

What is chlorantraniliprole?

Chlorantraniliprole is a human-made **insecticide**. It is in a class of pesticides called anthranilic diamides.¹ It controls moth and butterfly caterpillars (larvae). It also controls some beetles and “true” bugs like **aphids** and spittlebugs.^{2,3} Chlorantraniliprole was first registered for use in 2008.²

Technical Grade Chlorantraniliprole: This fact sheet refers to the technical grade, or “pure” chlorantraniliprole only. Products you buy from the store include other ingredients as well. While many of the chemicals used as other ingredients may not pose health or environmental risks, some of them can be toxic. In some cases, the other ingredients can pose greater risks than the active ingredient itself.

What are some products that contain chlorantraniliprole?

There are over 60 **products** that contain chlorantraniliprole. Some of these can only be used by licensed professionals. Products with chlorantraniliprole may be labeled for use on a variety of fruits, vegetables, potatoes, and rice. They are also used on cotton, turf grass, ornamental plants, public landscaped areas, and as seed treatments. Products containing chlorantraniliprole may be granules, concentrates, or liquids.^{2,4} Chlorantraniliprole is considered a reduced-risk pesticide for certain uses by the U.S. Environmental Protection Agency (U.S. EPA).⁴

How does chlorantraniliprole work?

Chlorantraniliprole binds to a specific receptor in muscles called the ryanodine receptor. When chlorantraniliprole binds to this receptor, it causes muscle cells to leak calcium. The muscles stop working normally. The insect is paralyzed and dies. The ryanodine receptor is different in insects than in mammals. Chlorantraniliprole binds much more tightly to the receptor in insects.^{5,6} It is toxic to insects mainly if it is eaten.⁷ Chlorantraniliprole is also toxic to insect eggs, larvae, and pupae on contact.^{8,9}



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Chlorantraniliprole is based on the extract of *Ryania speciosa*, a plant that grows in South America and the Caribbean.⁶ Scientists realized in the 1940s that *Ryania speciosa* is toxic to insects.¹⁰ *Ryania* extract was used as a registered insecticide until 1996.² *Ryania* extract itself is no longer used because it is very toxic to mammals.^{5,6}

What are pesticide tolerances?

The EPA sets legal limits for how much pesticide is allowed in food and drinking water. In food, those limits are called “tolerances.” Every pesticide has its own tolerance for each crop it can be used on. In water, those limits may be called Maximum Contaminant Levels (MCLs), health advisories (HA), or other names. The amount allowed in water is specifically regulated for some pesticides. Health advisories are issued for others.

How might I be exposed to chlorantraniliprole?

You could be exposed to chlorantraniliprole while using a product or being too close to an application. You could get chlorantraniliprole on your skin, in your eyes, or breathe it in. Granules may be mistaken for food crumbs by very young children or pets. Very low levels of chlorantraniliprole may be found in food and drinking water.^{11,12} Pesticides used on food crops have **tolerances**. **See the text box about pesticide tolerances.**

IMPORTANT: Always **follow label instructions** and take steps to minimize exposure. If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 800-222-1222. If you wish to discuss a pesticide problem, please call NPIC at 800-858-7378.

What are some signs and symptoms from a brief exposure to chlorantraniliprole?

Chlorantraniliprole is very low in toxicity to people and other mammals. Chlorantraniliprole does not irritate skin. It may be slightly irritating to the eyes. It is not a skin sensitizer.⁴ **See the text box about pesticide risk.**

Pesticide Risk: Any chemical, including pesticides, can pose risks to people, pets, or the environment. Understanding pesticide risk will help you take steps to minimize it.

The risk of a pesticide depends on two things, exposure (how much?) and toxicity (how poisonous?). The exposure is the amount you get in or on your body, or the amount that is released into the environment. The toxicity of a pesticide is a measure of how poisonous it is to people or the environment. Even products that are low in toxicity can be hazardous if the exposure is high enough. Take steps to lower your chance of exposure to reduce your risk.

If chlorantraniliprole is eaten, it is very low in toxicity.⁴ A person who drank a product containing chlorantraniliprole had abnormal heart function.¹³ Chlorantraniliprole caused some minor eye irritation in rabbits, but all signs of irritation disappeared in 72 hours.⁴ No other symptoms from exposure were found at the time this fact sheet was written. For more information about how NPIC finds scientific studies, see our page on [Writing NPIC Fact Sheets](#).

