Unraveling the Epidemiology of *Angiostrongylus cantonensis* in the Southeastern United States: A One Health Approach

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Project Narrative

Abstract :

This research aims to elucidate the transmission dynamics of *Angiostrongylus cantonensis* within coastal, freshwater, and urban ecosystems in the Southeastern USA. Focusing on urban, brackish, and freshwater habitats—including riparian zones, wetlands, lakes, and ponds—we will identify gastropod and other invertebrate hosts, assess the prevalence of *A. cantonensis* across terrestrial and aquatic species, and evaluate the influence of invasive species and habitat conditions on parasite persistence. Our integrated approach aligns with the One Health framework by studying wildlife, environmental, and potential human exposure pathways, particularly in ecologically sensitive coastal wetlands and urban waterways. Outcomes will inform management strategies to mitigate zoonotic and ecological impacts of this emerging pathogen.

Introduction:

Angiostrongylus cantonensis (rat lungworm) is an emerging zoonotic parasite of increasing concern in the southeastern United States (1,2,3,4). This nematode, traditionally associated with Asia and the Pacific Islands, has expanded its range dramatically in recent decades. The parasite's life cycle involves rodents as definitive hosts, gastropods (snails and slugs) as intermediate hosts, and various organisms as paratenic hosts (5,6). In humans and other aberrant hosts like dogs, *A. cantonensis* can cause severe neurological disease, including eosinophilic meningitis for which it has the distinction of being the leading cause of eosinophilic meningitis of humans in the world (7).

The southeastern United States has experienced significant ecological changes with the introduction of multiple invasive gastropod species that may serve as competent intermediate hosts. The recent discovery of *A. cantonensis* in novel definitive hosts beyond typical Rattus species, such as the hispid cotton rat (Sigmodon hispidus) in Oklahoma, suggests the parasite's life cycle is adapting to local ecological conditions (8). In Florida, the parasite has been identified in various wildlife including non-human primates and birds of prey, indicating complex transmission dynamics that remain poorly understood and oftentimes resulting in high morbidity or even mortality (9).

Aquatic environments, especially wetlands and estuaries, are ideal habitats for invasive species such as mystery snails, invasive fish, and introduced rats. These habitats can serve as hot spots for parasite life cycle completion, especially considering the potential for *A. cantonensis* larvae to survive in water, intermediate hosts, and mechanically infect piscivores and omnivores—raising concerns for aquatic mammals, birds, and even

recreational fishers consuming undercooked seafood. Furthermore, urban waterways and aquarium habitats often harbor invasive rodents and gastropods, with some populations identified as sources of environmental contamination and vectoring of the parasite.

The emergence of this parasite in Georgia and Florida represents a concerning northward expansion (10). Particularly alarming is the recent detection of infected Florida Burrowing owls, suggesting novel transmission pathways through predator-prey relationships in imperiled species (11). The presence of both native and invasive gastropod species, coupled with diverse potential paratenic hosts including insects, reptiles, amphibians, and freshwater crayfish, creates a complex epidemiological landscape that requires a One Health approach to unravel. Understanding these ecological interactions, particularly amid complex coastal and inland ecosystems, is essential for anticipating and mitigating *A. cantonensis* transmission risks within a One Health framework that integrates wildlife health, ecosystem integrity, and human safety.

Despite increasing reports of *A. cantonensis* in wildlife and occasional human cases, critical knowledge gaps remain regarding: [1] the relative importance of different gastropod species as intermediate hosts; [2] the role of various paratenic hosts in transmission; and [3] the ecological factors facilitating transmission to non-rodent definitive hosts like Florida burrowing owls.

Project Goals:

- Identify and characterize gastropod intermediate hosts in Georgia and Florida, determining their relative importance in *A. cantonensis* transmission
    - Compare prevalence between native and invasive gastropod species
    - Differentiate morphologically similar invasive species (e.g., Japanese and Chinese mystery snails) through molecular barcoding
    - Assess differences in parasite prevalence between terrestrial and aquatic gastropods

- Determine *A. cantonensis* prevalence in potential paratenic hosts and their role in transmission
    - Examine insects, myriapods, amphibians, reptiles, and freshwater invertebrates to Identify high-risk paratenic hosts for human and animal exposure

Methods:

Gastropod and Invertebrate Sampling:
We will conduct systematic collection of terrestrial and aquatic gastropods across Georgia, with collaborative sampling in Florida. All specimens will undergo molecular barcoding for accurate species identification and be screened for *A. cantonensis* using real-time PCR targeting the 18s and 66-kDa regions. Positive samples will undergo confirmatory sequencing to verify parasite identity

Paratenic Host Assessment:
We will collect paratenic hosts from and around sampled water bodies, focusing on those

with high gastropod populations. Tissue digestion and microscopic examination will be performed to detect and quantify Rat lungworm larvae, with molecular confirmation.

One Health Framework

By leveraging field, laboratory and computational studies we aim to provide insight into *A. cantonensis* transmission dynamics and host-parasite interactions. We hope for such data to inform sustainable Onehealth solutions addressing emerging parasitic threats through integrated human, animal, and environmental health approaches. This research will provide crucial transmission data, assess wildlife impacts, identify exposure risks, evaluate human activity roles in spread, and demonstrate integrated ecological-veterinary-public health approaches.

Importance & Contribution

Given the rapidly expanding range of *A. cantonensis* in the southeastern United States, establishing baseline data on transmission dynamics in this emerging system is imperative. These findings will be provided to local public health officials and policy makers, providing important context for targeted surveillance strategies. By integrating molecular and ecological approaches, we access detailed host community data to stratify analysis and cost-effectively maximize sample utility. As per One Health recommendations, community engagement will be central to our approach. We will work closely with Marco Island homeowners who host burrowing owl families in their urban lawns through community feedback workshops. Our research will inform evidence-based protocols that protect both human health and wildlife conservation priorities. Our findings will serve as a model for implementing the One Health paradigm in managing other emerging parasitic diseases, filling critical knowledge gaps identified by regional public health agencies.

Budget

Item	Quantity	Cost Per (USD)	Total (USD)
Confirmatory Sequencing	166	$3	$498
qPCR Reagents & Kit (cost per sample)	160	$25	$4,000
Travel	1	$500	$500
Total Budget			$4,998

Word Count: 971

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