

# HUMANS: MOSQUITO CONTROL COMMERCIAL AND GOVERNMENT AGENCIES

E.W. Gray and Ray Noblet, Entomologists

**ALERT** — As of October 31, 2011, mosquito control operators were required to conform to the Clean Water Act (CWA) and be permitted by Georgia’s National Pollutant Discharge Elimination System (NPDES). The state NPDES is managed through the Georgia Environmental Protection Division (404) 657-5947. A Notice of Intent (NOI) must be submitted to the EPD within 30-days of making a pesticide application that contacts “waters of the state”. In addition, the Georgia Dept. of

Agriculture now has a Mosquito Control category (41). License holders in category 31 who made mosquito control treatments are now required to be licensed in Category 41. The Georgia Mosquito Control Association website ([gamosquito.org](http://gamosquito.org)) has comprehensive information about these new regulations. The University of Georgia Cooperative Extension service can be reached at (706) 542-1184 for additional information related to these matters.

**Table 1. Label Recommendations of Insecticides for Use as Ultra Low Volume and Low Volume Sprays in Ground Applications for the Control of Adult Mosquitoes**

INSECTICIDE/ TRADE NAME	MOA	APPLICATION		REMARKS AND PRECAUTIONS	
		FLOW RATE FL OZ/MIN	SPEED MPH		
<i>chlorpyrifos</i> Mosquitomist One ULV	1B	3.9-7.8	10	Non-corrosive, quick knockdown, low odor and low mammalian toxicity. 100 ft water set back. Breaks down quickly.	
Pyrifos One Mist ULV EC		1.9-15.5	5-20		
PyroFos 1.5 ULV		1.4-10.5	5-20		
<i>chlorpyrifos</i> + <i>permethrin</i> ULV Mosquito Master 412	1B + 3	2.3-12.9	5-15	A choice where insecticide resistance is a serious concern.	
<i>deltamethrin</i> DeltaGard	3	1.0-60.9	5-20	No piperonyl butoxide (pbo) in formulation, Type II pyrethroid.	
<i>etofenprox</i> Aqua Zenivex E20	3A	0.9-40.4	10-20	Can be diluted with water.	
Zenivex E4 RTU		2.25-18.0	5-15	Newer product that may be helpful if resistance is a concern.	
Zenivex E20		0.9-52.8	10-20		
<i>malathion</i> Fyfanon ULV	1B	1-8.6	5-20	Long time standard and still effective and cost efficient. Odor present, excites mosquitoes prior to mortality.	
<i>naled</i> Dibrom Concentrate	1B	0.6-1.8	5-15	Best choice for salt-marsh mosquitoes, very safe environmentally, no water set back, however highly corrosive to all equipment.	
Trumpet EC		0.8-2.2	5-15		
<i>permethrin/pbo</i> Aqualuer 20-20	3	1.6-6.2	10-20	Excellent choice for ground applications. Variety of applications.	
Aqua Perm-X UL 30-30		0.5-21.5	10-20	Widely used and highly effective. Maintain the rate in the 0.0035 lb/A range. Some resistance along Gulf Coast. 100 ft water set back.	
Aqua-Reslin		0.7-35.4	10-20		
Biomist 1.5 - 7.5		6-54	5-15		
Biomist 3 + 15		1.5-27	5-15		
Biomist 4 + 4		4.5-18	5-15		
Biomist 30 + 30		1-6	5-15		
Biomist 31 + 66		1-6	5-15		
Envion		0.5-25.8	10-20		Can be diluted with water or oil.
Envion RTU		2.4-16.5	10		Pre-mixed, water diluted, ready to use formulation.
Evolver 4-4 ULV		4.7-75.2			Depending on dilution rate and speed.

Table 1 continued on next page.

## MOSQUITO CONTROL COMMERCIAL AND GOVERNMENT AGENCIES

**Table 1. Label Recommendations of Insecticides for Use as Ultra Low Volume and Low Volume Sprays in Ground Applications for the Control of Adult Mosquitoes**

