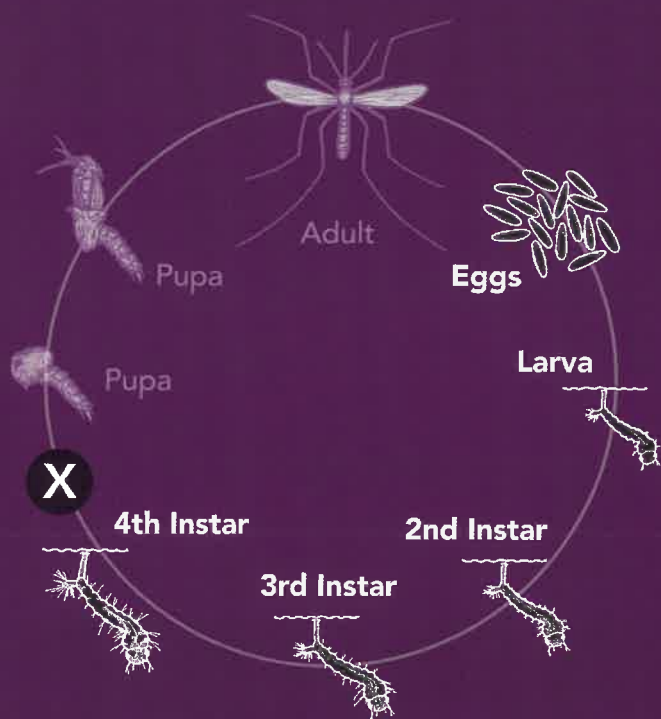


DUPLEX™

Following in the footsteps of our founders' trailblazing discovery of (S)-methoprene, we're proud to unveil our newest innovation: Duplex™-G. Duplex™-G offers dual-action control, helping you double down on coverage with both a biorational control agent and a biological control agent.



X Duplex®-G is effective in knocking down mosquitoes from the larvae through the 4th instar lifestages.

The biological agent provides a quick kill, and you'll see dead larvae within 24-72 hours. The biorational agent provides a long residual, with larvae control up to 28 days with continuous flooding.



ONE PRODUCT. TWO CONTROLS.

(S)-Methoprene: The biorational control agent is an insect growth regulator (IGR) that interrupts the normal development of mosquito larvae without impacting non-target mammals, waterfowl, fish or beneficial predatory insects.

As the core control agent, (S)-methoprene increases residual effectiveness, releasing over a 28-day period when continually flooded. In situations where occasional flooding predominates, the (S)-methoprene core stops releasing when the habitat dries and resumes releasing as the habitat refloods. Control release technology has been optimized along with stability enhancements.

Bacillus thuringiensis subspecies israelensis (Bti) Strain BMP144: The biological control agent layered on the outer shell is a feeding toxin to mosquito larvae without environmental impacts.

On the outer shell, *Bti* is also mixed with a floating agent, a release agent and an application protectant. The release agent will only deliver *Bti* to the water column when flooded. This ability allows for the pre-treatment of habitats prior to flooding. The release agent is referred to as Active Booster Release Technology. Water activates the release mechanisms that cause the separation of *Bti* and the floating agent from the (S)-methoprene core. Once the *Bti* and floating agent reach the water surface, the water surface's tension begins to separate the floating agent and *Bti*, causing the *Bti* to be bioavailable to mosquito larvae.

ACTIVE INGREDIENTS

- 5.35% *Bacillus thuringiensis subspecies israelensis (Bti) Strain BMP 144* solids, spores and insecticidal toxins
- 1.6% (S)-Methoprene



DUPLEX™ FORMULATION

Duplex™-G Granule

With consistent size, Duplex™-G granules offer a quick kill and a long residual in a formulation that provides calibration ease and normalized swath characterization for ground and aerial application equipment. It is a heavy granule with high bulk density, allowing for habitat penetration, no-drift application and on-target delivery to mosquito breeding habitats. Duplex™-G granules can be used as a pre-flood treatment on mosquito breeding habitats before water inundation from planned irrigation, snowmelt and rainfall. Active Booster Release Technology allows for 14-day pre-treatment in dry habitats and also quickly releases the *Bti* into the “kill zone.”



