual Strawberry Production Meeting in Ventura County
Camarillo, August 31, 2012

Lygus, Thrips, Corn Earworm and Drosophila

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Lygus Control Update - Insecticides
2011

Registered and Candidate Insecticides

Pesticide	Chemical	Subgroup	Target Site of Activity	IRAC #
Lannate	methomyl			
	malathion			
	naled			
	bifenthrin			
	fenpropathrin			
	thiamethoxam			
	acetamiprid			
	novaluron			
	borax			
	clothianidin			
	flonicamid			
	sulfoxaflor			
	tolyfenpyrad			

Not registered
Registered
Not registered for use on strawberries, but under study

Nerve Poisons

Pesticide	Chemical	Subgroup	Target Site of Activity	IRAC #
Malathion	malathion			
	naled			
	bifenthrin			
	fenpropathrin			
	thiamethoxam			
	acetamiprid			
	novaluron			
	borax			
	clothianidin			
	flonicamid			
	sulfoxaflor			
	tolyfenpyrad			

Insect Growth Regulator

Pesticide	Chemical	Subgroup	Target Site of Activity	IRAC #
Malathion	malathion			
	naled			
	bifenthrin			
	fenpropathrin			
	thiamethoxam			
	acetamiprid			
	novaluron			
	borax			
	clothianidin			
	flonicamid			
	sulfoxaflor			
	tolyfenpyrad			

Rimon Spray Timing

- Rimon is best used early season as it only affects Lygus nymphs and there is more synchronization of the Lygus generations at that time
- Later application is best when tank mixed with another product
- Timing is critical

Contact Poison - Little Residual Activity

Pesticide	Chemical	Subgroup	Target Site of Activity	IRAC #
Malathion	malathion			
	naled			
	bifenthrin			
	fenpropathrin			
	thiamethoxam			
	acetamiprid			
	novaluron			
	borax			
	clothianidin			
	flonicamid			
	sulfoxaflor			
	tolyfenpyrad			

May be useful in a mixture

Contact Poison - Little Residual Activity

Pesticide	Chemical	Subgroup	Target Site of Activity	IRAC #
Malathion	malathion naled bifenthrin fenpropathrin thiamethoxam acetamiprid novaluron borax clothianidin flonicamid sulfoxaflor tolyfenpyrad			

Unregistered Products

Pesticide	Chemical	Subgroup	Target Site of Activity	IRAC #
Malathion	malathion			
	naled			
	bifenthrin			
	fenpropathrin			
	thiamethoxam			
	acetamiprid			
	novaluron			
	borax			
	clothianidin			
	flonicamid			
	sulfoxaflor			
	tolyfenpyrad			

- Nerve poison
- Feeding blocker
- Affects insect's energy metabolism
- ??

Lygus Control - Insecticides - 2011

Treatment	Chemical name	Rate (form/ac)
Untreated		
Brigade WSB	bifenthrin	16 oz
Actara 25 WG +	thiamethoxam +	4 oz +
Brigade	bifenthrin	16 oz
Rimon 0.83 EC	novaluron	12 oz
Rimon + Brigade	novaluron + bifenthrin	12 oz + 16 oz
Beleaf 50SG	flonicamid	2.8 oz
Belay 2.13 EC	clothianidin	4.0 oz
Belay 2.13 EC	clothianidin	6.0 oz
tolfenpyrad 15 SC	tolfenpyrad	27 oz
tolfenpyrad 15 EC	tolfenpyrad	27 oz
sulfoxaflor (L)	sulfoxaflor	2.85 oz
sulfoxaflor (M)	sulfoxaflor	4.28 oz
sulfoxaflor (H)	sulfoxaflor	5.7 oz

Treatments applied September 30, 2011, to first year 'Albion' field
All include Dyne-amic

Lygus Control - Small Nymphs - 2011

Treatment	Mean ± SE small Lygus bug nymphs per plant			
	10/6/11	10/13/11	10/20/11	10/27/11
				0.04 ± 0.01
				0.08 ± 0.04
				0.05 ± 0.04
				0.11 ± 0.04
				0.06 ± 0.02
				0.09 ± 0.05
				0.02 ± 0.02
				0.09 ± 0.02
				0.08 ± 0.04
				0.12 ± 0.03
				0.06 ± 0.04
				0.05 ± 0.01
				0.04 ± 0.02

* Means are significantly different from control at *P*<0.05 using Dunnett's test.

