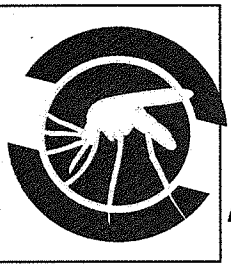
07 - 0476



mmcd

METROPOLITAN MOSQUITO CONTROL DISTRICT

# 2006 Operational Review & Plans for 2007

*Annual Report to the Technical Advisory Board*

METROPOLITAN MOSQUITO CONTROL DISTRICT
Metro Counties Government Center
2099 University Avenue West
St. Paul, MN 55104-3431

# Metropolitan Mosquito Control District

## Mission

The Metropolitan Mosquito Control District's mission is to promote health and well being by protecting the public from disease and annoyance caused by mosquitoes, black flies, and ticks in an environmentally sensitive manner.

## Governance

The Metropolitan Mosquito Control District, established in 1958, controls mosquitoes and gnats and monitors ticks in the metropolitan counties of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington. The District operates under the eighteen-member Metropolitan Mosquito Control Commission (MMCC), composed of county commissioners from the participating counties. A director is responsible for the operation of the program and reports to the MMCC.

## Metropolitan Mosquito Control Commission 2007

| | |
|---|---|
| Penny Steele, Chair | Hennepin County |
| Myra Peterson, Vice Chair | Washington Co. |
| Jim McDonough, Secretary | Ramsey County |
| Dick Lang | Anoka County |
| Rhonda Sivarajah | Anoka County |
| Robyn West | Anoka County |
| James Ische | Carver County |
| Tom Workman | Carver County |
| Thomas Egan | Dakota County |
| Kathleen Gaylord | Dakota County |
| Nancy Schouweiler | Dakota County |
| Randy Johnson | Hennepin County |
| Mike Opat | Hennepin County |
| Tony Bennett | Ramsey County |
| Janice Rettman | Ramsey County |
| Jerry Hennen | Scott County |
| Barbara Marschall | Scott County |
| Dennis Hegberg | Washington Co. |

## Technical Advisory Board

The TAB was formed in 1981 by the MMCC to provide annual independent review of the field control programs, to enhance inter-agency cooperation, and to facilitate compliance with Minnesota State Statute 473.716.

## Technical Advisory Board Members 2006-2007

| | |
|---|---|
| Sarma Straumanis | Mn Dept. of Transportation |
| Robert Koch | Mn Dept. of Agriculture |
| Laurence Gillette | Three Rivers Park District |
| Steve Hennes | Mn Pollution Control Agency |
| Gary Montz | Mn Dept. of Natural Resources |
| Roger Moon | University of Minnesota |
| David Neitzel, Chair | Mn Department of Health |
| Karen Oberhauser | University of Minnesota |
| Susan Palchick | Hennepin Co. Comm. Health |
| Robert Sherman | Independent Statistician |
| Terry Schreiner | US Fish & Wildlife Service |
| Rick Bennett | US EPA |

## Metropolitan Mosquito Control District Contributing Staff

| | |
|---|---|
| Jim Stark | Executive Director |
| Stephen Manweiler | Director of Operations/Tech. Serv. |
| Sandy Brogren | Entomologist |
| Diann Crane | Asst. Entomologist |
| Janet Jarnefeld | Technical Services/Tick |
| Kirk Johnson | Vector Ecologist |
| Carey LaMere | Technical Services |
| Mike McLean | Public Affairs |
| Nancy Read | Technical Services Coordinator |
| Mark Smith | Tech. Serv./Control Materials |
| John Walz | Technical Services/Black Fly |

mmcd
METROPOLITAN MOSQUITO CONTROL DISTRICT

Website: www.mmcd.org

Metro Counties Government Center
2099 University Avenue West
Saint Paul, MN 55104-3431

Phone: 651-645-9149
FAX: 651-645-3246
TTY use Minnesota Relay Service

Dear Reader:

The Technical Advisory Board (TAB) has reviewed the following report and provided comments and recommendations for improvement in District operations. At their April 2007 meeting the Metropolitan Mosquito Control Commission (MMCC) approved the Metropolitan Mosquito Control District's (MMCD) 2006 Operational Review and Plans for 2007 and thanked the TAB for their work.

In May of 2006, I became MMCD's Executive Director. I believe strategic planning is one of the most important of all business functions. MMCD staff has been working on establishing goals and developing short and long term plans to meet them. Management and the MMCC have developed a five year capital growth plan that provides for adequate infrastructure and increased staff and control materials to meet service needs. The following report reflects this strategic perspective and MMCD will continue to use long range planning as we move forward.

Advancements in technology are having significant impacts on mosquito abatement and MMCD is intimately involved in these technologies. Data from larval and adult inspections and control efforts are entered in the field using Palm OS-based Personal Digital Assistants, allowing for real-time scrutiny of data. MMCD continues to refine its electronic field and lab data entry system "DataGate". In addition, MMCD is using a new web-based mapping system that makes site maps and treatment records for the entire District readily available. In 2006 we began testing a global positioning navigation system in our contracted helicopters and plan to go operational with this system in 2007. This system helps locate breeding sites for the pilots and provides a graphic record of treatments for MMCD staff.

The following report contains other examples where new methods have improved our program and MMCD is committed to being an industry leader in the development and implementation of new technology. I hope you find the information in this report useful and please do not hesitate to contact me if you would like additional information regarding our program.

Sincerely,

James R. Stark

James R. Stark
Executive Director
Metropolitan Mosquito Control District
2099 University Avenue West
St. Paul, MN 55104
(651) 643-8363
jimstark@mmcd.org

MINNESOTA MDH DEPARTMENT OF HEALTH

*Protecting, maintaining and improving the health of all Minnesotans*

March 12, 2007

Commissioner Penny Steele, Chair
Metropolitan Mosquito Control Commission
2099 University Avenue West
St. Paul, MN 55104

Dear Commissioner Steele:

The Technical Advisory Board (TAB) met on February 21, 2007 to review and discuss Metropolitan Mosquito Control District (MMCD) operations in 2006 and plans for 2007. As you know, the TAB was originally formed to provide annual independent review of field control programs and to enhance inter-agency cooperation.

After an excellent interchange of questions and information between the TAB and MMCD staff, the TAB approved the following resolution:

> The TAB commends the District on using cutting-edge technology and methods and recommends that MMCD continues to explore new applications of information technology to improve District programs.

To enhance discussion in future meetings, we have also encouraged the District to focus the agenda on program changes, challenges, or other areas where TAB member comments are needed.

Thank you for the opportunity to review MMCD operations.

Sincerely,

David Neitzel

David Neitzel, MS
Chair, Technical Advisory Board
Epidemiologist
Foodborne, Vectorborne, and Zoonotic Disease Unit
Acute Disease Investigation and Control Section
Infectious Disease Epidemiology, Prevention, and Control Division
625 Robert Street North
Saint Paul, Minnesota 55164
(651) 201-5414
Fax: (651) 201-5743

DFN:dd

cc: Stephen Manweiler, PhD

# Table of Contents

*Page intentionally blank*

# Chapter 1 Mosquito Surveillance

**2006 Highlights**

- April was second warmest and second wettest on record, creating overlapping spring and summer mosquito broods
- Average rainfall below average for the season
- Rainstorms produced only 6 broods of mosquitoes
- Staff identified 20,506 larval samples
- *Coquillettidia perturbans* most predominant species captured in $CO_2$ traps

**2007 Plans**

- Continue *Aedes* surveillance strategies as in 2006
- Re-evaluate placements of both $CO_2$ traps and gravid traps
- Work to improve *Culex* larval and adult surveillance strategies
- Continue to improve relay of surveillance results from lab to field

## 2006 Mosquito Surveillance Results

### Background

The MMCD conducts larval and adult mosquito surveillance to determine levels of mosquitoes present, measure annoyance, and to detect the presence of disease vector species. Since different species of mosquitoes have different habits and habitat preferences, a variety of surveillance methods are used. Knowing what species are present in an area, and at what levels, helps the District direct its control measures effectively.

### Rainfall

Rainfall surveillance is an important tool used to estimate the amount of larval breeding and to determine the areas to dispatch work crews following a rain event. The District operates a network of 79 rain gauges from May to September. The Minnesota Department of Natural Resources (MnDNR) also uses this information to augment their rain gauge network.

Average rainfall in the District from May 1 through September 30, 2006 was 18.65 inches (Table 1.1). This is 5 inches less than last year and 0.93 inches below the 48-year District average. The distribution of the rain was fairly even throughout the District with Scott County receiving the most rain.

Typically, a rain event $\geq$ 1 inch can produce a brood of floodwater mosquitoes. We experienced six District-wide broods in 2006 (Figure 1.1). Warm temperatures in early March melted the snow, producing a brood of spring mosquito species. April was the second warmest and the second wettest on record. The combination of snowmelt, rain and warm temperatures created overlapping spring and summer mosquito broods. July was the third hottest on record, with only a few small broods. August had a 1-4 inch rain event and an event with baseball-sized hail in some areas of the District. There was one large, one medium and a few small broods in September that kept us busy until the end of the season.

Table 1.1 Average rainfall received in each county from May through September, 2002-2006 and 48-year District average.

| | Anoka | Carver | Dakota | Hennepin | Ramsey | Scott | Wash. | District |
|---|---|---|---|---|---|---|---|---|
| 2002 | 26.93 | 29.96 | 30.03 | 30.23 | 29.28 | 28.53 | 28.36 | 29.13 |
| 2003 | 17.30 | 14.15 | 14.72 | 17.59 | 18.07 | 13.34 | 18.00 | 16.79 |
| 2004 | 20.26 | 25.22 | 21.89 | 22.18 | 20.73 | 23.50 | 20.62 | 21.65 |
| 2005 | 22.20 | 22.75 | 21.53 | 22.75 | 23.00 | 24.25 | 23.87 | 23.60 |
| 2006 | 19.78 | 17.90 | 17.46 | 18.71 | 19.06 | 19.50 | 17.21 | 18.65 |
| 48-Year Avg | 19.07 | *20.49 | 19.81 | 19.75 | 19.99 | 19.48 | 20.21 | 19.58 |

*24-year average

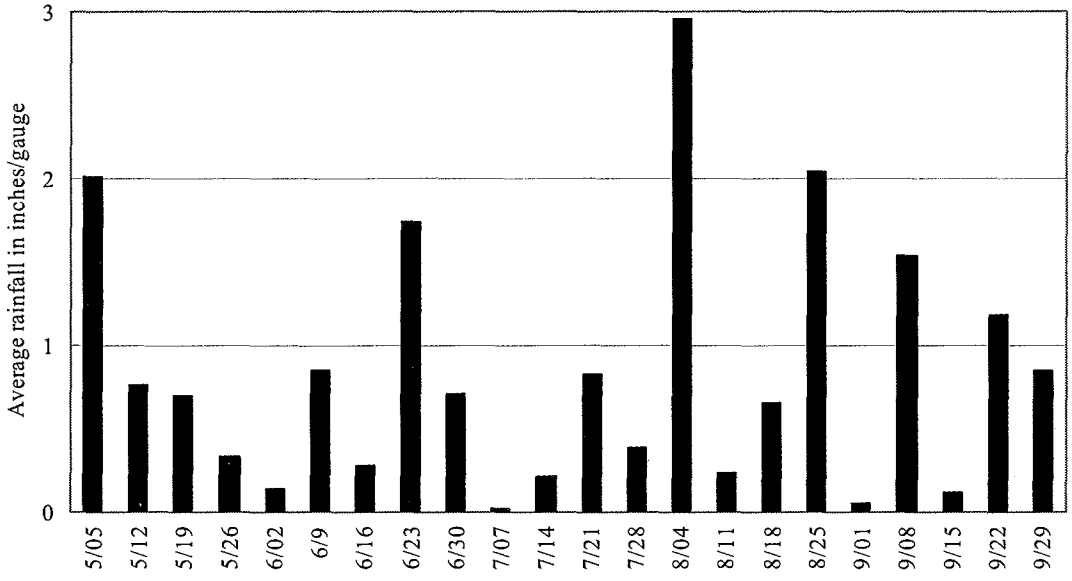



Figure 1.1 Average rainfall per gauge per week, 2006

## Larval Collections

Larval mosquito collections are taken to determine if targeted species are present at threshold levels or to obtain species history in a breeding site. In 2006, staff identified 20,506 larval collections. To accelerate the identification of samples from sites to be treated by helicopter, *Culex* larvae were identified to species, but all other larvae were identified to genus only. Lower priority samples were identified to species. Table 1.2 shows the results of the 11,650 samples identified to species and calculated as the percent of samples in which the species was present.

This season, Technical Services hired two seasonal Inspectors, based at the Main Office, to treat and inspect storm water catch basins in St. Paul that are normally the responsibility of other field facilities. This allowed those facilities more time to perform other duties and also provided an opportunity for more intensive catch basing sampling to be completed. Sample results are in Table 1.2.

Table 1.2 Percent of samples where larval species occurred in standard dipper collections by facility and District total, 2006. The total number of samples processed to species is in parentheses.

| | Percent of samples where species occurred by facility | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | North (755) | East (2,757) | South Rosemount (2,041) | South Jordan (1,521) | West Plymouth (2,663) | West Maple Grove (1,610) | Main Office (303) | District (11,634) |
| *Aedes abserratus* | 0.5 | 0.3 | 0.1 | 0.1 | 0.3 | | | 0.2 |
| *aurifer* | | | | 0.1 | | | | < |
| *canadensis* | 0.4 | 0.7 | 2.2 | 0.5 | 1.3 | 0.9 | | 1.0 |
| *cinereus* | 29.8 | 12.7 | 8.3 | 13.1 | 14.2 | 11.2 | | 12.9 |
| *dorsalis* | 0.1 | 0.1 | 0.3 | 0.6 | 0.3 | 0.6 | | 0.3 |
| *excrucians* | 6.6 | 10.2 | 4.5 | 2.7 | 4.1 | 4.1 | | 5.5 |
| *fitchii* | 1.6 | 3.1 | 1.7 | 0.9 | 0.5 | 1.5 | | 1.6 |
| *flavescens* | | < | | 0.1 | < | | | < |
| *implicatus* | 0.3 | 0.3 | 0.2 | 0.1 | 0.3 | 0.1 | | 0.2 |
| *nigromaculis* | | | 0.1 | | | | | < |
| *punctor* | 0.3 | 0.1 | | 0.1 | < | | | 0.1 |
| *riparius* | 0.7 | 0.3 | 0.5 | | 0.9 | 0.7 | | 0.5 |
| *spencerii* | | | | | | 0.1 | | < |
| *sticticus* | 2.3 | 2.4 | 3.3 | 1.0 | 3.0 | 1.6 | | 2.3 |
| *stimulans* | 3.0 | 8.6 | 6.5 | 3.8 | 9.2 | 1.8 | | 6.2 |
| *provocans* | | 0.2 | | | 0.1 | | | 0.1 |
| *trivittatus* | 0.5 | 3.2 | 1.4 | 1.8 | 2.0 | 3.1 | | 2.1 |
| *vexans* | 34.6 | 33.7 | 29.0 | 29.4 | 43.3 | 32.9 | 2.0 | 33.6 |
| *Ae.* species | 34.7 | 19.7 | 14.1 | 16.9 | 18.4 | 15.9 | 1.0 | 18.0 |
| *Anopheles earlei* | 0.1 | 0.1 | | | | 0.1 | | < |
| *punctipennis* | 0.4 | 0.4 | 0.4 | 0.1 | 0.1 | 0.1 | | 0.3 |
| *quadrimaculatus* | | 0.1 | 0.1 | 0.1 | < | | | 0.1 |
| *walkeri* | 0.1 | | | 0.1 | | | | < |
| *An.* species | 2.5 | 3.4 | 3.7 | 2.2 | 1.2 | 2.1 | | 2.5 |
| *Culex pipiens* | 1.3 | 2.8 | 7.7 | 3.2 | 2.3 | 6.4 | 38.3 | 4.9 |
| *restuans* | 7.9 | 7.7 | 23.6 | 13.7 | 14.1 | 19.9 | 85.1 | 16.4 |
| *salinarius* | | < | 0.1 | | | 0.2 | | < |
| *tarsalis* | 0.9 | 1.8 | 4.6 | 4.5 | 1.4 | 3.1 | 0.7 | 2.6 |
| *territans* | 8.6 | 14.9 | 12.8 | 22.5 | 5.5 | 17.7 | | 13.0 |
| *Cx.* species | 3.2 | 2.0 | 8.9 | 6.3 | 4.4 | 9.2 | 75.6 | 7.3 |
| *Culiseta inornata* | 13.1 | 24.2 | 28.1 | 19.5 | 22.3 | 15.5 | 1.0 | 21.3 |
| *melanura* | 0.1 | < | | | | 0.1 | | < |
| *minnesotae* | 0.1 | 0.7 | 0.4 | 1.3 | 0.4 | 1.4 | | 0.7 |
| *morsitans* | 0.1 | 0.1 | | | | | | < |
| *Cs.* species | 4.1 | 1.7 | 1.4 | 2.2 | 0.6 | 3.9 | | 1.9 |
| *Psorophora ferox* | | < | | | 0.1 | | | < |
| *Ps.* species | | | < | | 0.1 | | | < |
| *Uranotaenia sapphirina* | 1.5 | 2.6 | 0.6 | 1.1 | 0.4 | 0.9 | | 1.2 |

< = percent of total is less than 0.1%

*Aedes vexans* and the insidious ankle-biter, *Aedes cinereus,* were the most abundant human-biting species in larval collections, in 1st and 5th place District-wide. The typically non-human biting species, *Culiseta inornata,* had the second highest frequency overall and *Culex restuans* and *Culex territans* ranked 3rd and 4th overall. The spring species, *Aedes stimulans* and *Aedes excrucians* came in 6th and 7th place. *Culex tarsalis* larvae occurred in 2.6% of the samples, ranking 8th. The high amount of "*Aedes* species" is normal and represents 1st instar larvae that are unidentifiable to species.

## Adult Collections

There are 50 species of mosquitoes known to occur in Minnesota and different species exhibit a variety of host preferences. About 45 of these species, 20 of which are human biting, occur in the District. Other species prefer to feed on birds, large mammals, reptiles, or amphibians. Additionally, species of mosquitoes differ in their peak activity periods and in how strongly they are attracted to humans or trap baits (e.g., light or $CO_2$). Therefore, a variety of adult mosquito collection methods are used in order to capture targeted species.

Most of the mosquitoes collected are identified to species, but in some cases, species are grouped together to expedite sample processing. *Aedes* mosquitoes can be grouped by their seasonal occurrence (spring, summer). Some vector species are grouped because species-level separation is very difficult (*Cx. pipiens/restuans*).

Spring *Aedes* larvae hatch as a result of snow melt and adults emerge in late April to early May. They have one generation each season and adults can live for three months. The summer *Aedes* (*Ae. vexans, Ae. sticticus, Ae. trivittatus*) begin hatching in early May as a result of rainfall. They can have several generations throughout the summer. *Coquillettidia perturbans*, the cattail mosquito, breeds in cattail marshes and has one generation per year, peaking in early July. A more detailed description of the biologies of mosquitoes occurring in the District is in Appendix A.

The sweep net and $CO_2$ trap data reported in this chapter are weekly collections referred to as the Monday night network. Employees took two-minute sweep net collections and/or set overnight $CO_2$ traps in their yards every Monday night for 20 weeks.

**Sweep Net Collections** The District uses sweep net collections to monitor human annoyance during the peak mosquito activity period, which is 35-40 minutes after sunset for most mosquito species. The number of collectors varied from 79-149 per evening. Sweep net collection locations in 2006 are shown in Figure 1.2. A total of 2,297 collections were taken containing a total of 1,417 mosquitoes. Summer *Aedes* species and *Cq. perturbans* tied for the predominant species in the evening sweep net collections (Table 1.3). Summer *Aedes* were at their lowest levels in five years and spring *Aedes* levels were very low. *Culex tarsalis* is uncommon in sweep net collections; this is reflected in their very low abundance.

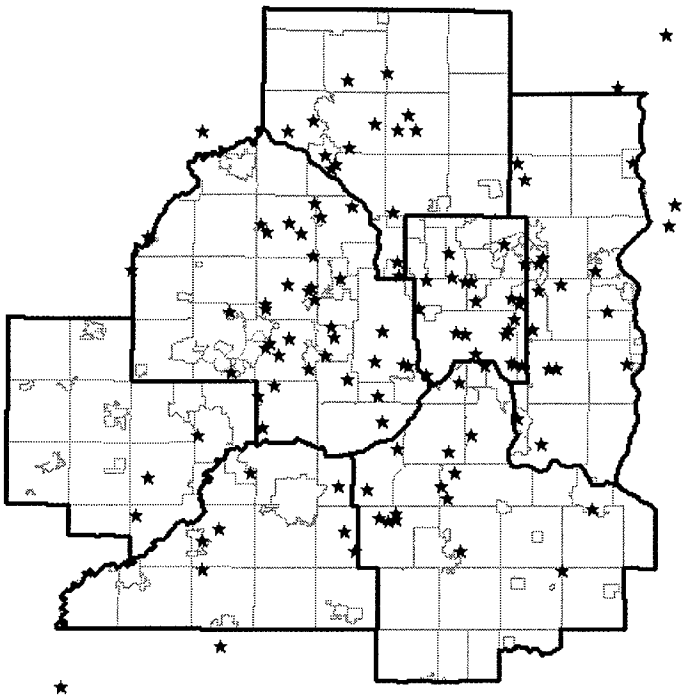


Figure 1.2 Locations of weekly evening sweep net collections, 2006

Table 1.3 Average number of mosquitoes collected per evening sweep net collection within the District, 2002-2006.

| Year | Summer *Aedes* | *Cq. perturbans* | Spring *Aedes* | *Cx. tarsalis* |
|---|---|---|---|---|
| 2002 | 4.2 | 0.5 | 0.1 | 0.01 |
| 2003 | 4.7 | 0.8 | 0.2 | 0.01 |
| 2004 | 3.4 | 0.3 | 0.02 | 0.01 |
| 2005 | 1.1 | 0.3 | 0.04 | 0.01 |
| 2006 | 0.3 | 0.3 | 0.03 | 0.004 |

**$CO_2$ Trap Collections** $CO_2$ traps baited with dry ice are used to monitor mosquito population levels and the presence of disease vector species. In 2006, we operated 128 traps to allow maximum coverage of the District. Some of these traps were placed in specific locations to collect the vector species *Cx. tarsalis* for WNV testing and *Culiseta melanura* for Eastern Equine encephalitis testing (Fig. 1.3). The number of traps operated per night varied from 109-121. A total of 2,085 trap collections were processed, containing 299,857 mosquitoes.

Summer *Aedes* and *Cq. perturbans* were the predominant species captured in the traps (Table 1.4). Even though *Cq. perturbans* populations were average this season, it was the predominant species. Typically, summer *Aedes* are the most numerous species. Due to the dry, hot summer with few broods of mosquitoes, summer *Aedes* populations were very low this season. In contrast, the very warm and wet spring caused an increase in the spring *Aedes* populations. *Culex tarsalis* numbers were similar to last year. Populations of the rare species *Anopheles quadrimaculatus* and *Culex erraticus* were unusually high this season. Staff are investigating the

possibility that climate changes are the cause of this occurrence. Their results will be presented at the American Mosquito Control Association meeting in April 2007.

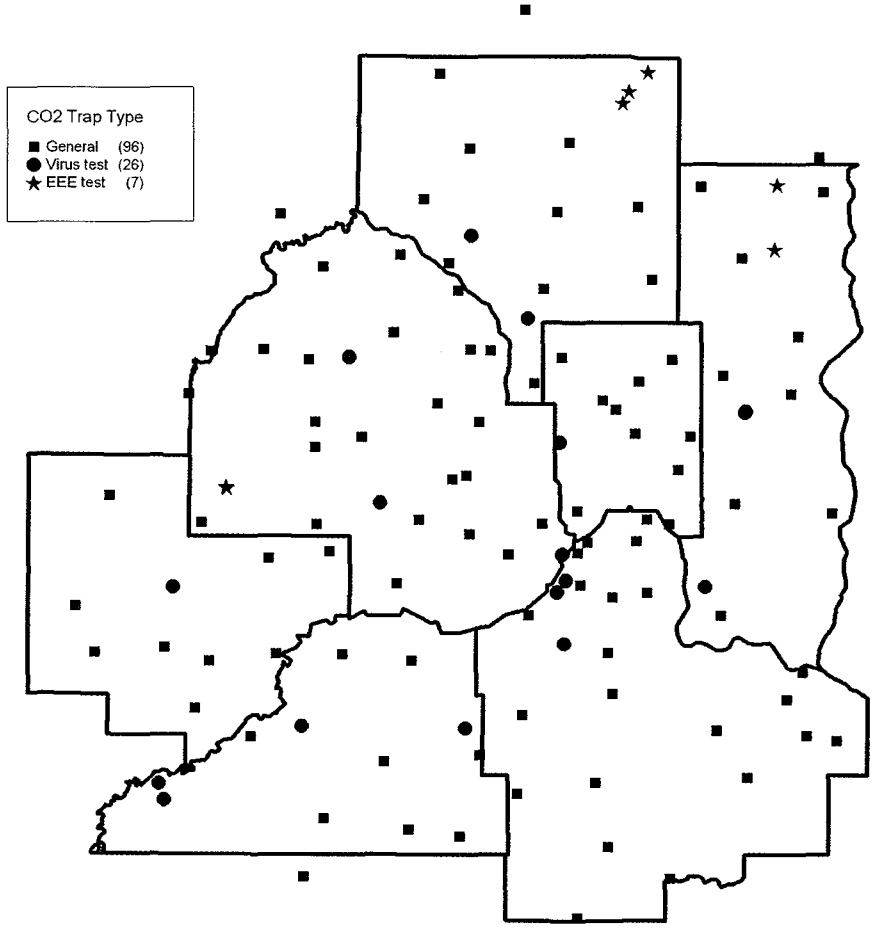



Fig. 1.3 Locations of $CO_2$ traps to monitor general mosquito populations, WNV vectors and the eastern equine encephalitis vector.

Table 1.4 Average number of mosquitoes collected in $CO_2$ traps within the District, 2002-2006.

| Year | Summer *Aedes* | *Cq. perturbans* | Spring *Aedes* | *Cx. tarsalis* |
|---|---|---|---|---|
| 2002 | 426.3 | 58.6 | 7.7 | 0.6 |
| 2003 | 457.8 | 103.7 | 6.9 | 1.2 |
| 2004 | 391.9 | 35.3 | 1.5 | 2.3 |
| 2005 | 201.5 | 42.0 | 6.9 | 1.6 |
| 2006 | 51.7 | 75.8 | 10.2 | 1.5 |

Figure 1.4 displays the geographic distribution of mosquitoes collected in sweep nets. White areas are tolerable annoyance levels (0-4), lightest gray is moderate (5-9), darker gray is bad (10-14), and black is extremely bad (>15). Except for a few locations in July, District mosquito levels were at tolerable levels throughout the season.

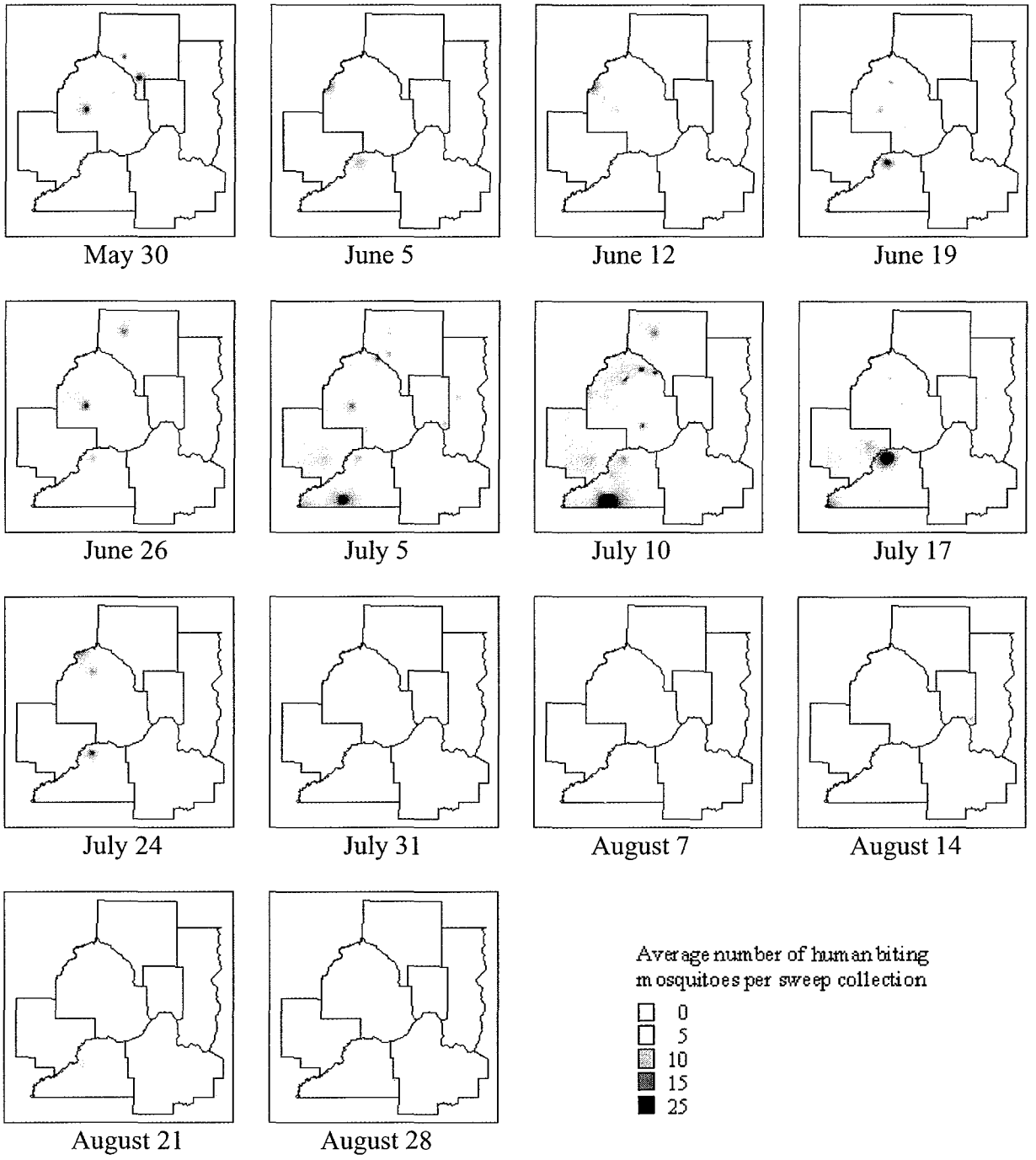



Fig. 1.4 Average number of human-biting mosquitoes in sweep net collections, 2006.

**Seasonal Distribution** Sweep net and $CO_2$ trap collections detected three peaks of *Aedes* mosquitoes in 2006 (Figures 1.5 and 1.6). Population levels of *Aedes* increased sharply at the end of May, peaked again in early July, then peaked a third time in mid-August. *Cq. perturbans* populations peaked in early July.

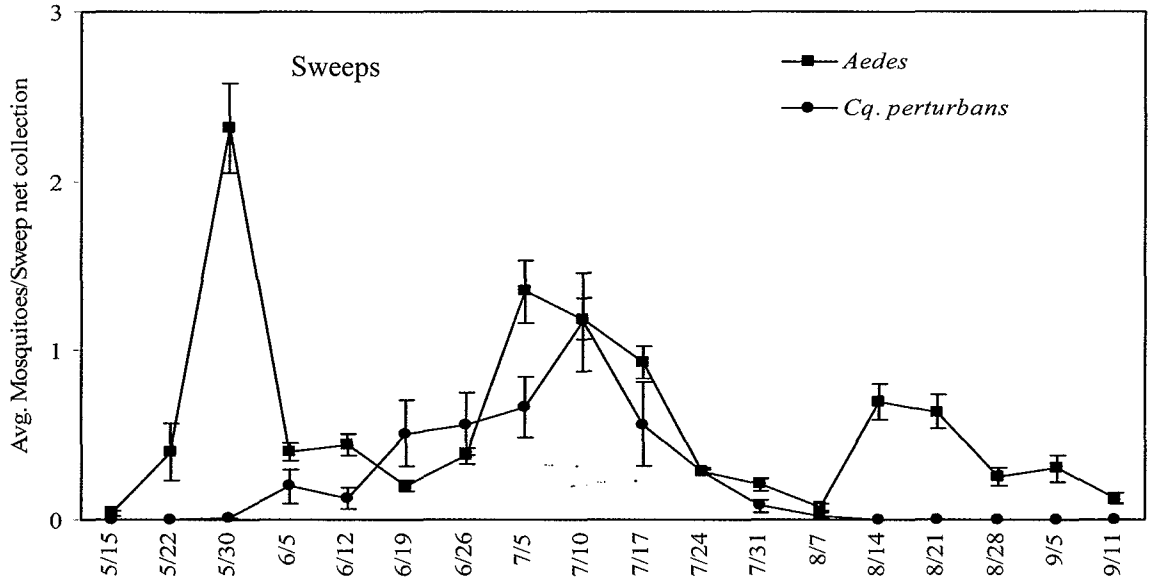



Figure 1.5 Average number of *Aedes* and *Cq. perturbans* per evening sweep net collection, 2006. Error bars equal ± 1 standard error of the mean.

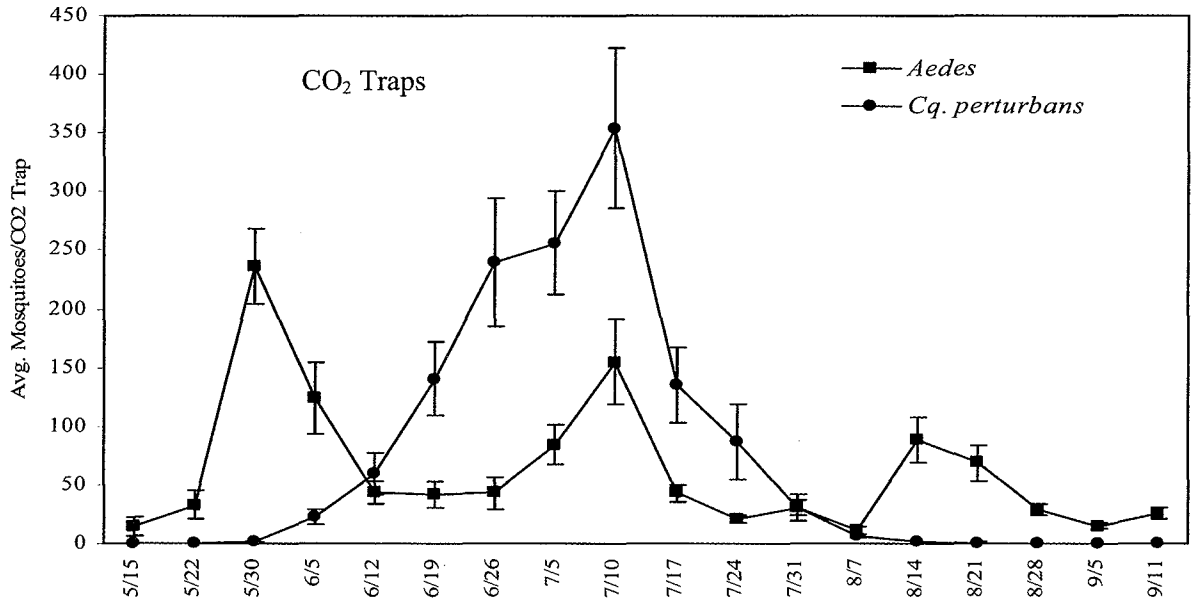



Figure 1.6 Average number of *Aedes* and *Cq. perturbans* per $CO_2$ trap, 2006. Error bars equal ± 1 standard error of the mean.

**New Jersey Light Traps** Data collected from New Jersey light traps are used to compare mosquito species population levels from year to year. These are the only collections where all adult female mosquitoes are identified to species. Traps are run nightly from May to September. The District operated seven traps in 2006. Trap 1 was located in St. Paul, trap 9 in Lake Elmo, trap 13 in Jordan, trap 16 in Lino Lakes, trap MG in Maple Grove (relocated 1 mile from 2005 location), trap CA in Carlos Avery Wildlife Refuge, and trap AV at the Minnesota Zoo in Apple Valley (Figure 1.7). Traps 1, 9, and 16 have operated each year since 1960.

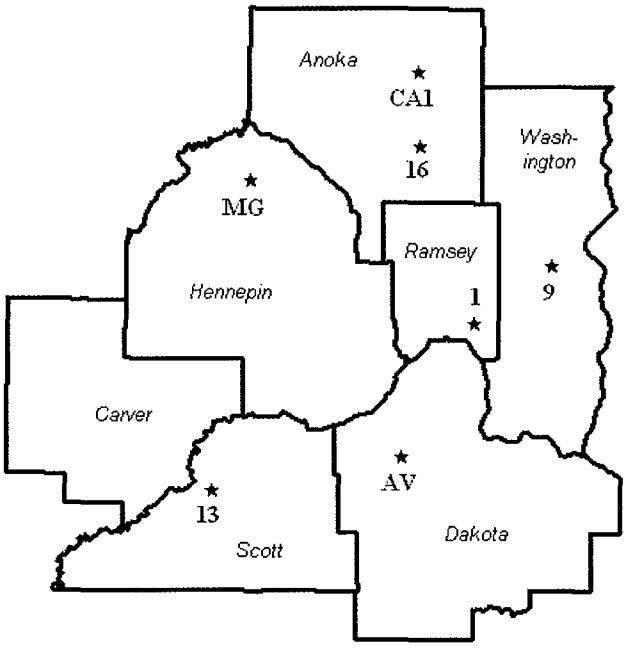



Figure 1.7 New Jersey light trap locations, 2006

A total of 40,813 females were identified in New Jersey traps in 2006 (Table 1.5). *Coquillettidia perturbans* was the most numerous comprising 46% of the total and *Aedes vexans* was the second most numerous at 28%. The number of the rare species, *Anopheles quadrimaculatus*, increased from 2 in 2005 to 61 in 2006. The number of female mosquitoes collected per night from 1965 to 2006 is shown in Appendix B.

