

INTEGRATED VECTOR MOSQUITO MANAGEMENT FOR DENGUE CONTROL



GLOBAL HISTORY OF DENGUE

1998— A pandemic in which 1.2 million cases of dengue fever and dengue hemorrhagic fever (DHF) were reported from 56 countries worldwide, was unprecedented.

2001— The Americas alone reported over 652,000 cases of which 15,500 were DHF, nearly double the cases reported for the same region in 1995.

2013— Today, dengue ranks as the most important mosquito-borne disease in the world.

PREDICTION

Headlines April 08, 2013

“Scientist Map Dengue, Estimate 390 Million Infections Per Year”
Eryn Brown January isotherm

THE PREDICTION APPEARS TO BE CORRECT

The Indian Express 13 June 2013

Singapore ... “The illnesses counted so far in 2013 are already twice the total for all of last year“ ... ”More than 9000 cases and two deaths since January.”

The Times of India 6 June 2013

Mysore India ... “Three more positive cases of dengue have been reported” ... “Despite carrying out awareness drive in the dengue-infected village, the residents are not keen to clean tanks.”

Bangkok Post 9 June 2013

Thailand ... “More than 4,000 people contracted dengue fever last week, the first seven days of the rainy season, the Public Health Ministry said yesterday. The figure, equates to about 570 infections per day ... between a 100,000 and 120,000 people are expected to contract the disease this year.”

Similar reports from: Cambodia, Pakistan, Argentina Costa Rica

**CASE SCENARIO
COSTA RICA EXPERIENCES
A DRAMATIC INCREASE IN DENGUE CASES**

(Posted: Thursday, June 06, 2013, The Tico Times and AFP)

Caja reports a total of 12,000 cases in early June which is only the beginning of the rainy season which runs from May to November.

The number of cases so far in 2013, according to official data is 4 times the number of cases recorded in the first 5 months of 2012

Last year, the Caja recorded a total of 26,808 cases—nearly double the 13,854 reported in 2011— which cost the agency \$9.5 million.

The number of cases in 2013 could exceed 100,000; substantially increasing the burden on the Costa Rican health system, the economy, and the personal lives of Costa Ricans

The culprit is *Aedes aegypti*
The mosquito species that spreads the disease from infected people to healthy people



**THE SOLUTION
IS
INTEGRATED VECTOR CONTROL**

**Dengue First Appeared in Costa Rica in 1993
There Are Four Types Of**

DENGUE FEVER

**EACH TYPE CAN CAUSE THE FOLLOWING
SYMPTOMS**

High Fever Headache
Rash Vomiting
Muscle and Joint Pains

Most patients recover from Dengue Fever in about 3-7 days but some may get Dengue Hemorrhagic Fever that can be fatal. Patients contract DHF by being bitten by mosquitoes each transmitting a different type of Dengue Fever.

**DENGUE HEMORRHAGIC FEVER
SYMPTOMS**

- The normal symptoms of Dengue Fever
- Bleeding from the nose or gums
- Brown or black vomit or feces (stools)
- Severe stomach pain
- Coldness of body
- Paleness of body
- Restlessness
- Drowsiness

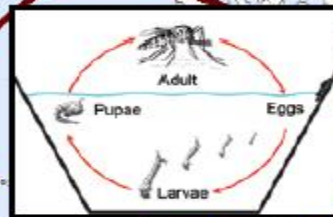


NO VACCINES— NO CURE

**INTEGRATED VECTOR MANAGEMENT IS THE SOLUTION
CONTROL THE MOSQUITO LARVAE BEFORE THE ADULTS
EMERGE, BITE AND TRANSMIT DENGUE**

LARVAL HABITATS FOR DENGUE MOSQUITOES

Typically larvae of dengue vectors are found in artificial or natural containers that are filled by people or rain. A rainy season will replenish the water in these containers causing multiple generations of mosquitoes to develop.



January isotherm



INTEGRATED DENGUE VECTOR MANAGEMENT

IS
A DECISION MAKING PROCESS WHEREBY ALL CONTROL MECHANISMS ARE CONSIDERED AND THE MOST FEASIBLE — EFFECTIVE AND ENVIRONMENTALLY APPROPRIATE — ARE APPLIED

It is generally agreed that it is easier to kill vector mosquitoes in the larval stage when they are confined to water habitats and before they disperse as adults, seeking blood meals.

