- Environ Pollut. 2007 Jun;147(3):535-9. Epub 2007 Jan 9.

Comparative toxicity of chlorpyrifos, diazinon, malathion and their oxon derivatives to larval Rana boylii.

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Organophosphorus pesticides (OPs) are ubiquitous in the environment and are highly toxic to amphibians. They deactivate cholinesterase, resulting in neurological dysfunction. Most chemicals in this group require oxidative desulfuration to achieve their greatest cholinesterase-inhibiting potencies. Oxon derivatives are formed within liver cells but also by bacterial decay of parental pesticides. This study examines the toxicity of chlorpyrifos, malathion and diazinon and their oxons on the foothill yellow-legged frog (Rana boylii). R. boylii is exposed to agricultural pesticides in the California Central Valley. Median lethal concentrations of the parental forms during a 96h exposure were 3.00mg/L (24h) for chlorpyrifos, 2.14mg/L for malathion and 7.49mg/L for diazinon. Corresponding oxons were 10 to 100 times more toxic than their parental forms. We conclude that environmental concentrations of these pesticides can be harmful to R. boylii populations.

PMID: 17218044 [PubMed - in process]

- Environ Geochem Health. 2004 Jun-Sep;26(2-3):277-83.

Single and joint effects of acetochlor and urea on earthworm Esisenia foelide populations in phaiozem.

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Much attention is paid to soil health and environmental safety. Earthworms are an important indicator of soil ecosystem health and safety. Ecological toxicity of acetochlor and excessive urea, in both their single and joint effects, on earthworm Esisenia foelide was thus studied using the soil-culture method. Acetochlor had an enhanced toxicity from low concentration to high concentration. The mortality of earthworms after a 6-day exposure was changed from 0 to 86.7%, and the weight change rate ranged from 7.86 to -30.43%, when the concentration of acetochlor was increased from 164 to 730 mg kg(-1). Urea expressed its positive and beneficial effects on earthworms when its concentration was lower than 500 mg kg(-1). Strongly toxic effects took place when the concentration of urea was higher than 1000 mg kg(-1). The mortality of earthworms exposed to urea reached 100% when its concentration was more than 1500 mg kg(-1). When the concentration of urea was lower than 500 mg kg(-1), there were antagonistic effects between the two agrochemicals on earthworms; when the concentration of urea was higher than 500 mg kg(-1), joint toxic effects of acetochlor and excessive urea on earthworms were synergic. In any case, excessive urea application is very harmful to the health of soil ecosystems.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 15499784 [PubMed - indexed for MEDLINE]

- Vet Hum Toxicol. 2003 Oct;45(5):261-5.

The toxicology of honey bee poisoning.

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The use of insecticides continues to be a basic tool in pest management, since there are many pest situations for which there are no known alternative management methods. However, the harmful effects of insecticides against beneficial Insects continuous to be a serious problem. Poisoning of bee pollinators is a serious adverse effect of insecticide use which leads to a decrease in insect population, to reduction of honey yields,

to destruction of plant communities, to insecticide residues in food, and to a significant loss of beekeepers' income. In bee poisoning, the identification of the responsible toxicant is necessary by both environmental and biological monitoring, to prevent bee poisoning and for the protection of public health. The different aspects of bee poisoning with anticholinesterase insecticides are discussed in detail.

PMID: 14513897 [PubMed - indexed for MEDLINE]

- Reprod Toxicol. 2007 Feb;23(2):182-91. Epub 2006 Nov 11.

Effects of the herbicide Roundup on the epididymal region of drakes Anas platyrhynchos.

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Exposure to the Roundup has been shown to affect StAR protein and aromatase expression and activity, pointing out that this herbicide may cause adverse effects in animal reproduction by affecting androgen and estrogen synthesis. We tested this hypothesis by investigating the in vivo effects of the Roundup on the testis and epididymal region of drake Anas platyrhynchos. The exposure to the herbicide resulted in alterations in the structure of the testis and epididymal region as well as in the serum levels of testosterone and estradiol, with changes in the expression of androgen receptors restricted to the testis. The harmful effects were more conspicuous in the proximal efferent ductules and epididymal ducts, suggesting higher sensitivity of these segments among the male genital organs. The effects were mostly dose dependent, indicating that this herbicide may cause disorder in the morphophysiology of the male genital system of animals.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 17166697 [PubMed - indexed for MEDLINE]

- Mar Environ Res. 2000 Jul-Dec;50(1-5):263-6.

