FINAL REPORT

CONTROL OF BITING INSECTS

Kanata North

2024 Season

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Introduction

The quality of life for residents of Kanata North has been impacted by significant populations of "nuisance" mosquitoes. Kanata North Ward is surrounded by major wetlands that contain great biodiversity. The high-water table and flat topography create ideal conditions for mosquito reproduction, leading to the formation of large breeding sites, many of which remain flooded or are refilled with water following rainfall throughout the season. For this reason, GDG Canada was contracted by the City of Ottawa to control spring and summer mosquito larvae by applying a biological larvicide in the Kanata North Ward. The surface area of the treatment zone (figure 1) is approximately 6,053 hectares (ha) to protect an area of 1825 hectares. The work and treatment were executed by G.D.G. Canada, a full subsidiary of G.D.G. Environment.

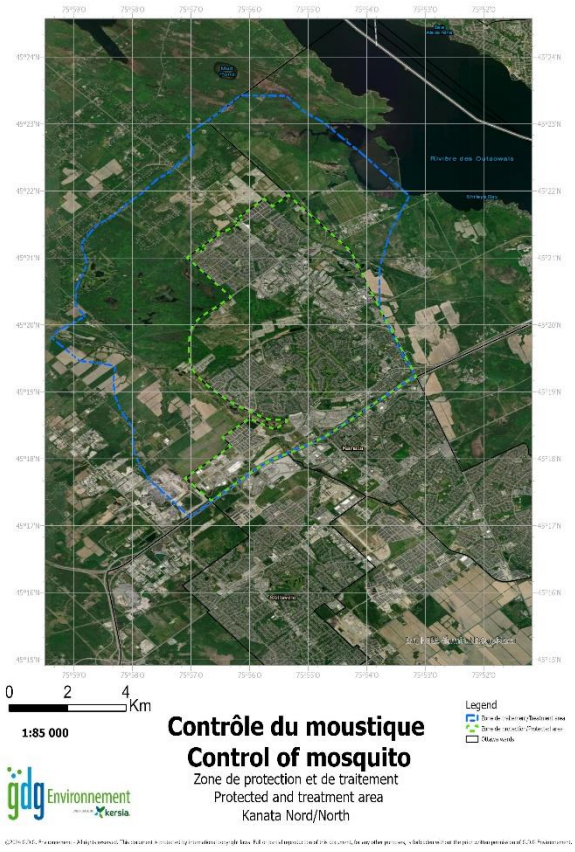

Figure 1. Treatment area in Kanata North

The mosquito control program uses primarily a biological larvicide named *Bacillus thuringiensis israelensis* (Bti) which is applied in the spring to control snowmelt mosquitoes and throughout the summer to control floodwater mosquitoes. *Bacillus sphaericus* (Bsph) is also use in spring but in smaller amounts. Larvicide applications are carried out by helicopter, drone, and ground equipment.

Larval breeding sites are found in environments containing stagnant waters, such as wetlands, marshes, bogs, flood plains, poorly drained forests, ditches, etc. Some species prefer temporary environments (rainfall dependent) while others prefer permanent sites (remaining throughout the seasons). Some species have many generations per season (multivoltine), while others have only one generation (univoltine). In addition, of the approximately 30 species found in the area, some cause nuisance to the residents, while others are only targeting animal species (amphibian, birds, etc.). Du to these factors, it is essential to document the mosquito species composition of the area and categorize the different habitat types to target the right species that cause nuisance to humans.

This report will outline the operational activities and analysis of mosquito surveillance during the 2024 program. In addition of this report, weekly reports have been sent to city authorities, intended for public information. Finally, monthly meetings also took place with city authorities for program follow up. The dates for these meetings are indicated in table 1.

Table 1. Monthly meetings with city authorities

Month	Date
April	April 18th
May	May 29th
June	June 26th
July	July 29th
August	August 26th
September	October 7th
Public session	July 30th

Kanata North Project History

GDG Canada has operated in the Kanata North ward since the inception of the City of Ottawa's West Nile virus program in 2003. As the service provider for the City of Ottawa's WNv program, GDG Canada has become familiar with the increasing nuisance mosquito situation in Kanata North. Before the start of the nuisance control program, GDG Canada and Ottawa public health (OPH) had already been fielding phone calls from citizens in the Kanata North ward concerning nuisance caused by mosquitoes.

Under the West Nile virus mandate, mosquito monitoring has demonstrated that these mosquitoes are not efficient vector carriers of WNv. But these mosquitoes will seek a blood meal from humans, and they can prevent residents from enjoying both their backyard and the outdoor areas of their community. To gain further insight into the nuisance situation, GDG Canada conducted at its own cost an operational study in the Morgan Grant and Beaverbrook neighbourhoods of Kanata North on the mosquito population composition and dynamics.

This study was conducted in 2014 and 2015 enabling GDG Canada to gain a better understanding of the breeding sites in the surrounding areas, allowing us to determine the sources of the mosquito nuisance. GDG Canada performed trapping and monitoring for mosquito population and species identification including larval and adult mosquito surveillance and breeding site mapping around and within the ward of Kanata North. The objective of this trapping and monitoring was to identify the realistic requirements of a program that will have a real and noticeable impact on the quality of life for the residents and visitors while maintaining the area's ecological integrity. Larval sampling has provided insight into the spatial and temporal distribution of nuisance mosquito breeding sites.

The entomology trapping and monitoring conducted by GDG Canada in Kanata North determined that the major cause of nuisance stemmed from the species *Ochlerotatus (Oc) stimulans, Oc. provocans, Oc. excrusians, Oc. trivitatus, Oc. japonicus, Aedes vexans* and *Coquillettidia perturbans* (CQP).

During our spring survey, the larval sampling results revealed the presence of *Oc. stimulans*, *Oc. provocans, Oc. absseratus* and *Oc. excrusians,* four aggressive human biters that emerge after snowmelt in non-permanent and permanent standing water sites. They have one generation per season, and their eggs will hatch in temporary standing water caused by spring snowmelt or where the Carp River overflows its banks. The eggs will only hatch in the spring as they must go through a dry period followed by a freezing period before hatching. Hatching is triggered by immersion in water followed by a drop in dissolved oxygen levels. Once eggs have hatched, larvae will emerge.

During our summer survey, the larval sampling results revealed the presence of *Oc. trivittatus, Aedes vexans,* and *Oc. japonicus*, three human biters that emerge following significant rainfall events. They have many generations per summer depending on rainfall frequency. The eggs will only hatch as they must go through a dry period followed by a flooded period. In contrast, *Oc.*

japonicus emerge from artificial sites (tires, gutter, tarp, etc.), *Oc. trivittatus* emerge from river floodplains (ex.: Carp River) and *Aedes vexans* grows in ground depressions that have been flooded by rain or from overflowing rivers. The hydrography of the Carp River and the Beaver Pond is very favorable to the development of summer mosquitoes due to its unstable water level fluctuations following each rain.

