Why Essential Oils for Honey Bees?

And Some Other Things to Think About!

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General Statement

The use of essential oils or chemicals to assist the honey bee in its daily activities is solely up to the Beekeeper. The same is true of Pesticides that we use on our gardens, lawns and flowerbeds. Do the research and follow your instincts. Arguments can be found for or against the use of Essential Oils, Chemicals and Pesticides. The choice is yours. The following should help you to think about your choices.

Essential Oils have Two Modes of Action:

1. Toxicity by direct contact:
    a. When varroa mites contact essential oils such as wintergreen, patchouli, tea tree oil et al., mixed into oil or grease, the are killed on contact – usually within a few minutes.
2. Impaired reproduction via feeding syrups containing essential oils:
    a. When varroa mites feed on larvae that contain essential oils, their reproduction interrupted. If the oil is strong enough, the females are unable to lay eggs. If the oils are low in concentration, eggs are layed, but development of immature mites is delayed; young mites do not reach maturity before the bees emerge from the cell; consequently, the immature mites die.

Timing of Treatments

We have found that colonies, heavily infested with varroa mites in August, September and October, probably cannot be saved. The treatments with grease patties and tracking strips will kill mites, but it is too late in the season to allow rearing of new, uninfected brood which would enhance survival of the colony. But, more importantly, even if all varroa mites are killed after heavy infestation, the bees may still be dying from the acute bee paralysis virus, Kashmir virus or other viruses transmitted earlier by the varroa mites.

However, strong, healthy colonies – free of mites in early September, but later overwhelmed by an influx of lost bees and mites from dying feral colonies or from untreated neighboring colonies – can be protected and saved by using the grease patties + essential oils throughout the fall and winter. Since little or no brood will be available as shelters, the contact of the grease and essential oils will kill virtually of the mites – before they are able to transmit the viruses.

The above information comes from James W. Amrine, Jr., Division of Plant and Soil Sciences, West Virginia University

Basic Guidelines for Safe Use of Essential Oils

- Storage
    - Pure vegetable oil will dilute the discomfort or skin irritation of EO spilled on the skin.
    - Keep the bottle tightly sealed, stored in a cool dark place. If stored correctly they will last many years.
    - Keep essential oil out of the reach of children.
    - Keep essential oil away from eyes and ears.
    - Don't handle contact lenses with essential oils on your fingers. It may damage the lenses and irritate you eyes.
    - Be aware of the reaction time of essential oils, it might be two to three days.

Medical Properties of Essential Oils

Camphor

- Medical Properties
    - as an antimicrobial substance

Eucalyptus

- Medical Properties
    - Analgesic
    - Antiviral
    - Antibacterial
    - Antifungal
    - Insecticidal

Lemon grass

- Medical Properties
    - Antifungal
    - Antibacterial
    - Antiparasitic
    - Anti-inflammatory
    - Improves circulation

Oregano

- Medical Properties
    - Anti-viral
    - Antibacterial
    - Antifungal
    - Antiparasitic
    - Anti-inflammatory
    - Immune stimulant

Peppermint

- Medical Properties
  - Anti-inflammatory
  - Antitumoral
  - Antiparasitic
  - Antibacterial
  - Antiviral
  - Antifungal
  - Digestive stimulation

Sweet Orange

- Medical Properties
  - Antitumural
- Antibacterial and antiparasitic effects on Paenibacillus Larvae (AFB) and Varroa Destructor (Mite)
- Information taken from:
  - Journal of Apicultural Research and Bee World 2009 (IBRA) (Argentina)
  - P larvae were highly susceptible to both grapefruit and sweat orange.
    - Grapefruit – 400 mg/l
    - Sweet Orange – 800 mg/l
    - Sweet Orange had a lower mortality rate then the Grapefruit
  - Varroa destructor was repelled more by grapefruit than sweet orange. But both did repel the mite.

Tea Tree

- Medical Properties
  - Powerful antibacterial
  - Antifungal
  - Antiviral
  - Antiparasitic
  - Anti-inflammatory

Thyme

- Medical Properties
  - Anti-aging
  - Highly anti-microbial
  - Antifungal
  - Antiviral
  - Antiparasitic
  - Proven to sterilize mites.

