REGULATORY UPDATES

Renewed
For managers of rangeland, pasture, uncultivated agricultural areas, and rural non-crop sites surrounding residential and resort areas—use of the pesticide Prozap® Zinc Phosphide Oat Bait (HACCO; EPA Reg. No. 61282-14)—requires having a copy of HI-010001, valid 7/27/2011–7/26/2016—note: For use only by or under “authorization” of the Hawaii Department of Health, Sanitation Branch, for the protection of public health. This is a restricted use pesticide.

NPDES Pesticides Permit Update
As of November 1, 2011, point source discharges from the applications of pesticides to waters of the state require National Pollutant Discharge Elimination System (NPDES) Permits, as required by the Clean Water Act. These discharges include applications of pesticides to, over, or near waters of the state. The Hawaii Department of Health (DOH), Clean Water Branch (CWB) is responsible for implementation of the NPDES pesticides permit program in the State of Hawaii.

Currently, applications to, over, or near waters of the state without a NPDES permit would be in violation of the Clean Water Act. However, prior to issuance of any NPDES permit for pesticide discharge, CWB must make revisions to the Hawaii Administrative Rules (HAR),
EPA APPROVES SOIL FUMIGANT LABELS

EPA has completed review and approval of nearly all soil fumigant product labels incorporating the second phase of mitigation measures required by the 2009 Reregistration Eligibility Decisions (REDs) for the soil fumigants methyl bromide, chloropicrin, metam sodium/metam potassium, and dazomet.

New risk reduction measures include buffer zones and related measures that will help protect workers and bystanders from exposure to potentially harmful airborne concentrations of these pesticides.

This represents a major step toward full implementation of the risk mitigation measures outlined in the 2009 REDs.

Measures added to labels in the first phase of implementation included Fumigant Management Plans (FMPs), good agricultural practice requirements, and new worker protection measures among other things. Phase 1 labels were approved in 2010.

Existing stocks of products bearing Phase 1 labels may be sold and distributed by registrants until December 1, 2012. After that date, only products bearing the newly approved labels may be sold or distributed by registrants. Distributors and retailers who are not registrants may sell and distribute products until their supplies are exhausted. Likewise, growers and applicators may apply products bearing old labels until those supplies have been exhausted.

The newly approved labels will be available through the Pesticide Product Label System (PPLS) (www.epa.gov/pesticides/ppls) within a few weeks as the labels are processed and entered into the system.

Visit the Office of Pesticide Programs’ Soil Fumigant Toolbox, www.epa.gov/pesticides/reregistration/soil_fumigants/ for more information about soil fumigants and new requirements for their safe use.


This information was provided by an EPA Pesticide Program Update on 13 January 2012.
Please contact the Clean Water Branch at (808) 586-4309 if you have more specific questions on Hawaii's NPDES permit for pesticide discharges. The CWB is currently revising HAR, Chapters 11-54 and 11-55, following the DOH Administrative Rulemaking Process.

For more information on the NPDES Permit:

http://cfpub.epa.gov/npdes/home.cfm?program_id=410


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**PHEROMONES**

(Recertification)

Semiochemicals, especially insect pheromones, can be a useful part of an integrated pest management (IPM) program. They are used to detect, monitor, and control various pests in agriculture, forestry, and in urban areas. This article defines semiochemicals and pheromones, and gives examples of how some organisms use them to communicate. It also presents ways pheromones are being used in IPM, including codling moth control in Washington State’s apple orchards.

Semiochemicals are chemical signals produced by a plant or animal that create a response in another plant or animal. The term comes from the Greek semeon, meaning “signal”. They can be divided into allelochemicals and pheromones.

Allelochemicals are produced by one organism and influence the growth, survival, or reproduction of another species of organism. The process is called allelopathy (Greek allele-, a gene form; and -pathy, mutual suffering) and it can be positive or negative. Of current interest is the inhibitory effect of allelochemicals secreted by certain plants on the growth of other plants. The lemon bottlebrush (Callistemon citrinus) secretes the allelochemical, leptospernone. It is a relatively weak herbicide, but provided the chemical structure for a synthetic herbicide,
mesotrione, marketed as Callisto®. Siam weed (Chromolaena odorata) and lantana also have allelopathic effects on some major crops.

