scaffolds Update on Pest Management and Crop Development

FRUIT JOURNAL

July 19, 1993 VOLUME 2 Geneva, NY

INSECTS

# NATURAL PESTICIDES

## BOTANICAL INSECTICIDES FOR FRUIT

(Dave Kain)

❖❖ Naturally occuring pesticides that are derived from plants or plant parts are commonly referred to as "botanicals". Botanicals have been around for quite a while. Along with arsenicals and other inorganic pesticides, they were pretty commonly used before the advent of the synthetic, organic pesticides rendered them "obsolete". From time to time they're resurrected for various reasons and may be familiar. Botanicals may be of interest to those concerned with pest management for a variety of reasons. They are generally less toxic to the applicator than many synthetic pesticides. They may be acceptable in the organic market where synthetic pesticides are not. Since, in general, they break down quickly, they may also be of use near harvest when control is needed but other materials may not be applied. Rapid degradation also means they are less likely to become environmental problems. Botanicals, however, are not without concerns. They are usually broad spectrum poisons that can be hard on beneficial insects. And, unlike "biological" pesticides, they are somewhat acutely toxic to humans and other animals. The fact that they break down rapidly in the environment, while an advantage in some respects, also means that sprays need to be timed precisely to coincide with pest events, applied at lower thresholds and, possibly, applied more often. They are also very expensive.

The four most common botanicals available for use in fruit crops today are rotenone, pyrethrin, sabadilla and ryania.

***Rotenone*** Rotenone is derived from the root of various plants of the *Derris* or *Lonchocarpus* species from Southeast Asia, Central and South America. It is available as at least 118 formulated products from a large number of manufacturers. It is synergized by the addition of piperonyl butoxide (PBO), which is another botanical material. Rotenone is expensive compared with synthetic insecticides, but is moderately priced for a botanical. It is the most commonly mentioned of the botanicals in pre-synthetic literature and is at least somewhat effective against a large number of insect pests. These include: pear psylla, strawberry leafroller, European corn borer, European apple sawfly, cherry fruit fly, apple maggot, cranberry fruitworm, raspberry fruitworm and pea aphid, which is similar to rosy apple aphid, European red mite and two-spotted spider mite, codling moth, plum curculio, Japanese beetle and tarnished plant bug. Unfortunately, it is also toxic to ladybird beetles and predatory mites. But, it is non-toxic to syrphid flies that feed on aphids, and to honeybees. Rotenone is rapidly degraded by sunlight, lasting a week or less.

Rotenone is the most toxic of the botanicals mentioned here, to humans and other mammals. The acute oral $LD_{50}$ is from 60–1500 mg/kg. In small doses it may be irritating or numbing to mucous membranes. It is highly toxic to fish, having been commonly used as a fish poison. It is also toxic to birds and pigs.

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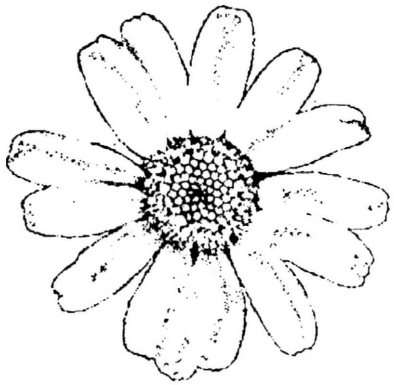
***Pyrethrin (Pyrethrum)*** This compound is produced in the flowers of *Chrysanthemum cinerariaefolium* and is the forerunner of the synthetic pyrethroid insecticides. There are not nearly as many commercially available formulations of this chemical as there are for rotenone, but it is available as an emulsifiable concen-



trate, in combination with rotenone, or alone as a wettable powder, from at least a couple of sources. Pyrethrin is the least expensive of these four materials. Depending on the rate used, it may be less expensive than many synthetic insecticides. It is also synergized by PBO. Pyrethrin is labelled against a large number of pests. An addendum to the label for one formulation of pyrethrin showed it to be moderately to highly effective (61–100% control) against the following pests of fruit: grape leafhopper, potato leafhopper, leaf curl plum aphid, blueberry flea beetle, blueberry thrips and blueberry sawfly. It is also effective against cranberry fruitworm. It is quickly broken down in the environment and may be used up to and including the day of harvest.

Pyrethrin is relatively non-toxic to humans and other mammals, although the dust produces allergy attacks in people who are allergic to ragweed pollen. The acute oral $LD_{50}$ is 1200–1500 mg/kg. It is toxic to fish, but "relatively" non-toxic to honey bees.

***Sabadilla*** The source of sabadilla is the seed of a tropical lily. There are very few commercial formulations of this material. It is available as a dust that may also be added to water and sprayed, but clogging of the nozzles has been noted. It is moderately priced for a botanical (similar to rotenone). It will control potato leafhopper and is somewhat effective against tarnished plant bug. It has little effect on predators or parasitoids, except for the predatory mite *Typholdromus pyri*, to which it was extremely toxic in recent tests by Joe Kovach. It is not toxic to honey bees. Sabadilla may be used up to 24 hours before harvest.

Sabadilla is less toxic to mammals than rotenone or pyrethrin; the acute oral $LD_{50}$ is greater than 4000 mg/kg.