Table 1. 5. Total number and frequency of occurrence for each species collected in New Jersey light traps, May 6-Sept. 22, 2006.

| | Trap Code, Location, and Number of Collections | | | | | | | Summary Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 9 | 13 | 16 | MG | CA1 | AV | Season | | |
| | St. Paul | Lk. Elmo | Jordan | Lino Lks. | N. Henn. | Carlos | Apple Valley | Total | % Female | Avg per |
| Species | 128 | 137 | 140 | 140 | 133 | 134 | 107 | 919 | Total | Night |
| *1. Ae. abserratus* | 1 | 0 | 0 | 0 | 2 | 216 | 0 | 219 | 0.54% | 0.24 |
| *3. aurifer* | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0.00% | 0.00 |
| *6. canadensis* | 0 | 0 | 1 | 0 | 0 | 13 | 0 | 14 | 0.03% | 0.02 |
| *7. cinereus* | 3 | 2 | 7 | 31 | 32 | 975 | 16 | 1,066 | 2.61% | 1.16 |
| *10. dorsalis* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *11. excrucians* | 0 | 2 | 0 | 0 | 8 | 37 | 1 | 48 | 0.12% | 0.05 |
| *12. fitchii* | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0.00% | 0.00 |
| *13. flavescens* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *14. implicatus* | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0.00% | 0.00 |
| *16. nigromaculus* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *18. punctor* | 1 | 1 | 0 | 2 | 3 | 239 | 0 | 246 | 0.60% | 0.27 |
| *19. riparius* | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 0.01% | 0.00 |
| *20. spenceri* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *21. sticticus* | 0 | 0 | 73 | 1 | 0 | 49 | 3 | 126 | 0.31% | 0.14 |
| *22. stimulans* | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 4 | 0.01% | 0.00 |
| *23. provocans* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *24. triseriatus* | 3 | 2 | 0 | 5 | 4 | 3 | 0 | 17 | 0.04% | 0.02 |
| *25. trivittatus* | 1 | 1 | 1 | 0 | 4 | 0 | 0 | 7 | 0.02% | 0.01 |
| *26. vexans* | 586 | 364 | 892 | 1,828 | 2,724 | 4,688 | 528 | 11,610 | 28.45% | 12.63 |
| *118. abs/punct.* | 3 | 6 | 0 | 2 | 7 | 5,760 | 3 | 5,781 | 14.16% | 6.29 |
| *261.* species | 8 | 9 | 5 | 15 | 28 | 418 | 7 | 490 | 1.20% | 0.53 |
| *262.* Spring *Aedes* | 0 | 1 | 0 | 1 | 6 | 250 | 1 | 259 | 0.63% | 0.28 |
| *264.* Summer *Aedes* | 0 | 0 | 7 | 0 | 0 | 2 | 0 | 9 | 0.02% | 0.01 |
| *27. An. barberi* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *28. earlei* | 0 | 0 | 0 | 0 | 3 | 17 | 0 | 20 | 0.05% | 0.02 |
| *29. punctipennis* | 11 | 7 | 27 | 6 | 18 | 55 | 7 | 131 | 0.32% | 0.14 |
| *30. quadrimac.* | 11 | 20 | 8 | 4 | 1 | 11 | 6 | 61 | 0.15% | 0.07 |
| *31. walkeri* | 0 | 2 | 39 | 6 | 15 | 689 | 0 | 751 | 1.84% | 0.82 |
| *311. An.* species | 0 | 2 | 0 | 1 | 0 | 19 | 1 | 23 | 0.06% | 0.03 |
| *32. Cx. erraticus* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *33. pipiens* | 1 | 0 | 3 | 0 | 0 | 1 | 0 | 5 | 0.01% | 0.01 |
| *34. restuans* | 33 | 26 | 11 | 40 | 37 | 26 | 14 | 187 | 0.46% | 0.20 |
| *35. salinarius* | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0.00% | 0.00 |
| *36. tarsalis* | 8 | 7 | 10 | 19 | 22 | 6 | 0 | 72 | 0.18% | 0.08 |
| *37. territans* | 5 | 1 | 1 | 3 | 13 | 9 | 14 | 46 | 0.11% | 0.05 |
| *371. Cx. species* | 6 | 3 | 0 | 6 | 3 | 3 | 2 | 23 | 0.06% | 0.03 |
| *372. Cx. pip/rest* | 19 | 24 | 3 | 23 | 10 | 27 | 8 | 114 | 0.28% | 0.12 |
| *38. Cs. inornata* | 44 | 19 | 11 | 34 | 37 | 76 | 80 | 301 | 0.74% | 0.33 |
| *39. melanura* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *40. minnesotae* | 0 | 0 | 0 | 19 | 8 | 58 | 0 | 85 | 0.21% | 0.09 |
| *41. morsitans* | 0 | 0 | 1 | 0 | 0 | 7 | 0 | 8 | 0.02% | 0.01 |
| *411. Cs. species* | 0 | 0 | 0 | 5 | 2 | 3 | 1 | 11 | 0.03% | 0.01 |
| *42. Cq. perturbans* | 160 | 22 | 119 | 709 | 3758 | 14,013 | 158 | 18,939 | 46.40% | 20.61 |
| *44. Ps. ciliata* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *47. horrida* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *471. Ps. species* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 0.00 |
| *48. Ur. sapphirina* | 7 | 36 | 9 | 4 | 44 | 7 | 5 | 112 | 0.27% | 0.12 |
| 501. Unident. | 0 | 1 | 0 | 11 | 3 | 1 | 3 | 19 | 0.05% | 0.02 |
| Female Total | 911 | 558 | 1,228 | 2,776 | 6,796 | 27,685 | 859 | 40,813 | 74.39% | 44.41 |
| Male Total | 332 | 573 | 504 | 891 | 1,614 | 9,737 | 397 | 14,048 | 25.61% | 15.29 |
| Grand Total | 1,243 | 1,131 | 1,732 | 3,667 | 8,410 | 37,422 | 1,256 | 54,861 | 100.00% | 59.70 |

## Vector Mosquito Surveillance

***Aedes triseriatus*** Aspirator surveillance for the La Crosse encephalitis vector *Ae. triseriatus* was initiated during the week of May 21st. The peak rate of capture of just over 1.5 *Ae. triseriatus* per sample occurred during the weeks of June 11th and August 27th (Figure 1.8). Because of the effects of the 2006 drought, capture rates were extremely low in July and early August.

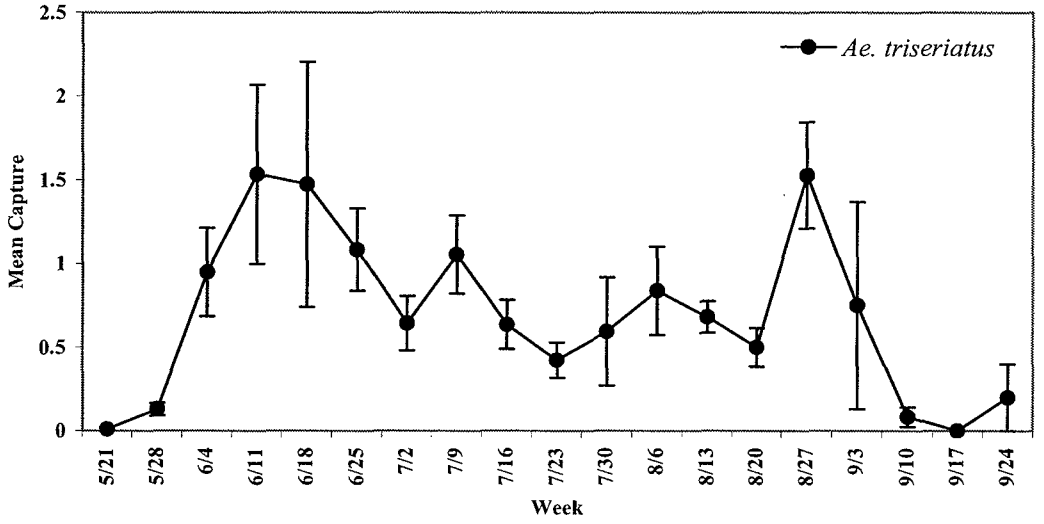



Figure 1.8 Mean number of *Ae. triseriatus* adults in aspirator samples, plotted by week. Dates listed are the first sampling day of each week. Sites sampled varied by week, although several locations were monitored repeatedly during the season. Error bars equal ± 1 standard error of the mean.

***Culiseta melanura*** District staff monitored six locations for *Cs. melanura* using seven $CO_2$ traps. Three of the sites are located in Anoka County, two in Washington County and one site in Hennepin County. The Hennepin County location had a ground level trap and a canopy level trap. *Culiseta melanura* have been collected from each of the locations in the past. In addition, 215 aspirator samples were collected from wooded habitats surrounding potential *Cs. melanura* larval habitat (i.e. tamarack bogs).

*Culiseta melanura* adults were collected in $CO_2$ traps at both of the Washington County sites and two Anoka County sites. Ten aspirator samples, five from Washington County and five from Anoka County, contained *Cs. melanura* adults.

The rate of *Cs. melanura* capture was low in 2006. Two generations were detected by the $CO_2$ trap network (Figure 1.9), one early in the season and one late in the season. In previous years, a mid-summer emergence occurred. This was not detected in 2006. Hot dry conditions may have suppressed the mid-summer population below detectable levels.

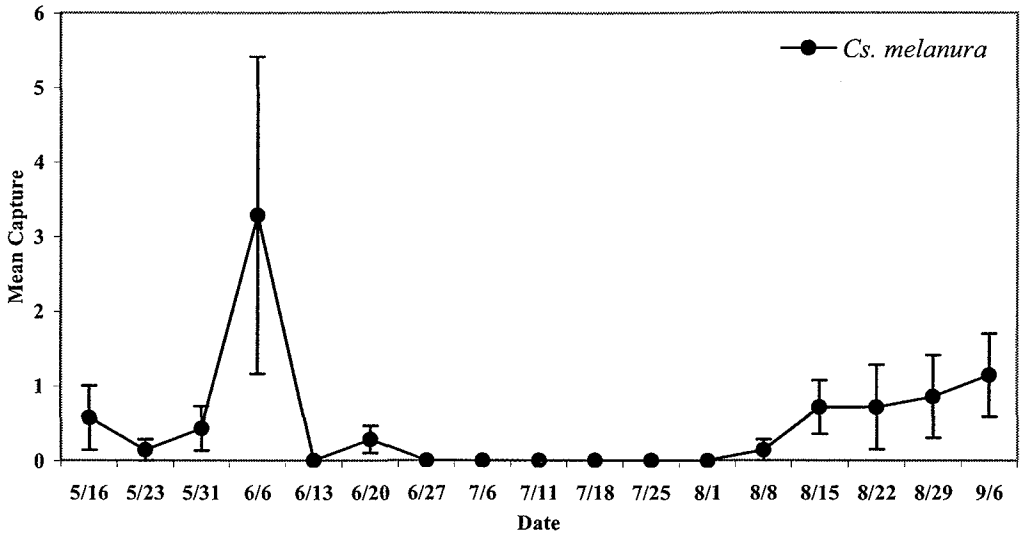



Figure 1.9 Mean number of *Cs. melanura* adults in $CO_2$ trap samples, plotted by week. Error bars equal ± 1 standard error of the mean.

***Culex* Surveillance** *Culex* species are important for the amplification and transmission of West Nile virus (WNV) and western equine encephalitis virus (WEE) in our area. In addition to $CO_2$ traps, gravid traps are used to monitor *Culex* adults. The gravid trap is designed to attract female mosquitoes that are seeking oviposition sites while the $CO_2$ trap is used for collecting female mosquitoes in their host-seeking phase. The District operated 128 $CO_2$ traps and 35 gravid traps in 2006.

*Culex tarsalis* has been identified as the most likely vector of WNV to humans in our area. All of the *Cx. tarsalis* captured in aspirator samples, Monday night sweeps, Monday night $CO_2$ traps, and gravid traps were submitted to Minnesota Department of Health (MDH) for viral analysis (see Chapter 2, Table 2.2). As is typical, very few *Cx. tarsalis* were collected by gravid trap in 2006. A moderate seasonal peak in $CO_2$ trap captures occurred during the week of July 30$^{th}$ (Figure 1.10). The mean capture declined each subsequent week.

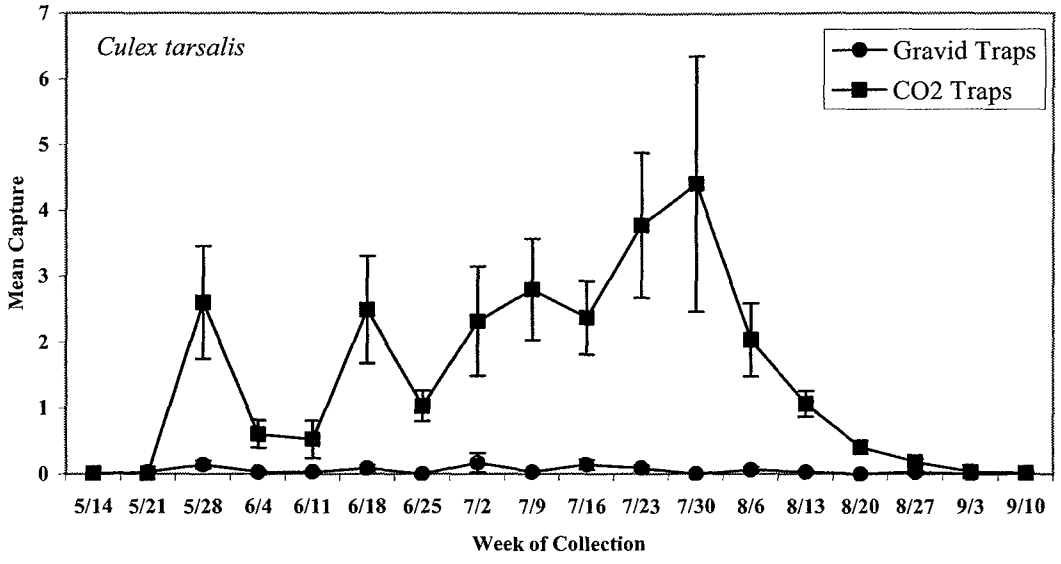



Figure 1.10 Average number of *Cx. tarsalis* in $CO_2$ traps and gravid traps, 2006. Error bars equal ± 1 standard error of the mean.

*Culex restuans* is another important vector of WNV in Minnesota. The species appears to be largely responsible for the early season amplification of the virus and possibly for season-long maintenance of the WNV cycle. *Culex restuans* collected in $CO_2$ traps were low for the entire season (Figure 1.11), which is common for this trap type. *Culex restuans* collected in gravid traps peaked during the second week of July. Populations declined over the next three weeks, then remained consistently low for the remainder of the season.

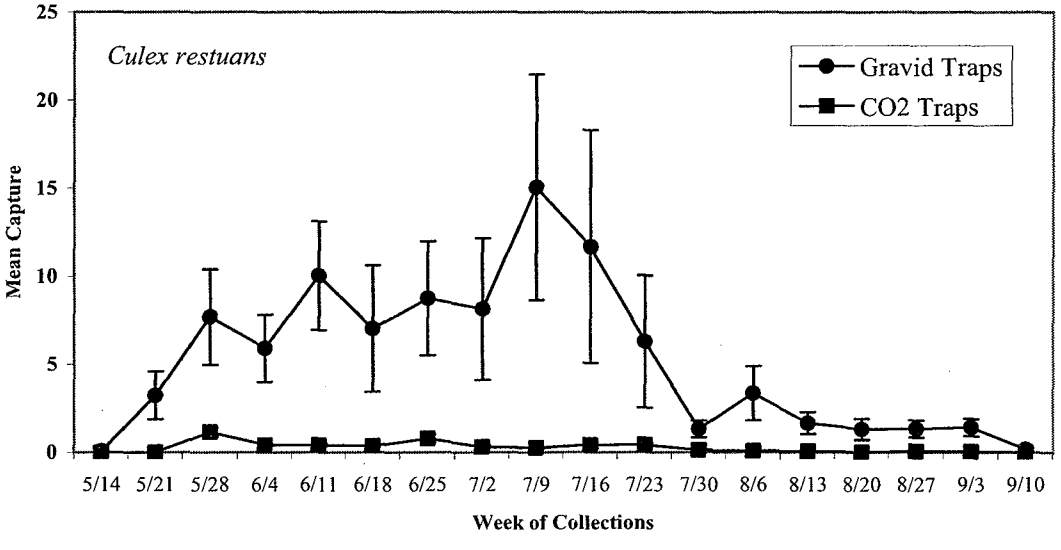



Figure 1.11 Average number of *Cx. restuans* in $CO_2$ traps and gravid traps, 2006. Error bars equal ± 1 standard error of the mean.

*Culex pipiens* has been an important vector of WNV in much of the United States. The species prefers warmer temperatures than *Cx. restuans*; therefore, populations of *Cx. pipiens* in the District tend to peak late in the summer when temperatures are typically warmer. Collections of *Cx. pipiens* were sporadic in $CO_2$ traps with a few traps capturing elevated numbers during weeks with apparent peaks (Figure 1.12). Gravid trap collections were very low until early August when a late season increase in the capture rate began.

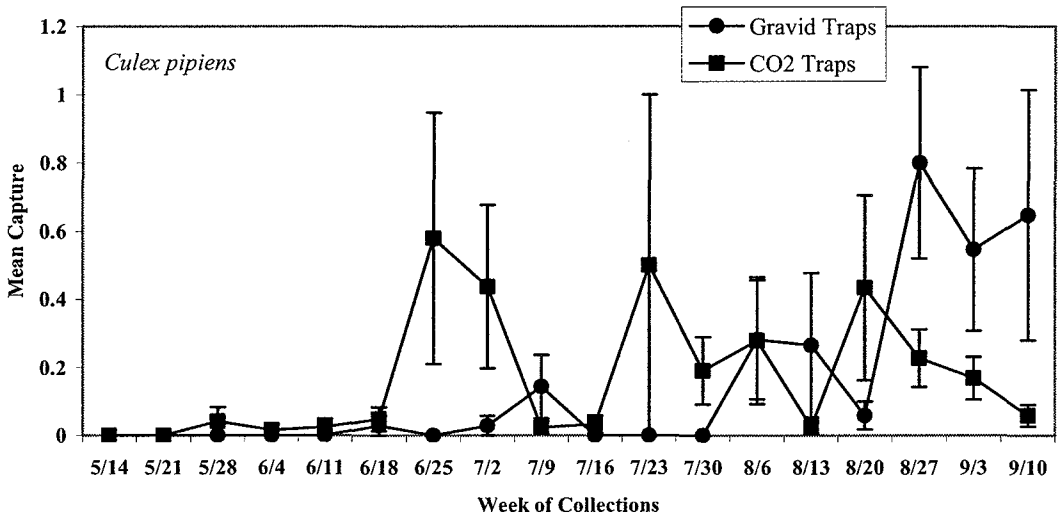



Figure 1.12 Average number of *Cx. pipiens* in $CO_2$ traps and gravid traps, 2006. Error bars equal ± 1 standard error of the mean.

**Exotic Species** Each season MMCD staff are watchful for exotic or introduced mosquito species. MMCD laboratory staff are trained to recognize exotic species in their adult and larval forms so that the mosquitoes can be spotted in any of the thousands of samples processed each year. In addition, field staff place ovitraps at possible points of introduction.

The two exotic species most likely to be found in the District are *Ae. albopictus* and *Ae. japonicus*. Both are native to Asia and both have adapted to survival in tires and other artificial containers. This allows them to be transported over great distances. Both of these species have the potential to transmit disease. *Aedes albopictus* has been established in the continental United States since 1985 and is now common in the southeastern states, along the East Coast, as well as in southern portions of the Midwest. *Aedes japonicus* was first identified in the United States in 1999 in New Jersey and has been spreading rapidly, as far west as Michigan and Missouri in 2005. Another *Ae. japonicus* introduction occurred in the Seattle area in 2001.

In 2006, *Ae. albopictus* were collected in the District for the second consecutive year at the same location. It is unlikely that the species carried over from the 2005 introduction, but rather that this was a reintroduction. Larvae of the species were identified from an ovitrap sample collected on July 19th in Scott County near a tire recycling facility. This was the fifth introduction of *Ae. albopictus* identified in Scott County (1991, 1996, 1999, 2005) and the sixth in Minnesota (Wright County,1997). Beginning on July 31st an exhaustive search of larval and adult habitats in

the area did not produce another collection of the species in 2006. Ovitraps were replaced each week, mosquito larvae were collected from 42 container/tire larval habitats and 43 aspirator samples were collected from woodlots in the area surrounding the introduction location. Crews eliminated 68 larval habitats in the area as well.

## 2007 Plans

Surveillance strategies for *Aedes* mosquitoes will remain unchanged. We will continue to review the distribution and type of $CO_2$ trap locations. Technology to allow surveillance results from the Technical Services Lab to be transmitted electronically to the field offices will continue to be updated and modified.

Thorough inspections of the area where *Ae. albopictus* were found in 2006 will occur again early in 2007. Routine ovitrap and aspirator sampling will be necessary to detect new introductions there and near other locations at high risk for exotic species introductions.

# Chapter 2 Vector-borne Disease

**2006 Highlights**

- There were no La Crosse encephalitis cases in the District
- WNV illness confirmed in 65 Minnesotans, 15 are District residents
- WNV detected in 89 District mosquito samples and 31 other samples statewide
- Conducted surveillance projects to evaluate storm water structures as *Culex* larval habitats
- Made 173,280 catch basin treatments
- Collected and recycled 10,513 waste tires
- The 2005 human case totals were at their 2nd highest level for Lyme disease (918) and at the all-time high (186) for human granulocytic anaplasmosis (HGA) *Source MDH*
- The overall 2005 season mean of *Ixodes scapularis* was 1.180 per mammal, the highest mean ever recorded
- Preliminary 2006 results indicate a decrease in both *I. scapularis* and *D. variabilis* collections, although *I. scapularis* continued to comprise > 50% of overall collections
- In 2006, MMCD created a ten-minute video comprising all aspects of Lyme disease and HGA

## Background

District staff provides a variety of disease surveillance and control services, as well as public education, to reduce the risk of mosquito-borne illnesses such as La Crosse encephalitis (LAC), western equine encephalitis (WEE), eastern equine encephalitis (EEE), and West Nile (WNV) encephalitis, as well as tick-borne illnesses such as Lyme disease and human granulocytic anaplasmosis (HGA, formerly ehrlichiosis). Past District efforts have also included determining metro-area risk for infections of Jamestown Canyon virus, babesiosis, Rocky Mountain spotted fever, and Sin Nombre virus (a hantavirus).

La Crosse encephalitis prevention services were initiated in 1987 to identify areas within the District where significant risk of acquiring this disease exists. High-risk areas are defined as having high populations of the primary vector *Aedes triseriatus* (eastern tree-hole mosquito) or history of LAC cases. MMCD targets these areas for intensive control efforts including public education, mosquito breeding site removal, and limited adult mosquito treatments. Additionally, routine surveillance and control activities are conducted at past LAC case sites. Surveillance for the exotic species *Aedes albopictus* (Asian tiger mosquito) and *Aedes japonicus* routinely occurs to detect infestations of these potential disease vectors.

MMCD monitors adult mosquitoes of the species *Culex tarsalis* for presence of WEE, which can cause severe illness in Minnesota horses and humans.

Eastern equine encephalitis was detected for the first time in Minnesota in 2001. Since then, MMCD has conducted surveillance for the enzootic vector, *Culiseta melanura.*

Since the arrival of WNV in Minnesota in 2002, MMCD has investigated a variety of mosquito control procedures to be used to enhance our comprehensive integrated mosquito management strategy for the prevention of West Nile illness.

**2007 Plans**

- Continue to provide surveillance and control for La Crosse encephalitis prevention
- Expand search for stormwater structures providing *Culex* larval habitat
- Continue catch basin larvicide treatments to manage WNV vectors
- Communicate treatment strategies to other local governments
- Continue surveillance for WNV and other mosquito-borne viruses
- Be watchful for *Ae. albopictus* and *Ae. japonicus*
- Continue *I. scapularis* surveillance at 100 sampling locations
- Continue tick-borne disease education activities and services with possible targeting of specific metro townships based on higher human case totals and/or numbers of *I. scapularis* collected
- We will distribute the tick-borne disease video and plans are underway to format it for use on MMCD's website and possibly also for presentation use

MMCD is involved in statewide and national efforts to monitor WNV and to reduce the risks it poses.

In 1989, the District was mandated by the state legislature "*to consult and cooperate with the MDH in developing management techniques to control disease vectoring ticks.*" The District responded by beginning tick surveillance and forming the Lyme Disease Tick Advisory Board (LDTAB) in 1990. The LDTAB includes MMCD and Minnesota Department of Health (MDH) staff, local scientists, and agency representatives who offer their expertise to the tick-borne effort.

MMCD initiated tick surveillance to determine the range and abundance of the black-legged tick (*Ixodes scapularis*, also known as the deer tick) and the Lyme disease spirochete, *Borrelia burgdorferi,* within the District. To date, MMCD has mapped the current distribution of black-legged ticks (545 total sites sampled) and continues to monitor their populations in the metropolitan area. Additionally, District employees have assisted with spirochete and ehrlichiosis (now known as anaplasmosis) studies with the University of Minnesota. All collected data are summarized and presented to the MDH for their risk analysis.

Because wide-scale tick control is neither ecologically nor economically feasible, tick-borne disease prevention is limited to public education activities which emphasize tick-borne disease awareness and personal precautions. District employees continue to provide tick identifications upon request and are used as a tick referral resource by agencies such as the MDH and the Minnesota Department of Natural Resources (MNDNR).

# 2006 Mosquito-borne Disease Services

## Breeding Source Reduction

Water-holding containers such as tires, buckets, tarps, and even plastic toys provide developmental habitat for many mosquito species including the La Crosse virus vector *Ae. triseriatus*, the exotic species *Ae. albopictus* and *Ae. japonicus*, and other probable vectors of WNV.

Removal of container habitats is a prominent component of the District's mosquito-borne disease prevention effort. District staff recycled 10,513 tires that were collected from the field in 2006. Since 1988, the District has recycled 440,365 tires. In addition, MMCD eliminated 2,059 containers and filled 228 tree holes. This reduction of breeding sources occurred while conducting a variety of mosquito, tick, and black fly surveillance and control activities, including the 2,194 property inspections by MMCD staff in 2006.

## La Crosse Encephalitis (LAC)

***Aedes triseriatus* Surveillance and Control** Drought conditions suppressed the *Ae. triseriatus* population in 2006 by limiting egg hatching. The LAC vector is a container inhabiting floodwater species. Still, intensive surveillance of adult *Ae. triseriatus* populations occurred throughout the District. MMCD sampled wooded mosquito habitats by vacuum aspirator to monitor adult *Ae. triseriatus* populations and to direct adult and larval control efforts.

In 2006, MMCD staff collected 2,680 aspirator samples for the purpose of monitoring *Ae. triseriatus*. The District's threshold of at least two adult *Ae. triseriatus* was met in 307 of these samples. Inspections of wooded areas and surrounding residential properties were provided as follow-up service when samples reached threshold. Additionally, 159 adulticide applications to wooded areas were prompted by collections of *Ae. triseriatus* in aspirator samples.

Adult *Ae. triseriatus* were captured in 518 of 1,849 individual wooded areas sampled. This ratio and the average number of *Ae. triseriatus* captured per sample were low this year compared to most recent seasons (Table 2.1).

Table 2.1 Individual wooded areas sampled by aspirator and the number of those where *Ae. triseriatus* were captured, 2000 – 2006.

| Year | Total areas surveyed | No. with *Ae. triseriatus* | Percent with *Ae. triseriatus* | Mean no. per aspirator sample |
|---|---|---|---|---|
| 2000 | 1,037 | 575 | 55.4 | 1.94 |
| 2001 | 1,222 | 567 | 46.4 | 1.32 |
| 2002 | 1,343 | 573 | 42.7 | 1.70 |
| 2003 | 1,558 | 470 | 30.2 | 1.20 |
| 2004 | 1,850 | 786 | 42.5 | 1.34 |
| 2005 | 1,993 | 700 | 35.1 | 0.84 |
| 2006 | 1,849 | 518 | 28.0 | 0.78 |

**La Crosse Encephalitis in Minnesota** One case of La Crosse illness was reported to MDH in 2006. A seven year-old girl from Sibley County was diagnosed with La Crosse encephalitis after an August 21st onset of illness. There were no LAC illnesses in District residents in 2006.

## Eastern Equine Encephalitis (EEE)

In 2006, EEE virus was detected in 16 states, primarily on the East Coast and along the Gulf of Mexico. There were eight human illnesses diagnosed, five in Massachusetts, and one each in Georgia, Louisiana, and North Carolina. Illnesses caused by EEE were documented in horses from 13 states. Eastern equine encephalitis virus is most common in areas near the habitat of its primary vector, *Culiseta melanura*. These habitats include many coastal wetlands, and in the interior of North America, tamarack bogs and other bog sites. The last record of EEE in Minnesota was in 2001 when three horses were infected with the virus including one from Anoka County.

***Culiseta melanura* Surveillance** *Culiseta melanura* is relatively rare in the District and is restricted to a few, bog-type larval habitats. The greatest concentration of this type of habitat is in the northeast part of MMCD in Anoka and Washington counties. Still, the species is occasionally collected in other areas of the District. Results of surveillance in 2006 for adults of this species are in Chapter 1 of this document.

## Western Equine Encephalitis (WEE)

Western equine encephalitis circulates among mosquitoes and birds in Minnesota, although normally below detectable levels. Occasionally, the virus causes illness in horses and less frequently in people. *Culex tarsalis* is the species most likely to transmit the virus to people and horses. In both 2004 and 2005, the virus was detected in *Cx. tarsalis* specimens collected in southern Minnesota. The virus was not detected in Minnesota in 2006.

In 2006, all *Cx. tarsalis* adults collected in the District during weekly $CO_2$ trap, gravid trap, and sweep net sampling were submitted to MDH for viral analysis. Additional samples collected by aspirator were also submitted. In total, 719 pools of *Cx. tarsalis* containing 3,692 mosquitoes were tested. Western equine encephalitis virus was not detected from any of the MMCD samples. The last record of WEE in the District was from a sentinel chicken sample collected in September of 2001.

## West Nile Virus (WNV)

**WNV in the United States** West Nile virus transmission was documented in each of the 48 contiguous states in 2006. The U.S. Centers for Disease Control and Prevention received reports of 4,268 WN illnesses from 43 states and Washington D. C. Fatalities occurred in 177 of the cases. Idaho led the nation with 996 illnesses. Screening of the American blood supply detected WNV in 361 donors from 32 states. Additionally, West Nile illness was diagnosed in 1,086 equines from 34 states.

**WNV in Minnesota** The Minnesota Department of Health reported 65 WNV illnesses in residents of 39 Minnesota counties. There were three fatalities related to WNV infections. The first WNV case was confirmed on July 21st. The earliest onset of a WNV illness in the state was

July 2nd. Four Minnesota blood donors from four counties screened positive for WNV in 2006. Additional WNV detections in Minnesota included 17 illnesses in horses, 478 birds, and 120 mosquito samples. The WNV positive mosquito samples consisted of 50 pools of *Cx. tarsalis*, 20 pools of *Cx. restuans*, one pool of *Cx. pipiens*, 39 mixed pools of *Cx. restuans* and *Cx. pipiens*, nine pools of *Culex* species, and one pool of *Coquillettidia perturbans*.

**West Nile Illness in the District** Fifteen residents of the District were diagnosed with WNV illnesses; five cases occurred in residents of Ramsey County, four in residents of Hennepin County, two in residents of Anoka County, two in residents of Dakota County, and one each in residents of Carver and Washington counties. One of the Hennepin County residents died due to the severity of the WNV illness.

**Surveillance for WNV** In 2006, MMCD conducted surveillance for WNV in mosquitoes and wild birds. Several mosquito species from 33 $CO_2$ traps (12 elevated into the tree canopy) and 35 gravid traps were submitted for viral analysis weekly. In addition, all *Cx. tarsalis* collected in Monday night $CO_2$ trap, aspirator, and sweep collections were submitted for viral analysis. MMCD submitted 2,867 mosquito pools to MDH for viral analysis. Eighty-nine pools returned positive results for WNV. Table 2.2 is a complete list of mosquitoes MMCD submitted to MDH for viral analysis.

In addition to mosquito surveillance for WNV, MMCD conducted surveillance for WNV in wild birds. Citizens reported dead birds to MMCD and staff determined which would be candidates for WNV analysis. Reports of 4,754 dead birds were received by telephone, internet or from employees. Tests were done on 745 birds, 484 were positive for WNV. The results of testing are displayed by the week of report in Figure 2.1.

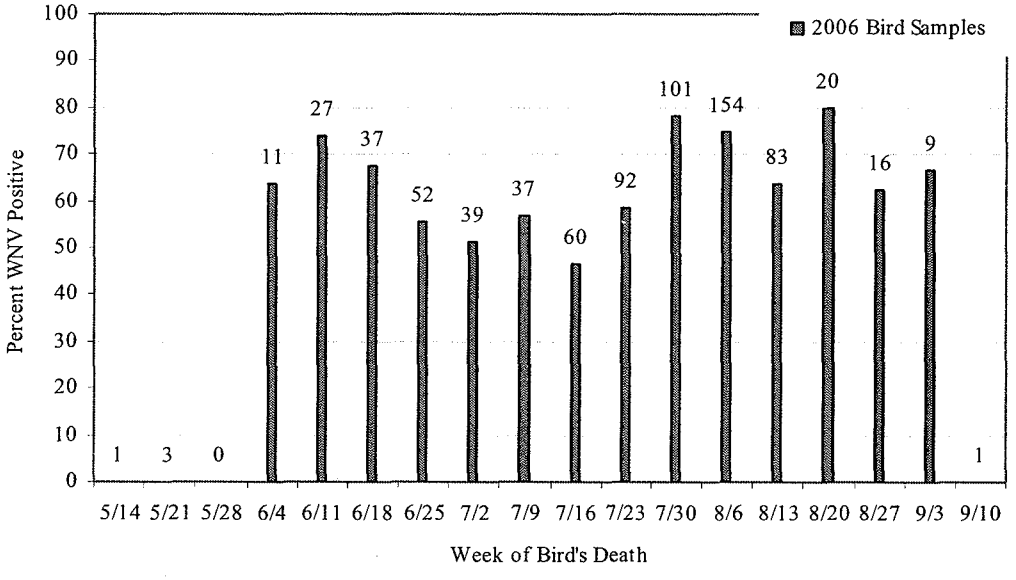



Figure 2.1 Percentage of birds collected by MMCD for WNV analysis returning positive results, by week. Labels above bars are the total number of birds tested.

Table 2.2 Number of MMCD mosquito samples submitted for viral analysis and minimum infection rate (MIR) by species.

| Species | # Mosquitoes | # Pools | WNV+ Pools | MIR per 1000 |
|---|---|---|---|---|
| *Aedes triseriatus* | 461 | 101 | 0 | 0 |
| *Aedes albopictus* | 1 | 1 | 0 | 0 |
| *Anopheles punctipennis* | 16 | 4 | 0 | 0 |
| *Culex erraticus* | 2 | 2 | 0 | 0 |
| *Culex pipiens* | 472 | 93 | 1 | 2.12 |
| *Culex restuans* | 3517 | 408 | 21 | 5.97 |
| *Culex salinarius* | 18 | 7 | 0 | 0 |
| *Culex tarsalis* | 3692 | 719 | 21 | 5.69 |
| *Culex* species | 2857 | 310 | 9 | 3.15 |
| *Culex pipiens/restuans* | 5118 | 531 | 36* | 7.03 |
| *Culiseta inornata* | 133 | 76 | 0 | 0 |
| *Culiseta melanura* | 105 | 37 | 0 | 0 |
| *Culiseta minnesotae* | 119 | 50 | 0 | 0 |
| *Culiseta morsitans* | 39 | 24 | 0 | 0 |
| *Culiseta* species | 10 | 10 | 0 | 0 |
| *Coquillettidia perturbans* | 9834 | 494 | 1 | 0.10 |
| **TOTAL** | **26394** | **2867** | **89*** | **3.37** |

* Includes both PCR and RAMP® Test results. All mosquitoes were sent to MDH for analysis by polymerase chain reaction (PCR). MMCD tested 124 samples by RAMP® Test which is a rapid assay kit. Seven samples were WNV positive by RAMP, all but one of the positive results were later confirmed by PCR.

The results of surveillance for WNV in both birds and mosquitoes indicated that amplification of the virus occurred rapidly in the early weeks of the 2006 season. Over 60 percent of the birds collected in June returned WNV positive results and five mosquito samples collected in June were WNV positive. Viral amplification of this magnitude had not been documented in past surveillance for WNV in the District. Drought conditions undoubtedly contributed to the rate of WNV amplification as vector habitats improved, specifically those used by *Cx. restuans*.

## West Nile Virus (WNV) Research

Researching WNV vector habits, habitat preferences, and surveillance techniques for locating these species remained an important focus of MMCD staff in 2006. Efforts were directed toward improving the District's understandings of some of the more likely vectors of WNV, including *Cx. tarsalis, Cx. restuans, Cx. pipiens,* and *Cx. salinarius*.

## Larval Mosquito Surveillance

**Biology Background** *Culex tarsalis, Cx. restuans, Cx. pipiens,* and *Cx. salinarius* lay rafts of eggs on the surface of standing water. Larvae will not be present in a wet habitat unless adult, egg-laying females have been recently active, the area was wet and attractive for oviposition, and the characteristics of the site allow for survival of newly hatched mosquitoes. *Culex* larvae can be difficult to find in our area because they are typically much less abundant than other types of mosquitoes. Furthermore, they can disperse over a wide area in large wetlands or they may

clump together in small portions of large wetlands. They are generally easier to locate in small habitats where greater concentrations of larvae tend to be more evenly dispersed.
***Culex***

**Larval Habitat Resulting from Stormwater Management** Staff members at MMCD's Rosemount facility designed and implemented a project to locate and survey a variety of small larval mosquito habitats, most resulting from stormwater management practices. A number of categories were established to help identify the habitats; these were:

- **Culverts** – areas inside or at the openings of culverts where water is stagnate
- **Washouts** – pools of water in areas of erosion caused by water flow
- **Artificial Ponds** – stormwater retention and detention ponds
- **Pond Regulators** – devices designed to regulate water levels of overflow structures
- **Rip Rap** – small pools of water in piled rock or rubble used to prevent erosion
- **Underground Structures** – devices installed below ground in the stormwater system to catch sediment and other pollutants
- **Intermittent Streams** – areas of stagnant water during periods of low stream flow
- **Abandoned Swimming Pools** – pools that are not maintained
- **Others** – a category for habitats that do not fit the above categories

MMCD uses MapInfo® software to digitize map layers of larval mosquito habitat including: large wetlands (air sites), small wetlands (ground sites), and catch basins. Many of the *Culex* larval habitats described above are not included on these map layers. Some of the *Culex* habitats are within areas mapped on a wetlands layer (i.e. culverts, washouts, pond regulators, rip rap), however these small habitats of concern function differently than the wetland they are in or near. Often they appear to be preferred by *Culex* species over the remainder of a wetland as an oviposition location. In fact, the small *Culex* habitats are often isolated from associated wetlands when there is little or no water flowing through the stormwater system.

When field staff discovered a habitat that fit one of the above categories, its location was recorded along with other descriptive information and the site was assigned a code number. Mosquito samples were collected from some locations when a site was identified. Staff returned later to survey some sites for mosquitoes, as well. However, the primary objective was to locate, describe, and map potential mosquito habitats.

Inspectors surveyed and mapped 2,744 structures throughout an urban/suburban area comprising 305 square miles. Nearly 15 percent of 2,062 structures holding water were found to contain mosquito larvae at the time they were inspected. However, 36% of those inspected from June through September contained larvae. Four hundred fifty-seven larval samples were collected from 306 different structures. Eighty percent of all samples contained one of three WNV vectors found in Minnesota. Sixty-nine percent of the samples contained *Culex restuans*, 17.7% *Cx. pipiens*, 7.9% *Cx. tarsalis*. None of the samples contained *Cx. salinarius*.

