

# **Canadian Coalition for Health and Environment**

## ***Citizens Urging Ecological Strategy for West Nile Virus***

### **The Concern:**

How do basic tenets of medicine to practise "evidence-based medicine", and to "above all do no harm" fit into public health decisions to use pesticides in response to West Nile virus? They should preclude widespread pesticide spraying. WNV is a complex disease in the environment, and human health is directly linked to ecological health.

Regardless of the severity of the vector-borne illness, public health initiatives such as pesticides for either larvae or adult mosquitoes must not compromise ecosystem health so that mosquito populations subsequently flourish as predator populations are diminished. This is a common consequence of pesticide use. Malathion fogging to kill adult mosquitoes may render human and other populations more susceptible to WNV infection, and is responsible for a myriad of serious health problems arising from the pesticide exposure. There is little if any evidence that pesticides improve public health or ecosystem outcomes with regard to WNV. Nevertheless, if insecticides are used to kill either larval or adult mosquitoes, public health authorities should also monitor for effectiveness and adverse effects, as for any medical trial.

### **The Solution:**

A multi-faceted approach including public education and co-ordinated community action with respect to mosquito avoidance and small container (mosquito-specific) breeding site cleanup, and maintaining healthy landscapes with a diversity of mosquito predators are of paramount importance. These are proven internationally to be the most successful strategies for vector-borne disease reduction.

### **Background:**

WNV usually causes a mild flu-like illness in humans, although unfortunately some deaths and long-term disabilities have resulted from the virus when infection spread to the central nervous system. People are occasionally infected by the bite of a mosquito that has previously fed on an ill animal, and transmission by blood products and tissue donation is possible. Not all mosquito species are capable of transmitting WNV.

WNV is primarily a bird disease. It is spreading rapidly among the birds of North America, and some species may face extinction. However, even the most effective mosquito control measures would not halt this spread, because the virus is spread amongst birds by other insects (e.g. ticks), and birds become infected by eating infected animals (bird, mammal or insect) or by exposure to virus in skin or excrement of infected birds. Fortunately, many of the birds surveyed developed immunity after recovering from West Nile Virus. Based on experience elsewhere, it is hoped that WNV will fade into the background when the "viral pool" in the environment drops because immunity has developed in a large portion of wildlife, particularly in birds, the most susceptible and mobile host. (1)

Mosquito-borne diseases will become more common with global warming and international trade and travel.(2) Canadians' response to WNV is a rehearsal for response to other diseases on our doorstep. The most effective, sustainable means of disease control are to dress appropriately, use non-toxic insect repellents, exclude insects from homes, minimise mosquito-specific breeding habitats, and nurture mosquito-predator populations such as amphibians, fish, birds, bats and dragonflies. Indeed, release of native predators such as fish and dragonflies may effectively reduce both mosquitoes and vector-borne disease. (3)

Broad-spectrum insecticide resistance is increasing, and is hastened by wide-range, frequent insecticide applications. (4) As insects adapt, higher application rates increase risk to other species, including humans. Non-specific pesticides harm people and mosquito-predator populations directly, (5) and also decrease predator populations indirectly by interrupting (temporarily) the supply of the mosquitoes they eat. For example, eleven years of pesticide spraying to control adult mosquitoes carrying equine encephalitis in NY state led to a fifteen-fold increase in mosquito carriers of the disease. (6) When the pesticide effect wears off, the environment has lost its natural checks and balances. Mosquitoes have short life spans and populations rebound in days or weeks, while mosquito predator populations rebuild more slowly, if at all.

Present pesticide use practices probably put people at greater risk of WNV. For instance, in urban areas, rain washes turf care insecticides and fungicides into rivers, at levels that affect dragonfly, amphibian and fish populations.(7) Rather than using yet more pesticides to fight WNV, it would be more effective not to pollute and to clean up our rivers and lakes, and to nurture diverse ecosystems that would keep mosquitoes in check.

## Comments on specific pesticides proposed for control of WNV:

### Larvicides:

*Bacillus thuringiensis* (var. *israelis*) (Bti) is a relatively specific mosquito larvicide, (8) affecting only mosquitoes and some flies. However, as with many pesticides, secret toxic additives (formulants) may pose risks.

Non-specific insect growth regulators methoprene and diflubenzuron are larvicides that may be used to treat wet areas and the catch-basins at the bottom of street drainage holes, connected to storm sewers. It is inevitable that these pesticides will be washed into streams during storm events, compromising invertebrate, amphibian and fish populations that prey on mosquitoes. (9) During breakdown, methoprene is converted to retinoids, that are potent teratogens.(10) The diflubenzuron metabolite, 4-chloroaniline is a mutagen, is carcinogenic in rats and mice, and causes methaemoglobinaemia ("blue baby syndrome") in exposed workers and in neonates inadvertently exposed. (11) These chemicals are toxic to crustaceans such as crayfish, shrimp and lobster.