Kanata North is surrounded by many wetlands that contain cattail marsh, especially in the South Marsh Highlands Conservation Forest, the Kizell Pond and the Beaver Pond areas. The cattail marshes are ideal sites for *Coquillettidia perturbans (*CQP*)* development. These mosquitoes overwinter as larvae attached to the roots of cattail plants. CQP has a unique life cycle and is the only specie of mosquitoes that overwinter as larvae. This specie only has one generation per summer and emerges as adult mosquitoes in late June and early July. Primarily active late in the evening, they are aggressive biters and are a very noticeable nuisance.

The following map identifies an estimated productivity gradient for the breeding sites located in the Kanata North area.

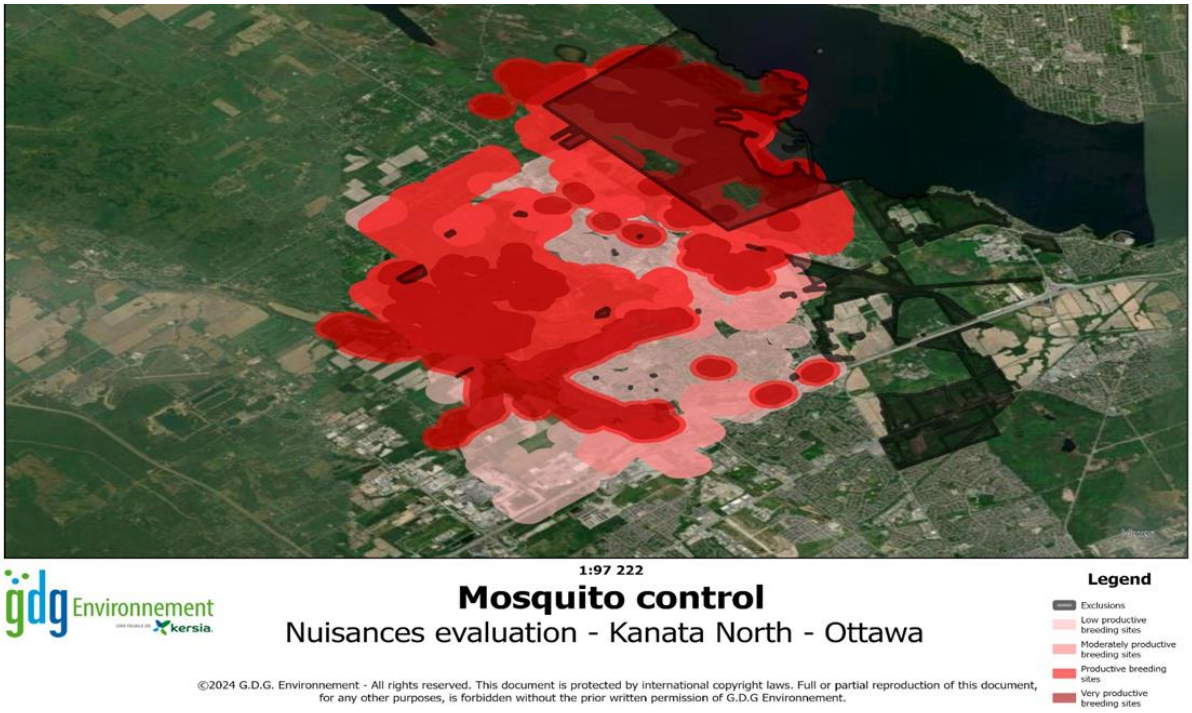

Figure 2. Estimated productivity gradient for breeding sites located in the Kanata North area

The key to a successful program is monitoring larval development stages and sequencing the treatments based on the larval surveillance data results.

Larvicide products used

G.D.G. Canada uses a biological insecticide called *Bacillus thuringiensis israelensis* (Bti) to control mosquito larvae. This bacterium is unique because it is only causes mortality to the larval stages of dipteran insects species, such as mosquitoes and black flies. It does not impact non-target species such as amphibians, fish or wildlife. The active ingredient in Bti is a small diamond-shaped protein crystal produced over the fermentation process of the bacterium. This bacterium occurs naturally in the soil and is not the result of genetic manipulation.

Mosquito larvae are known as filter feeders, and when the larvae filter water to find food, the Bti is ingested. These crystal-shaped proteins become toxic only when the Bti enters the insect's gut. At this point, the Bti crystals react with the high pH level in the gut, and then the gut wall gets perforated. The content of the gut spill into the body cavity, and death occurs within few hours.

Bti comes in two forms; a water-based liquid and a granular product that uses corn cob granules as a carrier. The liquid formulation is used to control mosquito larvae in stagnant water, and it can also control black flies when applied in running water. The granular formulation is applied to standing water; it floats for a short while, releasing the Bti product dose to the mosquito larvae, which feed near the water surface.

Part of the applications is made from the ground with trained and licensed field technicians equipped with backpack sprayers. Our aerial support team more efficiently treats larger areas or harder-to-reach sites. Bti formulations may be applied several times during the spring and summer to control successive generations and species of mosquitoes as they emerge at various periods throughout the year, from early spring until the first frost.

Over the years, Bti has proven to be a quality product that provides consistent, cost-effective results. It is the biological insecticide now used worldwide to control the mosquito species that can carry harmful and debilitating diseases such as West Nile Virus, Encephalitis, Chikungunya, Dengue Fever and Zika virus. However, in Canada, residents of many communities where mosquito control programs are conducted can now fully enjoy the outdoors and experience a better quality of life.

To control specifically *Coquillettidia perturbans* larvae, GDG Canada uses another biological larvicide called *Bacillus sphaericus* (Bsph). This Bacteria act similarly and is as specific as the Bti. The Bsph is used once in spring in permanent cattail sites.

Mosquito treatment

Spring Treatment

An orientation meeting was held on April 17th between responsible of the Town and those from G.D.G. Canada. The first pre-treatment monitoring was completed on March 29th. At the time there was no snow left on the ground. During the first monitoring, we observed that hatching had

already started, and that 1st instar larvae were found in low densities, indicating the start of egg hatch.

The permanent team arrived in Kanata North on April 1st. Larval development advanced slowly due to the cold and inclement weather in April. The spring treatment started when most larvae were in their 2nd instar in the warmer sites. Our team also ensured that the larval egg hatch was complete before starting the treatment. Biological larvicide application began on April 13rd. Ground treatment was performed from April 13th to May 5th. Aerial treatment with helicopter occurred between April 21st and May 2nd.