Staff in Rosemount will continue to evaluate *Culex* habitats that were identified in 2006. MMCD will expand this project in 2007 to include the remainder of the District. Mapping and evaluating these habitats will be an ongoing, long-term project. Most of these habitats are directly related to

urban/suburban development and resultant stormwater management practices; therefore, we expect the number of these sites to increase annually.

**Underground Stormwater Structures** In addition to catch basins with sumps, many stormwater management systems include large underground chambers to trap sediments and other pollutants. There are several designs in use that vary in dimension and name, but collectively, they are often referred to as BMPs from Best Management Practices for Stormwater under the U.S. Environmental Protection Agency's National Pollution Discharge Elimination System (NPDES). In 2005, MMCD worked with city crews to survey underground BMPs. Mosquito larvae were found in nearly 2/3 of the underground structures that were inspected.

The District initiated a pilot project for cooperative larval control in stormwater structures managed by local municipalities. City assistance is necessary since large underground structures are difficult for MMCD staff to locate and access. City staff possess working knowledge of the structure locations, are trained in accessing the water-holding chambers, and may have specialized equipment for removing heavy manhole covers. Additionally, some of the structures are locked to prevent access by anyone other than City staff.

District staff solicited participation by city public works staff. All of the communities contacted that manage BMPs were willing to assist. Twelve communities indicated that they could provide necessary information for determining control material requirements. We elected to use Altosid® XR briquets at the label rate of 1 briquet per 1,500 gallons of water retained. The cities of Bloomington and Maplewood were selected for participation.

MMCD provided Bloomington and Maplewood staff with briquets to treat BMPs in their inventories and training to ensure proper application of the larvicide. Additionally, city staff were instructed on proper record keeping so that the dates and locations of all treatments were documented. Maplewood crews treated 75 BMPs during the week of May 7. Bloomington crews treated 83 BMPs during the week of May 21. MMCD staff were able to collect only two bioassays from treated sites, both on June 30 from Bloomington structures. The results of both were promising, with unadjusted emergence rates of 15 percent and 31 percent *Cx. restuans*.

We would like to expand the pilot project in 2007 to include more cities and to better document the efficacy of the larvicides used. Mosquito development in BMPs has been recognized. The majority of mosquitoes found in local BMPs are *Culex* species and controlling their emergence from underground habitats will be an important part of MMCDs comprehensive plan to manage WNV vectors.

**Catch Basins** A new larvicide called FourStar®, a *Bti* briquet designed to last at least 150 days was evaluated for control of mosquitoes in catch basins. A review of this research is located in Chapter 5, starting on page 46. Catch basins selected for the evaluation were located in St. Paul and were previously determined to be sites that remain wet even with little rainfall. From June 14 through August 16, a total of 321 catch basin inspections occurred, pretreatment and post-treatment combined. Larvae were found 267 times (83%).

District-wide, the rate of catch basins found to be inhabited by mosquito larvae when inspected was lower than during the FourStar® evaluations. Larvae were found during 568 of 1005 catch basin inspections (57%). Rates of larval presence by week are displayed as Figure 2.2.

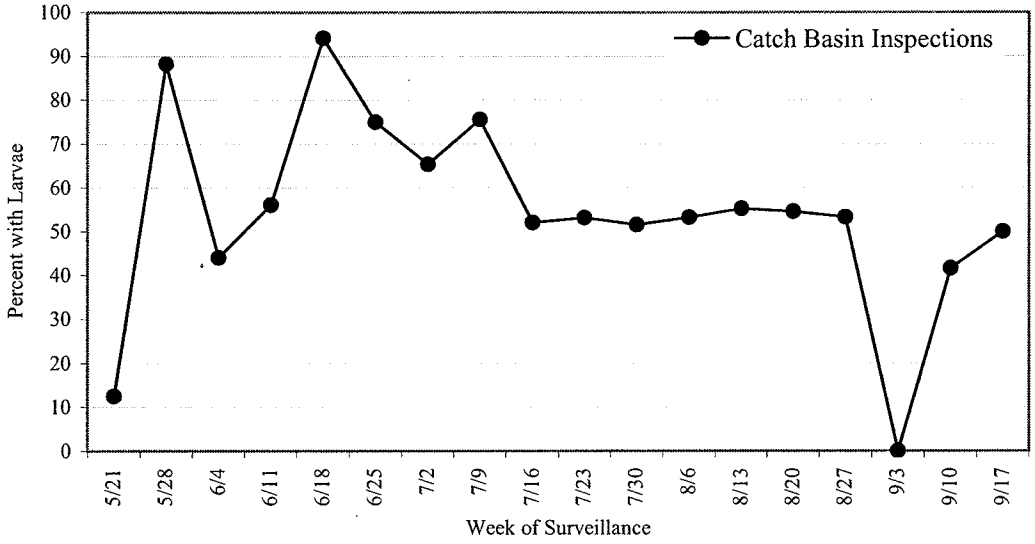



Figure 2.2 Weekly ratio of catch basin inspections where mosquitoes were found.

Mosquito larvae were identified in 539 samples from catch basins (Figure 2.3). The predominant species was *Cx. restuans*, as is usually the case in our area. *Culex restuans* were found in 85 percent of catch basin larval samples. *Culex pipiens* were identified more frequently in catch basin larval samples than has been the case in recent years: 31 percent of samples contained the species. *Culex tarsalis* were collected infrequently from catch basins.

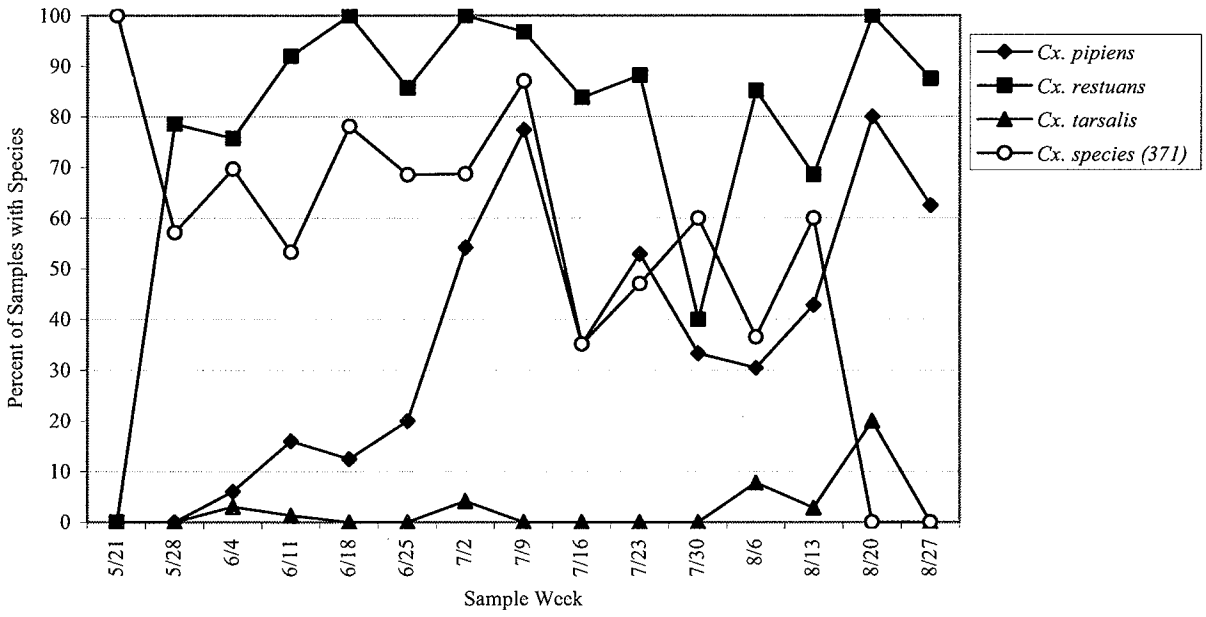



Figure 2.3 Composition of *Culex* mosquito species in catch basin larval samples by week.

### Adult Mosquito Research

The District's protocol for *Culex* adult control for 2006, as communicated to staff, stated any *Culex* collection in excess of our established thresholds could be used to justify an adulticide application; however, a $CO_2$ trap collection in excess of 15 *Culex* vectors should receive stronger consideration for adult control. Truck mounted cold-fogging was the recommended primary adult control method, while hand-held ULV and backpack treatments were secondary. Areas to receive first priority for treatments were within ½ mile of the above-threshold trap.

The question arose as to how well a single $CO_2$ trap collection represented the mosquito population over a larger area. For a preliminary study, we did additional sampling near 4 Monday night collection locations that had high counts of *Culex* (15 or more). Six $CO_2$ traps were placed radiating out up to three miles from the Monday night trap location. Adult control applications in these selected areas were delayed until additional surveillance was complete. Results in 3 of the 4 sets showed that the majority of other traps also had *Culex*, but there was not usually a clear relationship with distance. Additional work is planned for 2007 to address this question.

## Plans for 2007 – Mosquito-borne Disease

District staff will continue to provide mosquito surveillance and control services for the prevention of La Crosse encephalitis. Preventive measures include adult sampling, adult control, and tree hole and container habitat reduction along with property inspections.

MMCD staff will review and revise the District's surveillance and control strategies for adult *Culex* mosquitoes. We will continue to survey aquatic habitats for *Culex* larvae for use in design and improvement of larval control strategies. *Culex tarsalis* will remain a species of particular interest.

Staff will identify, survey and map potential *Culex* larval habitats that result from storm water management practices.

District staff will continue to refine catch basin larviciding operations. We are especially interested in improving efficiency.

In 2007, we will be working with municipalities within the District to expand treatments of underground stormwater structures that produce mosquitoes.

MMCD will continue to conduct surveillance for WNV and other mosquito-borne viruses in coordination with MDH, MDA, the University of Minnesota, and other local authorities.

District staff will continue to monitor *Cs. melanura* in the District, with attention focused on areas in Anoka and Washington counties where the species has been encountered in the past.

MMCD staff will remain watchful for the introduction of exotic mosquito species, especially *Ae. albopictus* and *Ae. japonicus.*

# 2006 Tick-borne Disease Services

## *Ixodes scapularis* Distribution

The District continued to sample the network of 100 sites set up in 1991-1992 to monitor potential changes in tick distribution over time. As in previous years, the primary sampling method involved capturing small mammals from each site and removing any attached ticks from them. Collections from the northeastern metropolitan area (primarily Anoka and Washington counties) have consistently detected *I. scapularis*, and in 1998 *I. scapularis* was detected in Hennepin and Scott counties for the first time. The 2006 report will be available on our website (www.mmcd.org) in June. Following are the latest data compilations available (2005 results and preliminary 2006 results).

The 2005 distribution study results seemed to provide continued evidence of an elevated *I. scapularis* population. In 2005, the overall season mean of 1.180 *I. scapularis* per mammal was the first year an overall average of >1.0 has been tabulated, but we considered it comparable with the elevated 2000 – 2002 and 2004 averages (all $\geq$ 0.806). *Ixodes scapularis* also comprised $\geq$ 50% of our overall collections for only the 3rd time since the inception of the study, with the 2005 tabulation of 58% being the highest recorded total in our databases. It surpassed our previous high of 55% tabulated for 2004 (Table 2.3).

Similarly, since 2000 the MDH has been consistently tabulating record-setting human tick-borne disease case totals. Their all-time high statewide Lyme case total occurred in 2004 (1,023 cases) with the Lyme case totals in 2000, 2001, and 2003 being comparable (all $\geq$ 463). In the same period, HGA cases also rose, ranging from 78 to 152 compared with an average of roughly 15 cases per year through 1999.

In 2005, the MDH recorded their 2nd highest Lyme disease case total (918) as well as their highest HGA case total (186). Human disease case data for 2006 is not yet available.

Preliminary 2006 *I. scapularis* distribution study results indicate a decrease in both *I. scapularis* and *Dermacentor variabilis* collections. The overall 2006 season mean is currently calculated at 0.637, although at 58%, *I. scapularis* continued to comprise > 50% of our overall collections.

## Tick Identification Services/Outreach

The overall scope of tick-borne disease education activities and services were maintained in 2006 using previously described methods and tools but we completed several new projects to compliment our outreach efforts. The Lyme disease brochure was translated into Spanish and is available on our website. Also, a ten-minute video was created. It is comprised of operational aspects and basic Lyme disease and HGA information. Editing was completed late in 2006.

Table 2.3 Numbers and percentages of tick species collected by stage and year

| Year | No. sites | Total ticks collected | *Dermacentor variabilis* Percent larvae (n) | *Dermacentor variabilis* Percent nymphs (n) | *Ixodes scapularis* Percent larvae (n) | *Ixodes scapularis* Percent nymphs (n) | Other species[b] percent (n) |
|---|---|---|---|---|---|---|---|
| 1990[a] | 250 | 9957 | 83 (8289) | 10 (994) | 6 (573) | 1 (74) | 0% (27) |
| 1991 | 270 | 8452 | 81 (6807) | 13 (1094) | 5 (441) | 1 (73) | 0% (37) |
| 1992 | 200 | 4130 | 79 (3259) | 17 (703) | 3 (114) | 1 (34) | 0% (20) |
| 1993 | 100 | 1785 | 64 (1136) | 12 (221) | 22 (388) | 1 (21) | 1% (19) |
| 1994 | 100 | 1514 | 53 (797) | 11 (163) | 31 (476) | 4 (67) | 1% (11) |
| 1995 | 100 | 1196 | 54 (650) | 19 (232) | 22 (258) | 4 (48) | 1% (8) |
| 1996 | 100 | 724 | 64 (466) | 20 (146) | 11 (82) | 3 (20) | 1% (10) |
| 1997 | 100 | 693 | 73 (506) | 10 (66) | 14 (96) | 3 (22) | 0% (3) |
| 1998 | 100 | 1389 | 56 (779) | 7 100) | 32 (439) | 5 (67) | 0% (4) |
| 1999 | 100 | 1594 | 51 (820) | 8 128) | 36 (570) | 4 (64) | 1% (12) |
| 2000 | 100 | 2207 | 47 (1030) | 10 (228) | 31 (688) | 12 (257) | 0% (4) |
| 2001 | 100 | 1957 | 54 (1054) | 8 (159) | 36 (697) | 2 (44) | 0% (3) |
| 2002 | 100 | 2185 | 36 (797) | 13 (280) | 42 (922) | 8 (177) | 0% (9) |
| 2003 | 100 | 1293 | 52 (676) | 11 (139) | 26 (337) | 11 (140) | 0% (1) |
| 2004 | 100 | 1773 | 37 (653) | 8 (136) | 51 (901) | 4 (75) | 0% (8) |
| 2005 | 100 | 1974 | 36 (708) | 6 (120) | 53 (1054) | 4 (85) | 0% (7) |
| 2006 | 100 | 1353 | 30 (411) | 10 (140) | 54 (733) | 4 (58) | 1% (11) |

[a] 1990 data excludes one *Tamias striatus* with 102 *I. scapularis* larvae and 31 nymphs
[b] other species mostly *Ixodes muris*. 1999—second adult *I. muris* collected

# 2007 Plans for Tick-borne Services

## Metro Surveillance

The metro-based *I. scapularis* distribution study that began in 1990 is planned to continue unchanged.

## Tick Identification Services/Outreach

We plan to maintain our tick-borne disease education activities and services (including tick identifications and homeowner consultations) using previously described methods and tools. Since our *I. scapularis* collections as well as the MDH's tabulated human tick-borne disease case totals have continued to be elevated, we plan to continue to set up information booths at events as opportunities arise. As in past years, we will continue to offer an encompassing slide presentation as well as to stock local parks and other appropriate locations with tick cards and brochures and distribute materials at local fairs and the Minnesota State Fair. We may expand our efforts by targeting specific metro townships for public education based on higher human case totals and/or numbers of *I. scapularis* collected. We plan to distribute our tick-borne disease video to local cable-access television stations. We also plan to work on formatting this video for placement onto our website.

# Chapter 3 Mosquito Control

**2006 Highlights**

- 14,858 fewer acres worth of larvicides were applied to wetlands than in 2005
- More effective initiation of aerial larviciding enabled us to treat much farther into Zone 2 early in the season (8,832 acres in April)
- 33,051 fewer acres worth of adulticides were applied in 2006 than in 2005
- A cumulative total of 173,007 catch basin treatments were made in three rounds to control vectors of WNV

**2007 Plans**

- Review breeding histories of ground sites to identify those that breed most often to better prioritize which sites to inspect before treatment, which sites to treat before breeding with Altosid® and which sites to not visit
- Critically review surveillance and control of *Coquillettidia perturbans* (cattail mosquitoes)
- Continue to review the catch basin treatment program to maintain efficacy and reduce workload to enable staff to provide additional mosquito control services

## Background

The mosquito control program targets the principal summer pest mosquito *Aedes vexans*, several species of spring *Aedes*, the cattail mosquito *Coquillettidia perturbans*, the eastern treehole mosquito *Aedes triseriatus* (La Crosse encephalitis vector), and the vector of western equine encephalitis *Culex tarsalis*. The arrival of West Nile virus (WNV) in Minnesota in 2002 elevated the importance of controlling *Cx. tarsalis* and three other *Culex* species (*Culex pipiens, Culex restuans,* and *Culex salinarius*) which are potential vectors of WNV. Larval control is the main focus of the program but is supplemented by adult mosquito control when necessary.

*Aedes* larvae hatch in response to snow melt or rain with adults emerging at various times during the spring and summer. Cattail mosquito larvae develop in cattail marshes over twelve months and emerge as adult mosquitoes in June and July. *Culex* species also breed during periods of greater precipitation but inhabit more permanent waters and therefore are not as dependent upon rainfall. Stormwater catch basins can also support breeding of *Cx. pipiens* and *Cx. restuans.* This type of mosquito habitat can be the primary source of WNV vectors in heavily urbanized areas. Such was the case in the WNV epidemics in Chicago in 2002 and 2005.

MMCD uses "Priority Zones" to focus service in areas where it will benefit the highest number of citizens. Priority Zone 1 contains the majority of the population of the Twin Cities metro area and has boundaries similar to the Metropolitan Urban Service Area (MUSA, Metropolitan Council). Priority Zone 2 includes sparsely populated and rural parts of the District. Small towns or population centers in Priority Zone 2 are considered satellite communities and receive services similar to Priority Zone 1.

Adult mosquito control supplements the larval control program. Adulticide applications are performed after sampling detects mosquito populations meeting threshold levels, primarily in high use park and recreation areas, for public events, or in response to citizen mosquito annoyance reports. Three synthetic pyrethroids are used: resmethrin, permethrin, and sumithrin. A description of the control materials is found in Appendix C. Appendix D shows the dosages of control materials used by MMCD, both in terms of amount of formulated (and in some cases diluted) product applied per acre and the amount of active ingredient (AI) applied per acre. Appendix E contains a historical summary of the number of acres treated with each control material. Pesticide labels are located in Appendix F.

# 2006 Mosquito Control

## Larval Mosquito Control

Beginning in April 2006, the threshold for treatment with *Bti* was 0.1 larvae per dip for spring *Aedes* in Priority Zone 1. A higher threshold of 0.5 larvae per dip was used in Priority Zone 2 to target limited control materials to sites with the most intense breeding. After mid-May, the threshold was increased to control the summer floodwater mosquitoes and *Culex*. For sites with only *Culex* (*Cx. restuans*, *Cx. pipiens*, *Cx. salinarius*, *Cx. tarsalis*), the threshold was 1 per dip in all priority zones. For sites with both *Culex* and floodwater mosquitoes, the threshold was 2 per dip in Priority Zone 1 and 5 per dip in Priority Zone 2.

Precipitation in 2006 began earlier than in 2003, 2004 and 2005. Greater than average rainfall occurred in April and early May 2006, followed by a period of below average precipitation through September. Early July was especially dry. Half of the 2006 total aerial *Bti* treatments were completed in April (38,777 acres) and May (37,922 acres). The remaining 75,629 acres of aerial treatments were completed between June and September (Figure 3.1).

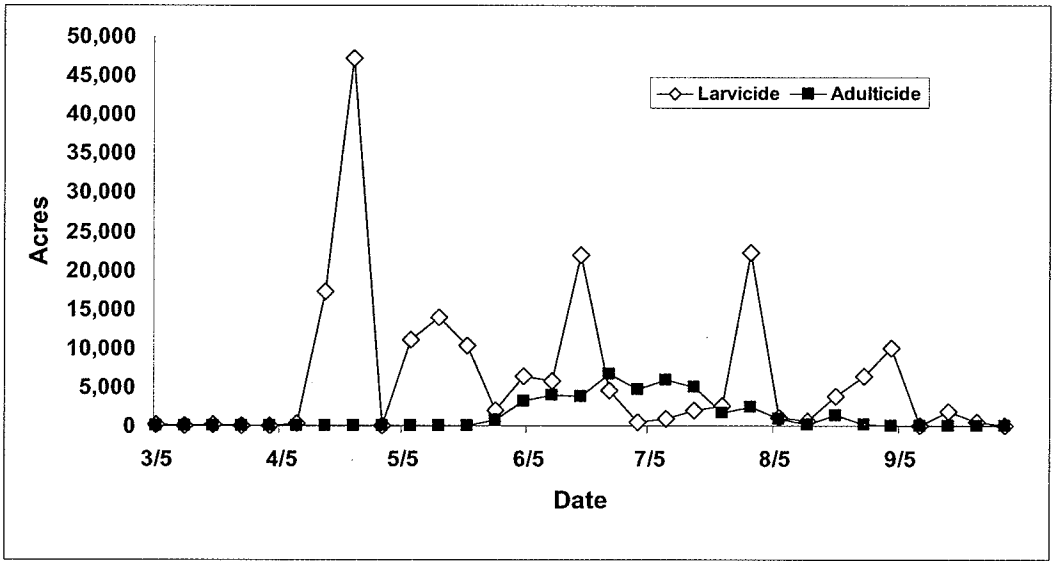



Figure 3.1 Acres of larvicide and adulticide treatments each week (March-September 2006).

We emphasized using all seven helicopters earlier during each brood, which helped us treat more acreage with *Bti* in Priority Zone 2 (23% of total treated aerially in April and 20% in May) before the first application of longer lasting larvicides in mid-May. Drier conditions after late May resulted in fewer acres needing treatment with *Bti*. However, we were able to maintain treatments in Priority Zone 2 (25% of acreage treated with *Bti* in late May and 16% in late June). Because of dry conditions after late May, 14,858 fewer acres worth of larvicides were applied to wetlands in 2006 than in 2005 (Table 3.1)

In mid-May and again in mid-June 2006, MMCD treated 4,500 acres of sites that breed two or more times monthly with larvicides that can control mosquitoes for up to four weeks (Altosid® pellets). Because these sites did not require multiple treatments per month, MMCD was able to treat an additional 8,726 acres of breeding sites in Zone 2 with *Bti* between mid-May and mid-June while maintaining treatment levels in Zone 1 (34,220 acres). Our ability to treat additional Zone 2 acreage between mid-May and mid-June 2006 was comparable to that achieved in 2005. Fewer acres (3,658 in Zone 2, 19,647 in Zone 1) required treatment with *Bti* between mid-June and mid-July due to much drier conditions.

Stormwater catch basin treatments began in early June and ended in early September. Most catch basins were treated three times with Altosid® pellets (3.5 grams per catch basin) to control *Culex* mosquitoes from June through mid-September. In 2006, two inspectors were hired to exclusively treat St. Paul catch basins to free staff from other facilities to conduct other mosquito control work (including catch basin treatments). This strategy worked well, not only by decreasing the distance field staff needed to drive to treat St. Paul catch basins but also by making available staff (St. Paul inspectors) to conduct more rigorous sampling of test catch basins to evaluate control material efficacy (results in Chapter 5). These two inspectors completed 16,214 pellet applications in catch basins in 2006 (9.7% of total of 167,797 pellet treatments).

Table 3.1 Comparison of larval control material usage in wetlands and stormwater catch basins for 2006 and 2005

| | 2006 | | 2005 | |
|---|---|---|---|---|
| Material | Amount used | Area treated | Amount used | Area treated |
| Wetlands | | | | |
| Altosid® briquets | 617.66 cases | 352 acres | 1,040 cases | 635 acres |
| Altosid® pellets | 107,608.91 lb | 31,827 acres | 99,972.77 lb | 29,965 acres |
| Vectolex® CG | 4,320.00 lb | 540 acres | 6,480.00 lb | 810 acres |
| *Bti* corncob | 1,286,076.36 lb | 160,780 acres | 1,415,630.51 lb | 176,947 acres |
| Larvicide subtotals | | 193,499 acres | | 208,357 acres |
| Catch basins | | | | |
| Altosid® briquets | 23.68 cases | 5,210 CB[1] | 24.36 cases | 4,867 CB |
| Altosid® pellets | 1,351.51 lb | 167,797 CB | 1,259.05 lb | 140,519 CB |
| Larvicide subtotals | | 173,007 CB | | 145,386 CB |

[1]CB=catch basin treatments

### Adult Mosquito Control

In 2006, MMCD applied adulticides to 33,051 fewer acres than in 2005 (Table 3.2). Adulticide treatments began in early June, peaked in late June, and continued until late July with a few treatments being applied in August (Fig. 3.1). Floodwater mosquito (*Ae. vexans*) abundance was generally lower than in 2005. Populations of the permanent water species *Cq. perturbans* were more typical during June and July and *Culex* levels were elevated throughout the season compared to 2005. Adult mosquito control operations were considered when mosquito levels rose above established thresholds of two mosquitoes in a 2-minute sweep or 2-minute slap count or 130 mosquitoes in an overnight $CO_2$ trap.

In 2004, we established treatment thresholds for adult control specific to four *Culex* species: *Cx. restuans*, *Cx. pipiens*, *Cx. salinarius*, and *Cx. tarsalis*. The thresholds are one of any of these *Culex* species in a 2-minute sweep, five in an overnight $CO_2$ trap, five in an overnight gravid trap, and one *Cx. tarsalis* in a vacuum aspirator sample. Adulticide treatments were also considered when two or more *Ae. triseriatus* were captured in a vacuum aspirator sample.

Table 3.2 Comparison of adult control material usage in 2006 and 2005

| | 2006 | | 2005 | |
|---|---|---|---|---|
| Material | Amount used | Area treated | Amount used | Area treated |
| Permethrin | 930.56 gal | 5,114 acres | 1,333.29 gal | 7,982 acres |
| Resmethrin | 377.15 gal | 29,876 acres | 453.64 gal | 40,343 acres |
| Sumithrin | 119.85 gal | 5,350 acres | 541.85 gal | 25,067 acres |
| Total | | 40,341 acres | | 73,392 acres |

## 2007 Plans for Mosquito Control Services

### Larval Control

**Cattail Mosquitoes** In 2007, control of *Cq. perturbans* will use a strategy similar to that employed in 2006. MMCD will focus control activities on the most productive cattail marshes near human population centers. Briquet applications will start in early March to frozen sites (e.g., floating bogs, deep water cattail sites, remotely located sites). Beginning in late May, staff will treat with pellets applied by helicopter at a rate of 4 lbs/acre. We plan to critically review surveillance and control of *Cq. perturbans*.

**Floodwater Mosquitoes and *Culex* Species** MMCD has expanded control of four *Culex* species since the arrival of WNV in 2002. Ground and aerial larvicide treatments of wetlands have been increased to control *Culex*. Catch basin treatments control *Cx. restuans* and *Cx. pipiens* breeding in urban areas.

The primary control material will again be *Bti* corn cob granules. Forecasted *Bti* (Vectobac® G), Altosid® pellet and Vectolex® CG needs in 2007 are similar to 2006 requirements. As in previous years, to minimize shortfalls, control material use may be more strictly rationed during the second half of the season, depending upon the amount of the season remaining and control

material supplies. Regardless of annoyance levels, MMCD will maintain sufficient resources to protect the public from potential disease risk.

Staff will treat ground sites (<3 acres) with methoprene products (Altosid® pellets, Altosid® briquets) or *Bti* corn cob granules. Breeding sites in highly populated areas will receive treatments first during a wide-scale mosquito brood. The District will then expand treatments into less populated areas where treatment thresholds are higher. In 2007, larval treatment thresholds will be the same as in 2006.

We intend to review breeding histories of ground sites to identify those that breed most often to better prioritize which sites to inspect before treatment, which sites to treat before breeding with Altosid® products, and which sites to not visit. The ultimate aim is to provide larval control services to a larger part of the District by focusing on the most prolific breeding sites.

In 2007, catch basins will be treated with Altosid® pellets and briquets. Catch basins selected for treatment include those found holding water, those that potentially could hold water based on their design, and those for which we have insufficient information to determine whether they will hold water. Treatments could begin as early as the end of May and no later than the third week of June. We have tentatively planned to complete a first round of pellet treatments by June 25 with subsequent Altosid® pellet treatments every 30 days. Catch basins treated with Altosid® briquets will be treated once by June 25.

## Adult Mosquito Control

Forecasted permethrin, resmethrin and sumithrin requirements in 2007 are similar to 2006. MMCD will direct adult mosquito control treatments to provide the greatest customer benefit, generally higher risk disease areas and human populated areas that have high levels of mosquitoes. Also, MMCD will provide service in high-use park and recreation areas and for public functions.

## Vector Mosquito Control

Employees will routinely monitor and control *Ae. triseriatus*, *Cs. melanura*, *Cx. tarsalis*, *Cx. pipiens*, *Cx. restuans*, *Cx. salinarius*, and *Aedes albopictus* populations. See Chapter 2 Vector-Borne Disease of this report for more details.

# Chapter 4 Black Fly Control

**2006 Highlights**

- Minnesota River not treated due to spring flood then summer drought conditions
- Larval mortality following *Bti* treatments on the large rivers (Rum, Mississippi and Crow) averaged 90%
- Treated South Fork of the Crow River with *Bti* in the Carver County expansion area for a second year

**2007 Plans**

- Threshold for treatments are the same as previous years
- Monitor adult populations by the overhead net sweep and $CO_2$-baited light trap methods
- Complete non-target monitoring report for samples collected in 2005
- Collect multiplate samples in the Mississippi River for the non-target monitoring program

## Background

The goal of the black fly program is to reduce pest populations of adult black flies within the MMCD to tolerable levels. Five large rivers and numerous small streams produce large populations of black flies throughout the spring and summer. Four black fly species found in this area are particularly annoying to humans and are targeted for control. Black fly larval populations are monitored at small stream and large river sites listed in the MNDNR permit using standardized sampling techniques. Liquid *Bti* is applied to sites when the target species reach the treatment threshold.

The small stream program began in 1984. The large river program began with experimental treatments and non-target impact studies in 1987. A full-scale large river treatment program did not go into effect until 1996. The large river treatment program was expanded in 2005 to the South Fork Crow River in Carver County.

## 2006 Program

### Small Stream Program – *Simulium venustum* Control

One human biting species of black fly that is targeted for control and breeds in small streams is *Simulium venustum*. It has one early spring generation. Larvae are found in small streams throughout the District, although the largest populations generally are found in Anoka County.

One-hundred thirteen *S. venustum* breeding sites were sampled in mid-April to determine larval abundance using the standard grab sampling technique developed by the MMCD in 1990. The treatment threshold was 100 *S. venustum* per sample. A total of 58 sites on 15 streams met the threshold and were treated once with Vectobac® 12AS formulation of *Bti*. A total of 35.1 gallons of *Bti* was used (Table 4.1).

Table 4.1 Summary of *Bti* treatments for black fly control by the MMCD in 2006.

| Water body | No. treatment sites | No. treatments | Gallons of *Bti* used |
|---|---|---|---|
| Small streams | 58 | 58 | 35.1 |
| Mississippi River | 2 | 8 | 503.2 |
| Crow River | 3 | 5 | 147.5 |
| South Fork Crow River | 5 | 13 | 176.2 |
| Minnesota River | 0 | 0 | 0.0 |
| Rum River | 5 | 31 | 178.6 |
| Total | 70 | 115 | 1040.5 |

## Large River Program

There are three large river-breeding black fly species that the MMCD targets for control. *Simulium luggeri* breeds mainly in the Rum and Mississippi rivers, although it also breeds in smaller numbers in the Minnesota and Crow rivers. *Simulium luggeri* is abundant from early-May through September. *Simulium meridionale* and *Simulium johannseni* breed primarily in the Crow, South Fork Crow and Minnesota rivers. These species are most abundant in May and June, although *S. meridionale* populations will remain high throughout the summer if stream flow is also high.

The black fly larval population was monitored weekly between May and early September using artificial substrates at the 27 sites permitted by the Minnesota Department of Natural Resources on the Rum, Mississippi, Crow, South Fork Crow and Minnesota rivers. The treatment thresholds were the same as those used since 1990. Fifty-seven treatments using 1005.4 gallons of Vectobac® 12AS (*Bti*) were applied to control large river-breeding black fly larvae in 2006 (Table 4.1). The Minnesota River was not treated in 2006 because treatment thresholds were not met for any of the 119 samples collected from the 7 monitoring stations. Two possible reasons treatment thresholds were not met on the Minnesota River could have been due to flood-level discharge that persisted in April and May and the drought level flows experienced in June through August. High discharge results in lower colonization rates of black fly larvae on the artificial substrates while very low discharge rates naturally reduce black fly production.

*Bti* treatment effectiveness was excellent in 2006. The average post-*Bti* treatment larval mortality (measured at least 250 m downstream of the point of the *Bti* application) was 98% on the Crow River, 99% on the Mississippi River, 88% on the Rum River, and 90% on the South Fork Crow River. Larval mortality following *Bti* treatment averaged 90% on the large rivers in 2006.

## Adult Population Sampling

The adult black fly population was monitored in 2006 at the 53 standard stations throughout the MMCD using the District's standard black fly over-head net sweep monitoring technique that was established in 1984. Samples were taken once weekly from early May to mid-September, generally between 8:00 AM and 10:00 AM. The average number of all species of adult black

flies captured in 2006 was 0.55 (Table 4.2). This was the lowest average adult sample count recorded since adult monitoring began in 1984 (Table 4.2). The average number of adult black flies captured per net sweep sample from 1984 to 1986 when no large river *Bti* treatments were done was 14.8. Between 1987 and 1995 when experimental *Bti* treatments were conducted on the large rivers the average number of adult black flies captured per sample was 3.6. The average number of adult black flies captured per sample from the start of the District's full-scale large river larval black fly control program began is 1.5 (1996-2006).

The most abundant black fly collected in the overhead net-sweep samples in 2006 was *S. luggeri*, comprising 82% of the total black flies captured. The overall average number of *S. luggeri* captured per net-sweep sample in 2006 was 0.45 (Table 4.2). This was the third lowest number of *S. luggeri* collected in the net-sweep samples since the black fly program began in 1984. *Simulium luggeri* was most abundant in Anoka County in 2006, as it has been since the program began. The average number of *S. luggeri* captured in Anoka County was 1.07 in 2006 compared to averages of 1.65, 8.92, 1.82 and 2.74 in 2002, 2003, 2004 and 2005, respectively. The higher number of *S. luggeri* captured in Anoka County compared to other counties within the MMCD is most likely due to the close proximity of prime *S. luggeri* larval habitat in the nearby Rum and Mississippi rivers.

The second most abundant black fly adult species captured in overhead net-sweep samples in 2006 was *S. meridionale*, averaging 0.34 per sample (Table 4.2) and comprising 6.5% of the total black flies collected. *Simulium meridionale* was most abundant in Carver County in 2006 where an average of 0.06 adults was captured per sample. Five additional adult net-sweep sample stations were added to Carver County beginning in 2004 to collect data prior to control activities scheduled to begin in 2005. The average number of *S. meridionale* captured at these sample stations was 1.41 in 2004, 0.41 in 2005 and 0.09 in 2006.

Adult black fly populations were also monitored in 2006 between mid-May and late June with $CO_2$-baited light traps at 13 stations in Anoka, Scott and Carver counties. The sites in Anoka and Scott counties have been monitored with $CO_2$ traps since 1998; monitoring in the Carver County expansion area began in 2004.

*Simulium meridionale* and *S. johannseni* are the two most abundant black fly species captured in the $CO_2$ traps. Results from trapping during 2004 through 2006 are shown in Table 4.3. The number of *S. meridionale* captured per trap in the Carver County expansion area in 2004 was 327 compared to 188 in 2005 and 106 in 2006. The mean number of *S. johannseni* captured per trap in Carver County in 2004 was 33 compared to 99 in 2005 as well as in 2006. In Scott County, the average number of *S. meridionale* captured per trap in 2004 was 0.65 compared to 23 in 2005 and 11 in 2006. The average number of *S. johannseni* collected per trap in Scott County was 0.2 in 2004 compared to 4 in 2005 and 38 in 2006. The average number of *S. meridionale* captured per trap in Anoka County was 14 in 2004 and 1.2 in 2005 and 0.8 in 2006. The average number of *S. johannseni* captured per trap in the Anoka County traps was 5 in 2004 compared to 0.03 in 2005 and 0.8 in 2006. The largest larval populations of both species are found in the Minnesota and Crow river systems.

Table 4.2 Annual mean number of black fly adults captured in over-head net sweeps in weekly samples taken at standard sampling locations throughout the MMCD between mid-May and mid-September. Samples were taken once weekly beginning in 2004 and twice weekly in previous years. The first operational treatments of the Mississippi River began in 1990 at the Coon Rapids Dam. 1988 was a severe drought year and limited black fly production occurred.

| Year | All species[1] | *Simulium luggeri* | *Simulium johannseni* | *Simulium meridionale* |
|---|---|---|---|---|
| 1984 | 17.95 | 16.12 | 0.01 | 1.43 |
| 1985 | 14.56 | 13.88 | 0.02 | 0.63 |
| 1986 | 11.88 | 9.35 | 0.69 | 1.69 |
| 1987 | 6.53 | 6.33 | 0.02 | 0.13 |
| 1988 | 1.60 | 1.54 | 0.05 | 0.00 |
| 1989 | 6.16 | 5.52 | 0.29 | 0.18 |
| 1990 | 6.02 | 5.70 | 0.01 | 0.24 |
| 1991 | 2.59 | 1.85 | 0.09 | 0.60 |
| 1992 | 2.63 | 2.19 | 0.12 | 0.21 |
| 1993 | 3.00 | 1.63 | 0.04 | 1.24 |
| 1994 | 2.41 | 2.31 | 0.00 | 0.03 |
| 1995 | 1.77 | 1.34 | 0.32 | 0.01 |
| 1996 | 0.64 | 0.51 | 0.01 | 0.07 |
| 1997 | 2.91 | 2.49 | 0.00 | 0.25 |
| 1998 | 2.85 | 2.64 | 0.04 | 0.04 |
| 1999 | 1.63 | 1.34 | 0.04 | 0.06 |
| 2000 | 2.38 | 2.11 | 0.01 | 0.02 |
| 2001 | 1.30 | 0.98 | 0.04 | 0.18 |
| 2002 | 0.61 | 0.43 | 0.01 | 0.14 |
| 2003 | 1.96 | 1.65 | 0.01 | 0.20 |
| 2004 | 0.97 | 0.35 | 0.02 | 0.39 |
| 2005 | 0.74 | 0.58 | 0.01 | 0.08 |
| 2006 | 0.55 | 0.45 | 0.01 | 0.34 |

[1]All species includes *S. luggeri*, *S. meridionale*, *S. johannseni*, *S. vittatum* and *S. venustum*

Table 4.3 Mean number of adult *S. meridionale* and *S. johannseni* captured in $CO_2$-baited light traps set twice weekly between May and mid-June in 2004, 2005, and 2006. Traps monitor black fly populations on the South Fork Crow River (Carver Co), the Minnesota River (Scott County), and the Mississippi River (Anoka County).

| | Carver County | | Scott County | | Anoka County | |
|---|---|---|---|---|---|---|
| Year | *S. meridionale* | *S. johannseni* | *S. meridionale* | *S. johannseni* | *S. meridionale* | *S. johannseni* |
| 2004 | 327.0 | 33.0 | 0.65 | 0.2 | 14.0 | 5.00 |
| 2005 | 188.0 | 99.0 | 23.00 | 4.0 | 1.2 | 0.03 |
| 2006 | 106.0 | 99.0 | 11.00 | 38.0 | 0.8 | 0.80 |

### Non-target Monitoring

The District conducts biennial monitoring of the non-target invertebrate population in the Mississippi River as part of the permit requirements set by the Minnesota Department of Natural Resources. The study was designed to provide a long-term assessment of the invertebrate community in *Bti*-treated reaches of the Mississippi River. The results from the monitoring work conducted in 1995, 1997, 1999, 2001 and 2003 have not indicated that any large-scale changes have occurred within the invertebrate community in the *Bti*-treated reaches of the Mississippi River. Monitoring was repeated as scheduled on the Mississippi River in 2005. Sample processing and enumeration will be completed in January 2007. A report is scheduled for completion in April. Non-target field samples are scheduled to be collected again in 2007.

