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NPTN fact sheets are designed to answer questions that are commonly asked by the general public about pesticides that are regulated by the U.S. Environmental Protection Agency (US EPA). This document is intended to be educational in nature and helpful to consumers for making decisions about pesticide use.

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**N**ational  
**P**esticide  
**T**elecommunications  
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# Pyrethrins & Pyrethroids

**The Pesticide Label:** Labels provide directions for the proper use of a pesticide product. *Be sure to read the entire label before using any product.* A signal word on each product label indicates the product's short-term toxicity.

**CAUTION-** low toxicity

**WARNING-** moderate toxicity

**DANGER-** high toxicity

## What are pyrethrins?

- Pyrethrins are insecticides that are derived from the extract of chrysanthemum flowers (pyrethrum) (1).
- The plant extract, called pyrethrum contains pyrethrin I and pyrethrin II collectively, called pyrethrins.
- Pyrethrins are widely used for control of various insect pests.

## What are pyrethroids?

- Pyrethroids are synthetic (human-made) forms of pyrethrins. There are two types that differ in chemical structure and symptoms of exposure.
- Type I pyrethroids include allethrin, tetramethrin, resmethrin, d-phenothrin, bioresmethrin, and permethrin (1, 2).
- Some examples of type II pyrethroids are cypermethrin, cyfluthrin, deltamethrin, cyphenothrin, fenvalerate, and fluvalinate (1, 2).
- Both type I and II pyrethroids inhibit the nervous system of insects. This occurs at the sodium ion channels in the nerve cell membrane. Some type II pyrethroids also affect the action of a neurotransmitter called GABA (3).

## How do pyrethrins (and pyrethroids) work?

- Nerve cell membranes have a specific electrical charge. Altering the amount of ions (charged atoms) passing through ion channels causes the membrane to depolarize which, in turn, causes a neurotransmitter to be released. Neurotransmitters help nerve cells communicate. Electrical messages sent between nerve cells allow them to generate a response, like a movement in an animal or insect.
- Pyrethrins affect the nervous system of insects by causing multiple action potentials in the nerve cells by delaying the closing of an ion channel (3).
- Pyrethrins and pyrethroids act as contact poisons, affecting the insect's nervous system (1, 4).
- Even though pyrethrins and pyrethroids are nerve poisons, they are not cholinesterase inhibitors like organophosphate or carbamate insecticides.
- Pesticide products containing pyrethrins usually contain a synergist (such as piperonyl butoxide). Synergists work by restricting an enzyme that insects use to detoxify the pyrethrins. A synergist allows the insecticide to be more effective (4).

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**There are many different types of pyrethroids, but the remainder of this fact sheet will deal with pyrethrins. Information on specific pyrethroids is available in other fact sheets.**

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## What are some types of products that contain pyrethrins?

- indoor bugbombs or foggers
- human head-lice treatments
- pet flea sprays
- Dragon
- Drione
- Pyrenone
- Pyroicide

## How toxic are pyrethrins?

### Animals

- Pyrethrins are one of the least poisonous insecticides to mammals (2).
- Rats fed high doses (1,000 milligrams per kilogram of body weight or mg/kg) of pyrethrins showed liver damage (5).
- Rats exposed to pyrethrins exhibited difficulty or rapid breathing, incoordination, sprawling of limbs, tremors, aggression, sensitivity to external stimuli, twitching, and exhaustion (6). See box on **laboratory testing**.

### Humans

- Inhaling pyrethrins can cause coughing, wheezing, shortness of breath, runny or stuffy nose, chest pain, or difficulty breathing (7).
- Skin contact can cause a rash, itching, or blisters (7).

**Laboratory Testing:** Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term and long-term health effects. In these tests, laboratory animals are purposely fed a pesticide at high doses to cause toxic effects. These tests help scientists judge how these chemicals might affect humans, domestic animals, and wildlife in cases of overexposure. When pesticide products are used according to the label directions, toxic effects are not likely to occur because the amount of pesticide that people and animals may be exposed to is low compared to the doses fed to laboratory animals.

Effects of pyrethrins on human health and the environment depend on how much pyrethrins are present and the length and frequency of exposure. Effects also depend on the health of a person and/or certain environmental factors.