Given the early season, the spring treatment was completed about two weeks earlier compared to previous treatment years. Additionally, the showers in early May helped maintain the stagnant water left from the snowmelt. As a result, conditions were favorable for late hatching of spring species. A second application began on May 6th. Ground treatment was performed from May 6th to May 17th. Aerial treatment with helicopter occurred on May 11th.

Post-treatment monitoring was completed in every treated site 48 hours after the treatments. Results of the monitoring showed near 100% efficacy of larval mortality. However, in a few places, touch-up treatments were completed when needed.

Coquillettidia perturbans Treatment

Mosquitoes of the specie *Coquillettidia perturbans* develop in permanent cattail sites. The larvae of this species hatch from August and overwinter as larvae in wet environments. The larvae are not freely present in the water column but attach to the roots of emergent aquatic plants. Therefore, they develop in permanent wet environments with high nutrient inputs.

An aerial treatment was conducted on May 7th when the water is warm enough for larval activity. This treatment is conducted independently of other treatments since this specie has a different developmental cycle from other mosquito larvae included in the control program. The product used to control most other mosquito species is ineffective against this species. Another biological product must be used: VectoLex CG.

Summer Treatments

Monitoring and surveillance are performed every week and according to rainfall accumulations throughout the summer because mosquito development depend on precipitation. After every rain event, the permanent team verifies the four rain gauges installed in Kanata to have a more precise view of the local water accumulations (see table 2). The Carp River area is also monitored more than once after rain events, since the water level can fluctuate more than one day after the rain, or when it has only been raining southern of the protected area. According to Environnement Canada (table 2), almost all months had higher total rainfall than the seasonal average (1981-2023).

Table 2. Total monthly rainfall accumulations of 2024 and 1981-2023 average (Source: Environment Canada Ottawa Intl A weather station)

Month	2024	1981-2023
April	107.8	64.1
May	98.1	63.7
June	149.5	76.2
July	154.0	74.9
August	101.9	72.4
September	44.3	68.0
Total	**655.6**	**419.2**

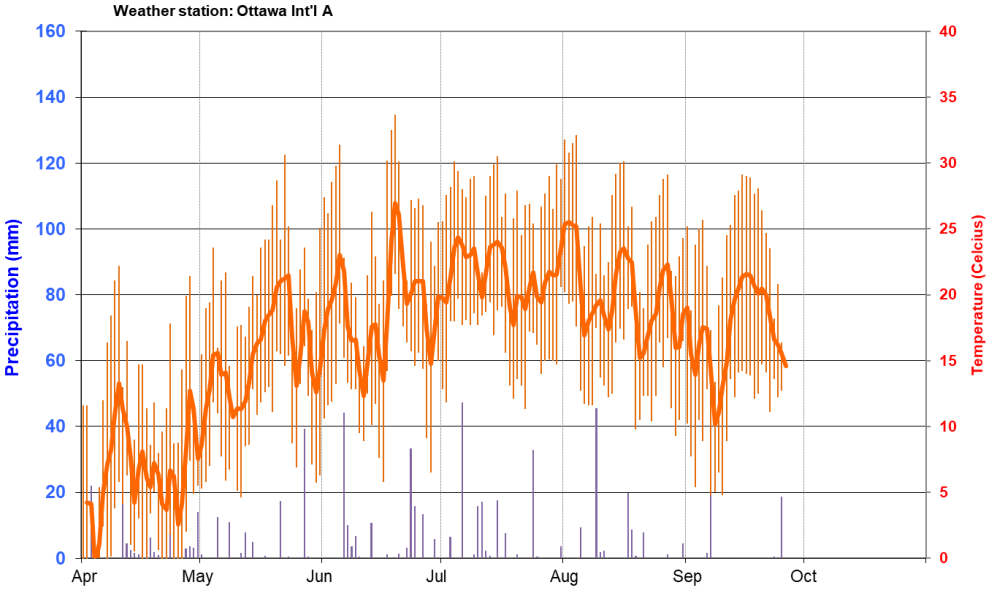

Figure 3. 2024 April to September daily total precipitation (mm) and mean temperatures in Ottawa

Despite the rainy season we've had (table 2), we have taken steps to reduce the nuisance in Kanata North by applying biological larvicides. The field teams have worked every week, particularly after rainy periods, to monitor larval populations and conduct both ground and aerial treatments. We performed 8 summer treatments in 2024, which almost always required the support of aerial treatment. Following the first two treatments in the spring, larval activity remained high for the region until mid-August. From May to July, the cumulative rainfall was sufficient to start new generations of mosquito larvae almost every two weeks. Almost every rainfall triggered larval development.

Table 3. Treatments summary

Treatment	Beginning	End	Type of treatment
1	April 13th	May 5th	Ground and aerial (helicopter)
2	May 6th	May 17th	Ground and aerial (helicopter)l
CQ	May 7th		Aerial (helicopter)
3	May 23th	May 26th	Ground and aerial (helicopter)l
4	May 28th	June 3rd	Ground and aerial (drone)
5	June 10th	June 15th	Ground and aerial (drone)
6	June 26th	July 1st	Ground and aerial (drone)
7	July 11th	July 18th	Ground and aerial (drone)
8	July 20th	July 24th	Ground
9	July 28th	July 30th	Ground
10	August 12th	August 16th	Ground and aerial (drone)

*Note: Drone treatments were carried out in Kanata North on July 30 and September 4 as part of the WNV program. These treatments are not included in table 3.

Post-treatment larval surveillance

Post-treatment monitoring was completed in every treated site 48 hours after the treatments. Results of the monitoring showed 100% efficacy of larval mortality after 48 hours. However, in a few places touch-up treatments were completed if needed. During the summer treatments, since monitoring and treatment are performed almost continuously, pre-treatment monitoring could sometimes function as post-treatment monitoring from the previous week.

Sweep net tests

Operational efficiency is also measured by calculating the level of nuisance reduction caused by biting insects using the nuisance sweep net tests.

The method is used to identify the number of insects that could bite us over a period of five minutes. Each test must be performed under the same conditions (weather, clothing, manipulations, no insect repellent) and repeated at different locations inside the protected area. The effectiveness of the treatment is calculated on the average catch for the eight (8) stations weekly. The average catch should be less than five (5) mosquitoes. Moreover, if one of the eight (8) stations displays a capture rate of more than fifteen (15) mosquitoes, the test is considered failed. All tests done in 2024 complied with requirements.

New this year, each test conducted in the protected area was compared to the average catch for at least two (2) outside stations, identified by City authorities, conducted on the same day and following the same procedure, in order to evaluate the effectiveness of the treatments carried out throughout the season. This program aims to reduce the nuisance caused by mosquitoes by at least 80%.

