Cooperative Extension, University of California

San Joaquin Valley Entomology Newsletter

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Despite record cold temperatures, expect most pests to be business as usual

There are many factors that influence the ability of insects to survive the winter and reach pest status the following year. Important factors include availability of food, moisture in the form of rainfall, and temperature. There is no doubt that extreme cold temperatures will negatively impact some species of both beneficial and harmful insects; however, most insects are proficient at knowing how to cope.

Avoidance of temperature extremes is the most common method for insect survival in the winter. Many insects, including ants and the immature stages of most beetles, spend their winter living below the soil surface. Temperatures just inches below the surface can be considerably warmer in the winter and cooler in the summer than ambient temperature. For example, ambient temperatures in Shafter dropped to 20°F or colder for four straight nights (13 to 16 Jan., 2007), whereas data from soil temperature probes at the same sites just six inches in the soil never dropped below 43°F. Many other insects also buffer themselves by spending the winter inside living plants, such as bark beetle larvae, or in leaf litter where freezing temperatures rarely occur. These insects should be relatively unaffected by the cold January weather in the San Joaquin Valley.

Many insects that are unable to avoid cold weather have two excellent mechanisms for surviving its effects. The first is that insects are cold-blooded, and do not regulate their own temperature. This is a disadvantage to insects that want to warm themselves up. However, it is a huge advantage in that their bodies are made to tolerate a wide range of body temperatures. Humans, for example, being warm-blooded can never 'freeze' to death. Instead, if our body temperatures were to drop twenty or so degrees below optimal we would lose motor skills, and then cease to function. However, actual 'freezing' would require dropping the body temperature another 50 to 60 degrees. Insects, on the other hand, just stop moving when they are cold, and as long as they don't freeze solid, most can just wait until temperatures warm back up and then continue doing whatever they were doing.

The other mechanism insects have for tolerating cold weather is to go into a state of hibernation, called diapause. During diapause an insect becomes almost completely metabolically inactive. While this means that the insect does not eat, drink, grow, or move for a period that can extend months, it also means that the insect does not expend energy. During this state of inactivity most insects can tolerate long periods of cold weather. In many cases diapause in insects is triggered by day-length, such that insects can tell that winter is coming by the ratio between hours of sunlight and dark, and use this to enter a state of diapause before winter weather arrives. In other insects diapause is entered when temperatures begin to lower in the winter, or when food becomes scarce. Despite the trigger that causes an insect to go into diapause, this genetically engrained survival mechanism protects many insects from temperatures reaching far below the norm, and well below freezing.

The most notable exceptions to insects that fall into the aforementioned categories are many of the tropical insects such as whiteflies and fruit flies. In the native habitats of these insects there is no need to go into diapause or hide from cold winter weather, since temperatures never drop below freezing. As such they are susceptible to extreme cold temperature. One such example is the olive fruit fly, where an entire generation of this pest has likely been killed. Other examples include silverleaf, giant, and other species of whiteflies as well as some scale insects. It is likely that initial spring populations of these pests will be significantly lower than in most years. However, many tropical insects are recognized for their ability to have exponential growth rates, such that even low initial populations in the spring can quickly reach treatable levels.

Predicting the influence of cold weather on insects is a tricky business and in most cases nearly impossible. Even when only one insect species is considered at a time, complicated factors related to pest biology, temperature, food availability, and moisture make predictions about as difficult as asking a weatherman for a prediction of the high and low temperatures for a weekend two months in the future. When adding in the complexity that the prevalence on many insects depends on other insects, such as the relationship among pest and beneficial insects, there is no telling what may happen.

So, as far as insects are concerned, it should be considered business as usual. Learn about the biology of pests you frequently encounter, learn how to monitor for them, evaluate pest densities throughout the year, and make treatment decisions based on established treatment thresholds where available. Information on how to do this is available for many crops, as well as many household and landscape pests, through the University of California Pest Management Web Site at http://www.ipm.ucdavis.edu.

New miticide mode of action and treatment program chart available for 2007

During the past few years there have been several new miticides registered in California; keeping up with the registration status of each of these products, as well as how each works has been quite a challenge.

In order to help me keep the different products straight I came up with a miticide table in 2006 that lists the major miticides in California, how each works, and includes an IRAC number. IRAC stands for Insecticide Resistance Action Committee, and any insecticides or miticides that are given the same IRAC rating have the same mode of action. As an example, Fujimite and Nexter are both made by different companies and both have different active ingredients. However, these two products both have the same mode of action (IRAC category 21), and thereby should not be used on the same field during the same season. Without consulting these charts it would be easy to accidentally use these products back to back in crops such as grapes where they are both registered.