Reference:

- The above information was taken from “Essential Oils, Desk Reference, Compiled by Essential Science Publishing, Fourth Edition, September 2007, and ISBN 0-943685-49-4 (1)

Disease and Pests of Honey Bees

American Foul Brood

- Cause – Paenibacillus (bacillus) larvae
- Cause – Spore Forming Bacterium
- Information taken from:
    - Bee World 1998 – by Marla Spivak and Martha Gilliam
- Drugs have little beneficial effect on the P larvae. They merely obscure clinical symptoms and risk the accumulation of drugs within the honey and bees wax.
- Lactobacillus sp. Potential probiotics for the prevention of Paenibacillus larvae infection in honey bees.
- The study is to help determine what potential probiotics can be used to prevent P. larvae infection.
    - Study from Journal of Apicultural research 2011. University of Veterinary Medicine, Kosice, Slovak Republic
    - The purpose of the study was to show a low pH of about 4.5 would kill Paenibacillus larvae.
    - Further studies needed to prove this theory.
- The pure essential oils or blends of essential oils have a positive effect on AFB
    - Evaluation of some essential oils for the control and prevention of AFB in honey bees. Apidologie 34, 2003, Gracoela N. Albo, Cirso de Zootecnia AMG, Universidad Nacional de La Plata, Argentina

Nosema

- Oldest Classification – Nosema apis (old)
    - Spore forming parasite that invades the digestive tract of the honey bee.
    - Old classification -Protozoan spores
- Newest Classification – Nosema ceranae (new from Asia)
    - New classification – Fungi spores
    - A small parasite that affects the Asiatic honey bee. In 1996 it was discovered in Taiwan and has moved into the US.
    - Fumagilin is the only approved control of nosema by the US. N.ceranae increases faster when the Fumagilin starts to decline in the hive. Fumagilin doesn't suppress the spread of N.ceranae.
    - PLOS – Nosema ceranae escapes Fumagilin control in Honey Bees, 3/07/13Wei-Fone Huang, Leellen F. Solter, Peter M. Yau, Brain S. Imai
    - Wikipedia, Nosema Ceranae, Chapon. L., M.D. Ellis, and A. L. Szalanski, 2009 Nosema and Tracheal mites in the north central region. American Bee Journal 149.

Varroa destructor

- Mite
- Information taken from:
    - Bee World 1998 – by Marla Spivak and Martha Gilliam
    - Essential Oils that are toxic to Varroa destructor:
    - Adult honey bees:
        - Menthol – 87% effective mite mortality
        - Clover oil – 96% effective mite mortality
        - Origanum oil – 100% effective mite mortality
        - Thymol – 100% effective mite mortality
        - Thymol oil lowest LC50 for adult bees at 210.3 ug/bee
        - Menthol had the highest LC50 for adult bees of 523.5 ug/bee

    - Larval
        - Thymol most toxic product with an LC50 of 150.7 ug/larva
        - Menthol was least toxic with LC50 of 382.8 ug/bee
    - Tau-fluvalinate (Apistan) used to control was less toxic to the mites and more toxic to adult honey bees and larvae than the essential oils listed above.

    - Reference:
        - Acute toxicity of essential oils and other natural compounds to the parasitic mite, Varroa destructor, and the larval and adult worker honey bees, Journal of Apicultural Research vol 48. October 2009
    - Air space in the hive is important for mite control
        - Evaporation and temperature are important in the effectiveness of Thymol oil against the Varroa mite.
        - Inner Covers:
            - ¼" side down – 78.3% efficient of treatment
            - 1 1/8" bee escape board – 87.3% efficient of treatment
            - 2.25" side up – 92.4% efficient of treatment
            - The experiment shows that larger the air space the better the Thymol treats is against mites.

    - Maximizing the efficacy of a Thymol based product against the mite Varroa destructor by increasing the air space in the hive. Marco Lodesani and Cecilla Costa, Journal of Apicultural Research and Bee World 47, 2009.

