

Frequently Asked Questions

Floodwater Mosquito Biology and Disease Transmission



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Category 1: Mosquito Ecology

Question 1: What type of mosquitoes are controlled by Morrow BioScience Ltd (MBL)?

Most mosquito control program operated by MBL focus on one complex of mosquitoes, those that develop in floodwaters, primarily during the Spring freshet (e.g. Aedes vexans, Aedes sticticus). However, certain programs within BC also have snowmelt mosquito species (e.g. Aedes communis). The females of these snowmelt species lay eggs in depressions within the landscape that allow for snowmelt or precipitation to accumulate. Eggs are able to hatch under considerably cooler conditions than those of floodwater or container mosquito species. At this time, MBL does not control mosquito species typically found in containers (e.g. Culex pipiens).

Question 2: Why doesn't MBL control container mosquitoes like those in residential backyards and catch basins?

At this time, MBL doesn't focus on treating containers (i.e. catch basins, bird baths, gutters, old tires, etc.) to control container mosquito species primarily because besides catch basin habitats, most of the container mosquito development sites are located on private property. While sometimes producing enough mosquitoes to create very localized annoyance, they don't create broader nuisance levels. Although MBL doesn't specifically target container mosquitoes, field and outreach staff have developed messaging aimed at informing residents of proactive measures that can reduce container mosquito habitat around their homes. Measures include refreshing stagnant water daily during the height of the season, ensuring gutters are cleaned and not holding water, removing old tires, covering rain barrels with a fine mesh to prevent mosquitoes from accessing, and many more.

Question 3: What conditions need to be present for floodwater mosquitoes to hatch?

Floodwater mosquito eggs are triggered to hatch when submerged by fresh floodwaters, typically occurring as a result of the Spring freshet in BC. As water warms up in the late spring, larvae develop faster.

Question 4: What environmental factors in BC govern floodwater mosquito development?

Tracking environmental factors that affect the flooding capacity within an area are important. Flooding in BC typically occurs in the Spring as a result of the Spring freshet from snow basins contributing to local rivers. Snowpacks vary inter-annually. When snowpacks in contributing basins are low, the freshet usually follows suit and when they are high, the freshet is comparatively high. A high freshet means more mosquito eggs may be activated to hatch,

especially if previous seasons' freshets resulted in low local river levels. Snowpacks in BC are assessed by automated snow weather stations throughout the year and can be found at: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-science-data/water-data-tools/snow-survey-data>.

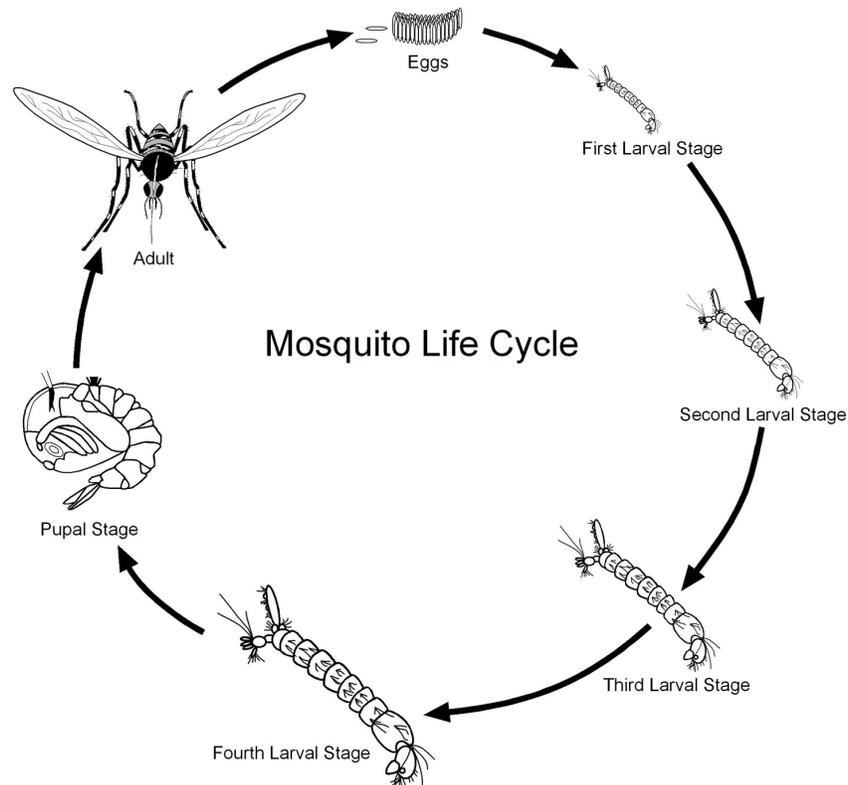
Significant temporally and spatially concentrated precipitation accumulation may also elevate local river levels. Local precipitation can temporarily increase seepage site levels, where considerable mosquito development habitat is located. Thus, tracking local precipitation accumulation can aid MBL field staff with determining how long mosquito development sites may require management. Local weather station data can be found at: <https://climate.weather.gc.ca>

Question 5: Why are adult mosquitoes most abundant after the peak in local rivers?

Peak river levels represent the time at which the majority of floodwater mosquito eggs have been triggered to hatch for the season. The time from when an egg hatches to emergence and dispersal is typically 2-3 weeks (although this is highly dependent upon water temperatures). So even as local river levels are receding, mosquito development may still be taking place. Adult floodwater mosquitoes are strong enough to disperse from their hatch site quickly and are able to fly multiple kilometers in search of a blood meal. Significantly warm weather increases the rate at which a mosquito develops and may lead to more aggressive activity toward the end of a mosquito's lifespan.