Lygus Control - Total Lygus - 2011

	Mean ± SE Total Lygus bugs (adults + nymphs) per plant			
Treatment	10/6/11	10/13/11	10/20/11	10/27/11
				0.23 ± 0.05
				0.23 ± 0.03
				0.14 ± 0.03
				0.19 ± 0.02
				0.10 ± 0.03
				0.17 ± 0.07
				0.07 ± 0.02
				0.12 ± 0.03
				0.11 ± 0.07
				0.19 ± 0.04
				0.15 ± 0.06
				0.16 ± 0.03
				0.09 ± 0.03

Pre-treat count = 0.061 small Lygus nymphs per plant, 0.022 large Lygus nymphs per plant, and 0.015 Lygus adults per plant, for a total of 0.098 Lygus per plant

Percent fruit damage at 3, 4 and 5 weeks

Treatment	Percent fruit damaged per plot		
	10/20/11	10/27/11	11/3/2011
Untreated	16.09 ± 1.22	8.64 ± 2.84	24.35 ± 7.33
Brigade	11.66 ± 1.03	9.85 ± 3.94	9.57 ± 4.91
Actara + Brigade	9.79 ± 0.25	8.45 ± 0.17	11.55 ± 2.78
Agri-flex	11.55 ± 2.06	7.16 ± 2.55	9.90 ± 2.80
Rimon	7.77 ± 1.29	4.24 ± 1.34	9.31 ± 1.19
Rimon + Brigade	5.17 ± 0.78	4.19 ± 0.97	7.23 ± 0.33
Beleaf	10.73 ± 2.28	8.99 ± 1.06	12.83 ± 1.30
Belay (L)	9.59 ± 3.04	5.78 ± 2.52	6.31 ± 2.80
Belay (H)	13.17 ± 2.16	4.91 ± 1.32	11.36 ± 3.99
tolfenpyrad 15 SC	10.74 ± 1.10	7.03 ± 2.60	11.73 ± 2.40
tolfenpyrad 15 EC	12.08 ± 1.97	4.76 ± 1.88	8.16 ± 0.91
sulfoxaflor (L)	12.37 ± 2.86	7.42 ± 1.86	7.06 ± 2.16
sulfoxaflor (M)	10.57 2.04	7.77 1.79	10.03 3.00
sulfoxaflor (H)	10.53 ± 2.28	7.59 ± 1.21	10.25 ± 2.72

Percent fruit damage reduction at 3, 4 and 5 weeks

	Percent damage reduction			
Treatment	10/20/11	10/27/11	11/3/11	Average
				21.99
				33.53
				35.68
				57.64
				55.54
				34.42
				42.25
				37.72
				39.44
				46.93
				32.02
				34.05
				35.78

Western Flower Thrips

Frankliniella occidentalis

Type I Bronzing

Bronzing

3 types identified

Causes of Type 3 Bronzing

Koike, S.T., F.G. Zalom, and K.D. Larson. 2009. Bronzing of strawberry fruit as affected by production practices, environmental factors, and thrips. HortScience. 44(6): 1-6.

Causes of Type 3 Bronzing

Elevated temperature and solar radiation

Mitigated by:

- overhead sprinkling
- certain foliar pesticides
- lignin

Koike, S.T., F.G. Zalom, and K.D. Larson. 2009. Bronzing of strawberry fruit as affected by production practices, environmental factors, and thrips. HortScience. 44(6): 1-6.

