The RNA virome of parasitic nematodes

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1. Background

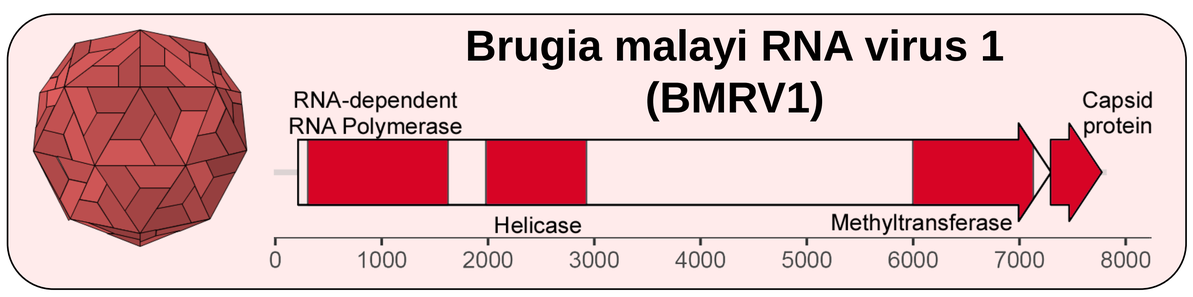
- Parasitic nematodes infect billions of humans and animals worldwide
- They cause significant impacts on mental and physical health, as well as economic productivity
- Basic biology knowledge for several species is lacking, e.g. role of microbiome, and specifically their “RNA virome”

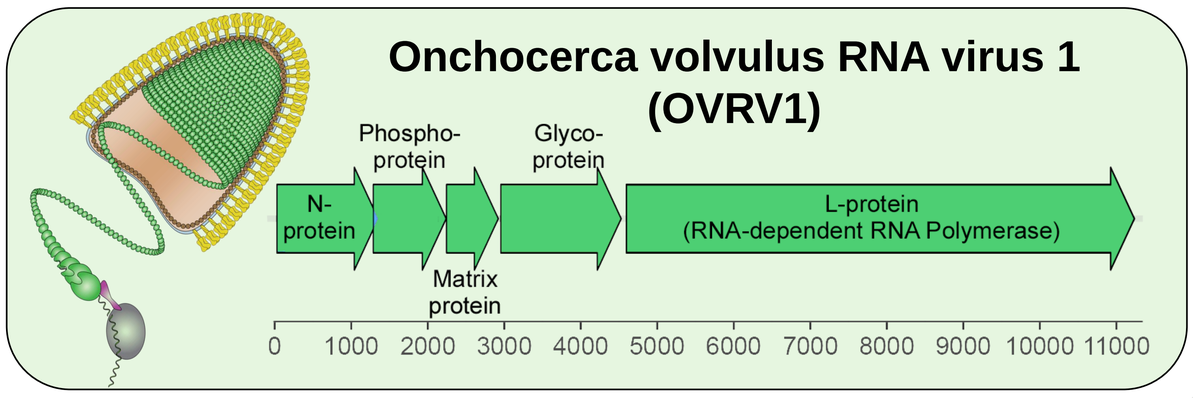
2. Results

Order	Nematode Species	Definitive host	Viruses
Spirurida	*Brugia malayi*	Humans, monkeys, cats, dogs	1
	Brugia pahangi	Cats, dogs	2
	Onchocerca volvulus	Humans	6
	Onchocerca ochengi	Cattle	11
	Anguillicola crassus	Eels	1
Ascaridida	*Ascaris suum/lumbricodes*	Pigs, humans	4
	Toxocara canis	Dogs	7
	Ancylostoma ceylanicum	Humans, dogs, cats	4
Strongyloida	*Angiostrongylus cantonensis*	Rodents	2
	Dictylocalus viviparus	Cattle	2
	Haemonchus contortus	Ruminants	2
	Heligmosomoides polygyrus	Rodents	3
	Nippostrongylus brasiliensis	Rodents	5
	Oesophagostomum dentatum	Swine	2
	Ostertagia ostertagi	Ruminants	3
	Teladorsagia circumcincta	Sheep, goats	1
Trichinellida	*Encapsulated Trichinella spp.*	Human, swine, ursine	2
	Trichinella pseudospiralis	Human, swine, ursine	7
	Trichuris muris	Mouse	10
	Trichuris suis	Swine	5
	Trichuris trichiura	Humans, primates	3

Bioinformatic analysis of previously published transcriptome data identified 91 different RNA viruses across 28 species of parasitic nematodes of medical and veterinary importance.

