This fact sheet was created in 2001; some of the information may be out-of-date. NPIC is not planning to update this fact sheet. More pesticide fact sheets are available here. Please call NPIC with any questions you have about pesticides at 800-858-7378, Monday through Friday, 8:00 am to 12:00 pm PST.

NPTN Technical Fact Sheets are designed to provide information that is technical in nature for individuals with a scientific background or familiarity with the regulation of pesticides by the U.S. Environmental Protection Agency (U.S. EPA). This document is intended to be helpful to professionals and to the general public for making decisions about pesticide use.

Lambda-cyhalothrin

(Technical Fact Sheet)

For less technical information please refer to the **General Fact Sheet**.

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 potential hazard.

CAUTION - low toxicity **WARNING - moderate toxicity** **DANGER - high toxicity**

What is lambda-cyhalothrin?

- Lambda-cyhalothrin is a pyrethroid insecticide registered by the U.S. Environmental Protection Agency (EPA) in 1988 (1).

- Pyrethroids are synthetic chemicals that are structurally similar to the natural insecticides pyrethrins. Scientists developed pyrethroid insecticides to have enhanced biological activity and desired physical and chemical properties relative to pyrethrins (2).

- Lambda-cyhalothrin is similar to the pyrethroid cyhalothrin. Cyhalothrin is a mixture of four isomers, and two of these isomers compose lambda-cyhalothrin (2, 3). Due to their similarity, researchers sometimes use toxicity tests conducted with cyhalothrin to evaluate the toxicity of lambda-cyhalothrin (3).

- Lambda-cyhalothrin is a colorless to beige solid that has a mild odor. It has a low water solubility (5×10^{-3} mg/L) and is nonvolatile with a vapor pressure of 1.5×10^{-9} mm Hg at 20 ^{o}C (2, 4).

- Signal words for products containing lambda-cyhalothrin range from Caution to Danger (5). The signal word reflects the combined toxicity of lambda-cyhalothrin and other ingredients in each product. See the **Pesticide Label** box above.

- Examples of product formulations for lambda-cyhalothrin include wettable powders, pellets, emulsifiable concentrates, solutions, impregnated materials, and microencapsulate (5).

How does lambda-cyhalothrin work?

- Pyrethroids affect the nervous system of an organism. They act by disrupting the gating mechanism of sodium channels that are involved in the generation and conduction of nerve impulses (2).

- Pyrethroids disrupt the sodium channel activation gate by keeping it in the open position. Delayed closing of the gate

results in prolonged excitation of nerve fibers (2).

- Lambda-cyhalothrin causes rapid paralysis and death to an insect when ingested or exposed externally (4). Temperature influences insect paralysis and the toxicity of lambda-cyhalothrin (6).

- Lambda-cyhalothrin has repellent properties (4).

What types of products contain lambda-cyhalothrin?

- Agricultural insecticides for food and non-food crops
- Insecticides used indoors and outdoors for homes, hospitals, and other buildings
- Greenhouse, ornamental plant, and lawn insecticides
- Insecticide products for use on cattle
- Termite treatments
- Insecticide products for use on right-of-ways
- Aerially-applied insecticides
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Exposure: Effects of lambda-cyhalothrin on human health and the environment depend on how much lambda-cyhalothrin is present and the length and frequency of exposure. Effects also depend on the health of a person and/or certain environmental factors.

What are some products that contain lambda-cyhalothrin?

- Demand®
- Karate®
- Warrior®

Laboratory Testing: Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term (acute) and long-term (chronic) health effects. Laboratory animals are purposely fed high enough 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 pets may be exposed to is low compared to the doses fed to laboratory animals.

How toxic is lambda-cyhalothrin?

Animals

- Lambda-cyhalothrin is highly to moderately toxic when ingested. The acute oral LD50 in rats is 79 mg/kg for males and 56 mg/kg for females (2, 3). In mice, the acute oral LD50 is 19.9 mg/kg (2). See boxes on **Laboratory Testing**, **LD50/LC50,** and **Toxicity Category**.

- In a 4-hour inhalation study with a lambda-cyhalothrin product, the LC50 ranged from 0.315 to 0.175 mg/L, indicating moderate toxicity (1).

- Lambda-cyhalothrin is moderately toxic when applied to the skin. The acute dermal LD50 in rats is 632 mg/kg for males and 696 mg/kg for females (2).

- In skin irritation studies, lambda-cyhalothrin causes no skin irritation in rabbits (2). The EPA classifies lambda-cyhalothrin as very low in toxicity for skin effects (3).

- Lambda-cyhalothrin causes mild eye irritation in rabbits (2). The U.S. EPA categorizes lambda-cyhalothrin as moderately toxic for eye effects (3).