Effects of the herbicide Roundup on the ultrastructural pattern of hepatocytes in carp (Cyprinus carpio).

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Experimental studies were performed on healthy, 80-100 g carp (Cyprinus carpio). Fish were exposed by emersion in Roundup (205 mg of glyphosate/l or 410 mg of glyphosate/l) in concentrations of 40- to 20-fold lower than those used in practice. Electron microscopy revealed that the herbicide caused appearance of myelin-like structures in carp hepatocytes, swelling of mitochondria and disappearance of internal membrane of mitochondria in carp at both exposure concentrations. It means that Roundup was harmful to carp when used in applied concentrations. Results of these studies enhance our knowledge of ultrastructural pathomorphology of fish organs following exposure to Roundup.

PMID: 11460701 [PubMed - indexed for MEDLINE]

- Arch Toxicol. 2007 Jul 19; [Epub ahead of print]

Pre- and postnatal toxicity of the commercial glyphosate formulation in Wistar rats.

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Glyphosate is the active ingredient and polyoxyethyleneamine is the surfactant present in the herbicide Roundup((R)) formulation commercialized in Brazil. The aim of this study was to assess the reproductive effects of glyphosate-Roundup((R)) on male and female offspring of Wistar rats exposed during pregnancy

and lactation. Dams were treated orally with water or 50, 150 or 450 mg/kg glyphosate during pregnancy (21-23 days) and lactation (21 days). These doses do not correspond to human exposure levels. The results showed that glyphosate-Roundup((R)) did not induce maternal toxicity but induced adverse reproductive effects on male offspring rats: a decrease in sperm number per epididymis tail and in daily sperm production during adulthood, an increase in the percentage of abnormal sperms and a dose-related decrease in the serum testosterone level at puberty, and signs of individual spermatid degeneration during both periods. There was only a vaginal canal-opening delay in the exposed female offspring. These findings suggest that in utero and lactational exposure to glyphosate-Roundup((R)) may induce significant adverse effects on the reproductive system of male Wistar rats at puberty and during adulthood.
PMID: 17634926 [PubMed - as supplied by publisher]

- Neurotoxicology. 2007 Jun 14; [Epub ahead of print]

Evaluation of neurodevelopmental effects on rats exposed prenatally to sulfentrazone.

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Although some studies have pointed to embryo/fetal toxicity at treatment levels that were not maternally toxic, knowledge about the potential toxic effects of the herbicide sulfentrazone is still limited. Since the results of these studies have raised some concern, the present work studied the effects of sulfentrazone maternal exposure on the physical and neurobehavioral endpoints in the development of rat pups. To accomplish that, the effects of the herbicide sulfentrazone (25 and 50mg/kg) were examined at two different developmental stages in rats: during the first 6 days of gestation, or in the organogenesis period (6-15 days). After parturition, pups were tested in a developmental test battery including measures of growth, maturational milestones, and neurobehavioral development. Maternal exposure to the herbicide resulted in significant alterations of the postnatal age at which the developmental milestones of ear and eye opening and testes descent were observed. There was a reduced weight gain rate in pups and their mothers when treated during the gestational period at the highest dose tested. Also, the functional state of the rat pup nervous system at different stages of postnatal development showed some neurodevelopmental delays in righting reflex, negative geotaxis, grip response, and motor coordination-locomotion and rearing (21-90 days of life) in the treated groups. Herbicide genotoxicity was investigated in fresh leukocytes both in mothers and pups using the comet assay: the data did not show any significant genotoxic effect induced by the herbicide. The findings of this study emphasize that sulfentrazone maternal exposure may lead to some neuromuscular and behavioral deficits in nursing pups.

PMID: 17659344 [PubMed - as supplied by publisher]

- J Basic Microbiol. 2007 Jul 23;47(4):325-331 [Epub ahead of print]

Effects of a phosphinothricin based herbicide on selected groups of soil microorganisms.

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The effects of the herbicide glufosinate-ammonium on soil microbial populations and activity were observed in a laboratory microcosms over a 40 day period. Culturable aerobic bacteria, fungi and actinomycetes, the fundamental groups of heterotrophic microorganisms, were studied. Nitrifiers, considered a very sensitive group to these compounds were also evaluated. Since herbicides have been found to inhibit decomposition of cellulose in the soil, the effects of glufosinate on cellulolytic bacteria and fungi were determined. Dehydrogenase activity as a measure of microbial activity was another parameter considered. Both stimulating and inhibitory effects on microbial populations were observed, depending on concentration of the herbicide and the period of incubation. A severe inhibiting effect of glufosinate on dehydrogenase activity was found. We concluded that the widespread use of this herbicide may have possible injurious effects on soil microorganisms and their activities. The toxicity exerted by glufosinate may lead to a shift in microbial

community structure tending toward a significant loss in functional diversity. Dehydrogenase activity was shown to be an important indicator of glufosinate side effects. ((c) 2007 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim).