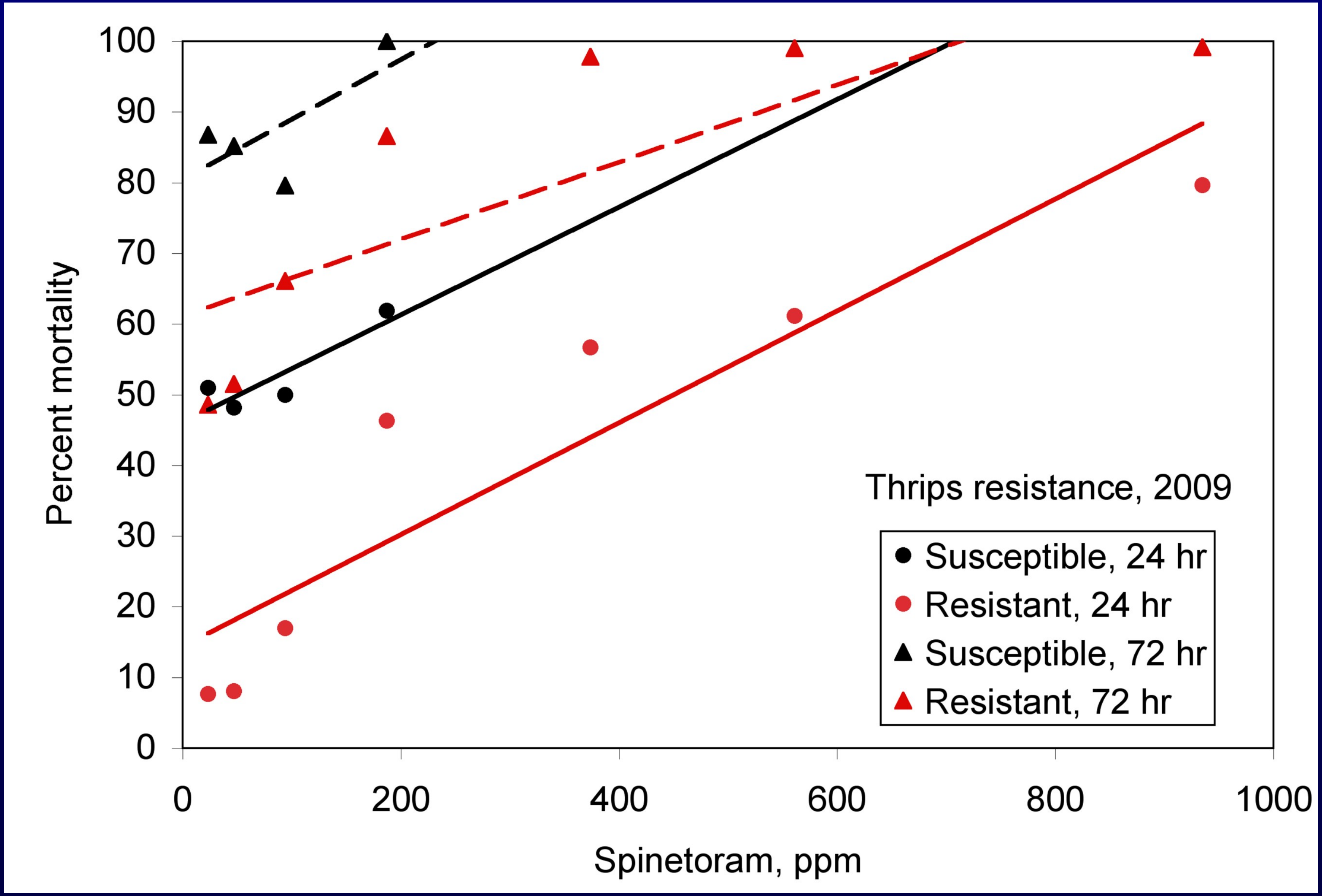
Western Flower Thrips Control, Orange Co.