The sweep tests were conducted from the week of May 19th to September 11th for a total of 136 nuisance sweep tests in the protected area and 37 nuisance sweep tests in the unprotected area.

The sweep test locations are indicated on figure 4 and 5. The average for the season was 0 mosquito captures per test in the protected area and 12 mosquito captures in the unprotected area. The percentage of nuisance reduction between the protected area and the unprotected area is 84.9%. Black fly populations are high in some sectors of Kanata North and can be a nuisance to citizens, but they are not included in the control program, as they come from different breeding sites than mosquitoes. Detailed results are shown in table 4 and identification are shown in table 5.

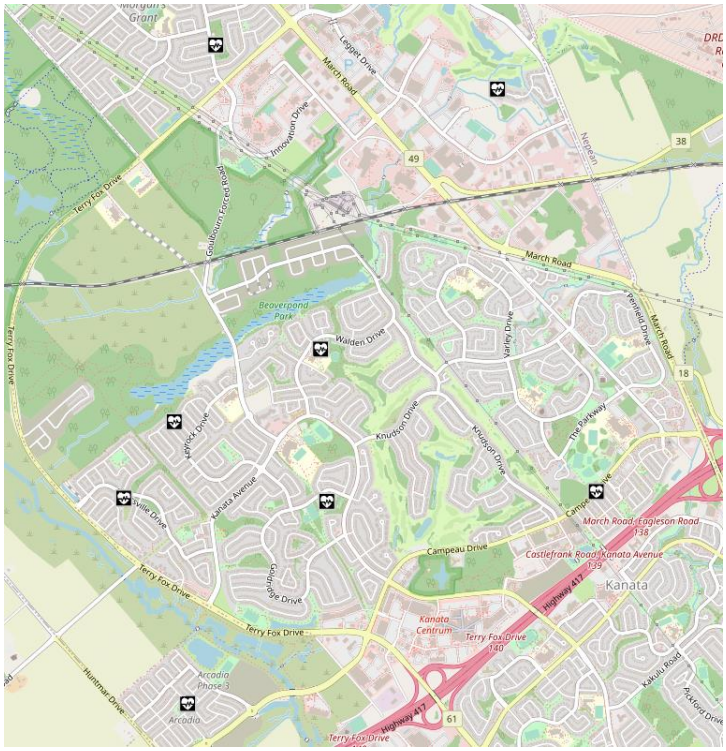

Figure 4. Sweep net tests locations in the protected area

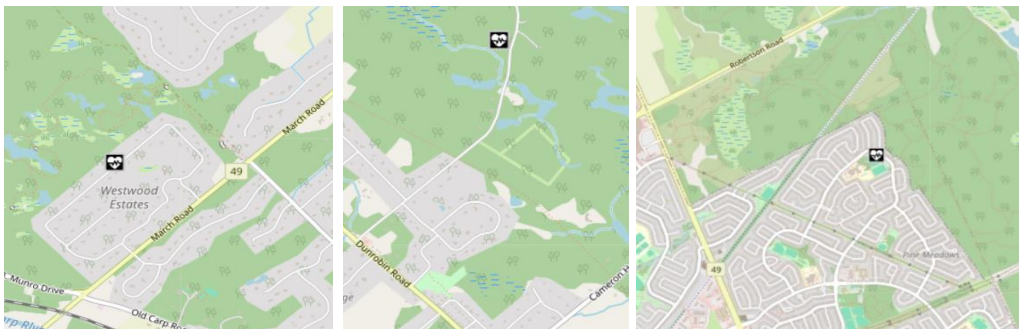

Figure 5. Sweep net tests locations in the unprotected area

Table 4. Sweep net tests results (1/2)