***Ryania*** A product of the roots and stems of *Ryania speciosa* of Trinidad, ryania acts as both a stomach and contact poison to target insects. It is the most expensive of the materials covered in this article, and is not as readily available as rotenone or pyrethrin. Ryanodine, the active ingredient, is formulated as a wettable powder and is labelled for use against the codling moth in apples. It is also toxic to the European corn borer and may control cranberry fruitworm. In Joe Kovach's tests it provided excellent control of a pest complex comprising codling moth, oriental fruit moth and lesser appleworm. It also controlled aphids, white apple leafhopper and spotted tentiform leafminer. It is more persistent than rotenone or pyrethrin and is more selective. It is generally not very harmful to

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is published weekly from March to September by Cornell University—NYS Agricultural Experiment Station (Geneva) and Ithaca—with the assistance of Cornell Cooperative Extension. New York field reports welcomed. Send submissions by 3 pm Monday to:

**scaffolds** FRUIT JOURNAL
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This newsletter available on CENET, on the Tree Fruit News bulletin board under FRUIT.

pest predators and parasites, but it is somewhat toxic to the predatory mites *Atractotomus mali* and *Diaphnocoris spp*. It may also be used up to 24 hours before harvest.

The acute oral $LD_{50}$ of ryania is 750–1200 mg/kg, less toxic than rotenone and slightly more toxic than pyrethrin. It is also toxic to fish.

***Piperonyl Butoxide (PBO)*** PBO is a synergist (in this case, a material that when added to a pesticide increases the activity of its active ingredient) of both rotenone and pyrethrin. It is also a botanical product, being derived from Brazilian sassafras. Acutely, it is very safe, having an acute oral $LD_{50}$ greater than 7,500 mg/kg, but it may be chronically toxic in high doses.❖❖

## PEST FOCUS

**Geneva:**
**Spotted tentiform leafminer** 2nd flight began 6/21. Sampling for STLM sap-feeding larvae should commence in 500–700 $DD_{43}$ from this date. So far 804 $DD_{43}$ have accumulated.
**Potato leafhoppers** present.

**Highland:**
The 2nd flight of **spotted tentiform leafminer** began 6/20 in the Hudson Valley. 889 $DD_{43}$ have accumulated since then. 2nd brood pupa observed 7/14.
**Leafhoppers** at 1/leaf on R. Del. check trees. Adult **WALH** developing.
**Mite** populations causing bronzing damage in above-threshold blocks.

## UPCOMING PEST EVENTS

| | 43°F | 50°F |
|---|---|---|
| Current DD accumulations (Geneva 1/1 - 7/19): | 1795 | 1276 |
| (Highland 1/1 - 7/18): | 2243 | 1546 |
| **Coming Events:** | **Ranges:** | |
| Obliquebanded leafroller 1st flight subsiding | 1433–2277 | 899–1528 |
| Lesser peachtree borer flight peak | 1099–2330 | 667–1526 |
| Redbanded leafroller 2nd flight subsiding | 2037–2665 | 1342–1777 |
| San Jose scale 2nd flight start | 1449–1764 | 893–1115 |
| Codling moth 2nd flight start | 1599–2302 | 1030–1531 |
| Oriental fruit moth 2nd flight subsiding | 1806–2783 | 1164–1963 |
| Spotted tentiform leafminer 2nd generation tissue feeders present | 1504–2086 | 952–1201 |
| Comstock mealybug 2nd generation crawlers emerging | 2106–2468 | 1447–1631 |

## INSECT TRAP CATCHES (Number/Trap/Day)

**Geneva NY**

| | 7/8 | 7/12 | 7/15 | 7/19 |
|---|---|---|---|---|
| Redbanded Leafroller | 8.8 | 6.8 | 4.8 | 4.0 |
| Spotted Tentiform Leafminer | 900.5 | 768.1 | 865.3 | 419 |
| Oriental fruit moth (apple) | 1.3 | 1.3 | 14.8 | 8.6 |
| Oriental fruit moth (peach) | 0.8 | 0.6 | 2.2 | 1.1 |
| Lesser appleworm | 0 | 0.5 | 1.0 | 0.6 |
| Codling moth | 2.0 | 0.5 | 1.0 | 0.1 |
| Obliquebanded leafroller | 2.3 | 2.6 | 2.0 | 1.0 |
| Lesser peachtree borer (cherry) | 4.8 | 1.9 | 1.3 | 0.3 |
| Lesser peachtree borer (peach) | 1.5 | 1.4 | 2.7 | 0.3 |
| American plum borer (plum) | 0 | 0.1 | 1.0 | 0.8 |
| American plum borer (cherry) | 0.3 | 0.9 | 0.8 | 0.8 |
| Peachtree borer | 0.5 | 0.6 | 0.7 | 0.4 |
| Apple maggot | 0 | 0.09 | 0.2 | 0.09 |

* 1st catch

**HVL, Highland NY**

| | 7/6 | 7/12 | 7/19 |
|---|---|---|---|
| Redbanded Leafroller | 0 | 0.3 | 0 |
| Spotted Tentiform Leafminer | 151.0 | 119.0 | 27.3 |
| Sparganothis Fruitworm | 1.3 | 0.6 | 0.2 |
| Oriental fruit moth | 2.6 | 2.2 | 2.2 |
| Fruittree leafroller | 0 | 0 | 0.1 |
| Lesser appleworm | 0 | 0 | 0 |
| Codling moth | 0.8 | 1.7 | 3.7 |
| Variegated leafroller | 0 | 0.2 | 0 |
| Obliquebanded leafroller | 3.3 | 1.0 | 0.1 |
| Apple maggot | 0.2* | 0.1 | 0.3 |

(Dick Straub, Peter Jentsch)



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