E X T O X N E T

Extension Toxicology Network

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Michigan State University, Oregon State University, and University of California at Davis. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

Pesticide
Information
Profile

Diflubenzuron

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TRADE OR OTHER NAMES

Diflubenzuron is sold under the trade name Dimilin. It is used world wide for a variety of applications.

INTRODUCTION

Diflubenzuron is a benzamide insecticide used on forest and field crops to selectively control insects and parasites. Principle target insect species are the gypsy moth, forest tent caterpiller, several evergreen eating moths and the boll weevil. Diflubenzuron is a stomach and contact poison which acts by inhibiting the production of chitin (a compound that makes the outer covering of the insect hard) and so interferes with the formation of the insect's cuticle or shell. It is also used as a larvae control chemical in mushroom operations and animal houses.

Diflubenzuron is classified as a Restricted Use Pesticide (RUP) in the United States. Restricted Use Pesticides may be purchased and used only by certified applicators.

TOXICOLOGICAL EFFECTS

ACUTE TOXICITY

Diflurobenzuron is slightly toxic pesticide and carries the signal word CAUTION. No overt signs of toxicity were observed in any of the acute studies conducted (3). The oral LD50 for rats and mice is greater than 4,640 mg/kg and the rat dermal LD50 is greater than 10,000 mg/kg and greater than 4000 mg/kg for rabbits. The inhalation LD50 for rats and rabbits was >35 and >30 mg/l, respectively. The breakdown products formed in sheep, swine, and chickens, are also slightly toxic. The rat oral LD50 is between 1080 and 4640 mg/kg.

CHRONIC TOXICITY

No measurable pathological changes were observed at very low, long term exposure to diflurobenzuron (3).

In a study with cats fed over a wide range of doses for 21 days, all of the females had dose-related blood chemistry changes at low doses and the males exhibited changes at dose levels that were slightly higher (3). The chemistry changes were associated with the formation of methemoglobin. This is a form of hemoglobin that is unable to carry oxygen. Methemoglobin formation is reversible however.

Reproductive Effects

Day-old ducks and turkeys fed moderate amounts of the pesticide in their diets for 90 days had decreased testosterone levels after 42 days, but this did not occur in chickens and pheasants in the same study. Combs and wattles, which reflect hormone activity, appeared unaffected. Other studies showed some comb abnormalities. Some were underdeveloped and others more developed compared to controls.

Testosterone levels in rats and bull calves was studied and a short term decrease was shown in the sexually immature rats but no clear cut change was shown in the young bulls (3).

When female rats were fed very high levels of diflurobenzuron over one generation (through one-litter), dose-related effects on liver weight were seen in the parents and offspring. A three-generation study on rats at much lower doses, showed no effect on mating performance. It does not appear that diflurobenzuron has a significant effect on reproduction at low exposure levels in test animals and similar results may be expected in humans.

Teratogenic Effects

Newborn rats and rabbits did not develop any birth defects after their mothers were exposed to low levels of diflurobenzuron (1 to 4 mg/kg) on days 6 to 18 of gestation.

Mutagenic Effects

Extensive testing on mamalian cells and on bacterial cells have shown that diflurobenzuron is not mutagenic.

Carcinogenic Effects

Rats fed diets containing low to moderate amounts of diflubenzuron daily for two years had no increase in the number of new or abnormal tissue growths or lesions. Mice fed low doses for eighty weeks showed no significant tumor development. Other studies on both species at higher levels were also negative for malignant tumors (3). It does not appear that diflurobenzuron would pose a cancer threat to humans at low levels of exposure.

Organ Toxicity

Rats given moderate amounts of the compound for two years had enlarged spleens while mice in a similer study had liver and spleen enlargement at slightly lower levels of exposure. This suggests that moderate levels of exposure over a lifetime might pose a risk to humans.

Fate in Humans and Animals

Intestinal absorption in mammals decreases with increasing dose levels (5). For example, in rats the total excretion in urine and bile decreased from about fifty percent of the dose at 4 mg/kg to only four percent at 900 mg/kg. Mice showed similar results.

A cow given 10 mg/kg orally, eliminated almost all of the product over a four-day period. There were only minute amounts of the pesticide in the milk. The chemical is not degraded in the digestive tract, but that which is absorbed by the gut is completely broken down before excretion (3). Rabbits' skin absorbed only very small amounts, all of which was recovered in the urine.

Chickens excreted almost all of an oral dose in 13 days. Their eggs had low levels of pesticide residues (0.3 to 0.6 mg/kg) from day nine to the end of the nine-week study. The test animals were fed with 10 mg/kg diflubenzuron in their feed. A 28-day study at very low doses produced no residues in the eggs and only minute amounts of the compound were deposited in the fat. Body tissues (non-fatty) do not retain diflubenzuron.

ECOLOGICAL EFFECTS

Diflurobenzuron is practically non toxic to wild birds. Bobwhite quail and mallard ducks both have an eight-day dietary LC50 of greater than 4640 ppm. The 96-hour LC50 for diflurobenzuron in various fish were: bluegill sunfish, 660 ppm; rainbow trout, 240 ppm; saltwater minnow 255 ppm; channel catfish 180 ppm. Oyster larvae and juveniles had EC50s of 130 and 250 ppm, respectively. These values indicate the the compound is practically non-toxic to aquatic invertebrates and to fish. Fish tissue can show some traces of the metabolites when water is contaminated with

diflubenzuron, however, tissue concentrations decline steadily with time in clean water.

Insects and other arthropods are most susceptible in the pre- molting stage. For instance, fiddler crabs, exposed for as little as one week at levels up to 50 ppb exhibited limb regeneration effects (7).

ENVIRONMENTAL FATE

The rate of degradation in soil is strongly dependent on the particle size of the diflubenzuron (5). For larger particles (10 microns) the half-life is 8 to 16 weeks and for smaller particles (2 microns) it is 0.5 to 1 week. Almost all of the parent compound breaks down to form DFBA and CPU. A very minor amount forms 4-chloroaniline (PCA) which rapidly binds to the soil. Under field conditions diflubenzuron has very low mobility.

In sterilized water (no microbes), there appears to be little degradation under neutral or acidic conditions. However, under field conditions it is degraded rapidly, with CPU being the major metabolite. Residues could not be detected 72 hours after an application of 110 g/hectare of field water. Other studies suggest half-lives of one to three weeks.

Very little diflubenzuron is absorbed, metabolized, or translocated in plants. It also is not readily taken up from treated soil. Although very persistent in greenhouse studies (5), residues on crops such as apples have a half-life of five to ten weeks. The half-life in oak leaf litter is six to nine months.

Exposure Guidelines:

NOEL:	dog: 2 mg/kg (ppm), based on changes in met- and sulfhemoglobin mouse: 2.4 mg/kg (ppm), based on changes in met- and sulfhemoglobin rat: 2 mg/kg (ppm), based on toxic effects
ADI:	0.02mg/kg/day (WHO)
RfD:	0.02mg/kg/day
LEL:	10 mg/kg/day (rat)

Physical Properties:

CAS #:	35367-38-5
Chemical name:	N-[{(4-chlorophenyl) amino}carbonyl]-2,6-difluorobenzamide
Chemical class/use:	benzamide insecticide

Solubility in water:	0.08 mg/l
Solubility in other solvents:	DMSO 12 g/100 g; acetone 0.615 g/100 g; methanol 0.09 g/100 g
Melting Point:	230-232 degrees C
Vapor Pressure:	9 x 10 to the minus 10 power mm Hg
Partition Coefficient:	5,000 (octanol/water)

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