    - The use of Thymol for Mite Control

- When essential oils are mixed into a grease patty the mites are killed on contact.
- When mites feed on larvae that contain essential oils their reproduction is stopped.
- If the essential mixture is low the eggs are laid and the immature mites don't reach maturity and die.
- If the essential oil mixture in the larvae is strong enough the females can't lay eggs.
- The use of canola oil, mineral oil, or shortening will cause the essential oils to be ineffective.
- The essential oils should be delivered in syrups.
- Reference:
    - Using essential oils for Honey Bee Mite Control, Jim Amrine, Bob Noel, Harry Mallow, Terry Stasny, Robert Skidmore, WVU, December 30, 1996.

- New Methods of Varroa control.
    - The delivery of essential oils, Thymol, Origanum and Clove, into the hive. Based on the toxicity to Varroa.
    - Mixed with powder sugar and feed to the bees.
    - Test showed that 3% of the active ingredient resulted in control of the varroa mite.
    - Mite drop was determined by use of a sticky board.
    - The delivery system works but the release rate needs to improve.
    - Reference:
        - USDA/ARS/Almond Board of California, project 5342-21000-014-00D, Improve Crop Pollination Rates by Increasing Colony Populations and Defining Pollination Mechanisms. 2008.

- Essential Oils in Sugar Syrup
    - Essential oils used: Origanum oil, Cinnamon oil, Thymol and 2-heptanone.
    - Reference: Journal of Apicultural Research and Bee World, 48, 2009, Feeding essential oils and 2-heptanone in sugar syrup and liquid protein diets to honey bees as potential varroa mite controls
    - After nine days of treatment Origanum oil and Thymol were found in the larvae.

- Essential Oils tested on honey bees

- The essential oils were mixed into sugar water.
- Tested essential oils:
- Each essential oil test was with 495 bees
- Eight DOT @ 1000 PPM the results are an average % mortality

	8 DOT	LT
Control Hives Fed	10%	17 days
Control Hives Unfed	100%**	1.9 days
Wintergreen	24%	14.4 days
Thymol	43%	NS
Oxalic Acid	96%	4.8 days
Oregano	41%	10.8 days
Marjoram Oil	34%	27.0 days
Formic Acid	33%	11.8 days
Cineole	11%	NS

- ** all bees dead in 4 days
- NS – No significant model. Mortality during test did not reach 50%
- Reference: Journal of Apicultural Research and the Bee World 46, 2007, Ohio Agricultural Research and Development Center, Ohio State University.
- Enviroquest Ltd., 352 River Road, Cambridge, ON, Canada

Cooking with Honey

- When substituting honey for granulated sugar in recipes:
    - Substitute honey for up to ½ the sugar.
    - With experimentation, honey can be substituted for all the sugar in some recipes.
    - Honey is acidic. In baked goods add ½ teaspoon of baking soda for each cup of honey used. Baking soda is not necessary with yeast breads. Bread leavening thrives in the mildly acid environment of honey.
    - To prevent over-browning of baked goods, reduce oven temperature by 25 degrees F.
    - Honey absorbs and retains moisture readily so baked goods will stay fresher longer.

Pesticides, the Good, Bad and Ugly!

The following information was taken from four books:

1. The Myths of Safe Pesticides by Andre Leu
2. Pesticides & Health, Myths vs. Realities, Professor Allen S. Felsot, WSU
3. Monsanto vs. The World, Jason Louv
4. Naturally Healthy Living With Diatomaceous Earth, L. A. Nicholas, Ph.D

Book review of: the Myths of Safe Pesticides

This author explains about the natural system of good bugs vs. bad bugs. If all the bad bugs are killed in an area, then the good bugs leave the area in search of bad bugs. Then the bad bugs come back and they are not stopped in reproducing and multiply in vast numbers and at a fast rate. The good bugs start to return to the area, but pesticides are used to kill the bad bugs, as well as the good bugs, and finally we are in a cycle of killing with pesticides. If we use less pesticides and more Integrated Pest management (IPM) the natural cycle of good bugs vs. bad bugs will work to everyone's advantage.