Date	Time	Address - Protected area	Mosquito	Black flies	Other species	Address - Unprotected area	Mosquito	Black flies	Other species	% Efficacity (Mosquito)
May 23th	18:45	124 marsh sparrow	1	3	0	Out average	1	9	1	0,0%
	19:00	2600 Campeau Dr.	0	0	0	Out average	1	9	1	100,0%
	20:49	Calvington avenue	0	2	0	Out average	1	9	1	100,0%
	21:03	35 Arkose street	0	7	0	Out average	1	9	1	100,0%
	21:19	Laughlin cercle	0	4	1	Out average	1	9	1	100,0%
	21:36	400 Goldridge	0	1	0	Out average	1	9	1	100,0%
	21:46	Walden park	0	0	0	Out average	1	9	1	100,0%
	22:03	50 Flamborough way	0	1	1	Out average	1	9	1	100,0%
May 29th	20:20	124 marsh sparrow	0	10	16	Out average	1	12	1	100,0%
	21:17	2600 Campeau Dr.	0	0	3	Out average	1	12	1	100,0%
	19:33	Calvington avenue	0	0	0	Out average	1	12	1	100,0%
	19:52	35 Arkose street	0	7	0	Out average	1	12	1	100,0%
	18:50	Laughlin cercle	0	0	1	Out average	1	12	1	100,0%
	19:15	400 Goldridge	0	30	0	Out average	1	12	1	100,0%
	19:34	Walden park	0	1	0	Out average	1	12	1	100,0%
	19:57	50 Flamborough way	1	1	2	Out average	1	12	1	0,0%
June 3rd	20:20	124 marsh sparrow	0	2	3	Out average	3	6	2	100,0%
	20:40	2600 Campeau Dr.	0	2	5	Out average	3	6	2	100,0%
	18:39	Calvington avenue	0	0	0	Out average	3	6	2	100,0%
	18:20	35 Arkose street	0	3	1	Out average	3	6	2	100,0%
	18:48	Laughlin cercle	0	2	16	Out average	3	6	2	100,0%
	19:23	400 Goldridge	0	8	13	Out average	3	6	2	100,0%
	19:38	Walden park	0	7	1	Out average	3	6	2	100,0%
	19:55	50 Flamborough way	0	5	3	Out average	3	6	2	100,0%
June 10th	20:36	124 marsh sparrow	0	0	1	Out average	23	1	1	100,0%
	20:12	2600 Campeau Dr.	0	1	0	Out average	23	1	1	100,0%
	18:22	Calvington avenue	0	0	1	Out average	23	1	1	100,0%
	18:00	35 Arkose street	0	0	0	Out average	23	1	1	100,0%
	18:32	Laughlin cercle	0	3	1	Out average	23	1	1	100,0%
	18:59	400 Goldridge	0	3	4	Out average	23	1	1	100,0%
	19:39	Walden park	1	1	1	Out average	23	1	1	100,0%
	19:27	50 Flamborough way	0	1	1	Out average	23	1	1	100,0%
June 19th	21:25	124 marsh sparrow	0	4	12	Out average	14	15	2	100,0%
	20:54	2600 Campeau Dr.	0	11	2	Out average	14	15	2	100,0%
	18:35	Calvington avenue	0	1	0	Out average	14	15	2	100,0%
	18:16	35 Arkose street	1	0	0	Out average	14	15	2	100,0%
	18:56	Laughlin cercle	0	2	4	Out average	14	15	2	100,0%
	19:30	400 Goldridge	0	112	1	Out average	14	15	2	100,0%
	20:05	Walden park	0	5	3	Out average	14	15	2	100,0%
	20:22	50 Flamborough way	0	37	3	Out average	14	15	2	100,0%
June 26th	20:30	124 marsh sparrow	1	9	1	Out average	37	25	0	100,0%
	20:15	2600 Campeau Dr.	0	13	4	Out average	37	25	0	100,0%
	20:06	Calvington avenue	1	8	1	Out average	37	25	0	100,0%
	20:31	35 Arkose street	2	2	0	Out average	37	25	0	100,0%
	18:34	Laughlin cercle	1	47	0	Out average	37	25	0	100,0%
	18:53	400 Goldridge	0	123	1	Out average	37	25	0	100,0%
	19:24	Walden park	2	93	1	Out average	37	25	0	100,0%
	19:50	50 Flamborough way	0	33	9	Out average	37	25	0	100,0%
July 2nd	21:07	124 marsh sparrow	0	0	33	Out average	36	15	4	100,0%
	20:32	2600 Campeau Dr.	0	4	11	Out average	36	15	4	100,0%
	19:01	Calvington avenue	0	0	1	Out average	36	15	4	100,0%
	18:45	35 Arkose street	1	0	0	Out average	36	15	4	97,2%
	19:24	Laughlin cercle	0	14	1	Out average	36	15	4	100,0%
	19:43	400 Goldridge	0	12	13	Out average	36	15	4	100,0%
	20:10	Walden park	0	7	5	Out average	36	15	4	100,0%
	19:00	50 Flamborough way	1	3	1	Out average	36	15	4	97,2%
July 7th	21:20	124 marsh sparrow	0	4	5	Out average	10	8	2	100,0%
	20:26	2600 Campeau Dr.	0	15	3	Out average	10	8	2	100,0%
	19:10	Calvington avenue	2	0	1	Out average	10	8	2	78,9%
	18:49	35 Arkose street	2	0	0	Out average	10	8	2	78,9%
	19:17	Laughlin cercle	0	3	5	Out average	10	8	2	100,0%
	19:30	400 Goldridge	1	100	0	Out average	10	8	2	89,5%
	19:52	Walden park	1	13	1	Out average	10	8	2	89,5%
	20:25	50 Flamborough way	0	5	3	Out average	10	8	2	100,0%
July 17th	21:02	124 marsh sparrow	0	1	3	Out average	23	0	0	100,0%
	20:31	2600 Campeau Dr.	0	0	5	Out average	23	0	0	100,0%
	19:00	Calvington avenue	2	0	0	Out average	23	0	0	91,1%
	18:36	35 Arkose street	1	0	0	Out average	23	0	0	95,6%
	18:35	Laughlin cercle	0	8	0	Out average	23	0	0	100,0%
	19:01	400 Goldridge	0	42	2	Out average	23	0	0	100,0%
	19:44	Walden park	1	14	1	Out average	23	0	0	95,6%
	20:11	50 Flamborough way	1	14	1	Out average	23	0	0	95,6%

Table 4. Sweep net tests results (2/2)

July 23th	21:03	124 marsh sparrow	0	4	5	Out average	9	5	4	100,0%
	20:24	2600 Campeau Dr.	0	2	2	Out average	9	5	4	100,0%
	19:01	Calvington avenue	1	0	1	Out average	9	5	4	88,9%
	18:45	35 Arkose street	0	0	0	Out average	9	5	4	100,0%
	19:20	Laughlin cercle	0	1	9	Out average	9	5	4	100,0%
	19:35	400 Goldridge	0	3	5	Out average	9	5	4	100,0%
	20:01	Walden park	0	1	5	Out average	9	5	4	100,0%
	18:54	50 Flamborough way	0	2	4	Out average	9	5	4	100,0%
August 1st	18:47	124 marsh sparrow	0	5	2	Out average	14	0	7	100,0%
	20:18	2600 Campeau Dr.	0	2	3	Out average	14	0	7	100,0%
	18:54	Calvington avenue	0	1	5	Out average	14	0	7	100,0%
	19:39	35 Arkose street	0	20	0	Out average	14	0	7	100,0%
	19:21	Laughlin cercle	1	0	3	Out average	14	0	7	92,6%
	19:50	400 Goldridge	0	55	0	Out average	14	0	7	100,0%
	19:20	Walden park	0	9	1	Out average	14	0	7	100,0%
	19:03	50 Flamborough way	0	0	2	Out average	14	0	7	100,0%
August 7th	18:39	124 marsh sparrow	0	22	0	Out average	15	6	7	100,0%
	19:50	2600 Campeau Dr.	0	2	3	Out average	15	6	7	100,0%
	18:42	Calvington avenue	0	0	15	Out average	15	6	7	100,0%
	19:07	35 Arkose street	0	7	3	Out average	15	0	7	100,0%
	19:24	Laughlin cercle	0	0	3	Out average	15	0	7	100,0%
	20:25	400 Goldridge	0	2	7	Out average	15	0	7	100,0%
	19:20	Walden park	0	1	3	Out average	15	0	7	100,0%
	19:01	50 Flamborough way	1	4	2	Out average	15	0	7	93,3%
August 14th	18:38	124 marsh sparrow	0	31	1	Out average	12	25	9	100,0%
	20:16	2600 Campeau Dr.	0	2	2	Out average	12	25	9	100,0%
	18:37	Calvington avenue	0	2	30	Out average	12	25	9	100,0%
	18:54	35 Arkose street	0	8	15	Out average	12	25	9	100,0%
	19:13	Laughlin cercle	0	15	0	Out average	12	25	9	100,0%
	19:49	400 Goldridge	0	4	1	Out average	12	25	9	100,0%
	19:30	Walden park	0	11	0	Out average	12	25	9	100,0%
	19:14	50 Flamborough way	0	5	3	Out average	12	25	9	100,0%
August 22nd	20:30	124 marsh sparrow	0	0	9	Out average	4	0	1	100,0%
	20:08	2600 Campeau Dr.	0	15	4	Out average	4	0	1	100,0%
	18:37	Calvington avenue	0	2	7	Out average	4	0	1	100,0%
	19:16	35 Arkose street	0	6	4	Out average	4	0	1	100,0%
	18:58	Laughlin cercle	0	0	6	Out average	4	0	1	100,0%
	19:33	400 Goldridge	0	1	5	Out average	4	0	1	100,0%
	19:48	Walden park	0	3	0	Out average	4	0	1	100,0%
	20:49	50 Flamborough way	0	0	1	Out average	4	0	1	100,0%
August 28th	20:16	124 marsh sparrow	10	0	30	Out average	3	0	3	0,0%
	19:55	2600 Campeau Dr.	0	0	2	Out average	3	0	3	100,0%
	18:36	Calvington avenue	0	0	0	Out average	3	0	3	100,0%
	19:05	35 Arkose street	0	0	4	Out average	3	0	3	100,0%
	18:54	Laughlin cercle	1	0	8	Out average	3	0	3	66,7%
	19:38	400 Goldridge	0	0	2	Out average	3	0	3	100,0%
	19:21	Walden park	0	0	2	Out average	3	0	3	100,0%
	20:34	50 Flamborough way	0	0	2	Out average	3	0	3	100,0%
Sept. 3rd	20:59	124 marsh sparrow	0	0	1	Out average	0	0	0	0,0%
	20:37	2600 Campeau Dr.	0	0	1	Out average	0	0	0	0,0%
	18:36	Calvington avenue	0	2	5	Out average	0	0	0	0,0%
	19:31	35 Arkose street	1	12	1	Out average	0	0	0	0,0%
	19:08	Laughlin cercle	2	7	2	Out average	0	0	0	0,0%
	20:20	400 Goldridge	1	1	3	Out average	0	0	0	0,0%
	20:00	Walden park	2	1	4	Out average	0	0	0	0,0%
	21:15	50 Flamborough way	0	0	0	Out average	0	0	0	0,0%
Sept. 11st	19:41	124 marsh sparrow	1	0	2	Out average	0	0	0	0,0%
	19:27	2600 Campeau Dr.	0	0	0	Out average	0	0	0	0,0%
	18:03	Calvington avenue	0	0	0	Out average	0	0	0	0,0%
	18:21	35 Arkose street	0	0	20	Out average	0	0	0	0,0%
	18:28	Laughlin cercle	4	100	0	Out average	0	0	0	0,0%
	19:11	400 Goldridge	0	30	4	Out average	0	0	0	0,0%
	18:55	Walden park	0	10	3	Out average	0	0	0	0,0%
	20:09	50 Flamborough way	1	0	1	Out average	0	0	0	0,0%
		Average	0			Average	12			84,9%

