The Effects of Pesticides on Birds

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SUMMARY

Pesticides are primarily used to increase agriculture production, manage and maintain important habitats, and to control pest outbreaks. Although pesticides play an important role in many functions that humans and wildlife need to survive, in some circumstances pesticides can have negative environmental impacts, including those that adversely affect, and even kill, birds.

WBCI encourages scientific research, education, and outreach aimed at understanding the risks associated with pesticide use. The following list suggests actions that can be taken to help reduce exposure of pesticides to birds.

- Educate citizens regarding pesticide use
- Limit use to where absolutely necessary
- Use pesticides in areas in which wildlife will not be exposed
- Learn what chemicals are in the pesticide and the environmental risks associated with those chemicals
- Consider whether the benefits of using the pesticide outweigh the perceived risks to wildlife
- Use IPM: Integrated Pest Management
- Use safer pesticides (e.g. biopesticides)
- Purchase green or eco-friendly household cleaning products, lawn care products, and personal care products when possible
- Adopt best practices for farming that reduce the quantity of pesticides used in agriculture production while maintaining output

INTRODUCTION

The cost in bird, fish, and other wildlife losses due to pesticide use in the United States is approximately 2.2 billion dollars annually (Pimentel 2009). There are 20,000 pesticide products registered in the United States, and 5.7 billion pounds are annually used worldwide (Aspelin 2003). In the United States, 1.2 billion pounds are used per year; this equates to 12.5 billion dollars spent on pesticides (U.S. EPA 2011).

So, what is a pesticide? The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) defines a pesticide as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant. Pesticides include insecticides, rodenticides, fungicides, herbicides, and other substances designed to kill target organisms (U.S. EPA 2013). There are numerous consumer

products licensed as pesticides that are readily available in stores, including cleaning products, pest traps, and lawn care products.

There are a number of different types of pesticides consisting of various chemical properties and designed for many functions. Some examples are organophosphates, carbamates, organochlorines (many have been removed from the market due to their environmental effects), and pyrethroids. Pesticides have various effects on target and non-target species. They can disrupt the central nervous systems, alter behavior, cause endocrine system dysfunctions, affect immune systems, and inhibit growth in organisms (Mitra et al. 2011). The Environmental Protection Agency (EPA) under the authority of FIFRA regulates pesticides for use in the United States. The EPA requires the pesticide manufacturing company to determine the risk of the particular pesticide to certain test species using toxicity studies based on a standard protocol. This testing is mandated before registering the pesticides for commercial use. Pesticides are registered for use with certain restrictions based on the results of the toxicity tests. Once the pesticide is registered for use by the EPA, the states can either adopt the same list of pesticides or apply a more strict selection. States then register pesticides under specific state pesticide registration laws.

DISCUSSION

Although EPA-mandated toxicity tests shed light on the risk of pesticides to particular tested species, they do not definitely rule out risk to all species. For example, birds can face risks from pesticides depending on their exposure time, sensitivity to the pesticide, and the toxicity of the pesticide. The major chemical pesticides that are a concern for birds are chemical insecticides and fungicides commonly used in agricultural and farming practices, herbicides used to control invasive plant species, and rodenticides used to control mammal species (mostly rats, mice, prairie dogs). The threat of chemical pesticides to birds can occur directly (causing a health impact such as mortality, central nervous system impairments) or indirectly (causing a threat to something the bird depends on for survival). Birds can be directly exposed to a pesticide (i.e., sprayed) or can be exposed by consuming food with the pesticide on it, or absorbed in it. Birds can be indirectly impacted if their prey-base is adversely affected. A decline in invertebrates can lead to a decrease in the food that is available for birds and could have negative impacts for nesting success, health, and fitness. Further studies on the indirect effects of pesticides are needed, as scientific literature is sparse. Although it is very difficult to estimate annual mortality rates to birds from pesticides due to many factors (i.e., scavenging of bird carcasses, exposed birds can die away from the source), studies have postulated that bird deaths are regular and frequent in insecticide-treated fields (Mineau 2005).

Pesticides have been reported to cause adverse effects to many species of birds (neotropical migrants - Gard 1995; raptors - Goldstein et al. 1999, Mineau et al. 1999; passerines - Mineau 2013; cranes - Pain et al. 2004). In 2004, it was reported that approximately 50 types of pesticides have been shown to kill different species of birds (songbirds, raptors, game birds, seabirds, shorebirds; BLI 2004). For example, the use

of the granular pesticide carbofuran resulted in an estimated annual mortality rate of 3 to 16 songbirds per hectare based on typical Midwest cornfields (Mineau 2005). Carbofuran is effective at killing aphids, a pest of soybeans. Although it was once commonly used, it is now being phased off the U.S. market, and it is already banned in Europe. Organochlorine and organophosphate pesticides (some already banned in the U.S.) have been shown to cause reproductive effects in birds at both adult and embryonic life stages (Fry 1995). Although many of these highly toxic pesticides are now banned, they can still persist in the environment for decades, depending on the specific chemical. For example, dithio dimethyl trichloroethane (DDT), an organochlorine banned decades ago, continues to be detected in fish and bed-sediment from streams in developed watersheds (Gilliom 2007). This study also detected pesticides in 50% of groundwater wells tested nation-wide and sampled beneath agricultural and urban areas (Gilliom 2007).