A 2009 study by the Environmental Working Group found up to 232 chemicals in the placental cord blood of newborns in the United States. Many of these chemicals, such as mercury and polychlorinated biphenyls, are known to harm brain development and the nervous system. (Page 6)

Studies have been done on the various pesticides and herbicides to determine their potential usefulness. The problem is that they only test on the main chemical. They do not test the combination of chemicals within the solution. Example would be testing of one chemical and its effect on the target and surrounding area. The test shows that the one chemical has little or no effect on surrounding area and is mildly efficient on the target. However when mixed with another chemical to make the chemical highly efficient on the target, the mixed solution is deadly to surrounding area. The current testing is only on the single chemical.

In the United States the pesticides and herbicides are innocent until proven guilty. In the European Union the pesticides and herbicides are guilty until proven innocent. In the United States who tests the various pesticides and herbicides? The chemical companies and universities provide the testing. The universities obtain grant monies for the studies. Where does the grant money come from?

Acute toxicity of a product is fatal to animals and humans. An LD_{50} lethal dose at 50 milligrams will kill 50% of the animals. Example: LD_{50} 100 milligrams per kilogram is more deadly than LD_{50} 400 milligrams, only a ¼ of the amount is needed to kill the same amount of animals.

Fungicides are the most toxic to humans, even concentrations below the agricultural dilutions. Herbicides are second and then insecticides.

Roundup – The main ingredient is Glyphosate which was tested on tadpoles and found that their mouths, eyes, skulls vertebrae and tail did not develop. And that the tadpoles did not grow to normal size when subjected to Glyphosate.

Research has found that Roundup from 1 ppm to 20,000 ppm causes cells of the human body to die prematurely. In March of 1999 Swedish scientists have shown that non-Hodgkin's lymphoma is linked to exposure of pesticides and herbicides, including Glyphosate.

Atrazine is an herbicide and is used to prevent broadleaf weeds in crops, turf and residential lawns. It has been banned in the European Union in 2004 because of groundwater contamination. Tests have shown it may alter the natural hormonal system in animals. In 2009 the EPA had concluded that the chemical could lead to reproductive effects in humans. The EPA review was criticized and atrazine's safety remains controversial.

Book Review of: Pesticides & Health

This book is just the opposite the book "The Myths of Safe Pesticides". There pesticides and herbicides that are used today are safe for humans. Humans are the problem. They are using too much of the product. They are not following directions. The government needs to be educated so that they can better set the regulations for the use.

Book Review of: Monsanto vs. the World

Some terminology should be reviewed before we visit this book.

Hybridization: In 1960 Norman Borlaug developed cytogenic hybridization techniques. He cross breed different strains of wheat and selected favorable traits. (Taken from Monsanto vs. the World, page 31)

Plant breeding: Plant breeding is the art and science of changing the traits of plants in order to produce desired characteristics. Plant breeding can be accomplished through many different techniques ranging from simply selecting plants with desirable characteristics for propagation, to more complex molecular structures.

Plant breeding has been practiced for thousands of years, since near the beginning of human civilization. It is now practiced worldwide by individuals such as gardeners and farmers, or by professional plant breeders employed by organizations such as government institutions, universities, crop-specific industry associations or research centers.

International development agencies believe that breeding new crops is important for ensuring food security by developing new varieties that are higher-yielding, resistant to pests and diseases, drought-resistant or regionally adapted to different environments and growing conditions. (Taken from Wikipedia)

Transgenesis: Transgenesis is the process of introducing an exogenous gene — called a transgene — into a living organism so that the organism will exhibit a new property and transmit that property to its offspring. Transgenesis can be facilitated by liposomes, plasmid vectors, viral vectors, pronuclear injection, protoplast fusion, and ballistic DNA injection. (Taken from Wikipedia)

Monsanto is a 113 year old company with its headquarters at Creve Coeur, Missouri. Monsanto developed and markets Roundup herbicide and Roundup Ready seeds. Roundup kills weeds. Roundup Ready seeds resist Roundup. So if you buy both you can kill all the weeds thereby your crop will not fail because of weeds.

Monsanto also produces Bt seeds. These crops produce their own insecticide. The plants have a built in insecticide and this eliminates the need for you to purchase insecticides to spray on the plants. However, the insecticide is already in the plant and can't be removed thus it goes into our food chain.

