VALENT BIOSCIENCES®

TECHNICAL USE BULLETIN

MetaLarv™ S-PT

Mosquito Growth Regulator

Mosquito larval habitats that have unpredictable flooding patterns due to hydrologic events such as tides, snow melt, rain, etc. **or** have predictable but multiple flood/dry-down/re-flood events (e.g., irrigation fields, pastures, etc.) can be difficult to manage. Historically, mosquito control professionals have had limited options at their disposal for pre-flood and residual treatment of these habitats.

MetaLarv® S-PT
MOSQUITO GROWTH REGULATOR
PELLET

In order to provide the industry with more advanced options, Valent BioSciences developed MetaLarv™ S-PT Mosquito Growth Regulator, a 4.25% (S)-methoprene spherical pellet formulation utilizing Valent BioSciences Corporation's proprietary Triple Release Technology.™ MetaLarv™ S-PT can be applied both pre-flood and directly into water to control mosquito adult emergence for extended periods of time. MetaLarv™ S-PT's spherical pellet design is essentially dust-free and allows for more effective low-rate applications, improved aerial application swaths, and better point-source coverage for greater application flexibility.

FEATURES

- Biorational mosquito larvicide
- Spherical pellet formulation
- Triple Release Technology™
- Non-dusty formulation
- Non-charcoal UV protectant
- Packaged in easy-open bags (bags can be opened manually without the need for a utility/safety knife)

BENEFITS

- Provides up to 42 days residual control*
- Can be applied up to 28 days prior to flood
- Remains effective after flood/dry-down/re-flood event
- Improved coverage at low rates
- Wider aerial swath in tests conducted
- Less respirable and particulate dust
- Easily flowable for greater application flexibility
- Low hazard to non-target organisms
- Packaging allows for easy handling and material loading

*Length of control dependent on local conditions.

HISTORY – DEVELOPED "BY REQUEST"

In the mid-1970s, (S)-methoprene became the first successful biorational mosquito larvicide to be used in the U.S. Its excellent safety record, very low mammalian toxicity (LD_{50} for oral toxicity is more than 34,000 mg/kg), and negligible long-term effects against almost all non-target populations at field rates (USEPA 2001)* resulted in (S)-methoprene-based products becoming a key tool for many mosquito abatement programs across the U.S. With the economic downturn in the U.S. that began in 2007 and oil prices already at an all-time high, Valent BioSciences Corporation was asked by mosquito abatement programs to develop a pre-flood, residual product that reduced operational costs while improving on many of the issues programs faced with (S)-methoprene products. So in partnership with these public health professionals, Valent BioSciences developed its first pre-flood solution – MetaLarv™ S-PT.

*U.S. Environmental Protection Agency. 2001. Update of the March 1991 methoprene R.E.D. fact sheet. 9 p Available from U.S. Environmental Protection Agency, Washington, DC. http://www.epa.gov/pesticides/biopesticides/ingredients/factsheets/factsheet_105401.pdf