Table 5. Identification of mosquitoes captured

Species	Quantity	Pourcentage
Ochlerotatus trivittatus	17	34%
Culicidae sp.	12	24%
Ochlerotatus sp.	6	12%
Aedes vexans	5	10%
Ochlerotatus-black legs	4	8%
Coquillettidia perturbans	2	4%
Culex pipiens-restuans gr.	2	4%
Anopheles punctipennis	1	2%
Ochlerotatus japonicus	1	2%
Total	50	100%

In the protected area, only 50 mosquitos were captured during the season . Of that number, most of the mosquito species captured were summer species (*Ochlerotatus trivittatus* and *Aedes vexans*). Indeed, the hatching of those two species is dependent on flooding of wetland and river floodplain. The weather and all the precipitations of this summer season were favorable for those species. The hydrography of the Carp River is also very favorable to the development of these species due to its unstable water level fluctuations. Weekly inspections, the coordination of ground and aerial treatments, thorough knowledge of the Kanata North area, as well as the team's expertise, have significantly reduced the nuisance caused by mosquitos across the entire territory.

As a clarification, when a mosquito is too damaged to be identified, it will be classified as *Culicidae sp.* or by the identifiable genus (e.g., *Ochlerotatus sp.*).

CDC light traps

The CDC light traps are used to capture adult mosquitos using dry ice and an ultraviolet light. These traps help us identify the species in place and therefore better target our operations. At least five (5) CDC light traps were installed in the protection area weekly, from the week of May 19th to September 10th. Traps were installed in the afternoon and collected the following morning. In addition, some other traps were also installed in citizens' backyards, for example, to identify and quantify the nuisance after a request. Take note that trapping operations have been suspended during week 33 to focus our efforts on ongoing treatments.

Once mosquitoes were collected, they were placed on dry ice and shipped to our laboratory to identify at the specie level. This allowed GDG Canada to document the mosquito species present in the protected area.

Trapping locations are shown in figure 6. Table 6 and 7 present the average mosquito captured by species. Table 6 presents the data by the seasonal distribution, while table 7 presents it by the geographical distribution.

According to table 6, an average of 546 mosquitoes were captured within the protected area, per trap per night. According to knowledge, captures of around 500 mosquitoes per trap per night are considered low. Week 28 (the week of July 7th) had the highest abundance, with the greatest number of captures. The most abundant species on week 28 was *Coquillettidia perturbans* and *Oc. Trivittatus,* which accounted for 42% and 35% of the captured mosquitoes, respectively.

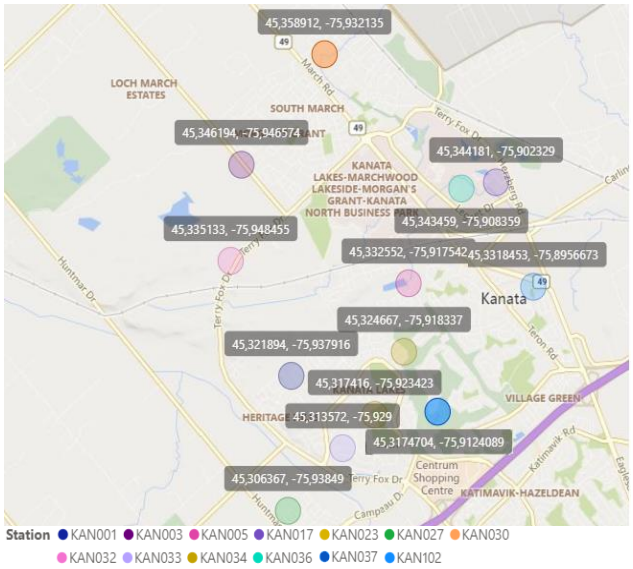

Figure 6. CDC trap locations for the trapping period

Aoccording to geographical distribution (table 7), station near of Kanata Golf (KAN023) had the highest average per trap per night of mainly *Coquillettidia perturbans* (CQP). The two stations near of Carp River (KAN033 and KAN001) also had a high average per trap per night. The most abundant species for those stations is *C. perturbans* and *Oc. Trivittatus.* Finally, the station near of Penfield Dr. (KAN102) had a high average per trap per night of *C. perturbans.*

As indicated in the report, the hydrography of the Carp River and the Beaver Pond is very favorable to the development of summer mosquitoes like *Oc. Trivittatus* due to its unstable water level fluctuations following each rain. This is a floodwater mosquito species that bites aggressively and is difficult to find while still developing as larvae. Adult *Oc. trivittatus* were found throughout the region, but their greatest abundance is within and around the Carp River.

