

Miticide Resistance in Twospotted Spider Mite Populations from Pear

Interim Report April 2014 – E. H. Beers

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Summary: The adulticides appear to have higher levels of resistance than the ovicides; of the three adulticides, FujiMite has changed the least, and Agri-Mek the most. So far, none of the (4) populations has been resistant to Envidor, but at least 1 population is resistant to the other 2 ovicides.

Project Description:

We started a 2-year project in the field season of 2013 exploring the levels of resistance of 6 miticides used on pear for control of mites. We collected populations of twospotted spider mite (TSM) from 4 Washington pear orchards, three in the Wenatchee River Valley (Monitor, Dryden1, and Dryden2) and one from the Yakima valley (Wapato). We used a laboratory bioassay of the miticides for all 4 populations for all 6 miticides (Acramite, AgriMek, FujiMite, Envidor, Onager, and Zeal). The first three are adulticides, and the last three are ovicide/larvicides. All have different modes of action (IRAC classifications), although Onager (10A) and Zeal (10B) are arguably very similar.

Table 1. Miticides for bioassays of twospotted spider mite

Trade name	Common name	Group	MOA	bioassay type
Agri-Mek	Abamectin	avermectins	6	adulticide
Acramite	bifenazate		unknown	adulticide
FujiMite	fenpyroximate	METI	21A	adulticide
Envidor	spiroticlofen	tetronic/tetramic acid derivatives	23	ovicide
Onager	hexythiazox	mite growth inhibitors	10A	ovicide
Zeal	etoxazole	mite growth inhibitors	10B	ovicide

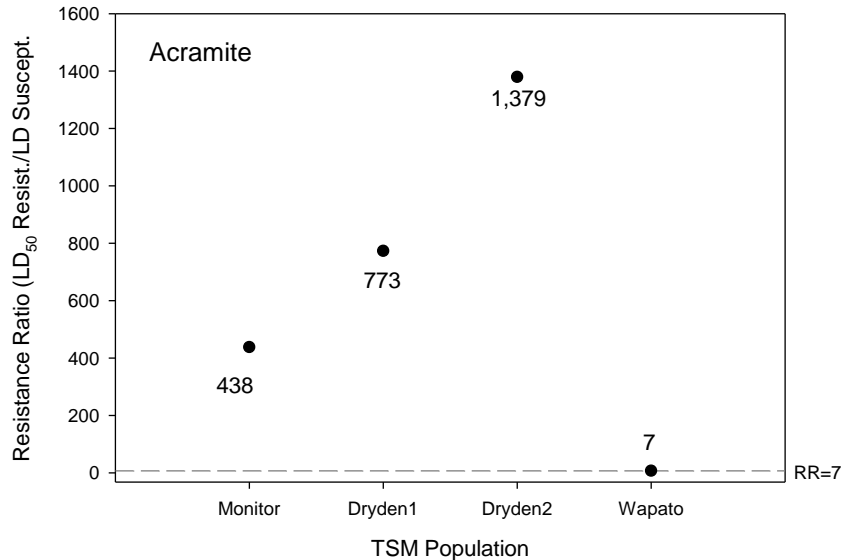
We conducted probit bioassays to determine an LC₅₀ for each mite population/pesticide, and compared it to the historical baseline for that pesticide. The ‘Resistance Ratio’ is just a ratio of the 2 LC₅₀s, viz.

$$RR = \frac{LC_{50} \text{ Resistant}}{LC_{50} \text{ Susceptible}}$$

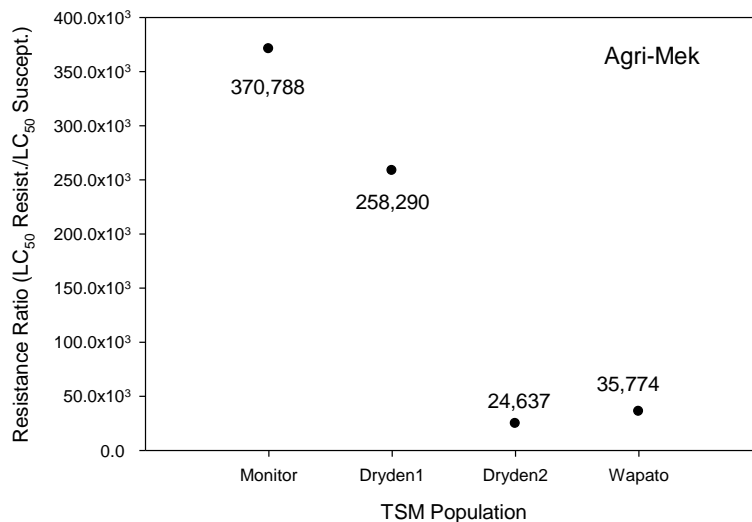
In general, the higher the RR, the more resistant the population (the more its LC₅₀ has shifted above the baseline). RRs over 7 are considered potentially problematic.

