

Rat Lungworm Disease Prevention





RLW Response

1. Prevention

- **Producer: Vector control**
- **Consumer: Food handling**
 - Rinse
 - Inspect
 - Cook or Freeze

2. Disease

- Diagnosis
- Treatment

Our focus:

Prevention at the **Producer** level
(farmer and home gardener)

East Maui RLW Task Force

- HCF grant thru HFUF
- Farm Visits
- Vector Control Supplies
- Educational Outreach
- Model for other chapters?



RLW = Permanent Lifestyle Change

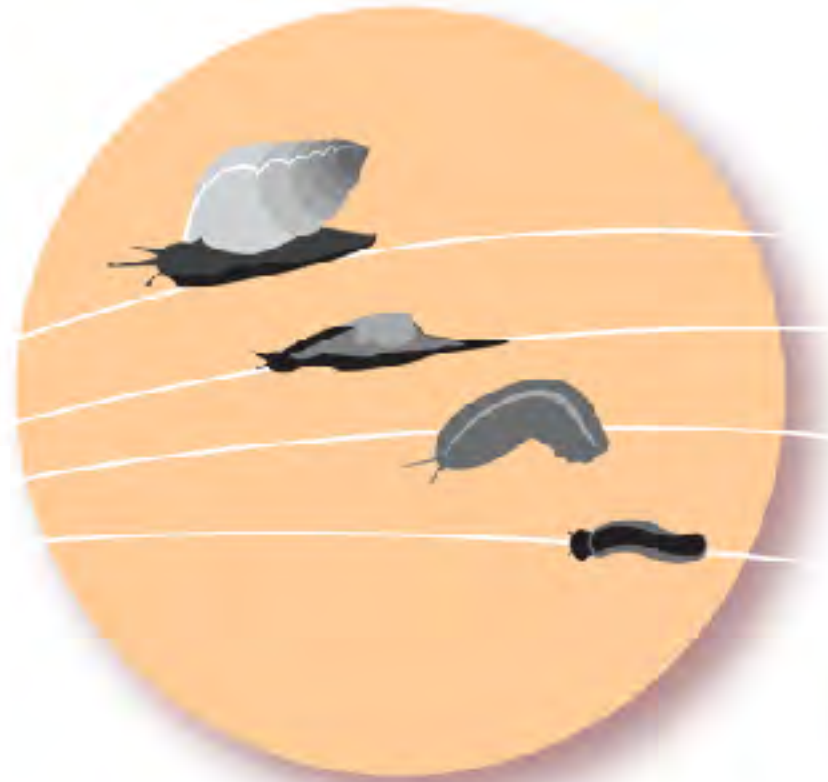
- Several cases in 2016, a few new local incidents known since then
- Consumer education + producer safety
- Parasite is here to stay
- Semi-slug is here to stay and spreading
- Must remain vigilant!



RLW Disease Life Cycle

- parasite lives in lungs of rat
- rat coughs up larvae, swallows, then poops out
- slugs eat rat poop and become infected
- rats eat slugs/snails and perpetuate cycle
- slugs hide in leafy greens and other produce in farms and gardens
- humans become infected by accidentally consuming infected slug/snail
- parasite migrates to brain and dies
- nerve damage caused by inflammatory response as immune system attacks dead worms





Vector Control

Rats
+
Slugs

Control both hosts
=
reduce risks most



All mollusks can carry RLW

- Semi-Slug
- Cuban slugs
- Giant African snails
- Other garden slugs & snails



Semi-Slug

Parmarion martensi

= highest risk vector

- high parasite occurrence
- high parasite load => worse and long-term symptoms
- habits bring into contact with human food sources



Mahele Farm Slug Control

- Community farm, providing fresh produce to local volunteers
- Semi-slug was present in large numbers
- Other slugs and snails also present (e.g. cuban slug and giant African snail)
- Trained staff in slug ID and hand picking of slugs
- Initial slug removal sessions 1-2 x per week for ~ 45 mins
- Over several weeks, number of slugs collected reduced each time
- Eventually, no semi-slugs found in growing area, only on periphery of farm in tall grass, etc.; other slugs and snails nearly eliminated in growing area
- Continued maintenance of slug populations

