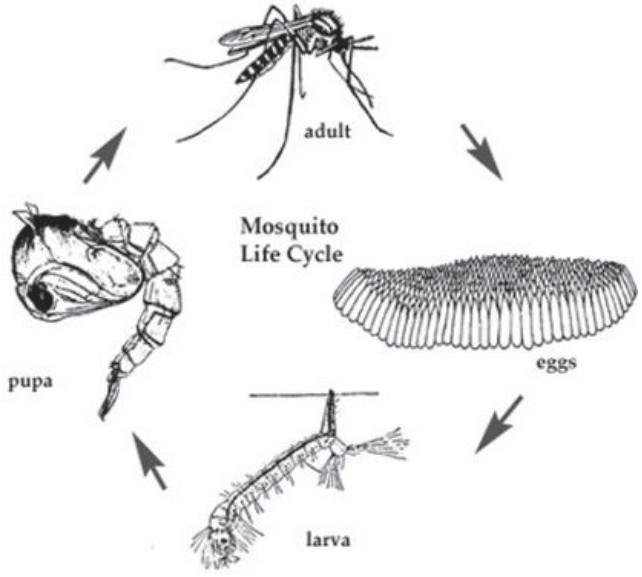
Mosquitoes in Confined Livestock Facilities Protocol

Importance of Mosquito Control

- Mosquitoes are one of the most detrimental insects to attack humans and livestock, vectoring diseases such as West Nile virus, Japanese encephalitis virus (JEV), Eastern equine encephalitis (EEE), and porcine reproductive and respiratory syndrome (PRRSV).
- Large populations of mosquitoes can cause irritation, allergic reactions, and anemia in livestock. Skin lesions from bites on livestock such as swine can result in reduced value when processed.
- Irritation from large numbers of mosquitoes can lower feed intake, causing reduced growth and productivity. Mosquitoes can also cause death associated with vectored disease pathogens.



Mosquito Biology and Life Cycle

- Mosquitoes have 4 life stages: egg, larva, pupa, and adult.
- Development time from egg to adult will vary based on species.
- Mosquito eggs are laid on the surface of water or near water. All immature stages are spent in still water.
- Adult mosquitoes are usually most active at dawn and dusk.
- Female mosquitoes need a blood meal to produce eggs. Males do not suck blood.

MOSQUITO	IDENTIFICATION	IMMATURES	ADULTS
	1/8 – 1/4 inches long Slender body, long legs Scales on wings/body Long proboscis	Eggs laid singly or in rafts 4 larval instars (wigglers) Pupal stage (tumblers) as short as 2 days	Adult females live 1-2 months in warm weather Most mosquitoes stay within 1-3 miles of breeding site

Inspection

- Locate breeding sites, which can include:
  - Areas with poor drainage, puddles and other surface water buildup, particularly after rainfall. Examples include nearby irrigated crops, tire tracks filled after rainfall, settling ponds, sewage lagoons, and clogged gutters.
  - Collected water in farm equipment, tires, buckets, water troughs, items covered with tarps, etc.
- Mosquito populations can be monitored with mosquito traps or by regularly dipping breeding sites (such as lagoons) for larval counts.
- Accurate identification is important. Nontarget insects, such as crane flies and nonbiting midges, can look similar to mosquito adults and larvae but do not pose a threat.

Pre-Treatment

- When possible, reduce and remove conducive conditions, focusing on standing and stagnant water sources. Dump buckets and other water holding containers when possible.
- Ensure proper drainage of the property to eliminate surface water buildup. Fill in tire tracks and potholes.
- Keep weeds down around edges of lagoons and other water sources.
- Aim to inspect and flush out water troughs on a weekly basis during mosquito season.
- Avoid using whole tires to hold down silage tarps because they easily accumulate stagnant water. Use tire sidewalls or other means.

Post-Treatment

- Re-inspect during your next treatment interval. Always be aware of product retreatment intervals prior to reapplying.

Immature Mosquito Control Measures

- When immature mosquitoes such as eggs, larvae and pupae are present, treat water holding sites that cannot be emptied with insect growth regulators (IGRs). When treating larger water holding sites, focus applications along the edges where mosquito larvae are most likely to congregate.
  - Sumilarv® 0.5G may be applied using hand spreaders, scoops, or power-operated mechanical granule spreaders. Broadcast applications may be made for large areas, such as lagoons.
  - Bacillus thuriengiensis israelensis (Bti) is a bacteria commonly used in mosquito control for its highly targeted action.

Adult Mosquito Control Measures

- Prior to any insecticide treatment, follow all label directions, restrictions and PPE requirements.
- Residual insecticides, such as Tobex® Multi MoA Insecticide, may be applied in areas where animals are not present when a controlled release of active ingredient is desired. Focus applications in areas with little air movement where adult mosquitoes rest, including shaded areas, foliage, soffits and entryways.
- On and over animal applications are a good option for knockdown of adult mosquitoes.
  - For best results, apply in calm conditions to ensure mist remains airborne as long as possible.

Recommended Equipment

- Cold foggers (ULV) – Generate fog by a mechanical action. Sprayers may be handheld, backpack, or truck mounted. Users can calibrate the unit to produce droplets of the optimum size for the situation or product being used.
- Backpack or hand sprayer – commonly used for spot, crack or crevice treatments around the premises. Do not apply insecticide to runoff.