Category 2: Mosquito Development

Question 1: What is the lifecycle of floodwater mosquito species within the program area?



Source: North Shore Mosquito Abatement District (<https://www.nsmad.com>)

Floodwater mosquito eggs are laid in the damp substrate along floodwater corridors. Flooding along with other appropriate environmental triggers (i.e. sufficiently warm, low dissolved oxygen) allow for the eggs to hatch into larvae. The larvae go through four aquatic instar stages, which are also the primary feeding stages, prior to developing into pupae (i.e. non-feeding stage). Pupae then emerge into adults. The development process can take as little as four days in some species to as long as two weeks. Development times also depend on ambient and aquatic temperature, with warmer water resulting in accelerated mosquito development.

Question 2: At what life stage are mosquitoes targeted for control?

MBL does not conduct adult mosquito control. Adult control requires the use of pesticides with considerable indirect and non-target effects. Instead, MBL targets the larval stage of the mosquito. Mosquito larvae are the feeding stage of the life cycle, which makes the larval instars particularly susceptible to larvicides dependent on ingestion. Specifically, the 3rd and early 4th

larval instars are the target of MBL's floodwater mosquito control program. The feeding rate increases within the 3rd and early 4th instar stages, making the larvicide more effective. Additionally, the 1st and 2nd instar larval stages are left as biomass in the aquatic ecosystem to support the food web. This strategy helps with limiting the frequency of treatments and supporting as robust a food web as possible.

Question 3: How far can mosquitoes fly from their hatch site?

*Maximum flight distance from hatch site varies widely dependent upon species. A common floodwater, *Aedes vexans*, may fly greater than 4 km from their hatch site, on average. The main implication of these data is that uncontrolled mosquitoes may impact people from distances farther than 4 km, in some circumstances. MBL endeavours to reduce mosquito annoyance to residents in all areas within the contract purview.*

Category 3: Disease Transmission

Question 1: What diseases can mosquitoes transmit in Canada?

In Canada, mosquitoes have been shown to transmit West Nile virus, Eastern Equine encephalitis virus, and California serogroup viruses. West Nile virus is the most widely distributed vector borne disease in North America. As the climate in Canada becomes warmer, the environment is more hospitable to additional vectors and associated viruses.

Question 2: Is West Nile virus a concern in BC? What are the most recent levels?

*West Nile virus (WNV) is only a slight concern in BC given the relatively few number mosquito pools, birds, horses, and humans who have tested positive. From 1 January – 12 October 2019, one positive human WNV case was detected in BC. In that same year no animals, no mosquito pools, and no birds tested positive for the virus. Certain container mosquitoes, such as *Culex pipiens* and *Culex tarsalis*, are primary WNV vectors. Thus, in years and situations where container mosquito breeding is more prolific (i.e. warmer weather), more WNV transmissions may occur.*

To reduce WNV exposure through mosquitoes, MBL and the BC Centre for Disease Control urges residents to:

- *remove or refresh standing water daily in the warmer months,*
- *ensure that outdoor plants or containers have a drainage hole,*
- *clear rain gutters of debris and make sure they drain,*
- *turn over wading pools when not in use, and*
- *install screens on windows and doors.*

Question 3: Where can I go to find more information about West Nile virus?

Health Canada maintains a thorough surveillance website, delineating cases by type (i.e. human, animal, mosquito), week, and province from mid-April through October. The Health Canada site also provides health-specific information surrounding WNV. It can be found at: <https://www.canada.ca/en/public-health/services/diseases/west-nile-virus.html>

The BC Centre for Disease Control (BCCDC) website also contains health-related information for residents. The BCCDC site has a more detailed map of surveillance activity by region. It can be found at: <http://www.bccdc.ca/health-info/diseases-conditions/west-nile-virus-wnv>

Question 4: Can mosquitoes act as a vector for COVID-19?

At this time, there is no evidence that mosquitoes are involved in the spread of COVID-19 (SARS-CoV-2). It is thought that the COVID-19 virus may not survive the internal processes of the mosquito. Other supportive evidence for the inability of mosquitoes to act as vectors COVID-19 is that other Coronaviruses have not proven transmissible through mosquitoes.

Question 5: Where can I go to learn more about potential vectorization of COVID-19 in mosquitoes?

The Center for Disease Control addresses the potential for vectorization of COVID-19 in mosquitoes: <https://www.cdc.gov/coronavirus/2019-ncov/faq.html>

The World Health Organization also addresses this question:

<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters>

To date there has been no information nor evidence to suggest that the new coronavirus could be transmitted by mosquitoes.

The new coronavirus is a respiratory virus which spreads primarily through droplets generated when an infected person coughs or sneezes, or through droplets of saliva or discharge from the nose.

To protect yourself, clean your hands frequently with an alcohol-based hand rub or wash them with soap and water. Also, avoid close contact with anyone who is coughing and sneezing.

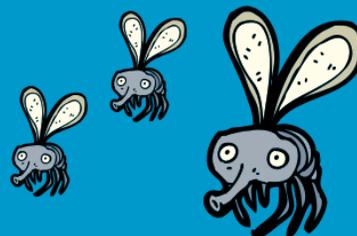


World Health Organization

#Coronavirus

#COVID19

FACT:
The new coronavirus
CANNOT
be transmitted through
mosquito bites



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