LD50/LC50: A common measure of acute toxicity is the lethal dose (LD50) or lethal concentration (LC50) that causes death (resulting from a single or limited exposure) in 50 percent of the treated animals. LD50 is generally expressed as the dose in milligrams (mg) of chemical per kilogram (kg) of body weight. LC50 is often expressed as mg of chemical per volume (e.g., liter (L)) of medium (i.e., air or water) the organism is exposed to. Chemicals are considered highly toxic when the LD50/LC50 is small and practically non-toxic when the value is large. However, the LD50/LC50 does not reflect any effects from long-term exposure (i.e., cancer, birth defects, or reproductive toxicity) that may occur at levels below those that cause death.

- In studies with guinea pigs, lambda-cyhalothrin did not cause skin sensitization (2).

- In a 90-day oral study, investigators exposed male and female rats to lambda-cyhalothrin at doses of 0, 0.5, 2.5, or 12.5 mg/kg/day. At the highest dose (12.5 mg/kg/day), body weight gains were lower in both male and female rats. The no observable adverse effect level (NOAEL) was 2.5 mg/kg/day (2, 3).

- Researchers fed dogs lambda-cyhalothrin for 1 year at doses of 0, 0.1, 0.5, or 3.5 mg/kg/day. The dogs exhibited signs of neurological effects at the highest dose (3.5 mg/kg/day), but researchers detected no changes in nerve cells or tissues. The NOAEL was 0.5 mg/kg (2).

Toxicity Category

	High Toxicity (*Danger*)	**Moderate Toxicity (*Warning*)**	**Low Toxicity (*Caution*)**	**Very Low Toxicity (*Caution*)**
Oral LD50	Less than 50 mg/kg	50 - 500 mg/kg	500 - 5000 mg/kg	Greater than 5000 mg/kg
Dermal LD50	Less than 200 mg/kg	200 - 2000 mg/kg	2000 - 5000 mg/kg	Greater than 5000 mg/kg
Inhalation LC50	Less than 0.05 mg/l	0.05 - 0.5 mg/l	0.5 - 2 mg/l	Greater than 2 mg/l
Eye Effects	Corrosive	Irritation persisting for 7 days	Irritation reversible within 7 days	Minimal effects, gone within 24 hrs
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation

- In a 21-day inhalation study, laboratory workers exposed rats to lambda-cyhalothrin 6 hours a day, 5 days a week for 3 weeks at air concentrations of 0.3, 3.3, or 16.7 g/L. At the highest dose (16.7 mg/kg/day), body weight gains were lower for males, and food consumption decreased for both sexes. Workers observed the following signs of toxicity: paw flicking, erect tails, altered gait, eye tearing, and salivation. The NOAEL was 0.3 g/L (3).

- In a 21-day dermal study, scientists exposed rats to lambda-cyhalothrin doses of 1, 10, or 100 (reduced to 50) mg/kg for 6 hours/day. Two male rats died after 3 applications of 100 mg/kg. No cause of death was determined, but scientists speculated a link to lambda-cyhalothrin exposure. At the highest dose (50 mg/kg), they detected signs of toxicity in the rats and decreased body weight gain and food consumption in male rats. The NOAEL was 10 mg/L (3).

Humans

- Individuals working with lambda-cyhalothrin in laboratories reported symptoms of facial tingling and burning sensations. Symptoms began within 30 minutes of exposure and persisted for 6 hours to 2 days. All incidents involved people handling technical grade or concentrated lambda-cyhalothrin (2).

- Four field workers out of 38 reported adverse health effects from exposure to lambda-cyhalothrin. Three of the workers reported skin irritation or burning sensations developing 45-60 minutes after exposure and lasting for 5, 18, and 72 hours. The other worker experienced a skin rash that developed 24 hours after exposure and lasted several days. All workers handled concentrated lambda-cyhalothrin, and three of the four applied diluted solutions (2).

- Depending on the route of exposure, lambda-cyhalothrin may cause irritation to skin and the respiratory and digestive tracts. Abnormal skin sensations (tingling, burning, prickling), particularly in the facial region, are unique temporary symptoms of pyrethroid exposure. Systemic symptoms may include dizziness, headache, nausea, anorexia, and fatigue. In severe poisonings, seizures and coma may occur (8).

Is lambda-cyhalothrin metabolized and eliminated from the body?

Animals

- Researchers gave male and female rats a single oral dose of cyhalothrin (1 or 25 mg/kg) and determined that the rats absorbed approximately 55% of the dose. During the 7 days following dosing, the rats excreted the absorbed dose in urine (20-40%) and feces (40-65%) (2).

- Scientists have observed that cyhalothrin is extensively metabolized in multiple mammalian species. The main routes of metabolism include ester hydrolysis, oxidation, and conjugation (2).

Humans
- Human data are not available regarding the metabolism and elimination of lambda-cyhalothrin.

Does lambda-cyhalothrin cause reproductive or teratogenic effects?

Animals
- In a three generation reproductive study, researchers fed rats cyhalothrin at 0, 10, 30, or 100 mg/kg diet (approximately 0, 0.5, 1.5, or 5 mg/kg body weight/day). They detected no effects to fertility. At the highest dose (5 mg/kg/day), researchers noted decreased body weights and body weight gains in adult and progeny rats but no signs of neurological effects or tissue/cellular changes. The NOAEL was 1.5 mg/kg/day (2, 3).