## 2007 Plans

Our goal is to continue to effectively control black flies in the large rivers and small streams. The larval population monitoring program and thresholds for treatment will continue as in previous years. The six larval treatment sites on the South Fork Crow River will continue to be monitored and treated if the treatment threshold is reached. The 2007 black fly control permit application request has been submitted to the Minnesota Department of Natural Resources. Taxonomic identification and enumeration of the non-target samples collected in 2005 will be completed in January 2007 and a report will be submitted to the MDNR in April. A research project with the goal of developing less labor intensive protocols for monitoring the non-target invertebrate community in the Mississippi River will be initiated. The current protocols are effective for monitoring the non-target invertebrate community but are extremely labor intensive and costly. The input of the MDNR will be sought during all phases of this study.

# Chapter 5 Product & Equipment Tests

**2006 Highlights**

- Vectobac® G *Bti* achieved the same high level of control of *Ae. vexans* in air sites as in previous years
- Altosid® XR-G sand and Altosid® pellets effectively controlled *Cq. perturbans* in cattail sites
- Permethrin controlled mosquitoes in woodlots at ground level and higher in trees for up to six days after treatment
- Scourge® effectively controlled adult mosquitoes at ground level and higher in trees

**2007 Plans**

- Repeat tests of Altosid® XR-G sand and other new materials to control *Cq. perturbans* in cattail sites
- Continue testing control materials in catch basins with the goal of decreasing the number of treatments per season while maintaining efficacy
- Repeat tests of permethrin in woodlots to include more mosquito species
- Test Pyrenone® and Pyrocide® for adult mosquito control in croplands

## Background

Quality assurance (QA) is an integral part of MMCD services. The QA process focuses on control material evaluations, label compliance, application analysis, calibration, and exploration of new technologies to improve our operations. The Technical Services team provides project management and technical support. The regional process teams coordinate field testing and data collection.

## 2006 Projects

Quality assurance processes focused on equipment, product evaluations, and waste reduction. Before being used operationally, all products must complete a certification process that consists of tests to demonstrate how to use the product to effectively control mosquitoes. The District continued certification testing of four larvicides and one new adulticide. All four larvicides have been tested in different control situations in the past. Three larvicides were tested to control *Culex* breeding in catch basins, two to control *Culex* developing in wetlands, and one to control the cattail mosquito. The adulticide was tested for use in croplands. These additional materials will provide MMCD with more tools to utilize in its operations.

### Acceptance Testing of Altosid® (methoprene) Briquets and Pellets

Warehouse staff collected random Altosid® product samples from shipments received from Wellmark International for methoprene content analysis. MMCD contracts an independent testing laboratory, Legend Technical Services, to complete the active ingredient (AI) analysis. Zoecon

Corporation, Dallas, Texas, provided the testing methodologies. The laboratory protocol used was CAP No. 311, "Procedures for the Analysis of S-Methoprene in Briquets and Premix." All 2006 samples were within acceptable values of the label claim of percent methoprene (Table 5.1).

Table 5.1 Methoprene content of Altosid® (methoprene) briquets and pellets

| Methoprene Product | Samples Analyzed | Methoprene Content: Label Claim | Methoprene Content: Analysis Average | SE |
|---|---|---|---|---|
| XR-Briquet | 10 | 2.10% | 2.06% | 0.014 |
| Ingot Briquet | 1 | 2.10% | 2.20% | 0.000 |
| Pellets | 72 | 4.25% | 4.20% | 0.074 |
| XR-G Sand | 2 | 1.50% | 1.60% | 0.064 |
| Calibration Sand | 1 | 0.00% | 0.00% | 0.000 |

## Evaluation of Active Ingredient Levels in Adult Mosquito Control Products

MMCD has requested the certificates of Active Ingredient (AI) analysis from the manufacturers to verify product AI levels at the time of manufacture. MMCD incorporated AI analysis as part of a product evaluation procedure and will submit randomly selected samples of adulticide control materials to an independent laboratory for AI level verification. This process will assure that all adulticides (purchased, formulated and/or stored) meet the necessary quality standards. Voucher samples of all adulticides were collected and stored under the same conditions as operational materials. In 2007, analyses of resmethrin and sumithrin will be expanded to include AI levels of the synergist, piperonyl butoxide (PBO).

## Improvement of Warehouse Facilities

The District uses the Oakdale location as its main warehouse facility for liquid control materials. This facility has controlled environmental conditions throughout the year and liquid materials are stored there to prevent material degradation due to extremes of temperature.

MMCD improved the formulating facilities by purchasing a 50 gal graduated vessel to accurately measure ingredients prior to mixing. This large vessel, mounted above the mixing tank, eliminated the need to measure multiple small allotments and decreased spillage. This improvement significantly reduced the amount of time needed to complete mixing and increased the safety of the mixing operation.

As part of our inventory improvement process, we redesigned our container filling operations to accurately weigh each container as it is filled. Warehouse staff incorporated multiple fluid metering pumps to add/subtract liquid control materials while the containers were on the scale to quickly portion each container. This improvement significantly reduced the time required to portion each adulticide container and reduced the exposure of material handlers to insecticides.

Warehouse staff increased the amount of permethrin pallets to improve the logistics of moving permethrin products throughout the District. This improvement allowed facilities to receive fixed

amounts of control materials without waiting for containers to be refilled and allowed for unimpeded field operations.

## Increase of Control Material Storage Space

MMCD increased the capacity of four facilities by better using the vertical space of our control material warehousing facilities. Due to the bulkiness of the larvicides, we installed pallet racks to increase the capacity of these storage areas. This enables warehouse staff to maintain adequate inventory levels for field operations.

## Improvement of Warehouse Operations

Due to limited warehouse space in each region facility and increased pace of control material usage in the District as it expands its larval control program, Technical Services and warehouse staff are developing methods to handle the increased demand for control material transfers. The logistics of warehouse control material transfers in our busiest times can tax the warehouse staff, which needs to maintain adequate levels of 39 products (control materials, calibration materials, and product ingredients) in six field offices and two warehouse locations.

MMCD is attempting to reduce the direct handling of all control materials by using vendor drop shipments to the regional facilities whenever possible. These shipments have increased the efficiency of our warehouse operations by increasing the quantity received in a single transfer. These larger transfers reduce the amount of time, effort, and paperwork for both warehouse and regional facility staff when compared to multiple internal control material transfers.

The warehouse is also experimenting with using real-time and historical control material usage data to improve warehouse operations. Warehouse staff is forecasting control material use in each facility and attempting to maintain inventory levels to reduce or eliminate the need for immediate transfers that might impede field operations. This method increases the need to monitor each product to assure that each control material inventory is properly rotated to maintain our First In, First Out inventory procedures.

In addition, MMCD purchased a larger capacity warehouse truck to increase the quantity of materials that could be transferred per trip. This flatbed truck has open sides to ease forklift pallet loading, which increased the speed of loading/unloading. Multiple ratcheting straps to secure the pallets to the flatbed ensured the safety of the shipment.

## Recycling of Pesticide Containers

MMCD continued to use the Minnesota Department of Agriculture's (MDA) pesticide container recycling program. This project focuses on properly disposing of agricultural pesticide waste containers thereby protecting the environment from the related pesticide contamination of ground and water. MDA used Tri-Rinse, Inc., St. Louis, MO for disposal services of their plastic pesticide container-recycling program.

Warehouse personnel arranged for all of MMCD's plastic containers to be collected and properly stored until they could be processed. MMCD staff collected over 5,442 jugs for this recycling program. The control materials that use plastic 2.5-gallon containers are sumithrin (49 jugs), *Bti* liquid (414 jugs), Altosid® pellets (4,939 jugs), permethrin (30 jugs) and Aquaprene granules (10 jugs). Twelve MMCD staff members (two employees from each regional facility) assisted in the jug grinding process which was completed in one day and resulted in approximately 5,450 lbs of recycled shredded plastic.

In addition, the warehouse recycles numerous steel drums and steel containers each season. These 55- or 30 gal drums are brought to a local company to be refurbished and reused.

## Reduced Production of Hazardous Waste

To properly handle and dispose of pesticide containers, each oil-based adulticide container had to be triple-rinsed with mineral spirits. This rinsing process creates a rinsate that MMCD manages as hazardous waste.

MMCD's centralized triple-rinsing process used our warehouse personnel expertise to maintain low quantities of hazardous waste created by our operations. By rinsing all the containers at the same time, warehouse staff was able to utilize a minimal quantity of mineral spirits in the recycling process. MMCD further reduced the creation of hazardous waste and only produced two gallons of mineral spirit rinsate in 2006.

## Efficacy of Control Materials

**Vectobac® G Applications** Vectobac® G brand *Bti* (5/8 inch mesh size corncob granules) from Valent BioSciences was the primary *Bti* product applied by helicopter in 2006. Efficacy as calculated in terms of pre-treatment and post-treatment larval counts was similar in 2005 and 2006 (Table 5.2).

Table 5.2 Efficacy of aerial Vectobac® G applications in 2005 and 2006. SE=standard error.

| Year | n | Mean % mortality | Median % mortality | SE | Min % mortality | Max % mortality |
|---|---|---|---|---|---|---|
| 2006 | 506 | 90.2 | 100.0 | 1.2 % | 0.0 | 100.0 |
| 2005 | 78 | 88.1 | 100.0 | 3.2 % | 0.0 | 100.0 |

**Vectolex® CG Treatments** Efficacy of aerial treatments of Vectolex® CG (*Bacillus sphaericus*) was high throughout the 28-day control period (Table 5.3, Figure 5.1). Efficacy was comparable to that observed in 2004 and 2005 treated with the same dosage (8 lb/acre). Statistical analysis confirmed that efficacy remained high for over four weeks (Figure 5.1).

Table 5.3 Efficacy of aerial Vectolex® CG applications in 2006. SE=standard error.

| Days after treatment | n | Mean % Control | Median % Control | SE | Min % Control | Max % Control |
|---|---|---|---|---|---|---|
| 2 – 35 | 59 | 77 | 100 | 4.9% | 0 | 100 |
| 2 | 13 | 89 | 100 | 7.6% | 0 | 100 |
| 7 - 8 | 14 | 89 | 100 | 8.0% | 0 | 100 |
| 14 | 13 | 88 | 100 | 8.3% | 0 | 100 |
| 21 – 22 | 13 | 38 | 33 | 10.7% | 0 | 100 |
| 29 – 35 | 6 | 83 | 100 | 16.7% | 0 | 100 |

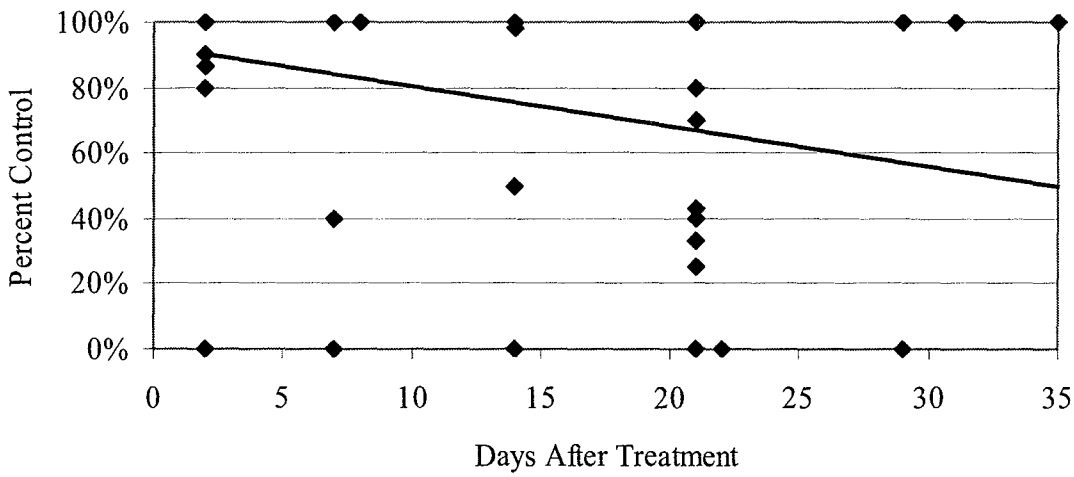



Figure 5.1 Mean efficacy calculated in terms of pre-treatment and post-treatment larval counts in sites treated aerially with Vectolex® CG in 2006. (Linear Regression; slope = -0.01233, F = 5.396, p = 0.3315; df = 57; R-squared = 0.0864)

**Altosid® Pellet Treatments** In 2006, MMCD applied Altosid® pellets aerially to control *Ae. vexans* and *Culex* mosquitoes in sites which historically produce multiple mosquito broods from May though July. Unusually dry conditions after mid-June limited the number of sites from which pupae could be collected for bioassay. Untreated control emergence in 2006 from wetlands similar to those treated with Altosid® pellets was higher than that observed in comparable sites in 2005 (Table 5.4). Bioassays from sites treated with Altosid® pellets in 2006 indicated high efficacy essentially identical to that observed in 2005 (Table 5.5).

Table 5.4 Bioassay results for untreated control breeding sites in 2005 and 2006. SE=standard error.

| Year | n | Mean % emergence | Median % emergence | SE | Min % emergence | Max % emergence |
|---|---|---|---|---|---|---|
| 2005 | 29 | 78.9 | 84.6 | 5.6% | 5.6 | 100 |
| 2006 | 6 | 95.9 | 96.7 | 1.4% | 90 | 100 |

Table 5.5 Results of bioassays from sites treated with Altosid® pellets in 2005 and 2006. Emergence inhibition (EI) is corrected for 2006 untreated control mortality. SE=standard error.

| Year | n | Mean % EI | Median % EI | SE | Min % EI | Max % EI |
|---|---|---|---|---|---|---|
| 2005 | 84 | 73.7 | 96.2 | 4.1% | 0.0 | 100 |
| 2006 | 40 | 76.5 | 97.0 | 4.9% | 0.98 | 100 |

**Altosid® Pellets in Catch Basins** In 2006, MMCD completed 167,797 treatments of catch basins with Altosid® pellets to control WNV vectors (i.e. *Cx. restuans* and *Cx. pipiens*). In 2006, it was very difficult for staff to locate pupae in catch basins treated with Altosid® pellets. Larvae were very abundant (see Table 5.13). The few successful pupal collections from pellet-treated catch basins indicated a high level of control (Mean EI = 90.6%, n = 8, Median EI = 94.7%, SE = 3.7%, Minimum EI = 73.9%, Maximum EI = 100%).

**Scourge® 2+2** A test of Scourge® in June that included high and low $CO_2$ traps and caged mosquitoes demonstrated that ULV applications made using a truck-mounted sprayer were able to effectively control mosquitoes at ground level and higher in trees (20-25 ft) (Table 5.6). Efficacy was evaluated using Mulla's equation (a correction that accounts for changes in the control as well as the treatment) that compares mean mosquito captures the first night of trapping (pre-treatment counts) with mean mosquito captures the second and third nights of trapping (post-treatment counts). Test materials were applied the evening of the second night of trapping; $CO_2$ traps were placed 30 minutes after the treatments were completed at both treated locations and the untreated control location. An additional set of post-treatment collections were made the following evening. Caged mosquitoes included in the test indicated that control of both low and high mosquitoes was due to direct contact with ULV droplets (Table 5.7). Too few *Culex* mosquitoes were captured to evaluate *Culex*-specific efficacy.

Table 5.6 Results of a test of Scourge® efficacy using low and high $CO_2$ traps. Mulla's formula incorporates untreated control trap counts to correct for changes in the treated traps that are not due to the treatment.

| Treatment | Collection | Efficacy | Average mosquitoes per trap | SE |
|---|---|---|---|---|
| Low traps Scourge® | Pre-treat | --- | 414 | 104.0 |
| | Treatment* | 93% | 46 | 1.5 |
| | Post-treatment | 0% | 50 | 26.0 |
| Untreated control | Pre-treat | --- | 697 | 70.0 |
| | Treatment day* | --- | 1,067 | 53.0 |
| | Post-treatment | --- | 70 | 35.5 |
| High traps Scourge® | Pre-treat | --- | 10 | 0.0 |
| | Treatment* | 69% | 17 | 1.5 |
| | Post-treatment | 0% | 15 | 11.5 |
| Untreated control | Pre-treat | --- | 34 | 6.5 |
| | Treatment day* | --- | 179 | 159.5 |
| | Post-treatment | --- | 22 | 20.0 |

* Traps placed ½ hour after treatment application

Table 5.7 Mortality of caged mosquitoes in a Scourge® efficacy test.

| | % Mortality | | | |
|---|---|---|---|---|
| Hours after treatment | Control N=3 | Scourge® (10-20 ft away)§ N=3 | Scourge® low* N=2 | Scourge® high* N=2 |
| 0.5 hr | 0% | 33% | 52% | 22% |
| 9.5 hr | 0% | 97% | 100% | 71% |
| 19.5 hr | 0% | 100% | 100% | 91% |

* Low and high cages were positioned at the same places as low and high $CO_2$ traps reported in Table 5.6.

§ Cages placed 10-20 ft from spray were positioned for optimal contact with the ULV spray cloud

**Permethrin** In 2006, we began developing a protocol to evaluate the effectiveness of permethrin barrier treatments. Our goal was to begin with an operational situation in which we could employ more than one kind of sampling to increase the diversity of mosquitoes we could evaluate. We reviewed the literature and found only one paper that describes tests of backpack permethrin treatments (Hubbard et al., 2005). Hubbard et al. examined backyard mosquito applications and included a water treatment as a "control." They used several sampling methods including light traps, landing counts, ovitraps and gravid traps to evaluate effectiveness against multiple species of mosquitoes and were able to detect a reduction of the most numerous mosquitoes (including *Aedes albopictus*) significant enough that property owners could enjoy their backyards after treatment.

MMCD applies permethrin barrier sprays in woodlots to control adult mosquitoes, especially *Aedes triseriatus*. We chose a pair of woodlots with a history of *Ae. triseriatus* breeding that were small enough to treat and relatively close together (0.25 mile apart). Before treatment, we placed a high/low pair of $CO_2$ traps in both woodlots. We also sampled the woodlots with vacuum aspirators. If one of the sampling methods captured threshold numbers of mosquitoes, we applied a barrier permethrin treatment to one of the woodlots and left the other untreated. We repeated the sampling 1-2 days after treatment and 6 days after treatment.

We had intended to repeat this test several times throughout the season to maximize the diversity of mosquito species included. Low adult mosquito populations later in the season precluded tests after mid-July. We were able to capture threshold levels in low $CO_2$ traps in June and July which permitted us to conduct the test twice. The results suggest that permethrin was effective soon after application (within 1-2 days) (Table 5.8). Permethrin reduced the number of *Cq. perturbans* at ground level and ~20 feet up in trees. In both tests, efficacy against *Cq. perturbans* decreased by 6 days after treatment.

In both tests we were able to capture enough *Cq. perturbans* to evaluate efficacy against this mosquito species (Table 5.8). Vacuum aspirator sampling conducted during both tests did not collect *Aedes triseriatus* nor did $CO_2$ traps collect enough *Culex* or other mosquitoes to evaluate efficacy against these mosquitoes.

Table 5.8 Results of a test of permethrin efficacy using low and high $CO_2$ traps. Mulla's formula incorporates untreated control trap counts to correct for changes in the treated traps that are not due to the treatment.

| | | *Cq. perturbans* (% Efficacy; Mulla's formula) | | All other mosquito species (% Efficacy, Mulla's formula) | |
|---|---|---|---|---|---|
| Trap | Days after treatment | Test 1* | Test 2* | Test 1* | Test 2* |
| **Low traps** | | | | | |
| Permethrin | Pre-treat | 178 | 273 | 40 | 37 |
| | 1-2§ | 11 (90%) | 63 (81%) | 6 (86%) | 19 (29%) |
| | 6 | 134 (27%) | 56 (49%) | 8 (17%) | 12 (0%) |
| Untreated control | Pre-treat | 76 | 114 | 25 | 25 |
| | 1-2§ | 46 | 135 | 27 | 18 |
| | 6 | 78 | 46 | 6 | 3 |
| **High traps** | | | | | |
| Permethrin | Pre-treat | 17 | 21 | 1 | 0 |
| | 1-2§ | 8 (84%) | 8 (61%) | 0 | 0 |
| | 6 | 96 (0%) | 5 (58%) | 1 | 0 |
| Untreated control | Pre-treat | 9 | 28 | 0 | 0 |
| | 1-2§ | 26 | 27 | 4 | 1 |
| | 6 | 19 | 16 | 1 | 3 |

* Test 1 conducted June 20-28, 2006, Test 2 conducted July 12-18, 2006
§ Test 1 first post treatment sampling conducted 2 days after treatment
Test 2 first post treatment sampling conducted 1 day after treatment

## New Control Material Evaluations

The District, as part of its Continuous Quality Improvement philosophy, desires to continually improve its control methods. Much testing has focused upon controlling potential vectors of WNV since its arrival to Minnesota in 2002

**Season-long Control in Catch Basins** Most of our catch basin research focused upon reducing the amount of work required to treat catch basins while maintaining effective control. The FourStar® briquet potentially could control mosquito larvae breeding in catch basins for the entire season. *Bti* is the active ingredient. Preliminary efficacy results provided by the manufacturer (B2E) looked promising.

**FourStar® Briquets in Catch Basins** In 2006, we selected 38 catch basins in St. Paul that we sampled approximately weekly throughout from mid-June through mid-August. Twenty-eight catch basins were treated with one FourStar® briquet each on June 21st; ten were not treated and served as untreated controls. We observed no difference in the percentage of catch basins that contained larvae after treatment with FourStar® briquets compared to untreated catch basins (Table 5.9). Three days after treatment a 2+ inch rainfall may have flushed the briquets from treated catch basins.

Table 5.9 Percent of catch basins treated with FourStar® briquets in 2006 that contained larvae compared to untreated catch basins. SE=standard error. n = catch basins sampled

| | FourStar® briquets | | Untreated Control | |
|---|---|---|---|---|
| Sample dates | Percent containing larvae | n | Percent containing larvae | n |
| 14-15 June | 100 | 28 | 100 | 10 |
| 22 June | 92 | 24 | 100 | 10 |
| 29 June | 100 | 22 | 86 | 7 |
| 6-7 July | 100 | 22 | 100 | 10 |
| 12-13 July | 95 | 20 | 100 | 10 |
| 21 July | 74 | 23 | 60 | 10 |
| 26-27 July | 52 | 21 | 60 | 10 |
| 4 August | 45 | 20 | 60 | 10 |
| 9 August | 74 | 23 | 100 | 10 |
| 16 August | 76 | 21 | 90 | 10 |

We observed no difference in the mean number of larvae per dip in catch basins that contained larvae after treatment with FourStar® briquets compared to untreated catch basins (Table 5.10).

Table 5.10 Mean dip counts from catch basins treated with FourStar® briquets in 2006 compared to untreated catch basins. SE=standard error. Control = untreated catch basins.

| | FourStar® briquets | | Untreated control | |
|---|---|---|---|---|
| Sample dates | Mean dip count (larvae per dip) | SE | Mean dip count (larvae per dip) | SE |
| 14-15 June | 55.41 | 18.57 | 34.25 | 8.36 |
| 22 June | 50.06 | 17.93 | 36.93 | 10.93 |
| 29 June | 40.52 | 15.83 | 10.33 | 6.38 |
| 6-7 July | 102.26 | 21.90 | 66.22 | 16.47 |
| 12-13 July | 130.87 | 30.01 | 108.30 | 25.13 |
| 21 July | 6.73 | 2.28 | 9.45 | 4.56 |
| 26-27 July | 4.81 | 2.20 | 5.30 | 3.71 |
| 4 August | 1.67 | 0.95 | 3.29 | 2.16 |
| 9 August | 23.28 | 5.90 | 25.15 | 9.67 |
| 16 August | 13.95 | 6.52 | 16.95 | 5.57 |

If the FourStar® briquets were killing larvae slowly, we might observe a higher percentage of first instar larvae in treated catch basins. We observed no difference in the percentage of larvae that are first instars in catch basins that contained larvae after treatment with FourStar® briquets compared to untreated catch basins (Table 5.11).

Table 5.11 Percent of larvae in catch basins treated with FourStar® briquets in 2006 that are first instars compared to untreated catch basins. SE=standard error.

| | FourStar® briquets | | Untreated Control | |
|---|---|---|---|---|
| Sample dates | Percent first instar larvae | SE | Percent first instar larvae | SE |
| 14-15 June | 23.9 | 5.1% | 24.5 | 7.3% |
| 22 June | 26.6 | 5.5% | 25.5 | 11.8% |
| 29 June | 39.1 | 8.0% | 46.7 | 17.8% |
| 6-7 July | 16.8 | 3.8% | 20.5 | 5.6% |
| 12-13 July | 30.0 | 5.7% | 22.5 | 7.8% |
| 21 July | 40.3 | 10.2% | 32.5 | 18.5% |
| 26-27 July | 31.8 | 10.2% | 33.3 | 21.1% |
| 4 August | 53.3 | 14.8% | 62.5 | 20.0% |
| 9 August | 61.2 | 7.6% | 67.0 | 8.5% |
| 16 August | 46.3 | 10.4% | 65.0 | 13.8% |

In summary, we observed no significant effect of treatment with FourStar® briquets. We hope to repeat this test and include a method of determining if the FourStar® briquet remained in the catch basins.

**Altosid® XR-G Sand Treatments** An emergence cage test conducted in 2006 compared the ability of Altosid® XR-G Sand and Altosid® pellets to suppress emergence of the cattail mosquito, *Cq. perturbans*. The test included nine cattail sites, three of which were treated aerially with Altosid® XR-G sand (10 lb/acre), three with Altosid® pellets (4 lb/acre), and three left untreated. Five emergence cages were placed in each of the nine sites. All mosquitoes that emerged into the cages were collected twice each week beginning on June 8th and continuing through August 4th. Both products effectively suppressed *Cq. perturbans* (Table 5.12).

Table 5.12 Emergence cage test results of Altosid® XR-G sand and Altosid® pellets against *Cq. perturbans*. The percent reduction is compared to the control treatment.

| Treatment | Total emerged from all 15 cages | Mean emerged per cage | Percent reduction | No. of cages with *Cq. perturbans* |
|---|---|---|---|---|
| Control | 1,483 | 98.87 | N/A | 15 of 15 |
| XR-G | 59 | 3.93 | 96.0 | 9 of 15 |
| Pellets | 2 | 0.13 | 99.9 | 2 of 15 |

## Equipment Evaluations

**Helicopter Swath Analysis and Calibration Procedures for Larvicides** Technical Services and field staff conducted eight aerial calibration sessions for dry granular materials during the 2006 season. These computerized calibrations directly calculate application rates and swath patterns for each pass so each helicopter's dispersal characteristics are optimized. Seven sessions were held at the municipal airport in LeSueur, MN and one session was held in Lino

Lakes, MN. Staff completed calibrations for six different operational and experimental control materials. In total, seven helicopters were calibrated and each helicopter was configured to apply an average of three different control materials.

The number of trials increased significantly due to the use of pre-hatch materials (Altosid® pellets) in 2006. Altosid® pellets are challenging to apply at our low dosage rates primarily due to the designs of the control material (extruded pellet) and the application equipment (gravity-fed hoppers). The pellets inter-lock, bridge, and do not flow freely through metering gates. Therefore, equipment settings must be accurately readjusted just prior to application to apply the desired treatment rate.

**Development of GPS Navigation Systems in Helicopters** For many years MMCD has experimented with handheld GPS units to track sampling and control material applications and aid mapping. Valuable operational information can be gained by tracking and physically recording these control material applications. GPS information can help staff locate breeding sites and analyze efficiency, and help our quality assurance program improve operations, automate treatment records, and provide other advantages. In 2005, handheld GPS units were placed in each helicopter to track Altosid® pellet applications. Due to the successful tracking of these aerial applications and the information gained, MMCD included the requirement of an aircraft-mounted GPS navigational system as part of the aerial application contract in 2006.

Our helicopter operations contractor, Scott's Helicopter Service, installed Ag-Nav® Guia GPS-navigational systems in all their helicopters during the 2006 season. Due to delays in manufacturing, the Ag-Nav systems were not fully installed prior to the start of the season. Further delays occurred as MMCD operations limited the availability of these aircrafts to be fitted with new electronic systems. Therefore, MMCD was not able to begin using the systems until mid-July.

Evaluation of these systems showed very encouraging results. MMCD was able to upload breeding site information into the helicopter's navigational computer and then download a complete track of the aerial applications. This information could then be electronically overlaid on digitized aerial photos and analyzed. In conjunction with the encouraging results, MMCD discovered that many new processes and procedures would have to be developed to manage the overall data flow so it would not impede operations. In addition, these evaluations found multiple problems in the new Ag-Nav system's hardware and software programming. MMCD worked with the helicopter contractor and the manufacturer to resolve many of these issues. A subgroup of MMCD staff and helicopter pilots was formed to resolve any remaining issues and develop procedures to assist all parties in understanding and using the system. The goal is to have the systems fully operational for the start of 2007 aerial application season (see Chapter 6 - Plans).

**Evaluation of Fixed Wing Aircraft for Use in Northern Regions of MMCD** As the District expands the acres treated by larvicides, Technical Services is continuing to explore methods to increase the efficiencies of our control operations. Application of granular larvicides by fixed-wing aircraft in the large continuous mosquito breeding acreage holds promise for the northernmost portion of the District (Washington, Anoka and Hennepin counties). Technical Services is evaluating an AirTractor 502 fixed-wing aircraft, which are used primarily in

agricultural application industry. This aircraft has a 5,000 lb payload capacity and can hold approximately 1,625 lbs of *Bti* granules (203 acres per flight). We do not reach the payload capacity due to the bulk density of our *Bti* larvicide. The application flight speed of a fixed wing aircraft is approximately 120 mph. When comparing these application parameters to our currently used Bell 47 helicopters, which have a capacity of 640 lbs (80 acres per flight) and an application speed of approximately 50 mph, we may be able to significantly increase the amount of acres treated per day in these larger continuous sites.

In April 2006, Technical Services staff traveled to Halstad, MN to evaluate the applicability of an AirTractor 502 aircraft to mosquito control operations. By using the same methods used in our helicopter calibrations, we evaluated the fixed wing's granular distribution to determine if the aircraft could adequately apply materials at our low application rates and swath requirements. The aircraft was calibrated and was able to consistently apply *Bti* granules at an 8 lbs/acre rate at a 75 ft swath. This result was achieved without the use of a seeder plate, which is often used when applying low volume rates out of fixed-wing aircraft. The swath width is equivalent to swaths achieved by our helicopters.

In August 2006, a field application evaluation was planned and set up to determine if we can properly place control materials within our mosquito breeding sites. A 300 acre plot was chosen in Anoka County and contained multiple sites to represent a typical application flight. Breeding site coordinate data was uploaded into the aircraft's GPS guidance system (Satloc) so the pilot would have pertinent site information. The trial would determine the accuracy of placement of our control materials and concentrate on edges of breeding sites.

In addition, Technical Services met with officials of the Anoka County Airport (Janes Field) to arrange to use one of the taxi ways as a staging area for conducting these operations. A congested area waiver was filed with the Federal Aviation Administration (FAA) to gain all necessary approvals for flying within the metropolitan area.

Due to the dry environmental conditions and lack of mosquito breeding in the test sites, this trial was postponed until the 2007 season.

**Aerial Adulticide Applications** MMCD continues to research emergency methods for controlling adult mosquitoes in the event of a large-scale outbreak of vector-borne disease. Technical Services staff evaluated five companies that have conducted aerial adulticide operations around the country and reviewed the methodology and contractual agreements used in these operations. In addition, Technical Services contacted the 910$^{th}$ Airlift Wing of the US Air Force Reserve which maintains the Department of Defense's fixed-wing aerial spray unit. This Youngstown, Ohio unit has conducted mosquito control spray missions in response to natural disasters (multiple hurricanes) and public health emergencies (Eastern and Western Equine Encephalitis, Dengue). Since the Air Force Reserve has an airbase at the Minneapolis/St. Paul International Airport, this unit could effectively support their operations within our region. In 2007, Technical Services will continue to build the relationships with the local Air Force Reserve Unit and 910$^{th}$ Airlift Wing to familiarize them with our operations.

Technical Service staff did not conduct any aerial adulticide trials in 2006 but continues to work with our helicopter contractor to be properly prepared for an emergency response in the event of an outbreak of vector-borne disease.

**Droplet Analysis of Ground-based Spray Equipment** Technical Service staff optimized fifty-six Ultra Low Volume (ULV) insecticide generators (truck-mounted, ATV-mounted or handheld) using the KLD Model DC-III portable droplet analyzer. Staff uses this analyzer to fine-tune equipment to produce an ideal droplet spectrum of 8-20 microns. Adjusting the ULV sprayers to produce a more uniform droplet range maximizes efficacy by creating droplets of the correct size to impinge upon flying mosquitoes. In addition, more uniform swaths allow staff to better predict ULV application patterns and swath coverage throughout the District.

**Evaluation of Truck-mounted ULV Generators Utilizing GPS-tracking Technology** MMCD continues to evaluate new methods of tracking adulticide treatments utilizing data collection systems which use GPS location technology. These systems are able to electronically plot applications on treatment maps and assist in determining the exact locations of adulticide treatments. These systems will eliminate the need for field staff to physically record the applications on maps and will provide an electronic record of all activities of the vehicle in any given timeframe. These records are immediately available as soon as the information is uploaded from the cold fog vehicle to the computer system. These records should eliminate recording errors and is seen as an improvement in many areas: operation efficiency, driver safety, treatment records, inventory calculations, and legal documentation.

MMCD continued to evaluate three GPS data recording systems in 2006. The three systems being reviewed are Clarke's DataMaster, ADAPCO's Monitor 3L, and Curtis Dyna-Fog's DynaTrax. Each system is unique and challenging to fit each system's output into MMCD's current mapping and reporting structure. Three operational facilities were chosen and each received multiple units of one company's data recording system. This concentration of a particular system within a facility allowed staff to become fully familiar with one operating system and gain in-depth experience with the units. Each facility would evaluate the system and report their findings to MMCD's equipment team. Due to the dry environmental conditions and lack of adult mosquitoes, MMCD conducted minimal adulticiding and therefore, full evaluations of these systems did not occur in 2006. The data that was collected will be added to 2007 evaluations to assist the equipment team to review and purchase the best operating system that meets our requirements.

## 2007 Plans

Quality assurance processes will continue to be incorporated into the everyday operations of the regional process teams. Technical Services will continue to support field operations to improve their ability to complete their responsibilities most effectively. A primary goal will be to continue to assure the collection of quality information for all evaluations so decisions are based upon good data. We will continue to improve our calibration techniques to optimize all of our mosquito control equipment.

In 2007, tests of Altosid® XR-G sand against the cattail mosquito (*Cq. perturbans*) will be repeated if sampling for larvae in the spring detects sufficient larval densities. We will continue testing control materials in catch basins with the goal of decreasing the number of treatments per season while maintaining efficacy. We plan to repeat our tests of permethrin barrier treatments to include more mosquito species in more areas. Finally, we plan to continue evaluating the effectiveness of adulticide treatments against vectors of WNV or other mosquito-borne diseases, potentially including more tests with high and low traps and repeat tests of Pyrenone® and Pyrocide® in croplands.

## References

Mulla's Formula:

$$\text{Percent Efficacy} = 100 - \left(100 \times \left(\frac{\text{Cntl Pre}}{\text{Trt Pre}}\right) \times \left(\frac{\text{TrtPost}}{\text{CntlPost}}\right)\right)$$

CntlPre = Mean pretreatment count of untreated control
TrtPre = Mean pretreatment count of treated group
CntlPost = Mean post treatment count of untreated control
TrtPost = Mean post treatment count of treated group

Mulla, Mir S., R. Lee Norland, Dean M. Fanara, Husam A. Darwazeh and Donald W. McKean. 1971. Control of Chironomid Midges in Recreational Lakes. J. Econ. Ent. 64(1): 300-307.

Hubbard, Jamee L., Rebecca T. Trout, Grayson C. Brown and Michael F. Potter. 2005. Do Backyard Mosquito Sprays Work? Pest Control Technology. May: 44-56.

# Chapter 6 Supporting Work

### 2006 Highlights

- Conducted public opinion survey
- Developed public web site with access to larval inspection and treatment data
- Updated wetland maps and restricted access list/map
- Dr. Karen Oberhauser published results of tests of permethrin toxicity to monarch butterfly larvae
- Staff prepared companion publication on milkweed occurrence relative to MMCD adulticide treatments for risk evaluation
- Requests for service from the public still low
- Improved field office access to trap data, and improved inventory reporting

### 2007 Plans

- Develop software, hardware, and procedures to help staff load map files and collect treatment data using new helicopter GPS tracking/guidance system ("Agnav")
- Refine web map based on public and internal feedback
- Continue efforts to publish nontarget research

## 2006 Projects

### Field & Lab Data Entry and Reporting

Additions to our electronic field and lab data entry system, "DataGate", this year included direct entry of adult trap results allowing field staff quicker access to their weekly collection data. The physical inventory entry system developed last year was tested and used extensively and more automated reports were developed to allow quick assessment of material on hand and use patterns.