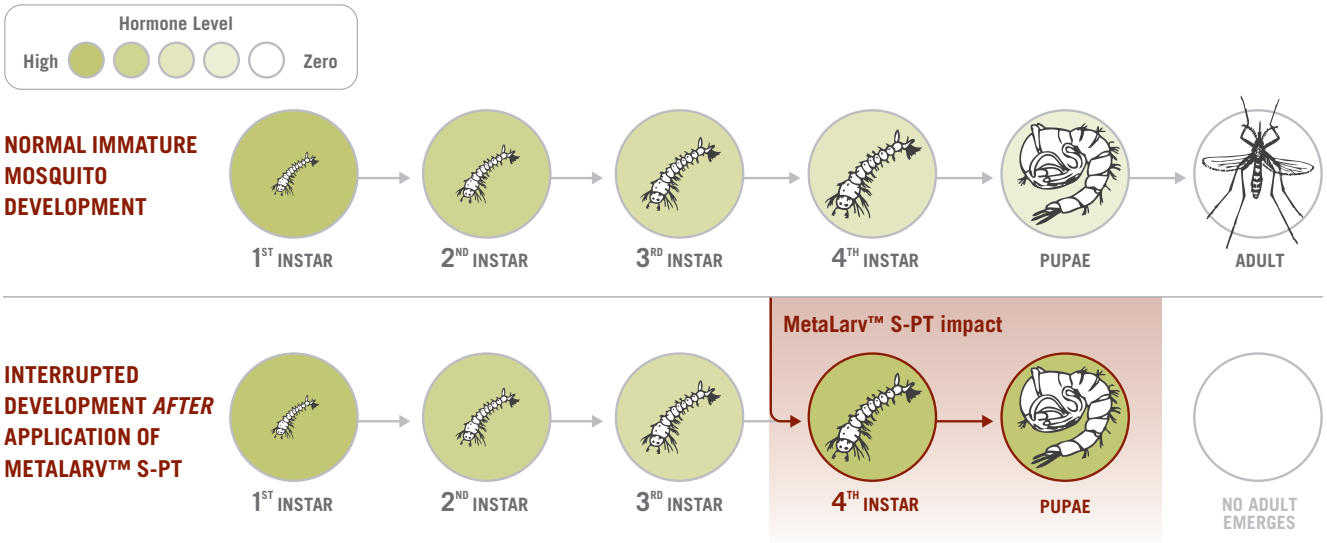
MODE OF ACTION

(S)-methoprene is an insect growth regulator that acts as a mimic of the natural juvenile hormone (JH) in mosquitoes. In nature, the JH works together with the molting hormone to determine the outcome of each molt (i.e., growth stage). High concentrations of JH are needed for immature larvae to grow and molt into larger larval stages (instars). Low concentrations of JH are required during the last larval stage (4th instar) prior to the larval-to-pupal molt, and the JH must be essentially zero in the pupae before metamorphosis can occur. Since JH levels must be extremely low for 4th instars to pupate, and near zero for pupae to emerge into adults, applications (or presence) of (S)-methoprene during these sensitive stages produce morphological abnormalities in the mosquitoes that, in most cases, lead to death during or after metamorphosis. Early instar larvae that are exposed to (S)-methoprene develop normally until they reach the pupal stage. (S)-methoprene has little effect on mosquitoes that have already reached the pupal or adult stage. Species belonging to the genera *Aedes*, *Ochlerotatus*, and *Anopheles* are the most susceptible to (S)-methoprene, whereas *Culex* species are less sensitive (Jakob 1972, Staal 1975).*

*Jakob WL. 1972. Additional studies with juvenile hormone-type compounds against mosquito larvae. *Mosq News* 32:592-595

Staal GB. 1975. Insect growth regulators with juvenile hormone activity. *Ann Rev Entomol* 20:417-460

JUVENILE HORMONE (JH) LEVEL INTENSITY



TRIPLE RELEASE TECHNOLOGY™

(S)-methoprene degrades naturally under field conditions and is extremely sensitive to sunlight. While these features make (S)-methoprene an attractive biorational/biodegradable mosquito control option, it also creates challenges for developing long-lasting formulations that provide immediate, effective control with free (S)-methoprene while maintaining an effective level of (S)-methoprene at the treatment site for extended control.

In addition, many mosquito abatement programs that have historically depended on (S)-methoprene formulations require applications be made to dry soil before an expected flood and egg hatch (i.e., "pre-flood" or "pre-hatch" applications) and/or products to be effective after these habitats have dried down and are subsequently re-flooded.

Through Valent BioSciences' advanced, proprietary Triple Release Technology,™ MetaLarv™ S-PT addresses these challenging habitats.

Triple Release Technology provides public health professionals greater flexibility during uncertain weather conditions, with up to 28 days of pre-flood application efficacy. Even if the anticipated flooding is delayed, MetaLarv™ S-PT will be ready. It also provides up to 42 days of control in floodwater habitats and remains effective after flood/dry-down/re-flood events*.

