National Center of Forest Health Management/Forest Health Protection

TECHNOLOGY
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Bibliography

The Effects of Diflubenzuron on Non-targets

Amy Onken

USDA Forest Service FHM-NC-02-95
January 1995

Pesticide Precautionary Statement

This publication reports on the use of pesticides. It does not contain recommendations for pesticide use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and Federal agencies before they can be recommended.

Caution: Pesticides may be injurious to humans, domestic animals, desirable plants, and fish or other wildlife, if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

The use of trade, firm, or corporation names in this publication is for the benefit of the reader. Such use does not constitute an endorsement or approval of any service or product by the U.S. Department of Agriculture to the exclusion of others that may be suitable.

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Preface

The following is a subset of the Diflubenzuron Bibliography (FHM-NC-02-95) which is maintained by USDA Forest Service, Forest Health Protection, Morgantown, WV. All references pertaining to the effects of Diflubenzuron on non-targets have been categorized (see table of contents) and references for each category are listed in alphabetical order by author's name. Copies of articles can be received from the Morgantown office, but only from references that are preceded by double asterisks (**). This list of Diflubenzuron non-target references will be updated every 6 months.

If you have any questions or would be interested in receiving copies of articles, please contact:

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Invertebrates

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EVALUATION OF INSECT GROWTH REGULATORS AGAINST FLORIDA USA CHIRONOMIDS EFFECTS ON AQUATIC NONTARGET INVERTEBRATES
48TH MEETING, ANAHEIM, CALIF., USA, JAN. 20-23, 1980. PROC PAP ANN CONF CALIF MOSQ VECTOR CONTROL ASSOC INC 48 (0). 1980 . 99.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Descriptors/Keywords: CHIRONOMUS-DECORUS, GLYPTOTENDIPES-PARIPES, CYCLOPS-SPP,CHAOBORUS BAETIS-SP, DIFLUBENZURON, 2 METHOXY-9-4-ISOPROPYLPHENYL-2 6-DIMETHYL NONANE 1-4 ETHYLPHENOXY-6 7-EPOXY-3 7-DIMETHYL-2 OCTENE, INSECTICIDES

ALI A; LORD J
IMPACT OF EXPERIMENTAL INSECT GROWTH REGULATORS ON SOME NONTARGET AQUATIC INVERTEBRATES
MOSQ NEWS 40 (4). 1980. 564-571.
Full Journal Title: Mosquito News
Language: ENGLISH
ABSTRACT
Adverse effects of 3 IGR [insect growth regulators], 25% WP [wettable powder] of diflubenzuron, 25% WP and 0.5% G [granular formulation] of Bay SIR-8514 [1-(4-trifluoromethoxyphenyl)-3-(2-chlorobenzoyl)-urea] and EC-4 [emulsifiable concentrate] of MV-678 [2 methoxy-9-(4-isopropylphenyl)- 2,6-dimethylnonane] were studied, when evaluated for chironomid control in a few experimental ponds, a sewage polishing-pond and a natural pond on aquatic nontarget invertebrates. WP and G of SIR-8514 at 56 and 112 g AI[active ingredient]/ha adversely affected Cyclops spp., Collembola, Chaoborus larvae, nymphs of Baetis sp., notonectids and corixids, and larvae of Coleoptera in experimental ponds. Difflubenzuron at 28 and 56 g AI/ha reduced Cyclops spp., Collembola, Chaoborus sp. and Baetis sp. in these ponds, but Cyclops spp. and Coleoptera showed more sensitivity to SIR-8514. EC of MV-678 at 56 and 112 g AI/ha proved the least harmful to invertebrates. In sewage pond, SIR-8514 (WP) at 70 g AI/ha adversely affected Cyclops spp. and Hyalella azteca. Cypridopsis sp. and Oligochaeta were not affected. EC of MV-678 at 0.22 kg AI/ha had no significant ($P > 0.05$) adverse effects on Diaphanosoma brachyurum, Bosmina coregoni, Ceriodaphnia spp., Diaptomus spp., Hydrachnellae, Hirudinea and Oligochaeta in the natural pond.

Keywords/ CYCLOPS-SPP, COLLEMBOLA, CHAOBORUS BAETIS-SP, COLEOPTERA, HYALELLA-AZTECA, CYPRIDOPSIS-SP, OLIGOCHAETA, DIAPHANOSOMA-BRACHYURUM, BOSMINA-COREGONI, CERIODAPHNIA-SP, DIAPTOMUS-SPP, HYDRACHNELLAE, HIRUDINEA, CHIRONOMID, NOTONECTID, CORIXID, DIFLUBENZURON, MV-678, 2 METHOXY-9-4-ISOPROPYLPHENYL-2 6-DIMETHYL NONANE, BAY-SIR-8514, 1-4 TRI FLUOROMETHOXYPHENYL-3-2-CHLOROBENZOYL UREA, ENVIRONMENTAL TOXICITY, SEWAGE, WATER POLLUTION, INSECTICIDE

***ALI, A., AND M. S. MULLA*. 1978. IMPACT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON INVERTEBRATES IN A RESIDENTIAL-RECREATIONAL LAKE. (AL) ARCH. ENVIRON. CONTAM. TOXICOL. 7:483-491.

***ALI A; MULLA M S*

EFFECTS OF CHIRONOMID LARVICIDES AND DIFLUBENZURON ON NONTARGET INVERTEBRATES IN RESIDENTIAL RECREATIONAL LAKES
ENVIRON ENTOMOL 7 (1). 1978 21-27.
Full Journal Title: Environmental Entomology
Language: ENGLISH
ABSTRACT
Effects of granular formulations of chlorpyrifos, temephos, and diflubenzuron on nontarget invertebrates in 2 residential-recreational lakes [North and South Silver Lakes, California, USA] were studied during June, 1976-Jan., 1977. Chlorpyrifos at 0.22 kg (.0074 ppm) AI[active ingredient]/ha in partial areas (fingers) of one lake, and at 0.14 kg (.003 ppm) AI/ha in the other entire lake was evaluated. Temephos at 0.28 kg (.0092 ppm) AI/ha in the fingers, and at 0.17 kg (.0042 ppm) AI/ha in main areas of the same lake was tested. Diflubenzuron at 0.11 kg (.0037 ppm) and at 0.22 kg (.0074 ppm) AI/ha was applied to the fingers only. All 3 chemicals reduced populations of Daphnia pulex Leydig and D. galeata Sars from the fingers but they recovered within 1-3 wk. Bosmina longirostris (O. F. Muller) was susceptible to temephos and chlorpyrifos but tolerated diflubenzuron. Cyclops sp. was affected by temephos only. Diaptomus spp. were affected by diflubenzuron, slightly at the lower and severely at the higher rate, recovering within 2 wk. Cyprinotus sp., tolerant to temephos, was reduced by chlorpyrifos, 60-90% in the fingers, and up to 80% in the main lake, recovering in 1-4 wk. Cyprinotus sp. also was affected by diflubenzuron at 0.22 kg AI/ha. Hyalella azteca (Saussure), tolerant to temephos, was markedly reduced by chlorpyrifos as well as diflubenzuron for several wk. Oligochaetes (mostly Naididae) were not affected by any treatment employed during this study. The impact on nontarget organisms was much more severe and longer lasting when most or the entire habitat was treated as compared to partial treatments in semi-isolated fingers.

Keywords/ DAPHNIA-PULEX, DAPHNIA-GALEATA, BOSMINA-LONGIROSTRIS, CYCLOPS-SP, DIAPTOMUS-SPP, CYPRINOTUS-SP, HYALELLA-AZTECA, OLIGOCHAETES, CHLORPYRIFOS, TEMEPHOS, CONCENTRATION, POPULATION TOLERANCE, RECOVERY, NORTH AND SOUTH SILVER LAKES CALIFORNIA, USA

ALI A; NIGG H N; STAMPER J H; KOK-YOKOMI M L; WEAVER M
DIFLUBENZURON APPLICATION TO CITRUS AND ITS IMPACT ON INVERTEBRATES IN AN ADJACENT POND
BULL ENVIRON CONTAM TOXICOL 41 (5). 1988. 781-790.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Keywords/ INSECTICIDE, WATER POLLUTION, ZOOPLANKTON

ALI, A., AND B. H. STANLEY. 1981. EFFECTS OF A NEW INSECT GROWTH REGULATOR, UC-62644, ON TARGET CHIRONOMIDAE AND SOME NON-TARGET AQUATIC INVERTEBRATES. MOSQUITO NEWS. 41(4):692-701.

***ANTIA N J; HARRISON P J; SULLIVAN D S; BISALPUTRA T*
INFLUENCE OF THE INSECTICIDE DIFLUBENZURON DIMILIN ON THE GROWTH OF MARINE DIATOMS AND A HARPACTICOID COPEPOD IN CULTURE
CAN J FISH AQUAT SCI 42 (7). 1985. 1272-1277.
Full Journal Title: Canadian Journal of Fisheries and Aquatic Sciences
Language: ENGLISH
ABSTRACT
Diflubenzuron (Dimilin) was tested, in the concentration range 0.1-5000 .mu.g .cntdot. l-1, for possible injurious effects on the growth and photosynthesis of 3 chitin-producing (Thalassiosira weissflogii, T. nordenskioldii, Cyclotella cryptica) and 1 nonchitinaceous (Skeletonema costatum)

diatoms. The effects of the pesticide were also examined on adult survival and juvenile development of the harpacticoid copepod Tigriopus californicus. While the development of the copepod was hindered at concentrations of the order of 1-10 .mu.g .cntdot. l-1, the diatoms were barely affected by Dimilin even at the highest concentration tested (5 mg .cntdot. l-1). Dimilin acts specifically on insects and crustaceans as a larvicide by interfering with chitin deposition into cuticles during juvenile development through ecdysis. The lack of effect from Dimilin on the chitin-producing diatoms suggested that the insecticide may not inhibit chitin biosynthesis per se as was previously believed, but that it presumably deregulates one or more of the larval postsynthetic processes responsible for chitin integration into cuticles.

Keywords/THALASSIOSIRA-WEISSFLOGII, THALASSIOSIRA-NORDENSKIOLDII, CYCLOTELLA-CRYPTICA, SKELETONEMA-COSTATUM, TIGRIOPUS-CALIFORNICUS, PHOTOSYNTHESIS, CHITIN, PRODUCTION, JUVENILE, DEVELOPMENT, LARVICIDE, CUTICLE

***APPERSON C S; SCHAEFER C H; COLWELL A E; WERNER G H; ANDERSON N L; DUPRAS E F JR; LONGANECKER D R*
EFFECTS OF DIFLUBENZURON ON CHAOBORUS ASTICTOPUS AND NONTARGET ORGANISMS AND PERSISTENCE OF DIFLUBENZURON IN LENTIC HABITATS
J ECON ENTOMOL 71 (3). 1978 521-527.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
Diflubenzuron [1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl)-urea] applied to 3 farm ponds at rates of 10, 5 and 2.5 ppb, and a lake at 5 ppb, inhibited emergence of adult C. astictopus Dyar and Shannon 2-7 days following the treatments by 95-100%. Emergence reoccurred in some ponds 4.5-6 wk after treatment. Larval populations in the ponds declined by 98, 88 and 44% of pretreatment at 10, 5 and 2.5 ppb, respectively, and recovered to 30, 87 and 131% of pretreatment numbers, respectively. In the control pond, larvae declined by 53% during the same period but increased to 314% of initial numbers. In the lake, larvae decreased by 99% of the pretreatment level 3 wk posttreatment and remained at low levels. Suppression of crustacean zooplankton occurred at all treatment rates. Cladocerans were more susceptible than copepods and required longer recovery periods. Pond and lake rotifer and algal populations were not altered by the treatments. Bluegill sunfish, Lepomis macrochirus Rafinesque, collected from the lake fed predominantly on cladocerans and copepods but switched to chironomid midges and terrestrial insects after the treatment. Fish growth was not altered by the treatment. Residues in ponds treated at 10, 5 and 2.5 ppb averaged 9.8, 4.6 and 1.9 ppb, respectively, shortly after the applications, and declined steadily averaging 0.2, 0.3 and 0.5 ppb, respectively, 2 wk later. diflubenzuron residues in the lake averaged 3.3 ppb following treatment, and after 35 days, averaged 0.4 ppb. No residues were found in lake sediment. Residues in white crappie, Pomoxis annularis Rafinesque, varied from 355.1-62.2 ppb at 4 and 21 days, respectively, following treatment. Fish residues did not persist at high levels and by 14 days post-treatment, they had begun to decline rapidly.

Keywords/ LEPOMIS-MACROCHIRUS, POMOXIS-ANNULARIS, CLADOCERANS, COPEPODS, ROTIFERS, ALGAE, CHIRONOMIDS, TERRESTRIAL INSECTS, INSECT GROWTH REGULATOR, RESIDUES

ARSHAD, A., AND B.H. STANLEY. 1981. EFFECT OF A NEW INSECT GROWTH REGULATOR, UC-62644, ON TARGET CHIRONOMIDAE AND SOME NON-TARGET AQUATIC INVERTEBRATES. MOSQUITO NEWS 41 (4): 692-701.

BELLUCK D; FELSOT A

BIO CONCENTRATION OF PESTICIDES BY EGG MASSES OF THE CADDIS-FLY TRIAENODES TARDUS
BULL ENVIRON CONTAM TOXICOL 26 (3). 1981. 299-306.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Descriptors/Keywords: DDT, DDD, HEXA CHLORO BENZENE, CARBOFURAN, DIELDRIN, METHOXYCHLOR, TERBUFOS, MALATHION, DIFLUBENZURON, MONURON, WATER POLLUTION

BOCSOR, J. G. AND R. B. MOORE. 1975. THE EFFECTS OF DIMILIN ON A STREAM MACROINVERTEBRATE COMMUNITY. IN: REPORT STATE UNIV. OF NEW YORK, LAKE ONTARIO ENVIRONMENT LAB.

BOOTH, G. M. 1975. THE IMPACT OF DIMILIN W-25 ON NON-TARGET INVERTEBRATES IN PONDS LOCATED IN SALT LAKE COUNTY, UTAH. FINAL REPORT. (UNPUBLISHED STUDY RECEIVED FEB. 10, 1976 UNDER 6G1744, PREPARED BY BRIGHAM YOUNG UNIV., DEPT. OF ZOOLOGY, SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS.

***BRADT P T; WILLIAMS J A*
RESPONSE OF HYDROPSYCHIDAE INSECTA TRICHOPTERA LARVAE TO DIFLUBENZURON
J PA ACAD SCI 64 (1). 1990. 19-22.
Full Journal Title: Journal of the Pennsylvania Academy of Science
Language: ENGLISH
ABSTRACT
The purpose of this study was to test the effects of diflubenzuron on a widely distributed stream insect. Hydropsychidae (Insecta: Trichoptera) larvae were collected from a local stream and exposed in the laboratory to different concentrations of diflubenzuron (0.25 ppm 0.025 ppm and 0.0025 ppm active ingredient), an insect growth regulator. Fifteen days following exposure 1.9% (8 out of 419) Hydropsychidae larvae survived at 0.0025 ppm, 2.2% (10 out of 459) at 0.025 ppm and 0.59% (2 out of 449) at 0.25 ppm. In the control tanks 44.6% (193 out of 433) of the larvae survived, including 31.6% (137) of the surviving larvae that emerged as adults. Percent survival in the control tanks was lowest (40 to 42%) in May and June when tank water temperatures exceeded those temperatures occurring naturally in the stream. In the three experimental tanks no larvae emerged. Seventy-seven percent of the deaths in the experimental tanks occurred in the first seven days following exposure. The genus Hydropsyche comprised 94% of the test organisms while Cheumatopsyche made up the remaining 6%. These results suggest that extreme care should be taken when Hydropsychidae larvae may be exposed directly or indirectly to low concentrations of diflubenzuron.

Keywords/ CHEUMATOPSYCHE, INSECT GROWTH REGULATOR, INSECTICIDE, BIOLOGICAL CONTROL, NON-TARGET ORGANISM, DEATH

BROWN., P. L. , R. W. LANGDON, AND R. B. MOORE. 1975. EFFECTS OF DIMILIN ON STREAM PLANKTON. IN: REPORT STATE UNIV. OF NEW YORK, LAKE ONTARIO ENVIRONMENTAL LAB.

CROSBY, D.G. 1964. TOXICITY OF CASORON TO DAPHIA MAGNA ; REPORT THOMPSON-HAYWARD CHEMICAL COMPANY NO.

EISLER R

DIFLUBENZURON HAZARDS TO FISH WILDLIFE AND INVERTEBRATES A SYNOPTIC REVIEW

U S FISH WILDL SERV BIOL REP 4 (25). 1992. I-III, 1-36.
Full Journal Title: U S Fish and Wildlife Service Biological Report
Language: ENGLISH

ABSTRACT

Diflubenzuron(1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl)urea), also known as dimilin, is a potent broad-spectrum insect growth regulator that interferes with chitin synthesis at time of molting and is effective in controlling immature stages of insects. Diflubenzuron seldom persists for more than a few days in soil and water. When used properly in forest management, it is unlikely to be leached into ground water from the application site. Degradation in water and soils is most rapid when small particle formulations are applied; microorganisms are abundant; and at elevated pH, temperature, and organic loading. Chemical and biological processes initially yield 2,6-difluorobenzoic acid and 4-chlorophenylurea. Soil degradation processes and plant and animal metabolism involve further conversion of these compounds to 2,6-difluorobenzamide and 4-chloroanaline. Ultimately, the end products are either conjugated into mostly water soluble products or biologically methylated. Diflubenzuron applied to foliage of terrestrial plants tends to remain adsorbed for several weeks with little or no absorption or translocation from plant surfaces; loss occurs mainly from wind abrasion, rain washing, or shedding of senescent leaves. Among terrestrial insects, there is great variability in sensitivity to diflubenzuron. Sensitive pestiferous species of insects die at topical applications of 0.003-0.034 .mu.g per larvae or after consuming diets containing 0.1 mg/kg. Some beneficial insects, such as the honey bee (Apis mellifera), are adversely affected at 1 mg/kg fresh weight (FW) of diet. Diflubenzuron application rates between 28 and 56 g/ha (0.025-0.05 pounds per acre) or 2.5 to 16 .mu.g/L are highly effective against pestiferous aquatic dipterans, including representative chaoborids, chironomids, and culicids. These same dosages temporarily suppress nontarget populations of cladocerans, copepods, mayfly nymphs, corixids, and springtails; population recovery is usually complete within 80 days. Adverse effects on crustacean growth, survival, reproduction, and behavior occur between 0.062 and 2 .mu.g/L. Next in sensitivity are mayflies, chironomids, caddisflies, and midges; concentrations between 0.1 and 1.9 .mu.g/L produce low emergence and survival. Moderately resistant to diflubenzuron are larvae of diving beetles, dragonfly adults and naiads, ostracods, spiders, backswimmers, and water boatmen. Relatively tolerant of diflubenzuron (i.e., no observable adverse effects at .ltoreq. 45 .mu.g/L) are the algae, molluscs, fishes, and amphibians. High accumulations occur on some aquatic plants during exposure to 100 .mu.g/L and in fish during exposure to 1 to 13 .mu.g/L, but all species in these groups seem unaffected by elevated body burdens and grow and metabolize normally. Birds seem comparatively resistant to diflubenzuron acute oral LD50 doses exceed 2,000 mg/kg body weight (BW); dietary concentrations < 4,640 mg/kg FW are tolerated for at least 8 days; and forest birds seem unharmed by recommended diflubenzuron application procedures to control pestiferous insects. Studies on small laboratory animals and domestic livestock indicate no observable effects in cows (Bos bovis) rabbits (Oryctolagus cuniculus) dogs (Canis familiaris) and rats (Rattus spp.). All experimental studies conducted with laboratory animals indicate that diflubenzuron is nonmutagenic, nonteratogenic, and noncarcinogenic. Adverse effects occur in dogs fed diets containing 160 mg/kg (6.2 mg/kg BW daily) for 13 weeks (abnormal blood chemistry), in mice (Mus spp.) given 125 mg/kg BW daily for 30 days (hepatocellular changes), in rabbits fed diets of 640 mg/kg for 3 weeks (abnormal hemoglobin), and in rats given 5,000 mg/kg BW daily for 13 weeks (abnormal hemoglobin). Elevated tissue residues-but no other measurable effects-occur in cows given 0.05 to 0.5 mg/kg ration for 28 days or 1 to 16 mg/kg BW for 4 months, in pigs (Sus spp.) given a single oral dose of 5 mg/kg BW, and in sheep (Ovis aries) given a single oral dose of 10 mg/kg BW. Criteria now recommended for protection of various species include the following: dietary loadings, in mg/kg FW ration, of < 0.05 for human health, < 0.05 for livestock, < 1 for honey bees, and < 5 for poultry; seawater concentrations < 0.1 .mu.g/L for estuarine crustacean larvae; and, for all aquatic life, restricted or prohibited use of diflubenzuron in salt-marsh mosquito breeding areas and on agricultural lands less than 5 km from coastal areas. No criteria are

available or proposed for protection of avian and mammalian wildlife against diflubenzuron, probably because of an incomplete toxicological data base.

Keywords/OVIS-ARIES, SUS-SPP, MUS-SPP, RATTUS-SPP, CANIS-FAMILIARIS , ORYCTOLAGUS-CUNICULUS, BOS-BOVIS, APIS-MELLIFERA, NON-TARGET ORGANISMS, DIMILIN, BENZOYLPHENYL UREA, INSECT GROWTH REGULATOR, INSECT CONTROL AGENT, LEACHING, GROUNDWATER DEGRADATION, ECOTOXICOLOGY

***FARLOW J E; BREAUD T P; STEELMAN C D; SCHILLING P E*
EFFECTS OF THE INSECT GROWTH REGULATOR DIFLUBENZURON ON NONTARGET AQUATIC POPULATION IN A LOUISIANA INTERMEDIATE MARSH
ENVIRON ENTOMOL 7 (2). 1978 199-204.
Full Journal Title: Environmental Entomology
Language: ENGLISH
ABSTRACT
A study was conducted in a Louisiana [USA] coastal marsh to determine theecological impact of the insect growth regulator diflubenzuron on populations of non-target aquatic organisms. Six applications of diflubenzuron (28 mg AI[active ingredient]/ha) [used for controlling mosquitoes] over an 18 mo. period caused statistically significant differences in the population density of aquatic organisms when treated and untreated populations were compared. Populations of 5 taxa [nymphs of Trichocorixa louisianae Jaczewski and Buenoa spp., Coenagrionidae naiad species, Berosus infuscatus LeConte adults and Hyalella azteca (Saussure)] were significantly ($P < 0.01$) reduced while populations of 15 taxa (Physa sp., Caenis sp. and Callibaetis sp. naiads, Noteridae larvae, Hydrovatus cuspidatus Kunze adults, Hydrovatus sp. larvae, Dytiscidae (tribe Bidessini) larvae, Mesovelia mulsanti Jaczewski adults, Trichocorixa louisianae adults, larvae of Chironomidae, Ephdridae, Dolichopodiae and Tabanidae, and the fishes Gambusia affinis (Baird and Girard) and Jordanella floridae (Goode and Bean) showed significant ($P < 0.05$) increases after exposure to diflubenzuron. The analysis of data on the 27 remaining taxa collected indicated no statistically significant ($P > 0.05$) difference when the treated and untreated populations were compared.

