

Pyrethrin is a term used to describe the extract from one of the chrysanthemum species. The major components of pyrethrin are pyrethrin I, pyrethrin II, cinerin I, cinerin II, jasmolin I, jasmolin II. Pyrethrin is often described as one of the safest insecticides.

Pyrethroids are synthetic versions of pyrethrin. They are not included in this review.

### Acute toxicity

Pyrethrins are slightly to moderately toxic to mammals. They are extremely toxic to aquatic life. Pyrethrins are neurotoxic.

### Chronic toxicity

Carcinogenic tests have not been completed. Two older mutagenic studies are briefly mentioned, both with negative results. Teratogenic effects were seen in a rat study (dose-related increase in resorptions) and chick embryo study (damaged testes with absence of gonadocytes). A rabbit study using doses of 0 and 90 mg/kg found no apparent teratogenic effects. Reproductive effects (changes in fertility, decreased weanling weights) were seen in two studies.

### Environmental Fate

The literature did not include any specific data on the mobility of pyrethrins in soil or water. However, pyrethrins are practically insoluble in water. They undergo rapid photodecomposition -- one reference stated 90% of pyrethrin 1 will decompose within 12 minutes under a sunlamp at 40 degrees C. Historically, much of the safety of pyrethrins is attributed to their rapid decomposition. Thus, while direct data is not available, it is very likely persistence and mobility should not be of concern in outdoor applications. However, persistence in interior applications without direct sunlight could be much more significant. In stored grain, up to 50% of the applied pyrethrins remain after 3-4 months of storage.

### Synergists, other active ingredients, contaminants

One of the most common synergists used in conjunction with pyrethrin is piperonyl butoxide. It is also highly toxic to fish. Carcinogenic and mutagenic tests have had mixed results -- some positive, some negative. Fertility effects were found in four studies cited in RTECS. In mammals, piperonyl butoxide inhibits certain enzymes which normally detoxify many drugs and other

chemicals. A heavy exposure might make a person temporarily vulnerable to a variety of toxic insults that would normally be tolerated with ease.

Another synergist, N-octyl bicycloheptene dicarboximide, affected the female fertility index and newborn growth statistics at 346 mg/kg in a reproductive test.

Active ingredients used in combination with pyrethrins include methoxychlor, DEET, and DDVP. Methoxychlor is an experimental equivocal tumorigenic agent and experimental carcinogen. Mutagenic tests have been positive. DDVP also is considered an equivocal carcinogen, has positive mutagenic data, and is also highly acutely toxic.

While no data was available on possible contaminants, according to the literature, pyrethrins are extracted from the plant material using kerosene, alcohol, acetone, or ethylene dichloride. Ethylene dichloride is considered to be a carcinogen (sufficient evidence) by the National Toxicology Program.

### Conclusions

Pyrethrins have a uniform reputation as safe pesticides. Unfortunately, a review of the limited existing studies does not support that reputation. Teratogenic effects were noted in both rats and birds. In the rat study, the effects were dose-related and observed at even comparatively low doses. Reproductive effects in two different rat studies were also found, although at higher doses.

The synergists and other active ingredients found in many formulations are also of concern. Many have positive test results from long-term studies. One of the possible contaminants is a known carcinogen.

Finding specific test results was unusually difficult in this review. Some of the review articles referred to tests which were completed in the 1930's and 1940's. Manufacturers of pyrethrins will have to provide more recent and complete data to support reregistration. Once the new data is available, a re-review may reach very different conclusions.