Like all laboratory data, these RRs should only be used as a general guideline...there are too many differences between the conditions in a pear orchard and those in a lab. They are useful for indicating the degree of change, and variation among populations. Remember that ‘resistant’ as defined by laboratory bioassays, does not necessarily mean field failure, although very high RRs are more likely to be associated with field failures in control. So what did we find?

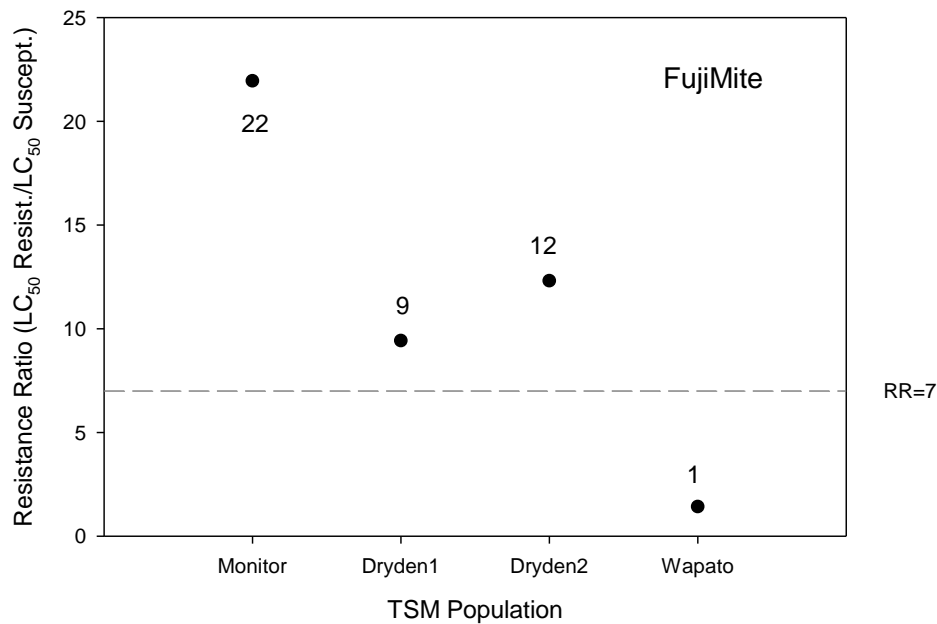
Adulticides



The RRs for Acramite ranged from 7 (considered borderline) to 1,379 (highly resistant). All 3 populations from the Wenatchee River Valley had quite high RRs, only the Wapato population was borderline.

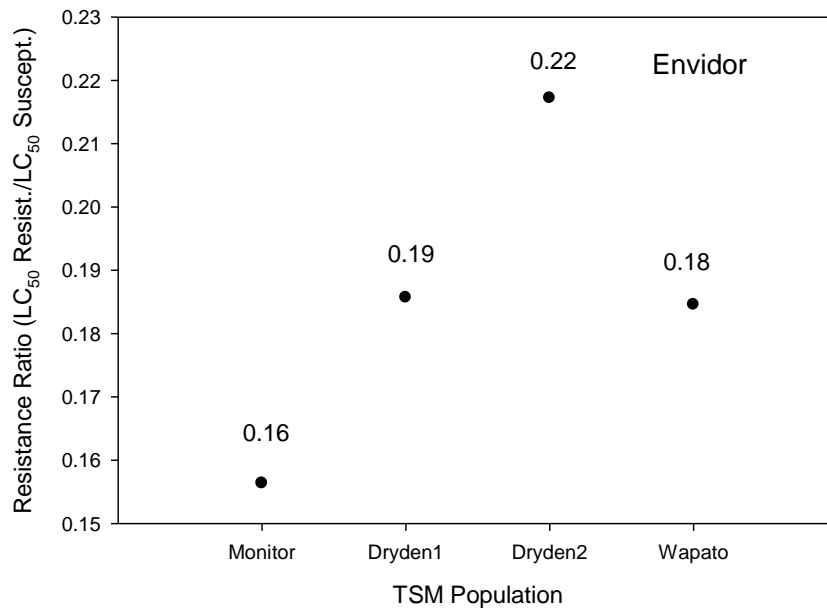


All the RRs for Agri-Mek were VERY high, and while there was originally a considerable margin of safety between the field rate and the LC50 or LC99 for TSM, these numbers are indicative of high levels of resistance to this compound. Pear growers should no longer consider this compound as a miticide for TSM; if you still find it works on rust mite and psylla, you can continue its use for those pests.