Some of the items that Monsanto has produced over the years and are now banned:

- DDT
- PCB
- Bovine growth hormone
- Aspartame
- Agent Orange

Monsanto is a very large lobbying firm. In 2012 they spent $5.97 million and $6.37 million in 2011. And over $1 million on campaign contributions to some of the recipients are:

- Claire McCaskill (D-MO) - $32,524
- Barack Obama (D) - $23,725
- Roy Blunt (R-MO) - $20,000

President Barack Obama signed the Farmer Assurance Provision into law while Roy Blunt works with Monsanto to design the rider. And Clair McCaskill voted for it.

The **Farmer Assurance Provision** refers to Section 735 (formerly Section 733) of US H.R. 933, a bill that was passed by the Senate on March 20, 2013 and then signed into law as part of the Consolidated and Further Continuing Appropriations Act, 2013 by President Barack Obama on March 26, 2013. The provisions of this law remained in effect for six months, until the end of the fiscal year on September 30, 2013. The bill is commonly referred to as the "Monsanto Protection Act" by its critics.

A court reversed that approval. The provision directed the Secretary of Agriculture to grant temporary deregulation status at the request of a grower or seed producer, toallow growers to continue the cultivation of the crop while legal challenges to the safety of those crops would still be underway.

NPR reported that Greg Jaffe, director of the Biotechnology Project at the Center for Science in the Public Interest, said that "It's not clear that this provision radically changes the powers USDA has under the law." NPR went on to report “That's an authority that the USDA has, in fact, already exercised in the past. Back in 2010, a federal judge in San Francisco ruled that the USDA had approved genetically modified sugar beets for commercial planting without adequately assessing their potential environmental impact. The ruling effectively banned future plantings of GMO sugar beets — which made up most of the country's crop — and raised the specter of a sugar shortage. So two giant biotech seed producers — Monsanto and Germany's KWS — petitioned the USDA to issue a "partial deregulation": Essentially, farmers got the go-ahead to keep planting the beets until the USDA's environmental assessment of the crop was complete." (Taken from Wikipedia)

Book Review of: Naturally Healthy Living with Diatomaceous Earth

What is Diatomaceous earth?

It is a white chalky material formed from the fossilized remains of tin, ancient one-celled algae.
What is it used for?
Used to filter water from swimming pools, it also used to filter drinking water and is used in the beer and wine making.
How many types of DE are there?
There are two types. One comes from salt water areas and is not safe to use with humans. The other type is from fresh water sources and is considered safe around humans.
How can we use this on our gardens, lawns and flower beds?
One can sprinkle the safe DE on the ground, around and over the plants. The insects that eat our plants will crawl over the DE and their exoskeletons will be penetrated thereby killing them. The same thing will happen to the good bugs.

What are GMOs?

GMOs (or "genetically modified organisms") are living organisms whose genetic material has been artificially manipulated in a laboratory through genetic engineering, or GE. This relatively new science creates unstable combinations of plant, animal, bacterial and viral genes that do not occur in nature or through traditional crossbreeding methods.

Virtually all commercial GMOs are engineered to withstand direct application of herbicide and/or to produce an insecticide. Despite biotech industry promises, none of the GMO traits currently on the market offer increased yield, drought tolerance, enhanced nutrition, or any other consumer benefit.

Meanwhile, a growing body of evidence connects GMOs with health problems, environmental damage and violation of farmers' and consumers' rights.

Are GMOs safe?
Most developed nations do not consider GMOs to be safe. In more than 60 countries around the world, including Australia, Japan, and all of the countries in the European Union, there are significant restrictions or outright bans on the production and sale of GMOs. In the U.S., the government has approved GMOs based on studies conducted by the same corporations that created them and profit from their sale. Increasingly, Americans are taking matters into their own hands and choosing to opt out of the GMO experiment.

The following is a copy of the EPA fact sheet on Integrated Pest Management (IPM).

Integrated Pest Management (IPM) Principles

What is IPM?
Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.
The IPM approach can be applied to both agricultural and non-agricultural settings, such as the home, garden, and workplace. IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides. In contrast, *organic* food production applies many of the same concepts as IPM but limits the use of pesticides to those that are produced from natural sources, as opposed to synthetic chemicals.

