



Federation of  
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## **West Nile Virus, Healthy Wetlands and Natural Predators**

There is a growing public concern, almost to the point of hysteria, over the spread of West Nile Virus. Some citizens are even demanding that their local governments drain wetlands and spray chemicals to kill mosquitoes. These five pages present factual information on mosquitoes, West Nile Virus and the many natural predators of mosquitoes which depend on healthy wetlands. Several websites are listed on the last page and each has extensive information.

### **Facts About Mosquitoes**

- Mosquitoes need standing water to mature from larva to adult. Mosquitoes can develop in any puddle that lasts more than 7-10 days.
- Mosquitoes have four stages in their life cycle: egg, larva (wigglers), pupa, and adult. Many mosquitoes have several generations a year. Some mosquitoes pass the winter as eggs that hatch in the spring when flooded with water. Some female (fertilized) adults pass the winter in cellars, burrows, hollow trees and unheated buildings, and appear early in spring to lay their eggs. The larva and pupa stage require standing water. They cannot grow in shrubbery or long grass, nor in deeper or moving water. When the adult emerges, it rests on the floating pupa skin long enough for its body to harden, then flies away to vegetation or moist and shady places. Both sexes feed on plant juices. A few days after emergence the mosquitoes mate. The females then search for the blood meal that is necessary to produce eggs. Males live only a few days, whereas females can live for several months. Only female mosquitoes bite to obtain a blood meal.
- Adult mosquitoes can travel great distances from their source of origin, over 15 kilometres has been reported.
- Many mosquitoes breed in man-made water habitats including standing water in ditches, old tires, bird baths, unused swimming pools, boats and eave troughs.
- Healthy wetlands are home to a host of species that eat mosquito larvae -- species such as beetles, backswimmers, water striders, dragonfly and damselfly larvae, threespine stickleback fish, tadpoles of newts and salamanders, juvenile ducks; and several species that eat adult mosquitoes -- species such as bats, dragonflies and damselflies, frogs and certain bird species. In some areas, restoration of healthy wetlands has significantly reduced mosquito populations. Wetlands are significantly less ideal breeding sites for mosquitoes than our own backyards!

### **About West Nile Virus**

- West Nile Virus (WNV) is a virus transmitted by mosquitoes. It was discovered in the West Nile district of Uganda in 1937.
- WNV was first reported in the eastern U.S. in 1999. WNV has not yet been identified in BC, but it is expected that it will be in summer 2003, because last year it was identified in Washington State. Last year the virus also reached five Canadian provinces, as close as Saskatchewan.

- It is normally passed between mosquitoes and birds, but humans can get WNV through the bite of an infected mosquito. Horses are also susceptible.
- Birds are reservoir hosts and most of them develop immunity after exposure to WNV, although many are killed directly by the disease.
- Most documented cases in birds are in the family *Corvidae* or corvids (crows, jays, nutcrackers, magpies, ravens). Infections in crows are most reported (and most monitored). However, WNV has been documented in over 110 species of birds, including Canada goose, mallard, coot, American kestrel, gulls, Great Horned Owl, House Finch, House Sparrow, robin, and starling.
- The Canadian Wildlife Service notes that WNV may already have a measurable impact on bird populations. In areas where WNV has been confirmed, long-term data such as the breeding bird survey and Christmas bird counts have shown significant declines in many families of songbirds following WNV outbreak.
- About ten mosquito species are possible vectors for WNV in BC. One of the most common is *Culex pipiens* (an introduced species), which is often found in backyards and urban areas, since it only needs a tea cup of water to grow, from eggs through to adult. Standing water in your eaves is often enough to grow this species. *Culex pipiens* feeds mostly on birds, but comes indoors on warm summer nights. It's the one you likely hear when lying in bed, and it does bite humans.
- Another species is *Culex tarsals*, which is a native species, widely distributed in ditches and permanent and semipermanent pools/ponds in grassland and open woodland in the southern third of BC.
- There is no human vaccine for WNV at this time, but there is a vaccine available for horses. Many BC horses were vaccinated early this spring.

### **How Sick May You Get?**

- Most people infected with WNV will experience no symptoms at all. Even in areas where mosquitoes do carry the virus, very few mosquitoes (much less than 1%) are infected. If the mosquito is infected, less than 1% of people who are bitten and become infected will get severely ill. The severe illness can cause meningitis (inflammation of lining of brain and spinal cord) or encephalitis (inflammation of brain). People over 50 years seem to be most at risk for the severe illness. Of the other 99% of people bitten by an infected mosquito, about 20% will experience mild flu-like symptoms lasting a week or less. Most (about 80%) are able to fight off the virus without even knowing they have it.
- Put in perspective, you are more likely to die from the flu than from WNV.
- Although a great deal of public attention is being given to WNV, it is not the only wildlife-borne disease of importance in North America. Other significant diseases include: Lyme disease (carried by ticks), *Hanta* virus (carried by mice), *Psittacosis* (Chlamydia transmitted to humans from birds or bird feces) and *Giardia* (beaver fever).