PMID: 17647211 [PubMed - as supplied by publisher]

- Mutat Res. 2007 Jun 17; [Epub ahead of print]

The chlorophenoxy herbicide dicamba and its commercial formulation banvel((R)) induce genotoxicity and cytotoxicity in Chinese hamster ovary (CHO) cells.

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The sister chromatid exchange (SCE) frequency, the cell-cycle progression analysis, and the single cell gel electrophoresis technique (SCGE, comet assay) were employed as genetic end-points to investigate the geno- and citotoxicity exerted by dicamba and one of its commercial formulation banvel((R)) (dicamba 57.71%) on Chinese hamster ovary (CHO) cells. Log-phase cells were treated with 1.0-500.0mug/ml of the herbicides and harvested 24h later for SCE and cell-cycle progression analyses. All concentrations assessed of both test compounds induced higher SCE frequencies over control values. SCEs increased in a non-dose-dependent manner neither for the pure compound ($r=0.48$; $P>0.05$) nor for the commercial formulation ($r=0.58$, $P>0.05$). For the 200.0mug/ml and 500.0mug/ml dicamba doses and the 500.0mug/ml banvel((R)) dose, a significant delay in the cell-cycle progression was found. A regression test showed that the proliferation rate index decreased as a function of either the concentration of dicamba ($r=-0.98$, $P<0.05$) or banvel((R)) ($r=-0.88$, $P<0.01$) titrated into cultures in the 1.0-500.0mug/ml dose-range. SCGE performed on CHO cells after a 90min pulse-treatment of dicamba and banvel((R)) within a 50.0-500.0mug/ml dose-range revealed a clear increase in dicamba-induced DNA damage as an enhancement of the proportion of slightly damaged and damaged cells for all concentrations used ($P<0.01$); concomitantly, a decrease of undamaged cells was found over control values ($P<0.01$). In banvel((R))-treated cells, a similar overall result was registered. Dicamba induced a significant increase both in comet length and width over control values ($P<0.01$) regardless of its concentration whereas banvel((R)) induced the same effect only within 100.0-500.0mug/ml dose range ($P<0.01$). As detected by three highly sensitive bioassays, the present results clearly showed the capability of dicamba and banvel((R)) to induce DNA and cellular damage on CHO cells.

PMID: 17643342 [PubMed - as supplied by publisher]

- Toxicol In Vitro. 2007 May 24; [Epub ahead of print]

In vitro induction of cytotoxicity and DNA strand breaks in CHO cells exposed to cypermethrin, pendimethalin and dichlorvos.

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The indiscriminate use of pesticides and herbicides to increase crop productivity has aroused a great concern among the environmental and health scientists due to their adverse effects in both target as well as non-target species. Although substantial information is available regarding their environmental and ecological impact, not much is known in regard to its toxicity in the mammalian system. Therefore a study was conducted for the assessment of cytotoxic and genotoxic effects of cypermethrin (Type II pyrethroid) dichlorvos (organophosphate) and pendimethalin (dinitroaniline herbicide) in Chinese hamster ovary (CHO) cells. CHO cells were exposed to 1muM, 10muM, 100muM, 1000muM, and 10,000muM, cypermethrin, pendimethalin and dichlorvos for 3h and cytotoxicity was assessed by MTT assay. Their genotoxic potential was also evaluated by Comet assay. The results demonstrate that dichlorvos and pendimethalin exhibited higher extent of cytotoxicity as compared to cypermethrin. A significant ($p<0.05$) concentration dependent increase in DNA damage was observed with dichlorvos (0.01muM and above) and pendimethalin (0.1muM and above)

as evident by Comet assay parameters viz., Olive tail moment (arbitrary units), tail DNA (%) and tail length (muM). Cypermethrin induced a significant ($p<0.05$) DNA damage only at higher concentrations (1000 and 5000muM). Our data indicates that these chemicals produce cytotoxicity and DNA damage in mammalian cells and should be used with caution.