Attached with this newsletter is the 2007 version of the miticide chart. New in 2007 are a broad label for Envidor, a label expansion for Fujimite on bearing nut trees, a label expansion for Onager to include bearing Citrus, Pome Fruits, and Grapes, and I have included Ecotrol on the chart as an OMRI certified option for use in organic crops. All other miticide crop combinations on the chart are unchanged since the 2006 season.

2006 Miticide Trial for Pacific Spider Mite in Peach

During the early summer of 2006 a trial was conducted near Arvin, Kern Co., CA to determine the effects of miticides on the density of Pacific spider mite in peaches. A total of 150 trees were organized into a RCBD with five blocks of 13 treatments and an untreated ceck. Plot size was one row by two trees and treatments were applied on 5 Jun using a Schaben, gas-powered sprayer equipped with a hand gun at 150 psi. Applications were made at 200 gpa.

Mite populations were evaluated before treatments on 2 June and 3, 7, 14, 21, 30 and 35 DAT on 8 Jun, 12 Jun, 19 Jun, 26 Jun, 5 Jul and 10 Jul. On each evaluation date, 10 leaves were collected at random from the center portion (between the two tree trunks) of each two-tree plot. Leaves were taken to a laboratory and evaluated under magnification for the total number of Pacific spider mite motiles (juveniles + adults) and eggs. Data for each plot were converted into average Pacific spider mite motiles per leaf and average Pacific spider mite eggs per leaf, and were analyzed by ANOVA using transformed data (squareroot (x+0.5)) with means separated by Fisher's Protected LSD at $P > 0.05$.

Table 1 shows the effects of miticide treatments on the number of motile spider mites per leaf. There were no differences in mite density in the precounts or 3 DAT. By 7 DAT, all treatments significantly reduced mite densities, with all other miticides outperforming Ecotrol. By 14 DAT all treatments reduced mite density, though superior control was achieved by Acramite, Agri-Mek, Desperado + Onager, Envidor, Envidor + Oil, Fujimite, the high rate of Kanemite, Spray Oil 415, Onager and Zeal which all had 2.0 or less mites per leaf compared to 14.5 mites per leaf in the untreated check. By 21 DAT the numbers of mites began to increase dramatically, and only Agri-Mek, Desperado + Onager, Envidor, Envidor + Oil, Onager and Zeal maintained mites to 4.0 or less compared to 66.4 for the untreated check. Mite densities in all other p lots were still significantly less than in the untreated check; however, they were also 2 to 22 times higher than in the precounts and would likely need to be retreated at this point under commercial conditions. By 30 DAT mite populations exploded and mite-induced defoliation began to occur in the untreated check. Mite densities in plots treated with Agri-Mek continued to be the lowest mite densities (7.5 mites per leaf), and were statistically equivalent to plots treated with Envidor, Envidor with Oil, and Onager (which ranged from 23.6 to 36.4 mites per leaf). Acramite, Fujimite, the low rate of Kanemite, and Zeal also maintained significant reductions in mite density (39.7 to 61.5 mites per leaf) compared to the untreated check (118.9 mites per leaf). By 35 DAT trees in all plots began to show high levels of defoliation with the exception of those treated with Agri-Mek.

Table 2 shows the effects of miticide treatments on the density of spider mite eggs. In general, densities of spider mite eggs paralleled the densities of spider mites. There were no significant differences in egg densities of the precounts or 3 DAT. By 7 DAT and 14 DAT all products reduced egg densities to less than 10 per leaf, with less than 2.5 per leaf in plots treated with Acramite, Agri-Mek, Desperado + Onager, Envidor, Envidor + Oil, the high rate of Kanemite, Onager and Zeal. By 21 DAT Agri-Mek, Envidor and Envidor with Oil maintained the mite eggs below 2.5 per leaf. By 30 and 35 DAT there were no significant differences in egg densities among treatments due to a large amount of variation among plots. However, Agri-Mek continued to maintain the lowest densities of spider mite eggs.

Table 1.