### **To Reduce the Chance of Mosquito Bites**

- Wear light-coloured, loose fitting clothing (dark colours attract mosquitoes), long-sleeved shirts or jackets, and long pants; mosquito netting hooded shirts are available.
- Dawn and dusk, and after rain, are times when mosquitoes are most active so you could avoid being outdoors at these times; however WNV has been found in a variety of mosquitoes including those that bite from dusk-to-dawn and those that bite during the day. The mosquito season (as if you don't already know!) lasts typically from May until hard frost (late September-October)
- Be aware that heat and moisture from barbecues attracts mosquitoes.

- Use screens on open doors and windows
- Some sources recommend mosquito repellents that contain DEET, but others report health hazards with this repellent, and instead recommend Citronella repellent. No definitive studies exist in scientific literature stating that any concentration of DEET is safe for children. Some studies have shown DEET can be toxic to children's central nervous systems and can cause skin reactions in adults.
- If you are going to use DEET, use the correct percentage. A product with 6.65% DEET provides almost 2 hours of protection. A product containing 20% DEET provides almost 4 hours of protection.

### **Take Precautions against Direct Transmission of WNV from Birds**

- Do not handle dead birds. BC Health Authorities are examining dead crows, ravens, stellar's jays and blue jays. If you find a dead bird, contact your Regional Health Authority (phone # in blue pages) for information on what to do. Or phone toll free to Canadian information centre in Saskatoon (1-866-544-4744).
- If handling live birds (e.g. bird banding or wildlife rescue) follow protocols established by Canadian Wildlife Service.

### **Prevent Mosquito Breeding in Man-made Standing Water**

- One of the most common carriers of WNV is *Culex pipiens*. It is often found in backyards and urban areas. It only needs a tea cup of water to mature from eggs through to adult.
- Destroy or dispose of tin cans, old tires, buckets, plastic sheeting, or other containers that collect and hold water (or drill holes in)
- Clean bird baths regularly (at least once a week) and empty pet water dishes regularly
- Empty saucers under flower pots, at least weekly
- Repair leaky plumbing and outside faucets
- Store boats and canoes upside down
- Clean out leaves and other debris blocking and holding water in roof gutters, and make sure the slope of the gutter is the correct angle so that water does flow out
- Irrigate lawns and gardens carefully to prevent water from standing for several days
- Drain wading pools when not in use; drain tarps and trampolines that fill with rainwater
- Use fine mesh of nylon or aluminum to cover rain barrels, cisterns and water containers that cannot be dumped
- Make sure drainage ditches are not clogged.

### **Use Natural Mosquito Predators as Controls**

- Natural predators are not yet being considered by government and they should be considered as the first choice for control of mosquitoes.
- Natural predators of mosquito larvae and pupa include threespine stickleback (a native fish of fresh, brackish and salt water which grows to a maximum size of 10 cm), juvenile ducks, larvae of dragonflies and damselflies, tadpoles of salamanders and newts, hydra (polyps) and possibly backswimmers and mayfly larvae (caddis flies). Research in this area should be encouraged to identify the species that eat the most mosquito larvae, and learn how to commercially market these tiny natural predators. Commercial marketing should use local species.
- Use and encourage natural predators of adult mosquitoes including: frogs, salamanders, newts, dragonflies, damselflies, birds (swallows, purple martins, fly catchers), and especially bats.
- Stock garden ponds with small fish or circulate the water in your pond.

- Grow emergent plants like cattails and bulrushes in your pond. Mosquito eaters such as dragonflies and other predatory insects are attracted to them.
- Install bat and bird houses on your property. The Little Brown Myotis (BC's most common bat) can consume over 500 mosquitoes in an hour's feeding at dusk.
- Avoid clearing dense shrubs and brush on your property to reduce mosquito populations. You may unnecessarily clear out a lot of vegetation -- and still find you have a mosquito problem since dense shrubbery provides habitat for many birds and insects that prey on mosquitoes.

### **Understand Control Methods which Municipalities Are Using**

- Control methods currently used by governments are either larvicides (which kill the larvae stage of mosquitoes), or adulticides (which kill the adult mosquito). Adulticides have extensive negative impacts. Governments have the responsibility to inform the public on the negative impacts caused by using these controls. Governments should first consider the benefits of using natural predators as controls, and should also encourage citizens to keep their backyards free of standing water that can be used by mosquitoes for breeding.

