

Integrated Mosquito Management Principles for Piggeries



Version 1



This document has been prepared for pig producers and licenced pest controllers to assist in the control of mosquitoes in piggeries. It was developed in March 2022 by the Japanese Encephalitis Vector Management Group – consisting of representatives from agriculture and health agencies, and the pork industry.

Contents

Introduction	2
Mosquitoes	3
Environmental management of mosquitoes	5
Chemical management	7
Water sources	8
Residual treatment outside pig sheds and piggery infrastructure	9
Staff facilities	10
Thermal fogging outside pig housing and farming infrastructure	11
Pigs and people	12



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Introduction

2

Mosquito management is required because they bite and transmit viruses that cause disease, including Japanese encephalitis. On farm, mosquito management that relies only on controlling adults is not effective or sustainable. An effective mosquito management program is only achieved by targeting all stages of the mosquito life cycle using a combination of methods. This is called integrated mosquito management, and it is the best way to reduce mosquitoes to protect workers and pigs. It requires a combination of:

- Environmental management to reduce breeding and resting sites
- Larviciding (treating the larvae)
- Adultciding (treating the adults)
- Ongoing monitoring and surveillance
- Record keeping.

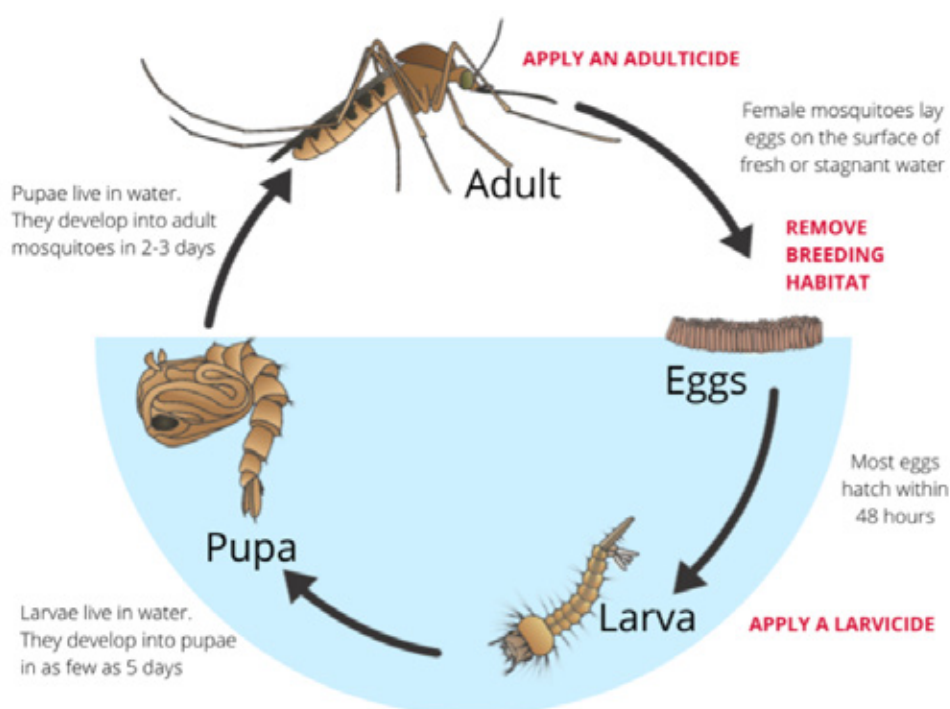


Figure 1: Diagram showing the *Culex* mosquito lifecycle with integrated mosquito management intervention points.

Mosquitoes

3

Mosquitoes lay eggs on or around any source of fresh, waste or stagnant standing water in natural or constructed places including ponds, dams, rainwater or septic tanks, scrap metal piles, old drums, farm equipment, roof gutters, buckets, puddles, creeks, ditches, and marshy areas.

When they hatch, larval mosquitoes (known as wigglers) remain in the water where they hatched. They then complete their development, and within 7-10 days, emerge as adults.

Adult mosquitoes prefer sheltered, cool, and dark places to rest, and tend to be on the underside of objects or plant foliage to avoid getting wet. They are most active at dawn, dusk, and into the evening but can also be active during the day.

Adult mosquitoes generally don't live longer than 3 weeks but will bite and blood feed every 3-4 days. During their life adult mosquitoes may travel up to 5km from where they hatched.