Semi-Slug Removal by Hand

- regularly picking can greatly reduce slug populations and make food safer!
- pick 1-2 times per week to start - *make schedule for workers*
- early in the morning when slugs are active
- look for slugs in the inside of smooth leaves like banana, taro and heliconia, just above where the water is stored inside the leaf
- wear gloves (e.g. nitrile) and/or use dedicated tongs
- place slugs in a widemouth jar with salt and water (throw away when full)



Other Slug Control Strategies

- Barriers
 - ★ keep growing areas clean, remove habitat
 - ★ buffer zone - maintain area around garden - semi-slugs don't like to be on the ground
 - ★ copper - must be polished
 - ★ electric barriers - Dr. Pang
 - ★ narrow fence for snails
- Slug bait (nontoxic iron phosphate - Sluggo) around habitat areas, bait stations
- Slug traps in garden area (e.g. water bottle with beer, folded black plastic)
- Slug jars handy in garden area for workers to use
- Ducks!



Farm Visits

- Based on success at Mahele, lessons learned, to share with other farms
- In cooperation with HDOA, Maui Branch (John Frostad)
- Visited ~ 20 farms over several months
- Scheduled 3-5 visits per day in different geographic areas from Nahiku to Kipahulu
- Priority for HFUU member farms



Farm Visits

- NOT an “inspection” - ‘self-audit’ - no reporting
- support farmers in best practices
- create conversation and awareness
- go over checklist
- talk about vector control methods
- feedback from farmers - experiences, lessons
- talk about disease lifecycle, vectors
- look around farm for habitats: rat + slug/snail
- check for presence of rats + slugs/snails
- share mollusk identification info
- demonstrate methods for slug removal
- provide educational materials
- provide free vector control supplies



Slugs/Snails

- Slug bait (nontoxic, iron phosphate, Sluggo)
- Gloves (nitrile)
- Tongs
- Slug jars
- Salt

Vector Control Kits

Rats

- Traps
 - wooden
 - plastic
 - sticky



Diagnosis & Treatment

- Recently published *Preliminary Guidelines for the Diagnosis and Treatment of Human Neuroangiostrongyliasis (Rat Lungworm Disease) in Hawai'i*
 - ★ available on www.eastmauirlw.com & DoH website
- Importance of **lumbar puncture** (LP, aka spinal tap)
 - ★ only way to confirm diagnosis and ensure proper treatment
 - ★ low-risk and nearly painless
 - ★ has therapeutic benefits, including relief of headaches, nausea, and vomiting
 - ★ if you think you may have RLW, get an LP!

Preliminary Guidelines for the Diagnosis and Treatment of Human Neuroangiostrongyliasis (Rat Lungworm Disease) in Hawaii

Authors: Clinical Subcommittee* of the Hawaii Governor's Joint Task Force on Rat Lungworm Disease

*Members of the Clinical Subcommittee and their affiliations are listed at the end of the document.

August 29, 2018



Outreach

~more information~

- Website EastMauiRLW.com
- Facebook group fb.com/groups/EastMauiRLW/
[@ratlungwormdiseasehawaii](https://www.instagram.com/ratlungwormdiseasehawaii)
- Brochures
- Event tables
- Free vector control supplies
- Slug picking game
- Training available for other Chapters

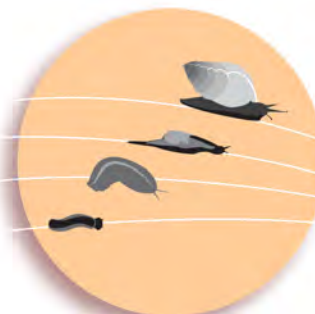


PREVENT RAT LUNGWORM DISEASE

Wash
Inspect
Cook or freeze

Learn more at

WWW.EASTMAUIRLW.COM



*Support
Maui
Farmers*
BUY LOCAL



What is Rat Lungworm Disease and how is it spread?



