Illinois Mosquito & Vector Control Association

N E W S L E T T E R

May 2004

PUT IT ON YOUR CALENDAR! Reserve Rooms by Nov. 3rd
50th Annual Meeting of the IMVCA
Urbana-Champaign, Illinois
Holiday Inn Convention Center
November 18-19, 2004

HEADLINES

CDC reports WNV Activity in NINE States as of April 14, 2004
WNV re-emerges in Illinois Earlier than in the Past
Lyme disease shows a big rebound in 2002
US Culex pipiens - A Hybrid with Cx. molestus?

MESSAGE FROM THE IMVCA PRESIDENT
DON OEMICK

I started working at the Northwest Mosquito Abatement District in 1967 and, unless my memory fails me, I have been President of the IMVCA four times. So, what "words of wisdom" can I give from 37 years of experience?

First, mosquito abatement districts are perennially bombarded with the same questions. "Are mosquitoes or ticks going to be worse this year than last year?" and "Is it going to be a bad year for St. Louis encephalitis virus, West Nile virus, Lyme disease, etc.?" I have heard these questions for almost four decades and my answer is simple --

"Only time and careful surveillance will tell."

Of course, this seldom satisfies anyone. Many people demand a definitive answer. Unfortunately, the only thing that is predictable is unpredictability. You can't predict fluctuations in mosquito populations, if you can't predict the weather. You can't predict the magnitude of arbovirus transmission if you don't know infection, seroprevalence, and vector biting rates. This is why vector management programs use a wide range of tools, targeting both larvae and adults, in order to reduce vector populations before they become a problem. But even widespread intensive larval control can miss many of the residential breeding sites of Culex vectors, which is why we constantly monitor mosquito abundance and test batches of vector mosquitoes for arboviruses. Although it's sometimes overlooked, mosquito abatement districts do this in an environmentally and economically sound way. Over the past 37 years, I have seen a shift away from toxic chemicals to biological and insect growth regulating agents for larval control--for adult control, a shift from organochlorine and organophosphate adulticides to safer pyrethroids at ULV application levels.

And that leads me to my final observations- Mosquito management is no longer the fogging truck travelling up and down the streets. It's an integration of surveillance and abatement practices. It requires that you "know your enemy", have well-trained personnel, conduct frequent equipment maintenance, analyze trends in vector and arbovirus abundance, and have a plan of attack. It also demands good leadership with the ability to react to changing situations. Mosquito abatement is not something you can take up as a pastime.

And that leads me to my final point - One way of keeping up with new ideas and to see how everyone else is coping with these perennial pest and vector problems is to attend the annual IMVCA meeting. So, what's your prediction for this year? Mine is – I'll see you at the meeting in Champaign in November.

Don Oemick

FIRST IMVCA SCHOLARSHIP AWARDED

Rockford native Laura Marie Offerman was selected Nov. 21st at the IMVCA Annual Business Meeting for the first $1500 scholarship awarded by the IMVCA. The IMVCA scholarship is designed to encourage the study of entomology, insect behavior, ecology and physiology, or a course dealing with insect-borne diseases that impact wildlife, domesticated animals, and public health. Laura is a biology major at Northern Illinois University in DeKalb, and preparing for future Ph. D. studies. Offerman received $1,000 to cover tuition, text, and manuals. She will receive an additional $300 and $200 to cover expenses when she gives a presentation at the 2004 annual meeting in Urbana-Champaign.

"I am intrigued by the ecological niches, social structures, negative impacts and benefits of many insects," says Offerman. "Insects are the root component of any ecosystem as they are an essential food source to many other organisms."

SPREAD THE NEWS ABOUT THE IMVCA SCHOLARSHIP

The deadline for the 2004 IMVCA scholarship is Aug. 1, 2004. 35 Scholarship Packets have been mailed to Illinois Colleges and Universities in January 2004. Applicants must be Illinois residents, sophomores, juniors or seniors attending Illinois colleges, and committed to a career in science or the teaching of science. The scholarship intends to introduce students to entomology and the medical and veterinary importance of insects and other arthropods.