Rats fed very high doses of chlorantraniliprole had small changes to the adrenal glands. Scientists did not consider this harmful although it was treatment related.⁴

TOXICITY CLASSIFICATION - CHLORANTRANILIPROLE⁴ (see the text box about mg/kg)

	High Toxicity	Moderate Toxicity	Low Toxicity	Very Low Toxicity
Acute Oral LD ₅₀	≤ 50 mg/kg	> 50 – 500 mg/kg	> 500 – 5000 mg/kg	> 5000 mg/kg
Inhalation LC ₅₀	≤ 0.05 mg/L	> 0.05 – 0.5 mg/L	> 0.5 – 2.0 mg/L	> 2.0 mg/L
Dermal LD ₅₀	≤ 200 mg/kg	> 200 - 2000 mg/kg	> 2000 – 5000 mg/kg	> 5000 mg/kg
Primary Eye Irritation	Corrosive (irreversible destruction of ocular tissue) or corneal involvement or irritation persisting for more than 21 days	Corneal involvement or other eye irritation clearing in 8 - 21 days	Corneal involvement or other eye irritation clearing in 7 days or less	Minimal effects clearing in less than 24 hours
Primary Skin Irritation	Corrosive (tissue destruction into the dermis and/or scarring)	Severe irritation at 72 hours (severe erythema or edema)	Moderate irritation at 72 hours (moderate erythema)	Mild or slight irritation at 72 hours (no irritation or erythema)

The shaded boxes reflect the signs and symptoms from a brief exposure discussed in this fact sheet. Modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Statements. <https://www.epa.gov/sites/default/files/2018-04/documents/chap-07-mar-2018.pdf>.

You may be wondering why the “High Toxicity” column has smaller numbers than the “Low Toxicity” column. This is because if a smaller amount of the pesticide caused a health effect, it’s more toxic. If it takes a larger amount of the pesticide to cause a health effect, it’s less toxic.

What happens to chlorantraniliprole when it enters the body?

Healthy skin blocks most chlorantraniliprole from entering the body. Less than 3% of a dose of chlorantraniliprole passed through skin in a study with rats. Chlorantraniliprole was found in many places in the body after a single dose was eaten by animals. It is not expected to build up in the body.¹¹

Rats given chlorantraniliprole absorbed most of it in 5-12 hours. They excreted nearly all of it in 48-72 hours, mostly in feces but also in urine. The half-life in blood plasma was 38-82 hours. Chlorantraniliprole is broken down in the body into a number of other chemicals. The type of chemicals may depend on the species of animal.¹¹ The U.S. EPA considers these breakdown chemicals to be less toxic than chlorantraniliprole.⁴

Scientists fed a goat 10 mg/kg chlorantraniliprole for a week. They also fed hens the same dose for two weeks. Less than 1% of the dose was recovered in the goat's milk, and less than 4% was recovered in eggs.^{4,14}

What is a mg/kg?

"Mg/kg" is a way to measure a chemical dose. This can tell us how toxic a chemical is. "Mg" means milligrams of a chemical. "Kg" means one kilogram of an animal's body weight. Something that is highly toxic may kill a person with a very small amount of chemical. If something is very low in toxicity, it may take much more for that same person to become very sick or die.

Is chlorantraniliprole likely to contribute to the development of cancer or birth defects?

Chlorantraniliprole is classified as "not likely to be carcinogenic to humans" by the U.S. EPA.¹¹ Test animals did not develop more tumors than expected when they were exposed to chlorantraniliprole. Chlorantraniliprole does not cause gene mutations that damage DNA. It is not considered toxic to the immune system.^{4,7}

Chlorantraniliprole does not seem to cause birth defects. Scientists fed mother rats and rabbits up to 1,000 mg/kg per day during their pregnancies. They did not see any effects on the babies.^{4,11} When scientists fed rats chlorantraniliprole for two generations, the rats' reproduction was not affected.⁴

Has anyone studied non-cancer effects from long-term exposure to chlorantraniliprole?

