INFORMATION REPORT

TO:	Mayor and Members Board of Health
COMMITTEE DATE:	May 14, 2018
SUBJECT/REPORT NO:	Integrated Pest Management Best Practices Including the Use of Acaricides to Mitigate Tick Populations (BOH18019) (City Wide)
WARD(S) AFFECTED:	City Wide
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Council Direction:

The Board of Health at its meeting on March 19, 2018, passed a motion requesting that public health staff investigate the pros and cons of public use of pesticides for mitigating tick populations.

Background:

In 2018, the majority of City of Hamilton became an estimated risk area for Lyme disease. The estimated risk area covers a 20 kilometre radius from where the blacklegged ticks were discovered through annual multi-seasonal active tick surveillance. The area includes all parts of the city, except parts of Stoney Creek and Glanbrook (refer to map of estimated risk area, Appendix A). There is a higher estimated risk of encountering a blacklegged tick within a risk area, although blacklegged ticks could still be found outside of this area.

Lyme disease is an infection caused by the bacterium *Borrelia burgdorferi*. Lyme disease is spread to humans through the bite of infected blacklegged ticks (*Ixodes*

scapularis) and infection does not occur until the tick has been feeding for at least 24 hours.

This information report provides an overview of Integrated Pest Management (IPM) best practices including the use of acaricides (a pesticide that kills ticks, mites and related pests) to reduce tick populations.

Local Tick Data Statistics

The most common tick species submitted by the public to the City of Hamilton passive surveillance program is the American dog tick. Less frequently, blacklegged ticks, squirrel ticks or other types of ticks are submitted.
American dog ticks do not transmit Lyme disease and are considered a nuisance pest, not normally associated with illness in our geographical area. The graph below (Figure 1) shows the number of ticks submitted over a five-year period, from 2013 to 2017.

Of the 892 ticks submitted in 2017, 78 blacklegged ticks were found locally, i.e., within the City of Hamilton. Seven of these ticks have tested positive for the Lyme disease bacteria (*Borrelia burgdorferi*) and one tick tested positive for *Anaplasma phagocytiphilum*—an infection with this bacteria can cause anaplasmosis.