1 The "first release" provides an initial flash of (S)-methoprene for immediate control of mosquitoes — and the rate of the release is not dependent on water temperature.

2 The "second release" takes place when the floodwaters rise, providing sustained control throughout the duration of the flood.

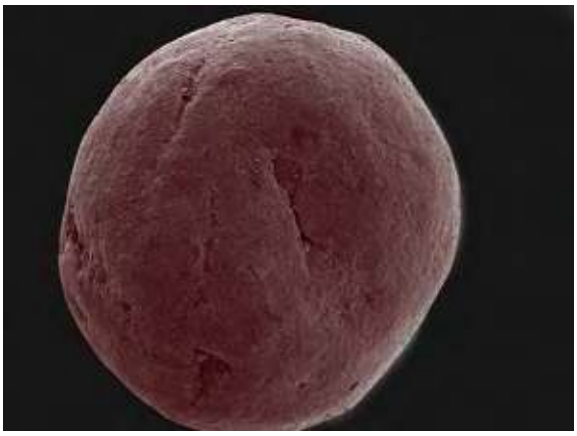
3 MetaLarv™ S-PT remains effective after the waters recede, ready to release (S)-methoprene during the next flooding cycle ("third release").

*Length of residual control is dependent on site specific environmental factors and use rates.

CLEAN FORMULATION

MetaLarv™ S-PT was designed to improve (S)-methoprene product handling. MetaLarv's Triple Release Technology utilizes a non-charcoal UV protectant that eliminates much of the particulate and respirable dust produced by standard (S)-methoprene pellets and sand-based products. This technology substantially reduces worker exposure to dust and keeps equipment cleaner.

SPHERICAL DESIGN



Scanning electron micrograph of a MetaLarv™ S-PT pellet

APPLICATION FLEXIBILITY

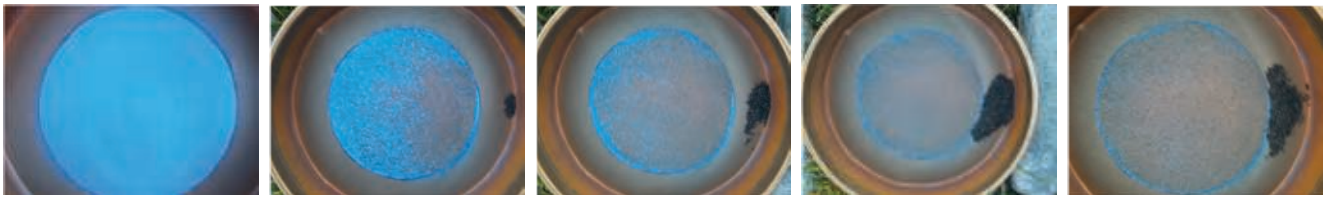
MetaLarv™ S-PT's unique spherical pellet design allows for fluid movement of the product through application equipment. This improves aerial swath width and reduces variability in pellet deposit by avoiding the bridging and skips in swath patterns seen with standard (S)-methoprene pellet applications at low rates. The spherical shape of MetaLarv™ S-PT is less susceptible to turbulence, and as such, provides more consistent and predictable distribution.

PROTECTING YOUR EQUIPMENT

The spherical shape of MetaLarv™ S-PT reduces attrition to application equipment when compared to sand-based products. For example, damage to rotor blades on aircraft can be a constant drain on resources. MetaLarv™ S-PT minimizes damage to equipment, thus reducing long-term capital costs for your program.