**Pheromones** (Greek *phereum*, to carry; *horman*, to excite or stimulate) are chemical signals released by one member of a species that have an effect on other members of the same species. EPA regulates pheromones as pesticides, except when they are the only active ingredient in a pheromone trap. These chemicals are classified as alarm pheromones, aggregation pheromones, or sex pheromones.

- **Alarm pheromones** agitate members of the same species, warn them of danger, or prepare them for defense. When honeybee workers sting, a pheromone is released that attracts other bees and causes them to behave defensively. When aphids are attacked by a predator, they release an alarm pheromone that makes nearby aphids drop from plant leaves. Some aphids will start producing offspring with wings so they can fly from the host plant. Crushed ants emit an alarm pheromone, sending ants nearby into an attack frenzy that attracts other ants.

- **Aggregation pheromones** can also include sex pheromones because both males and females are attracted to the same site. Cockroaches secrete an aggregation pheromone that is present in their feces. It appears to lead other cockroaches to good resting sites or safe shelter. Bark beetles use aggregation pheromones to attract other bark beetles to a susceptible tree. Foraging ants leave a pheromone trail on their way back to the colony so other ants can find the food source. If the trail is blocked, the foraging ants will look for another trail and if successful, will mark the shortest route on their return to the colony.

- **Sex pheromones** attract partners for mating. Dogs, cats, and other animals emit a pheromone when they are ready to breed. The male gametes of many animals use pheromones to help them find the female gamete (e.g. male sperm following a chemical trail to a female egg). In mice, a particular pheromone is responsible for the rodents’ ability to distinguish males from females. Some species of spiders emit a chemical that mimics the sex pheromone of certain moths. The male moth follows the pheromone trail and is captured by the spider. Several orchid species use pheromone-like chemicals to attract bees and wasps as aids to pollination.

**Pheromones in pest control**

Sex pheromones are the most commonly used semiochemicals in IPM programs. They are available for most insects pests of agricultural

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**Semiochemicals**: chemical signals produced by a plant or animal that create a response in another plant or animal.
crops, so insects are also the most common target pest. Sex pheromones are also used for pest detection, monitoring pest populations, male annihilation, and mating disruption.

**Trapping.** Insect traps commonly use either sex pheromones or aggregation pheromones. They can be detected by insects even when the insect population is extremely small. Therefore, this method is useful for detecting the first appearance of an insect pest or invasive species. The pheromone from a particular species signals only members of the same species. Other organisms may be trapped, however, so the ability to identify the target species is essential.

Traps are available in different sizes and designs depending on the behavior of the target insect. Trap bait should ideally release its pheromone uniformly over time. Bait designs have changed over the years but today most are made of plastic. Small hollow polyvinyl plastic fibers emit female sex pheromone from their open ends, closed hollow fibers in bags release pheromone through their walls, and laminated plastic flakes give off the chemical through their walls and from exposed edges. A new product on the market is SPLAT®, Specialized Pheromone & Lure Application Technology. The pheromone is mixed in a thick, biodegradable matrix and applied by spatula, caulking gun, large-nozzle sprayer, aircraft, etc. The glob of material can be formulated to release the pheromone at various rates, for weeks or months.

**Monitoring.** Pheromone traps can also be used to monitor increases or decreases in an insect population. This is useful in determining the Economic or Action Threshold in an IPM program. For example, by checking traps set out in an orchard or field at least twice a week, a rise or fall in the number of adult moths can be determined. Based on the effects of variations in weather on the insect’s life cycle, this will help determine the best time to apply control measures.

**Male annihilation.** Male annihilation occurs when a pesticide is used together with a female sex pheromone. The goal of this approach is to destroy enough males so that females of the species will not be able to mate. Male annihilation was used against the pink bollworm in Arizona for a few years, but the results were hard to verify because a non-treated area was not available for comparison. A researcher from USDA made some calculations, however, and determined that over 95% of the male population would have to be destroyed in order to control the bollworm population. Any males that were not trapped and killed just mated more often.