The IMVCA Executive Board voted that the Scholarship should be named for one of the academic founders of the association. The Board recommends it be called "The IMVCA William Horsfall Scholarship".

IN MEMORY OF HARVEY DOMINICK

Harvey J. Dominick was born on October 11, 1923 in Grand Rapids, Michigan.

During World War II, Harvey was a US Army Air Corps crewman on a B 24 bomber in the Mediterranean Theater. His bomber was shot down over Yugoslavia. Partisans friendly to the Allies helped him return to Allied lines. In 1948, Harvey married Blanche Frederick. Together, they had two daughters and a son; Harvey and Blanche had seven grandchildren and one great-grandchild. After the war, Harvey attended Michigan State University, where in 1953 he received his Masters Degree in Entomology. He also worked for a pest control company and taught biology at Quincy College.

From 1959 to 1991, Harvey was the entomologist for the Illinois Department of Public Health. section chief for the Structural Pest Control & Vector Control section. While with the Department, he was involved in a variety of projects and events including: problems with the salt marsh mosquito and mining operations in southern Illinois, the St. Louis encephalitis outbreaks of 1968 and 1975, establishment of the Department's arbovirus surveillance program, creation of the Structural Pest Control Act, the Used Tire Act and Vector Control Acts. He was a speaker at many conferences over the years. He retired from IDPH in 1991. At a retirement reception, Dr. John Lumpkin, the IDPH director at that time, presented him with a proclamation by Gov. Jim Edgar naming January 31, 1992 as "Harvey J. Dominick Day" in Illinois.

Outside of his professional public health work, Harvey had an intense interest in the cultivation of fruit trees and other ornamental plants. After retirement, in addition to his other interests, he was involved in the University of Illinois Extension's Master Gardener Program. He was a former Boy Scout leader and a member of the Cathedral of the Immaculate Conception.

During retirement, he remained very active with a variety of interests. In fact, two weeks before his passing he was bowling with several public health employees, including the writer. Harvey was always interested in helping people and he could always be counted on to help a neighbor or a friend. Harvey died on September 29, 2003 in Springfield. He has been greatly missed by his friends and professional associates.

-- Linn D. Haramis, hired by Harvey J. Dominick in August 1986.

Mission Statement of the IMVCA

The Illinois Mosquito and Vector Control Association (IMVCA) is a non-profit organization consisting of individuals who are interested in promoting the economic, environmental, and ecologically sound management of mosquitoes and other arthropod vectors and pests, in order to enhance human and animal health and well-being. Our mission is to provide leadership, information, and education concerning the suppression of mosquito and other vector transmitted diseases and the reduction of pest annoyance levels caused by mosquitoes and other arthropods of public health importance in Illinois.

THE MAIN GOALS OF THE IMVCA ARE:

Illinois Mosquito & Vector Control Association
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217-244-5509 or 217-333-1186

1. To promote the principles of integrated pest and vector management, i.e, to reduce vector and pest populations to tolerable levels through scientifically based methods that consider the long-term ecological, environmental, and economic impact on humans, domesticated animals, and wildlife;
2. To facilitate professional cooperation and collaboration between and among mosquito abatement districts, public health departments, applied and basic scientists, commercial and municipality vector control specialists, and the general public; and
3. To keep members abreast of new developments in the study of vector-borne diseases, insect control technology, and pest and vector surveillance.

The main method of achieving these goals is to provide a forum for the interaction of members at the annual meeting, in order to both review and preview insect, tick, and other arthropod-related public health issues relevant to Illinois.