	Number of thrips per flower			
Treatmen t	Feb 18	Feb 27	Mar 4	Mar 16
Untreate d	1.14			
	0.47			
	0.45			
	0.60			

* Treatment differs from untreated by pairwise t-test at *P*<0.05.

- Problem - concern for resistance and restriction on number of applications per season by Dow Agrosciences for all spinosyns (Entrust, Success and Radiant) on strawberries in the Monterey Bay area.
- Other registered insecticides are not very effective.

Thrips Susceptibility of Fields, Pretreatment



Thrips insecticide efficacy - Watsonville, 2009

Treatment	Rate	7/07/09	7/17/09
		Mean ± SE thrips per flower	
			15.96 ± 4.50
			12.04 ± 1.61
			14.99 ± 2.72
			12.54 ± 2.29
			17.33 ± 3.00

Treatments applied June 24 and July 10

Beleaf is not registered for strawberries

Thrips insecticide efficacy - Watsonville, 2011

Treatment	Mean ± SE thrips adults per flower
Untreated	
Actara + Brigade	
Tolfenpyrad 15SC	
Tolfenpyrad 15EC	
Closer	
Closer	
Closer	

Tolfenpyrad and Closer are not registered for strawberries

Corn Earworm

Helicoverpa zea

Corn Earworm Control, Orange County, 2007

Trade name	Chemical name	Rate form./acre
Untreated	--	--
Lannate	methomyl	1.0 lb
Intrepid	methoxyfenozide	12.0 oz
Rimon	novaluron	12.0 oz
Synapse WG	flubendiamide	2.0 oz
Synapse WG	flubendiamide	3.0 oz
Radiant SG	spinetoram	6.0 oz

Application date 4/13/2007

Corn Earworm Control, Orange County, 2007

Treatment	Rate (form/ A)	*H zea* damaged fruit per 20 plants
Untreate d	- -	12.75 ±
		±
		±
		±
		±
		±
		±

Application date 4/13/2007
Harvest date 5/2/2007
ANOV statistics - F=4.0938, df=6,20, P=0.0140

Corn Earworm Control, Orange County, 2008

Trade name	Chemical name	Rate form./acre
Untreated	--	--
Altacor	chlorantraniliprole	3.0 oz
Altacor	chlorantraniliprole	6.0 oz
Rimon	novaluron	12.0 oz
Intrepid	methoxyfenozide	10.0 oz
Synapse	flubendiamide	2.0 oz
Synapse	flubendiamide	3.0 oz
Radiant SG	spinetoram	8.0 oz

Application date 4/11/2008

Corn Earworm Control, Orange County, 2008

Treatment	Rate (form/A)	*H zea* damaged fruit per 20 plants
Untreated		
	3.0 oz	
	6.0 oz	
	12.0 fl oz	
	10.0 fl oz	
	2.0 oz	
	3.0 oz	
	8.0 fl oz	

Application date 4/11/2008
Harvest date 4/22/2008
ANOV statistics - F=6.4435, df=7,23 P=0.001

Corn Earworm Control, Watsonville, 2011

Treatment	chemical	Rate (form/acre)	Mean ± SE damaged fruit per 16 plants
Untreated	--	NA	
		0.25 lb	
		0.50 lb	
		1.0 lb	
		1.5 oz	

- Means followed by the same letter do not differ significantly by Student's t-test at *P*=0.05.

[1] Applied in 40 gal. per acre

Application date 6/29/2011

Harvest date 9/6/2011

Corn Earworm Control, Watsonville, 2011

Treatment	chemical	Rate (form/acre)	Mean ± SE damaged fruit per 20 plants
Untreated	--	--	
		4.5 oz	
		4.5 oz	
		10 oz	
		12 oz	
		10 oz	

* Means followed by the same letter do not differ significantly by Student's t-test at *P*=0.05.