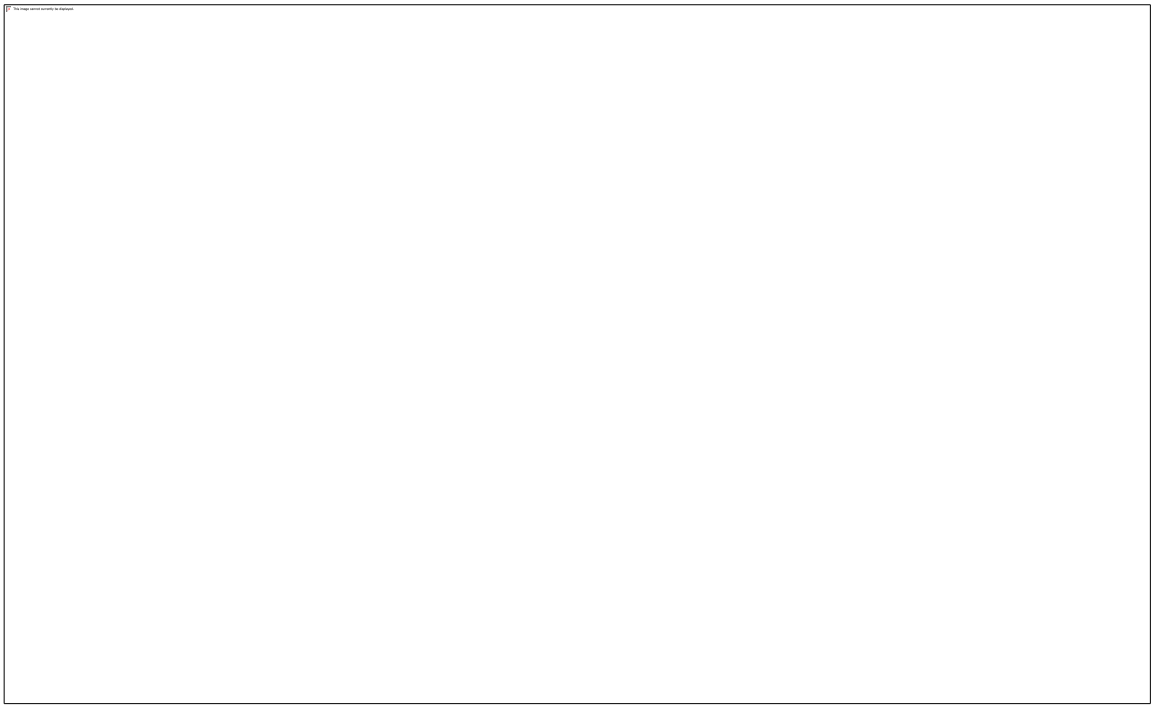

Figure 1: Annual Submissions of Ticks to the City of Hamilton, 2013-2017

Tick Ecology: Ticks, their hosts and environment

Ticks grow and reproduce by feeding on the blood of animals at different life stages. A tick's life cycle is comprised of four stages: egg, six-legged larvae, eight-legged nymph, and adult. Blacklegged ticks have a two-year life cycle; figure 2 illustrates the life cycle of blacklegged ticks. After hatching, a tick feeds at each life stage in order to survive[1]. Fed ticks will drop off the host after each feeding in order to moult into the next life stage[1]. The tick will then attach to a new host and continue the life cycle[1].

At the early stages, larvae and nymph ticks will feed on small to medium sized hosts such as rodents, birds, cats and other small mammals[2]. Due to its abundance, the white-footed mouse is the most common host species at this stage of tick development[1]. This is also the stage at which ticks can be infected by bacteria carried by host animals.

Adult ticks typically feed on wider ranging large animals, such as the white tailed deer. In the last stage, after feeding an adult female tick will seek out a sheltered area, produce a batch of 1,000-18,000 eggs, and die[1]. Once hatched, larval ticks will climb low vegetation such as grasses and low groundcover plants where they will await a host animal to feed[1], [2].

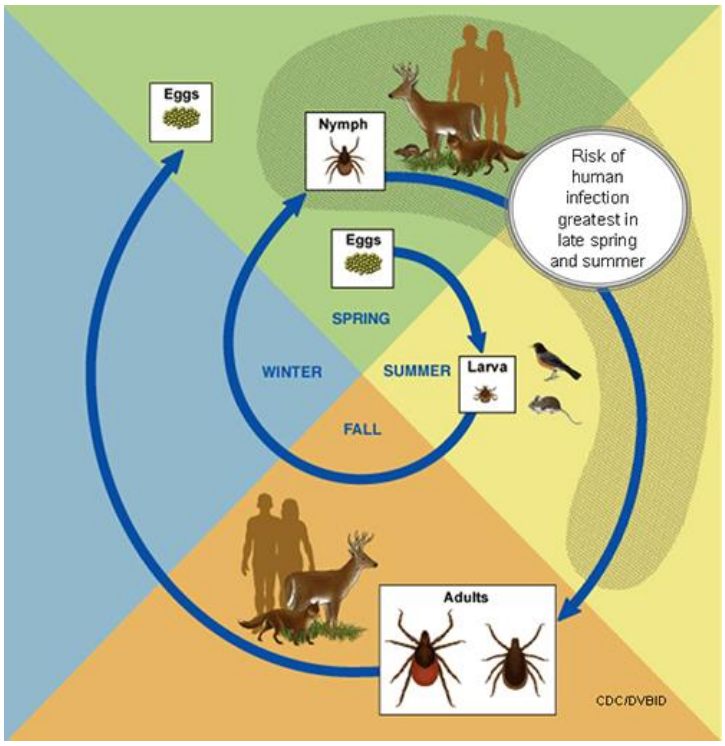

Figure 2: Life cycle of a blacklegged tick (image source: CDC)

Ticks must make direct contact with a host to gain access to feed. Since they cannot fly or jump, they will climb to the highest point of nearby, low-growing vegetation where they will cling with their front legs outstretched until they are able to make contact with a passing host—this action of looking for a host is called questing[1]. Once contact is made, the tick will attach itself to the animal to feed, where it can remain for several days[1].

A tick becomes infected with the Lyme disease causing bacteria when feeding on the blood of an infected host animal[2]. Small mammals are the known reservoir, and deer are not a source of the bacteria[1].

The ideal tick habitat for blacklegged ticks consists of a forested area with a dense shrub layer and deep litter layers[3]. The shrub layer vegetation and leaf litter provide moist, cool conditions, while providing cover and food resources for a variety of host animals[3]. Humans are accidental hosts as ticks can feed off any vertebrates including mammals, birds and reptiles[3].