EXCERPTS AND COMMENTS ON VECTOR-RELATED NEWS AND PUBLICATIONS

WNV IN ILLINOIS IN 2004

The new season has started and the reports of WNV positive mosquitoes and birds are trickling in. It seems that the discovery of WNV is earlier each year. Log on to http://www.idph.state.il.us/envhealth/wnvsurveillance04.htm to keep abreast of the new season.

SCIENCE MAGAZINE - CULEX PIPIENS IN NORTH AMERICA IS A HYBRID?

In the March 5th edition of Science, an article entitled "Emerging Vectors in the Culex pipiens Complex" by Dina Fonseca, et al. gained considerable media attention. It was widely reported (I saw it on CNN and several network broadcasts) that the reason for the greater human outbreaks in the US and Canada than in Europe and Africa was because the US populations of Culex pipiens showed a large amount of hybridization with the mammal feeding Culex pipiens molestus form. Many of you will recall that at one time Culex pipiens that could lay eggs on its first cycle without a bloodmeal (autogenous) were called Culex molestus and were commonly found breeding in wet basements and other underground galleries that maintained warm temperatures all year round. This "molestus form" was originally considered a separate species but later was reclassified as a genetic variant of Cx. pipiens, so Cx. molestus became synomymous with autogenous Cx. pipiens. In the US, most researchers say that Cx. pipiens typically takes a bloodmeal on its first gonotrophic cycle (anautogenous), but a small percentage can produce viable eggs from larval reserves (autogenous) if isolated in restricted access areas. Most "restricted access areas" that maintain high enough temperatures for the mosquitoes to maintain flight are natural or man-made underground structures. These underground mosquitoes will take a bloodmeal if offered one and the prevailing literature indicated that they were opportunistic feeders, whereas the above ground Cx. pipiens are primarily bird feeders. This distinction between the forms explains why Cx. pipiens in some areas of the Eastern Hemisphere are called mammal feeders, whereas in northern areas they are largely bird feeders. In Illinois, year round breeding of mosquitoes (notably the presence of males in winter) has been sporadically observed in restricted underground structures.

Unfortunately, the conclusions in the paper about differences between the US and European Cx. pipiens are questionable because the authors only tested a relatively low number of mosquitoes from the northestern US and they did not include specimens classified as autogenous and anautogenous. Furthermore, keep in mind that WNV didn't cause a major epidemic until it arrived in the Midwest, so represeantative samples from the the major Cx. pipiens populations where outbreaks occurred were never tested. The paper also states that 40% of the Cx. pipiens in the US were classified as hybrids and these probably had greater mammal feeding tendencies. This certainly surprised everyone doing bloodmeal analyses, which repeatedly indicate a strong avian feeding bias for Cx. pipiens.

How does this relate to members of the IMVCA? Look at the infection rates in mosquitoes from your area. Although there was a difference between 2003 and 2002, both years showed rates well above those expected to cause a major outbreak. Colorado in 2003 had more human cases than Illinois in 2002, yet the infection rates were lower. An explanation might be the feeding behavior of the vectors. In Illinois, infection rates in 2002 were as high as 70 Culex per 1000 (about 90% of the mosquito pools were infected in some areas). In 2003, infection rates in some areas reached 20 Culex per 1000 (and almost half of the pools were positive). One way you can reconcile the relatively low human cases with these astounding infection rates is by having an epidemic vector that only rarely transmits to mammals (see LESSONS LEARNED ABOUT WNV in this newletter, a summary of Linn Haramis's cover letter on a memo to local public health departments.)

CALIFORNIA DEMONSTRATES EARLY WNV TRANSMISSION

http://www.promedmail.org

PRO/AH/EDR> West Nile virus update 2004 - USA (02)

Vector Control District (OCVCD) biologists in Orange County, California, have found antibodies to West Nile virus (WNV) in 2 adult female house finches. The 2 birds were positive for specific antibody to West Nile virus using

a blocking ELISA to NS1 protein. One of the birds had been trapped and bled a short time earlier and was found seronegative, indicating a recent seroconversion.