**Para-pheromones** are man-made products based on the chemical structure of naturally occurring pheromones.
The Hawaii Fruit Fly IPM program (HAW-FLYPM) is a successful system for management of several fruit fly species. To attract the flies, the program uses protein baits; methyl eugenol, an insect attractant found naturally in many plants; and the para-pheromone Cuelure. Para-pheromones are man-made products structurally related to pheromones. If male annihilation is desired, a small amount of insecticide is added to the bait or traps and the attracted males are killed. This method has effectively reduced fruit fly populations attacking agricultural crops in Hawaii. It has also reduced the amount of organophosphate insecticide applied in the state (see References for more information).

**Mating disruption.** There are two basic approaches to mating disruption, false trail following and male confusion. *False trail following* occurs when many more point sources of pheromone are placed in an area than the estimated number of females. The males are more likely to follow a “false trail” and be led to bait—such as plastic tubes emitting a female sex pheromone—than to the greatly outnumbered females.

*Male confusion* uses a high concentration of sex pheromone in an attempt to hide the pheromone trails of the beckoning females. Large doses from numerous sources are used, such as large point source dispensers or pheromone impregnated tie-on polyethylene ropes. The pheromone receptor sites on the male’s antennae are overstimulated by the cloud of pheromone and become unresponsive. The male is essentially blind. The result of this confusion is that the male cannot detect a single trail leading to a female.

The use of pheromones to control pests is most effective when used with other methods. Hawaii’s fruit fly IPM program, for example, relies heavily on field sanitation, especially the removal of infected fruit containing fly eggs and feeding larvae. The program also includes protein baits and insecticides.

**Codling moth control in Washington**

Codling moth (*Cydia pomonella*) has been a major pest of apples in the state of Washington since the early 1900s. With the first treatment measures, losses of 10% to 25% were common. The first effective control for codling moth was DDT in 1948, followed by azinphos-methyl (Guthion®) in 1965. However, the organophosphate insecticide Guthion® is being phased out on 30 September 2012. New control measures are now being introduced to apple growers, including pheromones.
Codling moths can be difficult to control with the newer insecticides. Although the eggs, larvae, and adults may be susceptible, they are only present on the fruit surface for a short time. Eggs are laid and remain on the fruit surface for one to two weeks before they hatch. The hatched larvae immediately enter the fruit but stay near the surface for two to four days. They then burrow directly to the core of the fruit, where they are safe from pesticides.

A synthetic pheromone is used to detect the presence of males and roughly estimate the number of females in the area. Successful control of the moth depends on the proper timing of control measures during the first generation (early Spring). Computer modeling uses reports from area advisors of the number of moths trapped. Most growers watch local websites and time their control programs to fit the population predictions from the model.

Pheromone (male) confusion has been the most successful alternative to insecticides in large trials. It has been used for more than 15 years on almost half of the state’s apple-producing area. Small packets are tied onto trees and constantly emit female sex pheromone. The dense cloud of pheromone prevents most males from finding and mating with females. This approach is most successful when used over large areas, or when all orchards in the area are being treated. In small areas, or when untreated orchards are nearby, there is an “edge effect”. This effect occurs when females fly outside of the treated area, mate, then return to the treated area and lay their eggs. Isolated orchards are also successful with this method, since there is no edge effect. Damage levels for treated areas are at an historic low in Washington. However, some chemical sprays are still applied during the first season of the program, then as needed to control outbreaks during the following seasons.

References

Fruit flies http://www.ctahr.hawaii.edu/rubinoffd/rubinoff_lab/projects/Pest_Fruit_Flies/Pest_Fruit_Flies.htm
SPLAT http://www.iscatech.com/exec/SPLAT.htm

Codling moth larva in an apple core. Courtesy of Whitney Cranshaw, Colorado State
HONEY BEES DETOXIFY ACARICIDES

There is new information about Colony Collapse Disorder (CCD) and the role of pesticides. Many possible causes for CCD have been suggested since it became a national phenomenon in 2006. Currently, the top three suggested causes are: 1) pesticides, 2) new parasites or pathogens, and 3) a “perfect storm” of stresses leading to weakened honey bee colonies and their eventual collapse.

The massive impact of CCD on honey bees (Apis mellifera) from 2006 to 2009 led to reports of a 30 to 90 percent loss of hives in the U.S. Symptoms of CCD are:

- few or no adult worker bees in the hive, alive or dead,
- a live queen and brood (egg, larval and pupal stages), and
- the usual presence of honey and absence of robber bees.