Photo credit: Stephen Doggett

Figure 2: Eggs (*Culex annulirostris*)

4



Photo credit: Stephen Doggett

Figure 3: Larvae (*Culex annulirostris*)



Photo credit: Stephen Doggett

Figure 4: Adult (*Culex annulirostris*)

Environmental management of mosquitoes

5

The key actions to reducing the mosquito load around piggeries are:

- Reduce standing water sources and remove anything in the open that has the potential to hold water e.g. old equipment, scrap metal heaps, old drums, buckets, troughs and unused tyres.
- Fill potholes or other areas around the piggery that collect water.
- Ensure gutters, downpipes, and drains around buildings are free of debris that prevents the free flow of water. Trim overhanging tree branches.
- Ensure effluent drainage is free flowing, flushed regularly and does not pool.
- Where practical seal uncovered water storage such as tanks or other large containers, or screen with 1mm mesh.
- Reduce vegetation around the piggery and ponded areas to minimise areas where adult mosquitoes can congregate.
- Ensure all windows and doors are covered by well-maintained mosquito-proof screens.



Figure 5: examples of water sources where mosquitoes breed

Chemical Management

7

Chemical use for mosquito control should be conducted by people authorised to use chemicals in accordance with state/territory training and licensing requirements. Do not apply chemicals that are not registered for use on pigs to pigs, pig feed or surfaces that pigs may contact.

Here are 5 tips for effective chemical management:

- Always use chemicals strictly as per the product label
- Seek professional advice if you are unsure about how to use a chemical
- Preferably use a licensed pest control operator
- Keep records of pest control activities on your property and around your piggery
- Restrict chemical use strictly to areas required to be treated

Impacts of chemical misuse

Chemical residues in pork are a trade and food quality risk.

The misuse of chemicals can also create environmental risks to bees, wildlife, aquatic life and people.

The following guidance provides recommendations for products that may be suitable for piggery situations. Product lists are not exhaustive. Always ensure you read and comply with product labels and directions for use.

Water Sources		
Location	Larval Control	Adult Mosquito Control
Waste-water structures around piggeries (effluent ponds, drains, septic tanks, retention tanks, ponds, basins)	<p>Frequency and Timing</p> <p>Reapplication every two weeks or as required following rainfall or evidence of additional mosquito activity (an abundance of mosquito larvae).</p> <p>Products</p> <ul style="list-style-type: none"> • VectoLex (APVMA #55919; active ingredient <i>Bacillus sphaericus</i>) 	
Surrounding natural wetlands, water bodies and floodwaters	<p>Frequency and Timing</p> <p>Reapplication every 2 weeks (liquid), 4 weeks (pellets), 3 months (briquets) or as required following rainfall or evidence of additional mosquito activity (an abundance of mosquito larvae).</p> <p>Products</p> <p>Use products that have no withholding period for livestock drinking treated water when used as directed. Suggestions are listed below:</p> <ul style="list-style-type: none"> • Prolink Liquid Larvicide Mosquito Growth Regulator (APVMA #58063; active ingredient 50g/L s-methoprene) • VectoPrime FG Biological Larvicide Fine Granule (APVMA #82315; active ingredient 1g/kg s-methoprene, 400ITU/mg <i>Bacillus thuringiensis</i> subsp. <i>israelensis</i>) • Culithor Granular Mosquito Growth Regulator (APVMA #69802; active ingredient 12g/kg s-methoprene) • Biopren 50 Liquid Mosquito Larvicide (APVMA #62020; active ingredient 50g/L s-methoprene) • Biopren 4GR Mosquito Larvicide (APVMA #62018; active ingredient 4g/kg s-methoprene) 	
Open constructed water storage where water sits for more than 8 days without being disturbed (open water tanks and troughs)	<p>Preferably seal open water storage sources such as tanks, or screen with 1mm mesh. If not possible to seal, manage water flow so that the same water does not sit undisturbed for more than 8 days.</p>	

Residual treatment outside pig sheds and piggery infrastructure

Location	Larval Control	Adult Mosquito Control
Residual coarse spray treatment outside animal housing (solid exterior walls, eaves, boot change areas, workshops, and other cool, dark areas outside pig housing or handling facilities)		<p>Frequency and Timing</p> <p>High infestation – apply weekly</p> <p>Medium to Low infestation – one treatment then as required pending surveillance of adult mosquito activity.</p> <p>Products</p> <p>Use products that include label directions for use in and around agricultural/farm buildings or animal housing. Suggestions are listed below:</p> <ul style="list-style-type: none"> • Fendona Plus 60 SC Insecticide (APVMA #80739; active ingredient 60g/L alpha-cypermethrin) • Prolong Ultra Fly and Litter Beetle Insecticide (APVMA #66483; active ingredient 25g/L betacyfluthrin) • Solfac Duo Residual Insecticide (APVMA #68410; active ingredient 50g/L imidacloprid, 25g/L betacyfluthrin) • Seclira WSG Insecticide (APVMA #83011; active ingredient 400g/kg dinotefuran)