LEISHMANIASIS IN US TROOPS

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5312a4.htm

Cutaneous leishmaniasis (CL) is a sand fly-borne parasitic infection. During August 2002-February 2004, Department of Defense (DoD) staff identified 522 parasitologically confirmed cases of CL in military personnel. Leishmania major was the etiologic agent for all 176 cases for which species data are available. The patients represented multiple branches of the U.S. military; the majority of the patients were in the Active Force component of the Army. Self-reported dates of onset of skin lesions ranged from May 2002 to January 2004, with 274 (78 percent of 350) occurring during August - November 2003, including 169 (48 percent of 350) during September--October. Department of Defence (DoD) is implementing measures to decrease the risk for CL among U.S. military personnel in Southwest/Central Asia and to expedite detection and treatment of cases of CL. The measures include 1) improving living conditions for deployed personnel; 2) heightening awareness that leishmaniasis is endemic in this region (e.g., through publicity about cases of CL in U.S. military personnel and pre- and postdeployment briefings about leishmaniasis); 3) emphasizing the importance of deployed personnel using personal protective measures (e.g., using permethrin-treated clothing and bed nets or other barriers to sand flies, minimizing the amount of exposed skin, and applying insect repellent containing 30 percent-35 percent DEET to exposed skin, especially from dusk through dawn); and 4) enhancing vector-control activities.

VECTEST VERSUS TAQMAN

Advantages of VT – Simple instructions, quick results after processing mosquitoes, relatively inexpensive i processing equipment (centrifuge and pipetter), and relatively low technical training necessary
Disadvantaes of VT – High false negative rate (not constant through time; therefore, not adjustable by using a "fudge factor"); reader misinterpretation possible, especially of weak signals; some evidence of false positives if blooded mosquitoes included in sample; high sampling rate or resampling may be cost-inhibited (greater than or equal to $10 per test depending upon which kit is used).

Advantages of RT-PCR TaqMan – high specificity and sensitivity (the lowest false positive and false negative rates); quick results (about 3 hours after processing); larger number of samples can be run simultaneously (in our case 80 mosquito batches per run, about 160-240 samples a day); multiple positive and negative controls; low impact of extraneous materials (vertebrate blood); potential for quantification of arbovirus; low contamination, esp. when compared to straight PCR.
Disadvantages of RT-PCR TaqMan– high start up costs (equipment); more technical expertise required; cost of RT-PCR kits and reagents; longer processing time – about 3-4 hours (grinding, incubation, extraction of RNA, centrifugation, and pipetting), more expensive processing equipment and supplies; routine machine maintenance and calibration required.

VecTest Tips from the Editor -

1) **Do not put blooded mosquitoes in the batch to be tested.**
2) **Positives have to have a color change across the width of the reagent band (no thin lines, no grey lines).**
3) **After grinding mosquitoes, centrifuge and pipette liquid to separate test tube for the disptick testing.**
4) **Always check to make sure test liquid is not above the bottom line mark.**
5) **Follow instructions that come with the VecTest dipsticks.**
6) **If sending samples for verification, send positives and negatives and keep refrigerated.**

VecTest for SLEV and WNV has a very good record of specificity and provides a rapid means of making on-site judgements about mosquito infection rates. However, there is a small chance (about 2%) of getting false positives and a large chance (varying from about 10 %to 60%) of getting false negatives (below limit of detection). These estimates are based on two years of data in Illinois. The error rate varied through the season in both years and the overall rates differed between years.