Honey bees gather pollen and nectar from many different plant species. The nectar is concentrated into honey, and pollen and nectar are often made into beebread (pollen compressed into granules with nectar added). This process also concentrates any plant chemicals, including agricultural chemicals that are in or on the pollen or nectar. These chemicals are also deposited in the hive by worker bees when they produce wax for the honeycomb.

Researchers studying CCD during 2007–2008 found 121 different pesticides and their metabolites in pollen, beeswax (honeycomb), and bee bodies. About 60 percent of the wax and pollen samples included at least one systemic pesticide. Over 47 percent of all samples contained the pyrethroid tau-fluvalinate (Apistan®) (see text box) and the organophosphate insecticide/miticide coumaphos (Checkmite+®), used in hives to control varroa mites (Varroa destructor). The fungicide chlorothalonil was in almost half of the samples. The article concluded that pesticides in the honey bees’ environment represented a “remarkably high level for toxicants” and stated concern about the possible effects of these materials in combination with each other.

These findings and earlier concerns about the effects of pesticides on honey bees have prompted some researchers to focus their studies on the mechanisms bees use to detoxify these chemicals. A recent article reports on how honey bees break down both tau-fluvalinate and coumaphos using cytochrome P450 enzymes. Cytochrome P450 enzymes are present in all organisms. They metabolize naturally occurring substances in the body as well as foreign chemicals (e.g. drugs, pesticides,
etc.). You may remember P450 as part of the electron transport system in plant photosynthesis.

Fluvalinate is a pyrethroid, a synthetic insecticide and acaricide (miticide) derived from pyrethrins that naturally occur in flowers of the genus *Tanacetum* (=Chrysanthemum). Because the natural diet of the honey bee includes *Tanacetum* and other flowers in the daisy family (Asteraceae), they have developed a high tolerance to pyrethrins through their evolutionary history. It is likely that this tolerance also applies to the pyrethroids, which are very similar in structure. Couma-phos and tau-fluvalinate are synergistic (their toxicity increases) when used together in hives. Both of these acaricides are detoxified by the same three P450 enzymes.

Other insects have developed a tolerance to pyrethrin- and pyrethroid-based insecticides by metabolizing them with their P450 enzymes. These include the diamondback moth (*Plutella xylostella*), common housefly (*Musca domestica*), a complex of mosquitoes that carry malaria (*Anopheles gambiae*), the mosquito vector of lymphatic filariasis (*Culex quinquefasciatus*), and the tarnished plant bug (*Lygus lineolaris*).

References


PESTICIDE DRIFT AND ILLNESS: A NINE-YEAR STUDY

Problem. In the United States, 1.1 billion pounds of pesticide active ingredients are applied annually. Pesticides provide many benefits to society: they increase our food supply, control invasive pests in field and forest, reduce pest infestations in buildings (workplace, schools, homes, etc.), control disease-carrying insects and animals, and help maintain open roads and waterways. Like other chemicals, however, pesticides can cause harm to humans and the environment. A major cause of exposure to pesticides occurs when pesticides drift off-target. This can cause damage to humans in the area and the environment. Pesticide drift can occur whether applications are done legally or illegally.

The study. In June 2011, the National Institute of Occupational Safety and Health (NIOSH) released the results of a survey on acute pesticide illnesses associated with pesticide drift. Eleven states participated in the nine-year survey. Data were collected through the Sentinel Event Notification System for Occupational Risks (SENSOR) program and the California Pesticide Illness Surveillance Program.

Initial report. The report, “Acute pesticide illnesses associated with off-target pesticide drift from agricultural applications—11 states, 1998–2006” was published in June 2011 in the journal Environmental Health Perspectives (see References). Since the cause of many illnesses is often hard to determine, these drift cases were classified based on their probability. Of the 2,945 cases, the study considered pesticide drift illness to be definite in 53 cases (1.8%); probable in 2,019 cases (68.6%); possible in 823 cases (27.9%); and suspicious in 50 cases (1.7%).

Findings. During the nine-year period, 643 drift events occurred in which there were 2,945 drift cases associated with agricultural pesticide drift.