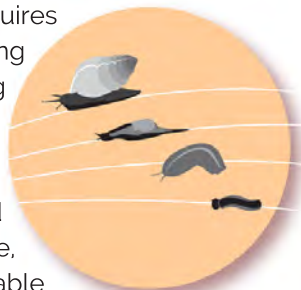
Rat lungworm disease is caused by a parasite nematode called *Angiostrongylus cantonensis*. The adult form of the parasite is found only in rodents. Infected rats pass larvae of the parasite in their feces. Snails and slugs get infected by ingesting the larvae.

Humans can then become infected by ingesting snails and slugs. (You cannot contract this disease by coming in contact with rats or rat feces.)

The slug itself is the vector that releases the parasite into the digestive tract, where it then makes its way into the spinal column and the brain.

Breaking the cycle that supports the parasite requires comprehensive efforts toward control of rats and slugs/snails. Preventing infection requires safe food handling. Thorough rinsing removes slugs and slime. Cooking or freezing kills the parasite.

While the slugs and rats that transmit this disease are here to stay and require a permanent lifestyle change, the good news is that it is preventable with proper food handling and vector control.



The semi-slug (*Parmarion martensi*), which is relatively new in Hawai'i, is the highest-risk vector, due to its higher likelihood of carrying the parasite, the high load of parasites in each slug (even a tiny juvenile slug), and the habits of the slug that bring it into contact with human food sources.

All slugs and snails may carry the disease, however, including the common **Cuban slug**, the giant **African snail**, and the **Apple snail**. Fresh water crabs, frogs, prawns, shrimp and 'opae may also be parasitic hosts.

Visit our website www.eastmauirlw.com to learn more. Download the printable **Gastropod Field Guide** and learn to identify and control semi-slugs, cuban slugs, and other mollusks.