Staff facilities

Location	Larval Control	Adult Mosquito Control
Residual coarse spray treatment in and around staff facilities associated with pig production areas (smoko areas, toilet and shower facilities, office areas)		<p>It is recommended that a licensed pest controller is engaged to treat these areas.</p> <p>Frequency and Timing</p> <p>High infestation – apply weekly</p> <p>Medium to Low infestation – one treatment then as required pending surveillance of adult mosquito activity.</p> <p>Products</p> <p>Use products that include label directions for use in and around agricultural/farm buildings or animal housing. Suggestions are listed below:</p> <ul style="list-style-type: none"> • Fendona Plus 60 SC Insecticide (APVMA #80739; active ingredient 60g/L alpha-cypermethrin) • Prolong Ultra Fly and Litter Beetle Insecticide (APVMA #66483; active ingredient 25g/L betacyfluthrin) • Solfac Duo Residual Insecticide (APVMA #68410; active ingredient 50g/L imidacloprid, 25g/L betacyfluthrin) • Seclira WSG Insecticide (APVMA #83011; active ingredient 400g/kg dinotefuran)
Controlled release devices for staff facilities away from food or food preparation areas and areas where pigs are housed or handled (toilet and shower facilities, office areas)		<p>Frequency and Timing</p> <p>Plug in or install as directed and leave in place. Service as directed on label.</p> <p>Products</p> <p>These are consumer products available from retail outlets or can be supplied and installed by pest control operators. Other brands are suitable too.</p> <ul style="list-style-type: none"> • Mortein Mozzie Zapper & Fly Control (APVMA #64992; active ingredient 7.13g/L transfluthrin) • Mortein Odourless Mozzie Zapper 30 Nights Protection Low Irritant (APVMA # 50749; active ingredient 44.0/L Allethrin) • Mortein Powergard The Expert's Multi-Insect Automatic Spray Odourless Indoor & Outdoor (APVMA # 69866; active ingredients: 8.0g/kg permethrin, 6.0g/kg transfluthrin) • Outdoor use only - Thermacell Zone Mosquito Repellent (APVMA # 89453; active ingredients: 43.8g/L metofluthrin)

Thermal fogging outside pig housing and farming infrastructure

Location	Larval Control	Adult Mosquito Control
Thermal fogging outside pig housing and other farming infrastructure		<p>Consider potential for residues and environmental risks before fogging any chemical that is not listed near areas where pigs are housed or handled including products containing deltamethrin, cypermethrin, bifenthrin or dinotefuran.</p> <p>Frequency and Timing</p> <p>High infestation/Japanese Encephalitis virus activity – daily treatments. Apply early in the morning before temperature starts to rise.</p> <p>Medium to Low infestation – weekly treatment pending surveillance for adult mosquitoes. Apply early in the morning before temperature starts to rise.</p> <p>Products</p> <p>Use products that have no withholding period when applied as directed to outside areas associated with animal production, e.g.,</p> <ul style="list-style-type: none"> • <u>Py-Bo (Scintex) Natural Pyrethrum Insecticidal Concentrate</u> (APVMA #53738; active ingredient 320g/L piperonyl butoxide, 80g/L pyrethrins) • <u>Py-Omni Insecticide with Natural Pyrethrum</u> (APVMA #65321; active ingredient 160g/L piperonyl butoxide, 40g/L pyrethrins) • <u>Py-Zap Insecticide with Natural Pyrethrum</u> (APVMA #60610; active ingredient 160g/L piperonyl butoxide, 40g/L pyrethrins) • <u>Pyrate Natural Insecticide</u> (APVMA #88596; active ingredient 160g/L piperonyl butoxide, 40g/L pyrethrins) • <u>Pyzap Insecticide</u> (APVMA #61779; active ingredient 160g/L piperonyl butoxide, 40g/L pyrethrins) • <u>Professional use only – Stryker Insecticide</u> (APVMA #87533; active ingredient 590g/L piperonyl butoxide, 60g/L pyrethrins)

Pigs and people

Location	Larval Control	Adult Mosquito Control
Pigs		<p>Frequency and Timing</p> <p>Apply twice daily where infestations are severe. Use as required where mosquito bites are observed on pigs.</p> <p>Products</p> <p>The following product may be applied to pigs with a nil withholding period.</p> <ul style="list-style-type: none"> • Repel-X Insecticidal and Repellent Spray (APVMA #52274; active ingredients 20g/L diethyltoluamide, 5g/L citronella, 2g/L pyrethrins, 8g/L piperonyl butoxide) <p>Seek veterinary advice before applying any other product directly to pigs</p>
People		<ul style="list-style-type: none"> • Wear light coloured, loose-fitting clothes including long pants, and long-sleeved shirt; and covered shoes. • Use registered repellents that contain diethyltoluamide (DEET), picaridin, or oil of lemon eucalyptus. • Apply the insect repellent on all exposed skin during your workday. • Read the label for reapplication times.



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