Application date(s) 8/16/2011 and 8/23/2012 (Bt only)

Harvest date 7/19/2011

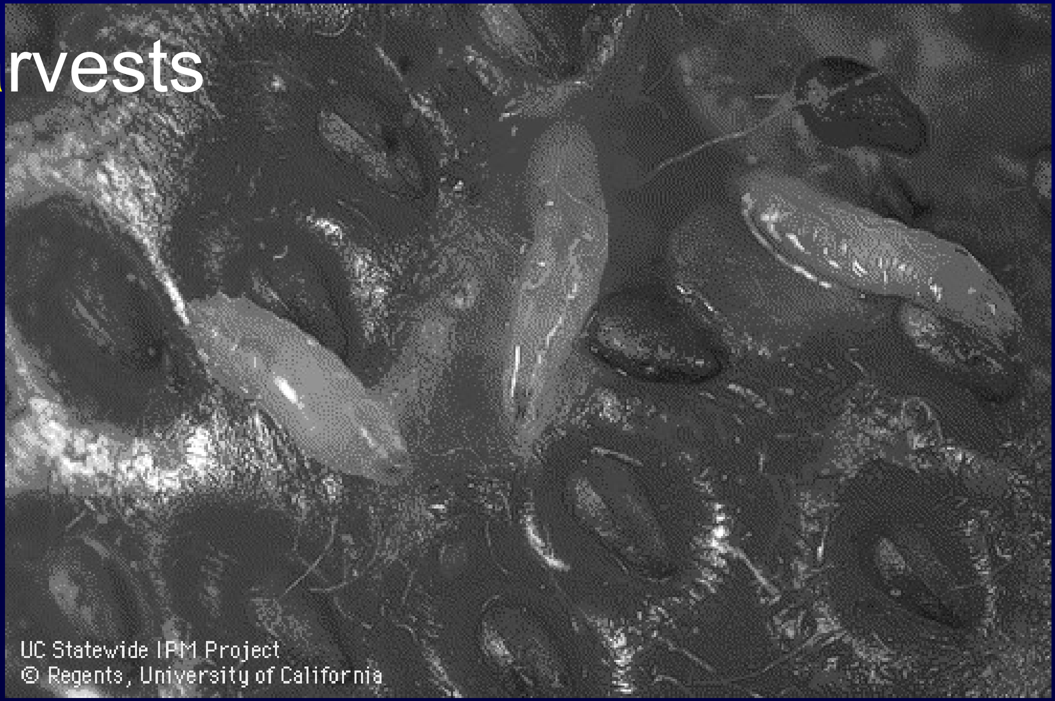
ANOV statistics - F=8.9714, df=5,23 P=0.0002

Vinegar flies - *Drosophila* spp.

An export phytosanitary and processing concern

Quality assurance protocol for
export to Japan - 1997

- Cultural controls
  - More frequent harvests
  - Sanitation



Vinegar flies - *Drosophila* spp.