Keywords/ USA, TRICHOCORIXA-LOUISIANAE, BUENOA-SPP, MESOVELIA- MULSANTI, BEROSUS-INFUSCATUS, HYDROVATUS-CUSPIDATUS, HYDROVATUS-SP, PHYSA-SP, CAENIS-SP, CALLIBAETIS-SP, GAMBUSIA-AFFINIS, JORDANELLA-FLORIDAE, HYALELLA-AZTECA, COENAGRIONIDAE, NOTERIDAE, CHIRONOMIDAE, EPHYDRIDAE, DOLICHOPODIDAE, TABANIDAE, DYTISCIDAE, MOSQUITO CONTROL

HARRAHY E A; PERRY S A; WIMMER M J; PERRY W B
THE EFFECTS OF DIFLUBENZURON (DIMILIN) ON SELECTED MAYFLIES (HEPTAGENIIDAE) AND STONEFLIES (PELTOPERLIDAE AND PTERONARCYIDAE)
ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY 13 (3). 1994. 517-522.
Full Journal Title: Environmental Toxicology and Chemistry
Language: ENGLISH
ABSTRACT
Two types of laboratory toxicity tests (exposure in water and feeding) were conducted to determine the effects of diflubenzuron (DFB) on nontarget aquatic insects. The mayflies Cynygmula subaequalis, Stenacron interpunctatum, Stenonema meririvulanum, and Stenonema femoratum (Heptageniidae) and the stonefly Peltoperla arcuata (Peltoperlidae) were exposed to DFB in water for 96 h, then transferred to pesticide-free water and observed for 36 d. The mayflies were exposed to 0, 0.6, 5.6, 55.7, or 557.2 ppb and the stoneflies to 0, 1.0, 10.2, 101.5, or 1,015 ppb DFB in water. The mayflies were found to be sensitive to DFB in water at concentrations as low as 0.6 ppb. The stonefly was less sensitive to DFB in water. In our feeding studies, Peltoperla arcuata and Pteronarcys proteus (Pteronarcyidae) were fed DFB-treated yellow poplar leaves for 24 d, then observed for 60 and 90 d, respectively. Survival of treated Peltoperla was

significantly different from the controls at day 60. Survival of treated Pteronarcys was not significantly different from the controls during the 90-d test period, although the low number of molts that occurred during that time may have influenced these results. Future studies should use early life stages that coincide with leaf fall, when treated leaves would be introduced to headwater streams. The life histories of many aquatic insects are timed to make maximum use of leaf detritus as a food base. Introduction of DFB-treated leaves to headwater streams may adversely affect these organisms.

Descriptors/Keywords: RESEARCH ARTICLE; CYNYGMULA SUBAEQUALIS; STENACRON INTERPUNCTATUM; STENONEMA MERIRIVULANUM; STENONEMA FEMORATUM; PELTOPERLA ARCUATA; PTERONARCYS PROTEUS; NONTARGET AQUATIC INSECTS; PESTICIDE

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***JONES, A. S. AND J. N. KOCHENDERFER..* 1988. PERSISTENCE OF DIFLUBENZURON (DIMILIN) IN A SMALL EASTERN WATERSHED AND ITS IMPACT ON INVERTEBRATES IN A HEADWATER STREAM. REPORT SOUTHEASTERN FOREST EXPERIMENT STATION. NO. 56637/26/1988.

***JONES, A. S. AND J. N. KOCHENDERFER..* 1986. PERSISTENCE OF DIFLUBENZURON (DIMILIN) IN A SMALL EASTERN WATERSHED AND ITS IMPACT ON INVERTEBRATES IN A HEADWATER STREAM. FORESTRY SCIENCE LABORATORY, RESEARCH TRIANGLE PARK, NC.

***JULIN A M; SANDERS H O*
TOXICITY OF THE INSECT GROWTH REGULATOR DIFLUBENZURON TO FRESH WATER INVERTEBRATES AND FISHES
MOSQ NEWS 38 (2). 1978 256-259.
Full Journal Title: Mosquito News
Language: ENGLISH
ABSTRACT
Technical grade material and wettable powder formulations of the insect growth regulator diflubenzuron and 3 of its degradation products were tested for toxicity to 3 spp. of aquatic invertebrates and 4 fishes: daphnids (Daphnia magna), scuds (Gammarus pseudolimnaeus), midges (Chironomus plumosus), rainbow trout (Salmo gairdneri), fathead minnows (Pimephales promeals), channel catfish (Ictalurus punctatus) and bluegills (Lepomis macrochirus). The acute toxicities of the wettable powder formulation of diflubenzuron ranged from a 48 h EC50 (estimated concentration immobilizing 50% of test organisms) of 0.015 mg/l for daphnids to a 96 h LC50 (estimated concentration producing 50% mortality) of 660 mg/l for bluegills. The 96 h LC50 of the technical grade material exceeded 100 mg/l for all 4 fishes. The most toxic degradation product, 4-chloroaniline, had a 96 h LC50 of 2.4 mg/l to bluegills and a 48 h EC50 of 43 mg/l to early 4-instar midge larvae. The 48 h EC50's (midge larvae) and 96 h LC50's for 3 of 4 spp. of fish fdr 4-chlorophenyl urea and 2,6-difluorobenzoic acid were greater than 100 mg/l.

Keywords/ DAPHNIA-MAGNA, GAMMARUS-PSEUDOLIMNAEUS, CHIRONOMUS-PLUMOSUS, SALMO-GAIRDNERI, PIMEPHALES-PROMELAS, ICTALURUS-PUNCTATUS, LEPOMIS-MACROCHIRUS, DEGRADATION PRODUCTS, 4 CHLORO ANILINE, 4 CHLOROPHENYL UREA, 2 6 DI FLUORO BENZOIC-ACID

LEBLANC, G. 1975. THE CHRONIC TOXICITY OF ALTOSID, TH-6040, AND R-20458 TO DAPHNIA MAGNA. UNPUBLISHED STUDY RECEIVED FEB. 8, 1977 UNDER 20954-1; PREPARED BY EG&G. BIONOMICS, SUBMITTED BY ZOECON CORP. PALO ALTO, CA.

LUDWIG G M
EFFECTS OF TRICHLORFON FENTHION AND DIFLUBENZURON ON THE ZOOPLANKTON COMMUNITY AND ON PRODUCTION OF RECIPROCAL-CROSS HYBRID STRIPED BASS FRY IN CULTURE PONDS
AQUACULTURE 110 (3-4). 1993. 301-319.
Full Journal Title: Aquaculture
Language: ENGLISH
ABSTRACT
The application of trichlorfon, diflubenzuron, or fenthion to fertilized culture ponds stocked with 5-day- old, reciprocal-cross, hybrid striped bass fry resulted in an initital reduction in the concentration of rotifers and longer-term alteration of zooplankton successional stages, including changes in concentrations of rotifers, cladocerans, and copepods. Culture ponds without applied chemicals had the highest concentrations of small rotifers when fry were stocked, followed by high concentrations of cladocerans, copepod nauplii, and adult copepods. Fry survival in untreated ponds was higher than in chemically-treated ponds. Initial high concentrations of copepods in some ponds corresponded with low fry survival. Untreated ponds that were filled at the time of broodfish spawning, and stocked with fry 5 days later, had the highest fry survival rates, corresponding with peak rotifer concentrations, followed by a typical zooplankton succession.

Keywords/ MORONE-SAXATILIS, ROTIFER, CLADOCERANS, COPEPOD, INVERTEBRATE, FISH, AQUACULTURE, WATER POLLUTION EFFECTS, AGRICHEMICAL, FRY SURVIVAL, SUCCESSION

***MOHSEN Z H; MULLA M S*
FIELD EVALUATION OF SIMULIUM LARVICIDES EFFECTS ON TARGET AND NONTARGET INSECTS
ENVIRON ENTOMOL 11 (2). 1982. 390-398.
Full Journal Title: Environmental Entomology
Language: ENGLISH
ABSTRACT
The effectiveness of 3 blackfly larvicides, FMC-45497 (10% EC [emulsifiable concentrate]) [(-)-cyano)-3-3 phenoxybenzyl-(.+-.) cis-3-(2,2-dichlorovinyl)-2,2-dimethyl cyclopropane-1-carboxylate], Abate (50% EC) [O,O,O',O'-tetramethyl-O-O',thiodi-p-phenylene phosphorothioate] and the insect growth regulator (IGR) Dimilin (25% WP [wettable powder] [1-(4-chlorophenyl)-3-(2,4- difluorobenzyl) urea], was studied in the field against target Simulium; their impact on selected aquatic nontarget insects was determined. Effectiveness and impact were assessed by 3 sampling techniques: drift net, Surber sampler and polyethylene strips. Interval drift samples gave rapid evaluation of the effectiveness of the fast-acting larvicides FMC-45497 and Abate. For Dimilin, which is slow-acting, Surber sampler and polyethylene strips were more suitable because drift among aquatic organisms was not induced when Dimilin was applied at 0.1 ppm/15 min. After the application of FMC-45497 at the rate of 0.01 ppm/15 min, catastrophic drift was noted in some components of the aquatic fauna, Baetis, Chironomidae, Hydropsyche and Odonata. Baetis naiads constituted over 85% of the drifting organisms in number. Abate applied at 0.1 ppm/15 min was selective, producing drift in Simulium larvae only; Dimilin at 0.1 ppm/15 min caused moderate decline in Simulium larvae, Baetis and Hydropsyche.

Keywords/ BAETIS, HYDROPSYCHE, ODONATA, CHIRONOMIDAE, CATASTROPHIC DRIFT, FMC-45497, ABATE, DIMILIN, INSECT GROWTH REGULATOR, DRIFT NET, SURBER SAMPLER, POLY ETHYLENE STRIP

MOORE, R. AND J. BOCSOR. 1975. "IMPACT OF DIMILIN ON THE MACROINVERTEBRATES OF A PENNSYLVANIA TROUT STREAM: COOPERATIVE AGREEMENT NO. 42-178. PRELIM. PROGRESS REPORT, JAN. 1975 THROUGH SEPT. 1975. UNPUBLISHED STUDY RECEIVED JAN 12, 1976 UNDER 148-1170, SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS.

***MULLA, M.S.; MAJORI, G; AND DARWAZEJI, H.*
EFFECTS OF THE INSECT GROWTH REGULATOR DIMILIN OR TH-6040 ON MOSQUITOES AND SOME NONTARGET ORGANISMS
MOSQUITO NEWS 35(2) 1975. 211-215.
Full Journal Title: Mosquito News
Language: ENGLISH
ABSTRACT
Granular and wettable powder formulations of the isect growth regulator Dimilin or TH-6040 {1-(4-chlorophenyl)-3-(2,6 difluorobenzoyl)urea} having novel growth modifying properties were evaluated in replicated ponds against Culex tarsalis Coquillert, dhironomid midges and some commonly associated nontarget organisms. The material was applied at the rates of 0.25 (0.08 ppm) and 0.05 (0.016 ppm) lb/acre active ingredients. Decline in the population of 3rd and 4th instar mosquito larvae was apparently from 2-8 days after treatment but was not observed 11 days posttreatments: no appreciable decline was noticed in 1st instars as these resulted from continuous oviposition. Adult emergence from treated larvae isolated in floating units was almost completely inhibited up to at least 11 days posttreatment. Marked decline in the population of noktonic chironomid larvae was not detected in the treatments during the 15 day duration of the experiment. Emergence of chironomids, however, was depressed up to 8-15 days after treatment. Among the nontarget organisms studied, mayfly, Bactis sp., naiads were depressed slightly but recovered to normal levels soon after treatment. Cladoccra (Daphnia sp.) were moderately depressed by the WP but not by the granualr formulation. THe copepods Cyclops sp. and Diaptomus sp. were affected for a short time. Al affected nontarget organisms recovered as did the target organisms 11-15 days after treatment. The ostracods (Cypricercus sp. and Cyprinotus sp.) were not affected by the treatments, nor were diving beetle larvae and adults and odonate naiads during the duration of these experiments.

***MUZZARELLI R*
CHITIN SYNTHESIS INHIBITORS EFFECTS ON INSECTS AND ON NONTARGET ORGANISMS
CRIT REV ENVIRON CONTROL 16 (2). 1986. 141-146.
Full Journal Title: Critical Reviews in Environmental Control
Language: ENGLISH

Keywords/ REVIEW, EPHEMEROPTERA, PLECOPTERA, DIPTERA, TRICOPTERA, COLEOPTERA, OLIGOCHAETA, GASTROPODA, LIVESTOCK, BIRD, DIFLUBENZURON, MORTALITY

NEBEKER A V; MCKINNEY P; CAIRNS M A
ACUTE AND CHRONIC EFFECTS OF DIFLUBENZURON DIMILIN IN FRESH WATER FISH AND INVERTEBRATES
ENVIRON TOXICOL CHEM 2 (3). 1983. 329-336.
Full Journal Title: Environmental Toxicology and Chemistry
Language: ENGLISH
ABSTRACT
Two fish and 7 invertebrate freshwater spp. [Pimephales promelas, Poecilia reticulata, Daphnia magna, Hyalella Azteca, Juga plicifera, Physa-spp., Clistoronia magnifica, Tanytarsus dissimilis, Cricotopus spp.] were exposed to diflubenzuron (Dimilin) in acute and chronic laboratory tests. No effects on newly hatched and juvenile fathead minnows juvenile guppies were

seen at .ltoreq. 36 .mu.g/l, the highest concentration tested. An early life stage test (30 days) with fathead minnows showed no effect .ltoreq. 36 .mu.g/l. No effects on survival, growth or reproduction were observed with 2 snail spp., J. plicifera and P. spp., at .ltoreq. 36 .mu.g/l. Adult emergence of the caddis fly C. magnifica was inhibited at 0.1 .mu.g/l. D. magna were killed at 2.0 .mu.g/l. H. azteca mortality was significant at 2.0 .mu.g/l. Molting and survival of the midge T. dissimilis were affected at 4.9 .mu.g/l. Molting and survival of the midge C. spp. were affected at 4.9 .mu.g/l and adult emergence did not occur at 1.6 .mu.g/l.

Keywords/ PIMEPHALES-PROMELAS, POECILIA-RETICULATA, DAPHNIA-MAGNA, HYALELLA-AZTECA, JUGA-PLICIFERA, PHYSA-SPP, CLISTORONIA-MAGNIFICA, TANYTARSUS-DISSIMILIS, CRICOTOPUS-SPP, INSECTICIDE, MORTALITY, MOLTING

***POIRIER, D. G. AND G. A. SURGEONER.** 1987. "TOXICITY OF THE INSECT GROWTH REGULATOR DIFLUENZURON TO STREAM INVERTEBRATES", DEPT. OF ENV. BIOLOGY, UNIVERSITY OF GUELPH, GUELPH, ONTARIO.

***RABENI, C. AND K. E. GIBBS.** 1977. THE EFFECTS OF DIMILIN ON NON TARGET STREAM INSECTS IN MAINE, 1975. REPORT THOMPSON-HAYWARD CHEMICAL COMPANY NO. C4324.

***RAVEN, C.** 1986. DIMILIN IN FORESTRY: SUMMARIES ON NON-TARGET AQUATIC INVERTEBRATES AND RESIDUES. UNPUBLISHED REPORT FOR DUPHAR B.V. REPORT NO. 56683/05/1986. CONTAINS 7 PAGES.

RODRIGUES, C. S. 1982. EFFECTS OF INSECTICIDES INCLUDING INSECT GROWTH REGULATORS ON BLACK FLY (DIPTERA: SIMULIIDAE) LARVAE AND ASSOCIATED NON-TARGET STREAM INVERTEBRATES. THESIS. UNIV. OF GUELPH, GUELPH, ONTARIO.

***RODRIGUES C S; KAUSHIK N K**
LABORATORY EVALUATION OF THE INSECT GROWTH REGULATOR DIFLUBENZURON AGAINST BLACK FLY DIPTERA SIMULIIDAE LARVAE AND ITS EFFECTS ON NONTARGET STREAM INVERTEBRATES
CAN ENTOMOL 118 (6). 1986. 549-558.
Full Journal Title: Canadian Entomologist
Language: ENGLISH
ABSTRACT
In laboratory tests conducted under simulated stream conditions treatment with the insect growth regulator diflubenzuron at 1.0 mg/L/30 min at 15.degree. C resulted in 100% mortality of Simulium larvae after 10 days. At 0.5 mg/L/15 min there was 97.6% mortality of S. vittatum larvae after 18 days in water at 10.5.degree. C. Diflubenzuron was less effective when the growth rate of simuliid larvae during the test was slow due to inadequate nutrition, and it was more effective at 25 than at 20.degree. C, but there was no difference in efficacy between 10 and 20.degree. C. Efficacy against simuliid larvae varied inversely with their instar. Diflubenzuron at 1.0 mg/L/30 min was tested in the laboratory against selected nontarget invertebrates. Among the Ephemeroptera tested at 15.degree. C, Baetis pygmaeus, Leptophlebia sp., and Isonychia sp. proved susceptible but not Stenonema fuscum and Ephemerella subvaria. Similarly diflubenzuron had little effect on the perlid stonefly Paragnetina media at 15.degree.C and on the filter-feeding caddisfly Hydropsyche betteni at 20.degree. C. Chironomid larvae (Phaenopsectra sp.) tested at 20.degree. C were affected and the amphipods Gammarus pseudolimnaeus and Hyalella azteca were particularly susceptible at 25 but not at 15.degree. C.

Keywords/ SIMULIUM-VITTATUM, BAETIS-PYGMAEUS, LEPTOPHLEBIA-SP, ISONYCHIA-SP, STENONEMA-FUSCUM, EPHEMERELLA-SUBVARIA, PARAGNETINA-MEDIA, HYDROPSYCHE-BETTENI, PHAENOPSECTRA-SP, GAMMARUS-PSEUDOLIMNAEUS, HYALELLA-AZTECA, MORTALITY, GROWTH RATE

***SATAKE K N; YASUNO M*
THE EFFECTS OF DIFLUBENZURON ON INVERTEBRATES AND FISHES IN A RIVER
JPN J SANIT ZOOL 38 (4). 1987. 303-316.
Full Journal Title: Japanese Journal of Sanitary Zoology
Language: ENGLISH
ABSTRACT
An insect growth regulator diflubenzuron was applied to the Kokawa River [Japan] at the concentration of 1.25 ppm for an hour to control simuliid larvae (Ogata et al., unpublished). On that occasion, the effects of the chemical on both invertebrate communities and fish were assessed. Weekly sampling of invertebrates and fish was conducted till the 4th week after the application in both treated and untreated region. Most of invertebrates were eliminated with 2 weeks, while Hydropsycidae died out gradually. Adults of Elmidae, which had not found before, appeared 1 week after in large number at the uppermost of the treated region. Fast recovery of Baetis at the same place was recognized. Downstream drifts from untreated region accounted for this result. While recolonizations by newly hatched larvae of Baetis, Chironomidae, Antocha and Simuliidae were prominent 3-4 weeks after in all the treated region. These fast recolonizers reached abnormally higher densities. On the other hand, most of caddisflies and mayflies had not recovered by the 4th weeks. Since application of diflubenzuron induces an enormous increase in target dipteran larvae including simuliids, once this chemical is used in a river, frequent applications are required subsequently. No fish mortality was observed on Phoxinus lagowski f. steindachneri and Leuciscus hakonensis. Both adults and fry of the former were commonly found during the study periods. Their condition factors increased after the application, suggesting that this species fed on attached algae which became abundant in the treated region.

Keywords/ BAETIS, ANTOCHA, PHOXINUS-LAGOWSKI-F-,STEINDACHNERI, LEUCISCUS-HAKONENSIS, DIPTERA, ELMIDAE, HYDROPSYCHIDAE, CHIRONOMIDAE, SIMULIIDAE, CADDISFLY, MAYFLY, ALGAE, LARVAE, TOXICITY, SPECIES ABUNDANCE, FEEDING, DENSITY, MORTALITY, JAPAN

SAVITZ J D; WRIGHT D A; SMUCKER R A
TOXIC EFFECTS OF THE INSECTICIDE DIFLUBENZURON (DIMILIN) ON SURVIVAL AND DEVELOPMENT OF NAUPLII OF THE ESTUARINE COPEPOD, EURYTEMORA AFFINIS
MARINE ENVIRONMENTAL RESEARCH 37 (3). 1994. 297-312.
Full Journal Title: Marine Environmental Research
Language: ENGLISH
ABSTRACT
This study focused on the effects of the insect growth regulator diflubenzuron (DFB) on nauplii of the estuarine copepod Eurytemora affinis. The 48-h LC50 for DFB and E. affinis nauplii was 2-2 mu-g/liter DFB. Short-term effects on naupliar survival and development to the copepodite stage were observed following 5 or 6 days exposure to 0.78 mu-g/liter DFB. These results suggest that DFB has substantial effects on the survival and development of E. affinis at water concentrations of less than 1 mu-g/liter. The test system included algae and clay added to mimic the maximum amount of kaolin present in the pesticide formulation. These effects may adversely impact natural zooplankton populations which are an important component of the estuarine food chain in Chesapeake Bay and
elsewhere. Due to reports of DFB concentrations occasionally exceeding 1 mu-g/liter in some Chesapeake Bay tributary surface waters, DFB represents a potential risk to E. affinis.

Descriptors/Keywords: RESEARCH ARTICLE; EURYTEMORA AFFINIS; POLLUTION; ZOOPLANKTON; ESTUARY; FOOD CHAIN; CHESAPEAKE BAY; USA

***SWIFT M C; SMUCKER R A; CUMMINS K W*
EFFECTS OF DIMILIN ON FRESHWATER LITTER DECOMPOSITION
ENVIRON TOXICOL CHEM 7 (2). 1988. 161-166.
Full Journal Title: Environmental Toxicology and Chemistry
Language: ENGLISH
ABSTRACT
The pesticide Dimilin (diflubenzuron) is widely used on forests in Maryland to control gypsy moths, and it may enter streams via leaf litter. We measured the effects of Dimilin on stream leaf litter processing using artificial leaf packs treated with the pesticide. Over the entire study period (464 degree days) the Dimilin-treated packs were processed more rapidly than control packs. There was a continuous loss of Dimilin from the packs, apparently due to leaching. Both Dimilin-treated and control packs were quickly colonized by macroinvertebrates and the maximum total macroinvertebrate biomass occurred when about 50% of the leaf-pack biomass remained. The macroinvertebrate community in the leaf packs was typical for western Maryland. There was little difference in the macroinvertebrate communities on the Dimilin-treated and the control packs; any possible differences between treatments were probably obscured by recolonization of the packs by invertebrate drift. Bioassays were conducted using twoshredder macroinvertebrates (Tipula abdominalis and Platycentropus radiatus) to compare growthand mortality when they were fed untreated and Dimilin-treated tulip poplar leaves. Mortality was significantly higher and growth significantly lower in the shredders fed Dimilin-treated leaves.

Keywords/ TIPULA-ABDOMINALIS, PLATYCENTROPUS-RADIATUS, INSECTICIDE GYPSY MOTH CONTROL, INDICATOR, ORGANISM, TULIP TREES, MARYLAND USA

***SWIFT, M. C. , R. A. SMUCKER, AND K. W. CUMMINS.* 1987. EFFECTS OF DIMILIN ON STREAM INVERTEBRATES IN WEST MARYLAND. GYPSY MOTH REVIEW. 1987. CHARLESTON, WV.

VEECH J A
THE EFFECT OF DIFLUBENZURON ON THE REPRODUCTION OF FREE LIVING NEMATODES
NEMATOLOGICA 24 (3). 1978 312-320.
Full Journal Title: Nematologica
Language: ENGLISH
ABSTRACT
Three species of free-living nematodes; Pelodera sp., Acrobeloides sp. and Panagrellus redivivus, were tested for their ability to reproduce in the presence of various concentrations of diflubenzuron [insecticide]. The nematodes were cultured on an oatmeal medium fortified with 0.01 to 10,000 ppm diflubenzuron. After 10 days the numbers of larvae in test Treatments were compared to the control. On medium containing 10 ppm diflubenzuron the populations, expressed as a percent of the control, were 5, 47 and 94 for Pelodera, P. redivivus and Acrobeloides, respectively; on media containing 100 ppm the population of Acrobeloides was only 3% of the control. Since diflubenzuron was not toxic to larvae and because it is a specific inhibitor of chitin synthetase, diflubenzuron probably inhibited chitin
synthesis in the eggshells effectively inhibiting reproduction.