PRODUCT	IRAC GROUP	ANIMALS PRESENT DURING APPLICATION	RATES	APPLICATION METHODS
Evergreen® Pro 60-6	3A	Yes	2 fl. oz. per gallon of water per 1,000 cu. ft. of space	Apply as a fog or fine mist directing the nozzle for maximum coverage above livestock and poultry toward the ceiling and upper corners of the area being treated.
NyGuard® IGR Concentrate	7C	Polutry Only	4 – 12 mL per gallon or sufficient water to treat 1,000 sq. ft.	Can be used alone to treat standing water sources listed in the label or tank mixed with Onslaught FastCap. Apply up to 1 gallon per 1,500 sq. ft.
Onslaught® FastCap Spider & Scorpion Insecticide	3A	No	0.5 fl. oz. per gallon or sufficient water to treat 1,000 sq. ft.	Apply as broadcast or foliar spray treatment to sites where mosquitoes rest, harbor and breed.
Riptide® Waterbased Pyrethrin ULV	3A	Yes	0.25-1 fl. oz. per 1,000 cu. ft. (undiluted); 1-2 fl. oz. per 1,000 cu. ft. (diluted at 1 part concentrate to 10 parts water)	Direct spray toward the upper portions of the enclosure, above the animals, filling the room with mist or fog.
Sector® Misting Concentrate	3A	Yes	2 tsp per gallon (maintenance); 4 tsp per gallon (normal); 1.28 fl. oz. per gallon (severe)	Apply to wet the hair thoroughly, with particular attention to topline, underline, flanks, withers, and other infested areas.
Sumilarv® 0.5G	7C	No	1 tsp granule or 1 WSP in treatment site less with 0-500 gallon of water at depth less than or equal to 1 ft.	Treatments should be made every 4-5 weeks for water retention or water detention ponds depending on the volume of water or frequency of rain events.
Tobex® Multi MoA Insecticide	3A; 7C	No	1 – 2 fl. oz. per gallon	Use as broadcast, foliar, or spot treatment to mosquito resting sites.
Troika® Farm and Livestock Aerosol	3A	Yes	2 seconds per 1,000 cu. ft. of space (animal quarters) 3 seconds on each side (livestock treatment)	In animal quarters, close windows and doors and spray, keep area closed for 10 min after spraying. When applying on livestock, spray each side being careful to spray back, withers, and forelegs thoroughly.
Troika® Misting Concentrate	3A	Yes	Undiluted at 0.20 fl. oz. or diluted with water at the rate of 1 part concentrate to 10 parts water and applied at the rate of 1-1.88 fl. oz. of diluted product per 1,000 cu. ft. of space above the animals	Direct spray toward the upper portions of the animals, filling the room with mist or fog. Animals may be present during application, but do not apply directly to poultry.

Tips and Tricks from the MGK Technical Department

- Note that the presence of actively swimming larvae after application of Sumilarv 0.5G or NyGuard IGR is normal. Immature mosquitoes will eventually die and not mature to the adult stage.
- Sumilarv 0.5G will have no effect on lagoon micro-digesters.
- Combat insecticide resistance by rotating modes of action (shown by the IRAC group) and incorporating synergists, such as piperonyl butoxide (PBO).
- The ideal target area for adulticide treatments is the bottom 20 ft. of trees.

INSECT GROWTH REGULATORS

NyGuard® IGR Concentrate

- Insect growth regulator that keeps insects in juvenile state and provides residual activity
- Breaks life cycle of over 50 insects and is effective at low concentrations
- Can be tank mixed with adulticides to control immature and adult insects

Sumilarv® 0.5G

- Insect growth regulator that prevents emergence of adult mosquitoes by disrupting development at the pupal stage
- The non-flushing active ingredient adheres to concrete and organic debris, allowing the granules to remain in place and effective through rain and temperature changes
- Available as a granule and in a water-soluble pouch to support flexible application needs

PREMISE SPRAYS

Onslaught® FastCap Spider & Scorpion Insecticide

- Microencapsulated residual insecticide and knockdown agent to deliver fast-acting and residual control of over 100 insects
- Flexible application methods, including indoor and outdoor broadcast use
- Synergized with piperonyl butoxide (PBO) to combat metabolic resistance and increase effectiveness

Tobex® Multi MoA Insecticide

- Combines a knockdown agent with controlled-release technology for residual control
- Formulated with NyGuard® IGR for dual modes of action to control immature and adult insects
- Synergized with piperonyl butoxide (PBO) to combat metabolic resistance and increase effectiveness

OVER-ANIMAL INSECTICIDES

EverGreen® Pro 60-6

- Contains botanically based pyrethrins synergized with piperonyl butoxide (PBO) to kill over 100 insects
- Formulated with a 1:10 pyrethrins to PBO ratio to combat resistance and increase effectiveness
- No withholding time periods for use before animal processing

Riptide® Waterbased Pyrethrin ULV

- Contains botanically based pyrethrins synergized with piperonyl butoxide (PBO) for knockdown and kill
- Formulated with a 1:5 pyrethrins to PBO ratio to combat resistance and increase effectiveness
- Designed for use in automatic misting systems or can be manually applied

Sector® Misting Concentrate

- Formulated with synergized permethrin to provide knockdown and residual control
- Synergized with piperonyl butoxide (PBO) to combat metabolic resistance and increase effectiveness
- Water-based insecticide that can be automatically misted or manually applied

Troika® Farm and Livestock Aerosol

- Provides quick kill and residual control up to 4 weeks
- Water-based, synergized formula containing botanically based pyrethrins and permethrin
- Synergized with piperonyl butoxide (PBO) to combat metabolic resistance and increase effectiveness

Troika® Misting Concentrate

- Water-based, synergized formula containing botanically based pyrethrins and permethrin to provide knockdown and kill
- Synergized with piperonyl butoxide (PBO) to combat metabolic resistance and increase effectiveness
- Labeled for use in automatic misting systems or manual application

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