Those sites also contain many wetlands that contain cattail marsh (breeding site of CQP), especially in the South Marsh Highlands Conservation Forest sector the Kizell Pond and the Beaver Pond areas. Also, the mild winter temperatures and the large amounts of precipitation received in 2023 could partly explain the strong presence of *Coquillettidia perturbans* this year. Other insect families (Tabanidae: deer fly or horse fly) that develop in the same environments as this species are also very abundant this year. This likely indicates excellent survival conditions for these different insect groups in these environments. It is also worth mentioning that *C. perturbans* moves over greater distances than other summer species, and the nuisance could very likely come from outside the treated area.

Following prospections, we discovered many new breeding sites of CQP that were not productive and were not mapped in the past. To improve CQP control, these sites will be treated in spring 2025.

Table 6. Average captured mosquitoes per CDC week.

Week	*Aedes cinereus*	*Aedes vexans*	*Anopheles punctipennis*	*Anopheles quadrimaculatus*	*Anopheles sp.*	*Anopheles walkeri*	*Coquillettidia perturbans*	*Coquillettidia perturbans pale legs*	*Culex pipiens-restuans gr.*	*Culiseta minnesotae*	*Ochlerotatus abserratus-punctor gr.*	*Ochlerotatus canadensis*	*Ochlerotatus cantator*	*Ochlerotatus communis gr.*	*Ochlerotatus implicatus*	*Ochlerotatus japonicus*	*Ochlerotatus provocans*	*Ochlerotatus sp.*	*Ochlerotatus sticticus*	*Ochlerotatus stimulans*	*Ochlerotatus stimulans gr.*	*Ochlerotatus triseriatus-hendersoni gr.*	*Ochlerotatus trivittatus*	*Ochlerotatus-black legs*	*Psorophora ferox*	*Uranotaenia sapphirina*	**Total of captured mosquitos**	**Average/trap/night**
21	4	11	6	1		28			7					14	2		1			1	3						**78**	**13**
22		1	11			2			1		5			15							1						**36**	**6**
23	18	406	37	12		34	590	1	9		19		2	19		2	19		1		11		406				**1586**	**159**
24		10			1	1	97		8	2	1							1					24				**145**	**21**
25		156		17		4	1081															8	982				**2248**	**321**
26		300	32			4	1324																516				**2176**	**435**
27		272	16	24			1432		24			8											456				**2232**	**446**
28		2956	160				8871									32							6739				**18758**	**3752**
29		137	8	16		1	884		16														144				**1206**	**402**
30		220	128				1380		96														764				**2588**	**1294**
31	16	836	48	8			417		66			4						68				4	619		4		**2090**	**348**
32		186	78	12		4	120		70							10		84			8	18	626	4			**1220**	**203**
33																											**0**	**0**
34	2	30	19	1			4		22									2				9	88	15			**192**	**38**
35	1	84	24			4	19		33			2		76				4					234				**481**	**96**
36	4	1156	80			20			112		4			24									996		8		**2404**	**401**
37	8	152	8			8			12					348								16	1008	32	12		**1604**	**802**
Total	**53**	**6913**	**655**	**91**	**1**	**110**	**16219**	**1**	**476**	**2**	**29**	**14**	**2**	**496**	**2**	**44**	**20**	**159**	**1**	**1**	**23**	**55**	**13602**	**51**	**24**	**0**	**39044**	**546**
%	**0,1**	**18**	**2**	**0,2**	**0,0**	**0,3**	**42**	**0,0**	**1**	**0,0**	**0,1**	**0,0**	**0,0**	**1**	**0,0**	**0,1**	**0,1**	**0,4**	**0,0**	**0,0**	**0,1**	**0,1**	**35**	**0,1**	**0,1**	**0,0**	**100**	

Table 7. Average captured mosquitoes per CDC light trap sampling site.

Locality	Site	*Aedes cinereus*	*Aedes vexans*	*Anopheles punctipennis*	*Anopheles quadrimaculatus*	*Anopheles sp.*	*Anopheles walkeri*	*Coquillettidia perturbans*	*Coquillettidia perturbans pale legs*	*Culex pipiens-restuans gr.*	*Culiseta minnesotae*	*Ochlerotatus abserratus-punctor gr.*	*Ochlerotatus canadensis*	*Ochlerotatus cantator*	*Ochlerotatus communis gr.*	*Ochlerotatus implicatus*	*Ochlerotatus japonicus*	*Ochlerotatus provocans*	*Ochlerotatus sp.*	*Ochlerotatus sticticus*	*Ochlerotatus stimulans*	*Ochlerotatus stimulans gr.*	*Ochlerotatus triseriatus-hendersoni gr.*	*Ochlerotatus trivittatus*	*Ochlerotatus-black legs*	*Psorophora ferox*	*Uranotaenia sapphirina*	**Total of captured mosquitos**	**Average/trap/night**
Kanata-Interior	KAN001	6	1754	209	1		31	5135		124		2	4		94		8		20	1		9	4	6702				**14104**	**830**
Kanata-Interior	KAN003	14	138	16	10		16	417		41		4	2						2				3	386		25	12	**1086**	**181**
Kanata-Interior	KAN005	2	680	75	1		25	1315		29	2	1			234		32					2		1055				**3453**	**345**
Kanata-Interior	KAN017	19	599	68	25		2	673		4		3			9	1			96			1	1	32	1101		14		**2648**	**221**
Kanata-Interior	KAN023		1152	128				4480																	512				**6272**	**6272**
Kanata-Interior	KAN027	3	1448	56	1		13	1096		210		17			41	1		16	32						1274				**4208**	**351**
Kanata-Interior	KAN030	6	87	63	20		4	181	1	6				2	54		4	3	4					16	687				**1138**	**126**
Kanata-Interior	KAN032		320				8	24														8			216				**576**	**576**
Kanata-Interior	KAN033		656	24	16			1604		36															1384				**3720**	**930**
Kanata-Interior	KAN034		2					18		6															30		4		**60**	**60**
Kanata-Interior	KAN036	3	69	16	1	1	11	418		4		2	8		64			1	5			3			229		8	12	**855**	**95**
Kanata-Interior	KAN037		8					90																	10				**108**	**108**
Kanata-Interior	KAN102				16			768		16															16				**816**	**816**
Total		**53**	**6913**	**655**	**91**	**1**	**110**	**16219**	**1**	**476**	**2**	**29**	**14**	**2**	**496**	**2**	**44**	**20**	**159**	**1**	**1**	**23**	**55**	**13602**	**0**	**51**	**24**	**39044**	
%		**0,1**	**18**	**2**	**0,2**	**0,0**	**0,3**	**42**	**0,0**	**1**	**0,0**	**0,1**	**0,0**	**0,0**	**1**	**0,0**	**0,1**	**0,1**	**0,4**	**0,0**	**0,0**	**0,1**	**0,1**	**35**	**0**	**0,1**	**0,1**	**100**	