Field data for larval and adult inspections and control continue to be entered using Palm OS-based Personal Digital Assistants (PDAs). In 2006, many minor changes and updates were made including being able to record treatments made from the Main Office in St. Paul, which were needed for catch basin work. A warning was also added to Black Fly treatment screens to remind workers to check for zebra mussels. Plans to add aerial treatment records to the PDA were postponed while the aerial GPS tracking system using Ag-Nav® systems installed in the helicopters was being tested.

### Mapping

Metro aerial photos flown by MarkHurd Inc. for the Metropolitan Council in spring 2005 were used to make extensive updates on wetland maps in the winter of 2005-2006. Staff are finishing updates for the outer areas of the District in winter of 2006-2007. Additional effort was made to map potential habitat for the cattail mosquito, *Cq. perturbans*, in conjunction with a review of control strategies for that species.

These updated site boundaries are being used in a new web-based mapping system that makes site maps and treatment records for the entire District readily available. The public version of this site is currently available from MMCD's home

page, www.mmcd.org, under Mosquito Control – Larval Control (Fig. 6.1). An internal version with greater detail is available from MMCD computers.

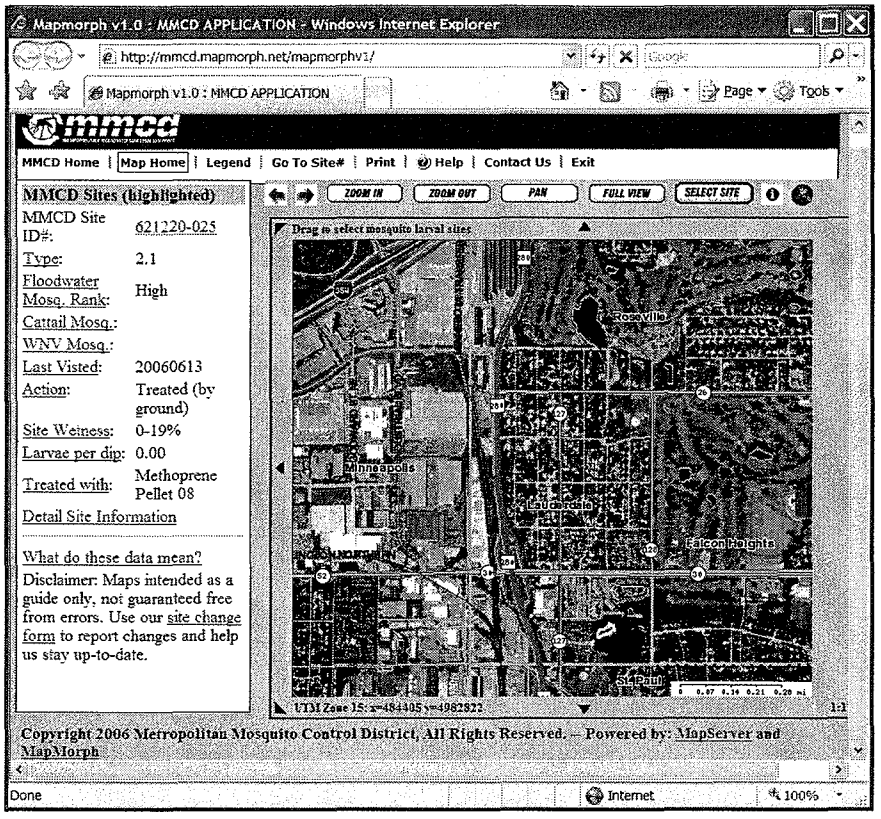



Figure 6.1 – MMCD public web map application showing site look-up.

Digital wetland files were provided on request to other units of government, including:

- City of Minneapolis – Public Works
- Washington Conservation District – wetland inventory
- City of Shoreview – wetland inventory and typing
- Short-Elliot-Henderson Engineering, Inc. – Ramsey County wetland inventory and typing
- Peterson Environmental – wetland typing

MMCD staff continue to participate in MetroGIS, including finishing a term as chair of the Coordinating Committee, working with Metropolitan Council members and staff on an evaluation of the value of the cooperative efforts of MetroGIS, planning a symposium on the future of GIS, and working with local governments on issues regarding property addresses.

The cooperative project with US Fish and Wildlife Service, Metropolitan Council Environmental Services, Minnesota Department of Natural Resources (MnDNR), and Ramsey Conservation District to use MMCD and other data to update the metro-area National Wetlands Inventory (NWI) showed that issues about different agencies' standards and use of wetland boundary data make it difficult to automate a NWI update process. However, MMCD and other data sources were useful to the interpreters updating NWI. We expect continued discussions on this as MMCD data becomes more readily available on the web.

Another major data update effort was to check the accuracy of the list of people who have requested some kind of restriction in access or treatment on their property. Lists were double-checked with maps and call records in April 2006 and postcards sent out to individual property owners on record as requesting restrictions. Lists were updated based on the response.

## Stormwater Management, Wetland Design, and Mosquitoes

Many local units of government continue to expand their interest in stormwater management in order to meet federal requirements and reduce effects on state impaired waters. Concerns about mosquitoes, especially West Niles virus vectors, have led to dialog on designs for stormwater management structures.

MMCD continued outreach efforts to stormwater and wetland designers to provide information on mosquito biology, prevention, and control.

- "Stormwater & Mosquitoes" presentation (see MMCD web site) was given for Pesticide Applicators Certification training at MMCD, and at the American Mosquito Control Association annual meeting.
- "Mosquitoes in Underground Structures" poster presented at MN Water Resources Conference (civil engineers, city & watershed dist. staff)

MMCD staff continued to stay in contact with Minnesota Pollution Control Agency (MPCA) staff regarding updates to the *Minnesota Stormwater Manual*, a Best Management Practices guidance document produced by MPCA, MnDNR, Minnesota Department of Transportation (MnDOT), Minnesota Department of Health (MDH), and soil and water conservation districts for meeting runoff pollution requirements. The *Manual* can be viewed at: http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html. We continue to seek ways to communicate with designers and engineers on this issue and appreciate any suggestions from TAB members.

MMCD staff participated in efforts by the Society of Wetland Scientists (SWS) to develop an SWS Position Statement on West Nile Virus, Mosquitoes, and Wetlands. Unfortunately, the members of the development group ended up having irreconcilable differences,mostly regarding the concept of "source reduction," and the paper developed will not appear as an SWS-approved document. However, some members of the development group are attempting to have it published as an independent review in the SWS journal, *Wetlands*.

## Nontarget Studies

As requested by the Technical Advisory Board, MMCD has continued to support efforts to evaluate possible adulticide nontarget effects. A TAB subgroup (Drs. Karen Oberhauser, Roger Moon, Nancy Read, and Stephen Manweiler) reported last year on tests done by Dr. Karen Oberhauser's lab showing toxicity of permethrin, as applied by MMCD as a barrier treatment, or resmethrin, applied as a ULV fog, to monarch (*Danaus plexippus* (L.)) larvae exposed directly or fed treated leaves (see 2004 and 2005 TAB reports). Results of the studies on permethrin by Dr. Oberhauser appeared in the December 2006 issue of the journal Environmental Entomology (see publications list, page 61). Results of the study of milkweed distribution relative to MMCD adulticide treatments are being submitted to the same journal for publication.

**Previous Larvicide Nontarget Impact Studies** We continue to get requests for earlier publications, including reports on Wright County Long-term Study and other studies on *Bti* and methoprene done under the direction of the Scientific Peer Review Panel assembled by MMCD. These reports are now available on the MMCD web site, and download totals for 2006 are as follows (note that these pdf files also end up "downloaded" in order to be read):

| | | |
|---|---|---|
| SPRP Final Report, 1996 | | 89 |
| Long-term study brief overview | | 72 |
| Results summary (1991-1998) with graphs | | 119 |
| Balcer et al. 1999 Report | text | 104 |
| | figures | 66 |
| | tables | 61 |
| | appx. – cores | 48 |
| | appx. – substrates | 41 |

Dr. Richard Anderson is working with staff to continue efforts to assemble a peer-reviewed journal publication from the 1997-1998 results of the Wright County Long-term Study.

## Public Opinion Survey

MMCD has conducted a series of public opinion surveys to help assess customer awareness, satisfaction and concerns, and track changes over time. From 1994-2000 surveys were done every 2 years; when changes were found to be small, the time between surveys was increased and the next survey was done in 2004. That year showed marked changes, probably relating to the arrival of West Nile Virus since the previous survey. We returned to a 2-year schedule to see if these changes were maintained. This year's telephone survey of 406 metro-area residents was done July 5 -August 14, 2006 by The Research Edge, LLC. The survey used standard polling techniques (random-digit sample, participant chosen by most recent birthday). Results can be generalized to the population of the 7-county metro area with a margin of error of ± 5%.

Most residents continued to express that it is important to control the mosquito populations in the metro area.

- 89% of respondents rated the importance of controlling mosquitoes 5, 6, or 7 on a 7-point scale (1 = not important, 4 = neutral, 7 = very important), the same as in 2004 and significantly higher than previous years (Fig. 6.2).

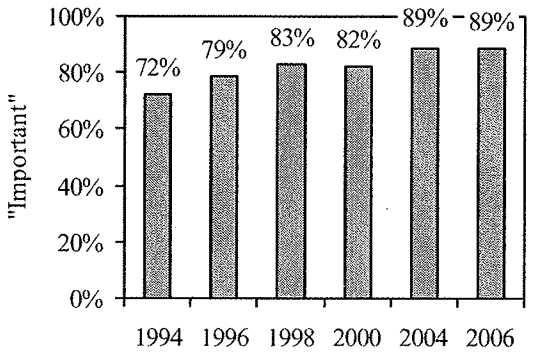



Figure 6.2 "How important do you feel it is to control the mosquito population in the metro area?"

However, given the low numbers of mosquitoes most of the year, relatively few respondents reported major effects of mosquitoes on their lives.

- 38% said mosquitoes in their neighborhood this year decreased their enjoyment of the outdoors very often or somewhat often. This is a large decrease from the spike in 2004 (Fig. 6.3) that may have reflected both West Nile virus concerns and high mosquito populations that year.

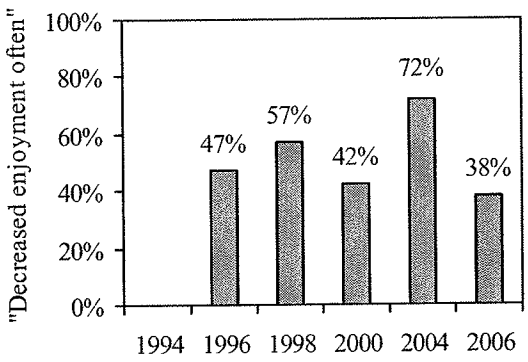



Figure 6.3 "In your neighborhood this year, how often have mosquitoes decreased your enjoyment of the outdoors? Would you say very often, somewhat often, a few times, or never?" Proportion of respondents replying somewhat or very often.

- Repellent use also went back to pre-2004 levels, declining from 84% in 2004 to 71% in 2006, up from 68% in 2000 (Fig. 6.4).

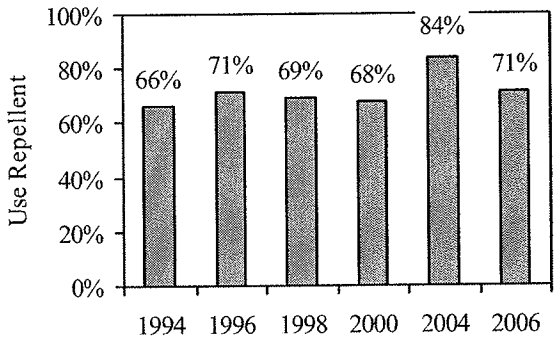



Figure 6.4 "Please indicate which of the following methods or products you use to repel or control mosquitoes or gnats. Do you use . . . Repellent?"

Median $ spent on control or repellent was back to $10, after going up to $15 in 2004.

Most respondents were aware that mosquitoes can transmit disease. Those aware that metro-area mosquitoes can transmit disease (98%) was about the same as 2004 and up significantly from 1994 (80%), the most recent time that question was asked. Those reporting checking their yard weekly to clean out containers were down slightly from 2004, closer to levels seen in previous years (Fig. 6.5)

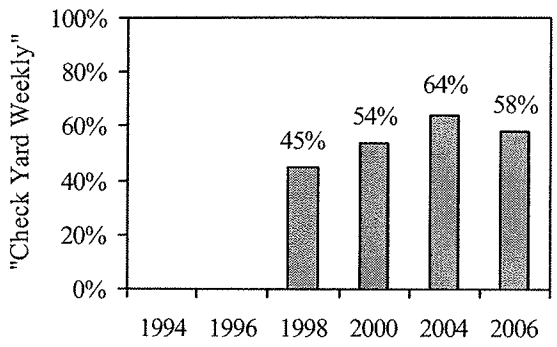



Figure 6.5 "About how often do you check your yard and remove or clean out water-holding containers that might breed mosquitoes that carry disease? Would you say weekly, monthly, once a year, or never?"

Most respondents were aware of mosquito control activities.

- 65% reported being aware of "a local government agency called the Metropolitan Mosquito Control District", similar to previous years (range 61% to 66%).
- As in past surveys, men were more likely to agree they had heard of MMCD than were women, but the difference was not significant (67% vs.63%).
- Households with children were less likely to be aware of MMCD (51% vs 73%).
- An additional 19% were aware of larval or adult control, although not of MMCD. The total aware that some control was being done was 84%.

Sources of information included TV, major newspapers, radio, contact with employees or seeing trucks, local newspapers, presentations and fairs, and MMCD's web site/e-mail. Those aware of MMCD who listed TV news as a source of information decreased from 77% in 2004 to 72%, and those who listed radio decreased from 32% to 23%. Respondents reporting seeing trucks or employees increased to 35%, up from 30% in 2004, and much higher than the original 19% in 1996. The increase in trucks on the streets for catch basin treatments may be contributing to this rise. Those listing e-mail or web site as a source of information remained steady at 2%.

Most felt MMCD was an important service, and many would like increased control.

- 84% agreed "MMCD provides an important service to the community", significantly higher than the 74% agreeing in 2004 or those in any previous year (Fig. 6.6).

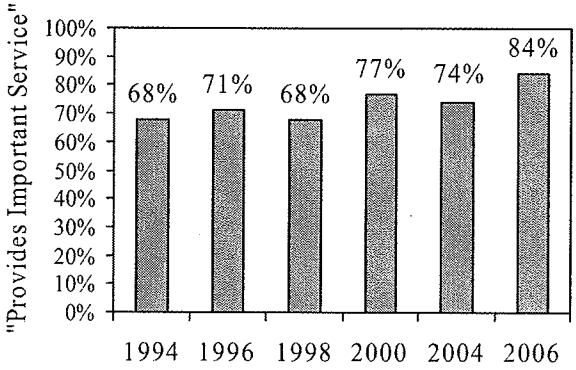



Figure 6.6 "MMCD provides an important service to the community." Respondents indicating 5, 6 or 7 on agreement scale.

- 73% agreed "MMCD is a good buy for the money", up significantly from 62% in 2004 and significantly higher than any previous year, despite the increase in amount paid (now "$12 of property taxes on a $200,000 house", up from "$5.40 per $120,000 house" in 2000) (Fig. 6.7).

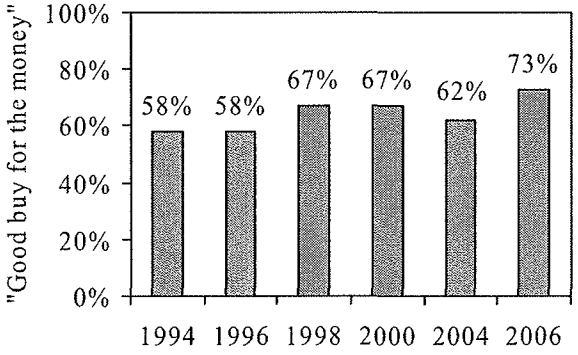



Figure 6.7 "Less than $12 of property taxes on a $200,000 house goes to fund MMCD. Considering the task and relative cost of the MMCD, ...MMCD is a good buy for the money." Respondents indicating 5, 6 or 7 on agreement scale.

- 51% agreed "Mosquito and gnat control should be increased", significantly lower than 2004 (63%) and similar to previous years (Fig. 6.8). Lack of mosquitoes in 2006 may have affected this result; in previous surveys those reporting frequent problems with mosquitoes were more likely to support increased control.

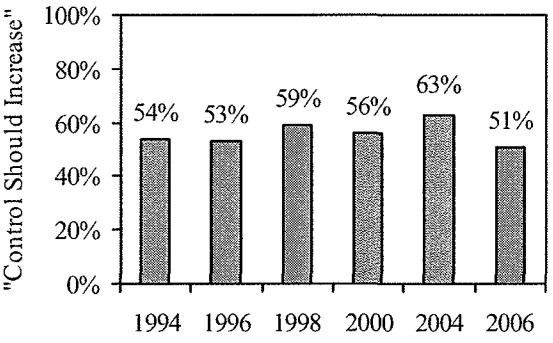



Figure 6.8 "The level of mosquito and gnat control should be increased." Respondents indicating 5, 6 or 7 on agreement scale.

- 44% agreed "MMCD funding should be increased," 17% disagree, about the same as previous years.

Few respondents showed concerns about environmental or health effects of controls.

- 16% agreed with a statement suggesting adult control harms environment or health, up somewhat from 2004 but still lower than 2000 (Fig. 6.9); 41% disagreed, 44% replied neutral or don't know. Similar concern levels were seen for larval control in wetlands and possible effects of those on human health.

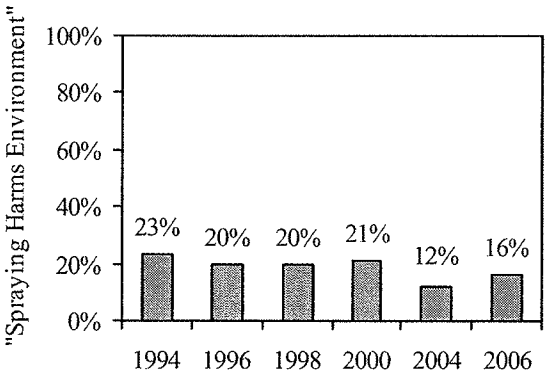



Figure 6.9 "If 1 is strongly disagree, 4 is neutral, and 7 is strongly agree, please indicate the extent to which you agree with the following statement: Spraying to control adult mosquitoes at parks, events, and wooded areas is harmful to the environment." Respondents indicating 5, 6 or 7 on agreement scale.

- 64% agreed "Spraying has some risk, but the benefit of a professionally-done spray program outweighs the risk," up slightly from previous years (range 57% to 63%); 9% disagreed with that statement.

In general, respondents aware of MMCD, of larval control, or of adult control were more likely to feel that controls do not cause harm.

An addition this year was a question about notification:

"MMCD notifies people about plans for spraying by putting an ad in the paper at the start of the year, putting treatment schedules on a web site, phone line, and e-mail list, and posting signs at park entrances. MMCD would like people to know about treatments, but notification can take time and money away from providing mosquito control. Given this trade-off, which best describes how MMCD should spend its resources:"

| | Results |
|---|---|
| - Should they increase notification, even if it means less control, | 13% |
| - Should they stay with the current system, | 45% |
| - or should they spend less on notification and more on control? | 37% |

In this case, most agreed that current efforts at notification are fine, if increased effort would decrease control. In 2004, a similar question was asked, but no cost was given for increasing notification, and in those results 46% wanted more options for notification.

A question was added to address pressures facing decision-makers as the metro area expands:

"As new homes are built in areas that once were farms or woods, people expect to add services such as streets and sewers in these new developments. Should mosquito control be another service that people in new growth areas should expect, or not?"

A large majority, 76%, responded "Yes" to this question.

Another new question asked for agreement/disagreement on a 1-7 scale with the following: "Sometimes mosquitoes coming out of wildlife areas can be a problem for nearby homes, and wildlife managers should consider mosquito control when they develop their management

plans." A total of 64% agreed with this statement, and 15% disagreed. Those who had previously indicated they thought controls were harmful were more likely to disagree with this statement.

MMCD has been trying to increase awareness of both tick-borne disease and of MMCD's services in this area, and added more questions relating to ticks and disease. Those indicating they were aware that "ticks in the metro-area can transmit disease to people or animals" was 96%. Another question probed whether people were taking action to protect themselves:

> "When you spend time in woods or on shaded trails, about how often do you take actions to avoid tick bites, such as choosing clothing, using tick repellents, or washing or checking after walking in brush? Would you say: Every time you go out, Usually, Seldom, or Never?"

Results showed 52% said "Every time", 28% said "Usually", 18% were "Seldom or Never."

Only 33% thought "the annual number of cases in Minnesota in recent years is increasing;" 33% thought it was about the same, 7% thought it was decreasing and 26% didn't know. Those aware of MMCD's activities to prevent Lyme disease was at 33% in 2006, slightly higher than 2004 and significantly higher than 2000 (24%).

Results of the survey are being used to help evaluate public communication efforts and design and target future work. MMCD Commissioners also use results to help ensure that the District's programs are relevant to public concerns.

## Notification

The District continues to post daily adulticide information on its web site (www.mmcd.org) and on its "Bite Line" (651-643-8383), a pre-recorded telephone message citizens can call to get the latest information on scheduled treatments. The District also publishes a three column by nine-inch ad in local newspapers each spring advising citizens how they can find out where and when adulticiding will take place throughout the season. In 2006, the District filmed and distributed a public service announcement, featuring the MMCD director, directing people to the web or phone notification services. This 30-second spot has been posted on the District website. Staff also sent summaries of District activities to city managers and continued to encourage cities to put a link on their web sites to MMCD's mosquito treatment notices.

## Calls Requesting Service

In past years, calls requesting adulticide treatment early in the season generally followed the seasonal pattern shown by sweep net counts for human-biting mosquitoes. A mid-July spike in sweep net numbers appears not to have been extreme enough to generate a significant increase in requests for adulticide treatments (Figure 6.10).

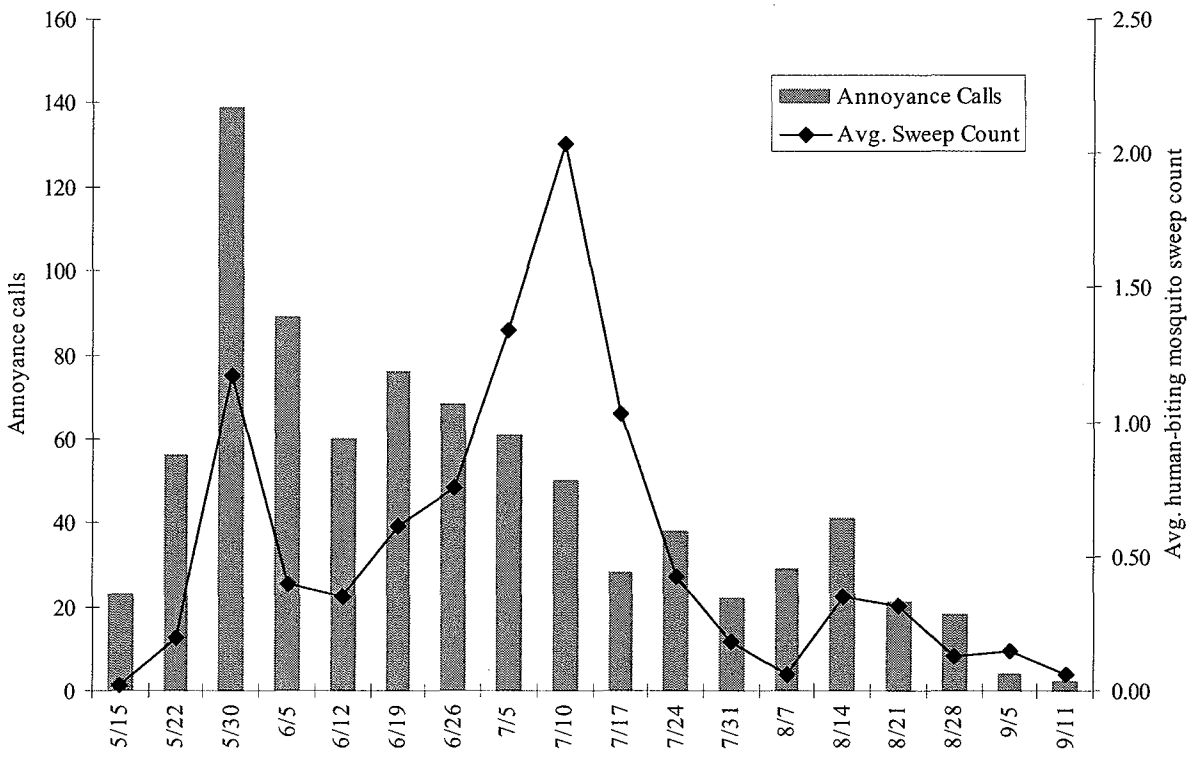



Figure 6.10 Calls requesting service and sweep net counts by week, 2006

## Curriculum in Schools

MMCD continued to deliver "Mosquito Mania," a three-day curriculum for upper elementary and middle school students. This curriculum was introduced to metro-area schools during 2005. "Mosquito Mania" builds on MMCD's relationship with schools by offering a standards-based approach to the subject of mosquitoes and their relationship to the environment. Regional facilities together with Main Office staff reached a total 7,611 students in 71 schools.

## Presentations, Posters, and Publications

MMCD staff attends a variety of scientific meetings throughout the year. Following is a list of papers and posters presented during 2006 and those scheduled for 2007. Also included are publications that have MMCD staff as authors or co-authors.

### 2006

Jarnefeld, J. 2006. Changes Over Time – 16 Years of *Ixodes scapularis* Surveillance-Twin Cities, Minnesota. Poster at the Society of Vector Ecology Conference. Anchorage, AK.

Johnson, K.A. 2006. Anatomy of a La Crosse Encephalitis Prevention Program. Poster at the Society of Vector Ecology Conference. Anchorage, AK.

Manweiler, S.A. 2006. Mosquito Control in the Twin Cities Metro Area in Minnesota: 2005 Update. Presentation at the American Mosquito Control Association. Detroit, MI. (in the Symposium: Mosquito Concerns in Great Lakes Region).

Oberhauser, K. S., S. J. Brinda, S. Weaver, R. D. Moon, S. A. Manweiler, and N. Read. 2006. Growth and Survival of Monarch Butterflies (Lepidoptera: Danaidae) After Exposure to Permethrin Barrier Treatments. Environ. Entomol. 35(6):1626-1634.

Read, N. R. 2006. Mosquitoes and Storm Water Management. Presentation at the American Mosquito Control Association. Detroit, MI.

Read, N. R. and Kirk Johnson. 2006. Mosquito Control in Underground BMPs – What Works? Poster presented at Minnesota Water Resources Conference, Brooklyn Center, MN.

Read, N. R. and Jim Nichols. 2006. Wetlands on the Web. Presentation given at Minnesota GIS/LIS Annual Conference, St. Cloud, MN.

**2007**

Beadle K, S. Grant, E. Sell, J. Osborne, and J. Peterson. 2007. Larval Control of West Nile Virus Vectors in Storm Water Management Structures. Presentation at the American Mosquito Control Association. Orlando, FL.

Crane, D.M, S.J. Brogren, and C.A. LaMere. 2007. Unusual Increases in Two Rare Species, *Anopheles quadrimaculatus* and *Culex erraticus*, in Minnesota. Presentation at the American Mosquito Control Association. Orlando, FL.

Griemann, L. and J. Jarnefeld. 2007. Sixteen Years of *Ixodes scapularis* Surveillance in the Twin Cities Area, Minnesota. Presentation at the American Mosquito Control Association. Orlando, FL.

Johnson, K.A. 2007. West Nile Virus in the Metropolitan Mosquito Control District, Minnesota. Presentation at the American Mosquito Control Association. Orlando, FL.

Manweiler, S.A, N. Read, K. Oberhauser, and R. Moon. 2007. Evaluating Potential Non-target Effects of Pyrethroid Mosquito Adulticides Using Monarch Butterflies as Sentinel. Presentation at the Annual Meeting of the Michigan Mosquito Control Association. Traverse City, MI.

Sell, E. and K. Beadle. 2007. Larval Control of West Nile Virus Vectors in Storm Water Management Structures. Presentation at the Annual Meeting of the Michigan Mosquito Control Association. Traverse City, MI.

Sell, E, J. Jarnefeld and S.A. Manweiler. 2007. Sixteen Years of *Ixodes scapularis* Surveillance in the Twin Cities Area. Presentation at the Annual Meeting of the Michigan Mosquito Control Association. Traverse City, MI.

Stevens, C. and N. Read. 2007. Integrating AgNav Technology into MMCD's Aerial Larvicide Program. Presentation at the Annual Meeting of the Michigan Mosquito Control Association. Traverse City, MI.

Smith, M. 2007.Control Material Inventory Management at the Metropolitan Mosquito Control District. Presentation at the American Mosquito Control Association annual meeting. Orlando, FL.

Read, N. R., Manweiler, S.A, K. Oberhauser, and R. Moon. 2007. Nontarget Effects of Permethrin and Resmethrin on Monarch Butterflies: Toxicity and Exposure Studies. Presentation at the American Mosquito Control Association annual meeting. Orlando, FL.

Walz, J., A. Benson, and C. LaMere. 2007. What's going on in Minnesota? Black Fly Monitoring and Control in the Greater Metropolitan Area of the Twin Cites of Minneapolis and St. Paul, Minnesota, USA. Presentation at the North American Black Fly Association annual meeting. Athens, GA.

## 2007 Plans

The major activity planned in data and mapping is to develop software, hardware, and procedures to allow staff to easily load map files and collect treatment data using new Ag-Nav® GPS tracking and guidance systems now installed in all of the helicopters used by our contractor, Scott's Helicopter Service. Testing of this system began in late 2006 (see Chapter 5). We plan to have procedures in place by the April calibration trials.

We also plan to continue to refine the web map application based on public and internal feedback, and take advantage of cooperative development efforts with other government units involved in the federal grant for this purpose.

We will continue efforts to publish nontarget research, present MMCD research at professional meetings, and interact with those involved with stormwater management structures and maintenance.

# APPENDICES

# APPENDIX A Mosquito Biology

There are 50 species of mosquitoes in Minnesota. Thirty-nine species are found within the MMCD. Species can be grouped according to their habits and habitat preferences. For example, the District uses the following categories when describing the various species: disease vectors, spring snow melt species, summer flood water species, permanent water species, and the cattail mosquito.

## Disease Vectors

***Aedes triseriatus*** Also known as the eastern treehole mosquito, *Ae. triseriatus*, is the vector of La Crosse encephalitis. It breeds in tree holes and artificial containers, especially discarded tires. The adults are found in wooded or shaded areas and stay within ¼ to ½ miles from where they emerged. They are not aggressive biters and are not attracted to light. Vacuum aspirators are best for collecting this species.

***Culex tarsalis*** *Culex tarsalis* is the vector of western equine encephalitis (WEE) and a vector of West Nile virus (WNV). In late summer, egg laying spreads to temporary pools and artificial containers, and feeding shifts from birds to horses or humans. MMCD monitors this species using New Jersey light traps and $CO_2$ traps.

**Other *Culex*** Three additional species of *Culex* (*Cx. pipiens, Cx. restuans, Cx. salinarius*) are vectors of WNV. All three breed in permanent and semipermanent sites and *Cx. pipiens* and *Cx. restuans* breed in storm sewers and catch basins as well. Gravid traps and $CO_2$ traps are used to monitor these mosquitoes.

***Culiseta melanura*** *Culiseta melanura* is the enzootic vector of eastern equine encephalitis. Its preferred breeding sites are spruce tamarack bogs. Adults do not fly far from their breeding sources. MMCD monitors *Cs. melanura* abundance with $CO_2$ traps and vacuum aspirators. Adults are tested for eastern equine encephalitis virus.

## Floodwater Mosquitoes

**Spring Snow Melt *Aedes*** Spring snow melt mosquitoes are the earliest mosquitoes to hatch in the spring. They breed in woodland pools, bogs, and marshes that are flooded with snow melt water. There is only one generation per year and overwintering is in the egg stage. Adult females live throughout the summer and can take up to four blood meals. These mosquitoes do not fly very far from their breeding sites, so localized hot spots of biting can occur both day and night. Our most common spring species are *Ae. abserratus*, *Ae. excrucians* and *Ae. stimulans*. Adults are not attracted to light, so human or $CO_2$-baited trapping is recommended.

**Summer Flood Water *Aedes*** Summer flood water eggs hatch in late April and early May. Eggs are laid at the margins of grassy depressions, marshes, and along river flood plains. There are multiple generations per year resulting from rainfalls greater than one inch. Overwintering is in the egg stage. Adult females live about three weeks. Most species can fly great distances and are highly attracted to light. Peak biting activity is as at dusk. Our most common summer *Aedes*

are *Ae. vexans*, *Ae. sticticus*, *Ae. trivittatus*, and *Ae. cinereus*. New Jersey light traps, $CO_2$-baited traps, and human-baited sweep net collections are effective methods for adult surveillance of these species.

### Cattail Mosquito

***Coquillettidia perturbans*** This summer species breeds in cattail marshes and is called the cattail mosquito. A unique characteristic of this mosquito is that it can obtain oxygen by attaching its specialized siphon to the roots of cattails and other aquatic plants. They overwinter in this manner. Adults begin to emerge in late June, with peak emergence around the first week of July. They are very aggressive biters, even indoors, and will fly up to five miles from the breeding site. Peak biting activity is at dusk and dawn. Surveillance of adults is best achieved with $CO_2$ traps.

### Permanent Water Species

Other mosquito species not previously mentioned breed in permanent and semipermanent sites. These mosquitoes comprise the remaining *Anopheles*, *Culex*, and *Culiseta* species. These mosquitoes are multi-brooded and lay their eggs in rafts on the surface of the water. The adults prefer to feed on birds or livestock but will bite humans. The adults overwinter in places like caves, hollow logs, stumps or buildings. The District targets four *Culex* species and one *Culiseta* species for surveillance and/or control.

## APPENDIX B Average Number of Common Mosquito Species Collected per Night in New Jersey Light Traps 1965-2006

| Year | *Aedes abs/punc* | *Aedes cinereus* | *Aedes sticticus* | *Aedes trivittatus* | *Aedes vexans* | *Culex tarsalis* | *Coquillettidia perturbans* | All species | Average Rainfall |
|---|---|---|---|---|---|---|---|---|---|
| 1965 | 1.03 | 0.77 | 0.19 | 0.08 | 89.00 | 4.70 | 1.43 | 111.74 | 27.97 |
| 1966 | 1.29 | 0.13 | 0.00 | 0.02 | 33.70 | 0.69 | 17.66 | 61.78 | 14.41 |
| 1967 | 0.64 | 0.24 | 0.65 | 0.12 | 75.40 | 1.61 | 14.37 | 101.55 | 15.60 |
| 1968 | 0.14 | 1.60 | 0.04 | 0.77 | 119.30 | 1.25 | 2.43 | 136.54 | 22.62 |
| 1969 | 0.70 | 0.19 | 0.02 | 0.17 | 19.90 | 0.65 | 4.27 | 30.82 | 9.75 |
| 1970 | 0.17 | 0.57 | 0.06 | 0.33 | 73.10 | 0.76 | 2.78 | 83.16 | 17.55 |
| 1971 | 0.69 | 0.55 | 0.15 | 0.33 | 52.10 | 0.28 | 3.51 | 62.93 | 17.82 |
| 1972 | 0.98 | 2.13 | 0.41 | 0.35 | 124.50 | 0.39 | 8.12 | 142.35 | 18.06 |
| 1973 | 1.29 | 0.70 | 0.11 | 0.06 | 62.20 | 0.41 | 25.86 | 95.14 | 17.95 |
| 1974 | 0.17 | 0.32 | 0.14 | 0.12 | 30.30 | 0.15 | 7.15 | 40.09 | 14.32 |
| 1975 | 0.28 | 0.63 | 0.44 | 0.17 | 40.10 | 6.94 | 4.93 | 60.64 | 21.47 |
| 1976 | 0.10 | 0.05 | 0.04 | 0.00 | 2.30 | 0.23 | 4.42 | 9.02 | 9.48 |
| 1977 | 0.20 | 0.16 | 0.01 | 0.02 | 17.50 | 2.44 | 1.16 | 25.17 | 20.90 |
| 1978 | 0.17 | 0.74 | 0.33 | 0.24 | 51.40 | 1.35 | 1.04 | 62.63 | 24.93 |
| 1979 | 0.07 | 0.24 | 0.10 | 0.21 | 18.30 | 0.13 | 4.39 | 25.59 | 19.98 |
| 1980 | 0.02 | 0.26 | 0.33 | 0.77 | 47.40 | 0.25 | 13.87 | 65.28 | 19.92 |
| 1981 | 0.01 | 0.10 | 0.25 | 1.03 | 57.00 | 0.44 | 3.98 | 65.30 | 19.08 |
| 1982 | 0.01 | 0.21 | 0.08 | 0.03 | 23.10 | 0.15 | 8.63 | 34.60 | 15.59 |
| 1983 | 0.03 | 0.24 | 0.08 | 0.14 | 55.60 | 0.58 | 8.72 | 69.71 | 20.31 |
| 1984 | 0.08 | 0.16 | 0.14 | 0.35 | 65.40 | 1.82 | 1.60 | 92.42 | 21.45 |
| 1985 | 0.05 | 0.17 | 0.05 | 0.02 | 21.20 | 0.21 | 5.07 | 28.51 | 20.73 |
| 1986 | 0.40 | 0.23 | 0.12 | 0.03 | 25.80 | 0.92 | 2.61 | 34.30 | 23.39 |
| 1987 | 0.00 | 0.11 | 0.01 | 0.15 | 29.10 | 0.96 | 3.37 | 37.77 | 19.48 |
| 1988 | 0.01 | 0.51 | 0.00 | 0.00 | 21.00 | 0.72 | 1.40 | 27.28 | 12.31 |
| 1989 | 0.66 | 1.60 | 0.01 | 0.12 | 14.40 | 1.01 | 0.12 | 26.35 | 16.64 |
| 1990 | 0.83 | 11.37 | 1.22 | 0.34 | 125.80 | 2.65 | 0.99 | 159.45 | 23.95 |
| 1991 | 1.17 | 2.67 | 1.55 | 0.51 | 90.80 | 1.37 | 6.03 | 14.44 | 26.88 |
| 1992 | 0.09 | 0.09 | 0.02 | 0.24 | 36.00 | 0.49 | 38.31 | 79.81 | 19.10 |
| 1993 | 0.54 | 0.50 | 1.01 | 1.50 | 71.20 | 1.20 | 34.10 | 120.45 | 27.84 |
| 1994 | 0.70 | 0.47 | 0.46 | 0.33 | 29.70 | 0.15 | 68.45 | 104.52 | 17.72 |
| 1995 | 2.13 | 1.62 | 0.25 | 0.40 | 129.01 | 0.37 | 48.28 | 193.26 | 21.00 |
| 1996 | 0.82 | 0.62 | 0.58 | 0.47 | 25.82 | 0.09 | 40.65 | 72.05 | 13.27 |
| 1997 | 1.53 | 1.91 | 0.19 | 4.46 | 72.66 | 0.10 | 48.47 | 132.48 | 21.33 |
| 1998 | 1.86 | 0.66 | 0.08 | 0.54 | 53.93 | 0.05 | 36.16 | 89.89 | 19.43 |
| 1999 | 2.48 | 0.93 | 0.31 | 0.37 | 60.73 | 0.04 | 28.71 | 82.64 | 22.41 |
| 2000 | 0.38 | 0.30 | 0.00 | 1.33 | 56.61 | 0.15 | 20.61 | 89.85 | 17.79 |
| 2001 | 1.20 | 2.65 | 1.38 | 6.05 | 76.77 | 0.23 | 10.93 | 114.23 | 17.73 |
| 2002 | 0.30 | 1.07 | 0.07 | 2.18 | 92.77 | 0.39 | 5.07 | 108.35 | 29.13 |
| 2003 | 6.54 | 1.69 | 1.00 | 2.31 | 76.80 | 0.17 | 51.13 | 149.75 | 16.79 |
| 2004 | 0.49 | 1.79 | 0.53 | 0.72 | 29.91 | 0.14 | 11.39 | 48.34 | 21.65 |
| 2005 | 1.42 | 2.03 | 0.11 | 0.37 | 29.04 | 0.18 | 12.16 | 49.21 | 23.60 |
| 2006 | 6.29 | 1.16 | 0.14 | 0.01 | 12.63 | 0.08 | 20.61 | 44.41 | 18.65 |

## APPENDIX C Description of Control Materials

The following is an explanation of the control materials currently in use by MMCD. The specific names of products used in 2006 are given. The generic products will not change in 2007, although the specific formulator may change.