Keywords/ PELODERA-SP, ACROBELOIDES-SP, PANAGRELLUS-REDIVIVUS, OATMEAL, TOXICITY, LARVA, CHITIN SYNTHETASE INHIBITOR

YASUNO M; SATAKE K

EFFECTS OF DIFLUBENZURON AND METHOPRENE ON THE EMERGENCE OF INSECTS AND THEIR DENSITY IN AN OUTDOOR EXPERIMENTAL STREAM

CHEMOSPHERE 21 (10-11). 1990. 1321-1336.
Full Journal Title: Chemosphere
Language: ENGLISH

ABSTRACT
Benthic communities in outdoor experimental streams were exposed to 1 and 10 mg l-1 of diflubenzuron and the same concentrations of methoprene for 30 min, respectively. The effects of these chemicals were assessed daily by examining drifting pupal exuviae over a period of one month following the treatment. Neither chemical induced the drift of macrobenthos at the time of application. However, diflubenzuron affected the emergence of all species examined. A high larval mortality of a species of chironomid was observed directly in the stream treated with diflubenzuron, where mayfly nymphs and caddisfly larvae were also decreased. However, in the stream treated with methoprene, no marked mortality of benthos could be observed, but chironomids and caddisflies disappeared. Methoprene treatment not only affected the emergence of the mayfly, Baetis sahoensis, but caused its outbreak.

Keywords/ BAETIS-SAHOENSIS, CHIRONOMID CADDIS FLY, TOXICITY, LARVAL MORTALITY, INSECTICIDE

Invertebrates/Crustaceans

BIONOMICS, E G & G, INCORPORATED. 1975. THE ACUTE AND SUBCHRONIC TOXICITY OF R-20458, ALTOSID AND TH-6040 TO THE GRASS SHRIMP, PALAEMONETES PUGLIO. FINAL REPORT (UNPUBLISHED STUDY RECEIVED FEB. 10, 1976 UNDER 6G1744, SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS.

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***CHRISTIANSEN M E*
EFFECTS OF A CHITIN SYNTHESIS INHIBITOR INSECTICIDE ON CRAB LARVAE
THIRD COLLOQUIUM ON MEDITERRANEAN DECAPOD CRUSTACEANS, BARCELONA, SPAIN,
MARCH 25, 1985. INVEST PESQ 51 (SUPPL. 1). 1987. 526-527.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ ABSTRACT, MOSQUITO, DIFLUBENZURON

***CHRISTIANSEN M E; COSTLOW J D JR*
ULTRASTRUCTURAL STUDY OF THE EXOSKELETON OF THE ESTUARINE CRAB RHITHROPANOPEUS HARRISII EFFECT OF THE INSECT GROWTH REGULATOR DIMILIN DIFLUBENZURON ON THE FORMATION OF THE LARVAL CUTICLE
MAR BIOL (BERL) 66 (3). 1982. 217-226.
Full Journal Title: Marine Biology (Berlin)
Language: ENGLISH
ABSTRACT
Ultrastructure of larval cuticle during the molt cycle of the estuarine crab R. harrisii (Crustacea: Brachyura) was studied in control larvae and 1st zoeal larvae exposed to 10 ppb of the insect growth regulator Dimilin (diflubenzuron). Dimilin 10 ppb was lethal to zoeal larvae of R. harrisii, and nearly all exposed larvae died during molting to the next stage. Distinct differences in structure of the cuticle were found between the 2 groups of larvae. Endocuticle and exocuticle were deformed in Dimilin-treated larvae, but formation of epicuticle was not affected. Dimilin probably inhibited chitin synthesis in crab larvae.

Keywords/ CHITIN

***CHRISTIANSEN, M. E. AND J. D. COSTLOW JR.* 1980. PERSISTENCE OF THE INSECT GROWTH REGUALTOR DIMILIN IN BRACKISH WATER: A LABORATORY USING LARVAE OF AN ESTINE CRAB AS INDICATOR. ZOOLOGICAL MUSEUM, UUNIV. OF OSLO, SARSGT. 1 OSLO 5, NORWAY, DUKE UNIVERSITY MARINE LABORATORY, BEAUFORT, NORTH CAROLINA, 28516, USA, HELGOLANDER MEERESUNTERSUCHUNGEN 33: 327-332.

***CHRISTIANSEN M E; COSTLOW J D JR; MONROE R J*
EFFECTS OF THE INSECT GROWTH REGULATOR DIMILIN TH-6040 ON LARVAL DEVELOPMENT OF 2 ESTUARINE CRABS
MAR BIOL (BERL) 50 (1). 1978. 29-36.
Full Journal Title: Marine Biology (Berlin)
Language: ENGLISH
ABSTRACT
Effects of Dimilin (TH 6040), an insect growth regulator which interferes with the formation of the insect cuticle, were studied on the larval development of Rhithropanopeus harrisii (Gould) and Sesarma reticulatum (Say) (Crustacea: Brachyura). When larvae were exposed to 0.5 (R. harrisii only), 1, 3, 5, 7 and 10 ppb Dimilin from hatching to the 1st crab stage, survival in both species decreased in relation to increased concentrations of Dimilin. Survival of R. hX>>o%i larvae was significantly lower at 1 ppb and higher levels compared with control experiments, and in S. reticulatum a significant decrease in survival began at the 3 ppb level. At 10 ppb Dimilin, no larvae survived to the megalopa stage in either of the 2 spp. Early stage larvae of R. harrisii are more sensitive to Dimilin than those of S. reticulatum. When R. harrisii larvae were treated with 10 ppb Dimilin during the intermolt period of each of the 4 zoeal stages, nearly all larvae died during molting to the succeeding stage. First zoeal larvae of R. harrisii exposed to 10 ppb Dimilin at various days during the intermolt period were more sensitive to the compound late in the period. Dimilin may also interfere with the formation of the cuticle in crab larvae.

Keywords/ RHITHROPANOPEUS-HARRISII, SESARMA-RETICULATUM, INSECTA, INSECT CUTICLE INHIBITOR, MEGALOPS, ZOEAL, INTER MOLT SURVIVAL

CHRISTIANSEN M E; GOSLING E; WILLIAMS M A
EFFECT OF THE INSECT GROWTH REGULATOR DIFLUBENZURON DIMILIN ON THE UPTAKE OF GLUCOSE AND N ACETYLGLUCOSAMINE INTO THE CUTICLE OF CRAB LARVAE
MAR BIOL (BERL) 83 (3). 1984. 225-230.
Full Journal Title: Marine Biology (Berlin)
Language: ENGLISH
ABSTRACT
Incorporation of 3H-labeled glucose and 3H-labeled N-acetylglucosamine (NAGA), both precursors to chitin, into the cuticle of Rhithropanopeus harrisii (Gould) larvae (Crustacea: Brachyura) was examined at different stages of the molt cycle in control larvae as well as in larvae treated with the insect growth regulator diflubenzuron. As far as the control larvae were concerned, the incorporation of both precursors was high at the postmolt stage when the endocuticle was secreted. NAGA appeared to be a more specifc precursor of cuticular material than glucose during the premolt stage when exocuticle was produced. Incorporation of both precursors was low immediately before ecdysis and during the intermolt stage when secretion of the cuticle is complete. Incorporation of glucose into chitin was greatly inhibited by the pollutant during the postmolt stage when the endocuticle is produced. Incorporation of NAGA was reduced to a lesser extent at this stage. Diflubenzuron treatment markedly affected the incorporation of both NAGA and glucose in the premolt stage during secretion of the exocuticle.

Keywords/ ENDOCUTICLE, MOLTING, ECDYSIS CHITIN, TRITIUM

COSTLOW, J.D. 1987. ACUTE TOXICITY OF DIFLUBENZURON DFB TO VARIOUS LIFE STAGES OF THE GRASS SHRIMP PALAEMONETES PUGIO. WATER AIR SOIL POLLUT. 33 (304) PP 411-418.

COSTLOW J D
EFFECT OF DIMILIN ON DEVELOPMENT OF LARVAE OF THE STONE CRAB MENIPPE MERCENARIA AND THE BLUE CRAB CALLINECTES SAPIDUS

VERNBERG, W. B. ET AL. (ED.). MARINE POLLUTION: FUNCTIONAL RESPONSES; PROCEEDINGS OF THE SYMPOSIUM ON POLLUTION AND PHYSIOLOGY OF MARINE ORGANISMS, GEORGETOWN, S.C., USA, NOV. 14-17, 1977. XIII+454P. ACADEMIC PRESS, INC.: NEW YORK, N.Y., USA; LONDON, ENGLAND. ILLUS. ISBN 0-12-718260-8. 0 (0). 1979. P 355-364.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ SURVIVAL RATE, INSECTICIDE

COSTLOW J D ; BOOKHOUT C G
THE EFFECTS OF POLLUTANTS ON LARVAL DEVELOPMENT OF THE BLUE CRAB CALLINECTES SAPIDUS
1982 ANNUAL MEETING OF THE NATIONAL SHELLFIHSERIES ASSOCIATION BALTIMORE, MD., USA, JUNE 14-17, 1982. J SHELLFISH RES 3 (1). 1983. 87-88.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Descriptors/Keywords: ABSTRACT, INSECTICIDE, METAL POLLUTION, WATER POLLUTION, MALATHION, METHOXYCHLOR, MIREX, KEPONE, DIMILIN, CADMIUM, MERCURY

***CUNNINGHAM P A*
A REVIEW OF TOXICITY TESTING AND DEGRADATION STUDIES USED TO PREDICT THE EFFECTS OF DIFLUBENZURON DIMILIN ON ESTUARINE CRUSTACEANS
ENVIRON POLLUT SER A ECOL BIOL 40 (1). 1986. 63-86.
Full Journal Title: Environmental Pollution Series A Ecological and Biological
Language: ENGLISH
ABSTRACT
This review surveys the pertinent literature on the effects of diflubenzuron (Dimilin) on non-target crustacean species when applied for mosquito control to freshwater and saltwater habitats. Freshwater research has focused on field testing, while estuarine research has been limited almost exclusively to laboratory toxicity studies. Several experimental design factors may affect the toxicity and persistence of diflubenzuron.These factors include formulation, frequency of application (exposure), presence of organic matter and sediment in the test system, pH and water temperature. Biological factors such as the age of the test organism and the frequency and synchrony of moulting during the exposure period also influence the observed response of the experimental crustacean population. Assessment of the impact of DFB on estuarine crustaceans is difficult as few studies have been conducted under conditions appropriate to its use in saltmarsh mosquito control.

Keywords/ SEDIMENT, INSECTICIDE, TEMPERATURE

CUNNINGHAM, P.A. 1976. EFFECTS OF DIMILIN (TH-6040) [INSECT GROWTH REGULATING COMPOUND] ON REPRODUCTION IN THE BRINE SHRIMP, ARTEMIA SALINA. ENVIRON. ENTOMOL. 5 (4) PP 701-706.

CUNNINGHAM P A; MYERS L E
EFFECTS OF DIFLUBENZURON DIMILIN ON SURVIVAL MOLTING AND BEHAVIOR OF JUVENILE FIDDLER CRABS UCA PUGILATOR
ARCH ENVIRON CONTAM TOXICOL 16 (6). 1987. 745-752.
Full Journal Title: Archives of Environmental Contamination and Toxicology
Language: ENGLISH

ABSTRACT
The effects of repetitive 24-hr weekly exposures to diflubenzuron (Dimilin) on juvenile fiddler crabs (U. pugilator) were studied in static seawater systems for 10 weeks. Crabs surviving the 10-week exposure period were maintained in clean seawater until death. Survival, molting, and behavior were monitored daily. The no-effect concentration (NOEC) for molting (time to the first molt), survival (time until death), and behavior (ability to escape from the test container) were 20, 2, and 0.2 .mu.g/L DFB, respectively. The behavioral effect induced by diflubenzuron (DFB) exposures (.gtoreq. 2 .mu.g/L) was the most sensitive indicator of DFB activity and potentially may influence the ability of juvenile crabs to avoid predation, construct burrows, or feed adequately to survive in nature.

Keywords/ MARICULTURE, WATER POLLUTION, GROWTH REGULATOR, INSECTICIDE

CUNNINGHAM P A; MYERS L E
DYNAMICS OF DIFLUBENZURON DIMILIN CONCENTRATIONS IN WATER AND SEDIMENT OF A SUPRATIDAL SALTMARSH SITE FOLLOWING REPETITIVE AERIAL APPLICATIONS FOR MOSQUITO CONTROL
ENVIRON POLLUT SER A ECOL BIOL 41 (1). 1986. 63-88.
Full Journal Title: Environmental Pollution Series A Ecological and Biological
Language: ENGLISH
ABSTRACT
A field study was conducted to monitor changes in diflubenzuron (DFB) and a degradation product, 4- chlorophenylurea (CPU) in water and sediment collected from a supratidal mosquito breeding lagoon. Three applications of a 0.4% sand granule followed by three applications of a 25% wettable powder formulation were made to the site. Substantial differences in the dynamics of both DFB and CPU concentrations in water were noted among applications. Non-linearity of the logarithm of DFB concentrations in water as a function of time was also evident in some applications. In such cases, the half- life parameter does not characterize the dynamics of the process and is of questionable value. For four of the six applications, there was strong evidence of a decreaase in DFB concentration in water. However, there was not significant evidence of a decrease in DFB concentrations in sediment, whichappeared to be a major site for DFB absorption. Water concentrations for each analyte (DFB, CPU) were negatively correlated with sediment concentrations for the same analyte, suggesting that an exchange of both analytes occurs across the water/sediment interface. Also, positive correlations were noted between DFB and CPU in both water and sediment. These correlation findings are counter- intuitive, if it is assumed that changes in DFB and CPU concentrations are mainly due to degradation of the former to the latter. While DFB concentrations in the supratidal lagoon water tended to remain above 0.4 .mu.g liter-1 for 7 days post application, it seems unlikely that this toxic concentration would`affect planktonic larval crustaceans in adjacent estuaries if DFB entered these waters via runoff or by flooding of supratidal areas. The persistent DFB concentrations in the water and sediment (.apprx. 100 .mu.g kg-1), however, could be detrimental to detrital-feeding populations of marsh crustaceans (e.g. Uca).

Keywords/ UCA, CRUSTACEAN, LARVAE, DETRITUS FEEDER, ESTUARY, 4 CHLOROPHENYLUREA

CUNNINGHAM P A; WILSON J E H; EVANS D W; COSTLOW J D JR
EFFECTS OF SEDIMENT ON THE PERSISTENCE AND TOXICITY OF DIFLUBENZURON DIMILIN IN ESTUARINE WATERS A LABORATORY EVALUATION USING LARVAE OF TWO ESTUARINE CRUSTACEANS
VERNBERG, W. B., ET AL. (ED.). THE BELLE W. BARUCH LIBRARY IN MARINE SCIENCE, NO. 17. POLLUTION PHYSIOLOGY OF ESTUARINE ORGANISMS; SYMPOSIUM, GEORGETOWN, SOUTH CAROLINA, USA, OCTOBER 21-24, 1985. XIII+458P. UNIVERSITY OF SOUTH CAROLINA PRESS: COLUMBIA, SOUTH CAROLINA, USA. ILLUS. ISBN

0-87249-510-8. 0 (0). 1987. 299-332.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ RHITHROPANOPAEUS-HARRISSI, PALAEMONETES-PUGIO, INSECTICIDE

FORWARD R B JR; COSTLOW J D JR
SUBLETHAL EFFECTS OF INSECT GROWTH REGULATORS UPON CRAB LARVAL BEHAVIOR
WATER AIR SOIL POLLUT 9 (2). 1978 227-238.
Full Journal Title: Water Air and Soil Pollution
Language: ENGLISH
ABSTRACT
Both swimming speeds and phototaxis by the 4 larval stages of the crab Rhithropanopeus harrisii were monitored on chronic exposure to sublethal concentrations of the insect growth regulators methroprene (Altosid: ZR-515), hydropene (Altozar: ZR-512) and dimiline (TH-6040). Larvae were reared under conditions of salinity (20.permill.) and temperature (25.degree. C) which produce the greatest developmental success. Sublethal concentrations of methroprene had no effect on swimming rates or phototaxis as compared to the acetone control larvae. For hydroprene, swimming rates by Stage I, II and III zoeae were unaffected while a significant increase in swimming speeds occurred in Stage IV zoeae exposed to concentrations of 0.05 and 0.1 ppm. Only Stage III zoeae exposed to 0.1 ppm showed a significant decrease in the level of positive phototaxis. Dimilin was much more potent, as significant increases in swimming speeds occurred in Stage I, II and III zoeae, with 0.3 ppb being the lowest effective concentration. Although swimming by Stage IV zoeae was unaffected, phototaxis was altered at concentrations as low as 0.1 ppb. Concentrations, which alter behavior, are related to levels which arereported to control mosquitoe larvae.

Keywords/ RHITHROPANOPEUS-HARRISII, METHOPRENE, HYDROPRENE, DIMILIN, SWIMMING SPEEDS, PHOTO TAXIS

***GULKA G; DOSCHER C M; WATABE N*
TOXICITY AND MOLT ACCELERATING EFFECTS OF DIFLUBENZURON ON THE BARNACLE BALANUS EBURNEUS
BULL ENVIRON CONTAM TOXICOL 25 (3). 1980. 477-481.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Keywords/ FEED INTAKE, EXOSKELETON, MORTALITY, INSECTICIDE

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**HESTER, P. G., M. A. OLSON, AND T. G. FLOOR.. 1986. EFFECTS OF DIFLUBENZURON ON THREE ESTUARINE DECAPODS, CALLINECTES SP., PALAEMONETES PUGIO AND UCA PUGILATO. J. OF THE FLORIDA ANTI-MOSQUITO ASSOC. 57:8-14.

HOLCK, A. R. AND C. L. MEEK. 1987. DOSE-MORTALITY RESPONSES OF CRAWFISH AND MOSQUITOES TO SELECTED PESTICIDES. JOURNAL OF THE AMERICAN MOSQUITO CONTROL ASSOC. 3:407-411.

HORST M N
THE BIOSYNTHESIS OF CRUSTACEAN CHITIN BY A MICROSOMAL ENZYME FROM LARVAL BRINE SHRIMP ARTEMIA SALINA
J BIOL CHEM 256 (3). 1981. 1412-1419.
Full Journal Title: Journal of Biological Chemistry
Language: ENGLISH
ABSTRACT
A microsomal preparation from larval stages of the brine shrimp A. salina catalyzed the transfer of N- acetyl-D-glucosamine from UDP-N-acetylglucosamine to an endogenous acceptor. The product was identified as chitin by its resistance to extraction with alkali and high concentrations of urea and the liberation of chito-oligosaccharides by treatment with purified chitinases. The enzyme requires Mg2+ for activity and is inhibited by UDP and diflubenzuron, but not by Polyoxin D. The pH optimum is 7.0. The enzyme is not significantly activated by N-acetyl-D-glucosamine nor by trypsin treatment. Incorporation of radioactivity into endogenous acceptor is inhibited by chitodextrins which appear to serve as alternate acceptors. The crustacean enzyme can also utilize exogenous, macromolecular chitin as acceptor. The enzyme, which was partially purified by sucrose step-gradient ultracentrifugation, appears maximally active after 72 h of larval growth.

Keywords/ LARVAL GROWTH, CHITINASE, PH OPTIMUM, DIFLUBENZURON, POLYOXIN D, METABOLIC-DRUG

HORST M N; WALKER A
EFFECTS OF PESTICIDES AND ANTIBIOTICS ON CHITIN SYNTHESIS IN BLUE CRABS
75TH ANNUAL MEETING OF THE FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY, ATLANTA, GEORGIA, USA, APRIL 21-25, 1991. FASEB (FED AM SOC EXP BIOL) J 5 (4). 1991. A463.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ ABSTRACT, DIFLUBENZURON, CUTICLE, DEPOSITION, EXOSKELETON

MACHADO J; COIMBRA J; CASTILHO F; SA C
EFFECTS OF DIFLUBENZURON ON SHELL FORMATION OF THE FRESHWATER CLAM ANODONTA CYGNEA
ARCH ENVIRON CONTAM TOXICOL 19 (1). 1990. 35-39.
Full Journal Title: Archives of Environmental Contamination and Toxicology
Language: ENGLISH
ABSTRACT
Freshwater clams, Anodonta cygnea, were treated during three months with the chitin-inhibitor, diflubenzuron (Dimilin PH 60-40), suspended in water at a concentration of 200 mg/L. Cytochemical observations, carried out on the outer mantle epithelium (OME) of the treated and control animals, showed secretory cells with a periodic-acid Schiff (PAS) positive reaction and a negative reaction to enzymatic hydrolysis by amylase. However, morphological observations by scanning electron microscopy (SEM) showed that diflubenzuron strongly affects the normal calcification

process on the lamellar layer of the shell, since the calcareous crystals do not form continuous layers, but rather disintegrated layers. These observations suggest that diflubenzuron may block the polycondensation reactions to chitin chains in the OME secretory cells of the freshwater clam, Anodonta cygnea, producing unpolymerized chitin (unstabilized chitin) only. Diflubenzuron suspended at this concentration (200 mg/L), is not directly toxic to freshwater clam, Anodonta cygnea; howver, a more persistent (chronic) exposure to this chemical compound may render the shell breakable.

Keywords/ INSECTICIDE, CHITIN INHIBITOR, CYTOCHEMISTRY, SCANNING ELECTRON MICROSCOPY

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NIMMO D R; HAMAKER T L; MATTHEWS E; MOORE J C
AN OVERVIEW OF THE ACUTE AND CHRONIC EFFECTS OF 1ST AND 2ND GENERATION PESTICIDES ON AN ESTUARINE MYSID MYSIDOPSIS BAHIA
VERNBERG, F. J. ET AL. (ED.). BIOLOGICAL MONITORING OF MARINE POLLUTANTS; SYMPOSIUM ON POLLUTION AND PHYSIOLOGY OF MARINE ORGANISM, MILFOR, CONN., USA, NOV. 7-9, 1979. XIII=559P. ACADEMIC PRESS, INC.: NEW YORK, N.Y., USA LONDON, ENGLAND. ILLUS. MAPS. ISBN 0-12-718450-3. 9 (0). 1981. P3-20
Language: ENGLISH
Document type: CONFERENCE PAPAER

Keywords/ DIAZINON, TREFLEN, KEPONE, TOXAPHENE, METHYL PARATHION LEPTOPHOS, THIMET, SEVIN, DIMILIN, REPRODUCTION, LC-50, GROWTH INSECTICIDE

NIMMO D R; HAMAKER T L; MOORE J C; SOMMERS C A
EFFECT OF DIFLUBENZURON ON AN ESTUARINE CRUSTACEAN MYSIDOPSIS BAHIA
BULL ENVIRON CONTAM TOXICOL 22 (6). 1979. 767-770.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Keywords/ INSECTICIDE, REPRODUCTION SUPPRESSION, LIQUID CHROMATOGRAPHY, CHITIN INHIBITOR

***NIMMO-D-R; HAMAKER-T-L; MOORE-J-JC; WOOD-R-A*
ACUTE AND CHRONIC EFFECTS OF DIMILIN ON SURVIVAL AND REPORDUCTION OF MYSIDOPSIS BAHIA
AQUATIC TOXICOLOGY. PROCEEDINGS OF THE THIRD ANNUAL SYMPOSIUM ON AQUATIC TOXICOLOGY, HELD NEW ORLEANS, LA. OCTOBER 17-18, 1978.
Language:ENGLISH
Document type: CONFERENCE PAPER

ABSTRACT
Dimilin (diflubenzuron), a new insecticide that inhibits chitin synthesis in insects, was found to be acutely and chronically toxic to an estuarine mysid shrimp, Mysidopsis bahia. The 96-h LC50 was 2.06 ug/litre, the 21-day LC50 1.24 ug/litre. Significantly, a 28-day exposure to an estimated concentration of 0.075 ug/litre decreased the production of offspring per female mysid. Data from the chronic tests suggest that the test concentrations not only decreased reproduction in the parents but also affected the reproduction of the progeny. The loss in reproductive success occurred even when the exposed parents or progeny had been moved to water that contained no Dimilin. Should Dimilin reach estuarine waters, the larval or the juvenile stages of other nontarget estuarine crustaceans may be threatened in a manner similar to that observed with M. bahia.

