

## **Rat Lungworm FAQ**

This page holds responses to questions from the audience of the Rat Lungworm Forum held Nov 9, 2011 at the University of Hawai'i College of Pharmacy. Responses are provided by forum participants Drs. Rob Cowie, Rob Hollingsworth, Jon Martell and Sue Jarvi, and Jim Hollyer, Ann Kobsa and Kay Howe, and Dr. Will Pitt.

**Q. Is the slime of the semi-slug dangerous too? I picked up 2 slugs to throw down the toilet and could not get the slime off my hand with water and soap, finally got it with gasoline.**

It has been shown that slug slime may carry a very small number of parasites in comparison with the body of the slug itself. Ingestion of a few parasites could possibly cause an infection, but it would probably be relatively mild. There are no studies that support an infection could be caused by skin contact. However two victims of RLW from the Big Island claim to have gotten it through skin contact. Yes, the slime is very difficult to get off. Further studies would need to be done to determine the most effective and safe way of removing the slime. Direct handling of slugs is not advised. The use of gloves, baggies or picking up slugs with disposable chopsticks is preferable.

**Q. I have had rat lung symptoms for nearly 4 years. What can I expect for my future? What is the mechanism for the pain I still suffer?**

Early cases of rat lungworm on the Big Island have shown that conditions and symptoms may persist for an indefinite length of time. To date, there have been no follow-up studies of long-term recovery rates of victims of rat lungworm on the Big Island. From meetings with rat lungworm victims from Hawai'i Island we have observed that some recoveries have been more successful than others. One case involved the long-term use of supplements that are antioxidants and support mitochondrial function. Other forms of alternative therapies have been reported, but many of these treatments can be prohibitively expensive as they are not covered by most insurance companies.

**Q. Can nerves become inflamed? Can damaged nerves become inflamed months or years later?**

Nerve damage often occurs in more serious cases of rat lungworm. It can persist for months or years.

**Q. Can rat worm larvae survive in the residual dried slime trails of slugs/snails? Example: a slime trail hours-days old?**

A study would have to be done to absolutely confirm this, but probably not, especially if the trail was well dried. The parasite has been reported to live in water for up to 72 hours, and could possibly survive in slime under very moist conditions.

**Q. Can marine gastropods or other mollusk carry this parasite (e.g. opihi...)?**

The Hawai'i Dept. of Health states that it is the fresh water opihi that can carry the parasite, as well as other aquatic organisms such as prawns, frogs, and water monitor lizards.

**Q. Do you know if all 3 rat species in Hawai'i can be primary carriers? What about mice (Mus musculus)?**

We know that Norways (*Rattus norvegicus*), black rats (*Rattus rattus*), and Polynesian rats (*Rattus exulans*) have been confirmed as carriers. House mice (*Mus musculus*) have not been confirmed.

**Q. What are the best ways to cleanse vegetables (salad)? Are bleach, salt water, warm water, vinegar, and/or hydrochloric acid effective cleaning agents?**

The best way to be sure your produce is free of slugs and snails is through careful washing and observation. We cannot yet recommend any products as the definitive studies have not been done. However, preliminary studies show vinegar, neem oil, grapefruit seed extract and food grade hydrogen peroxide to be ineffective as rinses that immobilize larvae. Bleach is not approved for use on food by the FDA and has carcinogenic byproducts. Studies are currently underway at UH Mānoa (R. Cowie and J. Hollyer) to determine what products will cause slugs and snails to drop off of produce in a wash.

**Q. Why is there so little known about RLW? What is the history behind where it is thought to have come from?**

The parasite is believed to have originated in Southeast Asia. This nematode was first discovered in China in 1935 (Chen HT, 1935), but is now endemic in Asia, Australia, the Caribbean islands and the Pacific Islands and has spread to the American continent and Brazil with more than 2,800 cases of human infection reported in 30 countries (Wang et al., 2008, 2011). *A. cantonensis* has been documented as a parasitic disease of humans in Hawai'i and other Pacific islands since the early 1960's (Wallace and Rosen 1969). The flatworm *Platydemus manokwari* and the semi-slug *Parmarion martensi* had recently immigrated to Japan and were thought to be the probable cause of an outbreak of angiostrongyliasis there in the year 2000 (Asato et al. 2004). The semi-slug is also a recent immigrant to the Hawaiian Islands (Cowie, 1997) and is thought to be responsible for a recent outbreak of angiostrongyliasis cases on the Island of Hawai'i (Hollingsworth et al. 2007). In the area where the disease outbreak occurred (Puna district of the Island of Hawai'i), *P. martensi* were very numerous and some of them were heavily infected (>75% infected) with L3 *A. cantonensis* larvae (Hollingsworth et al., 2007). There are a number of studies that have been done on rat lungworm in China, Thailand and Taiwan, where most cases have originated. At this time, there is no medical research that has been done in Hawai'i.

