

Mj&C

A Black Fly Suppression Program in Wisconsin: The Branch River Experience

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No other biting flies inspire more apprehension among outdoor enthusiasts than black flies (*Simuliidae*). They can be so numerous and can attack so persistently that outdoor activity during the day without some protection can become impossible. Even when they are not biting, their buzzing presence and constant crawling is as much an irritation as the bloodsucking itself. The painful, itchy bite of the black fly is characterized by a reddened area with a wound in the center. The pain and swelling of the bite are due to an allergic reaction to foreign proteins and toxins that the female injects when feeding. Although they cannot bite through clothing, black flies have a predilection for crawling into hair and under clothing, biting in inaccessible places, such as the ankles and belt line.

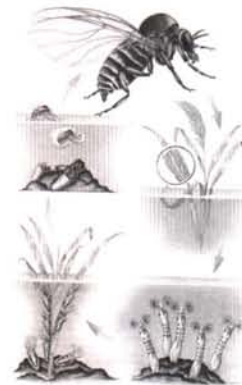
Many golf courses are designed around water bodies, especially small streams. This adds to the challenge of the course and provides aesthetic beauty. Unfortunately, the stream may contain larvae of black flies that will hatch into adults and detract from the enjoyment of the game. (Picture 1)

In the past, control methods have frequently used chemical insecticides to reduce the populations of nuisance species. Increasing pest resistance to chemicals and growing environmental concerns have contributed to the development of alternative technologies. One example of this is "microbial control," where naturally occurring bacteria are used to control insect pests.

Formulated insecticides based on the bacteria *Bacillus thuringiensis* (*Bt*) have been employed in vector control programs since the late 1970's. *Bt* is one bacterium that occurs naturally in the soil. Different varieties of this bacterium produce a crystal protein that is toxic to specific groups of insects. The toxic crystal *Bt* protein in commercial formulations is only effective when eaten by insects with a specific (usually alkaline) gut pH and the specific gut membrane structures required to bind the toxin. Not only must the insect have the correct physiology and be at a susceptible stage of development, but the bacterium must be eaten in sufficient quantity. When ingested by a susceptible insect, the protein toxin damages the gut lining, leading to gut paralysis. Affected insects stop feeding and die from the combined effects of starvation and tissue damage. The *Bt* variety *israelensis* (*Bti*) has been shown to kill larval stages of black flies and mosquitoes while not affecting non-target organisms. (Picture 2)



Picture 1



Picture 2



Picture 3

The use of *Bti* in the waters of Wisconsin is controlled by the Wisconsin Department of Natural Resources under Wisconsin Administrative Code NR 107. In 1997 the Branch River Country Club applied for a permit to use *Bti* to control adult populations of black flies on the golf course by reducing the number of larvae present in the stream adjacent to the course. The permit was denied by the WDNR in 1998 and subsequent permit applications in 1998 and 1999 also met with regulator resistance. Branch River Country Club filed a Petition for a Contested Case Hearing

with the Department of Natural Resources. The hearing was held in August of 1999, and based on the findings of that hearing, the WDNR was required to grant the permit. The permit stipulated that the use of *Bti* was contingent upon instream studies of potential impact on non-target species, and nuisance relief on the golf course from biting adults. The non-target species assessment required pre- and post- sampling of benthic macroinvertebrates from a control location and within the application zone. This sampling was intended to determine potential impact on non-target community structure and function, and the affect upon black fly larvae abundance. The nuisance relief portion of the permit required monitoring of adult blackflies at four locations on the golf course and at four background locations. Application of *Bti* was restricted to the Branch River adjacent to the golf course. Any downstream carry of the material beyond the application zone was not allowed. The 2003 permit also required a minimum number of larvae within a specified area before an application could be done (trigger).

The *Bti* formulation used in this black fly suppression program was VectoBac 12AS® (Abbott Laboratories, North Chicago, Illinois). The material is mixed with water and applied with conventional spray equipment across the upstream edge of the treatment area. The concentration of material to be used will depend on the size of the application area, stream flow, concentration of dissolved organic materials, algae, and density of aquatic vegetation. One needs to consult the manufacturer's specifications before applying the material.

The Branch River is a tributary to the Manitowoc River and drains approximately 108 square miles of Brown and Manitowoc Counties. The river winds through a portion of the Branch River Country Club just upstream from the confluence with the Manitowoc River. This section of the stream is charac-

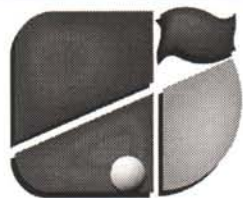
terized as fast flowing with several riffle areas that are perfect habitat for black fly propagation. (Picture 3)

Bti was applied in 2000, 2002, and 2003. The material was used in a small section (approximately 1 mile) of the Branch River adjacent to the golf course. The close proximity to the Manitowoc River, which is also a potential source of adult black flies, presented some problem for nuisance relief. A request to the WDNR for permission to treat a portion of the Manitowoc River has yet to be obtained. Although the treatment area in the Branch River was small, adult black fly relief averaged 50 percent on the golf course in 2000 and 2002 when compared to background levels. This was enough of a relief to be noticeable to golfers. Extremely low flows in 2003 caused problems with the dispersion of *Bti* in the stream thus reducing its effectiveness on adult black fly relief. The results of the non-target monitoring indicated no impact over the three year period. About 7 man hours per week are involved in larval and adult monitoring. This does not include the non-target organism monitoring assessment.

Bti used in a black fly suppression program can assist golf course superintendents in reducing this pest. It would improve not only the aesthetics of the course but also increase the number of rounds played.

Reference

Artwork by Barry Flahey, Courtesy of the Canada Department of National Defence



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