**Altosid® (methoprene) 150-day briquets** — Altosid® XR Extended Residual Briquet Wellmark International/Zoecon

Altosid® briquets are typically applied to mosquito breeding sites which are three acres or less. Briquets are applied to the lowest part of the site on a grid pattern of 14-16 ft apart at 220 briquets per acre. Sites which may flood and then dry up (Types 1 & 2) are treated completely. Sites which are somewhat permanent (Types 3, 4, 5) are treated with briquets to the perimeter of the site in the grassy areas. Pockety ground sites (i.e., sites without a dish type bottom) may not be treated with briquets due to spotty control achieved in the uneven drawdown of the site.

Cattail mosquito (*Cq. perturbans*) breeding sites are treated at 330 briquets per acre in rooted sites or 440 briquets per acre in floating cattail stands. Applications are made in the winter and early spring.

**Altosid® (methoprene) pellets** — Altosid® Pellets – Wellmark International/Zoecon

Altosid® pellets consist of methoprene formulated in a pellet shape. Altosid® pellets are designed to provide up to 30 days control but trials have indicated control up to 40 days. Applications will be made to ground sites (less than three acres in size) at a rate of 2.5 lbs per acre for *Aedes* control and 4-5 lbs per acre for *Cq. perturbans* control. Applications will also be done by helicopter in sites which are greater than three acres in size at the same rate as ground sites, primarily for *Cq. perturbans* control.

**Altosid® (methoprene) SR-20 liquid** — Altosid® Liquid Larvicide Concentrate-A.L.L. Liquid Wellmark International/Zoecon

Altosid® liquid is mixed with water and applied in the spring to mosquito breeding sites containing spring *Aedes/Ochlerotatus* mosquito larvae. Typical applications are to woodland pools. Sites which are greater than three acres in size are treated by the helicopter at a rate of twenty milliliters of concentrate per acre. The dilution is adjusted to achieve the best coverage of the site. Altosid® liquid treatments are ideally completed by June 1 of each season.

**Altosid® (methoprene) XR-G sand** — Altosid® XR-G Sand – Wellmark International/Zoecon

Altosid® XR-G Sand consists of methoprene formulated in a sand-sized granule designed to provide up to 20 days control. Applications will be made to ground sites (less than three acres in size) at a rate of five lbs per acre for *Aedes* control. Experimental applications for control of *Cq. perturbans* are being evaluated at 10 lbs per acre.

***Bacillus thuringiensis israelensis* (*Bti*) corn cob** — Vectobac® G – Valent Biosciences

*Bti* corn cob may be applied in all types of mosquito breeding. *Bti* can be effectively applied during the first three instars of the mosquito breeding cycle. Typical applications are by

helicopter in sites which are greater than three acres in size at a rate of 5-10 lbs per acre. In sites less than three acres, *Bti* is applied to pockety sites with cyclone seeders or power back packs.

***Bacillus thuringiensis israelensis* (*Bti*) liquid** Vectobac® 12AS – Valent Biosciences

*Bti* liquid is applied directly to small streams and large rivers to control black fly larvae. Treatments are applied when standard Mylar sampling devices collect threshold levels of black fly larvae. Maximum dosage rates are not to exceed 25 ppm of product as stipulated by the MNDNR. *Bti* is applied at pre-determined sites, usually at bridge crossings applied from the bridge, or by boat.

***Bacillus sphaericus*** Vectolex® CG – Valent Biosciences

*Bs* corn cob may be experimentally applied in all types of *Culex* mosquito breeding. *Bs* can be effectively applied during the first three instars of the mosquito breeding cycle. Typical experimental applications are by helicopter in sites which are greater than three acres in size at a rate of 5-10 lbs per acre. In sites less than three acres, *Bs* is applied to pockety sites with cyclone seeders or power back packs at rates of 7 lbs per acre. This product is also being evaluated as a control material for catch basin applications.

**Agnique® Mono-Molecular Film (MMF) liquid** Agnique® MMF – Cognis Corporation

Agnique liquid is applied directly to small mosquito breeding sites to control pupae. Experimental treatments are applied when mosquito larvae are no longer actively feeding or affected by other larvicides. Application rates are 0.2-0.3 gals per acre. Agnique® is applied by hand using a squirt bottle or pressurized sprayer to the surface of the water creating a thin self-spreading film layer and applications lowers the surface tension of the water's surface. This loss of surface tension does not allow the pupae to easily access the water's surface and breathe without significant effort. Therefore, pupae will eventually drown and control is obtained.

**Permethrin** Permethrin 57% OS – Clarke Mosquito Control Products

Permethrin is used by the District to treat adult mosquitoes in known daytime resting or harborage areas. Harborage areas are defined as wooded areas with good ground cover to provide a shaded, moist area for mosquitoes to rest during the daylight hours.

Adult control is initiated when MMCD surveillance (sweep net and light trap collections) indicates nuisance populations of mosquitoes, when employee conducted landing rate collections document high numbers of mosquitoes, or when a large number of citizen complaints of mosquito annoyance are received from an area. In the case of citizen complaints, MMCD staff evaluates mosquito levels to determine if treatment is warranted. MMCD also treats functions open to the public, and public owned park and recreation areas upon request and at no charge if the event is not-for-profit.

The District mixes permethrin with soybean and food grade mineral oil and applies it to wooded areas with a power backpack mister at a rate of 25 ounces of mixed material per acre (0.0977 lb active ingredient per acre).

**Resmethrin** Scourge® 4+12 – Bayer Environmental Science

Resmethrin is used by the District to treat adult mosquitoes in known areas of concentration or nuisance. Resmethrin is applied from truck or all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand-held cold fog machines that enable the applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Resmethrin is applied at a rate of 1.5 ounces of mixed material per acre (0.0035 lb active ingredient per acre). Resmethrin is a restricted used compound and is applied only by Minnesota Department of Agriculture licensed applicators.

**Sumithrin** Anvil® 2+2 – Clarke Mosquito Control Products

Sumithrin is used by the District to treat adult mosquitoes in known areas of concentration or nuisance. Sumithrin is applied from truck or all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enable applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Sumithrin is applied at a rates 1.5 and 3.0 ounces of mixed material per acre (0.00175 and 0.0035 lb active ingredient per acre). Sumithrin is a non-restricted use compound.

**Natural Pyrethrin** Pyrenone® 25-5 – Bayer Environmental Science

Pyrenone is used by the District to treat adult mosquitoes in known areas of concentration or nuisance where crop restrictions prevent treatments with resmethrin or sumithrin. Pyrenone is applied from truck or all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enables the applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Pyrenone is applied at a rate of 1.5 ounces of mixed material per acre (0.00172 lb active ingredient per acre). Pyrenone is a non-restricted used compound.

**Natural Pyrethrin** Pyrocide® 7396 (5+25) – Mc Laughlin Gormley King Company

Pyrocide is used by the District to treat adult mosquitoes in known areas of concentration or nuisance where crop restrictions prevent treatments with resmethrin or sumithrin. Pyrocide is applied from truck or all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enables the applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Pyrocide is applied at a rate of 1.5 ounces of mixed material per acre (0.00217 lb active ingredient per acre). Pyrocide is a non-restricted used compound.

## APPENDIX D 2006 Control Materials: AI Identity, Percent Active Ingredient (AI), Per Acre Dosage, AI Applied Per Acre and Field Life

| Material | AI | Percent AI | Per acre dosage | AI per acre (lbs) | Field life (days) |
|---|---|---|---|---|---|
| Altosid® briquets [a] | Methoprene | 2.10 | 220 | 0.4481 | 150 |
| | | | 330 | 0.6722 | 150 |
| | | | 440 | 0.8963 | 150 |
| | | | 1* | 0.0020* | 150 |
| Altosid® pellets | Methoprene | 4.25 | 2.5 lb | 0.1063 | 30 |
| | | | 4 lb | 0.1700 | 30 |
| | | | 0.0077 lb* (3.5 g) | 0.0003* | 30 |
| Altosid® SR-20 [b] | Methoprene | 20.00 | 20 ml | 0.0091 | 10 |
| Altosid® XR-G | Methoprene | 1.50 | 5 lb | 0.0750 | 20 |
| Altosand | Methoprene | 0.05 | 5 lb | 0.0025 | 10 |
| Vectobac® G | *Bti* | 0.20 | 5 lb | 0.0100 | 1 |
| | | | 8 lb | 0.0160 | 1 |
| Vectolex® CG | *Bs* | 7.50 | 8 lb | 0.6000 | 7-28 |
| | | | 0.0077 lb* (3.5 g) | 0.0006* | 7-28 |
| Permethrin 57%OS [c] | Permethrin | 5.70 | 25 fl oz | 0.0977 | 5 |
| Scourge® [d] | Resmethrin | 4.14 | 1.5 fl oz | 0.0035 | <1 |
| Anvil® [e] | Sumithrin | 2.00 | 3.0 fl oz | 0.0035 | <1 |
| | | | 1.5 fl oz | 0.00175 | <1 |
| Pyrenone® [f] | Pyrethrins | 2.00 | 1.5 fl oz | 0.00172 | <1 |
| Pyrocide® [g] | Pyrethrins | 2.50 | 1.5 fl oz | 0.00217 | <1 |

[a] 44 g per briquet total weight (220 briquets=21.34 lb total weight)
[b] 1.72 lb AI per 128 fl oz (1 gal); 0.45 lb AI per 1000 ml (1 liter)
[c] 0.50 lb AI per 128 fl oz (1 gal) (product diluted 1:10 before application, undiluted product contains 5.0 lb AI per 128 fl oz)
[d] 0.30 lb AI per 128 fl oz (1 gal)
[e] 0.15 lb AI per 128 fl oz (1 gal)
[f] 0.147 lb AI per 128 fl oz (1 gal) (product diluted 1:1.5 before application, undiluted product contains 0.367 lb AI per 128 fl oz)
[g] 0.185 lb AI per 128 fl oz (1 gal) (product diluted 1:1 before application, undiluted product contains 0.37 lb AI per 128 fl oz)
* Catch basin treatments—dosage is the amount of product per catch basin.

## APPENDIX E Acres Treated with Control Materials Used by MMCD for Mosquito and Black Fly Control for 1998-2006. The actual geographic area treated is smaller because some sites are treated more than once

| Control Material | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|
| Altosid® XR Briquet 150-day | 371 | 533 | 533 | 589 | 628 | 323 | 398 | 635 | 352 |
| Altosid® XR Briquet 90-day | 961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Altosid® Sand-Products | 1,868 | 3,968 | 786 | 1,889 | 1,822 | 0.5 | 0 | 0 | 0 |
| Altosid® Pellets 30-day | 10,432 | 13,775 | 11,121 | 14,791 | 16,521 | 18,458 | 19,139 | 29,965 | 31,827 |
| Altosid® Pellets Catch Basins | 0 | 0 | 0 | 0 | 0 | 135,978 | 148,023 | 145,386 | 167,797 |
| Altosid® SR-20 liquid | 529* | 355 | 29 | 91 | 51 | 33 | 0 | 0 | 0 |
| Vectolex CG granules | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 810 | 540 |
| *Bti* Corn Cob granules | 113,539* | 118,733 | 84,521 | 90,527 | 202,875 | 113,198 | 166,299 | 176,947 | 160,780 |
| *Bti* Liquid Black Fly (gallons used) | 4,233 | 4,343 | 821 | 4,047 | 3,169 | 3,408 | 2,813 | 3,230 | 1,035 |
| Permethrin Adulticide | 6,164 | 4,865 | 4,066 | 3,444 | 5,734 | 6,411 | 8,292 | 7,982 | 5,114 |
| Resmethrin Adulticide | 65,356 | 51,582 | 42,986 | 41,311 | 43,302 | 68,057 | 71,847 | 40,343 | 29,876 |
| Sumithrin Adulticide | 0 | 0 | 0 | 8,423 | 32,230 | 14,447 | 15,508 | 25,067 | 5,350 |

* These values are updated; therefore, some values may differ from similar values in earlier publications.

# APPENDIX F Control Material Labels

**Altosid® XR Extended Residual Briquets**

**Altosid® Pellets**

**Altosid® Liquid Larvicide Concentrate**

**Altosid® XR-G**

**VectoBac®12AS**

**VectoBac® G**

**Vectobac® WDG**

**VectoLex® CG**

**Agnique® MMF**

**Permethrin 57% OS**

**Scourge® Insecticide**

**Anvil® 2+2 ULV**

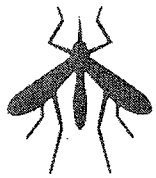
**Pyrenone® 25-5**

**Pyrocide®**

**4-Star™ Bti Briquets 150**

***Page intentionally left blank.***

# Altosid® XR
## EXTENDED RESIDUAL BRIQUETS



**A SUSTAINED RELEASE PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE**

# SPECIMEN LABEL

**ACTIVE INGREDIENT:**
(S)-Methoprene (CAS #65733-16-6)
(Dry Weight Basis) . . . . . 2.1%
**OTHER INGREDIENTS:** . . . . . 97.9%
Total . . . 100.0%

This product contains water; therefore the weight of the briquet and percent by weight of active ingredient will vary with hydration. The ingredient statement is expressed on a dry weight basis.

EPA Reg No. 2724-421

KEEP OUT OF REACH OF CHILDREN
**CAUTION**

## INTRODUCTION

**ALTOSID® XR BRIQUETS** are designed to release effective levels of methoprene insect growth regulator over a period up to 150 days in mosquito breeding sites. Release of methoprene insect growth regulator occurs by dissolution of the briquet. Soft mud and loose sediment can cover the briquets and inhibit normal dispersion of the active ingredient. The product may not be effective in those situations where the briquet can be removed from the site by flushing action.

**ALTOSID XR BRIQUETS** prevent the emergence of adult mosquitoes including: *Anopheles, Culex, Culiseta, Coquillettidia,* and *Mansonia* spp., as well as those of the floodwater mosquito complex (*Aedes* and *Psorophora* spp.) from treated water. Treated larvae continue to develop normally to the pupal stage where they die.

**NOTE:** Methoprene insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

## PRECAUTIONARY STATEMENTS
## HAZARDS TO HUMANS AND DOMESTIC ANIMALS
## CAUTION
## ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran. Using it in a manner other than that described by the label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

## DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

### APPLICATION TIME

Placement of **ALTOSID XR BRIQUETS** should be at or before the beginning of the mosquito season. **ALTOSID XR BRIQUETS** can be applied prior to flooding when sites are dry, or on snow and ice in breeding sites prior to spring thaw. Under normal conditions, 1 application should last the entire mosquito season, or up to 150 days, whichever is shorter. Alternate wetting and drying will not reduce their effectiveness.

### APPLICATION RATES

*Aedes* and *Psorophora* spp.: For control in non-(or low-) flow shallow depressions (≤ 2 feet in depth), treat on the basis of surface area, placing 1 briquet per 200 ft². Briquets should be placed in the lowest areas of mosquito breeding sites to maintain continuous control as the site alternately floods and dries up.

*Culex, Culiseta,* and *Anopheles* spp.: Place one **ALTOSID XR BRIQUET** per 100 ft².

*Coquillettidia* and *Mansonia* spp.: For application to cattail marshes and water hyacinth beds. For control of these mosquitoes, place 1 briquet per 100 ft².

*Culex* sp. in storm water drainage areas, sewers, and catch basins: For catch basins, place 1 briquet into each basin. In cases of large catch basins, follow the chart below to determine the number of briquets to use. For storm water drainage areas, place 1 briquet per 100 feet square of surface area up to 2 ft deep. In areas that are deeper than 2 feet, use 1 additional briquet per 2 feet of water depth.

Large water flows may increase the dissolution of the briquet thus reducing the residual life of the briquet. Regular inspections (visual or biological) in areas of heavy water flow may be necessary to determine if the briquet is still present. The retreatment interval may be adjusted based on the results of an inspection.

**Altosid XR Briquets Application Chart**

| Number of Briquets | Catch Basin Size (Gallons) | Surface Area/ Water Depth (ft) |
|---|---|---|
| 1 | 0 – 1500 | 0 – 2 |
| 2 | 1500 – 3000 | 2 – 4 |
| 3 | 3000 – 4500 | 4 – 6 |
| 4 | 4500 – 6000 | 6 – 8 |

APPLICATION SITES

**ALTOSID XR BRIQUETS** are designed to control mosquitoes in treated areas. Examples of application sites are: storm drains, catch basins, roadside ditches, fish ponds, ornamental ponds and fountains, other artificial water-holding containers, cesspools and septic tanks, waste treatment and settling ponds, flooded crypts, transformer vaults, abandoned swimming pools, tires, construction and other manmade depressions, cattail marshes, water hyacinth beds, vegetation-choked phospate pits, pastures, meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, treeholes, woodland pools, floodplains, and dredging spoil sites. For application sites connected by a water system, i.e., storm drains or catch basins, all of the water-holding sites in the system should be treated to maximize the efficiency of the treatment program.

## STORAGE AND DISPOSAL

STORAGE

Store in a cool place. Do not contaminate water, food, or feed by storage or disposal. Do not reuse empty container.

DISPOSAL

Dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## WARRANTY AND CONDITIONS OF SALE

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. Buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using this product.

For information, or in case of an emergency, call **1-800-248-7763** or visit our web site: **www.altosid.com**

Wellmark

ZOËCON Professional Products

Wellmark International
Schaumburg, Illinois U.S.A.



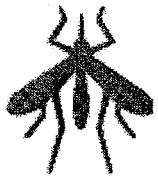
22 - 24 - 001

Made in the U.S.A.



January 2002
Schaumburg, IL

# Altosid® Pellets
## MOSQUITO GROWTH REGULATOR



A GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

## SPECIMEN LABEL

| ACTIVE INGREDIENT: | |
|---|---|
| (S)-Methoprene (CAS #65733-16-6) . . . . | 4.25% |
| OTHER INGREDIENTS: . . . . . | 95.75% |
| Total . . . . | 100.00% |

EPA Reg No. 2724-448
EPA EST. NO. 39578-TX-1

KEEP OUT OF REACH OF CHILDREN
CAUTION

### PRECAUTIONARY STATEMENTS
### HAZARDS TO HUMANS AND DOMESTIC ANIMALS
### CAUTION
### ENVIROMENTAL HAZARDS

This product is toxic to aquatic dipteran (mosquitoes) and chironomid (midge) larvae. Using it in a manner other than that described by the label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

### DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

### INTRODUCTION

ALTOSID® Pellets release ALTOSID® Insect Growth Regulator as they erode. The pellets prevent the emergence of adult standing water mosquitoes, including *Anopheles, Culex, Culiseta, Coquillettidia,* and *Mansonia* spp., as well as adults of the floodwater mosquitoes, such as *Aedes* and *Psorophora* spp. from treated sites.

### GENERAL DIRECTIONS

ALTOSID Pellets release effective levels of ALTOSID Insect Growth Regulator for up to 30 days under typical environmental conditions. Treatment should be continued through the last brood of the season. Treated larvae continue to develop normally to the pupal stage where they die. NOTE: This insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

### APPLICATION SITES AND RATES

| MOSQUITO HABITAT | RATES (Lb/Acre) |
|---|---|
| Floodwater sites | |
| Pastures, meadows, ricefields, freshwater swamps and marshes, salt and tidal marshes, cattail marshes, woodland pools, floodplains, tires, other artificial water-holding containers | 2.5-5.0 |
| Dredging spoil sites, waste treatment and settling ponds, ditches and other manmade depressions | 5.0-10.0 |
| Permanent water sites | |
| Ornamental ponds and fountains, fish ponds, cattail marshes, water hyacinth beds, flooded crypts, transformer vaults, abandoned swimming pools, construction and other manmade depressions, treeholes, other artificial water-holding containers | 2.5-5.0 |
| Storm drains, catch basins, roadside ditches, cesspools, septic tanks, waste settling ponds, vegetation-choked phosphate pits | 5.0-10.0 |

Use lower rates when water is shallow, vegetation and/or pollution are minimal, and mosquito populations are low. Use higher rates when water is deep (>2 ft), vegetation and/or pollution are high, and mosquito populations are high.

## APPLICATION METHODS

Apply ALTOSID Pellets up to 15 days prior to flooding, or at any stage of larval development after flooding, or in permanent water sites. Fixed wing aircraft or helicopters equipped with granular spreaders capable of applying rates from 2.5 to 10.0 lb/acre may be used to apply ALTOSID Pellets. The pellets may also be applied using ground equipment which will achieve good even coverage at the above rates. ALTOSID Pellets may be applied to artificial containers, such as tires and catch basins, etc.

Do not contaminate water, food, or feed by storage or disposal.

### STORAGE

Store closed containers of ALTOSID Pellets in a cool dry place.

### PESTICIDE DISPOSAL

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

### CONTAINER DISPOSAL

Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## WARRANTY AND CONDITIONS OF SALE

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. Buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using this product.

For information call 1-800-248-7763 or visit our web site: www.altosid.com.

Wellmark

ZOECON

Wellmark International
Schaumburg, Illinois U.S.A.

Zoecon®, A Wellmark International Brand
ALTOSID® Pellets, ALTOSID® Insect Growth Regulator and ZOECON® are registered trademarks of Wellmark International.

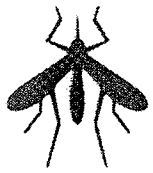
20 - 24 - 001

Made in the USA



November 1999
Bensenville, IL

# Altosid® Liquid Larvicide CONCENTRATE



PREVENTS EMERGENCE OF ADULT FLOODWATER MOSQUITOES

# SPECIMEN LABEL

**ACTIVE INGREDIENT:**

| | |
|---|---|
| (S)-Methoprene* | 20.0% |
| **OTHER INGREDIENTS:** | 80.0% |
| Total | 100.0% |

* CAS # 65733-16-6

Formulation contains 1.72 lb/gal (205.2 g/l) active ingredient.

EPA Reg No. 2724-446

KEEP OUT OF REACH OF CHILDREN

**CAUTION**

SEE ADDITIONAL PRECAUTIONARY STATEMENTS

Because of the unique mode of action of **A.L.L.**™, successful use requires familiarity with special techniques recommended for application timing and treatment evaluation. **See Guide to Product Application** or consult local Mosquito Abatement Agency.

## PRECAUTIONARY STATEMENTS

### HAZARDS TO HUMANS

### CAUTION

Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

### ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran. Using it in a manner other than that described by the label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

## DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

### CHEMIGATION

Refer to supplemental labeling entitled "**Guide to Product Application**" for use directions for chemigation. Do not apply this product through any irrigation system unless the supplemental labeling on chemigation is followed.

## MIXING AND HANDLING INSTRUCTIONS

1. **SHAKE WELL BEFORE USING. A.L.L.** may separate on standing and must be thoroughly agitated prior to dilution.
2. Do not mix with oil; use clean equipment.
3. Partially fill spray tank with water; then add the recommended amount of **A.L.L.**, agitate and complete filling. Mild agitation during application is desirable.
4. Spray solution should be used within 48 hours; always agitate before spraying.

## RECOMMENDED APPLICATIONS

### INTRODUCTION

**A.L.L.** must be applied to 2nd, 3rd, or 4th larval instars of floodwater mosquitoes to prevent adult emergence. Treated larvae continue normal development to the pupal stage where they die. This insect growth regulator **has no effect when applied to pupae or adult mosquitoes. A.L.L.** has sufficient field life to be effective at recommended rates when applied to larval stages under varying field conditions. For further information, see **Guide to Product Application**.

## METHODS OF APPLICATION

**AERIAL**
Use the recommended amount of **A.L.L.** listed below in sufficient water to give complete coverage. One-half to 5 gallons of spray solution per acre is usually satisfactory. Do not apply when weather conditions favor drift from areas treated.

**GROUND**
Determine the average spray volume used per acre by individual operators and/or specific equipment. Mix **A.L.L.** in the appropriate volume of water to give the rate per acre recommended below.

**APPLICATION RATE**
Apply ¾ to 1 fl oz of **A.L.L.** per acre (55 to 73 ml/hectare) in water as directed.

## APPLICATION SITES

**PASTURES**
**A.L.L.** may be applied after each flooding without removal of grazing livestock.

**RICE**
**A.L.L.** must be applied to 2nd, 3rd, and/or 4th instar larvae of mosquitoes found in rice, usually within 4 days after flooding. **A.L.L.** treatment may be repeated with each flooding.

**INTERMITTENTLY FLOODED NONCROP AREAS**
**A.L.L.** may be applied as directed above when flooding may result in floodwater mosquito hatch. Typical sites include: freshwater swamps and marshes, salt marshes, woodland pools and meadows, dredging spoil sites, drainage areas, waste treatment and settling ponds, ditches and other natural and manmade depressions.

**CROP AREAS**
**A.L.L.** may be applied to irrigated croplands after flooding to control mosquito emergence. Examples of such sites are: vineyards, rice fields (including wild rice), date palm orchards, fruit and nut orchards, and berry fields and bogs. Irrigated pastures may be treated after each flooding **without** the removal of livestock.

**DENSE VEGETATION OR CANOPY AREAS**
Apply an **A.L.L.** sand mixture using standard granular dispersal equipment. For detailed preparation instructions, refer to **Guide to Product Application.**

## STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

**STORAGE**
Store in cool place away from other pesticides, food, and feed. In case of leakage or spill, soak up with sand or another absorbent material

**PESTICIDE DISPOSAL**
Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL**
Triple rinse or equivalent. Then offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.



For information call 1-800-248-7763

Always read the label before using the product.

Wellmark

ZOËCON Professional Products

Wellmark International
Schaumburg, Illinois U.S.A.

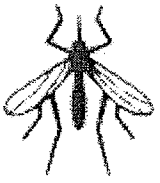


21-24-004

Made in the U.S.A.

October 2000
Schaumburg, IL

# Altosid® XR-G



**AN EXTENDED RESIDUAL GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE**

## SPECIMEN LABEL

| | |
|---|---|
| ACTIVE INGREDIENT: | |
| (S)-Methoprene (CAS #65733-16-6) . . . . | 1.5% |
| OTHER INGREDIENTS: . . . . . | 98.5% |
| Total . . . . . | 100.0% |

EPA Reg No. 2724-451

EPA Est. No. 2724-TX-1

KEEP OUT OF REACH OF CHILDREN

CAUTION

### PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS

### CAUTION

Avoid contact with skin or eyes. Due to the size and abrasiveness of the granule, use protective eyewear and clothing to minimize exposure during loading and handling.

### FIRST AID

In case of contact, immediately flush eyes or skin with plenty of water. Get medical attention if irritation persists.

### ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran (mosquitoes) and chironomid (midges). Using it in a manner other than that described by the label could result in harm to aquatic dipteran (mosquitoes) and chironomid (midges). Do not contaminate water when disposing of rinsate or equipment washwaters.

### DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

### GENERAL DIRECTIONS

ALTOSID® XR-G releases effective levels of ALTOSID® insect growth regulator for up to 21 days after application. Applications should be continued throughout the entire season to maintain adequate control. Treated larvae continue to develop normally to the pupal stage where they die.

Rotary and fixed-wing aircraft equipped with granular spreaders capable of applying rates listed below may be used to apply ALTOSID XR-G. Ground equipment which will achieve even coverage at these rates may also be used. Apply ALTOSID XR-G uniformly and repeat application as necessary.

NOTE

ALTOSID insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

### APPLICATION TIME

Apply ALTOSID XR-G at any stage of larval mosquito development. Granules may be applied prior to flooding (i.e., "pre-hatch" or "pre-flood") in areas which flood intermittently. In such areas, one application of ALTOSID XR-G can prevent adult mosquito emergence from several subsequent floodings. The actual length of control depends on the duration and frequency of flooding events.

## APPLICATION RATES

*Aedes, Anopheles,* and *Psorophora* spp.: Apply ALTOSID XR-G at 5-10 lb/acre (5.6-11.2 kg/ha). *Culex, Culiseta, Coquillettidia,* and *Mansonia* spp.: Apply ALTOSID XR-G at 10-20 lb/acre (11.2-22.4 kg/ha). Within these ranges, use lower rates when water is shallow [<2 feet (60 cm)] and vegetation and/or pollution are minimal. Use higher rates when water is deep [≥2 feet (60 cm)] and vegetation and/or pollution are heavy.

## APPLICATION SITES

### NON-CROP AREAS

ALTOSID XR-G may be applied as directed above to temporary and permanent sites which support mosquito larval development. Examples of such sites include: snow pools, salt and tidal marshes, freshwater swamps and marshes (cattail, red cedar, white maple marshes), woodland pools and meadows, dredging spoil sites, drainage areas, ditches, wastewater treatment facilities, livestock runoff lagoons, retention ponds, harvested timber stacks, swales, storm water drainage areas, sewers, catch basins, tree holes, water-holding receptacles (e.g., tires, urns, flower pots, cans, and other containers), and other natural and manmade depressions.

### CROP AREAS

ALTOSID XR-G may be applied as directed above to temporary and permanent sites which support mosquito larval development. Examples of such sites include: irrigated croplands, pastures, rangeland, vineyards, rice fields (domestic and wild), date palm, citrus, fruit, nut orchards, berry fields and bogs.

### NOTE

Application of ALTOSID XR-G to sites subject to water flow or exchange will diminish the product's effectiveness and may require higher application rates and/or more frequent applications.

## STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

### STORAGE

Store closed containers of ALTOSID XR-G in a cool dry place.

### PESTICIDE DISPOSAL

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

### CONTAINER DISPOSAL

Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## WARRANTY AND CONDITIONS OF SALE

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. Buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using this product.

For information call 1-800-248-7763 or visit our web site: www.altosid.com.

Wellmark

ZOECON Professional Products

Wellmark International
Bensenville, Illinois U.S.A.

Zoecon A Wellmark International Brand.
ALTOSID® Insect Growth Regulator, ALTOSID® XR-G and ZOECON® are registered trademarks of Wellmark International.

20 - 24 - 023

Made in the USA



January, 2000
Bensenville, IL

# VectoBac® 12AS

**Biological Larvicide**
**Aqueous Suspension**

Active Ingredient:
*Bacillus thuringiensis*, subspecies *israelensis*, 1200 International Toxic Units (ITU) per mg (Equivalent to 4.84 billion ITU per gallon; 1.279 billion ITU per liter) ..... 1.2%
Inert Ingredients ..... 98.8%
Total ..... 100.0%

EPA Reg. No.73049-38
EPA Est. No. 33762-IA-001 List No. 5605

INDEX:



**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**

**For MEDICAL and TRANSPORT Emergencies ONLY Call 24 Hours A Day 1-877-315-9819. For All Other Information Call 1-800-323-9597.**

## 1.0 STATEMENT OF PRACTICAL TREATMENT

**If In Eyes:** Flush with plenty of water. Get medical attention if signs of irritation persists.

**If on Skin:** Wash thoroughly with plenty of soap and water. Get medical attention if signs of irritation persists.

## 2.0 PRECAUTIONARY STATEMENTS

### 2.1 HAZARD TO HUMANS (AND DOMESTIC ANIMALS)

**CAUTION**

**Hazards to Humans**

Harmful if absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash contaminated clothing before reuse.

### 2.2 Physical and Chemical Hazards

Diluted or undiluted VectoBac 12AS can cause corrosion if left in prolonged contact with aluminum spray system components. Rinse spray system with plenty of clean water after use. Care should be taken to prevent contact with aluminum aircraft surfaces, structural components and control systems. In case of contact, rinse thoroughly with plenty of water. Inspect aluminum aircraft components regularly for signs of corrosion.

## 3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Do not apply directly to finished drinking water reservoirs or drinking water receptacles.

Do not apply when weather conditions favor drift from treated areas. Do not apply to metallic painted objects, such as automobiles, as spotting may occur. If spray is deposited on metallic painted surfaces, wash immediately with soap and water to avoid spotting.

### 3.1 Chemigation

Do not apply this product through any type of irrigation system unless labeling on chemigation is followed.

## 4.0 STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

**STORAGE:** Store in a cool [59°-86° F (15°-30° C)], dry place.

**PESTICIDE DISPOSAL:** Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL:** Triple rinse (or equivalent). Then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. Do not reuse container.

## 5.0 GROUND AND AERIAL APPLICATION

VectoBac 12AS may be applied in conventional ground or aerial application equipment with quantities of water sufficient to provide uniform coverage of the target area. The amount of water needed per acre will depend on weather, spray equipment, and mosquito habitat characteristics. Do not mix more VectoBac 12AS than can be used in a 72-hour period.

For most ground spraying, apply in 5-100 gallons per acre using hand-pump, airblast, mist blower, etc., spray equipment.

For aerial application, VectoBac 12AS may be applied either undiluted or diluted with water. For undiluted applications, apply 0.25 to 2.0 pt/acre of VectoBac 12AS through fixed wing or helicopter aircraft equipped with either conventional boom and nozzle systems or rotary atomizers.

For diluted application, fill the mix tank or plane hopper with the desired quantity of water. Start the mechanical or hydraulic agitation to provide moderate circulation before adding the VectoBac 12AS. VectoBac 12AS suspends readily in water and will stay suspended over normal application periods. Brief recirculation may be necessary if the spray mixture has sat for several hours or longer. AVOID CONTINUOUS AGITATION OF THE SPRAY MIXTURE DURING SPRAYING.

*CONTINUED*

Rinse and flush spray equipment thoroughly following each use.

For blackfly aerial applications, VectoBac 12AS can be applied undiluted via fixed wing or helicopter aircraft equipped with either conventional boom and nozzle systems or open pipes. Rate of application will be determined by the stream discharge and the required amount of VectoBac 12AS necessary to maintain a 0.5 - 25 ppm concentration for VectoBac 12AS in the stream water. VectoBac 12AS can also be applied diluted with similar spray equipment. Do not mix more VectoBac 12AS than can be used in a 72 hour period.

## 6.0 APPLICATION DIRECTIONS

Do not apply when wind speed favors drift beyond the area of treatment.

**Suggested Rate Range***

| Mosquito Habitat *(Such as the following examples):* | VectoBac 12AS |
|---|---|
| Irrigation ditches, roadside ditches, flood water, standing ponds, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields. | 0.25 - 1 pt/acre |

In addition, standing water containing mosquito larvae, in fields growing crops such as: Alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts, may be treated at the recommended rates.

When applying this product to standing water containing mosquito larvae in fields growing crops, do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

| | |
|---|---|
| Polluted water (such as sewage lagoons, animal waste lagoons). | 1 - 2 pts/acre |

*Use higher rate range in polluted water and when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted, and/or algae are abundant.

**Suggested Rate Range***

| Black flies Habitat | VectoBac 12AS |
|---|---|
| Streams | |
| stream water** (=ppm) for 1 minute exposure time | 0.5 - 25 mg/liter |
| stream water** (=ppm) for 10 minutes exposure time | 0.05 - 2.5 mg/liter |

**Use higher rate range when stream contains high concentration of organic materials, algae, or dense aquatic vegetation.

***Discharge is a principal factor determining carry of Bti. Use higher rate or increase volume by water dilution in low discharge rivers or streams under low volume (drought) conditions.

## 7.0 CHEMIGATION

Apply this product through flood*(basin) irrigation systems. Do not apply this product through any other type of irrigation system.

Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from nonuniform distribution of treated water.

If you have any questions about calibration, you should contact State Extension Service Specialists, equipment manufacturers or other experts.

A person knowledgeable of this chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

### 7.1 RICE-FLOOD (BASIN) CHEMIGATION

Systems using a gravity flow pesticide dispensing system must meter the pesticide into the water at the head of the field and downstream of a hydraulic discontinuity such as a drop structure or weir box to decrease potential for water source contamination from backflow if water flow stops.

VectoBac 12AS is metered or dripped into rice floodwater at application stations positioned at the point of introduction (levee cut) of water into each rice field or pan. Two to three pints of VectoBac 12AS are diluted in water to a final volume of 5 gallons. The diluted solution is contained in a 5 gallon container and metered or dispersed into the irrigation water using a constant flow device at the rate of 80 ml per minute. Introduction of the solution should begin when 1/3 to 1/2 of the pan or field is covered with floodwater. Delivery of the solution should continue for a period of approximately 4-1/2 hours. Floodwater depth should not exceed 10-12 inches to prevent excessive dilution of VectoBac 12AS which could result in reduced larval kill.

Agitation is not required during the period in which the VectoBac 12AS solution is being dispersed.

Application of VectoBac 12AS into rice floodwater is not permitted using a pressurized water and pesticide injection system.

## 8.0 SMALL QUANTITY DILUTION RATES

**Gallons Spray Solution/Acre**
**(Ounces Needed per Gallon of Spray)**

| VectoBac 12AS Rate in Pints Per Acre | 10 Gal/A | 25 Gal/A | 50 Gal/A |
|---|---|---|---|
| 0.25 (4 oz) | 0.4 | 0.16 | 0.08 |
| 0.5 (8 oz) | 0.8 | 0.32 | 0.16 |
| 1.0 (16 oz) | 1.6 | 0.64 | 0.32 |
| 2.0 (32 oz) | 3.2 | 1.28 | 0.64 |

## 9.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

VALENT BIOSCIENCES CORPORATION
870 TECHNOLOGY WAY
LIBERTYVILLE, IL 60048 • 800-323-5567

Valent BioSciences Corporation

# VectoBac® G

**Biological Larvicide Granules**

ACTIVE INGREDIENT:

| | |
|---|---|
| *Bacillus thuringiensis*, subspecies *israelensis*, 200 International Toxic Units (ITU) per mg (Equivalent to 0.091 billion ITU per pound) | 0.2% |
| INERT INGREDIENTS | 99.8% |
| TOTAL | 100.0% |

EPA Reg. No. 73049-10
EPA Est. No. 33762-IA-001 List No. 5108

INDEX:



**KEEP OUT OF REACH OF CHILDREN**
**CAUTION**
**For MEDICAL and TRANSPORT Emergencies ONLY**
**Call 24 Hours A Day 1-877-315-9819. For All Other Information Call 1-800-323-9597.**

## 1.0 STATEMENT OF PRACTICAL TREATMENT

**If in Eyes:** Flush eyes with plenty of water. Get medical attention if irritation persists.

## 2.0 DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles.

## 3.0 STORAGE AND DISPOSAL

Do not contaminate potable water, food or feed by storage or disposal.