**Q. Do rat predators (i.e. cats) contract the disease?**

At this time there have been no reported cases of cats contracting the disease, in spite of the fact that they are predators of rats. There have been cases of dogs and horses getting the disease.

**Q. Can slug-eating livestock get RLW, i.e. chickens or ducks? Can slug eating chickens pass it on to us through eggs or meat?**

The parasite cannot be passed on through meat or eggs. It is not known at this time if chickens can get the disease from eating slugs. However, studies done in Australia have shown that parrots can contract the disease.

**Q. Are sushi and poke safe?**

There is no reason that the fish, in sushi and poke, would have the parasite. It would have to be contaminated from an outside source, i.e. a slug crawling onto the sushi/poke and a person accidentally ingesting said item.

**Q. Can mongoose transmit?**

The only people I know who have tested it are Ralph Robinson et al. in Jamaica. They tested approximately 150 mongooses (same mongoose species as here in Hawai'i) and found no evidence that mongooses are hosts of *A. cantonensis*.

**Q. What kind of cooking is necessary to kill the parasite on leafy greens, etc.?**

The public Health Agency of Canada reports ([www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/acantonensis-eng.php](http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/acantonensis-eng.php)):  
Physical Inactivation: Inactivation can be achieved by exposure to -15°C for 12 to 24 hours or by boiling for 2–3 minutes. There has been some research on freezing as a way to totally eliminate the parasites in the bodies of giant African snails. It takes about 2 or 3 days before the animal is totally solid. However, that method is not very practical for lettuce.

**Q. Are severe cases common or are most cases minor?**

Approximately 2 to 3 years ago there was a very significant change in the nature of this disease as we're seeing it in the state of Hawai'i. Severe cases were extremely rare before about 3 years ago. The severity of the disease probably relates to the severity of the infestation. The more worms ingested in the 3rd phase, the higher the parasite load, and the more severe the damage. Severe cases are being discussed because it marks a change in the nature of this disease. Severe cases aren't common, but we run the very significant risk that they will become more common if the disease is not dealt with in a basic epidemiological way.

A thorough review of all cases, including those considered unconfirmed, would need to be done to completely answer this question. There have been a number of serious cases on Hawai'i Island, with most taking 6 or more months to begin to resolve themselves, and many reporting on going symptoms 6-10 years later.

**Q. Is there any kind of immunity against RLW if you've been infected previously?**

People have reported getting this disease two and three times or more on Hawai'i Island. This implies a lack of long-lasting immunity. However, a vaccine against *A. costaricensis* has been shown to be effective in mice and funding has been obtained by the Rat Lungworm Working Group to test this vaccine against *A. cantonensis* in wild Hawaiian rats (*Rattus rattus*). We are providing two recently published general reviews on immunity to helminthes as well as a reference to the vaccine.

**Q. Is there any evidence that anti-helminth meds (mebendazole, albendazole, ivermectin) work in acute infection or is it all experimental/theoretical? Could these meds actually worsen clinical course due to acute die off?**

The jury is still out on the use of the anthelmintics in treatment of rat lungworm disease. Physicians are concerned that the parasite die off might cause more inflammation in the brain, which could worsen a patient's condition. However, these drugs have been used in very serious cases, where the patient was not expected to survive and evidence of worm tracks could be seen in brain MRIs. We have had serious cases here on the island where these drugs have been prescribed and the patients did recover. An early detection diagnostic is sorely needed on the Big Island and the RLW working group is in the early stages of testing in a rat model.

**Q. Can we prevent slugs and snails from getting to produce by using a copper band or some kind of spray on chemical like copper hydroxide?**

Yes, copper does repel, but it's not 100%. There have been tests in the laboratory with copper bands and semi-slugs as well as other slugs were tested to see if they would cross it, but it depends on the width of the band. They generally turn around and go the other way, but sometimes they got confused and went across the band; so it doesn't always work.

**Q. Will UV light kill slugs and snails and their nematodes?**

We don't think so; otherwise they would be dead in the environment. Studies would have to be completed using various intensities of UV light on isolated larvae to evaluate any effects.

**Q. To what extent is the disease treatable?**

There is no specific treatment for *A. cantonensis* infection. There is some evidence that certain supportive treatments may reduce the severity of headache and the duration of symptoms. Persons with symptoms should consult their health care provider for more information.

**Q. Can rat lungworm disease be contracted directly from rat urine/droppings?**

We don't think so. The first stage larvae have only been found in rat droppings and it is the third stage larvae that cause infection in humans. It is demonstrated that the larvae continue their development to the third stage when ingested by slugs and snails.

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