INSECTICIDE/ TRADE NAME	MOA	APPLICATION		REMARKS AND PRECAUTIONS
		FLOW RATE FL OZ/MIN	SPEED MPH	
<i>permethrin/pbo (continued)</i>	3			
Evolver 30-30 ULV		1.1-2.2	10	
Aqua-Kontrol Concentrate		2-15.5	5-20	May be diluted with water.
Kontrol 2-2		2-15.5	5-20	
Kontrol 4-4		4-16	5-20	
Kontrol 30-30		0.5-2.2	5-20	
Permanone - Ready-to-use		6-18	5-15	
Permanone 30-30		0.5-2	5-20	
Permanone 31-66		0.5-15	5-20	
Perm-X UL 4-4		1.4-10.5	5-20	
Perm-X UL 30-30		0.3-38.2	5-20	
Perm-X UL 31-66		0.2-33.6	5-20	
<i>sumithrin/pbo</i>	3			
Anvil 2 + 2 ULV		3.1-37.2	5-20	No water set back, good for truck applications.
Anvil 10 + 10		0.6-7.6	5-20	
<i>pralletron and sumithrin</i> Duet	3	2.5-7.5	5-20	Combines two active ingredients, cause benign agitation, may have uses against Asian Tiger Mosquito.

MOSQUITO CONTROL COMMERCIAL AND GOVERNMENT AGENCIES

Table 2. Label recommendations of Insecticides for Use as Thermal Aerosols in Ground Applications for the Control of Adult Mosquitoes

INSECTICIDE/ TRADE NAME	MOA	APPLICATION		REMARKS AND PRECAUTIONS
		FLOW RATE FL OZ/MIN	SPEED MPH	
<i>chlorpyrifos</i> Mosquitomist One ULV	1B	9.6	5	Non-corrosive, quick knockdown, low odor and low mammalian toxicity. 100 ft water set back. Breaks down quickly.
PyroFos 1.5 ULV		6.4		
<i>etofenprox</i> Aqua Zenivex E20	3A	0.9-40.4	10-20	Apply at the rate of 0.00175-0.0070 lb ai/A.
Zenivex E4 RTU		0.3-48.0	5-15	
Zenivex E20		0.9-52.8	10-20	
<i>malathion</i> Fyfanon ULV	1B	1.6-2.1	5	Long time standard and still effective and cost efficient. Odor present, excites mosquitoes prior to mortality.
<i>naled</i> Dibrom Concentrate	1B	1.6-2.1	5-15	Best choice for salt-marsh mosquitoes, very safe environmentally, no water set back, however highly corrosive to all equipment.
<i>permethrin/pbo</i> Aqualuer 20-20	3	0.7-25.5	10-20	Rate not to exceed 0.007 lb/A.
Aqua Perm-X UL 30-30		0.5-21.5	10-20	
Envion		2.2-25.8	10-20	Do not exceed 0.007 lb ai/A.
Envion RTU		1.2- 32.9	5-20	Droplet size will range from 0.1-1 microns.
Evolver 4-4 ULV			5-20	Apply in 0.0035-0.007 lb ai/A range.
Evolver 30-30 ULV				Rates vary according to dilution, do not exceed 0.007 lb/A.
Kontrol 2-2		10.5-32	5-20	Widely used and highly effective. Maintain dose in the 0.0035 lb/A range. Some resistance along Gulf Coast. 100 ft water set-back.
Kontrol 4-4		21.0-64	5-20	
Kontrol 30-30		21.0-64	5-20	
Permanone 30-30		0.41-3	5-20	Flow rate depends on concentration. Rate not to exceed 0.007 lb permethrin/A.
Perm-X UL 4-4		1.4-105	5-20	
Perm-X UL 30-30		0.3-38.2	5-20	
Perm-X UL 31-66		0.2-33.6	5-20	
<i>pyrethrin/pbo</i> Pyrenone 25-5		3	12-30	Variable
<i>sumithrin/phenothrin/pbo</i> Anvil 2+2 ULV	3, 3A	3.1-37.2	5-20	No water set back, good for truck applications.
Anvil 10+10 ULV		0.6-7.6	5-20	

MOSQUITO CONTROL COMMERCIAL AND GOVERNMENT AGENCIES

Table 3. Label Recommendations of Insecticides for Use in Aerial Applications for Control of Adult Mosquitoes.