- Almost half of the exposures (47%) were occupational cases, or 114.3 workers per million persons. Of these, 73% were agricultural workers. This rate was 145 times greater than for non-agricultural workers.
- The second highest number of cases was residents of five heavily agricultural counties in California, 42.2 cases per million persons. This is 69 times higher than the rate in other California counties.
Due to their high volatility and toxicity, soil fumigants are often the cause of pesticide drift illnesses. In this survey, they were responsible for 45% of the reported cases. EPA now requires more strict safety measures for soil fumigant applications including worker training, wider buffer zones, public notification and signage, evacuation plans, and extensive written procedures (see References).

Aerial application was the most frequent application method responsible for drift events (39%). It was responsible for 24% of the 2,945 reported cases. Of the 79 events attributed to applicator carelessness, 56 (71%) were aerial applications.

92% of the acute pesticide exposures resulted in low-severity illnesses that usually required no treatment. The symptoms included eye and upper respiratory irritation, stomach upset and skin rashes.

14% were youths under 15 years of age.

Factors affecting drift. Factors that typically enhance pesticide drift include high winds, high temperatures and low relative humidity, temperature inversions, ineffective seal of a soil fumigation site or premature removal of the tarp, and applicator carelessness such as flying over houses or failure to turn off spray nozzles at the end of a crop row.

Study limitations. The first limitation concerns missing information on many of the cases (e.g. age, violations, contributing factors, distances). Second, the findings probably underestimate the magnitude of drift events and cases because of the passive data collection systems, underreporting, misdiagnosis, and failure of health care providers to report cases to public health agencies. The data may include false positives due to the nonspecific nature of pesticide poisoning symptoms and the lack of diagnostic tests. Duplication and misclassification of cases occurred when SENSOR and the California database were combined. Finally, information regarding contributing factors was not available for 48% of the cases. This was because a thorough investigation did not occur, or detailed findings were not entered into the databases.

Conclusion (from the article). The study findings suggest that the incidence of acute illness from off-target pesticide drift exposure was relatively low during 1998–2006 and most cases presented with low-severity illnesses. However, the rate of poisoning from pesticide drift was 69 times higher for residents in 5 agriculture-intensive California counties compared with other counties, and the rate of occupationally exposed cases was 145 times greater in agricultural workers than in non-agricultural workers. These poisonings may largely be avoided through
proper prevention measures and compliance with pesticide regulations. Aerial applications were the most frequent method associated with drift events, and soil fumigations were a major cause of large drift events. Aerial pesticide applications are rare in Hawaii and used almost exclusively for invasive pest eradication efforts. In 2008, two years after the end of this survey, EPA released broad, strict regulations for all soil fumigants. Their goal responds to the problem of accidental human exposure to pesticide drift.

References
EHP article http://ehp03.niehs.nih.gov/article/info%3Adoi%2F10.1289%2Fehp.1002843
EPA drift defined http://www.epa.gov/PR_Notices/prdraft-spraydrift801.htm

USING INDICATOR DYSES
(recertification)

Do you have a use in your business, or personal application of pesticides for a spray indicator dye? This article looks at indicator dyes, what they are, and some ways they might be used.

What are indicator dyes?
Indicator dyes change the color of the mix in a spray tank, commonly to a dark blue or green. The color change is usually temporary, lasting from 1 to 48 hours depending on the product. Though the dyes usually break down after exposure to sunlight and moisture, some manufacturers recommend a trial spray to be sure the dye does not stain non-target objects. Most dyes are available in premeasured bags, saving time and cleanup. When they are dropped into a tank containing the correct amount of water and pesticide, the bag dissolves and the spray mixture is evenly colored.

Why use a dye?
One reason to use a colored spray is to identify clogged or worn nozzles. This is especially useful with boom sprayers. If a nozzle is even
partially blocked there will be uncolored or lighter-colored areas in the spray pattern. Clearing blocked nozzle tips, or replacing worn nozzles can increase efficiency of your spraying and save money. It can also reduce the need for retreatment or call backs by providing a good initial treatment.

Spray dyes can be used as a training tool for new employees. Instead of learning by trial and error, the employee can experiment with the effects of tank pressure, ground speed, nozzle tips and wind conditions on spray patterns. Indicator dyes are also useful for familiarizing experienced applicators with new equipment or spray treatments. Spray drift must always be considered, either for the possible problems it can cause or because of ineffective application and wasted product. Light or incomplete coverage of the target can be monitored, as can overspray on a neighbor’s trees, playground equipment, or buildings.