#### **a) Larvicide Control**

- The most commonly used larvicide is *Bacillus thuringiensis israelensis*, a bacterium found naturally in soils. It is commonly referred to as Bti. Since 1982 it has been used worldwide as a biological pest control agent to combat mosquitoes and blackflies.
- Bti works by producing a protein crystal which is reportedly toxic only to mosquito and blackfly larvae. These microscopic crystals are ingested by insect larvae when they are feeding. In the alkaline environment of the susceptible insect's digestive system, the crystals are dissolved and converted into toxic protein molecules that destroy the walls of the insect's stomach. The insect usually stops feeding within hours and dies within days. (You may recall that another subspecies, *Bacillus thuringiensis kurstaki*, or Btk, was sprayed to kill gypsy moths in the past decade. Btk kills lepidopteran insects, including spruce budworms and tent caterpillars.)
- Bti is applied directly to the water where mosquito and blackfly larvae are found, and the larvae ingest it. Bti reportedly poses little threat to human health because the acidic stomachs of humans and animals do not activate Bti toxins, BUT it should not be applied to treated, finished drinking water intended for human consumption. It is also recommended that water containing Bti should not be discharged into lakes, streams, ponds, estuaries, oceans or public waters.
- There are 25 Bti control products registered for use in the US, including Aquabac, Neknar, Vectobac, Mosquito Dunks and LarvX.
- Bti reportedly does not affect insects other than larvae of mosquitoes and blackflies, but it is not stated which insects have been tested. Honeybees are specifically reported as not being affected. Studies should be reported on the effects on mosquito eating insect larvae such as dragonflies or damselflies, on the tadpoles of frogs or salamanders, or on the numerous insect populations which form the food for birds.
- The Canadian Pest Management Regulatory Agency does report that while adverse effects have been observed in individuals of some non-target aquatic insect species, no lasting impact on the populations of these species has been shown from the use of Bti, BUT they do not mention which insects. One report notes some concern with impact on *Daphnia*.
- Several municipalities in the Lower Mainland have been spraying standing water in ditches with Bti for several years, as a means to reduce mosquito populations. It is not clear whether these spray programs are even effective. No base line data has ever been kept. In 2003 some

municipalities are significantly increasing their budgets for spraying with Bti, but again without consideration of broad impacts.

- There are other larvicides (including Methoprene which spreads a thin oil film on the water surface), but no other larvicide is even recommended by the manufacturers for use on wetlands.
- Consideration must be given to impacts from use of larvicides on species which have no readily apparent economic value, but feed on mosquito larvae or adults. If larvicides are being applied, base data should be collected on several species. Before using a larvicide, control should first be attempted by natural predators such as: threespine stickleback, dragonfly and damselfly larvae, hydra, salamander and newt tadpoles, and juvenile ducks.

#### **b) Adulticide Control (killing the adult mosquito)**

- Adulticide spraying is reportedly happening in Eastern Canada. (This is reminiscent of the Silent Spring days when DDT was sprayed.) Chemicals such as malathion and pyretherin are used.
- Adulticides are most frequently used to control insects in agriculture.
- Health Canada recommends that you remain indoors during and immediately after spraying is taking place.
- Health Canada reports that Malathion is highly toxic to insects, including honeybees, and to fish and aquatic insects, so that care should be taken in applying to avoid overspray or drift to aquatic environments.
- Adulticides are considered ineffective against mosquitoes according to Health Canada's website since the chemical has to contact the individual mosquito to kill it and then as the spray settles, it poisons everything on the ground or water.
- Adulticides should not be used.

#### **More Information**

Canadian Cooperative Wildlife Health Centre has information on submitting dead birds and many links. Phone toll free to information centre in Saskatoon (1-866-544-4744)  
<http://wildlife.usask.ca/english/frameWestNile.htm>

Health Canada - <http://nile.healthcanada.net> This site links you to the BC Centre for Disease Control and US Centre for Disease Control.

Canadian Pest Management Regulatory Agency [www.hc-sc.gc.ca/pmra-arla](http://www.hc-sc.gc.ca/pmra-arla)

Ministry of Water, Land and Air Protection <http://www.gov.bc.ca/wlap/> Under keyword search, type in West Nile Virus. Links on mosquitoes, Bti, and insect repellents.

Canadian Coalition for Health and Environment - Coalition of citizens urging ecological strategy for West Nile Virus <http://www.cche-info.com/>

The Living By Water Project <http://www.livingbywater.ca> Look under Highlights.