EAST MAUI **RLW** TASKFORCE
WWW.EASTMAUIRLW.COM



Rat Lungworm - East Maui Task Force



coordinator@EastMauiRLW.com



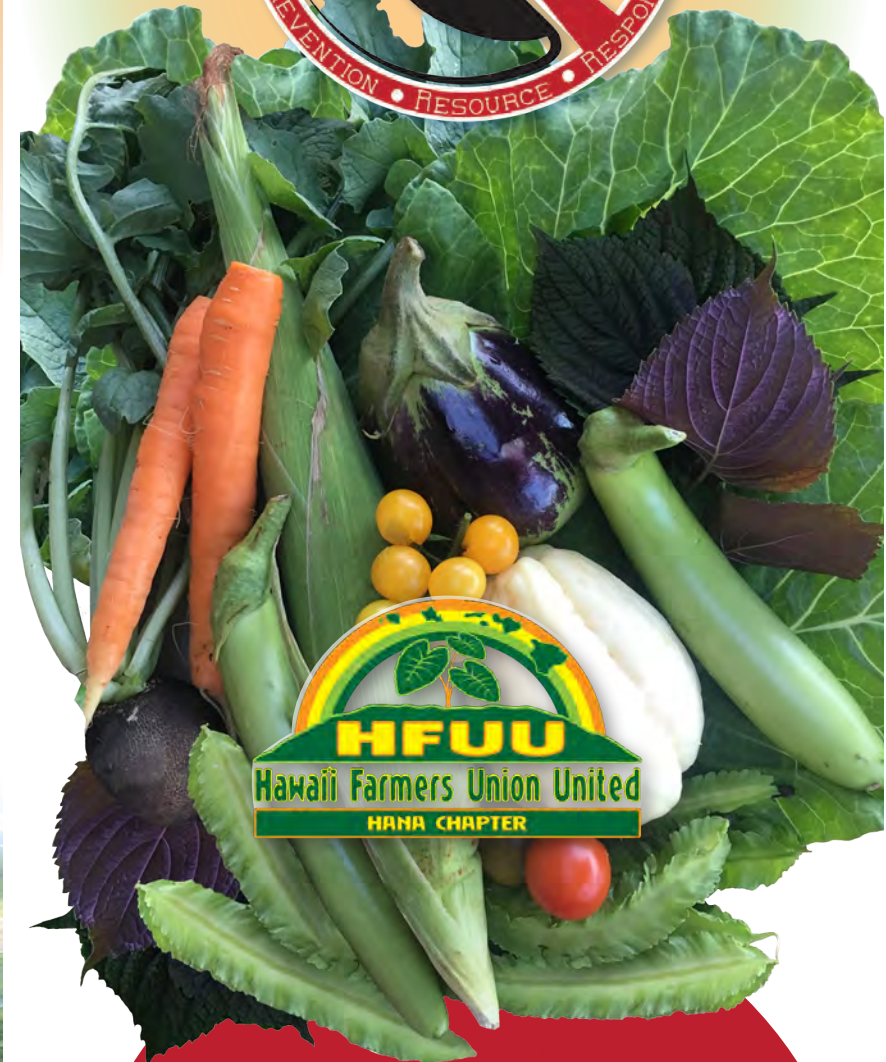
@EM_RLW



BUY LOCAL
Support East
Maui Farmers

East Maui RLW Taskforce is dedicated to preventing rat lungworm disease through education for residents and visitors, and support for East Maui's farmers and gardeners. As a program of **Hawai'i Farmers Union United Hana Chapter**, we actively share education, tools and practices to identify and control the vectors that spread the disease, and safe food handling practices to protect consumers. In addition to taking these precautions in your own household, you can help fortify your community:

- **Become a volunteer** - We need educators and field support.
- **Share the mana'o** - Talk about RLW in your 'ohana, educate the keiki, and share with our visitors how to protect themselves during their vacation on Maui.
- **Visit our website** www.eastmauirlw.com and stay up-to-date with the most recent studies, prevention practices and news.



PREVENT
Rat Lungworm Disease

www.EastMauiRLW.com



VECTOR CONTROL

It is vitally important to regularly **control rats and slugs** even if you do not grow food in your yard. The vectors of the disease travel from one property to another. If you're growing lettuce, leafy greens like kale or cabbage, and produce that is eaten raw, adopt these precautions and routines to prevent rat lungworm disease.

Generally slugs are active by night and hide in cool, damp, dark places by day. The semi-slug is often found inside the leaves of plants like taro, bananas and heliconias just above where the water collects. The cuban slug is usually found on the ground in dark, moist places, under rocks, planter pots or black plastic. Remove likely slug habitat near growing areas, and keep a buffer zone clear around gardens.

Routinely hunt slugs at night or in the early morning, especially during damp weather, using gloves or tongs. This can greatly decrease slug populations around your home and garden. We recommend placing slugs and snails into a 'slug jug' with salt water in a wide-mouth plastic bottle with secure lid, kept on hand in the garden. This kills the slugs and parasites, and it can be put in the trash when full.



Apply safe, nontoxic slug and snail bait products (iron phosphate) around food-growing areas. Slug traps can be made with beer. Always exercise caution and wear appropriate safety gear when mowing and weed-whacking your property.

We provide kits with supplies and tools, methods and instructions, so that every 'ohana can participate. Kits include:

- Rat traps (different types)
- Organic slug bait
- Salt
- Tongs
- Gloves
- Slug disposal bottle
- Survey checklist
- Guides and Instructions
- Our support & follow up.

PETS ~ LIVESTOCK

Pets and livestock can also be susceptible to rat lungworm infections. Make sure your pet and livestock food is stored in sealed containers safe from slugs; store food bowls in a safe place, especially at night when slugs are active; and rinse bowls out before feeding. Please stay alert to your pets' areas and activities on your property. Puppies with developing nervous systems, and that chew on everything, are at greater risk.