Recently, a study led by a Canadian toxicologist identified insecticides as the best predictor of grassland-bird declines in the U.S., followed by loss of cropped pasture (Mineau and Whiteside 2013). The scientific study assessed data over a 23-year period (from 1980 to 2003) and modeled five potential causes of grassland-bird declines: change in cropped pasture, such as hay or alfalfa production; farming intensity or the proportion of agricultural land that is actively cropped; herbicide use; overall insecticide use; and change in permanent pasture and rangeland. In the authors' words, "In conclusion, it would be foolhardy for anyone to argue that habitat loss is of no importance to bird declines. However, we should be careful to consider pest control and specifically the use of highly toxic insecticides as a potential contributor to those declines. Unfortunately, information on pesticide use is often difficult to obtain or considered to be confidential, hampering any serious analysis of its true impact"

The most widely used insecticides in the world are neonicotinoids with annual sales worth $1.9 billion (25%) of the global agrochemical market (Jeschke et al. 2011). Recent studies have reported neonicotinoids to have negative effects on honeybees and bumblebees and aquatic organisms (Hopwood et al. 2012, Mineau and Palmer 2003). In addition, the insecticide has been found in well-water in states in the U.S. (Starner and Goh 2012, Huseth and Groves 2013). Information has also lead scientists to hypothesize about links between systemic insecticides (i.e., neonicotinoid, imidacloprid) and increases in disease outbreaks in wildlife. A study of exposure of bees to the pesticide imidacloprid found that newly emerged worker bees had an increase in the gut pathogen *Nosema cernae* (Suchail et al. 2001). As the use of neonicotinoids on croplands in the United Kingdom became more frequent (from 0.65% in 1994 to 30.0% in 2010), so too did various pathogens in birds across the region (Mason et al. 2013). In the U.S., finch species saw an increase in mycoplasma conjunctivitis, and in Europe birds in the Paridas family were reported to have an increase in acute necrotizing pneumonitis (Mason et al. 2013). Mason et al. (2013) propose that the rise in the frequency of chytrid fungus in amphibians, white nose syndrome in bats, mycoplasmal in finches, maybe be the result of immune suppression from low levels of neonicotinoid exposure.

Pesticide use in Wisconsin

Pesticide use is not thoroughly tracked in the state; therefore, it is difficult to have a complete understanding of the quantity of pesticides used in Wisconsin. It is likely that the largest quantities of pesticides are used in agriculture production. The National Agriculture Statistics Service of the U.S. Department of Agriculture (USDA) tracks the quantity of agriculture land and type in the U.S. In 2013, Wisconsin was reported to have 8,473,192 acres of cropland consisting of 24% of the landscape (nass.usda.gov). The top three largest crop types in Wisconsin are corn (12%), soy beans (4%), and alfalfa (4%). For these crops, an array of pesticides can be used annually. The Wisconsin Department of Agriculture and Trade and Consumer Protection enforces federal and state pesticide laws which cover sales, distribution, proper handling, storage, mixing, application, and disposal of agricultural pesticides (WI DATCAP 2014). The Department estimates that approximately 12,000 types of pesticides are registered for use in Wisconsin.

Common Household Pesticides

Common household products can provide an exposure risk to birds and other wildlife depending on their toxicity and exposure potential. Some studies have reported bird mortality for pesticides that are applied to lawns. For example, young robins were poisoned after feeding on grubs that surfaced from a residential turf sprayed with the pesticide imidacloprod (U.S. EPA 2008). Many common household products are considered pesticides by the EPA (U.S. EPA 2013). These products should be used with caution if use occurs in areas where birds could be exposed.

- Cockroach sprays and baits
- Insect repellents for personal use
- Rat and other rodent poisons
- Flea and tick sprays, powders, and pet collars
- Kitchen, laundry, and bath disinfectants and sanitizers
- Products that kill mold and mildew
- Some lawn and garden products, such as weed killers
- Some swimming pool chemicals

Alternatives to Traditional Chemical Pesticides

Biopesticides and Integrated Pest Management (IPM) are considered to be alternatives to traditional chemical pesticides. Biopesticides, biologically-based pesticides such as pheromones and microbial pesticides, are becoming increasingly popular and often are safer than traditional chemical pesticides. The EPA is registering reduced-risk biopesticides at increasing rates. Integrated Pest Management provides a series of steps to control some insects while not exposing the general environment, wildlife or humans to toxic risks. The IPM approach aims at “assisting” plants to naturally respond to threats from pests and deliberately uses pesticides in a selective manner. In addition to these alternatives, there are a number of chemically “green” products on the market,

and the diversity in these products continues to rise. Chemically green products, also known as eco-friendly products, are chemicals that are not reported to cause a detrimental effect to humans or to wildlife.

RECOMMENDED ACTIONS

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Disclaimer: *The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service.*

RESOURCES

American Bird Conservancy:
http://www.abcbirds.org/abcprograms/policy/toxins/index.html

Audubon Society:
http://www.audubon.org/bird/at_home/ReducePesticideUse.html
http://www.audubon.org/bird/pesticides/

Birdlife International: http://www.birdlife.org/datazone/sowb/casestudy/158

Center for Biological Diversity: http://www.biologicaldiversity.org/

Ecological Agriculture Projects, McGill University:
http://eap.mcgill.ca/MagRack/JPR/JPR_14.htm

U.S. Fish and Wildlife Service:
http://digitalmedia.fws.gov/cdm/ref/collection/document/id/273

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