INSECTICIDE/ TRADE NAME	MOA	GROSS AMOUNT PER ACRE (OZ)	REMARKS AND PRECAUTIONS
<i>chlorpyrifos</i> Mosquitomist One ULV	1B	3	Non-corrosive, quick knockdown, low odor and low mammalian toxicity. 100 ft water set back. Breaks down quickly.
PyroFos 1.5 ULV		0.87	
<i>etofenprox</i> Aqua Zenivex E20	3A		Apply diluted or undiluted at rates up to 0.007 lb ai/A. Minimum application height 100 ft.
Zenivex E4 RTU			
Zenivex E20			
<i>malathion</i> Fyfanon ULV	1B	2.6-3	Long time standard and still effective and cost efficient. Odor present, excites mosquitoes prior to mortality.
<i>naled</i> Dibrom Concentrate	1B	0.5-1	Best choice for salt-marsh mosquitoes, very safe environmentally, no water set back, however, highly corrosive to all equipment.
Trumpet EC		0.6-1.2	
<i>permethrin/pbo</i> AquaHalt	3	0.28-0.76	Water based, labeled for use over crops.
Aqualuer 20-20			Apply diluted or undiluted at rates up to 0.007 lb ai/A.
Aqua-Reslin		0.25-0.5	Widely used and highly effective. Maintain dose in the 0.0035 lb/A range. Some resistance along gulf coast. 100 ft water set-back.
Biomist 1.5 + 7.5 ULV		9	
Biomist 4.0 + 4.0 ULV		3	
Biomist 12 + 60 ULV		1-3	
Biomist 30 + 30 ULV		0.33-1	
Biomist 31 + 66 ULV		0.33-1	
Envion			Apply diluted or undiluted at rates up to 0.007 lb permethrin/PBO/A.
Envion RTU		up to 2.72	Apply at altitudes between 100-300 ft.
Evolver 4-4 ULV		3.1	Do not exceed 3.1 fl oz/A.
Evolver 30-30 ULV		0.05-0.36	
Aqua-Kontrol Concentrate		up to 1.5	Apply at sufficient air speed to deliver the appropriate amount of a.i./A (from 0.00175-0.007 lb).
Kontrol 4 + 4		up to 3	
Kontrol 30 + 30		up to 0.35	
Permanone 31-66		0.16-0.6	
Perm-X UL 4-4		up to 3.1	
Perm-X UL 30-30		up to 0.32	
Perm-X UL 31-66		up to 0.36	
<i>pyrethrins/pbo</i> Pyrenone 25-5		3	
<i>sumithrin/pbo</i> Anvil 2 + 2 ULV	3	1-3	No water set back.
Anvil 10 + 10 ULV		0.21-0.62	
<i>prallethrin and sumithrin</i> Duet	3	0.41-1.24	Combines two active ingredients, causes benign agitation, option for Asian Tiger Mosquito.

**MOSQUITO CONTROL COMMERCIAL AND GOVERNMENT AGENCIES**

**Table 4. Label Recommendations of Insecticides for Use in Ground Applications for Larval Mosquito Control.**

INSECTICIDE/ TRADE NAME	MOA	GROSS AMOUNT PER ACRE (OZ)	REMARKS AND PRECAUTIONS	
mineral oil BVA2 Mosquito Larvicide Oil		1-5 gal	Surface film material. Effective against both larvae and pupae, low labor input required. Use higher rates for areas with more vegetation or pollution.	
Cocobear Mosquito Larvicide Oil		3-5 gal		
larvicide oil Kontrol Mosquito Larvicide		1-5 gal		
methoprene Altosid Liquid Larvicide	7A	3-4 fl oz	Significant residual effect possible, up-front cost more, can save labor costs. Approved for use in stock waters. Newly approved for ULV applications. Used to prepare Altosand granular formulation. For areas up to 2 ft in depth. Use additional briquette for areas over 2 ft in depth. Effective up to 150 days, rate depends on species targeted. Use lower rates when water is shallow or vegetation and/or pollution is minimal. Effective up to 30 days.	
Altosid Liquid Larvicide Concentrate		0.75-1 fl oz		
Altosid 30-Day Briquets		1/100 sq ft		
Altosid XR Briquets		1 briquet/100-200 sq ft		
Altosid Pellets		2.5-10 lb		
Altosid Pellets Water Soluble Pouch (WSP)		Up to 135 sq ft		
Altosid SBG II		3-20 lb		Rate depends on target species.
Altosid XR-G		5-20 lb		May be applied prior to flooding.
MetaLarv S-PT		2.5-10 lb		Use lower rates when water is shallow, vegetation and/or pollution are minimal and mosquito populations are low.
<i>Bacillus thuringiensis</i> subsp. <i>israelensis</i> Aquabac XT 12AS	11A	1-2 pt	Biological control agent, very effective, environmentally sound, store products in cool areas and use by expiration date. Timing of application critical for maximum effectiveness. Use higher label rates when large larval populations are present, larvae are in late 3rd or 4th instars or local experience has demonstrated that higher rates are required to achieve high levels of mortality.	
Aquabac 200G		2.5-10 lb		
Aquabac 400G		1.25-8 lb		
Bactimos/Summit Briquets/Dunks		1 briquet/100 sq ft		
Teknar HP-D		0.25-1 pt		
Vectobac CG		2.5-10 lb		
Vectobac 12AS		5-100 gal		
Vectobac G		2-20 lb		
Fourstar Multi-Brood Controlled Release Granule		7.5-20 lb/A		
Fourstar Bti Briquet 150-Day		1 briquet/100 sq ft		Alternate wetting and drying will not reduce effectiveness, performs optimally in shaded areas.
<i>Bacillus sphaericus</i> Vectolex WSP	11B	1 pouch/50 sq ft	Biological control agent with residual effect. Targets specific species, especial Culex. Not recommended for salt-marsh mosquitoes.	
Vectolex CG		5-20 lb		
(Waste Tires)		20-80 lb or 0.5-2 lb/1000 sq ft		
Vectolex WDG		0.5-1.5 lb		