WASHING ~ COOKING ~ FREEZING

Practicing diligent food hygiene and proper cooking methods are the most effective ways to avoid contracting this disease. The infection is caused most commonly by accidentally eating a slug that is hidden in raw produce, especially lettuce or leafy greens. Slugs may be as small as a grain of rice, and very difficult to spot in the folds of a leaf.

The best way to remove the slug is to rinse produce with forcefully running water, and carefully inspect each leaf. (Vinegar, peroxide and salt water dips are **not** any more effective than thoroughly cleaning with running water.)

Cooking and freezing also kill the parasite.

- Clean and inspect all fruits and vegetable regardless of where you purchased or gathered
- Wash with clean running water
- Cook, boil or steam produce at or above 165 degrees
- Cook well all culinary snails, crabs, frogs, prawns, shrimp and 'opae, which may also carry the disease
- Do not slice into produce until after it has been thoroughly cleaned
- Curly kale and other leafy greens with lots of folds are safest if cooked or frozen
- Wash cutting surfaces regularly, clean reusable produce bags
- If in doubt, throw it out
- Wash pet bowls regularly and bring them inside at night to protect from slug infestation.

When buying produce or prepared foods at roadside vendors, practice the same food hygiene. Ask the food server about the origin of their food and precautions in handling.



WATER SAFETY ~ CATCHMENT PROTECTION

- Drink only filtered potable water.
- Do not drink unfiltered catchment water.
- Do not drink from hoses.

College of Tropical Agriculture and Human Resources at University of Hawai'i at Mānoa has published **Guidelines on Rain-water Catchment in Hawaii** by Patricia S. Macomber. Please visit: <https://www.ctahr.hawaii.edu/oc/freepubs/pdf/rm-12.pdf>

SYMPTOMS ~ DIAGNOSIS ~ TREATMENT



Be alert to symptoms. Symptoms include hypersensitive skin, severe headache, paresthesia (a burning or prickling sensation that is usually felt in the hands, arms, legs, or feet, but can also occur in other parts of the body), and pain that moves from one area of the body to another. The vague initial symptoms mimic other diseases, like leptospirosis and typhus; these must be diagnosed and treated with antibiotics quickly. If these or flu-like symptoms appear, see your doctor immediately.

Symptoms are caused when the parasitic worms move into the brain, or when the worms die in the brain and then are attacked by the body's immune system, causing an inflammatory reaction. The severity and duration of the symptoms depends largely on the load of parasites consumed. The disease can be relatively mild and resolve with minimal intervention in a few weeks, or it can be a severely debilitating, chronic illness with neurological symptoms persisting for months or years after initial infection.

Diagnosis

Currently, a lumbar puncture (LP, aka spinal tap) is the only confirmed method of diagnosis according to the Department of Health. Lumbar punctures are safe, nearly painless, and can also help relieve the severe headache symptomatic of the disease. If you believe you may have the disease, having an LP done is highly recommended for a firm diagnosis and appropriate treatment plan.

Treatment

Steroids like prednisone counter the inflammation from meningitis. Pain medications may be administered. Some patients have found acupuncture helpful. Many patients report that, once past the initial infection stage, physical activity is helpful at relieving symptoms. Good nutrition is important, including vitamin and mineral supplements.

If you believe you may have accidentally consumed a slug or snail, but are not yet experiencing symptoms, your doctor may prescribe anti-parasitic medications to help prevent the infection.

Visit our website www.eastmauirw.com to learn the most recent treatment protocols and download the printable Preliminary Guidelines for Diagnosis and Treatment.

Eat Local!



Eat Healthy
Eat Safe
Support your
local farmer!

Mahalo

- Hawaii Community Foundation
- Hawaii Farmers Union Foundation
- HFUU-Hana Chapter
- RLW Survivors
- Mahele Farm Crew
- John Frostad, HDOA
- Dr. Chad Meyer
- Kay Howe
- Dr. Sue Jarvi
- Dr. Lorrin Pang
- Lynn Nakamura-Tengan