Keywords/ AQUATIC TOXICOLOGY, MYSIDOPSIS BAHIA, MYSIDS, WATER ANALYSIS, TOXICOLOGY, DIMILIN, DIFLUBENZURON, LIFE CYCLES, CHITIN INHIBITION, REPRODUCTION

TOUART L W; RAO K R
INFLUENCE OF DIFLUBENZURON ON SURVIVAL MOLTING AND LIMB REGENERATION IN THE GRASS SHRIMP PALAEMONETES PUGIO
VERNBERG, W. B., ET AL. (ED.). THE BELLE W. BARUCH LIBRARY IN MARINE SCIENCE, NO. 17. POLLUTION PHYSIOLOGY OF ESTUARINE ORGANISMS; SYMPOSIUM, GEORGETOWN, SOUTH CAROLINA, USA, OCTOBER 21-24, 1985. XIII+458P. UNIVERSITY OF SOUTH CAROLINA PRESS: COLUMBIA, SOUTH CAROLINA, USA. ILLUS. ISBN 0-87249-510-8. 0 (0). 1987. 333-350.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ INSECTICIDE, INDICATOR ORGANISM

UNION CARBIDE CORP. 1976. ACUTE TOXICITY OF DIMILIN W-25 TO ANODONTA SP., MERCENARIA MERCENARIA, UCA PUGILATOR, CARCINUS MAENAS. UNPUBLISHED STUDY RECEIVED APR. 7, 1976 UNDER 148-1259. SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS.

WALKER A N; HORST M N
EFFECTS OF DIFLUBENZURON ON CHITIN SYNTHESIS IN THE POSTMOLT BLUE CRAB CALLINECTES SAPIDUS A MORPHOLOGIC STUDY USING AN IN-VITRO EXPLANT CULTURE SYSTEM
J CRUSTACEAN BIOL 12 (3). 1992. 354-360.
Full Journal Title: Journal of Crustacean Biology
Language: ENGLISH
ABSTRACT
Diflubenzuron is an insect larvicide that inhibits chitin synthesis. The effects of diflubenzuron were investigated on a nontarget organism, the postmolt adult blue crab Callinectes sapidus. Sections (explants) of the cuticle and epithelium were cut from the dorsal carapace of freshly molted blue crabs and maintained for 6 h in a buffered Ringer's solution containing diflubenzuron and 3H-glucosamine Control sections were taken from the same animals and were maintained in a like fashion but without exposure todiflubenzuron. he sections were subsequently fixed, processed and examined by electron microscopy, or probed with a chitin oligosaccharide-binding lectin, or studied for 3H-glucosamine incorporation by autoradiography. Ultrastructurally, diflubenzuron-treated tissues showed coarse clumping of nuclear chromatin, dilation of the rough endoplasmic reticulum, and vesiculation of the apical cytoplasm of the cuticular epithelial cells. Decrease in nascent chitin in the treated tissues was demonstrated at the light microscopic level by scant binding of the lectin

and minimal radiolabeling in the endocuticular region. The results offer morphologic evidence that diflubenzuron can interfere with crustacean chitin synthesis.

Keywords/ NON-TARGET ORGANISM, COMMERCIALLY SIGNIFICANT SPECIES, INSECTICIDE, CUTICLE, EPITHELIUM, CYTOLOGICAL ANALYSIS, ELECTRON MICROSCOPY

***WEIS J S; COHEN R; KWIATKOWSI J K*
EFFECTS OF DIFLUBENZURON ON LIMB REGENERATION AND MOLTING IN THE FIDDLER CRAB UCA PUGILATOR
AQUAT TOXICOL (AMST) 10 (5-6). 1987. 279-290.
Full Journal Title: Aquatic Toxicology (Amsterdam)
Language: ENGLISH
ABSTRACT
iddler crabs, Uca pugilator, were exposed to the insect growth regulator diflubenzuron (Dimilin) at 0.5, 5, and 50 .mu.g/l after multiple autotomy of one chela and five walking legs. Regeneration of the first walking leg was monitored, and time to ecdysis, mortality, and morphology of the regenerated limbs observed. Continuous exposure to the chemical produced a dose-dependent retardation of regeneration. Animals molting in the higher concentrations exhibited significant mortality at ecdysis. Exposure to the pesticide for a single week produced similar but less severe effects. However, if crabs molted while in the pesticide, significant mortality was observed. The presence of sediment in the container with the crab moderated the effects of the pesticide, but did not eliminate them. The regenerated limbs of the crabs that survived ecdysis were found to have lesions in the form of black areas in which the cuticle was improperly developed. These lesions were seen in crabs that had been in the pesticide for only one week (week 2 or week 3) as well as those that had had continuous exposure. They were also seen in crabs that regenerated in Dimilin with sediment. In addition, the number of setae on limbs was reduced compared to the number on limbs that had regenerated in clean sea water.

Keywords/ INSECT GROWTH REGULATOR, ECDYSIS, INSECTICIDE

***WEIS J S; MA A*
EFFECTS OF THE PESTICIDE DIFLUBENZURON ON LARVAL HORSESHOE CRABS LIMULUS POLYPHEMUS
BULL ENVIRON CONTAM TOXICOL 39 (2). 1987. 224-228.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Keywords/ INSECTICIDE

WILSON J E H
AGE-DEPENDENT RESPONSE OF PALAEMONETES-PUGIO EMBRYOS FOLLOWING BRIEF EXPOSURE TO DIFLUBENZURON
ANNUAL MEETING OF THE AMERICAN SOCIETY OF ZOOLOGISTS, ANIMAL BEHAVIOR SOCIETY, THE CRUSTACEAN SOCIETY, INTERNATIONAL ASSOCIATION OF ASTACOLOGY, AND THE SOCIETY OF SYSTEMATIC ZOOLOGY, NASHVILLE, TENN., USA, DEC. 27-30, 1986.
AM ZOOL 26 (4). 1986. 34A.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ ABSTRACT, SUBLETHAL TOXICITY, NONTARGET ORGANISM, INSECT GROWTH REGULATOR

WILSON J E H; COSTLOW J D
ACUTE TOXICITY OF DIFLUBENZURON DFB TO VARIOUS LIFE STAGES OF THE GRASS SHRIMP PALAEMONETES PUGIO
WATER AIR SOIL POLLUT 33 (3-4). 1987. 411-418.
Full Journal Title: Water Air and Soil Pollution
Language: ENGLISH
ABSTRACT
The acute toxic effects of diflubenzuron (DFB) on various life stages of the grass shrimp, P. pugio, were determined using a static renewal system. It was observed that the larvae and the postlarvae were the most sensitive to acute DFB toxicity; 96-hr LC50's being 1.44 and 1.62 .mu.g L-1 respectively. Also variations among the 96-hr LC50's for these two life stages were the lowest (11.59% for larvae and 30.06% for postlarvae) compared to 68.9% for males and non-ovigerous females. Ovigerous female grass shrimp (hence the embryos) appeared to be the most resistant to acute toxic effects of DFB with a mean LC50 of 6985 .mu.g L-1. The limitations of LC50 data and the importance of molt-related sensitivity of the different life stages of P. pugio to diflubenzuron are discussed.

Keywords/ LARVA, MOLTING, INSECTICIDE, SEX DIFFERENCE, WATER POLLUTION

***WILSON J E H; COSTLOW J D*
COMPARATIVE TOXICITY OF TWO DIMILIN FORMULATIONS TO THE GRASS SHRIMP PALAEMONETES PUGIO
BULL ENVIRON CONTAM TOXICOL 36 (6). 1986. 858-865.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Keywords/ TECHNICAL GRADE, WETTABLE POWDER-25, SAND, GRANULE, INSECTICIDE, MORTALITY

WILSON J E H; FORWARD R B JR; COSTLOW J D
DELAYED EFFECTS OF DIFLUBENZURON ON THE SWIMMING AND VERTICAL DISTRIBUTION OF PALAEMONETES PUGIO LARVAE
VERNBERG, W. B., ET AL. (ED.). THE BELLE W. BARUCH LIBRARY IN MARINE SCIENCE, NO. 17. POLLUTION PHYSIOLOGY OF ESTUARINE ORGANISMS; SYMPOSIUM, GEORGETOWN, SOUTH CAROLINA, USA, OCTOBER 21-24, 1985. XIII+458P. UNIVERSITY OF SOUTH CAROLINA PRESS: COLUMBIA, SOUTH CAROLINA, USA. ILLUS. ISBN 0-87249-510-8. 0 (0). 1987. 351-372.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ INSECTICIDE, TOXICITY, PHOTOKINESIS

WILSON J E; FORWARD R B JR; COSTLOW J D
EFFECTS OF EMBRYONIC EXPOSURE TO SUBLETHAL CONCENTRATIONS OF DIMILIN ON THE PHOTOBEHAVIOR OF GRASS SHRIMP PALAEMONETES PUGIO LARVAE
VERNBERG, F. J. ET AL. (ED.). BELLE W. BARUCH LIBRARY IN MARINE SCIENCE, NO. 13. MARINE POLLUTION AND PHYSIOLOGY: RECENT ADVANCES; MEETING, MYSTIC, CONN., USA, NOV. 1-3, 1983. XVII+545P. UNIVERSITY OF SOUTH CAROLINA PRESS: COLUMBIA, S.C., USA. ILLUS. MAPS. ISBN 0-87249-446-2. 0 (0). 1985. 377-396.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ PHOTOTAXIS, INSECTICIDE

YOUNG, M. FL, L. D. TOMBETTA, AND S. CARSON. 1986. EFFECTS OF DIFLUBENZURON ON THE EMBRYOLOGICAL DEVELOPMENT OF A FRESH WATER SNAIL (LYMNAEIDAE). REPORT BRIGHAM YOUNG UNIV., PROVO UTAH.

Vertebrates

AHMED M T; EID A H
ACCUMULATION OF DIFLUBENZURON IN BOLTI FISH OREOCHROMIS NILOTICUS
NAHRUNG 35 (1). 1991. 27-31.
Full Journal Title: Nahrung
Language: ENGLISH
ABSTRACT
Orechromis niloticus fingerlings were exposed to the insect growth inhibitor diflubenzuron 1-(2,6-Difluorobenzyl)3-(4-chlorophenyl)urea for 21 days. Diflubenzuron was introduced to the aquariums where fish were maintained at the beginning of the experiment, then its level in water, gills and liver was detected after 1, 7, 14 and 21 days. The fish accumulated diflubenzuron 76 and 99 times greater than the water content when kept in an ambient concentration of 2.5 and 5 mg/l, respectively, indicating a low bioaccumulation potential. Some degradation products of diflubenzuron were found mainly in liver and water.

Keywords/GILLS, LIVER, POSSIBLE FOOD INSECTICIDE CONTAMINATION BIOACCUMULATION, RATIO, WATER CONTENT, TOXICANT STORAGE, TOXICANT METABOLISM, EGYPT

***APPERSON C S; SCHAEFER C H; COLWELL A E; WERNER G H; ANDERSON N L; DUPRAS E F JR; LONGANECKER D R*
EFFECTS OF DIFLUBENZURON ON CHAOBORUS ASTICTOPUS AND NONTARGET ORGANISMS AND PERSISTENCE OF DIFLUBENZURON IN LENTIC HABITATS
J ECON ENTOMOL 71 (3). 1978 521-527.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
Diflubenzuron [1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl)-urea] applied to 3 farm ponds at rates of 10, 5 and 2.5 ppb, and a lake at 5 ppb, inhibited emergence of adult C. astictopus Dyar and Shannon 2-7 days following the treatments by 95-100%. Emergence reoccurred in some ponds 4.5-6 wk after treatment. Larval populations in the ponds declined by 98, 88 and 44% of pretreatment at 10, 5 and 2.5 ppb, respectively, and recovered to 30, 87 and 131% of pretreatment numbers, respectively. In the control pond, larvae declined by 53% during the same period but increased to 314% of initial numbers. In the lake, larvae decreased by 99% of the pretreatment level 3 wk posttreatment and remained at low levels. Suppression of crustacean zooplankton occurred at all treatment rates. Cladocerans were more susceptible than copepods and required longer recovery periods. Pond and lake rotifer and algal populations were not altered by the treatments. Bluegill sunfish, Lepomis macrochirus Rafinesque, collected from the lake fed predominantly on cladocerans and copepods but switched to chironomid midges and terrestrial insects after the treatment. Fish growth was not altered by the treatment. Residues in ponds treated at 10, 5 and 2.5 ppb averaged 9.8, 4.6 and 1.9 ppb, respectively, shortly after the applications, and declined steadily averaging 0.2, 0.3 and 0.5 ppb, respectively, 2 wk later. diflubenzuron residues in the lake averaged 3.3 ppb following treatment, and after 35 days, averaged 0.4 ppb. No residues were found in lake sediment. Residues in white crappie, Pomoxis annularis Rafinesque, varied from 355.1-62.2 ppb at 4 and 21 days, respectively, following treatment. Fish residues did not persist at high levels and by 14 days post-treatment, they had begun to decline rapidly.

Keywords/ LEPOMIS-MACROCHIRUS, POMOXIS-ANNULARIS, CLADOCERANS, COPEPODS, ROTIFERS, ALGAE, CHIRONOMIDS, TERRESTRIAL INSECTS, INSECT GROWTH REGULATOR, RESIDUES

CANNON, G., AND J., KRIZE. 1976. TH-6040 EGG TO EGG REPRODUCTION STUDY IN FATHEAD MINNOWS: LABORATORY NO. 5E-6094. UNPUBLISHED STUDY RECEIVED JUL. 19, 1976 UNDER 148-1262, PREPARED BY CANNON LABORATORIES, INC., SUBMITTED BY THOMPSON-HAYWARD CHEMCIAL CO., KANSAS CITY, KS.

***COLWELL A E; SCHAEFER C H*
DIETS OF ICTALURUS NEBULOSUS AND POMOXIS NIGROMACULATUS ALTERED BY DIFLUBENZURON
CAN J FISH AQUAT SCI 37 (4). 1980. 632-639.
Full Journal Title: Canadian Journal of Fisheries and Aquatic Sciences
Language: ENGLISH
ABSTRACT
Diflubenzuron [an insect growth regulator] was applied to 5 experimental ponds, yielding a mean concentration of 13 .mu.g/l. Residues in the water declined below detectable limits (0.2 .mu.g/l) by 14 days posttreatment. Young-of-the-year black crappie (P. nigromaculatus) and brown bullhead (I. nebulosus) accumulated diflubenzuron and then eliminated all residues by 7 days posttreatment. No fish mortalities occurred after the treatment. For 1 mo. following treatment, stomach content analyses indicated major alterations in the diets of the fish. Growth rates and condition factors of the fish 3 mo.after treatment were similar to control fish in 4 untreated ponds.

Keywords/ BLACK CRAPPIE, BROWN BULLHEAD, STOMACH, INSECT GROWTH REGULATOR

***ELLGAARD E G; BARBER J T; TIWARI S C; FRIEND A L*
AN ANALYSIS OF THE SWIMMING BEHAVIOR OF FISH EXPOSED TO THE INSECT GROWTH REGULATORS METHOPRENE AND DIFLUBENZURON
MOSQ NEWS 39 (2). 1979. 311-314.
Full Journal Title: Mosquito News
Language: ENGLISH
ABSTRACT
Locomotor activities of mosquitofish (Gambusia affinis) and goldfish (Carassius auratus) were monitored for a 2-wk period in the presence of insect growth regulators, at concentrations approximately 10-fold greater than those generally recommended for application. Methoprene, the active ingredient in Altosid SR-10, at 0.2 ppm did not significantly alter the locomotor activity of either mosquitofish or goldfish. Diflubenzuron (trade name, Dimilin) at 0.2 ppm caused a temporary hyperactivity in mosquitofish. Within 2 days following exposure the fish became about 2.5 .times. more active than controls. Maximum activity was observed on days 4 through 8 when they were 4 .times. as active as controls. Activity then decreased to control levels by day 14, suggesting that the mosquitofish were able to adjust to or compensate for the presence of diflubenzuron.

Keywords/ HYPERACTIVITY

FRASER, W. D. AND I. B. PELL. 1977. THE ACUTE TOXICITY OF DU 112307 (DIMILIN 25% WP) TO THE COMMON CARP (CYPRINUS CARPIO) AND THE RAINBOW TROUT (SALMO GAIRDNERI. REPORT NO. 55645/1/77., UNPUBLISHED STUDY RECEIVED JUL. 31 1978 UNDER 148-1259, PREPARED BY HUNTINGTON RESEARCH CENTRE, ENGLAND, SUBMITTED BY THOMPSON HAYWARD CHEMICAL CO. KANSAS CITY, KS.

***GRANETT, J., S. MORANG, AND R. HATCH.* 1978. REDUCED MOVEMENT OF PRECOCIOUS MALE ATLANTIC SALMON PARR INTO SUBLETHAL DIMILIN-G1 (LARVACIDE) AND CARRIER CONCENTRATIONS [TOXICITY]. BULL. ENVIRON. CONTAM. TOXICOL. 19 (4):462-464.

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HORSBERG T E; HOY T
TISSUE DISTRIBUTION OF CARBON-14 DIFLUBENZURON IN ATLANTIC SALMON SALMO SALAR
ACTA VET SCAND 32 (4). 1991. 527-533.
Full Journal Title: Acta Veterinaria Scandinavica
Language: ENGLISH
ABSTRACT
Diflubenzuron is a potent inhibitor of chitin synthesis, with potential use against salmon lice infestations. The absorption, distribution and elimination of the substance in Atlantic salmon was examined after a single, oral dose of 75 mg/kg bodyweight. The kinetic properties were studied by whole-body autoradiography, liquid scintillation counting and thin layer chromatography, using a 14C-labelled isotope of the substance. The drug was poorly absorbed from the intestine, but reached a concentration of more than 4 .mu.g/g in the mucus layer of the skin 2 days after administration. If maintained for several days, this concentration is probably sufficient to control all moulting stages of sea lice in Atlantic salmon. The main route of excretion was via the bile.

Keywords/ ANTIPARASITIC-DRUG, LICE, INFESTATION

***JOHNSON, C. R.* 1977. THE EFFECTS OF SUBACUTE CONCENTRATIONS OF THE INSECT GROWTH REGULATORS, DIMILIN AND METHOPRENE, ON THERMAL TOLERANCE BEHAVIOR IN THE MOSQUITOFISH GAMBUSIA AFFINIS. PROC. PAPER. ANNU. CONF. CALIF. MOSQ. CONTROL. ASSOC. 45TH . PP. 54-55.

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JOHNSON, J. H. AND R. B. MOOR., 1975. EVALUATION OF DIMILIN AGAINST THE GYPSY MOTH AND EFFECT ON NON-TARGET ORGANISMS: THE EFFECTS OF DIMILIN ON FISH. REPORT USDA FOREST SERVICE.

***JULIN A M; SANDERS H O*
TOXICITY OF THE INSECT GROWTH REGULATOR DIFLUBENZURON TO FRESH WATER INVERTEBRATES AND FISHES
MOSQ NEWS 38 (2). 1978 256-259.
Full Journal Title: Mosquito News
Language: ENGLISH
ABSTRACT
Technical grade material and wettable powder formulations of the insect growth regulator diflubenzuron and 3 of its degradation products were tested for toxicity to 3 spp. of aquatic invertebrates and 4 fishes: daphnids (Daphnia magna), scuds (Gammarus pseudolimnaeus), midges (Chironomus plumosus), rainbow trout (Salmo gairdneri), fathead minnows (Pimephales promeals), channel catfish (Ictalurus punctatus) and bluegills (Lepomis macrochirus). The acute toxicities of the wettable powder formulation of diflubenzuron ranged from a 48 h EC50 (estimated concentration immobilizing 50% of test organisms) of 0.015 mg/l for daphnids to a 96 h LC50 (estimated concentration producing 50% mortality) of 660 mg/l for bluegills. The 96 h LC50 of the technical grade material exceeded 100 mg/l for all 4 fishes. The most toxic degradation product, 4-chloroaniline, had a 96 h LC50 of 2.4 mg/l to bluegills and a 48 h EC50 of 43

mg/l to early 4-instar midge larvae. The 48 h EC50's (midge larvae) and 96 h LC50's for 3 of 4 spp. of fish fdr 4-chlorophenyl urea and 2,6-difluorobenzoic acid were greater than 100 mg/l.

Keywords/ DAPHNIA-MAGNA, GAMMARUS-PSEUDOLIMNAEUS, CHIRONOMUS-PLUMOSUS, SALMO-GAIRDNERI, PIMEPHALES-PROMELAS, ICTALURUS-PUNCTATUS, LEPOMIS-MACROCHIRUS, DEGRADATION PRODUCTS, 4 CHLORO ANILINE, 4 CHLOROPHENYL UREA, 2 6 DI FLUORO BENZOIC-ACID

LEE B M; SCOTT G I
ACUTE TOXICITY OF TEMEPHOS FENOXYCARB DIFLUBENZURON AND METHOPRENE AND BACILLUS THURINGIENSIS-VAR-ISRAELENSIS TO THE MUMMICHOG FUNDULUS HETEROCLITUS
BULL ENVIRON CONTAM TOXICOL 43 (6). 1989. 827-832.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Keywords/ MOSQUITO FISH, INSECTICIDE, PEST CONTROL, WATER POLLUTION

LUDWIG G M
EFFECTS OF TRICHLORFON FENTHION AND DIFLUBENZURON ON THE ZOOPLANKTON COMMUNITY AND ON PRODUCTION OF RECIPROCAL-CROSS HYBRID STRIPED BASS FRY IN CULTURE PONDS
AQUACULTURE 110 (3-4). 1993. 301-319.
Full Journal Title: Aquaculture
Language: ENGLISH
ABSTRACT
The application of trichlorfon, diflubenzuron, or fenthion to fertilized culture ponds stocked with 5-day- old, reciprocal-cross, hybrid striped bass fry resulted in an initital reduction in the concentration of rotifers and longer-term alteration of zooplankton successional stages, including changes in concentrations of rotifers, cladocerans, and copepods. Culture ponds without applied chemicals had the highest concentrations of small rotifers when fry were stocked, followed by high concentrations of cladocerans, copepod nauplii, and adult copepods. Fry survival in untreated ponds was higher than in chemically-treated ponds. Initial high concentrations of copepods in some ponds corresponded with low fry survival. Untreated ponds that were filled at the time of broodfish spawning, and stocked with fry 5 days later, had the highest fry survival rates, corresponding with peak rotifer concentrations, followed by a typical zooplankton succession.

Keywords/ MORONE-SAXATILIS, ROTIFER, CLADOCERANS, COPEPOD, INVERTEBRATE, FISH, AQUACULTURE, WATER POLLUTION EFFECTS, AGRICHEMICAL, FRY SURVIVAL, SUCCESSION

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MARSHALL, B. L. 1973. 96 HOURS LC50 STUDIES WITH TH-6040 TECHNICAL AND WETTABLE POWDER FORMULATIONS ON SALT WATER MINNOW, FRESH WATER TROUT AND SUNFISH. REPORT MARINE RESEARCH INSTITUTE, MASSACHUSETTS.

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NEBEKER A V; MCKINNEY P; CAIRNS M A
ACUTE AND CHRONIC EFFECTS OF DIFLUBENZURON DIMILIN IN FRESH WATER FISH AND INVERTEBRATES
ENVIRON TOXICOL CHEM 2 (3). 1983. 329-336.
Full Journal Title: Environmental Toxicology and Chemistry
Language: ENGLISH
ABSTRACT
Two fish and 7 invertebrate freshwater spp. [Pimephales promelas, Poecilia reticulata, Daphnia magna, Hyalella Azteca, Juga plicifera, Physa-spp., Clistoronia magnifica, Tanytarsus dissimilis, Cricotopus spp.] were exposed to diflubenzuron (Dimilin) in acute and chronic laboratory tests. No effects on newly hatched and juvenile fathead minnows juvenile guppies were seen at .ltoreq. 36 .mu.g/l, the highest concentration tested. An early life stage test (30 days) with fathead minnows showed no effect .ltoreq. 36 .mu.g/l. No effects on survival, growth or reproduction were observed with 2 snail spp., J. plicifera and P. spp., at .ltoreq. 36 .mu.g/l. Adult emergence of the caddis fly C. magnifica was inhibited at 0.1 .mu.g/l. D. magna were killed at 2.0 .mu.g/l. H. azteca mortality was significant at 2.0 .mu.g/l. Molting and survival of the midge T. dissimilis were affected at 4.9 .mu.g/l. Molting and survival of the midge C. spp. were affected at 4.9 .mu.g/l and adult emergence did not occur at 1.6 .mu.g/l.