**Storage:** Store in a cool, dry place.

**Pesticide Disposal:** Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

**Container Disposal:** Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.


VALENT BIOSCIENCES CORPORATION
870 TECHNOLOGY WAY
LIBERTYVILLE, IL 60048 - 800-323-9597


## 4.0 APPLICATION DIRECTIONS

VectoBac G is an insecticide for use against mosquito larvae.

| Mosquitoes Habitat (Such as the following examples): | Suggested Range Rate* |
|---|---|
| Irrigation ditches, roadside ditches, flood water, standing ponds, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields | 2.5 - 10 lbs / acre |

In addition, standing water containing mosquito larvae, in fields growing alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts may be treated at the recommended rates.

* Use 10-20 lbs. / acre when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted (sewage lagoons, animal waste lagoons), and/or algae are abundant.

Apply uniformly by aerial or ground conventional equipment.

A 7 to 14 day interval between applications should be employed.

## 5.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING THE USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

***Page intentionally left blank.***

[redacted]

# VectoBac® WDG

**Biological Larvicide**

ACTIVE INGREDIENT:

| | |
|---|---|
| *Bacillus thuringiensis*, subsp. *israelensis* fermentation solids and solubles | 37.4% |
| INERT INGREDIENTS | 62.6% |
| TOTAL | 100.0% |

[potency: 3000 International toxic units (ITU) per mg]
Equivalent to 1.36 billion ITU/lb.

EPA Reg. No. 73049-56
EPA Est. No. 33762-IA-001 List No. 60215

INDEX:



**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**

**For MEDICAL and TRANSPORT Emergencies ONLY Call 24 Hours A Day 1-877-315-9819. For All Other Information Call 1-800-323-9597.**

## 1.0 STATEMENT OF PRACTICAL TREATMENT

**Inhaled:** Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

**If in Eyes:** Flush eyes with plenty of water. Call a physician if irritation persists.

## 2.0 PRECAUTIONARY STATEMENTS

### 2.1 HAZARDS TO HUMANS AND DOMESTIC ANIMALS

**CAUTION**

Harmful if inhaled. Avoid breathing dust. Remove contaminated clothing and wash before reuse. Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling.

As a general precaution when exposed to potentially high concentrations of living microbial products such as this, all mixer/loaders and applicators not in enclosed cabs or aircraft must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95.

### 2.2 ENVIRONMENTAL HAZARDS

Do not apply directly to treated finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.

## 3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

### 3.1 Chemigation

Do not apply this product through any type of irrigation system.

## 4.0 STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

**Storage:** Store in cool [59-86°F (15-30°C)], dry place.

**Pesticide Disposal:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**Container Disposal:** Triple rinse (or equivalent). Then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## 5.0 APPLICATION DIRECTIONS

Do not apply when wind speed favors drift beyond the area of treatment.

| Mosquito Habitat *(Such as the following examples):* | Suggested Rate Range* |
|---|---|
| Irrigation ditches, roadside ditches, flood water, standing pools, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields. | 1.75 - 7.0 oz/acre (50 - 200 g/acre) (125 - 500 g/ha) |

In addition, standing water containing mosquito larvae, in fields growing crops such as: Alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts, may be treated at the recommended rates.

When applying this product to standing water containing mosquito larvae in fields growing crops, do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

| | |
|---|---|
| Polluted water (such as sewage lagoons, animal waste lagoons) | 7.0 - 14.0 oz/acre (200 - 400 g/acre) (0.5 - 1.0 kg/ha) |

[redacted]

* Use higher rate range in polluted water and when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted, and/or algae are abundant.

## 6.0 SMALL QUANTITY DILUTION RATES

**Gallons Spray Mixture/Acre**
**(Ounces Needed per Gallon of Spray)**

**VectoBac WDG**

| Rates In | | Final concentration, ounces/gallon spray | | |
|---|---|---|---|---|
| Ounces/Acre | Grams/A | 10 Gal/A | 25 Gal/A | 50 Gal/A |
| 1.75 | 50 | 0.175 | 0.07 | 0.04 |
| 3.5 | 100 | 0.35 | 0.14 | 0.07 |
| 7 | 200 | 0.7 | 0.28 | 0.14 |
| 14 | 400 | 1.4 | 0.565 | 0.28 |

## 7.0 GROUND AND AERIAL APPLICATION

VectoBac WDG may be applied using conventional ground or aerial application equipment with quantities of water sufficient to provide uniform coverage of the target area. For application, first add the VectoBac WDG to water to produce a final spray mixture.

The amount of water will depend on weather, spray equipment, and mosquito habitat characteristics. For application, fill the mix tank or plane hopper with the desired quantity of water. **Start the mechanical or manual agitation to provide moderate circulation of water before adding the VectoBac WDG.** Backpack and compressed air sprayers may be agitated by shaking after adding VectoBac WDG to the water in the sprayer. VectoBac WDG suspends readily in water and will stay suspended over normal application periods. Brief recirculation may be necessary if the spray mixture has sat for several hours or longer. Do not mix more VectoBac WDG than can be used in a 48 hour period. AVOID CONTINUOUS AGITATION OF THE SPRAY MIXTURE DURING SPRAYING.

For ground spraying, apply 1.75-14 oz/acre (50-400 g/acre; 123-988 g/ha) of VectoBac WDG in 5-100 gallons of water per acre (47-950 liters/ha) using hand-pump, airblast, mist blower, or other spray equipment.

For aerial application, apply 1.75 - 14 oz/acre (50-400 g/acre; 123-988 g/ha) of VectoBac WDG in 0.25-10 gallons of water per acre (2.4-9.5 liters/ha) through fixed wing or helicopter aircraft equipped with either conventional boom and nozzle system or rotary atomizers to provide uniform coverage of the target area.

## 7.1 AERIAL APPLICATION

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all of these factors when making decisions.

Rinse and flush spray equipment thoroughly following each use.

## 8.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

VALENT BIOSCIENCES CORPORATION
870 TECHNOLOGY WAY
LIBERTYVILLE, IL 60048 • 800-323-9597

Valent BioSciences Corporation

# VectoLex® CG

**Biological Larvicide Granules**

ACTIVE INGREDIENT:

| | |
|---|---|
| *Bacillus sphaericus* Serotype H5a5b, strain 2362 Technical Powder (670 BsITU/mg) | 7.5% w/w |
| INERT INGREDIENTS | 92.5% w/w |
| TOTAL | 100.0% w/w |

Potency: This product contains 50 BsITU/mg or 0.023 Billion BsITU/lb.

EPA Reg. No.73049-20
EPA Est. No. 33762-IA-001 List No. 5722

INDEX:



**KEEP OUT OF REACH OF CHILDREN**
**CAUTION**
**For MEDICAL and TRANSPORT EmergenciesONLY**
**Call 24 Hours A Day 1-877-315-9819. For All Other Information Call 1-800-323-9597.**

## 1.0 STATEMENT OF PRACTICAL TREATMENT

**If In Eyes:** Immediately flush eyes with plenty of water. Get medical attention if irritation persists.

**If on Skin:** Wash thoroughly with plenty of soap and water. Get medical attention if irritation persists.

## 2.0 PRECAUTIONARY STATEMENTS

### 2.1 HAZARDS TO HUMANS AND DOMESTIC ANIMALS

**CAUTION**

Harmful if absorbed through the skin. Causes moderate eye irritation. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling.

### 2.2 Environmental Hazards

Do not contaminate water when disposing of equipment washwaters or rinsate.

## 3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

## 4.0 STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Do not contaminate water when disposing of equipment washwaters.

**Pesticide Storage:** Store in a cool, dry place.

**Pesticide Disposal:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**Container Disposal:** Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## 5.0 APPLICATION DIRECTIONS

**MOSQUITO CONTROL**

**I. For control of mosquito larvae species* in the following non-crop sites:**

| Habitat | Rate Range |
|---|---|
| **Wastewater:** Sewage effluent, sewage lagoons, oxidation ponds, septic ditches, animal waste lagoons, impounded wastewater associated with fruit and vegetable processing | 5-20 lbs/acre** |
| **Stormwater/Drainage Systems:** Storm sewers, catch basins, drainage ditches, retention, detention and seepage ponds | 5-20 lbs/acre** |
| **Marine/Coastal Areas:** Salt marshes, mangroves, estuaries | 5-20 lbs/acre** |
| **Water Bodies:** Natural and manmade aquatic sites such as lakes, ponds, rivers, canals and streams | 5-20 lbs/acre** |
| **Dormant Rice Fields:** Impounded water in dormant rice fields. (For application only during the interval between harvest and preparation of the field for the next cropping cycle.) | 5-20 lbs/acre** |
| **Waste Tires:** Tires stockpiled in dumps, landfills, recycling plants, and other similar sites. | 20-80 lbs/acre(1) |

(1) .5-2 lbs/1000 sq. ft

**II. For the control of mosquito larvae species* in agricultural/crop sites where mosquito breeding occurs:**

| Habitats: | Rate Range |
|---|---|
| Rice, pastures/hay fields, orchards, citrus groves, irrigated crops. | 5-20 lbs/acre** |

Apply uniformly by aerial or conventional ground equipment. Reapply as needed after 1-4 weeks.

* Mosquito species effectively controlled by VectoLex CG:

| | |
|---|---|
| *Culex* spp. | *Psorophora columbiae* |
| *Aedes vexans* | *Psorophora ferox* |
| *Aedes melanimon* | *Aedes triseriatus* |
| *Aedes stimulans* | *Aedes sollicitans* |
| *Aedes nigromaculis* | *Anopholes quadrimaculatus* |
| | *Coquillettidia perturbans* |

**Use higher rates (10 to 20 lbs/acre) in areas where extended residual control is necessary, or in habitats having deep water or dense surface cover.

*CONTINUED*

[redacted]

## 6.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING THE USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

VALENT BIOSCIENCES CORPORATION
870 TECHNOLOGY WAY
LIBERTYVILLE, IL 60048 - 800-323-9597

# AGNIQUE® MMF MOSQUITO LARVICIDE & PUPICIDE

## MONOMOLECULAR SURFACE FILM FOR CONTROL OF IMMATURE MOSQUITOES AND MIDGES

### ACTIVE INGREDIENT

Poly(oxy-1,2-ethanediyl),α-isooctadecyl-ω-hydroxyl (100%)

### CAUTION

**KEEP OUT OF THE REACH OF CHILDREN**

**FIRST AID TREATMENT**

**IF ON SKIN:** Wash with plenty of soap and water. Get medical attention if irritation develops.

**IF IN EYES:** Flush with plenty of water. Get medical attention if irritation develops.

### PRECAUTIONARY STATEMENTS

**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**

**CAUTION:** Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling.

### DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. To be used in governmental mosquito control programs, by professional pest control operators, or in other mosquito or midge control operations.

This product is for the control of immature mosquitoes and midges in ponds, lakes, swamps, ditches, floodwater areas and many other areas where they breed and develop. This product may be used in potable and irrigation waters, permanent and semi-permanent waters, and in croplands and pastures.

### STORAGE AND DISPOSAL

DO NOT CONTAMINATE WATER, FOOD, OR FEED BY STORAGE OR DISPOSAL.

**PESTICIDE STORAGE:** Do not allow storage containers to rust. Rust contamination may clog spray nozzles. Do not allow product to freeze.

**PESTICIDE DISPOSAL:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL:** Triple rinse, then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state or local authorities.

### APPLICATION DIRECTIONS

This product may be applied by both ground and aerial applications. To use, spray the desired rate of neat MMF onto the surface of the water. No dilution is required. The MMF will spread to cover hard to access areas. A fan spray is recommended. Do not pour or inject a stream spray directly into water.

AGNIQUE® MMF is not visible on the surface of the water. Excess MMF on the water surface will form a globule.

### APPLICATION NOTES

**Rate of kill:** The rate of kill when using MMF is dependent on the species, the life stage, the habitat and the temperature. Pupicidal action will typically result in 24 hours. Larvicidal action will usually result in 24 - 72 hours. If the film is present, as indicated by the Indicator Oil, control will be achieved.

**Indicator Oil:** AGNIQUE® MMF is not visible on the surface of the water. To check the habitat for the presence and persistence of the product, add a drop of AGNIQUE® MMF Indicator Oil to several locations in the habitat. If the Indicator Oil forms a tight bead on the surface of the water, then the MMF is present for control.

**Persistence:** The AGNIQUE® MMF surface film typically persists on the waters surface for 5 - 22 days. Polluted waters will cause more rapid degradation of the film. Higher application rates will prolong film life and extend the interval between retreatment.

**Species:** Mosquitoes and midges that require little or no surface contacts for breathing will be affected by the product during the pupae and emerging adult life stages.

**Winds:** The high end of the dosage rate is recommended when spraying habitats where multi-directional winds of 10 mph (16 km/hr) or greater are expected to persist. While the film will be pushed by the winds, it will re-spread quickly once the winds have subsided. If persistent unidirectional winds of 10 mph (16 km/hr) or greater are expected, the displacement of the surface film may result in poor control.

**Spray Tank:** Thoroughly clean the spray system of contaminants such as petroleum oils, water, detergents and conventional toxicants prior to adding AGNIQUE® MMF. Detergents will destroy the film-forming of the MMF; other contaminants (water and oil) will result in the formation of an unsprayable paste.

**Dilution:** AGNIQUE® MMF is typically applied to the water's surface without dilution. However if it is desired to spray higher volumes of liquid, AGNIQUE® MMF may be diluted using a high shear injection system, that dilutes the MMF at the nozzle to a maximum of 10% in water. Do not add AGNIQUE® MMF to water in non-agitated spray systems. Conventional bypass recirculation will not provide adequate agitation to effectively mix MMF with water.

**Expanding Waters:** Significant expansion of the habitat's surface area due to rain or tidal fluxes can be compensated for by using a dosage that is based on the largest expected surface area. This will ensure complete coverage, and eliminate the need for re-treatment of the flooded area.

### NOTICE

Cognis Corporation makes no warranty, express or implied of merchantability, fitness or otherwise concerning the use of this product other than as indicated on the label. User assumes all risks, storage or handling not in strict accordance with the label.

| MOSQUITO HABITAT | Suggested Rate Range* |
|---|---|
| **Fresh and brackish waters**<br>Examples include salt marshes, ponds, storm water and retention & detention basins, roadside ditches, grassy swales, fields, pastures, potable water containers, reservoirs, irrigated croplands, woodland pools, tidal water, etc. | **0.2 - 0.5 gallons/acre**<br>**2 - 5 liters/hectare** |
| **Polluted waters**<br>Examples include sewage lagoons, animal waste effluent lagoons, septic ditches, etc. | **0.35 - 1.0 gallons/acre**<br>**3.5 - 10 liters/hectare** |

* Use higher rates when emergent or surface vegetation is present, due to the wicking action of the product. The more vegetation or the drier the vegetation, the higher the rate

* The lower rates may be used when only pupae are present.

| MIDGE HABITAT | Suggested Rate Range^ |
|---|---|
| **Fresh water**<br>Examples include ponds and lakes | **0.5 gallons/acre**<br>**5 liters/hectare** |
| **Polluted waters**<br>Examples include sewage lagoons and percolation ponds | **0.5 - 1.0 gallons/acre**<br>**5 - 10 liters/hectare** |

^ Reapplication is recommended every two weeks during the midge season.

cognis agrosolutions

**COGNIS CORPORATION,**
**4900 ESTE AVENUE**
**CINCINNATI, OH 45232-1419**
**1-800-254-1029**

**24 HOUR EMERGENCY PHONE**
**CHEMTREC 1-800-424-9300**

**For information on this pesticide product (including health concerns, medical emergencies, or pesticide incidents), call the National Pesticide Telecommunications Network at 1-800-858-7378.**



EPA REG NO. 53263-28 EPA Establishment Number 53263-SC-01

# PERMETHRIN 57% OS

CLARKE

For Application Only By Public Health Officials and Trained Personnel of Mosquito Abatement Districts and Other Mosquito Control Programs. A SYNTHETIC PYRETHROID FOR EFFECTIVE CONTROL AND REPELLENCY OF ADULT MOSQUITOES. For Use As An Effective ULV and Barrier Spray for Control of Adult Mosquitoes, Gnats, Biting and Non-Biting Midges, Blackflies, Deer Flies and Other Biting Flies.

## Precautionary Statements

### HAZARDS TO HUMANS AND DOMESTIC ANIMALS

### CAUTION

Harmful if swallowed or absorbed through skin. Avoid contact with skin, eyes or clothing. Wash thoroughly after handling.

### STATEMENT OF PRACTICAL TREATMENT

If Swallowed: call a physician or Poison Control Center. Do not induce vomiting. This product contains aromatic petroleum solvent. Aspiration may be a hazard.

### ENVIRONMENTAL HAZARDS

This product is highly toxic to fish and aquatic invertebrates. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated area may be hazardous to aquatic organisms in neighboring areas. Do not allow spray treatment to drift on pastureland, cropland, poultry ranges or water supplies. Do not contaminate water when disposing of equipment washwaters.

### PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

### DIRECTIONS FOR USE

**It is a violation of Federal Law to use this product in a manner inconsistent with its' labeling.**

## CONDITIONS and RATES to USE for MOSQUITO CONTROL

### FOR A BARRIER SPRAY

This product is effective for reducing mosquito annoyance and control of mosquitoes that may transmit diseases such as La Crosse encephalitis, dog heartworm, dengue fever and western encephalitis. Apply product with mist blower, power backpack or ULV machine. If ULV machine is used, adjust pressure to deliver particles from 35-200 microns. Do not allow spray treatment to drift on pasture land, crop land, poultry ranges or water supplies. Do not use on crops used for food, forage or pasture.

Thermal fog pattern of product requires a residual application on plant and other surfaces where mosquitoes may rest. Product commonly provides sustained control in wooded areas lasting up to 14 days in shaded areas. Secondary activity of product is through repellency. Apply product by ground application equipment such as mist blower, ULV equipment, power backpack or pressure sprayer. Not to be used within 100 feet (30 meters) of lakes and streams. To kill or repel mosquitoes, midges, deer flies and other biting flies, mix with enough oil mixture so as to easily apply 0.1 pounds of Permethrin per acre. The oil-mixture is obtained by mixing one part of soybean oil to two parts of mineral oil. Non-phytotoxic oils must be used. The following chart represents some possible dilutions based on a 2 MPH walking speed with a fifty (50) foot swath. If a different dilution ratio or walking speed is used, adjust flow rate accordingly so as to achieve 0.1 pounds of Permethrin per acre.

**For A Two (2) Mile Per Hour Walking Speed And A 50 Foot Application Swath—The Following Are Typical Field Dilutions.**

| Permethrin 57% | Oil | Fl. oz. Finished Spray Per Acre | Fl. oz./Min. |
|---|---|---|---|
| 1 Part | 9.0 Parts | 25.6 | 5.0 |
| 1 Part | 5.8 Parts | 17.5 | 3.5 |
| 1 Part | 4.0 Parts | 12.5 | 2.5 |

| ACTIVE INGREDIENT: | |
|---|---|
| Permethrin (3-Phenoxyphenyl)methyl (±) cis; trans-3-(2,2-dichlorethenyl)-2,2-dimethyl-cyclopropanecarboxylate | 57.00% |
| INERT INGREDIENTS | 43.00% |
| | 100.00% |

Contains petroleum distillates.

Cis/trans isomers ratio: min. 35%(+)cis and max. 65%(+)trans.

Contains 5 lb./gal. Permethrin

## CAUTION

## KEEP OUT OF REACH OF CHILDREN



MANUFACTURED BY

**CLARKE MOSQUITO CONTROL PRODUCTS, INC.**
159 N. GARDEN AVENUE
ROSELLE, ILLINOIS 60172

E.P.A. EST. No. 8329IL01
EPA Reg. No. 8329-44

NET CONTENTS_____

LOT NO. _____

NOTICE: Seller makes no warranty, expressed or implied concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when use and/or handling is contrary to label instructions.

This is equivalent to 0.1 lb. of Permethrin/Acre. Apply the product with sufficient carrier to allow distribution over the area to be treated using particle sizes from 35-200 microns mmd. To obtain optimum results, cover the immediate surroundings of housing, buildings including plant surfaces where mosquitoes may rest. For large recreational areas such as football fields, stadiums, racetracks, and public parks, spray the insecticide-oil mixture at the above mentioned application rate on the interface of woods surrounding the main area where the event is to take place. Spray may also be applied in any vegetated area where mosquitoes may rest causing infestations in residential areas.

To Kill Gypsy Moths and Tentcaterpillars infesting woodland and forest areas: Apply the insecticide-oil mixture (as described above) directly to insect nests and vegetation by backpack applicator using 62 Fl. Oz./acre at a walking speed of 2 MPH over a swath of 50 feet, applying 12.6 Fl. Oz./minute. This is equivalent to 0.25 lb. of Permethrin/acre. Apply thoroughly to all foliage and insect nests.

## TRUCK MOUNTED -ULV- EQUIPMENT

PERMETHRIN 57% is recommended for application as an ultra-low volume (U.L.V.) nonthermal aerosol (cold fog) to control adult mosquitoes in residential and recreational areas where these insects are a problem such as but not limited to parks, campsites, woodlands, athletic fields, golf courses, residential areas and municipalities, gardens, playgrounds, recreational areas and overgrown waste areas. Do not apply this product within 100 feet (30 Meters) of lakes and streams. Do not allow spray treatment to drift on pastureland, cropland, poultry ranges or water supplies. For best results treat when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground, e.g. cool temperatures and wind speed not greater than 10 mph. Applications during the cool hours of the night or early morning is usually preferable. Repeat treatment as needed.

**U.L.V. Nonthermal Aerosol (Cold Fog) Application:** To control Mosquitoes, Midges and Blackflies, apply PERMETHRIN 57% using any standard U.L.V. ground applicator capable of producing a nonthermal aerosol spray with droplets ranging in size from 5 to 30 microns and a mass median diameter (MMD) of 10 to 20 microns. Apply the product undiluted at a flow rate of 0.54 to 3.25 fluid ounces per minute at an average vehicle speed of 10 mph. If a different vehicle speed is used, adjust rate accordingly. These rates are equivalent to 0.0035 to 0.021 pounds of Permethrin per acre. Vary flow rate according to vegetation density and mosquito population. Use higher flow rate in heavy vegetation or when populations are high. An accurate flow meter must be used to ensure the proper flow rate. PERMETHRIN 57% may also be applied by diluting with a suitable solvent such as a non-phytotoxic mineral oil. The following charts represent some suggested dilution and application rates for ground U.L.V. applications. If an alternate dilution rate is used, adjust flow rate accordingly.

**FOR A 1:4 PERMETHRIN 57%/SOLVENT DILUTION RATIO**
Mix one (1) part PERMETHRIN 57% with four (4) parts solvent and apply at the following rates.

| Permethrin pounds/acre | Application Rates Fl. oz./Min. 5MPH | 10MPH | 15MPH | Fl. oz. finished spray per acre |
|---|---|---|---|---|
| 0.007 | 2.70 | 5.40 | 8.1 | 0.90 |
| 0.0035 | 1.35 | 2.70 | 4.0 | 0.45 |
| 0.00175 | .68 | 1.35 | 2.0 | 0.23 |

**FOR A 1:9 PERMETHRIN 57%/SOLVENT DILUTION RATIO**
Mix one (1) part PERMETHRIN 57% with nine (9) parts solvent and apply at the following rates.

| Permethrin pounds/acre | Application Rates Fl. oz./Min. 5MPH | 10MPH | Fl. oz. finished spray per acre |
|---|---|---|---|
| 0.007 | 5.40 | 10.75 | 1.80 |
| 0.0035 | 2.70 | 5.40 | 0.90 |
| 0.00175 | 1.35 | 2.70 | 0.45 |

**FOR A 1:14 PERMETHRIN 57%/SOLVENT DILUTION RATIO**
Mix one (1) part PERMETHRIN 57% with fourteen (14) parts solvent and apply at the following rates.

| Permethrin pounds/acre | Application Rates Fl. oz./Min. 5MPH | 10MPH | 15MPH | Fl. oz. finished spray per acre |
|---|---|---|---|---|
| 0.007 | 8.0 | 16.0 | 32.0 | 2.70 |
| 0.0035 | 4.0 | 8.0 | 16.0 | 1.35 |
| 0.00175 | 2.0 | 4.0 | 8.0 | 0.68 |

For proper application, mount the fog applicator so that the nozzlers at least 4½ feet above ground level and directed out the back of the vehicle. Failure to follow the above directions may result in reduced effectiveness. Aerial applications should be done by suitable aerial U.L.V. equipment capable of producing droplets with an MMD of 50 microns or less with no more than 2.5% exceeding 100 microns. Flow rate and swath width should be set so as to achieve 0.2 to 0.6 fluid ounces of PERMETHRIN 57% per acre. PERMETHRIN 57% may also be diluted with a suitable diluent such as mineral oil and applied by aerial ULV equipment so long as 0.6 fluid ounces per acre of PERMETHRIN 57% is not exceeded. Both aerial and ground applications should be made when wind is less than 10 MPH.

**IN FLORIDA:** Do not apply by aircraft except in emergency situations and with the approval of the Florida Department of Agriculture and Consumer Services.

## STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

**PESTICIDE STORAGE AND SPILL PROCEDURES:** Do not store at temperatures below 40°F (4.5°C). If this material has been exposed to temperatures below 40°F (4.5°C), there may be precipitation. Check for crystallization. If evident, warm to 80°F (26.5°C) and thoroughly mix before using. DO NOT USE OPEN FLAME. Store upright at room temperature. Avoid exposure to extreme temperatures. In case of spill or leakage, soak up with an absorbent material such as sand, sawdust, earth, fuller's earth, etc. Dispose of with chemical waste.

**PESTICIDE DISPOSAL:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL:** Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other approved state and local procedures.

**CONTAINERS ONE GALLON AND SMALLER:** Do not reuse container. Wrap containers in several layers of newspaper and discard in trash.

**CONTAINERS LARGER THAN ONE GALLON:** Metal Containers—Triple rinse, or equivalent. Then offer for recycling or reconditioning, or puncture and dispose at in a sanitary landfill, or by other procedures approved by state and local authorities. Plastic Containers—Triple rinse or equivalent. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke. Then dispose at in a sanitary landfill or by other approved state and local procedures.

IN CASE OF EMERGENCY, CALL INFOTRAC 1-800-535-5053

FOR MORE INFORMATION CALL:
1-800-323-5727

12/97

RESTRICTED USE CLASSIFICATION
Due to Acute Fish Toxicity
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's Certification.

# SCOURGE® INSECTICIDE

## with SBP-1382®/PIPERONYL BUTOXIDE 4% + 12% ME FORMULA II

*Specimen Label*

- *A READY TO USE SYNTHETIC PYRETHROID FOR EFFECTIVE ADULT MOSQUITO (INCLUDING ORGANOPHOSPHATE RESISTANT SPECIES), MIDGE (BITING AND NON-BITING), AND BLACK FLY CONTROL*
- *TO BE APPLIED BY MOSQUITO ABATEMENT DISTRICTS, PUBLIC HEALTH OFFICIALS AND OTHER TRAINED PERSONNEL IN MOSQUITO CONTROL PROGRAMS.*
- *CONTAINS 0.3 lb/gal (36 g/L) OF SBP-1382 AND 0.9 lb/gal (108 g/L) OF PIPERONYL BUTOXIDE*
- *FOR AERIAL AND GROUND APPLICATION*

ACTIVE INGREDIENTS:

| | |
|---|---|
| * Resmethrin | 4.14% |
| **Piperonyl Butoxide Technical | 12.42% |
| INERT INGREDIENTS†: | 83.44% |
| | 100.00% |

*Cis/trans isomers ratio: max. 30% (±) cis and min. 70% (±) trans.
**Equivalent to 9.94% (butylcarbityl) (6-propylpiperonyl) ether and 2.48% related compounds.
†Contains Petroleum Distillates.

PRECAUCION AL CONSUMIDOR: Si usted no lee ingles, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.
(TO THE USER: If you cannot read English, do not use this product until the label has been fully explained to you.)

EPA REG. NO. 432-716 EPA EST. NO.

KEEP OUT OF REACH OF CHILDREN

## CAUTION

### FIRST AID

IF SWALLOWED: Call a doctor or get medical attention. Do not induce vomiting. Do not give anything by mouth to an unconscious person. Avoid Alcohol. This product contains aromatic petroleum solvent. Aspiration may be a hazard.
IF ON SKIN: Wash with soap and plenty of water. Get medical attention.

See Side Panel For Additional Precautionary Statements

For product information Call Toll-Free: 1-800-331-2867

In case of *Medical* emergencies or health and safety inquiries or in case of fire, leaking or damaged containers, information may be obtained by calling 1-800-334-7577.

*NET CONTENTS:*

BAYER ENVIRONMENTAL SCIENCE
A Business Group of Bayer CropScience LP
95 Chestnut Ridge Road • Montvale, NJ 07645

## PRECAUTIONARY STATEMENTS
## Hazards To Humans & Domestic Animals

CAUTION

Harmful if swallowed or absorbed through skin. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling.

## Environmental Hazards

This pesticide is highly toxic to fish. For terrestrial uses, do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff from treated sites may be hazardous to fish in adjacent waters. Consult your State's Fish and Wildlife Agency before treating such waters. Do not contaminate water by cleaning of equipment or disposal of equipment wash waters.

## DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

## STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

Storage: Store product in original container in a locked storage area.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and Local authorities.

READ ENTIRE LABEL FOR DIRECTIONS

For use only by certified applicators or under the supervision of such applicators, for the reduction in annoyance from adult mosquito infestations and as a part of a mosquito abatement program.

IN THE STATE OF CALIFORNIA: For use only by local districts or other public agencies which have entered into and operate under a cooperative agreement with the Department of Public Health pursuant to Section 2426 of the Health and Safety Code.

This product is to be used for control of adult mosquitoes (including organophosphate resistant species), midges (biting and non-biting) and blackflies by specially designed aircraft capable of applying ULTRA LOW VOLUME of finished spray formulation or by ground application with nonthermal or mechanical spray equipment that can deliver spray particles within the aerosol size range and at specified dosage levels.

NOTICE: This concentrate cannot be diluted in water. Mix well before using. Avoid storing excess formulation in spray equipment tank beyond the period needed for application.

ULTRA LOW VOLUME APPLICATIONS

For use in nonthermal ULV portable backpack equipment similar to the Hudson B.P., mix 70 fl oz (2068 ml) of this product with 1 gal (3.79 L) of refined soybean oil, light mineral oil of 54 second viscosity or other suitable solvent or diluent. Adjust equipment to deliver fog particles of 18-50 microns mass median diameter. Apply at the rate of 4.25-8.50 fl oz of finished formulation per acre (311-621 ml/ha) as a 50 ft (15.2 m) swath while walking at a speed of 2 mph (3.2 kph). This is equivalent to 0.0035-0.0070 lb ai SBP-1382/A (3.92- 7.85 gm/ha) plus 0.0105- 0.0210 lb ai piperonyl butoxide tech./A (11.77-23.54 gm/ha). Where dense vegetation is present, the higher rate is recommended.

For truck mounted nonthermal ULV equipment similar to LECO HD or MICRO-GEN or WHISPERMIST-XL, adjust equipment to deliver fog particles of 8-20 microns mass median diameter. Consult the following chart for application rates.

| Treatment lb ai/A of Scourge Wanted SBP-1382/PBO | Fl oz/A of Undiluted Spray to be Applied | Application Rate-Fl oz/Min | |
|---|---|---|---|
| | | 5 MPH | 10 MPH |
| 0.007/0.021 | 3.0(90 ml) | 9.0(266.2ml) | 18.0(532.3ml) |
| 0.0035/0.0105 | 1.5(45 ml) | 4.5(133.1 ml) | 9.0(266.2 ml) |
| 0.00175/0.00525 | 0.75(22.5 ml) | 2.25(66.6 ml) | 4.5(133.1 ml) |
| 0.00117/0.00351 | 0.50(15 ml) | 1.50(45 ml) | 3.0(90 ml) |

Where dense vegetation is present, the use of the higher rates and/or slower speed is recommended.

For best results, fog only when air currents are 2-8 mph (3.2-12.9 kph). It is preferable to fog during early morning and evening when there is less breeze and convection currents are minimal. Arrange to apply the fog in the direction with breeze to obtain maximum swath length and better distribution. Direct spray head of equipment in a manner to insure even distribution of the fog throughout the area to be treated. Avoid prolonged inhalation of fog.

Where practical, guide the direction of the equipment so that the discharge nozzle is generally maintained at a distance of more than 6 feet (1.83 m) from ornamental plants and 5-15 feet (1.5-4.5 m) or more from painted objects. Temperature fluctuations will require periodical adjustment of equipment to deliver the desired flow rate at the specified speed of travel. The flow rate must be maintained to insure the distribution of the proper dosage of finished formulation.

Spray parks, campsites, woodlands, athletic fields, golf courses, swamps, tidal marshes, residential areas and municipalities around the outside of apartment buildings, restaurants, stores and warehouses. Do not spray on cropland, feed or foodstuffs. Avoid direct application over lakes, ponds and streams.

DIRECTIONS FOR STABLE FLY, HORSE FLY, DEER FLY CONTROL:

Treat shrubbery and vegetation where the above flies may rest. Shrubbery and vegetation around stagnant pools, marshy areas, ponds and shore lines may be treated. Application of this product to any body of water is prohibited.

For control of adult flies in residential and recreational areas, apply this product undiluted at a rate of 178 fl oz/hr (5.26 L/hr) by use of a suitable ULV generator travelling at 5 mph (8 kph) or at a rate of 356 fl oz/hr (10.53 L/hr) while travelling at 10 mph (16 kph). When spraying, apply across wind direction approximately 300 ft (91.4 m) apart.

Apply when winds range from 1-10 mph (1.6-16.0 kph). Repeat for effective control.

DIRECTIONS FOR AERIAL APPLICATIONS
FOR USE WITH FIXED-WING AND ROTARY AIRCRAFT

This product is used in specially designed aircraft capable of applying ultra low volume of undiluted spray formulation for control of adult mosquitoes (including organophosphate resistant species), midges (biting and non-biting) and blackflies.

Aerial application should be made preferably in the early morning or evening. Application should be made preferably when there is little or no wind.

It is not recommended to make application when wind speeds exceed 10 mph (16 kph). Repeat applications should be made as necessary. Apply preferably when temperatures exceed 50°F (10°C).

May be used as a mosquito adulticide in recreational and residential areas, and in municipalities, around the outside of apartment buildings, golf courses, athletic fields, parks, campsites, woodlands, swamps, tidal marshes, and overgrown waste areas.

Do not spray on cropland, feed or foodstuffs. Avoid direct application over lakes, ponds and streams.

| lb ai/A Wanted SBP-1382/PBO | Fl oz/A of Undiluted Spray to be Applied |
|---|---|
| 0.007/0.021 | 3.0 (90 ml) |
| 0.0035/0.0105 | 1.5 (45 ml) |
| 0.00175/0.00525 | 0.75 (22.5 ml) |
| 0.00117/0.00351 | 0.50 (15 ml) |

## IMPORTANT: READ BEFORE USE

Read the entire Directions for Use, Conditions, Disclaimer of Warranties and Limitations of Liability before using this product. If terms are not acceptable, return the unopened product container at once.

By using this product, user or buyer accepts the following conditions, disclaimer of warranties and limitations of liability.

**CONDITIONS:** The directions for use of this product are believed to be adequate and should be followed carefully.However, because of manner of use and other factors beyond Bayer Environmental Science's control, it is impossible for Bayer Environmental Science to eliminate all risks associated with the use of this product. As a result, crop injury or ineffectiveness is always possible. All such risks shall be assumed by the user or buyer.

**DISCLAIMER OF WARRANTIES:** BAYER ENVIRONMENTAL SCIENCE MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, THAT EXTEND BEYOND THE STATEMENTS MADE ON THIS LABEL. No agent of Bayer Environmental Science is authorized to make any warranties beyond those contained herein or to modify the warranties contained herein. Bayer Environmental Science disclaims any liability whatsoever for special, incidental or consequential damages resulting from the use or handling of this product.

**LIMITATIONS OF LIABILITY:** THE EXCLUSIVE REMEDY OF THE USER OR BUYER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE PAID, OR AT BAYER ENVIRONMENTAL SCIENCE'S ELECTION, THE REPLACEMENT OF PRODUCT.



Scourge is a registered trademark of Bayer AG.
SBP-1382 is a registered trademark of Valent BioSciences Corporation.

Bayer Environmental Science
A Business Group of Bayer CropScience LP
95 Chestnut Ridge Road
Montvale, NJ 07645
S4-12-SL-9/02

CLARKE

# ANVIL® 2+2 ULV

**Contains An Oil Soluble Synergized Synthetic Pyrethroid For Control of Adult Mosquitoes (Including Organophosphate-Resistant Species) Midges, and Black Flies in Outdoor Residential and Recreational Areas.**

## Precautionary Statements
## HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Harmful if absorbed through the skin. Do not induce vomiting because of aspiration pneumonia hazard. Avoid contact with skin, eyes or clothing. In case of contact flush with plenty of water. Wash with soap and water after use. Obtain medical attention if irritation persists. Avoid contamination of food and feedstuffs.

## ENVIRONMENTAL HAZARDS

Do not contaminate untreated water by cleaning of equipment. Cleaning of equipment or disposal of wastes must be done in a manner that avoids contamination of bodies of water or wetlands. This product is toxic to fish. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark.

## PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

## DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

USE AREAS: For use in mosquito adulticiding programs involving outdoor residential and recreational areas where adult mosquitoes are present in annoying numbers in vegetation surrounding parks, woodlands, swamps, marshes, overgrown areas and golf courses.

IN CALIFORNIA: This product is to be applied by County Health Department, State Department of Health Services, Mosquito and Vector Control or Mosquito Abatement District personnel only.

For best results, apply when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground, i.e. cool temperatures and wind speed not greater than 10 mph.

E.P.A. EST. No. 8329-IL-01
EPA Reg. No.1021-1687-8329

**NET CONTENTS**

**LOT NO.**

| ACTIVE INGREDIENTS: | |
|---|---|
| 3-Phenoxybenzyl-(1RS, 3RS; 1RS, 3SR)-2,2-dimethyl-3-(2-methylprop-1-enyl) cyclopropanecarboxylate | 2.00% |
| * Piperonyl Butoxide, Technical | 2.00% |
| ** INERT INGREDIENTS | 96.00% |
| | 100.00% |

* Equivalent to 1.60% (butylcarbityl) (6-propylpiperonyl) ether and .40% related compounds

** Contains a petroleum distillate

Contains 0.15 pounds of Technical SUMITHRIN®/Gallon and 0.15 pounds Technical Piperonyl Butoxide/Gallon

SUMITHRIN®- Registered trademark of Sumitomo Chemical Company, Ltd.