CALENDAR OF MEETINGS AND EVENTS

The 2004 Biting Fly Workshop will take place on May 25-27, 2004, at Wakulla Springs State Park & Lodge in Wakulla Springs, Florida. *Contact*: Jim Cilek, J.A. Mulrennan Senior Entomological Research Laboratory, 4000 Franklin Avenue, Florida A&M University, Panama City, FL cilek_j@popmail.firn.edu; or Jeff Freeman, freemanj2@juno.com

The 50th Annual Meeting of the Michigan Entomological Society will take place on June 4-6, 2004, at the DNR Conference Center near Grayling, Michigan. http://insects.ummz.lsa.umich.edu/mes/

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The Society for Vector Ecology will hold its annual meeting on September 26-29, 2004, at the DoubleTree Guest Suites in Boston, Massachusetts. *Contact*: SOVE, 1966 Compton Avenue, Corona, CA 92881, Contact: Major Dhillon. phone 909-340-9792, fax 909-340-2515, sove@northwestmosquitovector.org, http://www.sove.org

CXXXII American Public Health Association (APHA) Annual Meeting (Washington, DC: November 7-11, 2004). Contact: Coordinator, APHA Annual Meeting, APHA, 800 I Street, NW, Washington, DC 20001. E-mail: donna.wright@apha.org;

American Society of Tropical Medicine and Hygiene, 53rd Annual Meeting, November 7 – November 11, 2004, Fontainebleau Hilton, Miami, Florida USA;. Contact: ASTMH Secretariat, 60 Revere Drive (Suite 500), Northbrook, IL 60062. Fax: 847/480-9282; E-mail: astmh@astmh.org;

The 2004 ESA Annual Meeting will be held November 14-18, 2004, in Salt Lake City, Utah. *Contact*: ESA Annual Meeting, 10001 Derekwood Lane, Suite 300, Lanham, MD 20706, phone 301-731-4535, fax 301-731-4538.

50th Annual Meeting of IMVCA at the Holiday Inn on November 18-19, 2004 in Urbana-Champaign, Illinois.

AMCA 2005 Annual Meeting, April 1 - 7, 2005, Vancouver, British Columbia V6C 2R7 Canada

The International Congress of Vector Ecology will be held on October 2-7, 2005, at John Ascuaga's Nugget Resort Casino in Reno, Nevada. *Contact*: sove@northwestmosquitovector.org, http://www.sove.org

54th American Society of Tropical Medicine and Hygiene Meeting, Washington, DC: December 11-15, 2005, astmh@astmh.org

From the Secretary-Treasurer's Desk

Nina Krasavin

As the new secretary-treasurer, I wanted to keep all of the members informed about our finances and new developments. I established a checking and savings account for the IMVCA at the University of Illinois Credit Union. Rosemarie Climpson transferred funds to these new accounts on March 17, 2004. The University of Illinois Credit Union offers free online banking and debit cards. Online banking allows us to have real-time access to account statements and it allows us to download electronic bank statements. A debit card is helpful because it is accepted by a large percentage of vendors, including online vendors. A debit card is not a line of credit (i.e.-a credit card). One can only spend funds that are present in the associated account. Thus, one can think of it as an "electronic check". Overall, these features allow for easy, accurate record keeping and reporting. A Dell laptop was purchased for financial book-keeping, keeping membership records, and will be taken to IMVCA meetings to facillitate check-in and collection of dues .

The IMVCA Executive Board voted me to chair the development of a webpage for the association. Karyla Trester was hired to create a webpage for IMVCA. She is still in the design phase of this project. Webhosting and DNS is being pursued through the University of Illinois. The domain "http://www.imvca.org/" will be requested.

That's all for now. The mosquito season has started so things are getting busy.

