chemicalWATCH Factsheet

METHOPRENE

Methoprene, an insect growth regulator, is being applied to many home and community pest control problems as a general use, slow-acting insecticide. This chemical can be used to control a number of pests, including fleas (Precor™), mosquitoes (AltosidTM), pharaoh ants, leaf miners and hoppers, and cucmber beetles. It is also used as an insect control in food production and agriculture (U.S. EPA 1991). EPA estimated in 1982 that 57% of use at that time was as an additive to cattle feed and mineral supplements to control horn flies.

Mode of Action

This chemical is an analog to a unique insect-growth regulating hormone, which does not ressemble any known mammalian hormones. Use requires careful attention to timing and patience. Applied at very low rates, while insect populations are still in the egg or larval stage of their life cycle, methoprene prevents development to the adult reproductive stages so that insects die in arrested immaturity. Methoprene is not toxic when applied to adult stages of the target insect. Because the chemical interferes with the insect's normal life cycle and is not directly toxic to the pest, it is considered to be a biochemical pesticide (EXTOXNET 2001).

Toxicity

According to information contained in a 1982 EPA Registration Standard, methoprene is of extremely low acute toxicity to mammals (LD50 equals 36,500 mg/kg). It is not a skin or eye irritant, although it is slightly toxic via dermal absorbtion. For this effect, methoprene is a toxicity category III with the signal word CAUTION required on the label

(U.S. EPA 1991).

No adverse effects have been reported in animal bio-assays for long-term health effects and short-term tests for mutagenicity were all negative. EPA reviewers found that animals rapidly metabolize and excrete the material, the major non-water soluble metabolite in animal assays being cholesterol.

Ecological Effects

Methoprene may have severe developmental effects on frogs. It was found to be a possible cause of a sharp rise in the incidence of frog deformities throughout North America. A 1997 study linked pesticides to frog deformities when they found a higher number of hindlimb frog deformities occurring in agricultural areas (Oulette 1997).

It is believed that a breakdown product of methoprene mimics retinoic acid, an important chemical to the development of fish and frog embryos. Laboratory tests involving raised levels of retinoic acid have resulted in a majority of the limb deformities found in the North American frogs (Conlan 1996).

Methoprene also has a moderate toxicity towards both warm and cold water, freshwater fish, although exposure of these organisms is limited due to methoprene's rapid degradation in unshaded water. It is highly acutely toxic to estuarine and marine invertebrates, which play an important role in the delicate estuarine ecosystem. The LC_{50} (concentration needed to kill half of the test population) for fresh water shrimp is greater than 0.1 ppb (parts per billion) and the LC_{50} for the estuarine mud crabs is greater than .0001 ppb. Meanwhile, the level of methoprene released into an

environment from a general application is expected to be around 10 ppb (EXTOXNET 2001).

Environmental Fate

Studies reviewed by EPA indicate that if protected from light, methoprene is quite stable in water within the pH range 5-9, not degrading after 30 days in the dark. The BioIntegral Research Center of Berkeley, CA reports that methoprene used inside homes is active for at least 6 months against developing fleas. When exposed to light, however, methoprene degrades within 7 days to more than 50 products, not all of which have been identified.

The chemical's soil half-life is between 10-14 days in four soils tested, where it is microbially degraded to carbon dioxide and soil-bound products.

Although the mode of action and low persistence of methoprene imply that resistance problems should be slow to develop, resistance to insect growth hormones has been induced experimentally and therefore might be possible in the field.

Data Gaps

A Reregistration Eligibility Document has been created for methoprene and most products were accepted for reregistration for use in the United States. However, the U.S. EPA is still requiring an estuarine invertebrate life cycle study in order to determine adverse effects of methoprene on those species from long term exposures to briquette formulations of the pesticide (EXTOXNET 2001).

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Methoprene *chemicalWATCH* Factsheet Bibliography

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