Update on rumen fluke and 'other' fluke in UK livestock

Philip Skuce[1], Ruth Zadoks[2] & Neil Sargison[3]

[1]Moredun Research Institute, [2]Glasgow University Vet School,[3]Royal (Dick) School of Veterinary Studies, University of Edinburgh

COWS - Control of cattle parasites sustainably

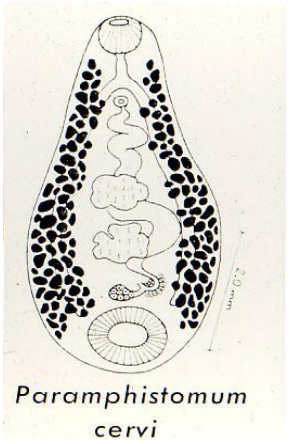
UNIVERSITY OF LIVERPOOL

COWS Fluke R&D Workshop,
Liverpool University, 11th March 2013

Moredun

Rumen fluke - paramphistomes

- Digenean (2-host) trematode parasites of sheep, goats, cattle, deer etc.
- Name derives from ‘double-mouth’, 2-sucker morphology
- Have been described in UK livestock as far back as 1950s – abattoir study in Glasgow
- species thought to be *Paramphistomum cervi* (+/- *P. hiberniae* & *P. scotiae)*
- wildlife ⟷ livestock?
- Rumen fluke eggs started to appear in ROI & UK diagnostic samples late 2000s (Murphy *et al*, 2008; Foster *et al*, 2008
- Has similar life-cycle to liver fluke and often found as co-infections in sheep & cattle



(5) S. WILLMOTT 159

Acetabulum : Paramphistomum type. Measurements were taken on sagittal sections. The external diameter is taken from the membrane which delimits the tissue of the acetabulum from the body parenchyma ; the internal diameter is the diameter of the cavity of the acetabulum.

External diameter :	1.5 mm.—1.7 mm.	Average 1.65 mm.
Internal diameter :	0.9 mm.—1.0 mm.	Average 0.95 mm.
Internal diam./body length :	1/5.0—1/6.2.	Average 1/5.7.
Diameter of opening :	0.2 mm.—0.5 mm.	Average 0.38 mm.

Circular muscles	No. of units	Average
Dorsal external 1	15–23	19
Dorsal external 2	26–39	30
Dorsal internal	42–48	46
Ventral internal	47–58	50
Ventral external	17–22	19

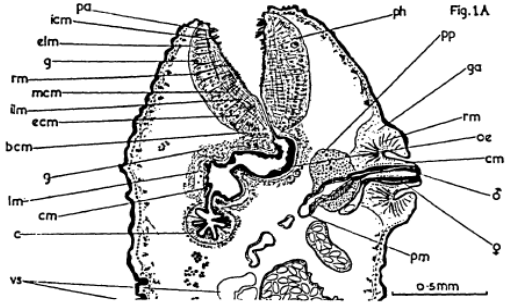
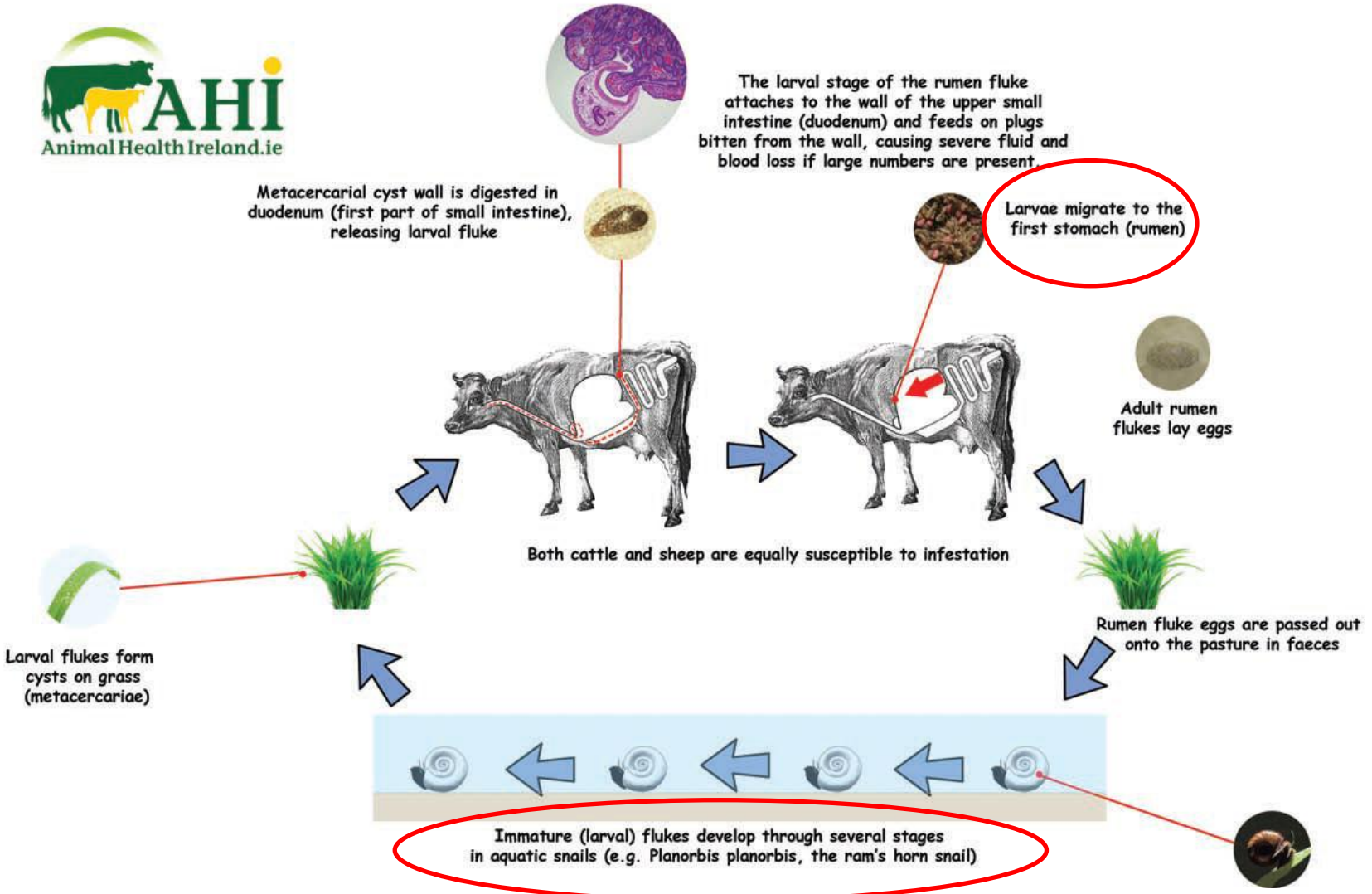