Scientists gave rats, mice, and dogs chlorantraniliprole in their food for up to two years. They saw no evidence of harm at high doses within the range of 1,000-1,500 mg/kg/day. Scientists saw some changes in the rats' adrenal glands' cell structure but no change in how the glands worked. The rats, mice, and dogs had some small increases in liver weight.⁴

No information was found regarding endocrine disruption by chlorantraniliprole at the time this fact sheet was written. For more information about how NPIC finds scientific studies, see our page on [Writing NPIC Fact Sheets](#).

Other scientists force-fed rats a commercial pesticide product with chlorantraniliprole and other ingredients every day for 28 days. The rats received a very high dose of 3,750 mg/kg of chlorantraniliprole. Rats in this group gained less weight than rats in the other groups. When the scientists force-fed rats the same pesticide product every other day for 90 days at the lower doses of 375 or 187.5 mg/kg, the rats gained less weight than rats which got less or none of the pesticide product. Rats who received smaller amounts gained the same weight as control rats in both groups.¹⁵

Are children more sensitive to chlorantraniliprole than adults?

Children are not expected to be more sensitive to chlorantraniliprole than adults.⁴ However, children may act in ways that put them at greater risk of being exposed. For example, they may spend more time on the ground. They may also be more likely to place their hands in their mouths after touching treated areas.

What happens to chlorantraniliprole in the environment?

Chlorantraniliprole is persistent and mobile in the **environment**. It does not easily dissolve in water but moves in the environment because it does not bind well to soil. It breaks down in soil very slowly, with half-lives of up to 1,130 days.⁴ Soil temperature, aging, and pH affect how long chlorantraniliprole lasts. Sunlight can also break down residues on soil. In water, chlorantraniliprole is broken down by reactions with light. It also reacts with water, particularly in alkaline water.¹⁶

Its half-lives ranged from 10 to 22 days¹⁷ to 228 to 924 days in aerobic soils. The half-life on bare ground ranged from 52 to 1,130 days.⁷ When chlorantraniliprole was sprayed on rice fields at twice the labeled rate, the half-life of the pesticide in the soil was 16 days, and less than one day in water. The half-life of the pesticide in rice straw was 3.5 days.¹⁸ When chlorantraniliprole was applied to maize straw, its half-lives were 9 to 11 days.¹⁷ It is expected to build up in soil where it is used continuously.⁴ See our fact sheet to learn more about **pesticide half-life**.

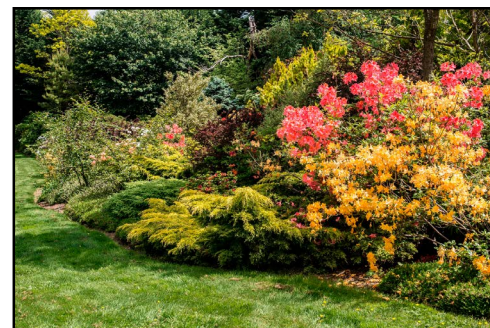


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Chlorantraniliprole breaks down in the environment to form other chemicals. At least five breakdown chemicals have been found in soil. Three others have been found in water in laboratory tests. However, scientists do not expect either the formulated products or the breakdown chemicals to be more toxic than pure chlorantraniliprole.⁴

In water, both sunlight and chemical reactions break down chlorantraniliprole.⁴ The reactions and the breakdown chemicals depend on water acidity.¹⁹

Scientists made **biochar** from walnut shells. The biochar did not affect the half-life or breakdown rate of chlorantraniliprole.²⁰ However, biochar affects the binding of chlorantraniliprole depending on the soil or biochar type. Different types of biochar decreased how much chlorantraniliprole earthworms absorbed.²¹

ECOTOXICOLOGY CLASSIFICATION - CHLORANTRANILIPROLE⁴

	High Toxicity	Moderate Toxicity	Low Toxicity	Very Low Toxicity
Avian (single dose) Oral LD ₅₀	≤ 50 mg/kg	> 50-500 mg/kg	> 500-2000 mg/kg	> 2000 mg/kg
Fish LC ₅₀	≤ 1 mg/L	> 1 - 10 mg/L	> 10 - 100 mg/L	> 100 mg/L
Aquatic Invertebrate LC ₅₀	≤ 1 mg/L	> 1 - 10 mg/L	> 10 - 100 mg/L	> 100 mg/L

HONEYBEE RATINGS⁴

	High Toxicity	Moderate Toxicity	Low Toxicity
Honeybee (direct contact or oral exposure) Acute LD ₅₀	≤ 2 µg/bee	> 2-11 µg/bee	> 11 µg/bee

The shaded boxes reflect the effects on birds, fish, and other wildlife mentioned in this fact sheet. Modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Ecotoxicity Categories for Terrestrial and Aquatic Organisms. <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0>

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Can chlorantraniliprole affect birds, fish, or other wildlife?