Treatment	Rate	Spider mites per leaf						
		Pre	3 DAT	7 DAT	14 DAT	21 DAT	30 DAT	35 DAT
Acramite	1 lb	1.2 a	7.3 a	1.2 a	1.1 abc	9.0 bcd	47.3 bcd	71.8 bc
Agri-Mek	10 fl	2.9 a	7.7 a	0.7 a	0.1 a	0.2 a	7.5 a	14.8 a
Desperado	8 pt	3.0 a	4.3 a	0.7 a	3.7 cd	13.4 d	81.4 cde	134.0 d
Desperado	4 pt	1.3 a	5.4 a	0.7 a	0.4 ab	4.0 abc	67.5 bcde	99.8 bcd
Ecotrol 10EC	4 pt	1.6 a	3.2 a	4.9 b	5.8 d	45.3 e	88.9 de	38.9 ab
Envidor	18 fl	0.8 a	4.0 a	0.6 a	1.7 abc	2.8 ab	36.4 abc	53.0 abc
Envidor	18 fl	1.5 a	0.7 a	0.1 a	0.3 a	0.3 a	23.6 ab	60.3 bc
Fujimite 5EC	2 pt	3.3 a	7.1 a	1.0 a	1.5 abc	8.2 bcd	39.7 bcd	40.8 ab
Kanemite	21 fl	0.4 a	8.2 a	1.1 a	2.4 bcd	12.3 cd	61.5 bcd	43.0 ab
Kanemite	31 fl	1.3 a	3.6 a	1.6 a	0.8 ab	13.6 d	77.2 cde	90.8 bcd
Spray Oil	2%	3.6 a	2.5 a	1.1 a	2.0 abc	22.6 d	61.0 bcde	96.7 bcd
Onager 1EC	20 fl	1.0 a	0.9 a	0.2 a	0.2 a	1.7 ab	30.1 ab	92.8 bcd
Zeal 72	3 oz	1.9 a	0.5 a	0.8 a	0.7 ab	2.3 ab	43.1 bcd	94.4 bcd
Untreated		3.9 a	9.8 a	8.7 c	14.5 e	66.4 f	118.9 e	104.6 cd
F		1.02	1.83	7.12	8.80	14.19	3.25	2.49
P		0.4483	0.0626	<0.0001	<0.0001	<0.0001	0.0012	0.0100

Means in a column followed by the same letter are not significantly different (*P* > 0.5, Fisher's protected LSD) after square root (x + 0.5) transformation of the data. Data are reported as original numbe

Table 2.		Spider mite eggs per leaf						
Treatment	Rate	Pre	3 DAT	7 DAT	14 DAT	21 DAT	30	35 DAT
Acramite 50WS	1 lb	1.2 a	8.0 a	0.7 abcd	2.3 abc	10.5 bc	38.2 a	32.3 bcde
Agri-Mek	10 fl	1.3 a	7.6 a	0.1 ab	0.1 a	0.1 a	2.9 a	3.7 a
Desperado 54AS	8 pt	3.1 a	3.6 a	0.8 abcd	5.0 cd	10.3 bc	37.7 a	43.3 de
Desperado 54AS	4 pt	2.1 a	11.1 a	0.5 abc	1.0 abc	4.6 ab	53.6 a	67.4 e
Ecotrol 10EC	4 pt	1.6 a	4.8 a	1.5 cd	8.7 d	32.5 d	25.7 a	10.2 ab
Envidor 240SC	18 fl	1.6 a	7.8 a	0.8 abcd	1.7 abc	2.4 ab	33.7 a	28.7 abcde
Envidor 240SC	18 fl	0.3 a	0.8 a	0.1 a	0.9 abc	0.4 a	40.2 a	41.3 cde
Fujimite 5EC	2 pt	4.1 a	8.6 a	0.9 abcd	3.5 abcd	6.3 ab	16.7 a	12.6 abc
Kanemite 15SC	21 fl	0.6 a	6.4 a	0.1 a	4.2 bcd	9.9 bc	22.8 a	19.2 abcd
Kanemite 15SC	31 fl	1.3 a	2.8 a	0.8 abcd	2.0 abc	19.3 cd	53.0 a	43.1 bcde
Spray Oil 415	2%	3.3 a	3.2 a	2.0 e	5.0 bcd	28.3 cd	45.3 a	33.8 bcde
Onager 1EC	20 fl	1.8 a	2.7 a	0.9 abcd	0.3 a	3.9 ab	35.1 a	60.3 e
Zeal 72 WDG	3 oz	1.8 a	6.1 a	1.3 bcd	0.9 ab	5.6 ab	55.8 a	61.8 e
Untreated check		2.5 a	0.8 a	3.4 e	22.7 e	42.1 d	52.2 a	23.2 abcde
F		1.09	1.19	2.99	6.78	6.39	1.21	2.42
P		0.3859	0.3151	0.0025	<0.0001	<0.0001	0.2987	0.0123

Means in a column followed by the same letter are not significantly different ($P > 0.5$, Fisher's protected LSD) after square root (x + 0.5) transformation of the data. Data are reported as original numbers.