Indicator dyes can be used as an added customer service. For example, herbicide treatments may be visible to a client when the weeds die, but not always. On the other hand, a reduction in insect pests after an insecticide application is not usually apparent unless it is followed by careful scouting. Colored pesticide treatments are immediate proof to your client that a spray was applied and where. A reduction in dye spots on the lawn in later visits emphasizes the value of your service.

This article is based on a February 2011 entry in “Turf Magazine”, available online at http://www.turfmagazine.com/article-6517.aspx

The pink dye allows an efficient application of the pesticide under different conditions. In sensitive areas, or during dry, windy conditions or the presence of a thermal inversion, the applicator can monitor unwanted pesticide drift. Courtesy Larry Barber, USDA Forest Service, Bugwood.com
EPA CONFIRMS SAFETY OF PYRETHRINS AND PYRETHROIDS

On 4 October 2011, EPA completed a two-year cumulative risk assessment of the naturally occurring pyrethrins and their man-made derivatives, the pyrethroids. The assessment determined that the labeled use of these pesticides did not pose a risk for children or adults. In fact, EPA will consider registering new uses for these important insecticides. Two possible new uses are to help manage the indoor (brown marmored) stink bug and bed bugs.

For the past decade, EPA has been restricting the uses of organophosphate and carbamate pesticides. These pesticides can cause acute toxicity in humans and wildlife. Pyrethrins and pyrethroids have taken their place in many situations. In 2009, EPA determined that the pyrethrins and pyrethroids have a common mechanism of toxicity (mode of action) and they have now finished a human health cumulative risk assessment for all uses of these chemicals.

This assessment of cumulative risk considered exposure from food, drinking water, and residential settings. It also considered whether exposure was through the mouth, the skin, or by inhalation. The assessment was highly conservative because it assumed that on the same day people would be exposed to the highest levels of residues in food, water, and in their homes. The assessment also assumed co-occurrence of some worst-case residential scenarios. Even using these very conservative assumptions that overestimated exposure to pyrethrins and pyrethroids, the estimated risk to both children and adults was well below EPA’s level of concern.

References
EPA pesticide Program Updates, 9 November 2011 http://www.epa.gov/pesticides/
EPA cumulative risk assessments http://epa.gov/pesticides/cumulative/
common_mech_groups.htm

PYRETHRINS

Pyrethrin I and pyrethrin II are chemicals found in the seeds of the plant pyrethrum (Chrysanthemum cinerariaefolium). Kenya grows the most potent flowers and supplies a majority of the world’s pyrethrins. These naturally occurring pesticides inhibit the nervous system of all insects. In high doses they are fatal, in low doses they act as a repellent. These insecticides are biodegradable, quickly breaking down when exposed to air or sunlight. Pyrethrins are highly toxic to fish and tadpoles, but have a low toxicity to birds, humans, and other mammals.

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Activated charcoal is a black, soft, porous substance. It is usually made by heating hardwood, coconut shells, peat, coal, etc., under low-oxygen conditions, with or without prior chemical treatment. The highly porous material formed has an extremely large surface area. Powdered activated charcoal can adsorb (bind or “fix”) 100 to 200 times its own weight in organic compounds.

**Uses for activated charcoal**

Activated charcoal is used in water purification systems and to filter organic contaminants from wastewater. It is the most widely used filter material in respirators. It can be used medicinally as an antidote for swallowed poisons. Industry uses activated charcoal to deodorize, decolorize, and purify solutions. When applied to a chemical spill or to soil contaminated with a pesticide, it binds to and deactivates the pesticide molecules on contact. Activated charcoal can be used to clean spray equipment and deactivate any remaining pesticide.

Activated charcoal will not neutralize inorganic pesticides such as ars- enates, lead compounds, sodium chlorate, sulfur, or water-soluble organic pesticides such as MSMA and DSMA.

**Applying activated charcoal**

The amount of activated charcoal to apply to an area contaminated with a pesticide varies with the chemical characteristics of the pesticide. Rates usually range from about 100 to 400 pounds of activated charcoal per acre (2.3 to 9.2 pounds per 1,000 ft²) for each pound of pesticide active ingredient per acre. A general rule is to apply about 200 pounds of activated charcoal per acre (4.6 pounds per 1,000 ft²) for each pound of pesticide active ingredient per acre.