LESSONS LEARNED ABOUT WEST NILE VIRUS

Excerpts from a cover letter for an IDPH Memo on Mosquito Control in 2004 from Linn Haramis to local health departments

"The 2002 WNV outbreak in Illinois occurred during a summer with above normal temperatures. In contrast, summer 2003 was cooler than normal and there were far fewer cases in Illinois, see Table 1:

Table 1. Temperature Deviations from Normal
O'Hare Airport, Chicago*

2002		**2003**	
April	2.1	0.5	April
May	**-3.5**	**-2.5**	May
June	2.7	**-2.7**	June
July	3.8	**-1.0**	July
August	1.4	1.9	August
Sept	3.5	**-0.4**	Sept

	+ 10.00	***- 4.20***

*Degrees Fahrenheit

Many public health officials believe hot summer temperatures increase the rate of *Culex* mosquito production, mosquito flight activity and increase the rate of virus replication in mosquitoes. In turn, this increases the proportion of birds and mosquitoes infected with WNV and the risk of disease to humans. Consequently, how active WNV is during 2004 may be dependent on summer temperatures.

Furthermore, as severe as the 2002 WNV outbreak was in Illinois, there exists the possibility that WNV could again cause a major disease outbreak in the region. In 2003, during a hot summer, Colorado suffered the worst outbreak of WNV since its appearance in the U.S. in 1999, see Table 2:

Table 2. WNV Attack Rates for Illinois, 2002 and Colorado, 2003

State	Illinois: 2002	Colorado: 2003
Cases	884	2,943
Population	12,419,293	4,301,261
Attack Rate per 100,000 Population	**7**	68

Note that the WNV attack rate for the 2003 Colorado outbreak per 100,000 population (68) was 9.7 times the rate of the 2002 Illinois outbreak (7). If the same attack rate had occurred in Illinois during 2002 as occurred in Colorado during 2003, Illinois would have had more than 8,000 cases. Additionally, it should be noted that some states have had an increase in WNV cases several years after the disease appeared in the state. For example, Pennsylvania observed 245 cases during 2003; no more than 60 cases had been reported in previous years.

IDPH staff have heard that some local officials believe because fewer WNV cases occurred in 2003 than 2002, the risk of WNV has declined. However, at the end of August 2003, nearly all the crows and blue jays submitted for WNV testing were positive, which demonstrated high virus activity in wild birds. The important point to remember is that cooler temperatures during 2003 (compared to 2002) slowed mosquito breeding and virus amplification by several weeks, which reduced the risk of human cases. We believe that if a hot summer occurs, there is still a significant risk of a WNV outbreak in Illinois. Consequently, local officials should not become complacent and they should continue public information efforts, source reduction and larviciding directed at *Culex* mosquitoes. Local municipalities and mosquito abatement districts need to plan and budget for adequate mosquito control measures for the season. Mosquito-borne West Nile virus is likely to remain a threat to Illinois for the foreseeable future."

Mosquito Larvicides Commonly Used in Illinois

FROM IDPH MEMO

Note: Mosquito larvicides with methoprene or *Bacillus sphaericus* as the active ingredient have been found to be particularly effective for control of *Culex* mosquito larvae in catch basins.

Larvicide	***Type***	***Action***	***Primary Use***
Abate^{R} (Temephos)	Organophosphate	Directly toxic	Tires, containers, floodwater sites
Altosid^{R} (Methoprene)	Growth regulator	Prevents larvae from developing to adults	Catch basins, containers, floodwater sites
Bacillus thuringiensis israelensis (Bti)	Bacterial	Gut toxin	Floodwater, catch basins
Bacillus sphaericus (Bs)	Bacterial	Gut toxin	Catch basins, septic waters (for ***Culex***)
Oils (Golden Bear^{R} and BVA^{R})	Surface treatment	Suffocation: film covers air tubes of larvae	Floodwater, catch basins, septic waters

PROPOSED IMVCA MOSQUITO MANAGEMENT POLICY.

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In 1990, a mosquito management policy was approved by the IMVCA. It focused on the potential misuse of synthetic pesticides. Since that time much has changed, so now may be time to update the policy. Below is a working document. Comments are welcome!

The IMVCA wishes to promote an integrated approach to mosquito management based on the principles of IPM with 4 major conrnerstones: Surveillance, Integrated Control, Training, and Public Education.