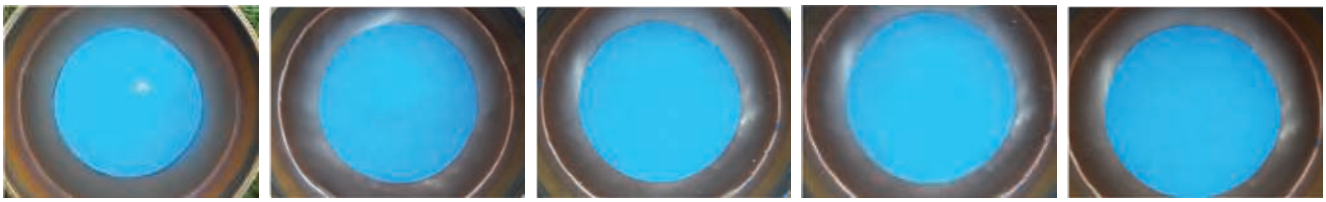
This sequence of pictures compares the effect sand-based products and MetaLarv™ S-PT can have on equipment. The top series of pictures starting on the far left shows a metal pan that was coated with a blue latex paint. The pan was then sprayed with product for 60 seconds utilizing a backpack sprayer. When sprayed with an XRG formulation, the latex paint was removed rapidly over the course of a minute. The bottom series shows the same painted pans sprayed with MetaLarv™ S-PT at the same rate. No paint was removed.

SAND-BASED PRODUCT (XRG FORMULATION)



0 sec → 15 sec → 30 sec → 45 sec → 60 sec

METALARV™ S-PT



0 sec → 15 sec → 30 sec → 45 sec → 60 sec

COVERAGE

When conducting aerial applications at low rates, uniform product coverage is critical. Historically, this has been difficult to achieve with standard (S)-methoprene pellets, since the number of pellets per square foot is extremely low at low application rates. In order to address this coverage issue, MetaLarv™ S-PT was designed to have a greater pellet count per gram. In fact, MetaLarv™ S-PT provides approximately 18 times greater coverage per square foot than standard (S)-methoprene pellets.

	COVERAGE					
	Standard (S)-methoprene pellet (5-10 pellets per gram)*		VectoBac® G (65 granules per gram)*		MetaLarv™ S-PT (135 pellets per gram)*	
RATE IN LBS/ACRE (KG/HECTARE)	NUMBER OF PELLETS PER FT^2	NUMBER OF PELLETS PER M^2	NUMBER OF GRANULES PER FT^2	NUMBER OF GRANULES PER M^2	NUMBER OF PELLETS PER FT^2	NUMBER OF PELLETS PER M^2
2.5 (2.8)	0.2	2.1	1.7	16.2	3.5	37.8
5.0 (5.6)	0.4	4.2	3.4	32.5	7.0	75.7
7.5 (8.4)	0.6	6.3	5.1	48.8	10.5	113.5
10.0 (11.2)	0.8	8.4	6.8	65.0	14.1	151.3

*Estimated pellets/granules per gram.

BULK DENSITY

The bulk density of MetaLarv™ S-PT is similar to standard (S)-methoprene pellets, so payload totals remain the same.

MetaLarv™ S-PT ~ 54 lbs/ft^3 (865 kg/m^3)*

*Expected mean bulk density; note there are lot-to-lot variations in bulk density.

GROUND APPLICATIONS

MetaLarv™ S-PT treatments can be made with many types of ground equipment designed for granule application. These include manually or mechanically driven devices relying on a whirling disk (e.g., Cyclone™ seeder, Ortho® Whirlybird,® Herd™ seeder), and air-blast applicators (e.g., Buffalo Turbine sprayers and Maruyama® or Stihl® power backpacks).

When using MetaLarv™ S-PT, it is important to properly calibrate application equipment. Pellet output at a given setting should be determined, as well as swath width and required speed of travel.

Consult your Valent BioSciences Technical Specialist to determine optimal application methods to meet your program objectives.

AERIAL APPLICATIONS

MetaLarv™ S-PT can be applied aerially with conventional fixed-wing aircraft or helicopter application equipment (e.g., Isolair Helicopter Systems application products). Each application unit should be calibrated and the swath characterized using MetaLarv™ S-PT before being used operationally. The variety of equipment in field use precludes specific instructions on settings, airspeed, etc.