Further, since hosts seem to be more abundant along forest edges, ticks tend to be more abundant at the margins of woodlands compared to forest interiors[1,3]. In residential settings, the majority of blacklegged ticks will be found within woods and associated edges, while about 10% occur in landscaped areas, particularly those with dense groundcover plantings[3]. Given the unfavorable microclimate, ticks are rarely found on lawns beyond a few feet from wooded edge[3].

Tick Management on Private Property– An IPM approach

Homeowners should be encouraged to use an integrated pest management (IPM) approach to managing ticks. Studies done on the use of acaricides to control tick populations on the perimeter of residential properties reported no impact on the risk of preventing tick bites and contracting Lyme disease[4]. Although the use of acaricides reduced the abundance of ticks in treated backyards, it did not eliminate the risk of ticks migrating from neighbouring properties, dropping off of animals (or pets) or reduce the possibility of a tick bite while doing recreational activities[4]. The use of prevention and personal protective measures that include frequent tick checks, dressing appropriately, and use of insect repellents along with the prompt removal of ticks helps to decrease the risk of contracting Lyme disease and other tick borne diseases.
An IPM approach to controlling ticks should include habitat management, biological controls, exclusion/reduction in hosts and the use of host targeted chemical controls[1,3].

1. Habitat management practices includes frequent mowing in landscaped areas, removing leaf litter, trimming back overhanging shrubs or tree branches. The goal of habitat management is to make tick friendly habitats undesirable. See Appendix B for a list of actions that can be taken.

2. Biological Control activities can include the use of predators, parasitoids or pathogens to reduce the population of a particular pest. Researchers have studied the impact of nematodes and pathogenic fungi as possible control methods. One product using pathogenic fungi is licensed for use in Canada.
3. Host exclusion/ reduction activities includes efforts to exclude or reduce the abundance of host animals such as the white-footed mice and the white- tailed deer on property by making the habitat less desirable usually by fencing or removal of food sources.
4. Host targeted chemical control involves the application of chemicals directly to host animals to target or repel ticks that might be feeding on the host animal. For people, this might include the use of insect repellents such as DEET or Icaridin.

In field studies, some limited success has been demonstrated around the use of biological controls, host exclusions/reduction and chemicals targeted to host animals. Best practices and the scientific research around tick management is still emerging.

Availability and use of Acaricides

Staff conducted a review of the Pest Management Regulatory Agency (PMRA) pesticide registry, consulted with the local office of the Ontario Ministry of Environment and Climate Change (MOECC) and surveyed local pest control operators to determine what approved chemicals are available for the control of ticks. The following products for tick control have been approved for commercial use: DeltaGard and Met52 EC Bioinsecticide. Additionally a plant based product (Mosquito Barrier) has been approved for use by home owners.

DeltaGard SC Insecticide (Bayer, 5% Deltamethrin, Registration # 28791) is a broad spectrum insecticide. This product is a commercial class product that is not available to homeowners and must be applied by a licensed Pest Control Operator. According to the product label, DeltaGard can be applied to turf areas including areas adjacent to forested areas, stonewalls, ornamental plantings and overgrown vegetation. Broadcast spraying with this chemical is not permitted (only perimeter spraying can be conducted) and use is limited to two applications per year.

Research conducted on the use of the active ingredient deltamethrin demonstrated that with a single application, there was a 90% or greater reduction in tick density[5]. However, this class of synthetic pyrethroids has a potential to cause unintended negative environmental impacts including being a known toxicant to aquatic organisms, non-target terrestrial plants, bees and other beneficial insects. Another drawback to the use of this chemical, is the potential for ticks to develop resistance to this class of pesticides.

A biological control product using pathogenic fungi spores is approved for use by commercial applicators. Met52 EC Biopesticide (Novozymes BioAg Limited, *Metarhizium anisopliae* strain F52, Registration # 30829) is approved for outdoor turf and greenhouse agricultural use. Ticks and target insects that come into contact with the fungus will become infected. The fungal spores once germinated will begin to grow inside the tick, causing the tick to die. A five-year study in New York is underway to determine the effectiveness of this product when used with other interventions to control ticks at a neighbourhood level[6].