Further characterization of two viruses

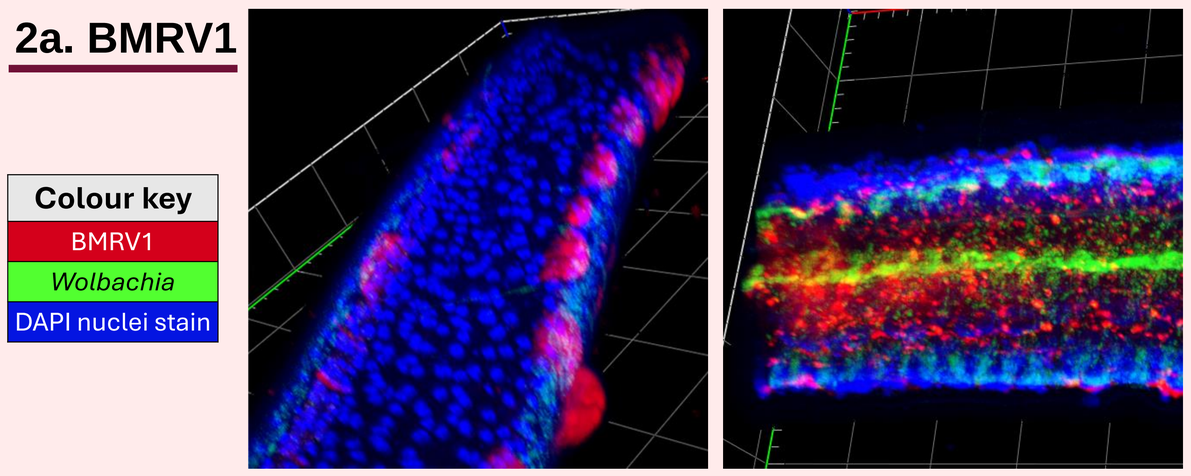




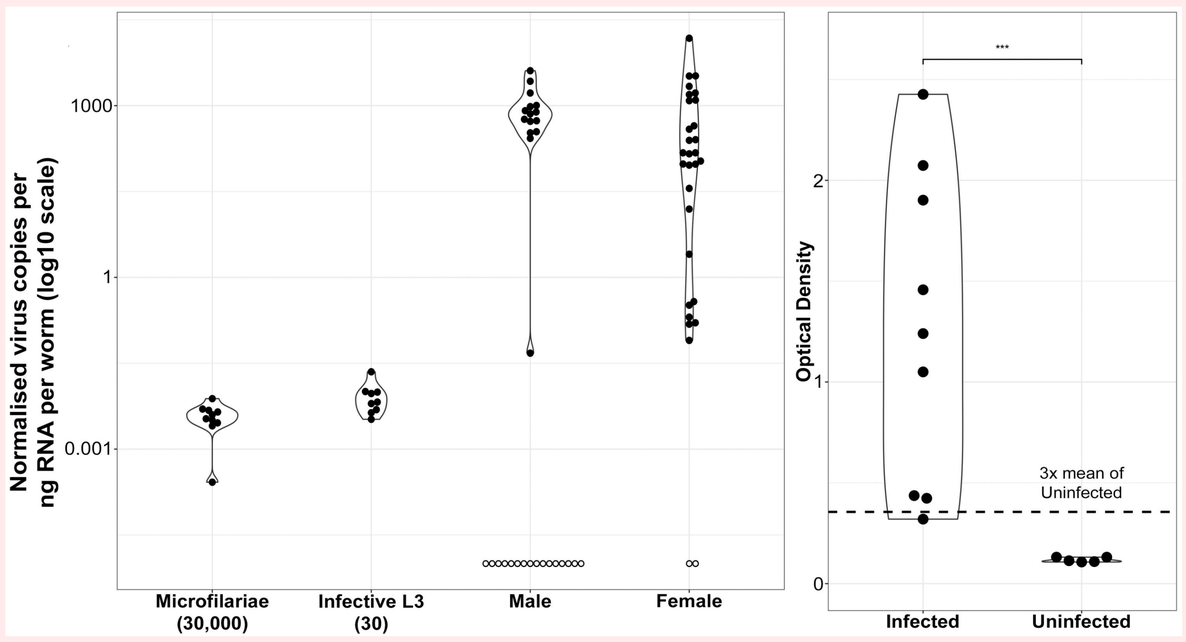
3. Major conclusions

- From published transcriptome data, we have identified 91 RNA viruses from 28 different parasitic nematode species
- We find extensive diversity and conserved global spread of virus-nematode associations across multiple continents, suggesting ancestral acquisition and host-virus co-evolution
- Viruses of *Brugia malayi* (BMRV1) and *Onchocerca volvulus* (OVRV1) are found in the reproductive tract suggesting sexual/vertical transmission
- BMRV1 RNA can be found in epicuticular inflations in older parasites
- BMRV1 and OVRV1 elicit antibody responses from the vertebrate host, demonstrating direct exposure to the immune system
- Interactions between parasite-virus are unknown, with potential effects on parasite biology/disease pathogenesis unknown
- Identified viruses are a novel paradigm for understanding parasitic nematode diseases