Keywords/ PIMEPHALES-PROMELAS, POECILIA-RETICULATA, DAPHNIA-MAGNA, HYALELLA-AZTECA, JUGA-PLICIFERA, PHYSA-SPP, CLISTORONIA-MAGNIFICA, TANYTARSUS-DISSIMILIS, CRICOTOPUS-SPP, INSECTICIDE, MORTALITY, MOLTING

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SATAKE K N; YASUNO M
THE EFFECTS OF DIFLUBENZURON ON INVERTEBRATES AND FISHES IN A RIVER
JPN J SANIT ZOOL 38 (4). 1987. 303-316.
Full Journal Title: Japanese Journal of Sanitary Zoology

Language: ENGLISH
ABSTRACT
An insect growth regulator diflubenzuron was applied to the Kokawa River [Japan] at the concentration of 1.25 ppm for an hour to control simuliid larvae (Ogata et al., unpublished). On that occasion, the effects of the chemical on both invertebrate communities and fish were assessed. Weekly sampling of invertebrates and fish was conducted till the 4th week after the application in both treated and untreated region. Most of invertebrates were eliminated with 2 weeks, while Hydropsycidae died out gradually. Adults of Elmidae, which had not found before, appeared 1 week after in large number at the uppermost of the treated region. Fast recovery of Baetis at the same place was recognized. Downstream drifts from untreated region accounted for this result. While recolonizations by newly hatched larvae of Baetis, Chironomidae, Antocha and Simuliidae were prominent 3-4 weeks after in all the treated region. These fast recolonizers reached abnormally higher densities. On the other hand, most of caddisflies and mayflies had not recovered by the 4th weeks. Since application of diflubenzuron induces an enormous increase in target dipteran larvae including simuliids, once this chemical is used in a river, frequent applications are required subsequently. No fish mortality was observed on Phoxinus lagowski f. steindachneri and Leuciscus hakonensis. Both adults and fry of the former were commonly found during the study periods. Their condition factors increased after the application, suggesting that this species fed on attached algae which became abundant in the treated region.

Keywords/ BAETIS, ANTOCHA, PHOXINUS-LAGOWSKI-F-,STEINDACHNERI, LEUCISCUS-HAKONENSIS, DIPTERA, ELMIDAE, HYDROPSYCHIDAE, CHIRONOMIDAE, SIMULIIDAE, CADDISFLY, MAYFLY, ALGAE, LARVAE, TOXICITY, SPECIES ABUNDANCE, FEEDING, DENSITY, MORTALITY, JAPAN

SCHAEFER C H; COLWELL A E; DUPRAS E F JR
OCCURRENCE OF P CHLORO ANILINE AND P CHLOROPHENYL UREA FROM THE DEGRADATION OF DIFLUBENZURON IN WATER AND FISH
48TH MEETING, ANAHEIM, CALIF., USA, JAN. 20-23, 1980. PROC PAP ANN CONF CALIF MOSQ VECTOR CONTROL ASSOC INC 48 (0). 1980. 84-89.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ INSECTICIDE, MOSQUITO CONTROL

SCHAEFER C H; DUPRAS E F JR; STEWART R J; DAVIDSON L W; COLWELL A E
THE ACCUMULATION AND ELIMINATION OF DIFLUBENZURON BY FISH
BULL ENVIRON CONTAM TOXICOL 21 (1-2). 1979. 249-254.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Keywords/ LEPOMIS-MACROCHIRUS, POMOXIS-ANNULARIS, MOSQUITO, DDT, PARTITION COEFFICIENT, WATER SOLUBILITIES, INSECTICIDE

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APPERSON C S; SCHAEFER C H; COLWELL A E; WERNER G H; ANDERSON N L; DUPRAS E F JR; LONGANECKER D R
EFFECTS OF DIFLUBENZURON ON CHAOBORUS ASTICTOPUS AND NONTARGET ORGANISMS AND PERSISTENCE OF DIFLUBENZURON IN LENTIC HABITATS
J ECON ENTOMOL 71 (3). 1978 521-527.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
Diflubenzuron [1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl)-urea] applied to 3 farm ponds at rates of 10, 5 and 2.5 ppb, and a lake at 5 ppb, inhibited emergence of adult C. astictopus Dyar and Shannon 2-7 days following the treatments by 95-100%. Emergence reoccurred in some ponds 4.5-6 wk after treatment. Larval populations in the ponds declined by 98, 88 and 44% of pretreatment at 10, 5 and 2.5 ppb, respectively, and recovered to 30, 87 and 131% of pretreatment numbers, respectively. In the control pond, larvae declined by 53% during the same period but increased to 314% of initial numbers. In the lake, larvae decreased by 99% of the pretreatment level 3 wk posttreatment and remained at low levels. Suppression of crustacean zooplankton occurred at all treatment rates. Cladocerans were more susceptible than copepods and required longer recovery periods. Pond and lake rotifer and algal populations were not altered by the treatments. Bluegill sunfish, Lepomis macrochirus Rafinesque, collected from the lake fed predominantly on cladocerans and copepods but switched to chironomid midges and terrestrial insects after the treatment. Fish growth was not altered by the treatment. Residues in ponds treated at 10, 5 and 2.5 ppb averaged 9.8, 4.6 and 1.9 ppb, respectively, shortly after the applications, and declined steadily averaging 0.2, 0.3 and 0.5 ppb, respectively, 2 wk later. diflubenzuron residues in the lake averaged 3.3 ppb following treatment, and after 35 days, averaged 0.4 ppb. No residues were found in lake sediment. Residues in white crappie, Pomoxis annularis Rafinesque, varied from 355.1-62.2 ppb at 4 and 21 days, respectively, following treatment. Fish residues did not persist at high levels and by 14 days post-treatment, they had begun to decline rapidly.

Keywords/ LEPOMIS-MACROCHIRUS, POMOXIS-ANNULARIS, CLADOCERANS, COPEPODS, ROTIFERS, ALGAE, CHIRONOMIDS, TERRESTRIAL INSECTS, INSECT GROWTH REGULATOR, RESIDUES

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COLWELL, A. E., AND C. H. SCHAEFER.. 1978. EFFECTS OF DIMILIN ON NON-TARGET ORGANISMS DURING A CHAOBORUS FIELD TRAIL. LAKE COUNTY MOSQUITO ABATEMENT DISTRICT, LAKEPORT, CALIFORNIA 95453.

*FARLOW, J E. 19*76. ECOLOGICAL IMPACT OF DIMILIN ON THE AQUATIC FAUNA (SIC) OF A LOUISIANA COASTAL MARSH. DOCTORIAL DISSERTATION, LOUISIANA STATE UNIV. AND AG. AND MECH. COLLEGE, DEPT. OF ENT. (UNPUBLISHED STUDY RECEIVED DEC. 23, 1976 UNDER 148-1258; SUBMITTED BY THOMPSON HAYWARD CHEMICAL CO. KANSAS CITY, KS.

***FISCHER S A; HALL L W JR*
ENVIRONMENTAL CONCENTRATIONS AND AQUATIC TOXICITY DATA ON DIFLUBENZURON DIMILIN
CRIT REV TOXICOL 22 (1). 1992. 45-79.
Full Journal Title: Critical Reviews in Toxicology
Language: ENGLISH
ABSTRACT
The insecticide diflubenzuron (DFB) is commonly used in various mid-Atlantic states for suppression of gypsy moths in hardwood forests. DFB is potentially toxic to nontarget biota because it can enter aquatic systems through aerial application or runoff after precipitation events. Based on this concern, the objectives of this study were to: (1) compile, review, and synthesize literature on the fate, persistence, and environmental concentrations of DFB in both freshwater and saltwater environments; (2) compile, review, and synthesize acute and chronic aquatic toxicity data on DFB effects on freshwater and saltwater organisms; (3) assess possible risk to aquatic biota associated with the use of this insecticide in one specific area (Maryland); and (4) recommended future research based on the data gaps identified from this study. DFB has low solubility in water and exists as a technical grade (TG) and wettable powder (WP) formulation. The toxcity of both formulations is similar at concentrations < 10 .mu.g/l. Organic matter is a major factor influencing the adsorption and degradation of DFB in freshwater, saltwater, and sediment. The half-life of this insecticide in freshwater is.apprxeq. 3 days at a pH of 10 and temperature of 36.degree. C. At lower pH conditions of 6 and at the same temperature, DFB is more persistent since half-life values of .apprxeq. 9 days hae been reported. The half- life of DFB in soil is < 14 days when the particle size was .approx. 2 .mu.m. The half-life is generally vegetation acts as a sink for DFB by gradually adsorbing the chemical and releasing it over a period of time. Freshwater organisms demonstrated a wide range of sensitivity to DFB. Sensitivity was dependent on body composition (i.e., exo- vs. endoskeleton), trophic level, and life stage. During acute exposures, aquatic invertebrtates were more than 25,000 times as sensitivie to DFB than fishes. The most acutely sensitive species tested was the Amphipod, Hyallela aztecà (96-h LC50 = 1.84 .mu.g/l). A mature Plecopteran, Skwala sp., was the most resistant invertebrate species tested in acute tests (96-h LC50 > 100,000 .mu.g/l). In chronic tests, DFB concentrations of 1 mu.g/l or greater were reported to eliminate populations of various Plecopteran (stoneflies) and Ephemeropteran (mayflies) species after 1 month of exposure. A 30-day LC50 of 0.1 .mu.g/l DFB was also reported for the Tricopteran, Clistorinia magnifica. Freshwater fish were resistant to acute exposures of DFB as 96-h LC50s were generally > 50,000 .mu.g/l. Fish were also reported to accumulate DFB rapidly during acute exposures but were capable of eliminating this insecticide within 7 days. Most of the DFB aquatic toxicity studies with saltwater organisms were conducted with invertebrates. The most acutely sensitive species tested was the premolt state of grass shrimp (96-h LC50 = 1.11 .mu.g/l). The mummichog, Fundulus heteroclitus, the most resistant species tested, had a 96-h LC50 of 32.99 mg/l. The lowest reported chronic effect concentration for saltwater organisms exposed to DFB was 0.075 .mu.g/l. This concentration was reported to significantly reduced reproduction in the mysid shrimp, Mysidopsis bahia. Data from the State of Maryland were used as a example for predicting the potential environmental effects of DFB on aquatic biota in Maryland waters. A case can be made for possible environmental effects given the worst case conditions of the host sensitive species (premolt stage of grass shrimp wih a 96-h LC50 of 1.11 .mu.g/l) exposed to the highest reported environmental

concentration (1.5 .mu.g/l DFB in water). However, in most cases, the present data base would suggest that environmental effects are not likely.

Keywords/ HYALELLA-AZTECA, CLISTORONIA-MAGNIFICA, FUNDULUS- HETEROCLITUS, MYSIDOPSIS-BAHIA, INSECTICIDE, MARYLAND

***GATTAVECCHIA E; DI PIETRA A M; TONELLI D; BORGATTI A*
EFFECT OF DIFLUBENZURON AND ITS MAJOR DEGRADATION PRODUCTS ON THE GROWTH OF EUGLENA GRACILIS AND INCORPORATION OF UNIFORMLY LABELED CARBON-14 GLYCINE IN PROTEIN
J ENVIRON SCI HEALTH PART B PESTIC FOOD CONTAM AGRIC WASTES 16 (2). 1981.159-166.
Full Journal Title: Journal of Environmental Science and Health Part B Pesticides Food Contaminants and Agricultural Wastes
Language: ENGLISH
ABSTRACT
Diflubenzuron (I) [an insect growth regulator] and its major degradation products 4-chlorophenyl urea (II), 2,6-difluorobenzoic acid (III) and 4-chloroaniline (IV) were tested for their activity on Euglena gracilis. The inhibition on the growth and on [U-14C]Gly incorporation in the protein of Euglena was measured in the presence of I-IV ranging 10-200 ppm 4-Chloroaniline caused a considerable inhibition at every tested level whereas I-III only slightly affected the incorporation. Diflubenzuron shows no effect on growth and protein biosynthesis for this nontarget organism.

Keywords/ 4 CHLOROPHENYL UREA, 2 6 DI FLUORO BENZOIC-ACID, 4 CHLORO ANILINE, INSECT GROWTH REGULATOR

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***HANSEN S R; GARTON R R*
ABILITY OF STANDARD TOXICITY TESTS TO PREDICT THE EFFECTS OF THE INSECTICIDE DIFLUBENZURON ON LABORATORY STREAM COMMUNITIES
CAN J FISH AQUAT SCI 39 (9). 1982. 1273-1288.
Full Journal Title: Canadian Journal of Fisheries and Aquatic Sciences
Language: ENGLISH
ABSTRACT
The ability of a standard set of freshwater single-species toxicity tests to predict accurately effects of the insecticide diflubenzuron on complex laboratory stream communities was assessed. The single-species tests complied with requirements prescribed for establishing freshwater quality criteria and included 9 freshwater animal [Salmo gairdneri, Pimephales promelas, Lebistes reticulatus, Cricotopus sp., Tanytarsus dissimilis, Hyallela azteca, Daphnia magna, Juga plicifera, Physa sp.] acute tests, 5 freshwater animal [S. gairdneri, P. promelas, D. magna, J. plicifera, Physa sp.] chronic tests and 1 freshwater algal [Selenastrum capricornutum] test. The stream communities were stocked from a natural source, equilibrated for 3 mo. and then treated with diflubenzuron for 5 mo. Effects on these stream communities were assessed at the functional group level using biomass and diversity for the analysis. The single-species tests adequately predicted the concentrations of diflubenzuron which affected these stream communities; the most-sensitive test species, insects and crustaceans, were up to an order of magnitude more sensitive than the observed community effects. The single-species tests were less successful in predicting the exact

nature of the community level effects. Those effects resulting from direct lethality to component species were clearly predicted; indirect effects due to altered interspecies interactions could only be predicted with an a priori knowledge of the system's trophic dynamics.

Keywords/ SALMO-GAIRDNERI, PIMEPHALES-PROMELAS, LEBISTES- RETICULATUS, CRICOTOPUS-SP, TANYTARSUS-DISSIMILIS, HYALLELA-AZTECA, DAPHNIA- MAGNA, JUGA-PLICIFERA, PHYSA-SP, SELANASTRUM-CAPRICORNUTUM

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PESTICIDES THEIR IMPACT ON THE ESTUARINE ENVIRONMENT
VERNBERG, W. B. ET AL. (ED.). MARINE POLLUTION: FUNCTIONAL RESPONSES; ` PROCEEDINGS OF THE SYMPOSIUM ON POLLUTION AND PHYSIOLOGY OF MARINE ORGANISMS, GEORGETOWN, S.C., USA, NOV. 14-17, 1977. XIII+454P. ACADEMIC PRESS, INC.: NEW YORK, N.Y., USA; LONDON, ENGLAND. ILLUS. ISBN 0-12-718260-8. 0 (0). 1979. P259-270.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/: REVIEW, PELICAN, TELEOST, ENDRIN, MALATHION, DDT, STROBANE, CHLORDANE, ALTOSID, DIMILIN, KEPONE, TRIFLURALIN, PENTA CHLORO PHENOL, FUNGICIDE, INSECTICIDE, HERBICIDE

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***SUNDARAM K M S; HOLMES S B; KREUTZWEISER D P; SUNDARAM A; KINGSBURY P D*
ENVIRONMENTAL PERSISTENCE AND IMPACT OF DIFLUBENZURON IN A FOREST AQUATIC ENVIRONMENT FOLLOWING AERIAL APPLICATION
ARCH ENVIRON CONTAM TOXICOL 20 (3). 1991. 313-324.
Full Journal Title: Archives of Environmental Contamination and Toxicology
Language: ENGLISH
ABSTRACT
Dimilin WP-25 (diflubenzuron) was applied at a rate of 70 g active ingredient (AI) in 10, 5, and 2.5 L/ha to three spray blocks in a mixed boreal forest near Kaladar, Ontario, Canada. Water, sediment, and aquatic plants were collected from two ponds and a stream at intervals up to 30 days post-treatment for analysis of diflubenzuron (DFB) residues. The duration of detectable residues was different for each substrate, but in all cases was less than two weeks. Zooplankton and benthic invertebrate populations were monitored for up to 110 days post-spray in two ponds in the high volume rate block and in control ponds. Significant mortality occurred in two groups of caged macroinvertebrates amphipoda and immature corixidae) 1 to 6 days after the ponds were treated with Dimilin. Three taxa of littoral insects (Caenis, elithemis and Coenagrion) were significantly reduced in abundance in the treated ponds 21 to 34 d post-treatment, but recovered to pre-treatment levels by the end of the season. Of the six remaining groups studied, only one (immature corixidae), may have been slightly affected by treatment. Zooplankton (cladocera and copepoda) populations were reduced 3 days after treatment and remained suppressed for 2-3 months.

Keywords/ CAENIS-SP, CELITHEMIS-SP, COENAGRION-SP, INSECT, ZOOPLANKTON, DIMILIN WP-25, WATER, SOIL POLLUTION 1-4 CHLOROPHENYL-3-2 6-DIFLUOROBENZOYLUREA, INSECTICIDE, FORESTRY ENVIRONMENTAL SURVEILLANCE, KALADAR ONTARIO CANADA

SUNDARAM K M S
DEPOSITION PERSISTENCE AND DISSIPATION OF DIFLUBENZURON IN POND AND STREAM ENVIRONMENTS FOLLOWING APPLICATION OF DIMILIN WP-25
ANNUAL MEETING OF THE CANADIAN PEST MANAGEMENT SOCIETY, LONDON, ONTARIO, CANADA, JUNE 22-26, 1987. CAN J PLANT SCI 69 (1). 1989. 259-260.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/ ABSTRACT, WATER SEDIMENT,AQUATIC PLANTS, INSECTICIDE

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Plants

***GATTAVECCHIA E; DI PIETRA A M; TONELLI D; BORGATTI A*
EFFECT OF DIFLUBENZURON AND ITS MAJOR DEGRADATION PRODUCTS ON THE GROWTH OF EUGLENA GRACILIS AND INCORPORATION OF UNIFORMLY LABELED CARBON-14 GLYCINE IN PROTEIN
J ENVIRON SCI HEALTH PART B PESTIC FOOD CONTAM AGRIC WASTES 16 (2). 1981.159-166.
Full Journal Title: Journal of Environmental Science and Health Part B Pesticides Food Contaminants and Agricultural Wastes
Language: ENGLISH
ABSTRACT
Diflubenzuron (I) [an insect growth regulator] and its major degradation products 4-chlorophenyl urea (II), 2,6-difluorobenzoic acid (III) and 4-chloroaniline (IV) were tested for their activity on Euglena gracilis. The inhibition on the growth and on [U-14C]Gly incorporation in the protein of Euglena was measured in the presence of I-IV ranging 10-200 ppm 4-Chloroaniline caused a considerable inhibition at every tested level whereas I-III only slightly affected the incorporation. Diflubenzuron shows no effect on growth and protein biosynthesis for this nontarget organism.

Keywords/ 4 CHLOROPHENYL UREA, 2 6 DI FLUORO BENZOIC-ACID, 4 CHLORO ANILINE, INSECT GROWTH REGULATOR

TERRESTRIAL

Invertebrates/Pollinators

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BARKER R J; WALLER G D
EFFECTS OF DIFLUBENZURON WETTABLE POWDER ON CAGED HONEY BEE COLONIES
ENVIRON ENTOMOL 7 (4). 1978 534-535.
Full Journal Title: Environmental Entomology
Language: ENGLISH
ABSTRACT
A 25% wettable powder formulation of diflubenzuron (100 ppm active ingredient) supplied in water to colonies of honeybees, Apis mellifera L., almost eliminated production of brood. Treated bees consumed significantly less water and pollen cake and produced significantly less comb, brood and new workers. Treated bees had more eggs in the combs.

Keywords/APIS-MELLIFERA, POLLEN CAKE, BROOD, PRODUCTION

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DAVIS E J; ROBINSON W S; ROUSH C F; AKRE R D; JOHANSEN C A; TURNER W J
IMPACT OF CHEMICAL CONTROL APPLICATIONS FOR THE DOUGLAS-FIR TUSSOCK MOTH ON BENEFICIAL INSECTS INCLUDING BIOLOGICAL STUDIES OF BEES YELLOW-JACKETS AND FLESH FLIES
MELANDERIA 30. 1978. III-IV, 1-8.
Full Journal Title: Melanderia
Language: ENGLISH
ABSTRACT

A suitable material to replace DDT was investigated for control of Orgyia pseudotsugata. The region studied included the Blue Mountains of the western USA. The insecticides studied were carbaryl, diflubenzuron and acephate. Results, methods and weather conditions are included.

Descriptors/Keywords: WESTERN USA, ORGYIA-PSEUDOTSUGATA, INSECTICIDE, DDT, ACEPHATE, CARBARYL, DIFLUBENZURON, WEATHER

DROBNIKOVA V; BACILEK J
EFFECT OF SOME PESTICIDES ON MICROORGANISMS ISOLATED FROM HONEY BEES
BULL ENVIRON CONTAM TOXICOL 29 (6). 1982. 734-738.
Full Journal Title: Bulletin of Environmental Contamination and Toxicology
Language: ENGLISH

Descriptors/Keywords: BACILLUS-BREVIS, BACILLUS-MACERANS, BACILLUS-LARVAE, MICROCOCCUS-VARIANS, ACINETOBACTER-SP, SCHIZOSACCHAROMYCES-SP, TORULOPSIS-VERSATILIS, CANDIDA-SHEHATAE, ALIMENTARY TRACT, FLORA CONTAMINATION, BIO MONITORING, FENITROTHION, PIRIMIPHOS-METHYL, PHOSALONE BROMOPHOS-ETHYL, EVISEKT, DIFLUBENZURON, PIRIMICARB, FOLPET, PHTHALIMIDE

EGGER, A. 1978. EFFECTS OF (THE INSECTICIDE) DIMILIN ON THE CARNIOLAN HONEY BEE APIS MELLIFERA CARNICA."; BIENENWELT 20 (7) PP 146-149.

EGGER, A. 1975. THE SIDE EFFECTS OF DIMILIN ON HONEY BEES, APIS MELIFERA, INVESTIGATION IN RELATION TO AIRPLANE APPLICATION IN FOREST (TO CONTROL PRISTIPHORA ABIETINA). CENTRALBL GESMATE FORSTWES 94 (2): 65-72. ENG. SUM.

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NATION J L; ROBINSON F A; YU S J; BOLTEN A B
INFLUENCE UPON HONEYBEES OF CHRONIC EXPOSURE TO VERY LOW LEVELS OF SELECTED INSECTICIDES IN THEIR DIET
J APIC RES 25 (3). 1986. 170-177.
Full Journal Title: Journal of Apicultural Research
Language: ENGLISH
ABSTRACT
Several sizes of hive were treated for colony viability and ease of manipulation when colonies of honeybees were confined within screened cages. Hives containing either a single standard frame (1742 cm2) or a single miniature frame (431 cm2) were acceptable, but hives containing a single standard frame were used in our experiments because they were easier to manipulate and produced more brood that could be used for other experimental purposes. A small colony was established in each of several 1.8 .times. 1.8 .times. 2.0-m screened cages. Pollen cakes containing 0.017 ppm permethrin, 0.16 ppm malathion, 5.12 ppm methoxychlor, 10 ppm diflubenzuron, 0.17 ppm carbaryl or no pesticide were fed to the colonies to determine the effects on the bees of chronic exposure. During a test period of 10 weeks only methoxychlor caused a significant reduction ($P < 0.05$) in quantity of brood reared, amount of pollen cake consumed, and amount of sucrose syrup stored in the colonies. Diflubenzuron at 10 ppm caused greater than 50% reduction in the amount of syrup stored compared to control colonies, but it did not cause reduction in consumption of pollen or in the quantity of brood reared. In general, colonies fed insecticides accumulated debris and dead bees on the hive bottom because of reduced house-cleaning. Colonies fed methoxychlor or malathion were particularly susceptible to invasion by wax moth.