As an example: The ram-air type of application used on most fixed-wing aircraft usually requires a simple adjustment of the baffle plate or gate to decrease the pellet flow rate.

APPLICATION RATES

Suggested rate range: 2.5–10 lbs/acre (2.8–11.2 kg/ha)

Use lower application rates when water is shallow and pollution is minimal. Use higher rates when water is deeper than 2 ft (0.6 m), pollution and/or organic debris are high, and/or water flow is high. The length of residual control and number of flood/dry-down/re-flood events that MetaLarv™ S-PT remains effective for depends largely on rate used, water flow in and out of site, water depth, species composition/size and other environmental factors.

EASY-OPEN PACKAGING

MetaLarv™ S-PT is packaged in 40 lb (18.1 kg), easy-open poly bags. The easy-open feature allows the applicator to open bags manually without the need for a utility/safety knife. In addition, should the product in the bag not be completely exhausted, the top of the bag can be folded over and temporarily held in place by a glue strip on the back of the bag (not intended to "reseal" the bag). For aerial operations, these bags allow for faster landing zone turnaround times relative to 2½ gallon (10 L) plastic jugs.

STORAGE AND DISPOSAL

Store in a cool, dry place, out of direct sunlight in original packaging.

The easy-open bags are non-refillable. Do not reuse or refill the bags once they have been emptied. In order to completely empty the bag into application equipment, shake and tap the sides and bottom to loosen clinging pellets, then offer for recycling (if available) or dispose of the bag in a sanitary landfill.

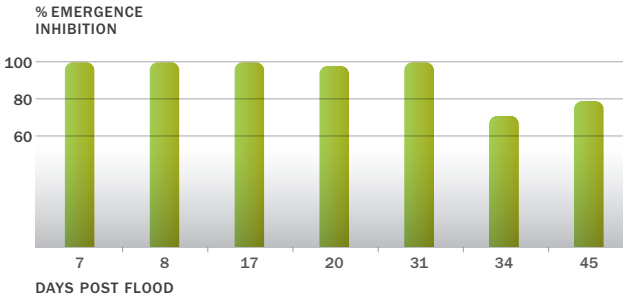
Do not contaminate water, food, or feed by storage or disposal.

FIELD TESTS

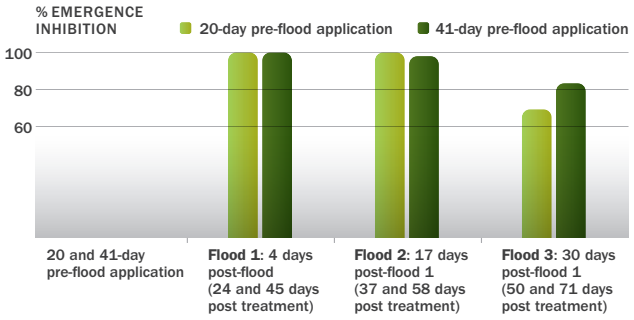
MetaLarv™ S-PT demonstrates a high level of efficacy in pre-flood applications, providing greater flexibility for mosquito abatement efforts. Tests were conducted with single flood and multiple flood/dry-down/re-flood events, and the application time prior to flooding was varied as well. The results showed MetaLarv™ S-PT's Triple Release Technology provided effective emergence inhibition (% EI) at the onset of flooding and throughout multiple flooding cycles.

PRE-FLOOD APPLICATIONS

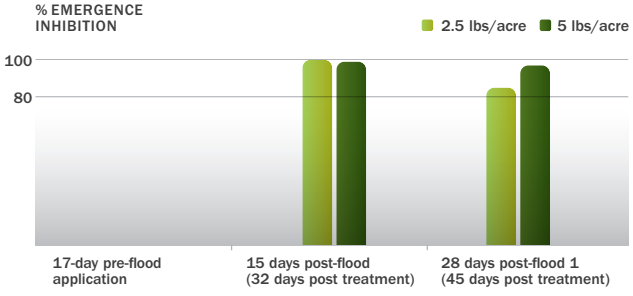
EI of *Aedes vexans* after pre-flood ground applications (4 lbs/acre) to floodplains in Minnesota