Aedes aegypti eggs are laid in natural and artificial containers often filled and maintained with water by deliberately by people or by the rain.

Filled By People

Drums and water cisterns, 5 gallon buckets, small buckets, plants in water, decorative fountains, animal drinking bowls, pools not in use, potted plants and bases, open or unsealed septic tanks, or septic tanks lacking vent pipe screen.



Filled By Rain Water

Discarded tires, bottles, pots and pans, broken appliances (toilets, washbasins, refrigerators, washing machines). Items left outside such as garbage cans, paint trays, tarps, buckets, lids and coolers.



Integrated Dengue Vector Management would support manually emptying, repairing or preventing mosquitoes from laying their eggs in such containers and thereby preventing the generation of biting adult mosquitoes.

UNFORTUNATELY THIS IS NOT ALWAYS EASY OR POSSIBLE



PESTALTO IS THE CANADIAN LEADER IN THE DEVELOPMENT AND IMPLEMENTATION OF INTEGRATED DISEASE VECTOR MANAGEMENT





**DR. BARRY TYLER & PESTALTO PERSONNEL
PROMOTED INTEGRATED VECTOR MANAGEMENT
IN ETHIOPIA, SOUTHERN SUDAN, NIGERIA,
CHINA & MEXICO
FROM 2007 TO 2012**



CURRICULUM VITAE

Barry M.J. Tyler Ph.D.

**President
Pestalto Environmental Health Services Inc.**

PROFILE

Highly motivated humanitarian entrepreneur with a demonstrated track record in the development and execution of integrated nuisance biting fly and disease vector control programs:

- Program design • Training
- Project Management • Leadership

Strategic thinker and analyst, adept at implementing innovative solutions to complex problems. Adaptive, able to handle multiple priorities and deliver to completion effective and high quality results. Action and results oriented, communicative and personable, technology proficient in integrated biting fly and disease vector control.

SELECTED ACCOMPLISHMENTS

Shared expertise with and provided training & guidance to Canadian Federal and Provincial government agencies, to Regional Health Units, and Regional First Nations in Central and Eastern Canada for the development and implementation of operational biting fly & integrated vector management programs.

- Oneida Nation of the Thames, Ontario
- Chippewas of the Thames First Nations, Ontario
- Innu – Labrador
- Inuit – Labrador

Developed with the cooperation of the Gambella Regional State Health Bureau, the larviciding strategy (Take Back the Night program) to enhance the malaria vector control program for the Capital of Gambella in Ethiopia.

Pestalto Environmental Health Services Inc.

Initiated the integrated malaria vector management strategy proposal for the Abuja Region, capitol of Nigeria.

Initiated the integrated malaria vector management strategy proposal for Juba, capitol of Southern Sudan.

Shared expertise and discussed a strategy to manage the mosquito dengue vector in Quintana Roo near Cancun with Dr. Ildefonso Fernández-Salas of Ciudad Universidad, Monterrey and the General Director of Health Programs.

As President of the Ontario Vector Control Association from 2002 to present provided insight and strategies to provincial and regional health agencies to mitigate the human incidence of West Nile virus in Ontario.

Created Pestalto Environmental Health Services Inc. which became the major service provider for the management of mosquito vectors of West Nile virus in Ontario.

List of Pestalto's government and First Nations clients from 2000 to 2013:

- Regional Municipality of Peel, Health Services Department
- Regional Municipality of Niagara, Public Health Department
- Haldimand Norfolk Health Unit
- Middlesex London Health Unit
- County of Oxford Board of Health
- Wellington Dufferin Guelph Health Unit
- Windsor Essex County Health Unit
- Leeds, Grenville & Lanark District Health Unit
- Regional Municipality of York, Health Services Department
- City of Peterborough
- City of Barrie
- Ministry of Transportation Ontario
- Canadian Forces Base, Petawawa and Borden
- Oneida Nation of the Thames
- Chippewas of the Thames First Nations
- Ontario Power Generation Corporation
- Greater Toronto Airports Authority
- Province of Ontario, Ministry of Health and Long-term Care
- City of Toronto
- Labrador City, Labrador
- Churchill Falls, Labrador



PERSONAL GOAL

To significantly contribute to the improvement of the human condition in third world countries by supporting the reduction in the incidence of dengue and malaria through the sharing of his expertise and providing guidance at the appropriate government levels.