Keywords/ WAX MOTH, SUSCEPTIBILITY, POLLEN CAKE, PERMETHRIN, MALATHION, METHOXYCHLOR, DIFLUBENZURON, CARBARYL, SUCROSE SYRUP, STORAGE

***ROBINSON, F.* 1979. THE EFFECTS OF REPEATED SPRAY APPLICATIONS OF DIMILIN W-25 ON HONEY BEE APIS MELLIFERA COLONIES IN COTTON FIELDS (TOXICITY, EFFECTS ON BROOD REARING). AM BEE JOURNAL 119(3): 193-194.

ROBINSON W S; JOHANSEN C A
EFFECTS OF CONTROL CHEMICALS FOR DOUGLAS-FIR TUSSOCK MOTH ORGYIA PSEUDOTSUGATA ON FOREST POLLINATION LEPIDOPTERA LYMANTRIIDAE
MELANDERIA 30. 1978. 9-56.
Full Journal Title: Melanderia
Language: ENGLISH
ABSTRACT
Honey bees were badly injured or killed by treatment with acephate or carbaryl (Sevin 4 Oil formulation) at several dosages. Diflubenzuron had no effect on honey bee colonies. Activity of foraging wild bees after the sprays indicated a similar pattern of immediate effects from the chemicals. Reduction of foragers occurred for several days in plots treated with acephate or carbaryl, while depressions in populations were rare in untreated or diflubenzuron-treated plots. At least 35 of 39 of the more abundant forbs and shrubs in the area were benefited by insect pollination. Fruit production by Mertensia paniculata was reduced on an acephate-treated plot. However, no continuing effects were obtained with 17 spp. of plantssampled the year after application. Bumble bees and mason bees (Osmia) were the major native pollinators in the plots, representing about 50% and 25% of all bees observed. A succession of wild bee species emerging through the summer and 3-6 wk or late season blooming periods of all but 5 of 39 plants of importance to wildlife make it unlikely that a single application of chemicals would cause long-term disruption of the pollination ecology of Pacific Northwest [USA] forests at the elevations studied. Overgrazing by cattle had a greater adverse effect on forest vegetation. All other factors being equal in a cost-benefit analysis, the results of this study encourage the use of diflubenzuron as the least disruptive of pollination if control measures for Douglas-fir tussock moth are necessary in the future.

Keywords/ USA, HONEY BEE COLONY, OSMIA, WILD BEE, FORB, SHRUB, FOREST, FOREST VEGETATION, MERTENSIA-PANICULATA, WILDLIFE, CATTLE, POLLINATORS, ACEPHATE, CARBARYL, DIFLUBENZURON, SUMMER

STEVENSON, J. 1978. THE ACUTE TOXICITY OF UNFORMULATED PESTICIDES TO WORKER HONEY BEES APIS MELLIFERA (L.). PLANT PATHOLOGY 27 (1): 38-40.

STONER A; WILSON W T
DIFLUBENZURON DIMILIN EFFECT OF LONG-TERM FEEDING OF LOW DOSES IN SUGAR CAKE OR SUCROSE SYRUP ON HONEY BEES APIS MELLIFERA IN STANDARD SIZE FIELD COLONIES
AM BEE J 122 (8). 1982. 579-582.
Full Journal Title: American Bee Journal
Language: ENGLISH
ABSTRACT
Standard-size (10-frame Langstroth) field colonies of honey bees, A. mellifera L., located in an area of limited natural bee forage were fed longterm controlled low doses of diflubenzuron (Dimilin) in sugar cake (1979) and sucrose syrup (1980). Dimilin fed in sugar cake significantly reduced sealed brood when fed at rates of 1.0 or 10 ppm and reduced adult bees when fed at the 10 ppm rate. No level of Dimilin, 0.01, 0.1 or 1.0 ppm, fed in sucrose syrup had any direct detectable effect on sealed brood, the adult bee population or mortality of adult bees.

Keywords/ SEALED BROOD, MORTALITY

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Invertebrates/Predators/Parasites

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***BROWN M W; RESPICIO N C*
EFFECT OF DIFLUBENZURON ON THE GYPSY MOTH EGG PARASITE OOENCYRTUS KUVANAE HYMENOPTERA ENCYRTIDAE
MELSHEIMER ENTOMOL SER 0 (31). 1981. 1-7.
Full Journal Title: Melsheimer Entomological Series
Language: ENGLISH
ABSTRACT
Effects of diflubenzuron on O. kuvanae (Howard) were tested in the laboratory. The parasites were exposed to egg masses topically treated with diflubenzuron and to eggs from Lymantria dispar (L.)(Lepidoptera:Lymantriidae) adults which were treated, as larvae, with sublethal concentrations. In both cases, there was no effect on the number of progeny produced, developmental time or sex ratio of the progeny. At the higher concentrations of diflubenzuron, the mortality rate of adult parasites increased slightly. Field data confirmed there was no measurable effect of diflubenzuron on parasitism by O. kuvanae. Use of diflubenzuron and O. kuvanae would be compatible control tactics in a gypsy moth pestmanagement program.

Descriptors/Keywords: LYMANTRIA-DISPAR, PEST MANAGEMENT, PROGENY, DEVELOPMENT, MORTALITY

BULL D L; COLEMAN R J
EFFECTS OF PESTICIDES ON TRICHOGRAMMA-SPP
SOUTHWEST ENTOMOL SUPPL 0 (8). 1985). 156-168.
Full Journal Title: Southwestern Entomologist Supplement
Language: ENGLISH
ABSTRACT
Adult stages of Trichogramma species are generally highly susceptible to most broad-spectrum chemical insecticides. In contrast, immature stages of the parasite developing within host eggs apparently are well protected from even the most toxic compounds. However, with some pesticides there are deleterious effects when pharate adults try to emerge from the host egg. Among the chemical insecticides evaluated, these parasites are generally most susceptible to compounds such as carbaryl, methyl parathion, permethrin, and oxydemeton-methyl. They are relatively tolerant of compounds such as endosulfan and thiodicarb, as well as chlordimeform and methomyl when the latter are used at recommended ovicidal rates. The parasites are applied in the absence of crop oil. Unfortunately, the oil must be included for diflubenzuron to be fully effective against the boll weevil, Anthonomus grandis Boheman, and crop oils have a highly deleterious effect on the parasites (at least on Trichogramma pretiosum Riley). Microbial pesticides are fully compatible with Trichogramma spp. It is conceivable that Trichogramma releases could be integrated with applications of certain pesticides, but only under carefully controlled conditions. The most likely use of this biological control procedure is incropping systems where insecticides are absent or are used only sparingly.

Descriptors/Keywords: ANTHONOMUS-GRANDIS, TRICHOGRAMMA-PRETIOSUM, CARBARYL, METHYL PARATHION, PERMETHRIN, OXYDEMETON METHYL, ENDOSULFAN, METHOMYL, THIODICARB, CHLORDIMEFORM, DIFLUBENZURON, MICROBIAL PESTICIDE

GRANETT, J., D. DUNBAR, AND R. WESELOH. 1978. GYPSY MOTH CONTROL WITH DIMILIN SPRAYS TIMED TO MINIMIZE EFFECTS ON THE PARASITE APANTELES MELANOSCELU. J. OF ECONOM. ENTOMOL 69(3):403-404.

GRANETT, J. AND R.M. WESELOH. 1975. FIMILIN TOXICITY TO THE GYPSY MOTH (PORTHETRIA DISPAR) LARVAL PARASITIOD, APANTELES MELANOSCELUS. J. ECON. ENTOMOL. 68(5):577-580.

GRANETT J., R. M. WESELOH, AND D. M. DUNBAR. 1975. DIMILIN TOXICITY TO APANTELES MELANOSCELUS (RATZEBURG) (HYMENOPTERA: BRACONIDAE) AND EFFECTS ON FIELD POPULATIONS. J. N.Y. ENTOMOL. SOC. 83 (4):242-243.

HOUSE V S; ABLES J R; MORRISON R K; BULL D L
EFFECT OF DIFLUBENZURON FORMULATIONS ON THE EGG PARASITE TRICHOGRAMMA PRETIOSUM
SOUTHWEST ENTOMOL 5 (2). 1980. 133-138.
Full Journal Title: Southwestern Entomologist
Language: ENGLISH
ABSTRACT
A mixture of diflubenzuron (25% WP [wettable powder], 70 g AI[active ingredient]/ha), crop oil (Savol, 4.7 l/ha) and water applied to control the boll weevil, Anthonomus grandis Boheman, had an adverse effect on the level of parasitism of Heliothis spp. eggs by Trichogramma pretiosum Riley. Laboratory studies subsequently demonstrated that application of diflubenzuron alone did not affect levels of parasitism; application of mixtures of crop oil and diflubenzuron or of crop oil alone significantly reduced the levels of parasitism of Heliothis spp. eggs by T. pretiosum.

Keywords/ ANTHONOMUS-GRANDIS HELIOTHIS-SPP

***KHOO B K; FORGASH A J; RESPICIO N C; RAMASWAMY S B*
MULTIPLE PROGENY PRODUCTION BY GYPSY MOTH PARASITES BRACHYMERIA-SPP HYMENOPTERA CHALCIDIDAE FOLLOWING EXPOSURE TO DIFLUBENZURON
ENVIRON ENTOMOL 14 (6). 1985. 820-825.
Full Journal Title: Environmental Entomology
Language: ENGLISH
ABSTRACT
Topical treatment of adult Brachymeria intermedia (Nees), a pupal parasite of Lymantria dispar (L.), with 2 or 4 .mu.g of the chitin synthesis inhibitor diflubenzuron resulted in the production of multiple progeny (up to 14) within a single host, whereasthere is normally only one offspring per host pupa. Only females needed to be treated to obtain the effect. Similar results were obtained with B. lasus (Walker). A single treatment lasted up to 3 weeks. Some malformed progeny were produced, and not all progeny survived to maturity or emerged successfully. Although there was considerable variation in the size of F1 adults, they produced normal progeny at the rate of one offspring per host.

Keywords/ BRACHYMERIA-LASUS, BRACHYMERIA-INTERMEDIA, LYMANTRIA-DISPAR, INSECT GROWTH REGULATOR, NONTARGET ORGANISM

***MADRID F J; STEWART R K*
IMPACT OF DIFLUBENZURON SPRAY ON GYPSY MOTH LYMANTRIA DISPAR PARASITOIDS IN THE FIELD

J ECON ENTOMOL 74 (1). 1981. 1-2.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
Diflubenzuron, [1(4-chlorophenyl)-3-(2,6 difluorobenzoyl)-urea], an insect growth regulator for control of L. dispar (L.) was applied once at .03 kg AI [active ingredient] in 4.76 l water/ha using a Grumman Ag Cat aircraft. Gypsy moth larval mortality was high, .apprx. 50% after 1 wk and 100% after 10 days. Apanteles melanoscelus (Ratzeburg) mortality was .apprx. 80% after 2 wk. Tachinids showed 100% mortality.

Descriptors/Keywords: APANTELES-MELANOSCELUS, TACHINID, LARVAL MORTALITY, 14 CHLOROPHENYL-3-2 6-DIFLUOROBENZOYL UREA, AIRCRAFT

MICHELETTI S M F B
INSECTICIDE EFFECTS ON TRICHOGRAMMA-SPP HYMENOPTERA TRICHOGRAMMATIDAE EMERGENCE
AN SOC ENTOMOL BRAS 20 (2). 1991. 265-269.
Full Journal Title: Anais da Sociedade Entomologica do Brasil
Language: PORTUGUESE
ABSTRACT
Studies were made on the action of different insecticides, using the largest recommended dosages for tests of cotton, on emergence of Trichogramma spp. The experiment was conducted at EMBRAPA/CNPA (National Cotton Research Center), in Campina Grande, Paraiba, Brazil. The experimental desing was entirely randomized. Eggs of Sitotroga cerealella (Oliv., 1818) (Lepidoptera: Gelechiidae), 10 days after being parasitized by Trichogramma were counted and submitted to the following treatments (ina. i./ha); cypermethrin 25 EC, 62, 5g; deltamethrin 2,5 EC, 10, 0g; endosulfan 35 EC, 700 g; demeton-s-methyl 250EC, 200g; parathion-methyl 600 EC, 600 g; carbaryl 850 WP, 1700 g; malathion 1000EC, 2000 g; diflubenzuron 25 WP, 15g and azinphos-ethyl 400 EC, 800g, replicated five times. The insecticide applications were made with a hand operated Knapsack sprayer. The evaluation was based on the counting of eggs containing emergence holes, 14 days after the eggs have been parasitized and 4 daysafter the treatment. The products applied did not cause harmful effects of Trichogramma spp.

Keywords/ SITOTROGA-CEREALELLA, COTTON CROP, CYPERMETHRIN, DELTAMETHRIN, ENDOSULFAN, DEMETON-S-METHYL PARATHION, CARBARYL, MALATHION, DIFLUBENZURON

NARAYANA M L; BABU T R
EVALUATION OF FIVE INSECT GROWTH REGULATORS ON THE EGG PARASITOID TRICHOGRAMMA CHILONIS ISHII HYM. TRICHOGRAMMATIDAE AND THE HATCHABILITY OF CORCYRA CEPHALONICA STAINT LEP. GALLERIIDAE
J APPL ENTOMOL 113 (1). 1992. 56-60.
Full Journal Title: Journal of Applied Entomology
Language: ENGLISH
ABSTRACT
The five antimoulting compounds viz., diflubenzuron, buprofezin, triflumuron, flucycloxuron and HOE 607 were evaluated for their effects on Trichogramma chilonis, an important egg parasitoid of castor semilooper, Achoea janata L. The development of the immature stages of T. chilonis was drastically affected when exposed to growth regulators at 4 days after parasitisation and the effects were more pronounced with triflumuron and HOE 607. Exposure at 7th day after parasitisation had very little effect on the emergence of adults, but decreased significantly the fecundity of emerged adults. Triflumuron and HOE 607 also exerted pronounced adverse effects on the hatchability of Corcyra cephalonica.

Keywords/ HYMENOPTERA, LEPIDOPTERA, NON-TARGET ORGANISM, ADULT EMERGENCE, BIOLOGICAL CONTROL, DIFLUBENZURON, BUPROFEZIN, TRIFLUMURON, FLUCYCLOXURON, HOE-607, FECUNDITY, HATCHABILITY

***SAMPLE B E; BUTLER L; WHITMORE R C*
EFFECTS OF AN OPERATIONAL APPLICATION OF DIMILIN ON NON-TARGET INSECTS
CAN ENTOMOL 125 (2). 1993. 173-179.
Full Journal Title: Canadian Entomologist
Language: ENGLISH
ABSTRACT
Effects of an operational application of Dimilin on non-target insects were evaluated in eastern West Virginia [USA] in 1988 and 1989. Diminlin was applied in 1988 (70, 75 g AI per ha). Insects were collected by light-traps at seven pairs of Dimilin-treated and control sites. Lepidoptera experienced the greatest impact, displaying reduced abundance and species richness at treated sites. No effects were observed among Coleoptera, Diptera, or Hymenoptera.

Keywords/ INSECTICIDE, LEPIDOPTERA, COLEOPTERA, HYMENOPTERA, DIPTERA, SPECIES ABUNDANCE SPECIES RICHNESS, WEST VIRGINIA USA

SAUPHANOR B; CHABROL L; FAIVRE-D'ARCIER F; SUREAU F; LENFANT C
SIDE EFFECTS OF DIFLUBENZURON ON A PEAR PSYLLA PREDATOR FORFICULA-AURICULARIA
ENTOMOPHAGA 38 (2). 1993. 163-174.
Full Journal Title: Entomophaga
Language: ENGLISH
ABSTRACT
A series of laboratory, semi-field and field tests showed the high toxicity of diflubenzuron to Forficula auricularia L. nymphs, at concentrations of 15 and 20 g a.i./hl registered in various European countries and the United States to control Cydia pomonella L. Diflubenzuron proved more selective using the 10 g/hl concentration registered in France, but several sublethal effects have been observed: morphological abnormalities, reduced weight increase and mobility. Unexpectedly for a chitin-deposit inhibitor, intake was reduced, which became apparent from the beginning of exposure to the insecticide, before the onset of the moulting process. In the semi-field tests, and despite diflubenzuron's slowing down effect on psylla nymphs, the earwig's reduced predatory activity due to the product resulted in greater growth of the psylla populations than without treatment. The field-test confirmed the efficacy of F. auricularia as a psylla predator, and the relative selectivity of diflubenzuron at the lowest concentration.

Keywords/ PESTS INSECT PEST CONTROL BIOLOGICAL CONTROL

SECHSER B; THUELER P; BACHMANN A
OBSERVATIONS ON POPULATION LEVELS OF THE EUROPEAN RED MITE PANONYCHUS ULMI ACARINA TETRANYCHIDAE AND ASSOCIATED ARTHROPOD PREDATOR COMPLEXES IN DIFFERENT SPRAY PROGRAMS OVER A 5-YEAR PERIOD
ENVIRON ENTOMOL 13 (6). 1984. 1577-1582.
Full Journal Title: Environmental Entomology
Language: ENGLISH
ABSTRACT
Selective and nonselective insecticide and fungicide treatments were applied in season-long programs in a Swiss apple orchard, for the control of arthropod and fungal pest complexes. The effects of these treatments on P. ulmi (Koch) and its predators were studied over a period of 5 yr. A broad-spectrum compound, azinphos-methyl, gave good control of the codling moth, Cydia pomonella L., under a program of 4 to 6 sprays every 2 wk per season. Equal or slightly inferior

control was given by the more selective chemicals, chlordimeform and diflubenzuron. Fungicides used were either mite-suppressive or had no effect on mite predators. Effective P. ulmi predation was also enhanced by the use of selective acaricides and the combined effects of a predaceous mite, Amblyseius finlandicus (Oudemans), and a number of beneficial insects which became established in the blocks that received the selective insecticide treatments. These beneficial arthropods kept P. ulmi numbers below the damage threshold, demonstrating that integrated chemical and biological control of this pest is possible.

Keywords/ CYDIA-POMONELLA, AMBLYSEIUS-FINLANDICUS, APPLE, AZINPHOS-METHYL, CHLORDIMEFORM, DIFLUBENZURON, INSECT GROWTH REGULATOR, INSECTICIDE, FUNGICIDE,ACARICIDE, SWITZERLAND

SIMMON, G. A. 1975. THE EFFECTS OF TH-6040 ON THE PARASITOIDS OF THE SPRUCE BUDWORM AND ON NON-TARGET ARTHROPODS IN MAINE, 1975. UNPUBLISHED STUDY RECEIVED FEB. 10, 1976 UNDER 6G1744; PREPARED BY UNIV. OF MAINE, DEPT. OF ENTOMOLOGY, SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS.

*****TICEHURST M; FUSCO R A; BLUMENTHAL E M***
EFFECTS OF REDUCED RATES OF DIPEL 4L DYLOX 1.5 OIL AND DIMILIN W-25 ON LYMANTRIA DISPAR LEPIDOPTERA LYMANTRIIDAE PARASITISM AND DEFOLIATION
ENVIRON ENTOMOL 11 (5). 1982. 1058-1062.
Full Journal Title: Environmental Entomology
Language: ENGLISH
ABSTRACT
Reduced rates of Dipel 4L, Dylox 1.5 oil and Dimilin W-25 were applied to an outbreak infestation of L. dispar (L.) in 1980. Treatment effects were investigated on larvae, pupae, adult males and egg masses as well as on parasitism and defoliation in 1980 and partially in 1981. Treatment effects for Dimilin were not reported because of improper aerial application. Dipel and Dylox provided excellent foliage protection in 1980 and reduced populations of stages of I-III by 87 and 38%, respectively. Enhancement of parasitism by Apanteles melanoscelus (Ratzeburg) (Hymenoptera: Braconidae) was most apparent in blocks treated with Dipel. Other positive and negative effects on parasitism were detected by both insecticides.

Keywords/ APANTELES-MELANOSCELUS, INSECTICIDE

WEBB R E; SHAPIRO M; PODGWAITE J D; REARDON R C; TATMAN K M; VENABLES L; KOLODNY-HIRSCH D M
EFFECT OF AERIAL SPRAYING WITH DIMILIN DIPEL OR GYPCHEK ON TWO NATURAL ENEMIES OF THE GYPSY MOTH LEPIDOPTERA LYMANTRIIDAE
J ECON ENTOMOL 82 (6). 1989. 1695-1701.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
The effects of three aerially applied insectides on the incidence of two components of the natural enemy complex of the gypsy moth, Lymantria dispar (L.), were evaluated for the 1987 year of application. Application of Gypchek, a registered formulation of the gypsy moth nuclear polyhedrosis virus (NPV), initiated a large early-seson (first-wave) epizootic of NPV; late-season NPV (second-wave) levels were higher in plots treated with Gypchek than in control plots, but not significantly so, whereas levels of the parasitoid Cotesia mealanoscela (Ratzeburg) were significantly reduced in Gypchek-treated plots compared with control plots. Application of Dipel (Bacillus thuringiensis Berliner) resulted in a significant increase in numbers of C. melanoscela. Application of either Dipel or Dimilin (diflubenzuron) resulted in a significant decrease in

incidence of NPV compared with control plots.Numbers of C. melanoscela in plots treated with Dimilin were not significantly different from those detected in control plots.

Keywords/ LYMANTRIA-DISPAR, COTESIA-MELANOSCELA, BACILLUS-THURINGIENSIS, NUCLEAR POLYHEDROSIS VIRUS, INSECT, BACTERIA, PARASITOID, BIOLOGICAL CONTROL, INSECTICIDE, DIFLUBENZURON, PEST CONTROL

WILKINSON J D; BIEVER K D; IGNOFFO C M; PONS W J; MORRISON R K; SEAY R S
EVALUATION OF DIFLUBENZURON FORMULATIONS ON SELECTED INSECT PARASITOIDS AND PREDATORS
J GA ENTOMOL SOC 13 (3). 1978 227-236.
Full Journal Title: Journal of the Georgia Entomological Society
Language: ENGLISH
ABSTRACT
The insect growth regulator (IGR) diflubenzuron as a 25% WP [wettable powder] in: H2O, Savol oil (2% em. [emulsifiers]) + H2O; Sun oil (2% em.) + H2O; Savol oil, or Sun oil 7-N; was topically applied (0.25 .mu.l/insect). IGR in H2O applied to adults of Apanteles marginiventris (Cresson), Voria uralis (Fallen), Chrysopa carnea (Stephens), Geocoris punctipes (Say) and Hippodamia convergens (Guerin Menneville) caused no significant mortality from concentrations .ltoreq. 10,000 ppm. When adults of these species were treated with IGR in Savol oil + H2O at 2100 ppm mortality was not significant. Sun oil used alone as a carrier was extremely toxic to adults of C. carnea. When 3rd instar C. carnea larvae were treated with the IGR + H2O at 10,000 ppm, mortality was significant; however, mortality was non-significant at 100 ppm. IGR in Savol + H2O or Sun oil + H2O produced significant mortality at 2100 ppm and 1000 ppm but at 21.0 ppm in Sun oil + H2O mortality was not significant. Mortality from diflubenzuron in H2O for 4th instar H. convergens larvae and 5th instar G. punctipes nymphs was not significantly different from the controls at 10,000 ppm. IGR in Savol + H2O or Sun oil + H2O at 2100 ppm did not cause significant mortality of G. punctipes nymphs. Parasitization by A. marginiventris, predation by G. punctipes, and fertility and fecundity by both species were also unaffected at 2100 ppm. Diflubenzuron could be used in an integrated pest management system to conserve adult entomophagous insects and some immatures, when compared with effects of broad spectrum insecticides.

Keywords/ APANTELES-MARGINIVENTRIS, VORIA-RURALIS, CHRYSOPA-CARNEA, GEOCORIS-PUNCTIPES, HIPPODAMIA-CONVERGENS, ENTOMOPHAGOUS INSECTS, INSECTICIDES, INSECT GROWTH REGULATOR, OIL, TOPICALLY APPLIED, MORTALITY, ADULTS, TOXIC, INSTAR, NYMPHS, PEST MANAGEMENT

Invertebrates/General

ABLES, J. R., R. P. WEST, AND M. SHEPARD. 1975. RESPONSE OF THE HOUSE FLY MUSCA DOMESTICA AND ITS PARASITOIDS TO DIMILIN (TH-6040). J. ECON. ENTOMOL. 68(5):622-624.