For example, suppose an herbicide was accidentally applied to an area to be seeded with turfgrass. If 2 pounds of active ingredient were applied per acre, it would take about 400 pounds of activated charcoal per acre (9.2 pounds per 1,000 ft²) to completely inactivate the herbicide. This same example would apply if an herbicide-sensitive crop were to be planted in an area previously treated with an herbicide, or in an area where herbicide residues remained.
On some sites, such as those used for mixing and loading, pesticide residues can build up over many years. In these cases, it is difficult to determine how much residue remains. Part of the soil may need to be replaced. If activated charcoal is used, some type of seed can be planted several weeks after the treatment. If the seeds germinate and the seedlings appear healthy, the herbicide has probably been deactivated. The area may need to be retreated if the seeds do not sprout, or if they look unhealthy or die.

When deactivating a pesticide in the soil, the activated charcoal needs to be thoroughly incorporated into it. Activated charcoal applied to the soil surface does not leach down into the soil. Uniform application and mixing of the activated charcoal with the soil will help ensure binding with the pesticide. How deep it must be incorporated will depend on how deeply the pesticide has penetrated. Activated charcoal is most effective if used soon after application of the unwanted pesticide.

Activated charcoal can be applied in its dry form with a spreader, but the small, light particles are easily carried away by the wind. The easiest method is to suspend the charcoal in water and apply it with a watering can (small areas) or sprayer. Activated charcoal does not mix easily with water. A 0.5% solution of a nonionic surfactant (equal to 1 quart per 50 gallons) will help form a suspension in water.

For spray applications of activated charcoal:

- make sure spray equipment, tubing, screens, and nozzles are clean; remove and examine if necessary.
- check the commercial literature or with the distributor of the activated charcoal for the proper nozzles, pressures, and other conditions to get the desired dosages; calibrate sprayer, if necessary.
- add enough water to begin agitation, then add the balance of the activated charcoal and water mixture.
- the final mix should be 1 to 2 pounds of activated charcoal per gallon of water.
- maintain moderate agitation while spraying.

Clean spray equipment thoroughly after applying activated charcoal. The particles are very abrasive and can cause excessive wear to nozzles and damage equipment.

References

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Activated Charcoal & Surface Area

1 gram (0.035 oz) of activated charcoal can have a surface area of between 200 m² (2,152 ft²) and 2,000 m² (21,520 ft²).

1 oz (28.3 g) of activated charcoal with a surface area of 500 m² per gram would have a total surface area of 152,309 ft² or 3.5 acres.

The more surface area activated charcoal has, the more chemicals it can deactivate (adsorb).
A NEW PEST OF HONEYBEES

According to a recent journal article, honeybees (*Apis mellifera*) have a new pest. Researchers recently found a species of phorid fly emerging from the bodies of dead honeybees. Other species of phorid flies parasitize wasps, ants, beetles, spiders, and bumblebees, but not honeybees. What did the researchers find? Could this new pest be related to colony collapse disorder (CCD)?

Honeybees forage for food during the daytime, seldom leaving the colony at night. During 2009 and 2010, however, researchers found masses of dead honeybees beneath lights and in light fixtures on the campus of San Francisco State University. In the laboratory, fly larvae began emerging from the bodies of the dead bees. The adults were identified as a species of phorid fly, *Apocephalus borealis* (Fig. A).

Female phorid flies placed in a container with a healthy honeybee began following the bee. The flies quickly landed on the bee’s abdomen, inserted their ovipositors for two to four seconds, and laid their eggs (Fig. B). About seven days later, mature fly larvae emerged from the area between a bee’s head and thorax (Fig. C). The larvae crawled away from the bee and formed pupae. Adult flies emerged from the pupae 28 days later, on average.

The parasitized bees showed unnatural behaviors before they died. They became disoriented, walked around in circles, and were unable to stand on their legs. The researchers tested whether bees leaving their hives at night may be another symptom of parasitism. They confirmed that the phorid flies parasitized the bees before, not after, they left the hive at night. The scientists have yet to find adult phorid flies in the hive. Therefore, the flies are probably parasitizing the honeybees in the field while the bees are foraging.