Table 4 continued on next page.

**MOSQUITO CONTROL COMMERCIAL AND GOVERNMENT AGENCIES**

**Table 4. Label Recommendations of Insecticides for Use in Ground Applications for Larval Mosquito Control.**

<b>INSECTICIDE/ TRADE NAME</b>	<b>MOA</b>	<b>GROSS AMOUNT PER ACRE (OZ)</b>	<b>REMARKS AND PRECAUTIONS</b>
<i>Bacillus thuringiensis</i> subsp. <i>israelensis</i> and <i>Bacillus sphaericus</i> Vectomax FG	11A +	5-20 lb/A 20-80 lb/A for tire piles	Effective against all pest species of mosquitoes, will reduce likelihood of resistance. Approved for use in organic crops and sensitive areas.
Vectomax WSP	11B	1 pouch/50 sq ft	
Vectomax G		5-20 lb/A 20-80 lb/A for tire piles	
Fourstar 45-Day Briquet		1 briquet/100 sq ft	
Fourstar 90-Day Briquet		1 briquet/100 sq ft	
Fourstar 180-Day Briquet		1 briquet/100 sq ft	
Fourstar Multi-Brood Granule		7.5-20 lb/A	Effective up to 4 weeks.
Fourstar Multi-Brood Controlled Release Granule		5-20 lb/A	
Fourstar Water Soluble Pouch		1 pouch/50 sq ft of larval habitat	
<i>Bacillus thuringiensis</i> subsp. <i>israelensis</i> and ( <i>s</i> )- <i>methoprene</i> Vectoprime	11A + 7A	1.25-10 lb/A 10-20 lb/A	Post-flood – Use higher rates when water is heavily polluted. Pre-Food – Use 10-20 rate 7 days pre-flood. 20 lb/A 7-14 days pre-flood. Wider application window for early or late instars.
<i>spinosad</i> Natular G – Single Brood Granule	5	3.5-9 lb/A	New product, registered as a reduced risk pesticide by EPA.
Natular G-30		5-20	Multiple-brood extended release granule.
Natular 2EC – Single Brood Liquid		1.3-2.8 fl oz/A	
Natular T30		1 tablet/100 sq ft	Multiple-brood, 30-day tablet.
Natular XRT		1 tablet/100 sq ft	Multiple-brood extended release tablet.

MOSQUITO CONTROL COMMERCIAL AND GOVERNMENT AGENCIES

Table 5. Label Recommendations of Insecticides for Use in Aerial Applications for Control of Larval Mosquitoes.