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BLUME, R., G. OHLER, D., ET. AL. 1975. THE EFFECT OF TH-6040 ON ONTHOPHAGUS GAZELLA F (SCARABAEIDAE); A NON-TARGET ORGANISM. UNPUBLISHED STUDY RECEIVED FEB. 7, 1977 UNDER UNKNOWN ADMIN. NO., SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO, KANSAS CITY KS.

DAVIS B N K; LAKHANI K H; YATES T J
THE HAZARDS OF INSECTICIDES TO BUTTERFLIES OF FIELD MARGINS
AGRIC ECOSYST ENVIRON 36 (3-4). 1991. 151-162.
Full Journal Title: Agriculture Ecosystems & Environment
Language: ENGLISH
ABSTRACT
Three species of field-margin butterflies are compared with laboratory-cultured Large white Pieris brassicae in their response to insecticides. Four insecticides, spanning a 600-fold range in toxicity, were tested by topical applications to young larvae. The Green-veined white Pieris napi was consistently found to be about half as sensitive as Pieris brassicae. Field tests with Pieris napi and laboratory tests with the Hedge brown Pyronia tithonus and the Common blue Polyommatus icarus supported the selection of Pieris brassicae as an indicator species for bioassay studies of insecticide spray drift.

Keywords/ INSECT, PIERIS-NAPI, PIERIS-BRASSICAE, PYRONIA-TITHONUS, POLYOMMATUS-ICARUS, INDICATOR SPECIES, DIMETHOATE, PHOSALONE, FENITROTHION, DIFLUBENZURON, TOXICITY

EDWARDS, C.A AND J. R. LOFTY. 1975. ECOLOGICAL EFFECTS ON THE SOIL FAUNA OF DIFLUBENZURON (DIMILIN), AN INSECT DEVELOPMENT INHIBITOR. UNPUBLISHED STUDY RECEIVED APR. 7, 1976 UNDER 148-1259; PREPARED BY ROTHAMSTED EXPERIMENTAL STATION, ENGLAND, SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS.

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KLENNER M F
THE CARABID FAUNA OF DIFLUBENZURON-SPRAYED AND UNSPRAYED PLOTS IN WESTPHALIAN OAK FORESTS: A POST-TREATMENT COMPARISON
LANDWIRTSCHAFTSKAMMER, WESTFALEN-LIPPE, NEVINGHOFF 40, D-48147 MUENSTER, GER 0 (0). 1994. 445-449.
Full Journal Title: Desender, K., et al. (Ed.). Series Entomologica (Dordrecht), Vol. 51. Carabid beetles: Ecology and evolution; 8th European Carabidologists' Meeting, Louvain, Belgium, September 1-4, 1992. xii+474p.
Kluwer Academic Publishers: Dordrecht, Netherlands; Norwell, Massachusetts, USA
Language: ENGLISH

Keywords/ MEETING PAPER; BOOK CHAPTER; INSECTICIDE; PEST CONTROL; GERMANY

KRUEGER K; SCHUMANN R D
EFFECTS OF DIMILIN AN INSECT GROWTH REGULATOR ON BEHAVIOUR FERTILITY AND DEVELOPMENT OF A NONTARGET ORGANISM LEPTOTHORAX-ACERVORUM HYM. FORMICIDAE
J APPL ENTOMOL 115 (5). 1993. 526-531.
Full Journal Title: Journal of Applied Entomology
Language: ENGLISH
ABSTRACT
Effects of the insect growth regulating chemical Dimilin (Diflubenzuron) on behavior, brood production and brood development of an ant, Leptothorax acervorum, were investigated in laboratory experiments. Artificial colonies containing 25 workers each were fed with Dimilin contaminated honey and protein. In comparison to control colonies Dimilin fed workers produced only few eggs and larvae died before reaching third instar. Adult morality was high for Dimilin treated colonies. In addition treated colonies showed a disarranged nesting behavior.

Keywords/ INSECTICIDE MORTALITY NESTING BEHAVIOR

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**MARTINAT P J; COFFMAN C C; DODGE K; COOPER R J; WHITMORE R C*
EFFECT OF DIFLUBENZURON ON THE CANOPY ARTHROPOD COMMUNITY IN A CENTRAL APPALACHIAN FOREST
J ECON ENTOMOL 81 (1). 1988. 261-267.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
Little is known of the effects of diflubenzuron on the nontarget forest arthropod community. We hypothesized that the use of this compound in gypsy moth, Lymantria dispar (L) (Lepidoptera: Lymantriidae), control may cause indiscriminate reduction of nontarget arthropods. This, in turn, might be an important loss of food for forest birds and small mammals. In a 2-yr replicated study we sampled canopy arthropods with pole pruners for up to 3 mo following application of diflubenzuron. Due to a strong trend over time and large between-tree variance in canopy arthropod abundance and taxonomic richness, intensive sampling was required to reveal the treatment effect. Besides reductions in gypsy moth larvae, significant reductions due to diflubenzuron application were found mainly in canopy macrolepidoptera and non-lepidopteran mandibulate herbivors. Sucking herbivorous insects, microlepidoptera, and predaceous arthropods were not affected.

Keywords/LYMANTRIA-DISPAR, INSECT GROWTH REGULATOR, NONTARGET ORGANISMS, BIRDS, MAMMALS

**MARTINAT P J; JENNINGS D T; WHITMORE R C*
EFFECTS OF DIFLUBENZURON ON THE LITTER SPIDER AND ORTHOPTEROID COMMUNITY IN A CENTRAL APPALACHIAN FOREST INFESTED WITH GYPSY MOTH (LEPIDOPTERA: LYMANTRIIDAE)
ENVIRONMENTAL ENTOMOLOGY 22 (5). 1993. 1003-1008.
Full Journal Title: Environmental Entomology
Language: ENGLISH
ABSTRACT
We searched for effects of diflubenzuron treatment on numbers and diversity of two groups of litter arthropods - spiders (Araneae) and orthopteroid insects (Orthoptera and Dictyoptera) - in a West Virginia hardwood forest infested with gypsy moth. We established sampling stations consisting of pitfall traps in treated and untreated plots (four each) and sampled for up to 75 d following spray. Variability in dependent variables (habitat differences) was reduced by performing principal components analysis on habitat variables and by introducing the principal components into the treatment effect models as covariates. A treatment effect was apparent from 21 to 42 d after spray in both spider and orthopteroid insect abundance, although the effect was significant on only two sample dates for orthopteroid insects. There was no treatment effect on species diversity for these two groups.

Descriptors/Keywords: RESEARCH ARTICLE; LYMANTRIA DISPAR; INSECT; PESTS; PEST CONTROL; INSECTICIDE; WEST VIRGINIA; USA

MARTINEZ TOLEDO M V; DE LA RUBIA T; MORENO J; GONZALEZ-LOPEZ J
EFFECT OF DIFLUBENZURON ON AZOTOBACTER NITROGEN FIXATION IN SOIL
CHEMOSPHERE 17 (4). 1988. 829-834.
Full Journal Title: Chemosphere
Language: ENGLISH
ABSTRACT
The effect of 100, 200, 300, 400 and 500 .mu.g diflubenzuron per gram of soil was studied in nonsterile soil incubated under aerobic conditions, and in sterilized soil inoculated with Azotobacter vinelandii. The presence of 100 to 500 .mu.g/g had a stimulatory effect on dinitrogen fixation in both nonsterile and sterile soil.

Keywords/ AZOTOBACTER-VINELANDII, INSECTICIDE

MOORE, R. B. AND J G. BOCSOR. 1976 "EFFICACY AND NON-TARGET EVALUATION OF DIMILIN WP AGAINST THEY GYPSY MOTH. 1.3.1. PRELIMINARY REPORT STATE UNIV. OF NEW YORK.

MURPHY C F; JEPSON P C; CROFT B A
DATABASE ANALYSIS OF THE TOXICITY OF ANTILOCUST PESTICIDES TO NON-TARGET, BENEFICIAL INVERTEBRATES
CROP PROTECTION 13 (6). 1994. 413-420.
Full Journal Title: Crop Protection
Language: ENGLISH
ABSTRACT
A database analysis of pesticide impact upon entomophagous arthropods was undertaken to assist in risk analysis for chlorpyrifos, malathion, fenitrothion, deltamethrin and diflubenzuron when used as acridicides in the Sahel. Eight test methods were included in the analysis to give a comprehensive assessment of toxicity, recorded in both laboratory and field. Initial analysis of all taxa (100 family pesticide combinations) showed diflubenzuron to be significantly less hazardous than the other insecticides. There was evidence that chlorpyrifos was less hazardous than other organophosphates and significantly less so, compared with deltamethrin. A three-stage toxicity classification was developed (1, lt 30% effect; 2, 30-90% effect and 3, gt 90% effect). When gt 50% of records were in toxicity class 3 or mean toxicity class exceeded 2.24, the chemical could be classified as significantly hazardous and possibly rejected for integrated pest management purposes or subjected to further testing. The toxicity class values are, however, not predictive and should be viewed as indicating the potential for harm. Once this potential has been established, relevant laboratory and field-based test methods will be required in the developing world.

Keywords/ RESEARCH ARTICLE; ENTOMOPHAGOUS ARTHROPODS; LOCUST CONTROL; INSECTICIDE; CHLORPYRIFOS; MALATHION; FENITROTHION; DELTAMETHRIN; DIFLUBENZURON; CLASSIFICATION; SAHEL

***MUZZARELLI R*
CHITIN SYNTHESIS INHIBITORS EFFECTS ON INSECTS AND ON NONTARGET ORGANISMS
CRIT REV ENVIRON CONTROL 16 (2). 1986. 141-146.
Full Journal Title: Critical Reviews in Environmental Control
Language: ENGLISH

Keywords/ REVIEW, EPHEMEROPTERA, PLECOPTERA, DIPTERA, TRICOPTERA, COLEOPTERA, OLIGOCHAETA, GASTROPODA, LIVESTOCK, BIRD, DIFLUBENZURON, MORTALITY

PIEROBOM C R; LOECK A E; BRANCHER N; SANTOS M L
EFFECT OF DIFLUBENZURON ON THE FUNGUS GROWN BY THE LEAF-CUTTING ANT ATTA SEXDENS PIRIVENTRIS SANTSCHI (HYMENOPTERA: FORMICIDAE)
ANAIS DA SOCIEDADE ENTOMOLOGICA DO BRASIL 22 (3). 1993. 623-625.
Full Journal Title: Anais da Sociedade Entomologica do Brasil
Language: PORTUGUESE
ABSTRACT
Addition of 100 ppm of diflubenzuron inhibited development of the fungus grown by the leaf-cutting ant Atta sexdens piriventris Santschi in a cellulose medium and only reduced its growth in a glucose medium. Results indicated that diflubenzuron, a chemical reported as atoxic to ants but

lethal to ant nests, acts on the fungus metabolism, specially inhibiting the use of the cellulose.

Keywords/ RESEARCH ARTICLE; ATTA SEXDENS PIRIVENTRIS; CELLULOSE; GROWTH; FUNGUS CONTROL; METABOLISM

***RIEDL H; HOYING S A*
IMPACT OF FENVALERATE AND DIFLUBENZURON ON TARGET AND NONTARGET ARTHROPOD SPECIES ON BARTLETT PEARS IN NORTHERN CALIFORNIA USA
J ECON ENTOMOL 73 (1). 1980. 117-122.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
The synthetic pyrethroid fenvalerate provided commercial control of the pear psylla, Psylla pyricola Foerster, during the prebloom as well as the foliar period. Two cover sprays at 6.7 and 13.5 g AI[active ingredient]/100 l gave seasonal control. This compound was equally effective against the codling moth, Laspeyresia pomonella (L.), at rates ranging from 3.4-13.5 g AI/100 l. Even a single well-timed 1st cover spray gave acceptable seasonal protection. All foliar applications of fenvalerate resulted in increased populations of spider mites, primarily the twospotted spider mite, Tetranychus urticae Koch, even though higher dosages were initially acaricidal. Peak levels of spider mites during the summer were correlated with the amount of foliage present at the time of pyrethroid application. Regulation of spider mites by natural enemies [Typhlodromus occidentalis Nesbitt] became decreasingly poorer as less pesticide-free leaf surface was available. Fenvalerate at 13.5 g AI/100 l temporarily suppressed the pear rust mite, Epitrimerus pyri (Nalepa) and did not induce outbreaks of this species. Diflubenzuron was weaker for codling moth, had no direct effect on pear psylla, but did not induce phytophagous mites.
Keywords/ PSYLLA-PYRICOLA, LASPEYRESIA-POMONELLA, TETRANYCHUS-URTICAE, TYPHLODROMUS-OCCIDENTALIS, EPITRIMERUS-PYRI, PHYTOPHAGOUS MITES, PREBLOOM, FOLIAR PERIOD, ACARICIDE, SUMMER PESTICIDE

ROUSH C F; AKRE R D
IMPACT OF CHEMICALS FOR CONTROL OF THE DOUGLAS-FIR TUSSOCK MOTH UPON POPULATIONS OF ANTS AND YELLOWJACKETS HYMENOPTERA FORMICIDAE VESPIDAE
MELANDERIA 30. 1978. 95-110.
Full Journal Title: Melanderia
Language: ENGLISH
ABSTRACT
The effect of 3 insecticides upon ants and yellowjackets was monitored on nine 320 acre research plots (6 treatment, 3 control) in northeastern Oregon [USA] forests. This was part of a 3 yr study to determine which material was least injurious to populations of beneficial insects if applied for future Douglas-fir tussock moth control. Acephate when applied at 1 and 2 lb ai[active ingredient]/acre had a severe effect upon mound-building ants of the Formica rufa group but showed no apparent effect on yellowjackets (Vespula and Dolichovespula). Diflubenzuron (2 and 4 oz ai/acre) had no effect on Formica but depressed yellowjacket populations. This effect was still observed during the year following treatment. The immediate effect of carbaryl (Sevin 4 Oil formulation), 2 lb ai/acre, was serious, but 2 wk post-treatment activity was again at a pre-spray level. Yellowjacket populations were depressed at one of 2 carbaryl-treated plots but this was also evident at a control plot and no effect was detected the following year.

Keywords/ OREGON, USA, FOREST, FORMICA-RUFA, VESPULA, DOLICHOVESPULA, ACEPHATE, DIFLUBENZURON, CARBARYL

***SAMPLE B E; BUTLER L; WHITMORE R C*
EFFECTS OF AN OPERATIONAL APPLICATION OF DIMILIN ON NON-TARGET INSECTS

CAN ENTOMOL 125 (2). 1993. 173-179.
Full Journal Title: Canadian Entomologist
Language: ENGLISH
ABSTRACT
Effects of an operational application of Dimilin on non-target insects were evaluated in eastern West Virginia [USA] in 1988 and 1989. Diminlin was applied in 1988 (70, 75 g AI per ha). Insects were collected by light-traps at seven pairs of Dimilin-treated and control sites. Lepidoptera experienced the greatest impact, displaying reduced abundance and species richness at treated sites. No effects were observed among Coleoptera, Diptera, or Hymenoptera.

Keywords/ INSECTICIDE, LEPIDOPTERA, COLEOPTERA, HYMENOPTERA, DIPTERA, SPECIES ABUNDANCE SPECIES RICHNESS, WEST VIRGINIA USA

SCHROEDER W J; SUTTON R A; BEAVERS J B
DIAPREPES-ABBREVIATUS FATE OF DIFLUBENZURON AND EFFECT ON NONTARGET PESTS AND BENEFICIAL SPECIES AFTER APPLICATION TO CITRUS FOR WEEVIL CONTROL
J ECON ENTOMOL 73 (5). 1980. 637-638.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
When IGR [insect growth regulator] diflubenzuron, 25W [wettable] was applied aerially to a commercial citrus grove for control of D. abbreviatus (L.), residues in ppm on fruit harvested 27 days after the 6th application (350 g AI[active ingredient]/ha per application) were: unwashed fruit, 0.34: washed fruit, 0.11: dried pulp, 0.26; peel frit, 0.31: chopped peel, 0.12: and oil, 20.55. No detectable residue (< .05 ppm) of diflubenzuron was found in finisher pulp, fruit juice, pressed liquor, molasses, prewash or afterwash water, and emulsion water fractions. No residue (< 0.05 ppm) of 4-chlorophenylurea or 4- chloroaniline was found in any of the citrus fractions. The total sealed brood in colonies of honey bees, Apis mellifera L., from the check and sprayed groves was not significantly different at 7 mo. No detectable residue (< 0.05 ppm) of diflubenzuron, 4-chlorophenylurea or 4-chloroaniline was found in the honey obtained after 8 aerial sprays. Populations of nontarget citrus pests and beneficial species [Phyllocoptruta oleivora (Ashmead), Eutetranychus banksi (McGregor), fungus, scale insects, i.e., Lepidosaphes gloveri (Packard)] were not affected by the spray program.

Keywords/ PHYLLOCOPTRUTA-OLEIVORA, APIS-MELLIFERA, EUTETRANYCHUS-BANKSI, LEPIDOSAPHES-GLOVERI, FUNGUS, HARVEST, PULP, PEEL, FRUIT OIL, FRUIT JUICE, HONEY, RESIDUE, 4 CHLOROPHENYL UREA, 4 CHLORO ANILINE

TURNER, W.J; DAVIS, E.J
IMPACT OF CHEMICAL CONTROL APPLICATION IN THE FOREST ON BENEFICIAL INSECTS (DIPTERA)
USDA/DFTM R&D PROGRAM FINAL REPORT. 1977.

U. S. FOREST SERVICE. 1975. EVALUATION OF DIMILIN AGAINST THE GYPSY MOTH AND EFFECTS ON NON-TARGET ORGANISMS. (NORTHEAST AREA STATE AND PRIVATE FORESTRY, EXPANDED GYPSY MOTH RESEARCH AND APPLICATIONS PROGRAM). UNPUBLISHED STUDY.

UNION CARBIDE CORP. 1976. IMPACT OF CHEMICAL AND MICROBIAL CONTROL APPLICATIONS IN THE FOREST ON BENEFICIAL INSECTS. COMPILATION OF REPORTS BY VARIOUS GOVERNMENT AGENCIES. UNPUBLISHED STUDY.

WESTIGARD P H
CODLING MOTH LASPEYRESIA POMONELLA CONTROL ON PEARS WITH DIFLUBENZURON AND EFFECTS ON NONTARGET PEST AND BENEFICIAL SPECIES
J ECON ENTOMOL 72 (4). 1979. 552-554.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
Diflubenzuron was evaluated in southern Oregon [USA] pear orchards for control of the codling moth, L. pomonella (L.), and for effects on nontarget species. Diflubenzuron was most effective when the 1st summer treatment was timed to coincide with 1st moth flight in late spring. Increased rates of diflubenzuron improved codling moth control but were more disruptive than lower rates to natural enemies of the pear psylla Psylla pyricola Foerster. Diflubenzuron used at 0.14 kg AI[active ingredient]/ha caused no reduction in psylla natural enemies compared to densities in untreated checks. Pear psylla levels were 3- to 4-fold higher in standard treatments with azinphosmethyl or phosmet compared to those in diflubenzuron plots. This was attributed to reduction in natural enemies found in the organophosphate control program. No increase in two-spotted spider mite, Tetranychus urticae Koch, densities was noted following diflubenzuron treatments compared to the untreated check plot.

Keywords/ PSYLLA-PYRICOLA, TETRANYCHUS-URTICAE, INSECT GROWTH REGULATOR, AZINPHOS-METHYL, PHOSMET, INSECTICIDES, FLIGHT PERIOD, OREGON USA

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WILSON, D. M. AND M. T. K. WAN. 1977 EFFECTS OF ORTHENE AND DIMILIN INSECTICIDES ON SELECTED NON-TARGET ARTHROPODS IN A DOUGLAS-FIR FOREST ENVIRONMENT: REPORT NO. EPS-5-PR-76-4. US ENVIRONMENTAL PROTECTION SERVICE, PACIFIC REGION, POLLUTION ABATEMENT BRANCH, UNPUBLISHED STUDY.

Vertebrates/Mammals

BROWN, H. L. AND J. B. DIMOND. 1976. EFFECTS OF AERIAL APPLICATIONS OF DIMILIN ON VERTEBRATE ANIMALS IN A BOREAL FOREST. UNPUBLISHED STUDY RECEIVED APR. 7, 1976 UNDER 148-1259, PREPARED BY UNIV. OF MAINE, LIFE SCIENCES AND AG. EXPER. STATION, DEPT. OF ENTOMOLOGY, SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS.

EISLER R
DIFLUBENZURON HAZARDS TO FISH WILDLIFE AND INVERTEBRATES A SYNOPTIC REVIEW
U S FISH WILDL SERV BIOL REP 4 (25). 1992. I-III, 1-36.
Full Journal Title: U S Fish and Wildlife Service Biological Report
Language: ENGLISH
ABSTRACT
Diflubenzuron(1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl)urea), also known as dimilin, is a potent broad-spectrum insect growth regulator that interferes with chitin synthesis at time of molting and is effective in controlling immature stages of insects. Diflubenzuron seldom persists for more than a few days in soil and water. When used properly in forest management, it is unlikely to be leached into ground water from the application site. Degradation in water and soils is most rapid when small particle formulations are applied; microorganisms are abundant; and at elevated pH, temperature, and organic loading. Chemical and biological processes initially yield 2,6-difluorobenzoic acid and 4-chlorophenylurea. Soil degradation processes and plant and animal metabolism involve further conversion of these compounds to 2,6-difluorobenzamide and 4-chloroanaline. Ultimately, the end products are either conjugated into mostly water soluble products or biologically methylated. Diflubenzuron applied to foliage of terrestrial plants tends to remain adsorbed for several weeks with little or no absorption or translocation from plant surfaces; loss occurs mainly from wind abrasion, rain washing, or shedding of senescent leaves. Among terrestrial insects, there is great variability in sensitivity to diflubenzuron. Sensitive pestiferous species of insects die at topical applications of 0.003-0.034 .mu.g per larvae or after consuming diets containing 0.1 mg/kg. Some beneficial insects, such as the honey bee (Apis mellifera), are adversely affected at 1 mg/kg fresh weight (FW) of diet. Diflubenzuron application rates between 28 and 56 g/ha (0.025-0.05 pounds per acre) or 2.5 to 16 .mu.g/L are highly effective against pestiferous aquatic dipterans, including representative chaoborids, chironomids, and culicids. These same dosages temporarily suppress nontarget populations of cladocerans, copepods, mayfly nymphs, corixids, and springtails; population recovery is usually complete within 80 days. Adverse effects on crustacean growth, survival, reproduction, and behavior occùr between 0.062 and 2 .mu.g/L. Next in sensitivity are mayflies, chironomids, caddisflies, and midges; concentrations between 0.1 and 1.9 .mu.g/L produce low emergence and survival. Moderately resistant to diflubenzuron are larvae of diving beetles, dragonfly adults and naiads, ostracods, spiders, backswimmers, and water boatmen. Relatively tolerant of diflubenzuron (i.e., no observable adverse effects at .ltoreq. 45 .mu.g/L) are the algae, molluscs, fishes, and amphibians. High accumulations occur on some aquatic plants during exposure to 100 .mu.g/L and in fish during exposure to 1 to 13 .mu.g/L, but all species in these groups seem unaffected by elevated body burdens and grow and metabolize normally. Birds seem comparatively resistant to diflubenzuron acute oral LD50 doses exceed 2,000 mg/kg body weight (BW); dietary concentrations < 4,640 mg/kg FW are tolerated for at least 8 days; and forest birds seem unharmed by recommended diflubenzuron application procedures to control pestiferous insects. Studies on small laboratory animals and domestic livestock indicate no observable effects in cows (Bos bovis) rabbits (Oryctolagus cuniculus) dogs (Canis familiaris) and rats (Rattus spp.). All experimental studies conducted with laboratory animals indicate that diflubenzuron is nonmutagenic, nonteratogenic, and noncarcinogenic. Adverse effects occur in dogs fed diets containing 160 mg/kg (6.2 mg/kg BW daily) for 13 weeks (abnormal blood chemistry), in mice (Mus spp.) given 125

mg/kg BW daily for 30 days (hepatocellular changes), in rabbits fed diets of 640 mg/kg for 3 weeks (abnormal hemoglobin), and in rats given 5,000 mg/kg BW daily for 13 weeks (abnormal hemoglobin). Elevated tissue residues-but no other measurable effects-occur in cows given 0.05 to 0.5 mg/kg ration for 28 days or 1 to 16 mg/kg BW for 4 months, in pigs (Sus spp.) given a single oral dose of 5 mg/kg BW, and in sheep (Ovis aries) given a single oral dose of 10 mg/kg BW. Criteria now recommended for protection of various species include the following: dietary loadings, in mg/kg FW ration, of < 0.05 for human health, < 0.05 for livestock, < 1 for honey bees, and < 5 for poultry; seawater concentrations < 0.1 .mu.g/L for estuarine crustacean larvae; and, for all aquatic life, restricted or prohibited use of diflubenzuron in salt-marsh mosquito breeding areas and on agricultural lands less than 5 km from coastal areas. No criteria are available or proposed for protection of avian and mammalian wildlife against diflubenzuron, probably because of an incomplete toxicological data base.