Duplex™-G Features:

- Quick kill with long residual
- Controls all species of mosquito larvae
- Active Booster Release Technology
- 14-day pretreatment ability in dry habitats
- High bulk density
- Uniform granule size
- *Bti* kills 1st through 4th instar mosquito larvae

Duplex™-G Benefits:

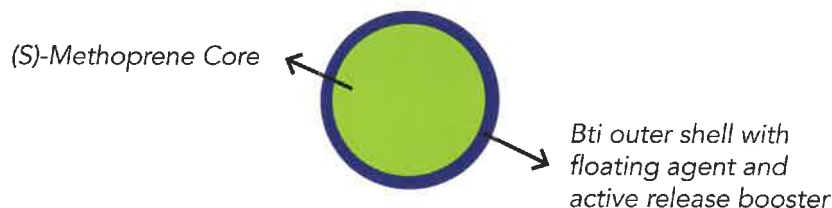
- No bioaccumulation of active ingredients
- Consistent product application through both ground and aerial equipment
- Excellent foliage penetration
- (S)-Methoprene disrupts adult mosquito development
- Consistent flow through application equipment
- Wide application range; 2.5 – 20 pounds per acre

Application Sites:

Duplex™-G granules can be applied to catch basins, crop areas, freshwater swamps, marshes, pastures, ponds, residential areas, storm drains, waste treatment and water-holding containers.

GRANULE DESIGN

The active ingredient *Bti* makes up the outer shell. The *Bti* is controlled by a release agent that only releases it when the water column is flooded, allowing for pre-flood treatment. When in water, the release agent allows *Bti* to separate from the (S)-methoprene core of the granule and float to the water surface.



IMPROVES RESISTANCE MANAGEMENT

With two modes of action, Duplex™-G granules help with resistance management. By combining the two active ingredients into a single product treatment, it eliminates the need for product rotation, creating fewer applications and less work for you.

DESIGNED FOR OPTIMAL ENVIRONMENTAL COMPATIBILITY

Since 1968, we have been dedicated to creating mosquito control solutions that are environmentally conscious. Duplex™ products are no different. While Duplex™ products have two control agents, both agents are broken down by the environment over a short time, which prevents the bioaccumulation of active ingredients in the environment. And (S)-methoprene disrupts adult mosquito development, providing an environmental solution to controlling mosquitoes.

DUPLEX™-G EFFICACY DATA *

SPECIES: ANOPHELES QUADRIMACULATUS				
Application		BTI Percent Control		
lbs/acre	Water Depth	24 hrs	48 hrs	72 hrs
5	6 inches	96%	100%	100%
7.5	12 inches	99%	100%	100%
15	24 inches	99%	100%	100%

SPECIES: ANOPHELES QUADRIMACULATUS					
Application		Methoprene Emergence Inhibition			
lbs/acre	Water Depth	7 days	14 days	21 days	28 days
5	6 inches	BTI*100	100%	100%	89%
7.5	12 inches	BTI*100	100%	100%	99%
15	24 inches	BTI*100	100%	100%	88%

SPECIES: OCHLEROTATUS TAENIORHYNCHUS OR AEDES TAENIORHYNCHUS				
Application		BTI Percent Control		
lbs/acre	Water Depth	24 hrs	48 hrs	72 hrs
2.5	4 inches	38%	75%	80%
5	6 inches	76%	100%	100%
7.5	12 inches	94%	100%	100%
7-DAY PRETREATMENT				
10	12 inches	100%	100%	100%

SPECIES: OCHLEROTATUS TAENIORHYNCHUS OR AEDES TAENIORHYNCHUS					
Application		Methoprene Emergence Inhibition			
lbs/acre	Water Depth	7 days	14 days	21 days	28 days
2.5	4 inches	BTI*100	98%	36%	3%
5	6 inches	BTI*100	BTI*100	100%	82%
7.5	12 inches	BTI*100	BTI*100	100%	97%
7-DAY PRETREATMENT					
10	12 inches	BTI*100	BTI*100	100%	100%

*Entomology consultants LLC test data. 6 reps per treatment. Used Mulla's formula for BTI assessments. (S)-Methoprene assessments used percent emergence inhibition recorded by days after treatment.

NOTES

DUPLEX™-G TESTING PROTOCOL

INTRODUCTION:

Duplex™-G is a unique dual-active larvicide that consists of a *Bti* coated (S)-methoprene sand-based granule. At application, the *Bti*-coating is released and will begin controlling larvae immediately. Within hours of application after the *Bti* release, (S)-methoprene will begin releasing and controlling adult emergence. During the initial application, you will get both *Bti* and IGR effects. After the first week post-application, there will be IGR effects only.

To evaluate the effectiveness of an application, there are a few simple steps to take that are outlined in the following protocol. Since Duplex™-G is a dual-action larvicide, the first indicators of effectiveness will be direct mortality to larvae caused by *Bti*. After an application, observations should be made in the first 72 hours to determine mortality. Dip counts taken at various locations at the treated site are a good way to observe larval mortality. The *Bti* effectiveness will decline after the first 72 hours following the initial application.