INSECTICIDE/ TRADE NAME	MOA	GROSS AMOUNT PER ACRE (OZ)	REMARKS AND PRECAUTIONS
<i>mineral oil</i> BVA 2 Mosquito Larvicide Oil		3-5 gal	Surface film material. Not for use in environmentally sensitive areas. Surface film product that controls larvae and pupae.
Cocobear Mosquito Larvicide Oil		3-5 gal	
Kontrol Mosquito Larvicide Oil		Aerial: 2-4 gal/A Ground: 1-5 gal/A	Rate depends on water surface conditions and vegetative density
<i>methoprene</i> Altosid Liquid Larvicide	7A	3-4 fl oz	Effective against both larvae and pupae, low labor input required.
Altoside Liquid Larvicide Concentrate		0.75-1 fl oz	
Altosid pellets		2.5-10 lb	
Altosid XR-G		1/200 sq ft	
Altosand G		8-10 lb	
MetaLarv S-PT		2.5-10 lb	Use lower rates when water is shallow, vegetation and/or pollution are minimal and mosquito populations are low.
<i>Bacillus thuringiensis</i> subsp. <i>israelensis</i> Aquabac XT	11A	0.25-2 pt	Biological control agent, very effective, environmentally sound, store products in cool areas and use by expiration date. Timing of application critical for maximum effectiveness.
Teknar HPD		0.25-1 pt	
Vectobac 12 AS		0.25-2 pt	
Vectobac CG		2.5-10 lb	
Vectobac G		2.5-5 lb	
Fourstar Single Brood Bti Sand Granule		3-20 lb	
Fourstar Multi-brood Controlled Release Granule		7.5-20 lb/A	Can be applied pre or post-hatch.
<i>Bacillus sphaericus</i> Vectolex CG	11B	5-20 lb	Biological control agent with residual effect. Targets specific species, especially Culex.
Vectolex WDG		0.5-1.5 lb	
Vectolex WSP		1 pouch/50 sq ft	Water soluble pouch, good choice for catch basins.
<i>Bacillus thuringiensis</i> subsp. <i>israensis</i> and <i>Bacillus sphaericus</i> Vectomax CG	11A +	5-20 lb/A	Effective against all pest species of mosquitoes, will reduce likelihood of resistance.
Vectomax G	11B	20-80 lb/a for tire piles	
		5-20 lb	
		20-80 lb/A for tire piles	
Fourstar Multi-Brood Granule		5-20 lb	Effective up to 40 days
Fourstar Multi-Brood Controlled Release Granule		5-20 lb	
<i>spinosad</i> Natular G	5	3.5-9 lb	New product, registered as a reduced risk pesticide by EPA.
Natular XRG		5-20 lb	
Natular 2EC		1.3-2.8 fl oz/A	

**MOSQUITO CONTROL COMMERCIAL AND GOVERNMENT AGENCIES**

**Table 6. Toxicity of Insecticides Used in Mosquito Control Compared to Some Other Common Insecticides and Chemicals.**

		ACUTE ORAL LD <sub>50</sub> IN MG. TECH/KG. FOR RATS BY REFERENCE NUMBER		
COMMON NAME	TRADE NAME	1*	2**	3***
<i>allethrin</i>	--- <sup>b</sup>	310	680-1,000	920
<i>aspirin</i>	---	1,900 <sup>a</sup>	---	---
<i>bendiocarb</i>	Ficam	40	40-64	40-64
<i>bti</i>	--- <sup>b</sup>	non-toxic	---	non-toxic
<i>chlorpyrifos</i>	Dursban	135	82-245	163/135
<i>dichlorvos</i>	DDVP	56	25-170	
<i>fenitrothion</i>	Sumithion	490	250-740	300/800
<i>fenthion</i>	Baytex	190	255-740	375/290
<i>malathion</i>	Fyfanon	1375	885-2800	1,375/1,000
<i>methoprene</i>	--- <sup>b</sup>	34600	> 34,600	> 34,600
<i>methoxychlor</i>	--- <sup>b</sup>	6000	5,000-7,000	> 6,000
<i>monomolecular firm</i>	Agnique	20000	---	> 20,000
<i>naled</i>	Dibrom	430	250-430	430
<i>parathion</i>	--- <sup>b</sup>	3	39170	---
<i>phenothrin</i>	Sumithrin	10000	> 10,000	> 10,000
<i>phenthoate</i>	Cidial	300	200-2,000	> 2,000
<i>piperonyl butoxide</i>	---	---	6,150-7,500	11500
<i>propoxur</i>	Baygon	90	83-104	95/104
<i>pyrethrin</i>	--- <sup>b</sup>	200	200-2,600	820-1,870
<i>resmethrin</i>	SBP-1382	2500	1500	4240
<i>salt</i>	---	4,500 <sup>a</sup>	---	---
<i>sugar</i>	---	27,000 <sup>a</sup>	---	---
<i>temephos</i>	--- <sup>b</sup>	2030	1,000-13,000	8,600-1,300

<sup>a</sup> The Bottom Line. Dow Chemical Co., Midland, MI. January 1981, 7 pp. (from: Hodge, H.C. and W.C. Downs, Toxicol. Appl. Pharmacol. 3:689-695, 1961).

<sup>b</sup> Manufactured under several trade names.

\* Thompson, W.T. 1985. Agricultural chemicals, Book 1 Insecticides, 1985-86 Revision. Thompson Pub., Fresno, CA 255 pp.

\*\* Kenaga, E.E., and R.W. Morgan. 1978. Commercial and Experimental Organic Insecticides. 1978 Revision, Entomol. Soc. of Am. Pub. 78-1. 79 pp.

\*\*\* From manufacturers technical data.