Keywords/OVIS-ARIES, SUS-SPP, MUS-SPP, RATTUS-SPP, CANIS-FAMILIARIS , ORYCTOLAGUS-CUNICULUS, BOS-BOVIS, APIS-MELLIFERA, NON-TARGET ORGANISMS, DIMILIN, BENZOYLPHENYL UREA, INSECT GROWTH REGULATOR, INSECT CONTROL AGENT, LEACHING, GROUNDWATER DEGRADATION, ECOTOXICOLOGY

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***MARTINAT P J; COFFMAN C C; DODGE K; COOPER R J; WHITMORE R C*
EFFECT OF DIFLUBENZURON ON THE CANOPY ARTHROPOD COMMUNITY IN A CENTRAL APPALACHIAN FOREST
J ECON ENTOMOL 81 (1). 1988. 261-267.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
Little is known of the effects of diflubenzuron on the nontarget forest arthropod community. We hypothesized that the use of this compound in gypsy moth, Lymantria dispar (L) (Lepidoptera: Lymantriidae), control may cause indiscriminate reduction of nontarget arthropods. This, in turn, might be an important loss of food for forest birds and small mammals. In a 2-yr replicated study we sampled canopy arthropods with pole pruners for up to 3 mo following application of diflubenzuron. Due to a strong trend over time and large between-tree variance in canopy arthropod abundance and taxonomic richness, intensive sampling was required to reveal the treatment effect. Besides reductions in gypsy moth larvae, significant reductions due to diflubenzuron application were found mainly in canopy macrolepidoptera and non-lepidopteran mandibulate herbivors. Sucking herbivorous insects, microlepidoptera, and predaceous arthropods were not affected.

Keywords/LYMANTRIA-DISPAR, INSECT GROWTH REGULATOR, NONTARGET ORGANISMS, BIRDS, MAMMALS

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**MUZZARELLI R*
CHITIN SYNTHESIS INHIBITORS EFFECTS ON INSECTS AND ON NONTARGET ORGANISMS
CRIT REV ENVIRON CONTROL 16 (2). 1986. 141-146.
Full Journal Title: Critical Reviews in Environmental Control
Language: ENGLISH

Descriptors/Keywords: REVIEW, EPHEMEROPTERA, PLECOPTERA, DIPTERA, TRICOPTERA, COLEOPTERA, OLIGOCHAETA, GASTROPODA, LIVESTOCK, BIRD, DIFLUBENZURON, MORTALITY

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Vertebrates/Birds

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COOPER R J; DODGE K M; MARTINAT P J; DONAHOE S B; WHITMORE R C
EFFECT OF DIFLUBENZURON APPLICATION ON EASTERN DECIDUOUS FOREST BIRDS
J WILDL MANAGE 54 (3). 1990. 486-493.
Full Journal Title: Journal of Wildlife Management
Language: ENGLISH
ABSTRACT
We conducted a replicated experiment in eastern West Virginia [USA] to examine the effect of diflubenzuron on the abundance of deciduous forest birds. Diets of 7 insectivorous bird species [Parusatricapillus, P. bicolor, Polioptila caerulea, Vireo olivaceus, Dendroica pinus, Helmitheros vermivorus and Piranga olivacea] and foraging behavior of male red-eyed vireos (Vireo olivaceus) also were examined in treated and untreated areas. Although caterpillars were less common on treated areas, none of the 21common bird species was significantly ($P < 0.10$) more abundant in untreated than treated plots. Significant differences in the percentage of Lepidoptera larvae in diets were observed for all species examined except the worm-eating warbler (Helmitheros vermivorus) and blue-gray gnatcatcher (Polioptila caerulea). Two different measures of area covered per unit time spent foraging indicated that vireo foraging areas were 3.1 and 2 times larger on

treated areas than on untreated areas, respectively. Differences in diet and foraging behavior were likely related to the decrease in abundance of caterpillars on treated plots.

Descriptors/Keywords: PARUS-ATRICAPILLUS, PARUS-BICOLOR ,POLIOPTILA-CAERULEA, VIREO-OLIVACEUS, DENDROICA-PINUS, HELMITHEROS-VERMIVORUS, PIRANGA-OLIVACEA, CATERPILLAR ,FORAGING BEHAVIOR, FOOD SOURCE LOSS, WEST VIRGINIA

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EISLER R
DIFLUBENZURON HAZARDS TO FISH WILDLIFE AND INVERTEBRATES A SYNOPTIC REVIEW
U S FISH WILDL SERV BIOL REP 4 (25). 1992. I-III, 1-36.
Full Journal Title: U S Fish and Wildlife Service Biological Report
Language: ENGLISH
ABSTRACT
Diflubenzuron(1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl)urea), also known as dimilin, is a potent broad-spectrum insect growth regulator that interferes with chitin synthesis at time of molting and is effective in controlling immature stages of insects. Diflubenzuron seldom persists for more than a few days in soil and water. When used properly in forest management, it is unlikely to be leached into ground water from the application site. Degradation in water and soils is most rapid when small particle formulations are applied; microorganisms are abundant; and at elevated pH, temperature, and organic loading. Chemical and biological processes initially yield 2,6-difluorobenzoic acid and 4-chlorophenylurea. Soil degradation processes and plant and animal metabolism involve further conversion of these compounds to 2,6-difluorobenzamide and 4-chloroanaline. Ultimately, the end products are either conjugated into mostly water soluble products or biologically methylated. Diflubenzuron applied to foliage of terrestrial plants tends to remain adsorbed for several weeks with little or no absorption or translocation from plant surfaces; loss occurs mainly from wind abrasion, rain washing, or shedding of senescent leaves. Among terrestrial insects, there is great variability in sensitivity to diflubenzuron. Sensitive pestiferous species of insects die at topical applications of 0.003-0.034 .mu.g per larvae or after consuming diets containing 0.1 mg/kg. Some beneficial insects, such as the honey bee (Apis mellifera), are adversely affected at 1 mg/kg fresh weight (FW) of diet. Diflubenzuron application rates between 28 and 56 g/ha (0.025-0.05 pounds per acre) or 2.5 to 16 .mu.g/L are highly effective against pestiferous aquatic dipterans, including representative chaoborids, chironomids, and culicids. These same dosages temporarily suppress nontarget populations of cladocerans, copepods, mayfly nymphs, corixids, and springtails; population recovery is usually complete within 80 days. Adverse effects on crustacean growth, survival, reproduction, and behavior occur between 0.062 and 2 .mu.g/L. Next in sensitivity are mayflies, chironomids, caddisflies, and midges; concentrations between 0.1 and 1.9 .mu.g/L produce low emergence and survival. Moderately resistant to diflubenzuron are larvae of diving beetles, dragonfly adults and naiads, ostracods, spiders, backswimmers, and water boatmen. Relatively tolerant of diflubenzuron (i.e., no observable adverse effects at .ltoreq. 45 .mu.g/L) are the algae, molluscs, fishes, and amphibians. High accumulations occur on some aquatic plants during exposure to 100 .mu.g/L and in fish during exposure to 1 to 13 .mu.g/L, but all species in these groups seem unaffected by elevated body burdens and grow and metabolize normally. Birds seem comparatively resistant to diflubenzuron acute oral LD50 doses exceed 2,000 mg/kg body weight (BW); dietary concentrations

< 4,640 mg/kg FW are tolerated for at least 8 days; and forest birds seem unharmed by recommended diflubenzuron application procedures to control pestiferous insects. Studies on small laboratory animals and domestic livestock indicate no observable effects in cows (Bos bovis) rabbits (Oryctolagus cuniculus) dogs (Canis familiaris) and rats (Rattus spp.). All experimental studies conducted with laboratory animals indicate that diflubenzuron is nonmutagenic, nonteratogenic, and noncarcinogenic. Adverse effects occur in dogs fed diets containing 160 mg/kg (6.2 mg/kg BW daily) for 13 weeks (abnormal blood chemistry), in mice (Mus spp.) given 125 mg/kg BW daily for 30 days (hepatocellular changes), in rabbits fed diets of 640 mg/kg for 3 weeks (abnormal hemoglobin), and in rats given 5,000 mg/kg BW daily for 13 weeks (abnormal hemoglobin). Elevated tissue residues-but no other measurable effects-occur in cows given 0.05 to 0.5 mg/kg ration for 28 days or 1 to 16 mg/kg BW for 4 months, in pigs (Sus spp.) given a single oral dose of 5 mg/kg BW, and in sheep (Ovis aries) given a single oral dose of 10 mg/kg BW. Criteria now recommended for protection of various species include the following: dietary loadings, in mg/kg FW ration, of < 0.05 for human health, < 0.05 for livestock, < 1 for honey bees, and < 5 for poultry; seawater concentrations < 0.1 .mu.g/L for estuarine crustacean larvae; and, for all aquatic life, restricted or prohibited use of diflubenzuron in salt-marsh mosquito breeding areas and on agricultural lands less than 5 km from coastal areas. No criteria are available or proposed for protection of avian and mammalian wildlife against diflubenzuron, probably because of an incomplete toxicological data base.

Keywords/OVIS-ARIES, SUS-SPP, MUS-SPP, RATTUS-SPP, CANIS-FAMILIARIS , ORYCTOLAGUS-CUNICULUS, BOS-BOVIS, APIS-MELLIFERA, NON-TARGET ORGANISMS, DIMILIN, BENZOYLPHENYL UREA, INSECT GROWTH REGULATOR, INSECT CONTROL AGENT, LEACHING, GROUNDWATER DEGRADATION, ECOTOXICOLOGY

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MARTINAT P J; COFFMAN C C; DODGE K; COOPER R J; WHITMORE R C
EFFECT OF DIFLUBENZURON ON THE CANOPY ARTHROPOD COMMUNITY IN A CENTRAL APPALACHIAN FOREST
J ECON ENTOMOL 81 (1). 1988. 261-267.
Full Journal Title: Journal of Economic Entomology
Language: ENGLISH
ABSTRACT
Little is known of the effects of diflubenzuron on the nontarget forest arthropod community. We hypothesized that the use of this compound in gypsy moth, Lymantria dispar (L) (Lepidoptera: Lymantriidae), control may cause indiscriminate reduction of nontarget arthropods. This, in turn, might be an important loss of food for forest birds and small mammals. In a 2-yr replicated study we sampled canopy arthropods with pole pruners for up to 3 mo following application of

diflubenzuron. Due to a strong trend over time and large between-tree variance in canopy arthropod abundance and taxonomic richness, intensive sampling was required to reveal the treatment effect. Besides reductions in gypsy moth larvae, significant reductions due to diflubenzuron application were found mainly in canopy macrolepidoptera and non-lepidopteran mandibulate herbivors. Sucking herbivorous insects, microlepidoptera, and predaceous arthropods were not affected.

Keywords/LYMANTRIA-DISPAR, INSECT GROWTH REGULATOR, NONTARGET ORGANISMS, BIRDS, MAMMALS

***MUZZARELLI R*
CHITIN SYNTHESIS INHIBITORS EFFECTS ON INSECTS AND ON NONTARGET ORGANISMS
CRIT REV ENVIRON CONTROL 16 (2). 1986. 141-146.
Full Journal Title: Critical Reviews in Environmental Control
Language: ENGLISH

Descriptors/Keywords: REVIEW, EPHEMEROPTERA, PLECOPTERA, DIPTERA, TRICOPTERA, COLEOPTERA, OLIGOCHAETA, GASTROPODA, LIVESTOCK, BIRD, DIFLUBENZURON, MORTALITY

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PESTICIDES THEIR IMPACT ON THE ESTUARINE ENVIRONMENT
VERNBERG, W. B. ET AL. (ED.). MARINE POLLUTION: FUNCTIONAL RESPONSES; PROCEEDINGS OF THE SYMPOSIUM ON POLLUTION AND PHYSIOLOGY OF MARINE ORGANISMS, GEORGETOWN, S.C., USA, NOV. 14-17, 1977. XIII+454P. ACADEMIC PRESS, INC.: NEW YORK, N.Y., USA; LONDON, ENGLAND. ILLUS. ISBN 0-12-718260-8. 0 (0). 1979. P259-270.
Language: ENGLISH
Document Type: CONFERENCE PAPER

Keywords/: REVIEW, PELICAN, TELEOST, ENDRIN, MALATHION, DDT, STROBANE, CHLORDANE, ALTOSID, DIMILIN, KEPONE, TRIFLURALIN, PENTA CHLORO PHENOL, FUNGICIDE, INSECTICIDE, HERBICIDE

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***RICHMOND, M.L.; HENNY, C.J.; FLOYD, R.L.; MANNAN, R.W.; FINCH, D.M.; DEWEESE, L.R.*
EFFECTS OF SECIN-4-OIL, DIMILIN, AND ORTHENE ON FOREST BIRDS IN NORTHEASTERN OREGON
PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, BERKELEY, CA. SEPT. 1979

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ROBERTS, S. AND G. PARKE. 1976 ACUTE ORAL TOXICITY IN BOBWHITE QUAIL COMPOUND: TH-6040 99.4% PURE (AIR MILLED): LABORATORY NO. 6E-2430 A. UNPUBLISHED STUDY RECEIVED DEC. 23, 1976 UNDER 148-1258; PREPARED BY CANNON LABORATORIES, INC. SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS.

ROBERTS, S. AND G. S. E. PARKE. 1976. ACUTE ORAL TOXICITY IN MALLARD DUCKS. LABORATORY NO. 6#-2430 B. UNPUBLISHED STUDY RECEIVED DEC. 23, 1976 UNDER 148-1258. PREPARED BY CANNON LABORATORIES, INC. SUBMITTED BY THOMPSON-HAYWARD CHEMICAL CO., KANSAS CITY, KS..

RUECHI R; JOSSI W
EFFECTS OF THE INSECT GROWTH REGULATOR DIMILIN ON THE COCKCHAFER MELOLONTHA MELOLONTHA AND GASTROIDEA VIRIDULA
MITT SCHWEIZ ENTOMOL GES 52 (1). 1979. 75-82.
Full Journal Title: Mitteilungen der Schweizerischen Entomologischen Gesellschaft
Language: ENGLISH
ABSTRACT
After feeding of males and females of M. melolontha (Coleoptera, Scarabaeidae) with leaves of eech trees sprayed with 0.1% Dimilin WP [wettable powder] 25, an ovicidal effect of 100% was observed. Dimilin has a weak repellent effect on the insects. Because of its low toxicity to birds and mammals and its good ovicidal effect Dimilin is a promising agent for the control of M. melolontha. Dimilin was also effective against larvae and eggs after feeding of larvae and adults of G. viridula (Coleoptera, Chrysomelidae) with sprayed leaves of sorrel.

Keywords/ BEECH TREE, SORREL, BIRD, MAMMAL CONTROL, TOXICITY, OVICIDE

SAMPLE B E; COOPER R J; WHITMORE R C
DIETARY SHIFTS AMONG SONGBIRDS FROM A DIFLUBENZURON-TREATED FOREST
CONDOR 95 (3). 1993. 616-624.
Full Journal Title: Condor
Language: ENGLISH
ABSTRACT
Effects of diflubenzuron (a chitin-synthesis inhibiting insecticide) application on diets of forest birds were evaluated in eastern West Virginia in 1986. Nine species of songbirds were collected from May through July from treated and untreated plots. Gut contents from each specimen were removed and 10 arthropod taxa were identified. The percentage biomass comprised by each food taxon and total gut biomass was determined for each specimen. The diets of five species were significantly different between treated and untreated plots. In general, biomass of Lepidoptera larvae was reduced and biomass of other orders (Homoptera, Diptera, Coleoptera, etc.) was greater at treated sites. In addition, two species displayed reduced total gut biomass at treated sites. These data show that while diflubenzuron is not directly toxic to vertebrates, birds are affected indirectly through reduced availability of Lepidoptera larvae. Birds possessed differing capabilities to compensate for these diflubenzuron-induced food reductions. Most birds adjusted by switching prey, while others consumed less food. Resident species experienced less impact than did migrants.

Descriptors/Keywords: CONTOPUS-VIRENS PARUS-ATRICAPILLUS PARUS-BICOLOR POLIOPTILA-CAERULEA VIREO-OLIVACEUS DENDROICA-CERULEA DENDROICA-PINUS

HELMITHEROS-VERMIVORUS PIRANGER-OLIVACEA INSECTICIDE NON-TARGET ORGANISM FOOD AVAILABILITY WEST VIRGINIA USA

***SHEARER, J.A.*
STUDIES OF THE ACADIAN FLYCATCHER, (EMPIDONAX VIRESCENS): RESPONSES TO DIMILIN TREATMENTS AND NEST SITE SELECTION
THESIS. WEST VIRGINIA UNIVERSITY. DIVISION OF FORESTRY. 1990

***STRIBLING, H. L. AND H. R. SMITH*. 1987. EFFECTS OF DIMILIN ON DIVERSITY AND ABUNDANCE OF FOREST BIRDS. NORTHERN J. OF APPL. FORESTRY 4 (1):37-38.

WHITMORE R C; COOPER R J; SAMPLE B E
BIRD FAT REDUCTIONS IN FORESTS TREATED WITH DIMILIN
ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY 12 (11). 1993. 2059-2064.
Full Journal Title: Environmental Toxicology and Chemistry
Language: ENGLISH
ABSTRACT
Indirect, nonacutely toxic, effects of pesticide applications on birds have been largely overlooked. Diflubenzuron (trade name Dimilin) has extremely low toxicity to birds (LD50 gt 3,762 mg/kg for red-winged blackbirds, Agelaius phoeniceus). It has gained widespread use for control of gypsy moth (Lymantria dispar) populations in Eastern forests. However, Dimilin has been implicated in mortality of nontarget insects, many of which have been shown to be food for birds. This study examined the overall condition of birds breeding on Dimilin-treated and untreated plots by determining the percentage of dry weight fat for a group of common forest songbirds. It was found that seven of the nine tested bird species had significantly (p lt 0.05) lower fat reserves on treated plots than those on nontreated plots. Although the two nonsignificantly different bird species were permanent residents (black-capped chickadee and tufted titmouse), all of the remaining seven species were neotropical migrants. Possible causes of the fat reductions center on (a) reduction in food, resulting in a decrease in biomass of ingested food; (b) increase cost in obtaining food; and (c) reduction in food quality. Whether or not the reduced fat levels cause concomitant reductions in adult/juvenile survival could not be demonstrated.

Descriptors/Keywords: RESEARCH ARTICLE; AGELAIUS PHOENICEUS; LYMANTRIA DISPAR; RED-WINGED BLACKBIRD; BLACK-CAPPED CHICKADEE; TUFTED TITMOUSE; GYPSY MOTH; DIFLUBENZURON; PESTICIDE

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EFFECT OF DIMILIN ON CAROTENE PRODUCTION IN BLAKESLEA TRISPORA
MICROBIOLOGY (ENGL TRANSL MIKROBIOLOGIYA) 51 (2). 1982. 222-225.
Full Journal Title: MICROBIOLOGY (English Translation of Mikrobiologiya)
Language: ENGLISH

Keywords/ ASPERGILLUS-NIGER, CUNNINGHAMELLA-JAPONICA, CHITIN SYNTHESIS, INSECTICIDE, GROWTH INHIBITION

SAPIEHA A; MIETKIEWSKI R
THE INFLUENCE OF CHITIN SYNTHESIS INHIBITORS ON GROWTH OF ENTOMOPATHOGENIC FUNGI IN-VITRO
ACTA MYCOL 27 (2). 1991-1992. 189-195.
Full Journal Title: Acta Mycologica
Language: POLISH
ABSTRACT
Beauveria bassiana, Paecilomyces farinosus, Verticillium lecanii, Conidiobolus thromboides, Erynia pieris, E. radicans were examined on medium to which were added three chitin synthesis inhibitors [Dimilin, Nomolt, Alsystin].

Keywords/ BEAUVERIA-BASSIANA PAECILOMYCES-FARINOSUS VERTICILLIUM-LECANII CONIDIOBOLUS-THROMBOIDES ERYNIA-PIERIS ERYNIA-RADICANS DIMILIN NOMOLT ALSYSTIN

SILVA L D; SILVA R F P; HEINECK M A
EFFECT OF DIFFERENT INSECTICIDES IN-VITRO ON THE SPORULATION OF THE FUNGUS NOMURAEA-RILEYI FARLOW SAMSON
AN SOC ENTOMOL BRAS 2 (1). 1993. 99-103.
Full Journal Title: Anais da Sociedade Entomologica do Brasil
Language: PORTUGUESE
ABSTRACT
The effects of the insecticides endosulfan; profenofos; triclorfon; permetrina and diflubenzuron on the sporulation of Nomuraea rileyi (Farlow) Samson were evaluated by mixing these products with Sabauroud-maltose-agar + 1% yeast extract (SMAY), equivalent of the field dosage recommended for
Anticarsia gemmatalis Hubner, 1818 (LEP., Noctuidae). Each plate with culture medium was spread with 0.1 ml of conidia suspension and twelve days later, the conidia were collected and counted. Permetrina and diflubenzuron didn't have a significant difference from the control. No statistical differences were detected among Triclorfon. Profenofos and Endosulfan, even though the sporulation was completely inhibited by Profenofos and Endosulfan.

Keywords/ ANTICARSIA-GEMMATALIS ENDOSULFAN PROFENOFOS TRICLORFON PERMETHRIN DIFLUBENZURON BIOLOGICAL CONTROL NON-TARGET ORGANISM

**WHITE P F*
EFFECTS OF BENDIOCARB AND DIFLUBENZURON ON MUSHROOM CROPPING
ANN APPL BIOL 108 (1). 1986. 11-20.
Full Journal Title: Annals of Applied Biology
Language: ENGLISH
ABSTRACT
When mixed into the casing or compost layers of a mushroom [Agaricus bisporus] bed in the absence of pests, [Lycoriella auripila] bendiocarb decreased yield and number of mushroom number at the two highest rates used (100 to 1000 .mu.g/g), and there were large increases in mushroom size. Effects of bendiocarb incorporation in the compost diminished with time, and there was partial compensation inyield and numbers at the fourth flush. The action of bendiocarb persisted when it was mixed into the casing. Diflubenzuron showed some opposite effects at lower concentrations. When either mixed into, or drenched onto the casing at the commercial rate (30 .mu.g/g), yield and size were both increased and the timing of the flushes was unaffected. At the two higher concentrations (180 and 1080 .mu.g/g), reductions in yield and number and an increase in mushroom size were shown. However, these effects became more severe with time, especially those on mushroom number, possibly due to the accumulation of a toxic breakdown product.

Keywords/AGARICUS-BISPORUS, LYCORIELLA-AURIPILA, INSECTICIDE,INSECT GROWTH REGULATOR, PHYTOTOXICITY, PERSISTENCE

MISCELLANEOUS

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