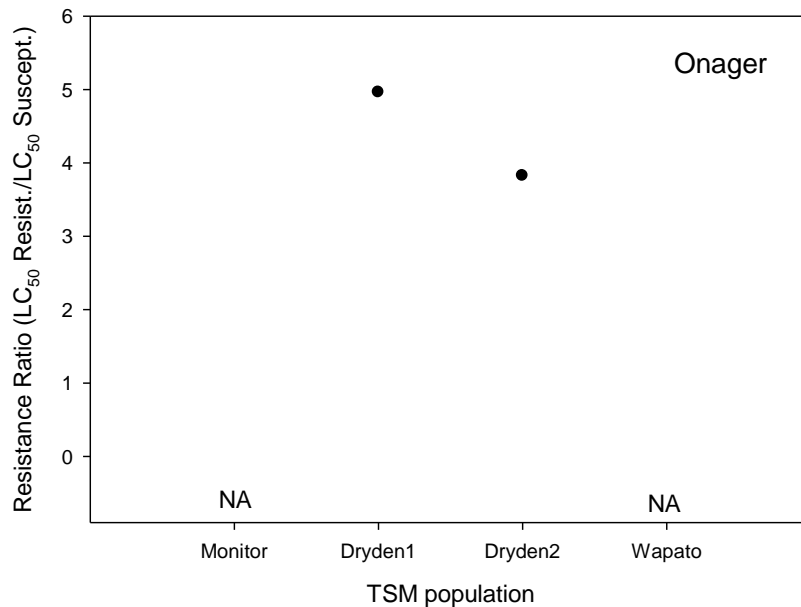


Of the three adulticides, FujiMite appears to have the overall lowest RRs – however, the RR must be considered in relation to the labeled rate for the pesticide. If the margin of safety was low originally, then even smaller shifts may translate to poor control in the field.

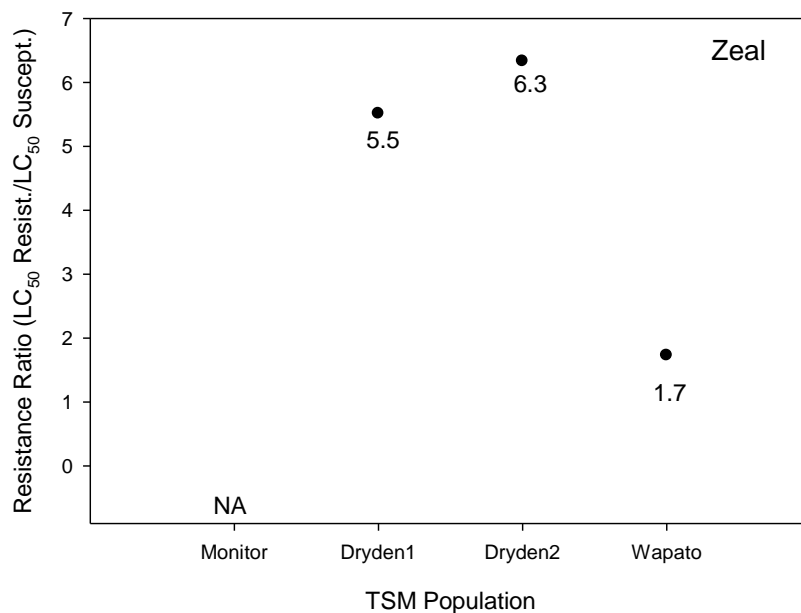
Ovicide/Larvicides



Of the three ovicide/larvicides, the RRs were lowest for Envidor. All were well below 1, indicating that they are not more resistant than in the past, possibly less so. This is good news for those with high RRs in other miticides.



We only have 2 valid bioassays for Onager, and the RRs are quite moderate. The Wapato population has not been tested, but the Monitor population has been tested repeatedly, and we still can't find a rate high enough to kill the mites. So, while unknown, we can predict that the RR for this population will be very high.



The RRs for Zeal are also quite moderate for 3 of the 4 populations. This is a second instance where the Monitor population has been tested repeatedly, but we have not found a rate range high enough to kill them, so we cannot generate an LC50 and RR. Clearly, this is a problematic population, and there may be other 'hot spots' in the Valley or in the state. So far, only Envidor appears to work on this population.