The organophosphate chlorpyrifos is registered as a larvicide. However, it adversely affects many non-target species, including people,(12) is more persistent in the environment, and cannot be justified when other less toxic alternatives exist.

Bti may appear to be more expensive than the growth regulators because it has to be reapplied more frequently. However, when distributed in sewers, outfall concentrations of growth regulators should be monitored, and these labour and testing costs could offset up-front costs of Bti distribution.

### Adulticides:

Killing adult mosquitoes by spraying insecticides is partially and temporarily effective at best, and poses the greatest risks to non-target species, including humans and mosquito predators. (3) Broadcasting pesticides contributes to insecticide resistance in a large number of species.

The organophosphates "malathion" and "chlorpyrifos" are adulticides approved for use in Canada. Organophosphate exposure has been a leading cause of hospitalisations for occupational pesticide poisonings in the US. (13) Organophosphates in humans can "overstimulate the nervous system causing nausea, dizziness, confusion, and, at very high exposures (e.g. accidents, major spills), respiratory paralysis and death."(14) They disturb the immune system in a number of species, (15) and in minute amounts are potent immunosuppressants in frogs. (16) Furthermore, this class of chemical has been implicated in cognitive and motor deficits in children. (17) Organophosphates are on the Quebec Pesticide Code list of pesticides banned for non-agricultural use. (18) They are very toxic to bees, other beneficial insects, snails, worms, crustaceans, fish and birds.

Canada's approval for malathion is consistent with the American registration. However, re-registration of malathion by the United States EPA was done without the safety margins for children required under Canada's new Pest Control Products Act, and despite dispute within the EPA over carcinogenicity conclusions(19) and its environmental impacts(20).

Chlorpyrifos has been banned in Canada for use around homes and schools, because of acute and long-term neurotoxicity and other concerns, but incredibly is still allowed for mosquito control.(21)

### Conclusion:

Wide-ranging effects of pesticides make them a very questionable and short-sighted means to minimise the public health risk of WNV. Just as the medical community is belatedly emphasising common-sense behavioural disease prevention (e.g. disease avoidance and hand-washing) and reduced reliance on antibiotics, we must appreciate that chemical meddling with natural systems has a high probability of back-firing. Comprehensive monitoring should accompany any pesticide use when the intention is to protect public health. Indeed, across the landscape, present pesticide use potentially contributes to increased risk of WNV, and should be reduced. Healthy immune systems and diverse ecosystems are our best lines of defence against WNV.

## **Recommendations:**

1. Effective community action from public education regarding mosquito avoidance and mosquito-specific breeding site cleanup , along with nurturing native mosquito predators are of utmost importance. These are proven internationally to be the most successful strategies to deal with vector-borne disease.
2. Larvicides may temporarily reduce mosquito populations, but are not proven to reduce disease, either in wildlife or in people. If mosquito populations are temporarily reduced, it could well have adverse effects on predator populations. The CCHE does not recommend larvicides but offers these observations:
  - If a larvicide is to be used, Bti is the least toxic, most specific agent. Products registered for organic farming are free of toxic formulants. Larviciding should be targeted, and restricted to areas known to have active disease in wildlife. A larvicide program should be accompanied with a monitoring program to examine effectiveness of mosquito control and impact on mosquito predator populations. The results should be published.
  - Growth inhibiting larvicides threaten non-target species, including mosquito predators and commercial seafood. Organophosphates cannot be justified for larval control because safer alternatives are available.
3. Spraying pesticides to kill adult mosquitoes in response to WNV poses greater risks than benefits both to people and to the environment. It is possible, even probable, that such attempts to kill adult mosquitoes will increase the frequency and severity of human WNV infections. Adulticiding is not justified, even as "last resort", and even if WNV is a more virulent, serious disease than thought previously. All governments should dismiss the possibility of spraying pesticides to kill adult mosquitoes. Nevertheless, if malathion is to be sprayed, health departments must give comprehensive notice of spraying, and alert the public, doctors and hospitals to the symptoms and treatment of organophosphate poisoning.
4. The WNV outbreak makes urgent the need to re-examine current pesticide use practices, to minimise the impacts on non-target species that prey on mosquitoes. These organisms are key to minimising human risk of WNV. In light of the seriousness of WNV, an immediate moratorium should be imposed on the non-essential use of pesticides. For example, why put citizens at increased risk of WNV for the sake of pristine lawns, especially since non-toxic alternatives are available?

### **Excellent peer-reviewed summary of many relevant issues:**

Ther A. Balancing the Risks: Vector Control and Pesticide Use in Response to Emerging Illness. J Urban Health 78(2):372-378, 2001

### **A few interesting websites:**

From Ottawa: <http://www.sankey.ws/wnv.html>

The Maine perspective: <http://www.meepi.org/wnv/overkill.htm>

Health Canada's West Nile Virus Information <http://www.hc-sc.gc.ca/pphb-dgspssp/wnv-vwn/index.html>

Ecocentric Rationale <http://www.ecospherics.net/>

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