BACKGROUND INFORMATION

Roughly 30 years ago, malaria was eliminated from several regions around the world through integrated mosquito control programs that included the use of larvacides. Funding was withdrawn with the consequent resurgence of malaria.

Dengue now has all but eclipsed malaria in importance with epidemics occurring in many regions of the world in 2013.

History and the current literature support that larvaciding is the necessary component of the equation that will significantly reduce the impact of this devastating disease.

Background

- Ph.D. in 1978 received from the Department of Environmental Biology, University of Guelph, interests and training encompassed applied Entomology including medical entomology and ecology. Since that time has worked for national and multinational companies and now is President of Pestalto Environmental Health Services Inc.
- Involved with medical entomology and biting fly control across Canada since 1983. Activities include the designing and implementation of successful integrated vector mosquito and black fly control programs for Government agencies as well as training client personnel in mosquito taxonomy and identification.

- Supports the development of new technology, the transfer of information to clients through easy access to data and operating in ways that have multiple benefits for the community.
- Current president of the Ontario Vector Control Association, a member of the American Mosquito Control Association and Editor of the Asian Society of Vector Ecology and Mosquito Control Newsletter. Over the past ten years, the executive and board of the OVCA have been primarily involved with facilitating the transfer of knowledge regarding West Nile virus and mosquito management to Ontario government agencies but also to other Canadian government agencies.

Education

UNIVERSITY OF SOUTH CAROLINA, The Wedge (1986)
Certificate: Larval and Adult Taxonomy of Mosquitoes of Medical Significance
Identification of specimens to species level

UNIVERSITY OF GUELPH, GUELPH, ONTARIO (1973-1978)
DEPARTMENT OF ENVIRONMENTAL BIOLOGY
Degree: Ph.D.
Thesis Title: The Northern Corn Rootworm, *Diabrotica longicornis* (Say), and Other Selected Arthropods in Three Tillage Systems
Specialization: Economic Entomology
Major Subjects: Medical Entomology, Economic Entomology
Minor Subjects: Biostatistics

SOUTH DAKOTA STATE UNIVERSITY, BROOKINGS, SOUTH DAKOTA, U.S. 57006 (1971-1972)
Degree: M.Sc.
Thesis Title: Bionomics of the Greenbug Parasite, *Lysiphlebus testaceipes* (Cresson)
Specialization: Economic Entomology
Major Subjects: Insect Taxonomy, Insect Ecology, Acarology
Minor Subjects: Animal Ecology, Aquatic Ecology, Plant Ecology
Awards: Entomological Society of America, North Central Region - Graduate Research Proposal Contest; First Place Winner

UNIVERSITY OF GUELPH, GUELPH, ONTARIO (1967-1971)
DEPARTMENT OF ENVIRONMENTAL BIOLOGY
Degree: B.Sc. (Agr.)
Specialization: Entomology
Major Subjects: Medical Entomology
Regulation of Insect Numbers, Applied
Insect Control, General Entomology, Insect Biology, Aquatic Insects, Apiculture
Minor Subjects: Plant Pathology, Plant Taxonomy, Animal Ecology, Invertebrate Physiology, Statistics

Pestalto Environmental Health Services Inc.



Dr. Barry Tyler is an applied economic entomologist with skill and experience in the management of mosquitoes that infect people with diseases.

Dr. Tyler is president of Pestalto, a Canadian company, formed in 1999 to address the mosquito borne West Nile virus in Ontario.

He has provided leadership and developed and implemented Integrated Vector Control strategies that are environmentally compatible and effective against vector borne diseases.

Dengue and malaria are two diseases that adversely impact on human health and the economies of countries in sub-tropical and tropical regions of the world. Between 300 to 500 million people are affected by Malaria and one to 3 million die; 2.5 billion people in Asia and Latin America (over 40% of the world's population) are at risk of contracting Dengue. These diseases are carried by adult mosquitoes that infect people and to date they have not been effectively controlled.

Mosquitoes lay their eggs on or around water and the immature stages grow in the water including drinking water in containers as well as in other artificial and natural sites.