PMID: 17604946 [PubMed - as supplied by publisher]

- Commun Agric Appl Biol Sci. 2006;71(2 Pt A):111-4

Teratogenicity testing of a 2,4-D containing herbicide formulation and three heavy metals in chicken embryos.

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The toxic effects of a widely used herbicide (Dikamin D containing 72% 2,4-D-amine Na as active ingredient) applied alone or in combination with three heavy elements (copper sulphate, cadmium sulphate and lead acetate) modelling the heavy metal load of the environment were studied on chicken embryos with injection treatment. The treatment was done on day 0 of incubation. Solutions and emulsions of different concentrations were made from the test materials and injected in 0.1 ml volume into the air space of eggs. The macroscopical evaluations were done on day 19 of the incubation. Summarizing the findings, it can be established that the individual administration of the 72% 2,4-D containing herbicide formulation was less toxic compared to the control group than the simultaneous administration of the pesticide and heavy elements. As compared with each other the results from the combined administrations of the 72% 2,4-D containing herbicide formulation and heavy elements the simultaneous administration of cadmium and the herbicide caused the highest embryomortality while the incidence of developmental anomalies were the highest in the interaction study of the copper and the pesticide.

PMID: 17390781 [PubMed - indexed for MEDLINE]

- Aquat Toxicol. 2007 May 1;82(2):73-84. Epub 2007 Feb 11.

Effects of the herbicide metazachlor on macrophytes and ecosystem function in freshwater pond and stream mesocosms.

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The chloroacetamide metazachlor is a commonly used pre-emergent herbicide to inhibit growth of plants especially in rape culture. It occurs in surface and ground water due to spray-drift or run-off in concentrations up to 100 microgL(-1). Direct and indirect effects of metazachlor on aquatic macrophytes were investigated at oligo- to mesotrophic nutrient levels employing eight stream and eight pond indoor mesocosms. Five systems of each type were dosed once with 5, 20, 80, 200 and 500 microgL(-1) metazachlor and three ponds and three streams served as controls. Pronounced direct negative effects on macrophyte biomass of Potamogeton natans, Myriophyllum verticillatum and filamentous green algae as well as associated changes in water chemistry were detected in the course of the summer 2003 in both pond and stream mesocosms. Filamentous green algae dominated by Cladophora glomerata were the most sensitive organisms in both pond and stream systems with EC(50) ranging from 3 (streams) to 9 (ponds) microgL(-1) metazachlor. In the contaminated pond mesocosms with high toxicant concentrations (200 and 500 microgL(-1)), a species shift from filamentous green algae to the yellow-green alga Vaucheria spec. was detected. The herbicide effects for the different macrophyte species were partly masked by interspecific competition. No recovery of macrophytes was observed at the highest metazachlor concentrations in both pond and stream mesocosms until the end of the study after 140 and 170 days. Based on the lowest EC(50) value of 4 microgL(-1) for total macrophyte biomass, it is argued that single exposure of aquatic macrophytes to metazachlor to nominal concentrations >5 microgL(-1) is likely to have pronounced long-term effects on aquatic biota and ecosystem function.

PMID: 17353057 [PubMed - in process]

- Environ Toxicol Chem. 2007 Jan;26(1):80-4.

Atrazine is an immune disruptor in adult northern leopard frogs (Rana pipiens).

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Atrazine, the most widely used herbicide in the United States, has been shown in several studies to be an endocrine disruptor in adult frogs. Results from this study indicate that atrazine also functions as an immune disruptor in frogs. Exposure to atrazine (21 ppb for 8 d) affects the innate immune response of adult Rana pipiens in similar ways to acid exposure (pH 5.5), as we have previously shown. Atrazine exposure suppressed the thioglycollate-stimulated recruitment of white blood cells to the peritoneal cavity to background (Ringer exposed) levels and also decreased the phagocytic activity of these cells. Unlike acid exposure, atrazine exposure did not cause mortality. Our results, from a dose-response study, indicate that atrazine acts as an immune disruptor at the same effective doses that it disrupts the endocrine system.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 17269463 [PubMed - indexed for MEDLINE]

- Bull Environ Contam Toxicol. 2007 Jul 17; [Epub ahead of print]

Microbial Toxicity of Pesticide Derivatives Produced with UV-photodegradation.