1. **How do IPM programs work?**

IPM is not a single pest control method but, rather, a series of pest management evaluations, decisions and controls. In practicing IPM, growers who are aware of the potential for pest infestation follow a four-tiered approach. The four steps include:

- **Set Action Thresholds**

Before taking any pest control action, IPM first sets an action threshold, a point at which pest populations or environmental conditions indicate that pest control action must be taken. Sighting a single pest does not always mean control is needed. The level at which pests will either become an economic threat is critical to guide future pest control decisions.

- **Monitor and Identify Pests**

Not all insects, weeds, and other living organisms require control. Many organisms are innocuous, and some are even beneficial. IPM programs work to monitor for pests and identify them accurately, so that appropriate control decisions can be made in conjunction with action thresholds. This monitoring and identification removes the possibility that pesticides will be used when they are not really needed or that the wrong kind of pesticide will be used.

- **Prevention**

As a first line of pest control, IPM programs work to manage the crop, lawn, or indoor space to prevent pests from becoming a threat. In an agricultural crop, this may mean using cultural methods, such as rotating between different crops, selecting pest-resistant varieties, and planting pest-free rootstock. These control methods can be very effective and cost-efficient and present little to no risk to people or the environment.

- **Control**

Once monitoring, identification, and action thresholds indicate that pest control is required, and preventive methods are no longer effective or available, IPM programs then evaluate the proper control method both for effectiveness and risk. Effective, less *risky* pest controls are chosen first, including highly targeted chemicals, such as pheromones to disrupt pest mating, or mechanical control, such as trapping or weeding. In further monitoring, identifications and action thresholds indicate that less risky controls are not working, then additional pest control methods would be employed, such as targeted spraying of pesticides. Broadcast spraying of non-specific pesticides is a last resort.

2. **Do most growers use IPM?**

With these steps, IPM is best described as a continuum. Many, if not most, agricultural growers identify their pests before spraying. A smaller subset of growers uses less risky pesticides such as pheromones. All of these growers are on the IPM continuum. The goal is to move growers further along the continuum to using all appropriate IPM techniques.

3. **How do you know if the food you buy is grown using IPM?**

In most cases, food grown using IPM practices is not identified in the marketplace like *organic* food. There is no national certification for growers using IPM, as the United States Department of Agriculture has developed for organic foods. Since IPM is a complex pest control process, not merely a series of practices, it is impossible to use one

IPM definition for all foods and all areas of the country. Many individual commodity growers, for such crop as potatoes and strawberries, are working to define what IPM means for their crop and region, and IPM-labeled foods are available in limited areas. With definitions, growers could begin to market more of their products as *IPM-Grown*, giving consumers another choice in their food purchases.

4. **If I grow my own fruits and vegetables, can I practice IPM in my garden?**

Yes, the same principles used by large farms can be applied to your own garden by following the four-tiered approach outlined above. For more specific information on practicing IPM in your garden, you can contact your state Extension Services for the services of a Master Gardener.

Definitions:

- **Lactobacillus:**
  - The production of lactic acid makes the environment acidic, which inhibits the growth of some harmful bacteria

- **Probiotics:**
  - Ingested microorganisms associated with beneficial effects to humans and animals.

- **Paenibacillus larvae:**
  - It is a spore forming bacterium that is the agent behind American Foulbrood (AFB).

- **LC50**
  - Standard measure of the toxicity of the surrounding medium that will kill half of the sample population of a specific test-animal in a specified period through exposure via inhalation (respiration). LC50 is measured in micrograms (or milligrams) of the material per liter, or parts per million (ppm), of air or water; lower the amount, more toxic the material. Used in the comparison of toxicities, LC50 values cannot be directly extrapolated from one specie to the other or to humans. Also called median lethal concentration or population critical concentration 50. Written also as LC50.
  - Reference: Read more: http://www.businessdictionary.com/definition/lethal-concentration-50-LC50.html#ixzz3DEhj7nAL
  - In toxicology, the **median lethal dose**, $\mathbf{LD_{50}}$ (abbreviation for "lethal dose, 50%"), $\mathbf{LC_{50}}$ (lethal concentration, 50%) or $\mathbf{LCt_{50}}$ (lethal concentration and time) of a toxin, radiation, or pathogen is the dose required to kill half the members of a tested population after a specified test duration.