Mosquitoes are a serious threat to human health and comfort ranging from the transmission of arboviruses, like West Nile virus, to the annoying bites of floodwater mosquitoes. The successful management of insect vectors and pests significantly increases access to the outdoors and the quality of life. The IMVCA wishes to establish a broad outline of the principles of integrated management of mosquitoes that can be adapted to local needs and conditions. Ideally, mosquito management should be based on the best available and scientifically supported methods of 1) surveillance and 2) integration of larval and adult control methods. In addition, two key components of any mosquito abatement program should be the appropriate training of personnel and a strong commitment to educating the public about vector-borne diseases, abatement actions, and the best methods for personal protection and source reduction by the homeowner.

SURVEILLANCE OF MOSQUITO POPULATIONS: Mosquito management measures should be based on adequate field data. Abatement efforts should respond to the presence of significant populations of pest and/or vector species or the detection of a risk of pathogen transmission, rather than based on a rigid temporal schedule of site treatment in the absence of monitoring. Preventive treatment of potential breeding sites by larvicidal agents or source reduction is both common and preferred in integrated management; however, this should be based on mapping of breeding sites and periodic surveillance. Surveillance provides the only means of judging the efficacy of various types of intervention. Regularly updated maps based on ground surveillance are an important component of a mosquito control program. Adult mosquito surveillance, coupled to an arbovirus surveillance protocol, provides a means of assessing risk levels and developing action thresholds for the use of adulticides.

INTEGRATED MANAGEMENT OF MOSQUITOES: Integrated management utilizes a spectrum of intervention measures to suppress the target mosquito population, while having minimal impact on non-targets. The primary or initial method of control should be source reduction i.e., the elimination, reduction, or modification of mosquito breeding sites. Source reduction is preferable to chemical control agents and should be attempted wherever economically and environmentally possible. Natural control by predators and/or parasites should be attempted under suitable conditions; however, the use of biological organisms should be based on scientific data and controlled field experiments rather than testimonials and tradition. These measures are typically effective against specific types of breeding sites.

Although source reduction and natural control are strongly encouraged, they rarely reduce mosquito populations to tolerable or acceptable levels over broad areas during mosquito population peaks. Therefore, a strong larviciding program is a prerequisite for any effective mosquito control organization. Adulticiding should be considered a supplement to, rather than a substitute for, larviciding. Consequently, safe and effective pesticides should be used with an emphasis on relatively mosquito-specific agents, whether they be synthetic chemicals, microbial insecticides, or insect growth regulators. Not all agents are suitable under all environmental conditions, so the choice of a particular agent should be based on: 1) the biology of the target mosquito species, 2) the life stage targeted (larvae or adults), and 3) the local environmental and ecological conditions. Chemical control agents are appropriate when chosen based on mammalian safety, target specificity, and biodegradability.

TRAINING OF MOSQUITO CONTROL PERSONNEL: All mosquito management personnel should receive adequate training, including periodic re-training on the proper use, and consequences of misuse, of various control methods and agents. Label recommendations and manufacturer's instructions should be followed. Chemical control agents should be applied under proper environmental and ecological conditions in order to ensure effective control and avoidance of beneficial insects and non-targets. Control programs should not be based on traditions and calendar dates, but should be periodically reviewed and updated when appropriate. In addition to their responsibility to serve the public, mosquito control personnel have a responsibility to protect the public and environment from improper use of mosquito control agents.

PUBLIC EDUCATION: One of the strongest weapons the mosquito control worker has is an informed, educated public. An informed public can help mosquito control workers minimize breeding sites in residential areas. An aggressive public education program will help reduce misinformation and minimize unreasonable demands on mosquito control workers. Various media groups should be enlisted to help inform the public about the methods and requirements for effective mosquito management, in order to reduce disease transmission and nuisance. This should be done providing the best scientific evidence available.

or policy of the IMVCA. Articles and comments can be emailed to richlamp@uiuc.edu Use IMVCA as the subject line.