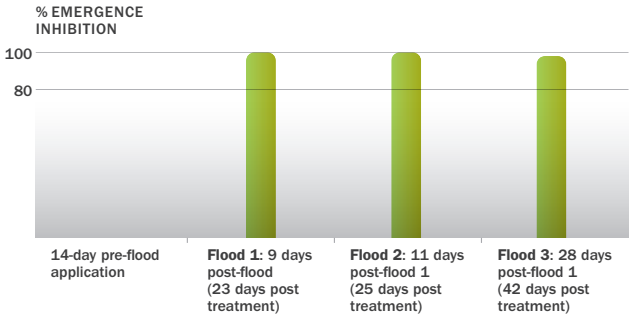
EI of *Aedes vexans* after 20 and 41 days pre-flood application (5 lbs/acre) to flood/dry-down/re-flood microcosms in Washington



EI of *Aedes vexans* after 17-day pre-flood application (2.5 and 5 lbs/acre) to flood/dry-down/re-flood microcosms in Oregon



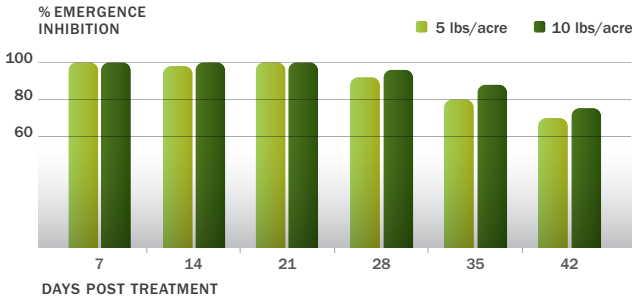
EI of *Ochlerotatus dorsalis* after 14-day pre-flood application (10 lbs/acre) to flood/dry-down/re-flood microcosms in Washington



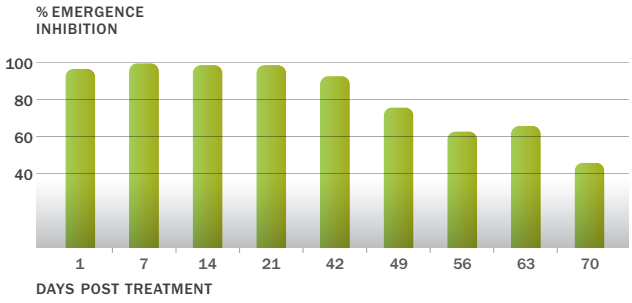
FIELD TESTS (CONTINUED)

DIRECT APPLICATIONS

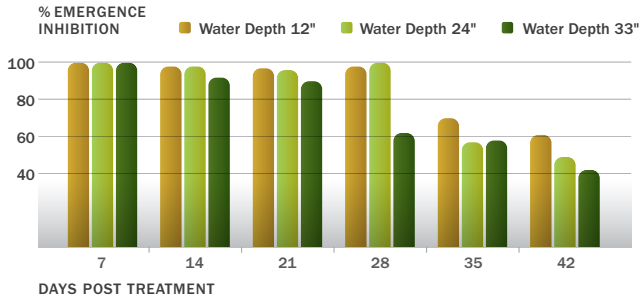
EI of *Aedes taeniorhynchus* after direct application (5 and 10 lbs/acre) to microcosms in California



EI of *Aedes aegypti* after direct application (2.5 lbs/acre) to containers in Malaysia



EI of *Culex quinquefasciatus* after direct application (10 lbs/acre) to large plastic barrels in California



CONTACT US

To learn more about MetaLarv™ S-PT call **800.323.9597** or visit us at **www.valentbiosciences.com/MLTUB**

Valent BioSciences is an ISO 9001:2008 Certified Company

Read and follow the label instructions before using.

VALENT BIOSCIENCES

870 Technology Way, Libertyville, IL 60048

AG5448