Chlorantraniliprole is practically non-toxic to birds when the birds are exposed for short periods of time. Bobwhite quail and mallards were fed high doses of chlorantraniliprole for longer periods of time. When bobwhite quail ate 20.7 mg/kg of chlorantraniliprole per day, the shells of their eggs were 9% thinner. When mallard ducks ate 133 mg/kg of chlorantraniliprole per day, their eggs had fewer live embryos after 3 weeks of incubation. According to the U.S. EPA, there is “no evidence of chlorantraniliprole toxicity” to mammals.¹⁶



photo credit: rainwater gallery, pixabay

Some researchers found that products with chlorantraniliprole should not harm **beneficial predatory insects or bees** when used according to the label.^{8,22,23,24} Chlorantraniliprole is low in toxicity to parasitic wasps.⁸

Other scientists have studied the effects of chlorantraniliprole on bees. They found that when honeybee larvae were fed doses of products containing chlorantraniliprole at low doses of 0.087-0.139 µg/chlorantraniliprole per larva per day, many of them died before becoming adult bees.¹⁶ Another group of scientists exposed bumblebees to chlorantraniliprole in a pollen and honey mixture. The mixture contained 0.615 mg/kg of chlorantraniliprole. The bumblebees ate the mixture for 30 days. They ate the same amount of pollen as control colonies that were not fed chlorantraniliprole. Colonies with queens showed no effects on reproduction or behavior.²⁵ However, the U.S. EPA has concluded that bumblebees may be more sensitive than honeybees to pesticide products with chlorantraniliprole.¹⁶

As expected, chlorantraniliprole is toxic to butterflies and moths.³ Monarch butterfly eggs were killed by chlorantraniliprole at very low doses of 0.018 µg/g. Chlorantraniliprole was also toxic to the monarch caterpillars when they ate leaves with residues of even lower doses. When researchers treated pupae with 0.04 µg/g of chlorantraniliprole, the butterflies did not emerge.⁹

Chlorantraniliprole is not very toxic to most soil invertebrates including earthworms.⁷ Scientists exposed earthworms to chlorantraniliprole at several low concentrations in the soil for 42 days. The concentrations of chlorantraniliprole were 0.1, 1.0, 5.0, and 10.0 mg/kg in soil. The residue built up in the earthworms' bodies. The earthworms lost weight and had fewer young at the two highest doses.²⁶ Chlorantraniliprole at high doses of 1,000 mg/kg did not affect soil isopods. One species of oribatid soil mite and a small white worm called an enchytraeid also showed no effects. The amount of organic matter in soil helped reduce the effects of chlorantraniliprole on springtails. However, very low amounts of 0.14 mg of chlorantraniliprole per kg of dried soil affected their reproduction. Scientists expect these levels to happen in the field under current use.²⁷

Short, one-time exposures to chlorantraniliprole are low in toxicity to fish. However, fish were more sensitive when exposed over longer periods of time.^{4,16} According to the U.S. EPA, risks of direct effects to amphibians are "below Agency screening levels of concern."¹⁴ No direct or indirect impacts to amphibians or reptiles are expected.⁷

Chlorantraniliprole is considered highly toxic to aquatic invertebrates.⁴ Chlorantraniliprole was highly toxic to crayfish when it was in the water, but not as residue on rice the crayfish ate. Scientists applied a seed treatment to the rice according to the label.²⁸ Other aquatic animals that are very sensitive to chlorantraniliprole include water fleas (*Daphnia*)^{29,30} and freshwater midges called chironomids.³¹ Chlorantraniliprole affected how fast midge larvae grew into adults when tested at levels found in the environment.³²

Where can I get more information?

For more detailed information about chlorantraniliprole, call the National Pesticide Information Center, Monday - Friday, between 8:00am - 12:00pm Pacific Time (11:00am - 3:00pm Eastern Time) at 800-858-7378, or visit us on the web at npic.orst.edu. NPIC provides objective, science-based answers to questions about pesticides.

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