Camarillo, 2012

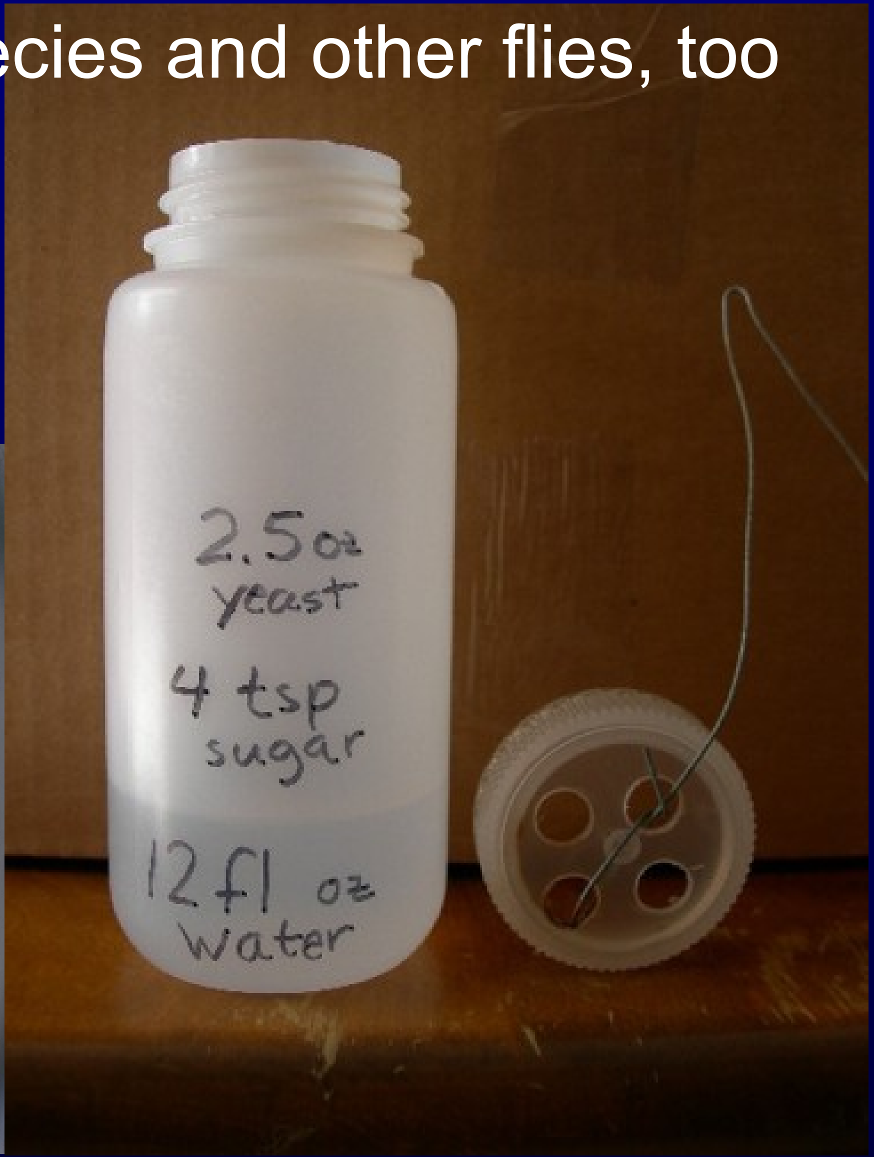
Vinegar flies - *Drosophila* spp.

Sources

Vinegar flies - *Drosophila* spp.

Traps will capture many species and other flies, too

Traps contain either
baker's yeast + sugar + water
or apple cider vinegar



Vinegar flies - *Drosophila* spp.

Insecticides won't control the maggots once fruit are infested, they can only knock down adult flies and protect uninfested fruit.

- Organophosphates
  - Malathion
- Pyrethroids*
  - Danitol, (Brigade, Bifenture)
- Spinosyns
  - Entrust, Success, Radiant

** Using pyrethroids can exacerbate Lygus resistance*

Spotted Wing Drosophila

Drosophila suzukii

New species in North America
Attacks sound fruit
Problem for fresh market

Drosophila melanogaster
and other species

Always present
Attacks older fruit
Problem for processing

Spotted Wing Drosophila

Damage to strawberry

Spotted Wing Drosophila

Identification and Biology

Male

Female

Adults are 2-3 mm in size. Females and their larvae (maggots) are easily confused with other *Drosophila*

Spotted Wing Drosophila

Drosophila suzukii

Other *Drosophila*

D. suzukii has a specialized sharp ovipositor, different from other *Drosophila*.

Spotted Wing Drosophila

Management is same as for all *Drosophila*

- Sanitation, remove mature and overripe fruit
- Sanitation, eliminate alternate habitat (culled fruit, abandoned host fields) that sustains the infestation
- Monitoring and trapping to quickly detect infestations - get ahead of the damage
- Use insecticidal sprays or baits to suppress fly populations

    organophosphates, pyrethroids, spinosyns

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Lygus, Thrips, Corn Earworm and Spotted Wing Drosophila

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