2a. BMRV1

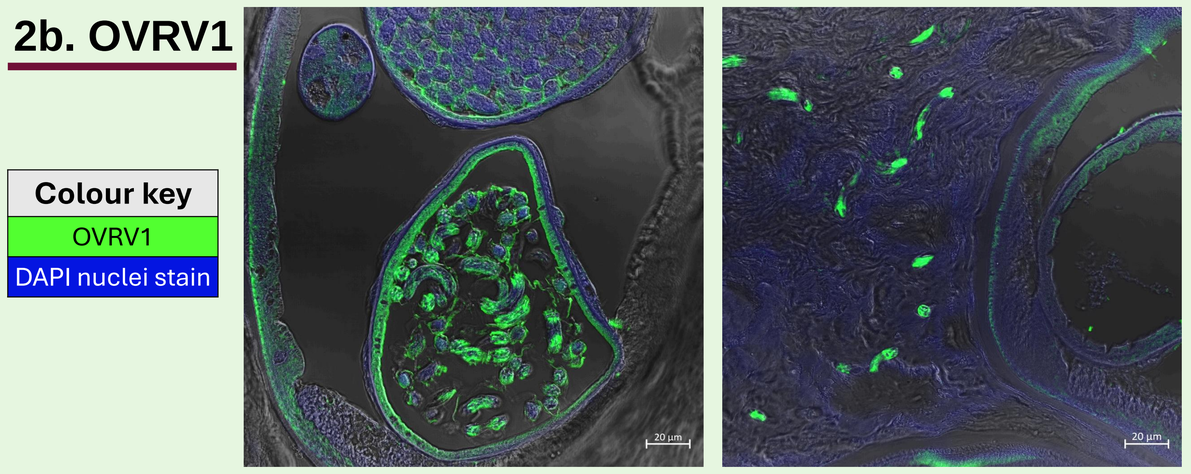


BMRV1 tissue tropism in *Brugia malayi* – confocal microscopy localizes viral signal to ‘worm warts’ within epicuticular inflations (left panel) and within reproductive tissues (right panel).

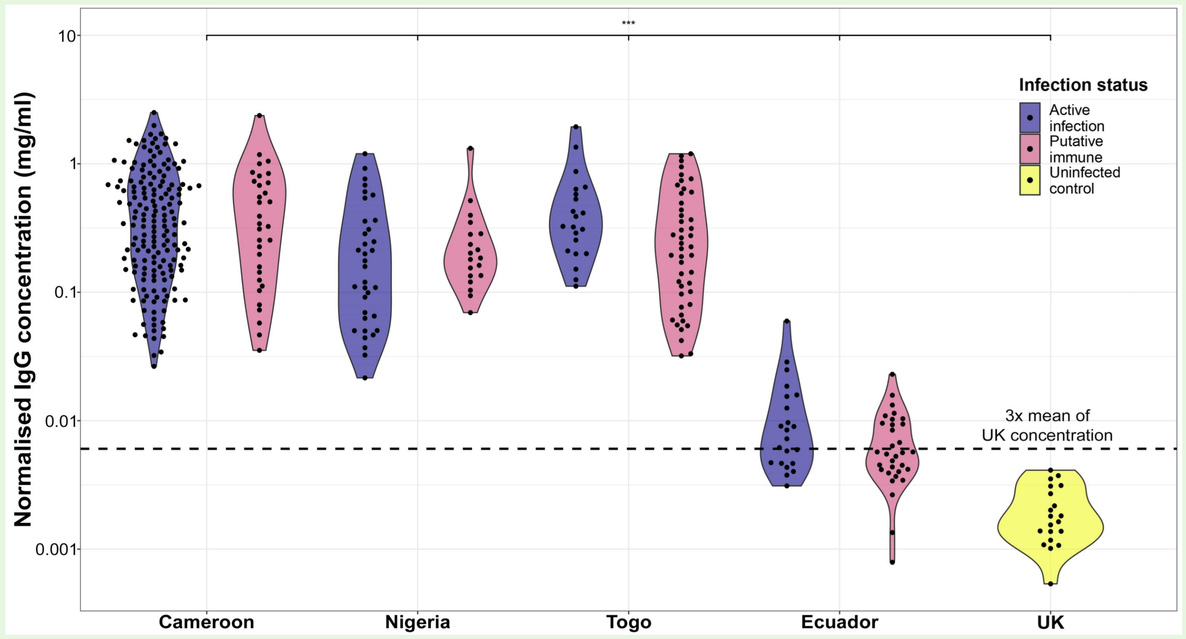


(Left) BMRV1 abundance within life-cycle stages, with low levels in larval stages that expand in adults (1.65-1.83 X 10^5 fold) with 48% of adult males and 93% of adult females infected with BMRV1. (Right) Antibody reactivity of *B. malayi* infected jirds to BMRV1 capsid protein.

2b. OVRV1



OVRV1 tissue tropism in *Onchocerca volvulus*– OVRV1 IFA localizes viral signal to reproductive tissues and developing embryos (left) and in microfilariae within nodular tissues (right).



Antibody serology of *Onchocerca volvulus* infected and exposed individuals to OVRV1 surface glycoprotein show all studied African communities are sero-positive for OVRV1 with a reduced sero-positivity in Ecuadorian populations.

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Research was funded by the Liverpool School of Tropical Medicine’s Director’s Catalyst Fund.

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