## KEEP OUT OF REACH OF CHILDREN
## CAUTION

PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que la etiqueta haya sido explicado ampliamente.

## STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center immediately. Do not induce vomiting because of aspiration pneumonia hazard.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

IF ON SKIN OR CLOTHING: Remove contaminated clothing and wash before reuse. Wash skin with soap and warm water. Get medical attention if irritation persists.

IF INHALED: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth.

**For information regarding medical emergencies or pesticide incidents, call the International Poison Center at 1-888-740-8712.**

DISTRIBUTED BY

**CLARKE MOSQUITO CONTROL PRODUCTS, INC.**
159 N. GARDEN AVENUE • ROSELLE, ILLINOIS 60172

NOTICE: Seller makes no warranty, expressed or implied concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when use and/or handling is contrary to label instructions.

## GROUND ULV APPLICATION

APPLICATION AND DILUTION DIRECTIONS: Consult the following table for examples of various dosage rates using a swath width of 300 feet for acreage calculations. This product should be used in cold aerosol generators capable of producing droplets with a MMD of 5 to 25 microns.

| Dosage Rate | Flow Rates in fluid oz./minute at truck speeds of: | | | |
|---|---|---|---|---|
| lbs.A.I./acre | 5MPH | 10MPH | 15MPH | 20MPH |
| 0.0036 | 9.3 oz. | 18.6 oz | 27.9 oz | 37.2 oz |
| 0.0024 | 6.2 oz | 12.4 oz | 18.6 oz | 24.8 oz |
| 0.0012 | 3.1 oz | 6.2 oz | 9.3 oz | 12.4 oz |

**ANVIL 2 + 2 ULV** may be applied undiluted with a non-thermal ULV portable "backpack" spray unit capable of delivering particles in the 5 to 25 micron range. Apply at a walking speed 2 mph, making sure that the same amount of A.I. is applied per acre.

**ANVIL 2 + 2 ULV** may be applied with suitable thermal fogging equipment. Do not exceed the maximum rates listed above. May be applied at speeds of 5 to 20 mph.

Prohibition on aerial use: Not for aerial application in Florida unless specifically authorized by the Bureau of Entomology, Florida Department of Agriculture and Consumer Services.

## AERIAL APPLICATION

Prohibition on aerial use: Not for aerial application in Florida unless specifically authorized by the Bureau of Entomology, Florida Department of Agriculture and Consumer Service.

| Dosage Rate | Flow Rates in fluid oz./acre |
|---|---|
| lbs.A.I./acre | ANVIL® 2 + 2 ULV |
| 0.0036 | 3.0 oz |
| 0.0024 | 2.0 oz |
| 0.0012 | 1.0 oz |

Aerial applications should be done by suitable aerial ULV equipment capable of producing droplets with an MMD of 50 microns or less with no more than 2.5% exceeding 100 microns. Flow rate and swath width should be set so as to achieve 1.0 to 3.0 fluid ounces of ANVIL® 2+2 ULV per acre. Both aerial and ground applications should be made when wind is less than 10 MPH. For application by Public Health Officials and personnel of Mosquito Abatement Districts and other mosquito control programs.

**ANVIL 2 + 2 ULV** cannot be diluted in water. Dilute this product with light mineral oil if dilution is preferred.

## STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

**STORAGE:** Store in a cool, dry place. Keep container closed.

**CONTAINER DISPOSAL:** Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other approved state and local procedures.

**PESTICIDE DISPOSAL:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**FOR MORE INFORMATION CALL: 1-800-323-5727**

12/11/00

# PYRENONE® 25-5

## PUBLIC HEALTH INSECTICIDE

*Specimen Label*

- *FOR USE BY TRAINED PERSONNEL ONLY.*
- *TO BE APPLIED ONLY BY OR UNDER THE SUPERVISION OF PEST CONTROL OPERATORS, MOSQUITO ABATEMENT DISTRICTS, PUBLIC HEALTH ORGANIZATIONS AND OTHER TRAINED PERSONNEL RESPONSIBLE FOR INSECT CONTROL PROGRAMS.*
- *FOR INDOOR AND OUTDOOR APPLICATION AS A SPACE, AREA OR CONTACT SPRAY.*
- *DEPENDENT UPON PESTS TO BE CONTROLLED AND THE AREA TO BE TREATED, MAY BE APPLIED THROUGH MECHANICAL AEROSOL GENERATORS (ULV) OR THERMAL FOGGING EQUIPMENT AS WELL AS CONVENTIONAL FOGGING OR SPRAYING EQUIPMENT.*
- *MAY BE USED OVER ALL CROPS.*
- *THE ACTIVE INGREDIENTS ARE EXEMPT FROM TOLERANCES WHEN APPLIED TO GROWING CROPS [see 40 CFR § 180.1001 (b)]*

| ACTIVE INGREDIENTS | |
|---|---|
| ♦Pyrethrins | 5.0% |
| *▲Piperonyl Butoxide, Technical | 25.0% |
| †OTHER INGREDIENTS | 70.0% |
| | 100.0% |

*Equivalent to 20% (butylcarbityl) (6-propylpiperonyl) ether and 5% related compounds.
†Contains Petroleum Distillate
♦Contains 0.367 pounds of Pyrethrins per gallon.
▲Contains 1.83 pounds of Piperonyl Butoxide per gallon.

KEEP OUT OF REACH OF CHILDREN

**CAUTION**

See Rear Panel For Additional Precautions

EPA REG. NO. 432-1050 EPA EST. NO.

*NET CONTENTS:*

BAYER ENVIRONMENTAL SCIENCE
A Business Group of Bayer CropScience LP
95 Chestnut Ridge Road • Montvale, NJ 07645

## FIRST AID

IF SWALLOWED: Call a doctor or get medical attention. Do not induce vomiting. Do not give anything by mouth to an unconscious person. Avoid Alcohol.

IF INHALED: Remove victim to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. Get medical attention.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

IF ON SKIN: Wash with plenty of soap and water. Get medical attention if irritation persists.

In case of Medical emergencies or health and safety inquiries or in case of fire, leaking or damaged containers, information may be obtained by calling 1-800-471-0660.

For Product Information Call Toll-Free: 1-800-331-2867

## PRECAUTIONARY STATEMENTS
## Hazards To Humans & Domestic Animals

**CAUTION**

Harmful if swallowed or inhaled. Avoid breathing spray mist. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash clothing before re-use. Remove pets, birds and cover fish aquaria before spraying.

Do not apply as a space spray while food processing is underway. Except in Federally inspected meat and poultry plants, when applied as a surface spray with care and in accordance with the directions and precautions given above, food processing operations may continue. Foods should be removed or covered before treatments. In food processing areas all surfaces must be washed and rinsed in potable water after spraying.

When using in animal quarters, do not apply directly to food, water or food supplements. Wash teats of dairy animals before milking.

## Environmental Hazards

This product is toxic to fish. For terrestrial uses, do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment or disposal of wastes. Shrimp and crab may be killed at application rates recommended on this label. Do not apply where these are important resources. Apply this product only as specified on this label.

## DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

## STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.
**Pesticide Storage And Spill Procedures:** Store upright at room temperature. Avoid exposure to extreme temperatures. In case of spill or leakage, soak up with an absorbent material such as sand, sawdust, earth, fuller's earth, etc. Dispose of with chemical waste.

**Pesticide Disposal:** Pesticide, spray mixture or rinse water that cannot be used according to label instructions may be disposed of on site or at an approved waste disposal facility.
**Container Disposal:** Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other approved State and local procedures.
CONTAINERS ONE GALLON AND SMALLER: Do not re-use container. Wrap container in several layers of newspaper and discard in trash.

SPACE AND/OR CONTACT USE AREAS:

| | |
|---|---|
| Homes | Poultry Houses |
| Horse Barns | Schools |
| Hotels | Supermarkets |
| Industrial Installations | Swine Houses |
| Motels | Truck Trailers |
| Office Buildings | Wineries |

OUTDOOR USE AREAS:

| | | |
|---|---|---|
| Recreational areas | Golf courses | Corrals |
| Drive-in Restaurants | Municipalities | Zoos |
| Drive-in Theaters | Swine Yards | Parks |
| Residences | Feedlots | Playgrounds |
| Vineyards | | |

PYRENONE® 25-5 Public Health Insecticide is effective in the control of the indicated insects if the applicator follows directions for use as enumerated below:

| | |
|---|---|
| ***All Common Diptera*** | |
| ***Deer Flies*** | ***Lice*** |
| ***Fruit Flies*** | ***Mosquitoes*** |
| ***Gnats*** | ***Small Flying Moths*** |
| ***Horn Flies*** | ***Stable Flies*** |
| ***Horse Flies*** | ***Wasps*** |
| ***House Flies*** | |

INDOOR USE AS A SPACE SPRAY, DILUTED:
For use in conventional mechanical fogging equipment, to kill ***Flies, Fruit Flies, Mosquitoes and Gnats.*** Cover or remove exposed food and food handling surfaces. Close room and shut off all air conditioning or ventilating equipment. Dilute 1 part of Pyrenone 25-5 plus 49 parts of oil or suitable solvent and mix well. Apply at the rate of 1-2 fl. oz. per 1000 cu. ft. filling the room with mist. Keep area closed for at least 15 minutes. Vacate treated area and ventilate before reoccupying. Repeat treatment when reinfestation occurs.

SURFACE SPRAY: As an aid in the control of ***Mosquitoes, Gnats and Wasps.*** Treat walls, ceilings, moldings, screens, door and window frames, light cords and similar resting places.

ANIMAL QUARTER USE: (cattle barns, horse barns, poultry houses, swine houses, zoos): As a space spray diluted for use in conventional mechanical fogging equipment to kill ***Flies, Mosquitoes, Small Flying Moths and Gnats.*** Dilute 1 part of Pyrenone 25-5 Public Health Insecticide plus 49 parts oil or suitable solvent and mix well. Apply at a rate of 2 fl. oz. per 1,000 cu. ft. of space above the animals. Direct spray towards the upper portions of the enclosure. Keep area closed for at least 15 minutes. Vacate treated area and ventilate before reoccupying. Repeat treatment when reinfestation occurs.

TEMPORARY REDUCTION OF ANNOYANCE from ***Flies, Mosquitoes and Small Flying Moths*** outdoors. The directions for outdoor ground application noted below will afford temporary reduction of annoyance from

these pests in public theaters, golf courses, municipalities, parks, playgrounds and recreational areas. Direct application into tall grass, shrubbery and around lawns where these pests may hover or rest. Apply while air is still. Avoid wetting foliage. Application should be made prior to attendance. Repeat as necessary.
In additional outdoor areas (corrals, feedlots, swine lots and zoos), cover water, drinking fountains and animal feed before use. Treat area with mist, directing application into tall grass, shrubbery and around lawns where these pests may hover or rest. Apply while air is still. Avoid wetting foliage. In zoos, avoid exposure of reptiles to the product. Repeat as necessary.

FOR USE ON ANIMALS: To protect beef and dairy cattle and horses from ***Horn Flies, House Flies, Mosquitoes and Gnats,*** dilute 1 part of Pyrenone 25-5 plus 49 parts oil or suitable solvent, mix well and apply a light mist sufficient to wet the tips of the hair. To control ***Stable Flies, Horse Flies and Deer Flies*** on beef and dairy cattle and horses, apply 2 oz. per adult animal, sufficient to wet the hair but not to soak the hide. Repeat treatment once or twice daily or at intervals to give continued protection.

**USE IN MOSQUITO CONTROL**

Pyrenone 25-5 Public Health Insecticide may be used for mosquito control programs involving residential, industrial, recreational and agricultural areas as well as swamps, marshes, overgrown waste areas, roadsides and pastures where adult mosquitoes occur. Pyrenone 25-5 Public Health Insecticide may be used over agricultural crops because the ingredients are exempt from tolerance when applied to growing crops. For best results, apply when meteorological conditions create a temperature inversion and wind speed does not exceed 10 miles per hour. The application should be made so the wind will carry the insecticidal fog into the area being treated. Treatment may be repeated as necessary to achieve the desired level of control.

When used in cold aerosol generators that produce a fog with the majority of droplets in the 10-25 micron VMD range, Pyrenone 25-5 Public Health Insecticide should be diluted with light mineral oil or suitable solvent (specific gravity of approximately 0.8 at 60°F; boiling point: 500-840°F). An N.F. grade oil is prefered.

GROUND APPLICATION: To control adult mosquitoes and all common diptera, apply up to 0.0025 pounds of pyrethrins per acre (use a 300 foot swath width for acreage calculations).

Truck-Mounted ULV Application: The delivery rate and truck speed may be varied as long as the application rate does not exceed 0.0025 pounds of pyrethrins per acre (use a 300 foot swath width for acreage calculations).

Backpack Spray Application: Dilute 1 part Pyrenone 25-5 Public Health Insecticide with 10 parts oil or suitable solvent and apply at the rate of 7 ounces per acre (based on a 50 foot swath, 7 ounces should be applied while walking 870 feet).

AERIAL APPLICATION (FIXED WING AND HELICOPTER): To control adult mosquitoes and biting flies, apply up to 0.0025 pounds of pyrethrins per acre with equipment designed and operated to produce a ULV spray application.

## IMPORTANT: READ BEFORE USE

By using this product, user or buyer accepts the following conditions, disclaimer of warranties and limitations of liability.

**CONDITIONS:** The directions for use of this product are believed to be adequate and should be followed carefully. However, because of manner of use and other factors beyond Bayer Environmental Science's control, it is impossible for Bayer Environmental Science to eliminate all risks associated with the use of this product. As a result, crop injury or ineffectiveness is always possible. All such risks shall be assumed by the user or buyer.

**DISCLAIMER OF WARRANTIES:** THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, WHICH EXTEND BEYOND THE STATEMENTS MADE ON THIS LABEL. No agent of Bayer Environmental Science is authorized to make any warranties beyond those contained herein or to modify the warranties contained herein. Bayer Environmental Science disclaims any liability whatsoever for incidental or consequential damages, including, but not limited to, liability arising out of breach of contract, express or implied warranty (including warranties of merchantability and fitness for a particular purpose), tort, negligence, strict liability or otherwise.

**LIMITATIONS OF LIABILITY:** THE EXCLUSIVE REMEDY OF THE USER OR BUYER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE PAID, OR AT BAYER ENVIRONMENTAL SCIENCE'S ELECTION, THE REPLACEMENT OF PRODUCT.


**Bayer Environmental Science**
A Business Group of Bayer CropScience LP
95 Chestnut Ridge Road
Montvale, NJ 07645

Py 25-5 PH-SL-9/02 Bayer

7396-902

# PYROCIDE® Mosquito Adulticiding Concentrate for ULV Fogging 7396

Recommended for use by Commercial or Governmental Mosquito Control Personnel

| | | |
|---|---|---|
| | ACTIVE INGREDIENTS: | |
| | Pyrethrins | 5.00% |
| * | Piperonyl butoxide, Technical | 25.00% |
| ** | OTHER INGREDIENTS | 70.00% |
| | | 100.00% |

* Equivalent to 20.00% (butylcarbityl) (6-propylpiperonyl) ether and 05.00% related compounds.
** Contains petroleum distillate
PYROCIDE® - Registered trademark of McLaughlin Gormley King Co.

KEEP OUT OF REACH OF CHILDREN

## CAUTION



| FIRST AID | |
|---|---|
| IF SWALLOWED: | ▪ Immediately call a poison control center or doctor.<br>▪ Do not give any liquid to the person.<br>▪ Do not induce vomiting unless told to do so by a poison control center or a doctor.<br>▪ Do not give anything by mouth to an unconscious person. |
| IF IN EYES: | ▪ Hold eye open and rinse slowly and gently with water for 15-20 minutes.<br>▪ Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes.<br>▪ Call a poison control center for treatment advice. |
| IF ON SKIN OR CLOTHING: | ▪ Take off contaminated clothing.<br>▪ Rinse skin immediately with plenty of water for 15-20 minutes.<br>▪ Call a poison control center or doctor for treatment advice. |
| IF INHALED: | ▪ Move person to fresh air.<br>▪ If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.<br>▪ Call a poison control center or doctor for further treatment advice. |
| NOTE TO PHYSICIAN: This product contains petroleum distillate and may pose an aspiration pneumonia hazard. Have the product container or label with you when calling a poison control center or doctor, or going for treatment. For information regarding medical emergencies or pesticide incidents, call the International Poison Center at 1-888-740-8712. | |

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

## CAUTION

Harmful if swallowed, inhaled, or absorbed through skin. Causes eye irritation. Avoid contact with skin, eyes, or clothing. Avoid breathing vapors or spray mist. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

ENVIRONMENTAL HAZARDS

This product is toxic to fish and other aquatic invertebrates. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product
in a manner inconsistent with its labeling.

This concentrate is formulated to be diluted with a suitable oil diluent, such as (but not restricted to) light mineral oil, deodorized kerosene or petroleum distillate, for use in cold fog aerosol generators.

This concentrate may be diluted or used as supplied for mosquito control programs involving residential, industrial, recreational and agricultural areas, swamps, marshes, overgrown waste areas, roadsides and pastures where adult mosquitoes occur.

Use in agricultural areas should be in such a manner as to avoid residues in excess of established tolerances for pyrethrins and piperonyl butoxide on crops or commodities.

Best results are expected from application when the meteorological conditions favor an inversion of air temperatures in the area treated, and when the wind is not excessive. Repeated applications may be made as necessary to obtain the desired reduction in adult mosquitoes.

This pesticide may be applied with equipment designed and operated to produce a suitable ultra low (ULV) spray application, which meets the dosage per acre objective of not more than .0025 pounds of pyrethrins and .0125 pounds of piperonyl butoxide per acre.

Back pack application may require a greater rate of dilution than the dilution used for vehicle or aircraft mounted sprayers, in order to achieve the desired rate of application of active ingredients per acre.



STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

STORAGE: Store in a cool, dry place. Keep container closed.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse (or equivalent) and offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or by other approved State and Local procedures.

Net Contents _____
Manufactured by:
Mc LAUGHLIN GORMLEY KING COMPANY
8810 Tenth Avenue North
Minneapolis, MN 55427

EPA Reg. No. 1021-1569

EPA Est. No. 1021-MN-2

# FourStar™ Bti Briquets 150

## A Sustained Release 150 day Bti Mosquito Larvicide Briquet

| | |
|---|---|
| ACTIVE INGREDIENT: | |
| *Bacillus thuringiensis* subspecies *israelensis* Strain BMP 144 solids, spores and insecticidal toxins* | 7.00% |
| OTHER INGREDIENTS: | 93.00% |
| TOTAL: | 100.00% |

* Equivalent to 490 International Toxic Units (ITU/mg) Potency units should not be used to adjust rates beyond those specified in the Directions for Use Section. Note: The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**

**See attached booklet for additional precautionary statements**

**NET CONTENTS: 3.5 LBS (1.6 KG) CONTAINS 50 BRIQUETS**

EPA Reg. No.: 69504-2 | EPA Est. No.: 39578-TX-1

**APPLICATION TIME**

Apply **FourStar™ Bti Briquets 150** to known mosquito breeding sites before, or at any time during the mosquito season. Apply **FourStar** to known breeding sites when the sites are dry and briquets will begin releasing Bti when flooding occurs. Under typical environmental conditions, one (1) application will control for 150 days or more. Alternate wetting and drying will not reduce briquet effectiveness. **FourStar** briquets perform optimally under shaded conditions.

The active ingredient Bti has no effect on mosquitoes that have reached the pupal or adult stage prior to treatment. Allow a minimum of 48 hours for control.

**APPLICATION RATES**

For control of mosquito larvae, place one (1) briquet in sites up to 100 square feet of surface area. For large sites, apply 1 additional briquet for each additional 100 square feet of water surface, regardless of water depth. When mosquito populations are high, water is heavily polluted, and/or algae are abundant, double the above application rate.

**STORAGE AND DISPOSAL**

Do not contaminate water, food, or feed by storage or disposal.

PESTICIDE STORAGE: Store in a cool, dry place.

PESTICIDE DISPOSAL: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Do not reuse empty carton or packaging material. Perforate or crush and discard carton in a sanitary landfill or by incineration or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

**NOTICE TO USER**

Seller makes no warranty express or implied, of merchantability, fitness or otherwise concerning the use of this product other than as indicated on the label. User assumes all risks of use, storage or handling not in strict accordance with label instructions.

**WARRANTY AND CONDITIONS OF SALE**

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. To the fullest extent permitted by law, buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using this product.

For product information, call 1-888-846-7233 or visit our web site: **www.fourstarbti.com**

Meridian LLC, Sherwood, OR USA

U.S. Patent Pending



FSL031006 REV050806

**PRECAUTIONARY STATEMENTS**

**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**

**CAUTION**

Harmful if inhaled. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Avoid breathing dust. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum or using tobacco. Remove and wash contaminated clothing before reuse.

**ENVIRONMENTAL HAZARDS**

Do not contaminate water when disposing of equipment washwaters. Do not apply to treated, finished drinking water reservoirs or drinking water receptacles when the water is intended for human consumption.

| **FIRST AID** | |
|---|---|
| If inhaled | • Move person to fresh air.<br>• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth to mouth if possible.<br>• Call poison control center or doctor for treatment advice. |
| If on skin or clothing | • Take off contaminated clothing.<br>• Rinse skin immediately with plenty of water for 15-20 minutes.<br>• Call poison control center or doctor for treatment advice. |
| If in eyes | • Hold eye open and rinse slowly and gently with water for 15-20 minutes.<br>• Remove contact lenses, if present, after the first 5 minutes, and then continue rinsing eyes.<br>• Call poison control center or doctor for treatment advice. |
| Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-222-1222 for emergency medical treatment information. | |

**DIRECTIONS FOR USE**

It is a violation of Federal law to apply this product in a manner inconsistent with its labeling.

**FourStar™ Bti Briquets 150** is a highly selective microbial insecticide effective against mosquitoes in a variety of habitats for up to 150 days or more. **FourStar** briquets release effective levels of *Bacillus thuringiensis* subspecies *israelensis* (Bti) to the water surface over time as the briquet dissolves.

**FourStar** can be applied to areas that contain aquatic life, fish and plants. **FourStar** can be applied to areas used by or in contact with humans, animals, horses, livestock, pets, birds or wildlife. Apply **FourStar** to any water sites except treated, finished water reservoirs or drinking water receptacles.

**APPLICATION SITES**

Examples of application sites include, but are not limited to: storm drains, catch basins, underground drainage systems, storm water retention areas, detention ponds, abandoned swimming pools, ornamental fountains and ponds, fish ponds, water gardens, tree holes, animal drinking troughs, standing water, water holding receptacles (old tires, urns, flower pots, cans and other containers), man made and natural sites where mosquitoes may develop.

**THIS PAGE LEFT INTENTIONALLY BLANK**

## APPENDIX G Technical Advisory Board Meeting Notes

Wednesday, February 21, 2007

**TAB Members Present:**
Dave Neitzel, Chair, MN Dept of Health
Gary Montz, MN Dept of Natural Resources
Karen Oberhauser, University of Minnesota
Roger Moon, University of Minnesota
Robert Sherman, Independent Statistician
Sarma Straumanis, MN Dept of Transportation
Rick Bennett, US Environmental Protection Agency
Robert Koch, MN Dept of Agriculture
Susan Palchick, Hennepin County Dept of Health

**TAB Members absent** (reviewed copies of the draft Operational Review):
Steven Hennes, MN Pollution Control Agency
Terry Schreiner, US Fish & Wildlife Service
Larry Gillette, Three Rivers Park District

**MMCD Staff in attendance:**
Jim Stark, Nancy Read, Stephen Manweiler, Carey LaMere, Michael McLean, Sandy Brogren, Mark Smith, Janet Jarnefeld, John Walz, Kirk Johnson

**Guests:**
Melissa Kemperman, MN Dept of Health

**Welcome and call to order** – 12:32 pm Chair Dave Neitzel (DN) introduced Jim Stark (JS), new Executive Director of MMCD.

**Welcome and opening remarks from Executive Director James R. Stark**

Jim described his background with MMCD, working as an inspector and foreman, his work in vector control in San Diego, then back at MMCD as a field supervisor, public relations manager, and Executive Director since May 2006.

As Executive Director, he will continue emphasis on communications and hopes TAB members have appreciated monthly Director's Reports. He also encouraged TAB members to give him feedback.

Jim described how the team concept originated at MMCD in 1994, in the wake of staff reductions, and how it is functioning now. We currently have 14 teams, many cross-functional, so it possible for employees from many physically separated facilities to share knowledge and expertise. Our interim Executive Director, Morris Anderson, encouraged MMCD to look at longer-range planning, and as part of the Management Team established MMCD Strategic Objectives. These provide a good framework for our discussions today.

MMCD Strategic Objectives

1. Expand treatment capacity and efficacy through improved strategies, techniques and products
2. Ensure the environmental impacts of treatment are minimized
3. Improve outreach and notification processes
4. Reduce the incidence of mosquito and tick-borne disease through education, monitoring, inspection and treatment
5. Ensure that service area facilities and staff are sufficient to meet and carry out the mission
6. Ensure a balance between the expectations of citizens and the cost of service

Jim also discussed the District's strategic growth plans for the coming years. Supported by the Commission, MMCD plans to provide larvicide services District-wide by 2010.
This long-term planning will help direct goals and provide a framework for the District's teams.

Jim also outlined Director's Initiatives which include using strategic planning, enhancing relations with elected officials, and with USF&W and DNR, and a reduced reliance on adult control, mainly by expanding larval control. Until we can get District-wide larval control we will still need adult control in many areas, but we are taking major steps to provide expanded larval control and this is one of Jim's major initiatives.

Karen Oberhauser (KO) asked what was meant by border-to-border larval control. Does that mean every site? Jim said that we want to have at least some control in each area, may have to adjust thresholds in some areas, but by 2010 we want to get to all townships. KO – So there will be an increase monitoring as well as control? JS – yes, treatments in response to reaching threshold.

Roger Moon (RDM) continued the discussion by asking what's driving MMCD's shift away from adulticiding. Is it cost? JS – no, it's cheaper to do adult control. Reasons include: environmental sensitivity and efficacy, trying to stay on the cutting edge, and a belief in the District that larval control the right way to go.
Robert Sherman (RS) asked if adulticiding helps control mosquitoes where people are and if there are areas where you can do larviciding to handle movement of population.
JS – There will always be edge areas. We'll try to follow where human population growth is. BS – what if requests for treatment come from farther away, outside metro? JS – This may be something that will be an issue, but MMCD is not funded to do treatments outside the District.
KO – It would be very helpful to add more about MMCD's growth plan in the TAB document, perhaps the preface.

Chair Dave Neitzel began the introduction of the District's 2006 overview with a round of introductions of TAB members and MMCD staff

**2006 Season Overview** – Sandy Brogren (SB) reviewed portions of the report that described the rainfall and mosquito numbers. 2006 started with a warm, wet spring and a sizeable peak in both

spring and floodwater species. Subsequent low rainfall, along with control efforts, resulted in lower levels of floodwater mosquitoes later in the year. Cattail mosquitoes did go up somewhat, and actually were more abundant than floodwater species. This low level of mosquitoes was also reflected in customer calls.

RDM – Were calls and sweep net samples not tracking that closely? SB and Mike McLean (MM) noted that lots of events in June actually drive some of the June calls. RS observed that sometimes people get annoyed by relatively few mosquitoes and that numbers have to get low before they think it's ok. Gary Montz (GM) said he would prefer to split out event calls from annoyance "I'm getting bitten" type. MM – sometimes those are actually mixed, they say "mosquitoes are real bad, and by the way I have an open house". RDM – can you structure interview of call? Susan Palchick (SP) –they may say both anyway and having an upcoming event doesn't negate that they have an annoyance problem. RDM – maybe change to "service request". BS – is there a recording MMCD makes if it can't provide service? Maybe MMCD provide brochure or info on alternatives. MM – we have a list of private contractors that we can suggest; also if we get a lot of calls from a particular area there's more apt to be a treatment (and sometimes neighbors know this). Rick Bennett (RB) asked if the response to these calls involves adulticiding. So, increasing larviciding should reduce this? JS – yes, we also try to tell them various ways to reduce problems – trimming, remove water-holding containers, use repellent. KO – this is a small number of calls relative to population. Melissa Kemperman (MK) – does this affect where you do adult treatments? SB and JS – we usually know where problem areas are from sampling, but also take calls into account. Much adulticiding, however, is targeted for vector control rather than call-based.

**Vector-borne Disease** – Kirk Johnson (KJ) discussed implications of the extreme weather in 2006. He started by describing West Nile virus (WNV) activity statewide and in the metro area. The number of birds and mosquito pools testing positive was very high this year. Weekly mean temperatures were higher than average for a number of weeks. Populations of wetland-based vectors were probably reduced by the hot, dry weather, but species such as *Culex restuans* and *Culex pipiens* in storm water structures did well. This was the first year we had enough positive mosquito pools to evaluate minimum infection rate (MIR). Kirk presented a graph of these showing a small spike in MIR early in the year, plus a large peak later in the year starting at the end of July through end of August (MIR calculated based on total number of mosquitoes in pool). MIR was still much lower here than in many areas with human epidemics. MIR was also compared with estimated onset dates for human cases in the District; most were after the large peak in mosquito MIR.

DN – how much of the *Culex tarsalis* MIR line is from the one trap at Post Road? KJ – said he could check, but he thought it was about half. RDM – is *Coquillettidia perturbans* really carrying or picking WNV up from others? KJ – there were no other positives collected in that trap that night.

KJ continued, pointing out a possible relationship between higher temperature periods and increased MIR, and showing infection rates in birds as well as calls reporting dead birds. Media reports probably also were related to increased number of calls. KJ discussed possible reasons

why human case rates, although they increased with the increased mosquito and bird infections, did not result in a major epidemic.
RDM – appreciates the additional information. Table 2.2 in the report has some of the same information. He suggested adding calculated MIRs to the table; all species were about 2 per 1000. KJ – this year the species were similar too.

**Tick-borne Disease Update** – Janet Jarnefeld (JJ) presented data that will be available in the upcoming tick distribution study to be distributed soon. From 1990-1997, we observed some year-to-year variability. Starting in 1998 tick abundance begins to climb with elevated averages in 2000 and beyond. In 1998, some had predicted El Nino and related weather would result in increased tick numbers. In hindsight, it was the beginning of an increasing population. Recent collections have also had higher percentage *Ixodes*. Starting in 1999, we also found *Ixodes scapularis* at more sites throughout the District as well, and recently increased numbers in areas south of Mississippi River, especially Dakota County. Human cases have gone up statewide, not as much in the metro area but also increasing. Also, HGA is increasing statewide and in the metro area.

**Black Fly Control Update** – John Walz (JW) – as with mosquitoes, weather affected river levels and black fly populations. Significantly less treatment was required, and the Minnesota River did not make threshold and thus was not treated at all this past year for the first time. Treatments are made "border-to-border" throughout District. Non-target monitoring has also continued and results are submitted to DNR when completed.
KO – what species are evaluated? How are communities of species evaluated? JW – we get caddis flies, midges, mayflies, some stoneflies. KO – control doesn't affect Diptera? GM – one species of midge was occasionally affected (*Tanytarsini*), and the DNR did have MMCD do a stonefly productivity study years ago, no impact. Robert Koch (RK) – are we looking at direct effects only? GM – stonefly productivity study was looking more at indirect effects. Filter-feeding caddis flies would be competitive with black flies. RM – impacts are small? GM – can't see any impacts, except on black flies. RDM – one could ask if you extended treatment farther upstream, would you see more effect? JW – could see more effect on black flies. RDM – so sweeps show effective control? How many of sweep nets above the annoyance threshold? JW, Carey – may be higher in Anoka Co. RDM indicated he would like to see geographic distribution map similar to mosquitoes.

(Break)

**Operational Strategies** – 2007 Plans: Stephen Manweiler (SM) – Discussed history of evaluating sites that frequently produce floodwater mosquitoes, and using pre-hatch treatments to expand capability for control. Helicopter use strategy was also evaluated in 2006 and improved to enable more efficient control. He described the color-coded site prioritization strategy that is used to help field staff target control to the most productive sites and use resources most efficiently.
BS – It seems like the most important sites to inspect are yellows, blue you know aren't breeding, red you know are? SM – red also is used to denote sites for which we need more breeding information. In trying to do multiple things simultaneously, we considered a combination rank but found it too complicated to work.

SM continued by showing how well the District is doing at making it to the sites selected for sampling and treatment after a major rainfall that would trigger a floodwater mosquito hatch. In 2006 we reached more "red" sites than we did in 2005 but there is still room for improvement. A larger percentage of red air-treatment sites were breeding than were yellow or blue; not as much difference in ground-treated sites, so there is probably more opportunity to improve rankings. Also, MMCD chose to check some sites that had been treated with pellets for many years to confirm that they were likely to breed and were a good use of pellets.

SM also discussed the MMCD strategy for catch basin treatments and efforts that have been taken to reduce effort required. In 2006 a test of bicycle-based treatments showed that this could be more efficient in areas with a high density of catch basins, such as St. Paul. One of the field offices also evaluated storm water regulator structures and found that many were breeding habitat for *Culex* vector species, and MMCD is expanding efforts to map and treat these.

For cattail mosquito control, we examined ways to expand control without a major increase in cost, so we looked at some less expensive control materials. We found Altosid XRG sand provided control as effective as Altosid pellets. MMCD will expand testing and use this material. We also plan to continue testing of alternative materials for catch basin treatments and stormwater structures.

BS – if you go to a red site, do you usually get mosquitoes? SM – in air sites, about 80%, ground sites, 50%. BS- is this predictable? If so, you may not need to inspect any more. SM – for air sites, we are using some of that information to choose which sites should be treated with pre-hatch.
RDM – this is neat stuff, good advance work. Is there a concern about combining need to inspect and need to treat? Also, is site size incorporated in prioritization? If not, it should be. SM – It is prioritized in that larger sites are air sites, smaller are ground.
KO – what about question of resistance, if you are treating same sites with same material every year? Any thought given to alternating treatments? SM – more thought is given to how to detect resistance; *Bti* literature shows pockets tend to develop, and we could look at effectiveness data that we collect and check for poor control. Also there is a lot of area treated only once per year and many areas not treated at all. KO – your restraint in not doing prophylactic treatment seems like a wise strategy, more non-treated sites help limit development of resistance. This is similar to the refuge strategy people are using with Bt corn.

**AgNav Update** – Mark Smith (MS) described current aerial applications and showed an example of the paper maps used to direct the pilots. In the past we have depended on the pilots to report which sites were treated. In recent years we have been using handheld GPS units to track areas treated. Our helicopter contract now includes the requirement to have GPS guidance and tracking units, which we are incorporating into aerial operations. In 2006 initial testing was done and the systems will be used more widely in 2007. This system involves field staff making digital map files of sites to be flown and giving those to the pilot so they have the boundaries for guidance as they make treatments. Pilots will download tracks and give these to field staff to show where they have treated.

Chair DN recommended that we move forward to later items on the agenda. Nancy Read stated that the Public Opinion Survey results were included in the report and anyone with questions or comments should contact her.

**Permethrin Research** – Stephen Manweiler (SAM) summarized previous research on permethrin and non-target insects, focusing on what happens to permethrin on the surface of a treated plant and its effect on herbivores. The studies suggest that ingestion of all of the leaf results in more exposure, but it does not seem to move within the plant. Another study showed a possible protocol for evaluating the effectiveness of barrier treatments on reducing human-biting mosquito activity. This was used as a basis for developing permethrin efficacy study protocols. In 2006, we set up a trial with pairs of small woodlots treated for *Aedes triseriatus*. The dry weather limited data collection, but were able to collect a small amount of data, as reported in TAB report p. 45. Results suggest that permethrin treatment was effective on the first day and probably ended between two and six days after treatment. We plan to repeat these tests in 2007 and expand sampling methods in each trial. Also, we will use more traps (2-3) per woodlot.
BS – from homeowners point of view, if you wanted to protect your yard, would this work or would you need a larger space to prevent invasion? RDM – basic design of the study is good, get lots of woodlot pairs. RK – you are only doing 8 pairs? Could you measure various things about canopy, look at covariates? SAM – We could get more pairs. Also, we want to look at what site types are most common, and where we do more treatments.

**Discussion** – BS – We present you with many challenges, things still get better every year. The TAB report is full of useful information. He suggested MMCD consider storing these ideas and producing monographs and/or reports. RDM – these stay on website indefinitely? The latest two years are on the website, the others are available upon request. JS – we share the TAB report with other districts. BS – make sure it's available to broader audience.
RDM – saw more analysis at this meeting than in the report. Is it because of a lag between report production and meeting date? Did you guys create all this new stuff in the last 2-3 weeks? RDM would like to see more of the information in print beforehand so the TAB can better evaluate it. GM – please don't forget to allow at least 2 weeks lead time SP – MMCD could possibly send out updates after the printed draft version of the TAB is sent out. KO – is there a way to give TAB members access to presentations before meeting? RDM – MMCD could send pdf versions of the presentations.
SAM – what if we send PowerPoint's a week before? RDM – There is also a problem that some stuff in printed draft TAB report had changed prior to the meeting. Is there a way to mark which parts are likely to change? SP – some of the "late-breaking" stuff is the most important – if it's worth presenting today, it's worth getting out soon enough for TAB to review. RDM – This all comes back to what is TAB is supposed to be doing. He suggested focusing TAB presentation more on what MMCD wants input on, less on data and review of what MMCD has done. JS – when TAB has new members, we want to balance introducing new members to what we're doing. BS – hope this also makes MMCD feel better about what staff are doing. KO – I had many more questions I would have liked to have asked, but ran out of time. DN – agreed that it would be helpful to focus meeting on things that are changing. JS – hopefully TAB members receiving regular Director's reports will help keep you updated. SP – we've never ended these meetings on time, would be good if we could use a mechanism such as the Directors Reports to keep up to date on District activities

MOTION – "The TAB commends the District on using cutting-edge technology and methods and recommends that MMCD continues to explore new applications of information technology to improve District programs."

Motion passed without dissent.

Chair DN recommended that additional questions be addressed directly to staff.
Meeting adjourned 3:45 p.m.

Next Chair: Robert Koch, MN Dept of Agriculture

TAB meeting note additions suggested by members:

Graph of weekly mean temperatures (reference to TAB report location? Like permethrin reference?)
Graph of positive mosquito pools/infection rates per KJ presentation.

# Editorial Staff

*Diann Crane, M.S.,* Assistant Entomologist
*Jill Sederholm,* Administrative Secretary

# Acknowledgments

The following people wrote or reviewed major portions of this document:
*Sandra Brogren, Janet Jarnefeld, Kirk Johnson, Carey LaMere, Stephen Manweiler, Mike McLean, Nancy Read, Ken Simmons, Mark Smith,* and *John Walz*

January 29, 2007
Second Draft, March 30, 2007
Final May 16, 2007