PhD Project Advertisement

Project title: Environmental DNA from Fasciola parasites as a novel biomarker to improve agriculture in the UK
Project No: FBS2022-27-Gobert-qa

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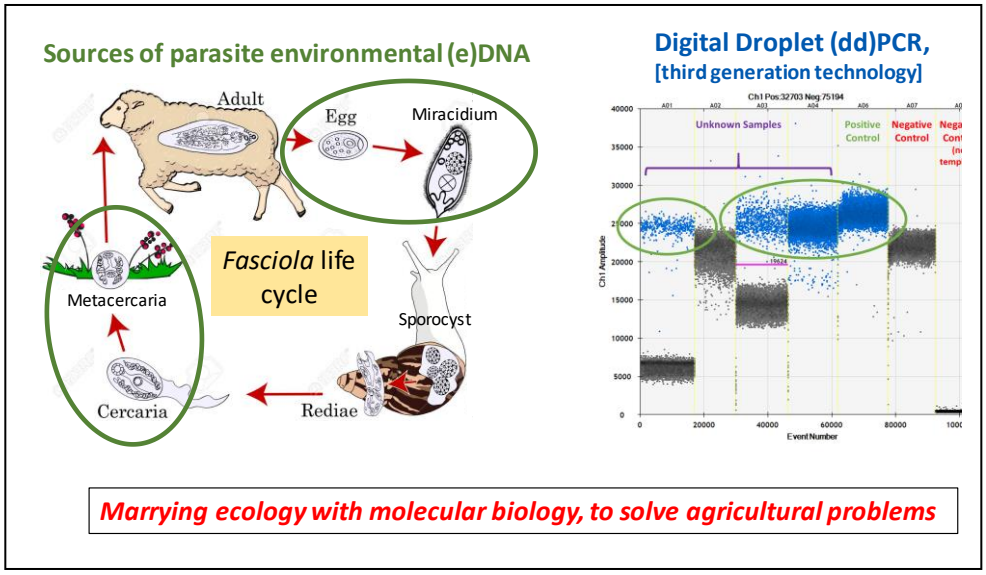
Project description:

Fasciola hepatica, usually termed "the temperate liver fluke", is found worldwide and causes disease known as fasciolosis. This infection caused by helminth parasites, primarily impacts on ruminant production, including within the UK and many other European countries. As a food-borne disease, fasciolosis occurs from the consumption of infective larvae by ruminant animals. Fasciolosis greatly reduces global agricultural outputs in both developing and developed communities, through production inefficiency in millions of ruminants. UK annual economic losses are estimated at £110 million, while internationally the impact is considerably larger, with as an example, India reports $4.8 billion (USD) in loses every year. Fasciolosis is also an important disease of humans, and is acknowledged by the World Health Organization (WHO).

All organisms shed DNA into their environment, this material is known as eDNA. The detection of this eDNA allows the classification of species diversity and abundance in an environment. During certain phases of the *Fasciola* lifecycle, parasites are present in the environment in order to infect either the snail or animal host (see Figure). It is at these times the parasite also leaves eDNA behind. The improved detection of this eDNA is the central basis of this project. While low levels of eDNA is expected in water or soil, or on plants, new innovative molecular methods will be used to overcome these issues. This will include the third generation technology- droplet digital PCR (ddPCR- see Figure), which greatly increases DNA detection sensitivity and reproducibility. ddPCR also as a fully quantitative method, simplifies the assay and provides better results.



Your project will drive a step-change in the way eDNA analysis is considered for the detection of important

helminth parasites of agricultural significance. You will do this by examining a range of environmental samples, including water, soil and grass for the presence of *Fasciola* parasite activity represented by their eDNA. To do this you will lead field collections, in partnership with long time collaborating sheep farmers of the Belfast region in Northern Ireland. These novel samples will be characterised by the highly sensitive ddPCR technology, in order to provide comprehensive quantitative measurements of parasite/vector (snail) eDNA. eDNA represents a less invasive and less labor intensive approach to disease monitoring.

In detecting parasitic infections earlier, the use of drugs (anthelmintics) can be reduced or avoided. This can be achieved through intelligent pasture management - rotating animals around pastures according to their age, species and season, relative to the perception of infection risk in those pastures. Future applications for the approaches you will develop, will allow farmers to make decisions more effectively through accessing improved, more relevant data from their own farms.

Training opportunities:

There will be regular requirements to undertake field collections at farm sites within 1-2 hours of Belfast. These visits will provide a unique opportunity to engage with agricultural industries and key stakeholders of your project. While primarily based in Queen's University Belfast, Northern Ireland, the student will also biannually visit their co-supervisor at the Aberystwyth University. While there, they will receive addition feedback, learn new techniques, and discuss how their results may be applied to the field settings of Wales.

The student will be trained in field site collection management (ecology) and subsequent molecular techniques (molecular biology). Geographical Information System methods will also be incorporated into the student training. The AU co-supervisor will provide training in skills associated will translational research.

Student profile:

This studentship is available only to individuals who are eligible for UK fees status. The project would be suitable for students with a 2:1 or higher degree in biology, ecology, agriculture or molecular biology, or other closely related subjects. The student should possess a strong background or interest in molecular biology and parasitology, and be prepared to undertake field site collections in agricultural settings. The student must hold or be eligible to hold, a Northern Ireland unrestricted driver's license.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2022/23 this will be £16,062 and this will increase slightly each year at rate set by UKRI.

For up to date information on funding eligibility, studentship rates and part time registration, please visit the FoodBioSystems website.

Equality Diversity and Inclusion:

The FoodBioSystems DTP is committed to equality, diversity and inclusion (EDI), to building a doctoral researcher(DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the FoodBioSystems DTP website.

In accordance with UKRI guidelines, our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

References:

- Davis C et al (2020) Rapid detection of *Galba truncatula* in water sources on pasture-land using loop-mediated isothermal amplification for control of trematode infections Parasite & Vectors 13, 496.
- Jones R et al (2018) Detection of *Galba truncatula*, *Fasciola hepatica* and *Calicophoron daubneyi* environmental DNA within water sources on pasture land, a future tool for fluke control? Parasites & Vectors 11: 342.