In 2004, the World Health Organization reported on the success of a new material, novaluron, for the control of mosquito larvae that would prevent their emergence as biting adults that would infect people. WHO recommended that novaluron be formulated as a solid and be registered for use in drinking water.

In 2005, Dr. Tyler started work on the development of a controlled release, long lasting novaluron formulation to control mosquito larvae, trade named Mosquiron. This new larvicide is superior to the original liquid formulation and exceeds the WHO recommendations for improvement.

In 2012, Mosquiron products were successfully registered in the U.S.A. and are approved for application to drinking water.

The time has come to introduce Mosquiron to those parts of the world plagued by death and sickness caused by Dengue and Malaria.

MOSQUITO LARVACIDING IS A CONSIDERATION IN INTEGRATED VECTOR MANAGEMENT

Countries such as Ecuador and Brazil use mosquito larviciding as part of their approach to dengue control

The larvicide product of choice should be appropriate for use in container larval habitats, effective, long lasting and safe to use in potable water.

New Residual Mosquito Larvacides
Containing Novaluron
MOSQUIRON®

MOSQUIRON 0.12CRD



MOSQUIRON 0.12P



MOSQUIRON DEVELOPMENT HISTORY



WHO RESEARCH REPORT 2004

Conclusions:

1. "Given its considerable activity against all developmental stages of mosquitoes, novaluron offers the flexibility of timing of application against asynchronous broods."
2. "Field studies in artificial and natural habitats showed that novaluron 10EC was effective against populations of *Ae. aegypti* (Mexico and Thailand), *Anopheles* species (Mexico and Sri Lanka) and *Culex* species (India, Mexico and USA) at application rates of 10-50 ppb."
3. "Studies on the efficacy of this formulation in water-storage containers against *Ae. aegypti* provided long-lasting residual activity for 5-6 months."
4. "Similarly, in confined sources of larvae such as gem pits and disused wells, novaluron at practical dosages provided control for up to 4 months."

MOSQUIRON DEVELOPMENT HISTORY



WHO RESEARCH REPORT 2004 Recommendations:

1. The use of novaluron larvacide for application in temporary mosquito habitats, polluted water and non-drinking water-storage containers at 10-50 ppb a.i. The higher dosages are needed for polluted and vegetated habitats.
2. Although the 10% EC formulation of novaluron has been found to show a high level of activity against larvae of various groups of mosquitoes, there is a critical need for the development and evaluation of other formulations (e.g. granules and tablets) operationally suitable for use in specific larval habitats such as containers and other confined sources of larvae.
3. WHO should conduct an assessment of the safety of novaluron for use in drinking water as a mosquito larvacide.

WHO RECOMMENDATION 2007

Novaluron is recommended for use in drinking water.

MOSQUIRON DEVELOPMENT HISTORY
Two Formulations Fully Registered IN 2012
by the United States
Federal Environmental Protection Agency

MOSQUIRON 0.12P



MOSQUIRON 0.12CRD



PRODUCT DETAILS

- ✓Addresses “the critical need for the development and evaluation of other formulations of novaluron(e.g. granules and tablets) operationally suitable for use in specific larval habitats such as containers and other confined sources of larvae.”
- ✓Registered for use in drinking water by the E.P.A. in the U.S.A.



MOSQUIRON FORMULATIONS



✓Increases solubility of novaluron in water from 3 ppb to 10-15 ppb vs WHO Report, "Field studies in artificial and natural habitats showed that novaluron 10EC was effective at application rates of 10-50 ppb."

✓Increases residual activity in excess of 6 months regardless of polluting organic matter vs WHO Report, "50 ppb a.i. dosages are needed for polluted and vegetated habitats."

These new properties are attributed to the formulations utilizing a novel carrier technology (involving food grade inerts) which has been patented in numerous countries

INTEGRATED DENGUE VECTOR MANAGEMENT IN EPIDEMIC SITUATIONS

In a dengue epidemic situation ... as is the case in many countries of the world in 2013 with thousands of lives at risk, impacting on the well-being of individuals, families, communities and regions ... it is appropriate to use the tools of IDVM.

Where one program may rely on ground adulticiding it may be appropriate to advance the program to ULV applications with aircraft.

Regardless, it is reasonable that every program should have a component seriously directed at mosquito abatement through the various techniques of larval control including larvaciding.