- **2-Heptanone**
  - Colorless, water-white liquid with a banana-like fruity odor.
  - Listed by FDA as a "food additive permitted for direct addition to food for human consumption"
  - It is excreted by honey bees when they bit small pest within the hive.
  - There are some allergic reactions by humans.
  - Reference: Wikipedia, 2-Heptanone. December 2013

- **Inverted Sugar**
  - A mixture of glucose and fructose.
  - Sucrose has been split into two components.
  - Sucrose, inverted is sweeter and retains moisture.
  - Sucrose is a disaccharide derived from two simple sugars (monosaccharide).
  - Honey has similar properties of inverted sugar.

- **Integrated Pest Management (IPM)**
  - Varroa Mites
    - 25 dropped Varroa Mites Average per day – OK
    - 26 dropped Varroa Mites Average per day – Not good
      - Must help the hive survive.
        - Powder sugar
        - Grease patty
- DOT – Days of Treatment
- LT – Length of treatment

EPA Registers New Insecticide Alternative to Neonicotinoids, Safer for Bees

Received January 21, 2015

The EPA is registering a new insecticide, flupyradifurone that is safer for bees. It is expected to be an alternative to more toxic products including certain pyrethroid, neonicotinoid, organophosphate and avermectin insecticides.

As an insecticide, flupyradifurone is unusual in that laboratory-based studies indicate that the compound is practically non-toxic to adult honeybees. Studies show no adverse effect on overall bee colony performance or overwintering ability when compared to untreated colonies.

EPA's decision meets the rigorous Food Quality Protection Act standard of "reasonable certainty of no harm" to human health. On the basis of protective and conservative human health and ecological risk assessments for the uses of the pesticide, EPA confirmed the safety of the use for the public, agricultural workers and wildlife. EPA coordinated its evaluation with our counterparts in Canada and Australia.

This decision was one of the first to incorporate newly-required bee studies and involved evaluating the largest number of bee-related studies ever for the registration of a new chemical. EPA reviewed 437 studies including 38 different tests on bees to analyze the potential exposure and effects of flupyradifurone. These included evaluation of the sub lethal effects of pesticides on all life stages of bees, as well as effects on colony health in field studies. The field studies examined pollinator-attractive crops while bees were actively foraging after the crops had been treated through various application methods (seed, soil and foliar) to demonstrate very high exposure.

Flupyradifurone is registered for a large number of crops such as citrus, cotton, potatoes and many others to protect against piercing and sucking insects such as aphids, whiteflies, thrips, and pysllids, all of which have become increasingly resistant to other pesticides and are difficult to control. The registration of flupyradifurone will provide growers across the U.S. with a new pest resistance management tool that presents an effective countermeasure to resistance development. No residential uses have been proposed.

More information on this regulatory action can be found at www.regulations.gov,

Docket ID: EPA-HQ-OPP-2013-0226-0044.

To learn more about EPA's actions to protect pollinators, visit our Pollinator Protection website. (3)

Another View on New Insecticide - Flupyradifurone Still Concerning for Honey Bees

by Michele Colopy, Program Director, Pollinator Stewardship Council
The Pollinator Stewardship Council is gravely concerned another systemic insecticide with similar insecticidal activity to neonicotinoids has been registered for seed, soil, and foliar treatments across a variety of crops. This new insecticide is proposed for use before, during and after bloom, three to five times per season.
Our concerns are derived from EPA's own analysis of this butenolide insecticide. Flupyradifurone has greater persistence in the water column than sediment, thus exposing honey bees through the ingestion of water with a Flupyradifurone half-life of 330.1 days. What is also concerning is the research submitted to EPA showed this

systemic insecticide may not be acutely toxic upon the first exposure, but the second and third applications show effects upon honey bee mortality, behavior, brood development, and food storage.