Home owners and pest control operators are able to source Mosquito Barrier (Upper Canada Organic Products Inc, 99.3% Garlic juice, Registration # 31022) from a number of garden centres/distributors or purchase the product online. This product is a liquid insect repellent that is a concentrated garlic juice solution that is sprayed on plants, shrubs, and turf to repel mosquitoes and ticks. The product label claims that natural sulfurs in garlic repel mosquitoes and ticks. Re-application is indicated after heavy rainfalls and use is prohibited near aquatic habitats, irrigation or drinking water supplies.

In a survey of local pest control companies, at least one company reported the use of DeltaGard as a part of an integrated pest management approach to controlling ticks. Cost of treatment is dependent on the number of treatments and the size of the property. The service manager reported around 20 active clients around the Hamilton/ Niagara area. Another pest control company is investigating the use of Mosquito Barrier and other plant based or natural extracts to control ticks. No PCOs reported using Met52 EC biopesticide.

The effectiveness of acaricides is impacted by the seasonal activity patterns of blacklegged ticks[3]. For example, nymphal ticks are most active during late spring, early summer; the use of acaricides to target nymphs will have little impact on the larval or adult stage or even other types of ticks, since they are active at different times of the year.

In summary, the use of tick management strategies should include an integrated pest management approach that utilizes cultural practices to reduce tick habitats around the home owner's property with the goal of making the area around a home less favourable for ticks and their host.

Lyme disease prevention activities planned for 2018

Health promotion messaging will focus on increasing awareness of the following Lyme disease prevention tips:

- Know your ticks & where to expect them
- Prevent tick bites

- Do a tick check
- Remove ticks quickly using the correct methods
- Know the signs & symptoms

Social Media Campaigns:

Throughout this year, targeted messaging using social medial (Facebook, Twitter and Instagram) will be done. These activities include using promoted tweets, guest posting on Facebook, paid ads on popular webpages.

Education and Outreach:

Plans include sharing of resources and conducting presentations to internal and external stakeholders (Hamilton-Burlington trail council, outreach to local gardening groups, children recreational camps and information sharing with garden centres and landscape supply companies). A continuing education event for family physicians and veterinarians is underway and would include information on Lyme disease and ticks.

Factsheet and Resource Development:

Development of resource material is underway with the help of an outside marketing company. Factsheets focusing on at-risk populations and control measures homeowners can take to control ticks are also being created.

City of Hamilton Integrated Tick Management Plan:

Internal staff from various City departments including, public works, planning and economic development, risk management, health & wellness are working alongside external stakeholders from the Royal Botanical Gardens, Hamilton Conservation and Halton Conservation Authorities to develop a tick management plan for the City. The goal of the working group and this plan is to summarize the best practices for the management of ticks on private and public properties. And to make use of a risk based decision framework to guide mitigation activities.

Appendices/Schedules Attached

Appendix A to Report BOH18019 - City of Hamilton Lyme disease estimated risk area include risk
Appendix B to Report BOH18019 - Integrated Pest Management practices to prevent ticks in a backyard

References

[1] Stafford, Kirby C. Tick Management Handbook: An integrated guide for homeowners, pest control operators, and public health officials for the prevention of tick-associated disease. Connecticut: The Connecticut Agricultural Experiment Station, 2007

[2] Ontario Agency for Health Protection and Promotion (Public Health Ontario). Blacklegged tick surveillance in Ontario: a systematic review. Toronto, ON: Queen's Printer, 2016

[3] Schulze, Terry L, and Robert A Jordan. Assessment and Management of Vector Tick Populations in New Jersey: A Guide for Pest Management Professionals, Land Managers, and Public Health Officials. New Jersey: Freehold Townshop Health Department, 2006.

[4] Hinckley, Alison F, et al. "Effectiveness of Residential Acaricides to Prevent Lyme and Other Tick-borne Diseases in Humans." The Journal of Infectious Diseases 214 (2016): 182-188.

[5] Schulze, T L, R A Jordan, R W Hung, R C Taylor, D Markowski, and M S Chomsky. "Efficacy of granular deltamethrin against Ixodes scapularis and Amblyomma americanum (Acari: Ixodidade) nymphs." Journal of Medical Entomology 38, no. 2 (2001): 344-346

[6] Keesing, F, and R S Ostfeld. "The Tick Project: Testing Environmental Methods of Preventing Tick-borne Diseases (article in press)." Cell Press Reviews, 2018: 1-4.