Citizen requests

Citizen can contact GDG directly by email at info.mosquito@gdg.ca or by calling the toll-free hotline 1-877-277-0552. Some requests are also transferred to GDG by the City. The local coordinator contacts the citizens within 48h, as far as possible, and a visit is usually made to investigate the origin of the nuisance problem, if needed.

In 2024, 59 citizen requests have been received, investigated, and solved. From this number, 11 citizen requests were done before the emergence of adult mosquitos. Also, 7 were requests from citizens who contacted us a second time during the season. In comparison, in 2023, we receive 148 citizen calls (table 8). Some citizens who contacted us in 2024 had also reached out to us in 2023.

Table 8. Yearly Comparison of citizen requests

Month	2024	2023
March and April	11	0
May	5	5
June	8	0
July	29	142
August	6	1
September	0	0
Total	**59**	**148**

Recommendations

The following recommendations and considerations are intended to improve the success of the Kanata North ward's biological mosquito control program. The objective is to offer a better-quality life to the citizens of Kanata North:

- The surveillance and monitoring demonstrated that the National Capital Commission (NCC) lands are large mosquito development sites. To improve the quality of spring mosquito control program, City of Ottawa officials and GDG must work together to obtain all necessary authorizations to treat those areas;
- Due to the mandatory 45 day evaluation period by the MECP, the permit request letter should be sent out to the MECP by the first week of December to be able to respond to issues that could arise;
- GDG proposes to attend the Councillor's annual activity to conduct mosquito clinics and answer questions from citizens;
- The MECP notice letter for objection must be sent out by January 20th and responses received by February 20th, giving time for GDG to meet with crucial objectors as to evaluate their concerns and explain the program;
- A four to five-question survey (T.B.D.) should also be included when the opt-out letter is sent out to the residents within the treatment area;

- It is essential to always consider the Bti in further conservation plans in the Kanata North area. Since it's a biological larvicide with a low risk for human health and natural habitats, Bti should be compatible with conservation plans.

Communications

Mosquitoes as vectors of diseases

In the current context of climate change and evolving ecosystems, mosquitoes are becoming an increasingly concerning source of worries. These insects, once regarded as mere summer nuisances in our latitudes, are now significant vectors of serious diseases. The rise of viruses transmitted by mosquitoes to humans and animals, such as West Nile virus, California serogroup virus, and Eastern Equine Encephalitis, underscores the crucial importance of protecting ourselves against these vectors.

Introduced to Canada in 2002, West Nile virus has quickly raised alarms. This virus can cause a range of symptoms from fever and joint pain to severe neurological complications. While the majority of infections are asymptomatic or mild, severe cases can result in serious consequences requiring urgent medical attention and even death.

The California serogroup virus, although less publicized, also poses a growing threat in Canada. Associated with flu-like symptoms, it can lead to serious complications, especially among vulnerable populations such as young children and the elderly.

Eastern Equine Encephalitis is another rare but severe disease transmitted by mosquitoes. This viral infection can cause inflammation to the brain, leading to severe neurological disorders and, in some cases, permanent disabilities or death. Earlier this month, GDG detected the presence of this virus (EEE) in the city of Ottawa. The city subsequently announced the death of a resident: A local human case of Eastern Equine Encephalitis virus infection is confirmed by the City of Ottawa.

Considering these rising risks, prevention is essential. Responsible management of mosquito populations using biological larvicides is an effective way to limit their proliferation. Additional measures, such as wearing protective clothing and cleaning up small breeding sites around homes, are also important precautions. In summary, vigilance and prevention are crucial in the face of the growing threat posed by mosquitoes. By taking proactive measures to protect ourselves, we can minimize the risks of transmission of these diseases and improve our quality of life during the summer months.

Safety of biological larvicides

The use of Bti is based on a strong scientific consensus. There is a vast body of scientific literature on the subject, and there is no doubt that the safety aspect of the product is well established.

In 2008, an assessment of the available scientific data revealed that Bt-based products pose no unacceptable risk to human health or the environment when used according to the instructions on their label […]. (Health Canada, 2008).

In 2018, Environment and Climate Change Canada (ECCC) and Health Canada published the Assessment as part of the scientific risk assessment procedure for regulated microorganisms. In this assessment, which combines all varieties of Bt as in previous evaluations, it is stated: "Despite the ubiquity and significant use of various subspecies of B. thuringiensis, there are no known harmful effects at the population level on targeted species in the ecosystems where they are used, and no harmful effects on non-target terrestrial or aquatic plants, vertebrates, or invertebrates."

For more information on biological products and our services:

- Health Canada, Search Product Label : Pesticide Label Search - Health Canada (hc-sc.gc.ca)
- Brochure « Integrated Management of Mosquito Populations » (French only) : https://www.gdg.ca/wp-content/uploads/2023/04/GDG-offre-gestion-moustiques.pdf
- Document « Everything you need to know about BTI » : Document-Mise-a-jour-Bti-2022-ENG.pdf (gdg.ca)

Conclusion

This final report for the 2024 season is a summary of the operations carried out under the mosquito control program using biological larvicides in Kanata North. Our strong knowledge of the municipality's territories and the biology of the biting species present has effectively reduced the intensity and duration of the nuisance while ensuring safety for the environment.

Our team is proud to have collaborated with the City of Ottawa to successfully implement the program and make a significant difference in the quality of life for citizens. The objective of the program is not the complete eradication of biting insects, but rather to reduce the nuisance they cause. The nuisance mosquito control program has the advantage of reducing the intensity and the duration of mosquito nuisance in the protected area. With this in mind, we can affirm that everything has been put in place to achieve this goal. We believe that the 2024 nuisance mosquito program has improved the quality of life for the residents of Kanata North Ward.

The entire GDG Environment team sends you its sincere regards.

Karolann Trépanier, M. Env.
Project manager

Richard Trudel, PH.D., Entomologist
Scientific Advisor