The research concerning the residues of Flupyradifurone in nectar and pollen found different levels of the chemical in pollen and nectar, the level varied per plant, and if the plant had extra nectaries. Pollen appeared to contain higher levels of Flupyradifurone, than nectar (3.5-106x), and the levels increased with the number of applications of Flupyradifurone. Table 28 in EPA's documentation further highlighted this concern as studies showed pollen in various crops showed an increase of Flupyradifurone at the second, and third applications during the same growing season. Further, the concentration remained high for 1-7 days after the second and third applications (depending on the crop).

Studies of caged honey bees fed Flupyradifurone do not reflect the real world of honey bees. Flupyradifurone will be utilized in a tank mix, and effects of Flupyradifurone, its degradates, mixed with herbicides, and fungicides is unknown. The synergistic effects of these chemicals upon honey bees is unknown; yet that will be how honey bees will encounter this compound. While a ten-day honey bee feeding study was conducted, what happened at day 16, 21, and 24—developmental stages of honey bees? To state there were "no consistent adverse effects" except "some increases in mortality and decreases in foraging activity immediately following applications . . . and in some cases there was recovery from the effects on mortality by test termination," does not inspire confidence in the use of this compound. EPA questioned the "large variation in starting colony size" and the "low number of replicates per treatment group" which limit the ability to detect the effects of Flupyradifurone. One study mixing Flupyradifurone with a tebuconazole formulation enhanced the toxicity of Flupyradifurone increasing the toxicity "116-fold and 6.1 fold via the contact and oral routes." Relying on the label guideline to protect against mixing Flupyradifurone with azole fungicides is unrealistic. According to EPA registration review documents, "Maximum residues in comb pollen, nectar, and wax varied, but generally occurred one week to several months after the second application indicating that residues were translocated within the hives to varying extents." Flupyradifurone appears to have pre-lethal effects which long term, replicated studies would reveal. Even when the studies prescribed Flupyradifurone based on the body weight of the honey bee there was increased worker mortality, decreased flight activity, and brood numbers varied widely during the evaluation periods and after over-wintering. In one study it showed the "mortality of the test group was 5 times greater than the control group during the 7-day period after 3rd (full bloom) application."

While Flupyradifurone is "practically non-toxic to bees on an acute contact exposure basis," "the greatest area of uncertainty surrounding the potential risk to bee pollinators is for foliar application at full bloom." "In addition, pollen, nectar, and wax residue data from one of the full field studies with Flupyradifurone (MRIDs 48844517) indicate that average residues did not reach their maxima until up to ***several months*** after the pesticide was applied.

The use of Flupyradifurone upon such a wide array of crops will translocate to pollinator forage areas developed through Federal and State initiatives. Its mobility in water will affect honey bees, and other pollinators. The repeated use of Flupyradifurone has shown to increase its toxicity with each application with a half-life of one application lasting 3-951 days in the plants, soil, and water. The use of this compound will further

exacerbate the concerns over the honey bees' food supply: pollen, nectar, and water.

For more information about the EPA's registration of this pesticide go to
http://www.regulations.gov/#!docketDetail;D=EPA-HQ-OPP-2013-0226

For more information about the Pollinator Stewardship Council go to
www.pollinatorstewardship.org (4)

References:

1. Page 4: The following was taken from "Essential Oils, Desk Reference, Compiled by Essential Science Publishing, Fourth Edition, September 2007, and ISBN 0-943685-49-4
2. Page 15: US EPA Integrated Pest Management (IPM) Principles, Pesticides: Topical & Chemical Fact Sheets, dated Tuesday, August 5, 2014
3. Pollinator Protection Web site. This is an EPA website go to: http://www/2.epa.gov/pollinator-protection
4. Pollinator Stewardship Council. This is a private origination. Go to their website: http/pollinatorstewardship.org

Status of Chemicals used in Beekeeping:

1. Apistan – No longer effective on Varroa mites
2. CheckMite – The effectiveness on Varroa mites is failing fast.
3. Hivastan – Has limited effect on Varroa mites
4. Sucrocide – Has no effect on Varroa mites
5. Api-Guards – Contains Thymol and has effect on several pathogens.
6. Mite Away – Is Formic Acid
7. Oxalic Acid – Not licensed in the USA
8. Fumagilin-B – Has limited effect on Nosema and is failing.