This study describes a new parasite of honeybees. It also addresses some important areas of concern.

- Is *A. borealis* the cause of hive abandonment in CCD? If so, why haven’t the flies been detected before now? The emerging larvae and pupae are obvious and many researchers and beekeepers have studied CCD intensively since 2006. This species of phorid fly was only known to parasitize bumblebees. The recent paper proposes *Apocephalus borealis* as a new parasite of honeybees.
How does the night flight in this study relate to hive abandonment in colony collapse disorder? In CCD, the bees usually abandon the hive in mass, with few left behind. In this report, the phorid flies had varying rates of parasitism during the study period. Therefore, the number of bees leaving the hive would change accordingly. Interestingly, peaks of infection occurred just before or during the time of year that losses from CCD were at their highest in the San Francisco Bay Area.

Why do varying numbers of worker bees leave the hive at night and die? An average of 45 bees left the study hive at night and the rate of parasitized bees found was as high as 90 percent. Adult phorid flies were not found in hives according to this report. The fly larvae leave the dead bees somewhere away from the hive, form pupae, and emerge as adults. This may be an evolved means of local population distribution for *A. borealis*.

Do these phorid flies carry other honeybee diseases? Adult flies and larvae contained the nucleic acids of two honeybee pathogens: a single-celled fungus, *Nosema ceranae*, and deformed wing virus. The particles may not have been infectious, but *N. ceranae* and the virus are both present in bumblebees and honeybees. *A. borealis* could be another carrier of these diseases.

Is *Apocephalus borealis* a threat to other pollinators? This phorid fly is able to parasitize several species of bumblebees, paper wasps (*Vespula* spp.), and now honeybees. It may also be a threat to native pollinators, both as a parasite and as a carrier of disease.

How could this discovery affect pollination and commercial beekeeping? During peak periods of hive abandonment, the worker bee population might become low enough to threaten the hive. If commercial beekeepers transport hives containing infected bees to new areas, there is a potential for this parasite to spread worldwide.

References


Colony Collapse Disorder [http://pestworld.stjohn.hawaii.edu/pat/AprJun09.pdf](http://pestworld.stjohn.hawaii.edu/pat/AprJun09.pdf)
ILLUSTRATED GLOSSARY

Terms from Pesticide Labels
(Recertification)

Banded spray application: Applying a pesticide product in parallel bands, leaving the area between the bands free of the chemical.

Label example: *Headline*® *may also be applied as a directed or banded spray over the rows or plant beds with alleys or row middles left unsprayed.*

Directed spray application: Applying a pesticide product to a specific area, such as a plant canopy, a row, or the base of plants.

Label example: *The following formula may be used to determine the broadcast equivalent rate for doing directed or banded sprays . . .

Definitions in this glossary are intended to help you understand the terms used on pesticide labels. Other definitions may be available for these terms. Mention of a trademark, company, or proprietary name is not an endorsement and does not imply a recommendation to the exclusion of other companies or products.
Greenhouse (WPS): A greenhouse is an operation that produces agricultural plants in a structure enclosed with nonporous covering and large enough to allow a person to enter. (Worker Protection Standard).

Label example: PRECAUTIONS, RESTRICTIONS. Desirable vegetation must not be present during application and air circulation fans must be turned off until after the application has dried. Do not use in residential greenhouses.

Root zone: The area of soil containing a plant’s roots. Normally, tree roots will extend to three times the branch spread. Only about one half of a tree’s roots are beneath the canopy.

Label example: Since Atrazine 4L® acts mainly through root absorption, its effectiveness depends on rainfall or irrigation to move it into the root zone.

Air blast (mist) sprayer: liquid is injected into a fast-moving stream of air, breaking down large droplets into smaller particles. Used for tall crops (e.g., bananas) where spray drift is a minor concern.

Label example: Mix with 20–250 gallons of water in conventional hydraulic-type or air blast sprayers.
The Pesticide Label

January–March 2012

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September 2011—The 3 C’s of Spills (p. 10), Heat vs. Pesticide Illness (p. 15)
April–August 2011—Pesticide Failure? (p. 10), Biopesticides vs. CBB (p. 14)
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