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Our study aimed at acquiring information about the biological effect of pesticides and their degradates produced by UV-treatment on microbiological activity. Five photosensitive pesticides (carbendazim, acetochlor, simazine, chlorpyrifos, EPTC) and six representative soil microbes (Bacillus subtilis, Pseudomonas fluorescens, Mycobacterium phlei, Fusarium oxysporum, Penicillium expansum, Trichoderma harzianum) were applied throughout our model experiments. The antimicrobial effects of the pesticides and their degradates were assessed with filter paper disk method. The antimicrobial effect of the degradation products exhibited marked differences in terms of pesticide types, irradiation time, and the test organisms. Acetochlor and its photolytic degradation products were found to be more toxic to bacteria than fungi. All the three bacteria proved to be sensitive to the basic compound and its degradation products as well. The end product of carbendazim was weakly antibacterial against P. fluorescens and B. subtilis but strongly antifungal against T. harzianum. Chlorpyrifos and its end product inhibited neither test organisms, but the degradates hindered the growth of four of them. The basic compound of EPTC and the degradates of simazine exhibited significant toxicity to the test bacteria. It might be claimed that the pesticide photodegradation may result in significant changes in soil microbiota, as well as formation of biologically harmful degradates.

PMID: 17639315 [PubMed - as supplied by publisher]

- Fish Shellfish Immunol. 2007 Feb 25; [Epub ahead of print]

Immunotoxicity and hepatic function evaluation in Nile tilapia (Oreochromis niloticus) exposed to diazinon.

Girón-Pérez MI, Santerre A, Gonzalez-Jaime F, Casas-Solis J, Hernández-Coronado M, Peregrina-Sandoval J, Takemura A, Zaitseva G.
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The LC(50) of the organophosphorus pesticides (OPs) diazinon to Nile tilapia (Oreochromis niloticus) was determined, thereafter, hepatic activity, phagocytic index, percentages of active cells, relative spleen weight, total IgM concentration and lymphoproliferation rates were compared between diazinon exposed groups (LC(50) and (1/2)LC(50)) and non-exposed control group. Experimental data show that diazinon is highly toxic for juvenile Nile tilapia (LC(50)=7.830ppm) and presents immunotoxic properties which affect both the innate and cellular adaptive immune responses of this fish, as revealed by the fact that splenocyte proliferation and phagocytic indices were significantly decreased after acute exposure to the pesticide. However, the hepatic biochemical parameters and the total circulating IgM concentrations were not affected in this experimental model.

PMID: 17478099 [PubMed - as supplied by publisher]

- Cell Biochem Funct. 2007 Apr 17; [Epub ahead of print]

Biochemical effects of chlorpyrifos and deltamethrin on altered antioxidative defense mechanisms and lipid peroxidation in rat liver.

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Pesticides such as organophosphorus and organochlorine compounds commonly used in agriculture for achieving better quality products are toxic substances and lead to generation of reactive oxygen species (ROS) which have harmful effects on human health. While pyrethroid pesticides are used in preference to organophosphates and organochlorines due to their high effectiveness, low toxicity to non-target organisms and easy biodegradability, they may also produce oxidative stress. Thus, we investigated the effects of chlorpyrifos (CP, an organophosphate) and deltamethrin (DM, a pyrethroid pesticide) treatments at low and high doses on lipid peroxidation (LPO) and antioxidant enzyme activities such as SOD, GSH-Px and CAT in rat liver following 16 weeks exposure. Antioxidative defence mechanisms and lipid peroxidation in rat liver tissues display different responses depending on different pesticide treatments and doses. Biochemical analysis showed that administrations of the chlorpyrifos and deltamethrin cause liver damage. In the present study, we observed that lipid peroxidation levels are higher at high doses than at low doses, but DM caused more pronounced increase than CP. Experimentally, we have also observed that oxidant-antioxidant balance is more affected by deltamethrin treatment than by chlorpyrifos. Copyright (c) 2007 John Wiley & Sons, Ltd.

PMID: 17437321 [PubMed - as supplied by publisher]

- Ecotoxicology. 2007 Apr;16(3):289-98. Epub 2007 Mar 10.

The toxic potential of aldrin and heptachlor on Danio rerio juveniles (Cypriniformes, Cyprinidae).