## Do pyrethrins cause sensitization?

### Animals

- The crude pyrethrum (initial plant extract) contains about 30 to 35 percent pyrethrins and about 50 percent impurities (2, 5).
- Various extracts from pyrethrum flowers have caused allergic contact dermatitis in sensitized and unsensitized guinea pigs (8). The commercially refined extract, which is present in insecticides today, did not produce any allergic reactions in guinea pigs (8, 9).
- Sensitization sometimes occurs in some individuals after a single exposure which causes either an asthmatic condition or a skin rash or inflammation. After the initial exposure to the sensitizing agent, the sensitized individual responds to a dose smaller than the initial dose.

### Humans

- In one study, a person with a history of allergic contact dermatitis experimentally exposed to crude pyrethrum developed contact dermatitis, although this may have been caused by impurities in the extract (10).

## Do pyrethrins break down and leave the body?

### Animals

- Pyrethrins are low in toxicity to mammals because they are quickly broken down into inactive forms and pass from the body in the urine and feces (2, 5).

### Humans

- Pyrethrum (the plant extract) may be absorbed by the digestive tract and the lungs. However, it is poorly absorbed through the skin (5).
- Based on animal studies, any amount of pyrethrins absorbed by humans would be expected to be rapidly excreted. Therefore, it is unlikely that pyrethrins

would accumulate in humans.

## Are pyrethrins likely to cause cancer?

### Animals

- In one study, rats were fed moderate to very high doses (100, 1000, or 3000 mg/kg) of pyrethrum (the plant extract) for 104 weeks. There was an increase in the non-cancerous (benign) thyroid tumors in females exposed to all doses and in males exposed to high to very high doses (11).
- In the same study, some females fed high doses (3000 mg/kg) of pyrethrum developed ovarian and benign liver tumors and males exposed to high doses (3000 mg/kg) developed benign parathyroid tumors and benign skin lesions.
- In another study, rats were fed low doses (up to 10 mg/kg) of pyrethrins, flavoring agents, and other pesticides showed no increase in tumors (6).

### Humans

- Scientists have no data from work-related, accidental poisonings, or epidemiological studies that indicate whether or not pyrethrins are likely to cause cancer in humans.
- Initially, the Health Effects Division Carcinogenicity Peer Review Committee (CPRC) at the US EPA recently reviewed the carcinogenicity data of pyrethrins in animals and decided that they showed carcinogenicity. However, the CPRC could not classify pyrethrins into a carcinogenicity group until some of the tissue specimens from rats and mice were re-read. Subsequently, the CPRC will perform a second review of the carcinogenicity of pyrethrins (11).

**Cancer:** The U.S. EPA has strict guidelines that require testing of pesticides for their potential to cause cancer. These studies involve feeding laboratory animals large daily doses of the pesticide for up to 2 years. These animals are compared with a group of animals that did not receive the chemical. Animal studies help show whether a chemical is a potential human carcinogen. If a pesticide does not cause cancer in animal tests, then the EPA considers it unlikely the pesticide will cause cancer in humans.

## Do pyrethrins cause reproductive problems or birth defects?

### Animals

- Rabbits fed moderate doses (up to 90 mg/kg) of pyrethrins during a sensitive period of pregnancy had normal litters (5).
- Rats fed very high doses (5000 mg/kg) of pyrethrins for three weeks before their first mating produced low birth weight pups (5).
- There were no birth defects in pups of rabbits exposed to pyrethrins (12).

### Humans

- There are no epidemiological, work-related or accidental exposure data on the potential of pyrethrins to cause reproductive problems or birth defects.

## What happens to pyrethrins in the environment?

### Soil

- Pyrethrins have a soil half-life of 12 days (13). They have an extremely low pesticide movement rating because they bind tightly to the soil (13). See box on **half-life**.

### Photodegradation

- Pyrethrins are unstable in light or air (2). Pyrethrins are rapidly degraded in sunlight at the soil surface and in water.

**Half-life** is the time required for half of the compound to degrade.

<b>1 half-life</b>	<b>=</b>	<b>50% degraded</b>
<b>2 half-lives</b>	<b>=</b>	<b>75% degraded</b>
<b>3 half-lives</b>	<b>=</b>	<b>88% degraded</b>
<b>4 half-lives</b>	<b>=</b>	<b>94% degraded</b>
<b>5 half-lives</b>	<b>=</b>	<b>97% degraded</b>

Remember that the amount of chemical remaining after a half-life will always depend on the amount of the chemical originally applied.

## What effects do pyrethrins have on wildlife?

- Pyrethrins are highly toxic to fish and tadpoles. They affect their skin touch receptors and balance organs (4).
- Pyrethrins are toxic to beneficial insect (such as honeybees) and many aquatic invertebrates (4).
- Pyrethrins are low in toxicity to humans, other mammals, and birds (4).

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