Once the *Bti* effectiveness has declined, the IGR effect from methoprene will control subsequent broods of mosquito larvae for up to 28 days post-treatment. Dip counts are still a good way to evaluate control but the evaluation procedures are different. Pupae must be collected from the field and held in the lab to determine the inhibition of adult emergence. Collecting larvae is not an effective method for determining inhibition of adult emergence. Mosquito larvae must be in a treated environment upon molting to pupae. Water brought back from the treatment site will lose methoprene and there may not be enough left in the water to cause an effect.

HELPFUL EVALUATION TIPS:

- Choose a site that is readily accessible containing abundant larval populations
- Ensure proper calibration of equipment and uniform application
- Existing pupae present at the site of treatment will not be affected by *Bti* or the IGR, wait 48 hours following the application to evaluate pupae for IGR effect
- Untreated sites may be used as a comparison to treatment sites
- Try to collect 25 larvae per dip for *Bti* evaluation and 25 pupae for IGR evaluation
- Record data and observations in a lab book or in prepared data sheets
- Take dip counts at random locations within the treatment site, dip count numbers will vary based on site size and is up to the investigator to determine the appropriate sampling size and location
- Duplex™-G has a range of application rates, it is suggested that on first evaluation 7.5 pounds per acre be used



DUPLEX™-G FIELD TESTING GUIDELINES:

Pre-treatment larval abundance (first and second instar larvae, third and fourth instar larvae, and pupae) should be recorded in both experimental and control sites. The sampling method should be appropriate to the type of breeding habitat, and the appropriate number of samples should be taken from each habitat based on the type and size of the habitat. Larval instars and pupae from each sample are counted and recorded.

Post-treatment larval abundance (all stages) should be monitored 24, 48 and 72 hours post-application and then weekly. Data should be recorded in a lab book or prepared data sheets. 10 random dip counts at each location will be recorded on the provided form for the first 72 hours minimum. *Bti* effects from Duplex™-G can persist for a week in some cases and should be monitored accordingly. After the first 48 hours, pupae may be collected if available and reared out for inhibition of emergence calculations. Inhibition of emergence begins at application, but waiting 48 hours after the initial treatment ensures that all pupae collected have developed in the presence of (S)-methoprene.

Collection of pupae starts at 48 hours, 1 week, 2 week, 3 week, 4 week and 5 week post-treatment, if possible.

Characterization of the habitats in terms of abiotic and biotic factors aids the interpretation of results. Rainfall and any change in water level or other parameters, such as algal bloom, water quality, outflow, temperature or predators in the habitats, should be recorded.



DATA COLLECTION:

Use the attached data sheets to record dip counts and pupae collected as follows:

1. Record conditions at treatment site and any factors that may affect application.
2. Record pre-treatment larval populations on the data sheet with 10 random dip counts for the treatment and control areas.
3. Make 10 random dip counts in treatment and control (if used) area every 24 hours until control drops below, usually after 96 hours for *Bti* evaluation.
4. Begin collecting pupae (if present) after the first 48 hours and rearing them for emergence calculations.
5. Make pupal collections weekly or when present and check for emergence inhibition until control percentages drop below 70%.
6. Pupae may be collected after the first 48 hours for IGR affects.

CALCULATION METHODS FOR IN-FIELD EFFICACY EVALUATIONS

The efficacy and residual activity of the larvicide is determined from the post-treatment counts of live larvae and pupae in treated and control sites compared with the pre-treatment counts or the control.

The assessment of an IGR's efficacy is based on the level of inhibition of emergence of adults and the percentage reduction in larval and pupal densities. Larvae and pupae are sampled as described above.

Adult emergence can be monitored directly in the field by using floating sentinel emergence traps in treated and untreated habitats, by pupal isolation, or by sampling and counting pupal skins. Adult emergence may also be assessed by collecting pupae (20–40 per replicate) and bringing them to the laboratory in appropriate containers with the water from the respective habitats, then transferring them to small cups inside the holding cages. Dead larvae and pupae found in the cups should be removed and any morphological abnormalities recorded.

When adult emergence is monitored in the laboratory using pupae collected from treated and untreated habitats, IE% is calculated using the following formula, on the basis of determining adult emergence from the number of pupae collected:

$$IE(\%) = \left(\frac{IC}{C-T} \right) \times 100$$

Where C = percentage emerging or living in control habitats and T = percentage emerging or living in treated habitats.