- Researchers orally exposed pregnant rats to cyhalothrin on gestation days 6-15 at doses of 0, 5, 10, or 15 mg/kg/day. They detected no effect on fetal development. At the highest dose (15 mg/kg/day), they detected decreased maternal body weight gain and food consumption. The NOAEL for maternal effects was 10 mg/kg/day and 15 mg/kg/day for developmental toxicity (2, 3).

- In a developmental study, scientists orally exposed pregnant rabbits to cyhalothrin on gestation days 6-18 at doses of 0, 3, 10, or 30 mg/kg/day. They detected no developmental effects. At the highest dose (30 mg/kg/day), scientists noted decreased maternal body weight gain and food consumption. The NOAEL for maternal toxicity was 10 mg/kg/day and 30 mg/kg/day for developmental toxicity (2, 3).

Humans
- Data are not available from occupational exposure, accidental poisonings, or epidemiological studies regarding the reproductive and developmental toxicity of lambda-cyhalothrin.

Is lambda-cyhalothrin a carcinogen?

Animals
- Laboratory workers fed rats 0, 10, 50, or 250 mg cyhalothrin/kg diet (approximately 0, 0.5, 2.5, or 12.5 mg/kg body weight/day) for 2 years. They noted no evidence of carcinogenicity in the study. Workers did observe decreased body weight gain and altered blood chemistry at the highest dose (12.5 mg/kg/day). The NOAEL was 2.5 mg/kg/day (2, 3).

- Researchers fed mice cyhalothrin at 0, 20, 100, or 500 mg/kg diet (approximately 0, 3, 15, or 75 mg/kg body weight/day) for 2 years. At the two highest doses (15 and 75 mg/kg/day), they detected an increase in the incidence of mammary tumors in female mice. No dose response occurred with tumor incidence, and the frequency of tumors was comparable to that normally observed in the mouse strain. Due to the equivocal results, researchers could not attribute carcinogenicity to cyhalothrin (2, 3).

- Researchers often use studies designed to test for mutagenicity to screen chemicals for carcinogenicity. Sufficient evidence exists to determine that lambda-cyhalothrin does not have significant potential to cause mutagenicity (2, 3).

Humans

- The U.S. EPA currently classifies lambda-cyhalothrin as a group D carcinogen (9). This classification denotes that lambda-cyhalothrin is not classifiable as to human carcinogenicity. See box on **Cancer**.

- Data are not available from occupational exposures or epidemiological studies regarding the carcinogenicity of lambda-cyhalothrin.

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 over most of the lifetime of the animal. Based on these tests, and any other available information, EPA gives the pesticide a rating for its potential to cause cancer in humans. For example, if a pesticide does not cause cancer in animal tests at large doses, then the EPA considers it unlikely the pesticide will cause cancer in humans. Testing for cancer is not done on human subjects.

What is the environmental fate and behavior of lambda-cyhalothrin?

- In laboratory studies, lambda-cyhalothrin hydrolyzed in water (pH 9) with a half-life of approximately 7 days. No hydrolysis occurred in water at lower pH values (pHs 5 and 7) (2). See box on **Half-life.**

- Lambda-cyhalothrin photodegraded when exposed to sunlight in water and soil studies with half-lives of 30 days and <30 days, respectively (2).

- The half-life of lambda-cyhalothrin on plant surfaces is 5 days (10).

- A representative soil half-life for lambda-cyhalothrin is 30 days with values ranging from 28-84 days (11). In a field study, lambda-cyhalothrin degraded with a half-life of approximately 9 days (12).

- The low water solubility and high binding affinity of lambda-cyhalothrin indicates a low potential to contaminate ground water (13).

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

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

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

What effects does lambda-cyhalothrin have on wildlife?

- Lambda-cyhalothrin is highly toxic to fish (LC50 = 0.078-2.3 µg/L) and aquatic invertebrates (EC50* = 0.0023-3.3 µg/L)(14). Laboratory studies indicate that cyhalothrin has the potential to bioconcentrate in fish (2).

- Adsorption of lambda-cyhalothrin to soil and sediment reduces exposure and may lessen the risk to aquatic organisms. In field studies with lambda-cyhalothrin products, researchers detected no significant adverse effects to fish. Researchers concluded that adverse effects to aquatic invertebrates at mid and high doses were transient (15, 16).

- Lambda-cyhalothrin is low in toxicity to birds (LD50 >3920 mg/kg) (2).

- Lambda-cyhalothrin is highly toxic to bees when ingested (LD50 = 0.97 µg/bee) or exposed externally (LD50 = 0.051 µg/bee). However, no increased risk was noted to bees in a field study conducted with a lambda-cyhalothrin product (2).

*Note: EC50 = Effective concentration that generates the toxicological endpoint of interest in half of the test organisms. For aquatic invertebrates, the toxicological endpoint of interest is immobilization of the test organism.

Date reviewed: January 2001

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