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With the objective of evaluating the effects of organochlorine pesticides (aldrin and heptachlor) on the survival, growth and gill morphology of juvenile zebrafish (Danio rerio), four partial chronic toxicity bioassays were conducted (seven days' duration) with both compounds in a semi-static system with renewal every 24 h. The results did not show any effects on the fish's survival, but did on their growth and gill morphology. Aldrin was more toxic than heptachlor, since the chronic value (CV) for growth was nearly 8.7 times less, a result confirmed by analyzing the histology of the gills, in which the changes detected were considered more severe for the former substance. In general, they were found branchial lesions of first stage, in other words, cell proliferation between the secondary lamellae, hyperplasia, lifting of respiratory epithelial cells; fusion of several secondary lamellae and dilation of blood vessels. Aneurysms (alterations of second stage) they were verified in the exposed organisms to the aldrin, which also presented about 10% of reduction in the standard length and 30% of reduction in the total weight in relation to the exposed organisms

to the control. For heptachlor these values were of 8% and 25%, respectively. The intensity of the gill lesions and growth of the fish did not depend on the pesticide concentration, suggesting different modes of action of the products.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 17351749 [PubMed - in process]

- Toxicol Appl Pharmacol. 2007 Mar;219(2-3):241-6. Epub 2006 Dec 6.

Differential toxic effects of Carbofuran and Diazinon on time of flight in pigeons (Columba livia): potential for pesticide effects on migration.

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Cholinesterase inhibiting compounds such as carbamates and organophosphate insecticides have been widely used in agriculture since the ban on organochlorines in the 1970s. Carbofuran, a carbamate, and diazinon, an organophosphate, are among the most commonly implicated cholinesterase inhibitors in episodes of accidental avian toxicity and mortality. Despite the apparent effects of these compounds, little work has been done to study effects of low-level, environmentally relevant doses at the population level in migratory bird species. In this study, homing pigeons were used as surrogate species to assess the differences in the effect of incrementally low doses (0.0, 0.25, 0.5, and 1.0 mg/kg) of carbofuran and diazinon on time of flight and determine whether there was a threshold dose of either or both xenobiotics when orally administered at these levels. The results indicate that there is a significant dose-dependent increase in flight time in pigeons dosed with carbofuran while diazinon exposed pigeons showed little effect. More profound effects were noted with carbofuran with pigeons falling off the pace of the flock and a dose for highly significant increase in flight time elucidated between 0.5 and 1.0 mg/kg. The results of the studies validate the homing pigeon as a good subject for comparative studies of cholinesterase inhibitors in birds and the need for further research on repeated low-level exposures on populations of avian species.

Publication Types: Comparative Study, Research Support, Non-U.S. Gov't
PMID: 17254622 [PubMed - indexed for MEDLINE]

- Toxicol Appl Pharmacol. 2006 Mar 15;211(3):188-97. Epub 2005 Jul 11.

Pyrethroid pesticide-induced alterations in dopamine transporter function.

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Center for Neurodegenerative Disease, School of Medicine, Emory University, Atlanta, GA 30322, USA.

Parkinson's disease (PD) is a progressive neurodegenerative disease affecting the nigrostriatal dopaminergic pathway. Several epidemiological studies have demonstrated an association between pesticide exposure and the incidence of PD. Studies from our laboratory and others have demonstrated that certain pesticides increase levels of the dopamine transporter (DAT), an integral component of dopaminergic neurotransmission and a gateway for dopaminergic neurotoxins. Here, we report that repeated exposure (3 injections over 2 weeks) of mice to two commonly used pyrethroid pesticides, deltamethrin (3 mg/kg) and permethrin (0.8 mg/kg), increases DAT-mediated dopamine uptake by 31 and 28%, respectively. Using cells stably expressing DAT, we determined that exposure (10 min) to deltamethrin and permethrin (1 nM-100 microM) had no effect on DAT-mediated dopamine uptake. Extending exposures to both pesticides for 30 min (10 microM) or 24 h (1, 5, and 10 microM) resulted in significant decrease in dopamine uptake. This reduction was not the result of competitive inhibition, loss of DAT protein, or cytotoxicity. However, there was an increase in DNA fragmentation, an index of apoptosis, in cells exhibiting reduced uptake at 30 min and 24 h. These data suggest that up-regulation of DAT by in vivo pyrethroid exposure is an indirect effect and that longer-term exposure of cells results in apoptosis. Since DAT can greatly affect the vulnerability of dopamine neurons to neurotoxicants, up-regulation of DAT by deltamethrin and permethrin may increase the susceptibility of dopamine neurons to toxic insult, which may provide insight into the association between pesticide exposure and PD.

Publication Types: Research Support, N.I.H., Extramural, Research Support, U.S. Gov't, Non-P.H.S.
PMID: 16005927 [PubMed - indexed for MEDLINE]