Fig. 1a. *P. hiberniae* n.sp. Genital atrium and pharynx.

Pharynx : (Fig. 1a). Modified *Liorchis* type. The middle and external circular muscle layers are better developed in the posterior two-thirds of the pharynx. At the anterior end they are quite indistinct. The papillae are fairly long round the opening of the pharynx to the exterior but become progressively smaller towards the oesophageal end, where they are inconspicuous or lacking. Under an oil immersion objective it is possible to distinguish strands running into the papillae

Willmot, J. Helminth. 1950;24:155-170

Rumen fluke life-cycle



How prevalent is it now?...

- More common in Ireland than liver fluke:

  - e.g. diagnosed in ~31% of sheep & 44% of cattle in NI (AFBI 2011)

- Sales of flukicides containing Oxyclozanide in Ireland have increased x 600% in 2012

- UK diagnoses based on Faecal Egg detection and finding adults in rumen at post mortem (data, AHVLA VIDA):

- 60 month period 22.01.07 to 21.01.12 SAC = 9; AHVLA = 188
- 12 month period 21.01.12 to 21.01.13 SAC = 20; AHVLA =119

i.e. 'big upsurge in diagnoses in last 12 months'

(R. Daniel, AHVLA, pers comm)

Surveillance

TABLE 2: Endoparasitic infections in ruminants in Northern Ireland, January to March 2011

	Total	Number negative	Number with <500 epg	Number with ≥500 epg*	Number of parasitic ova +	++	+++	++++	Percentage positive
Liver fluke									
Bovine	797	693			83	20	1	0	13.1
Ovine	79	63			9	5	1	1	20.3
Paramphistomes									
Bovine	797	448			155	138	34	22	43.8
Ovine	79	54			13	10	2	0	31.6
Coccidia									
Bovine	910	814			82	6	5	3	10.5
Ovine	102	62			25	7	1	7	39.2
Strongyle worm egg count									
Bovine	873		851	22					2.5
Ovine	101		89	12					11.9

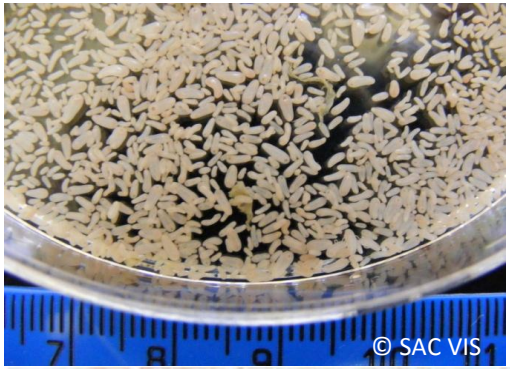
* ≥500 epg was considered of likely clinical significance
+ Low, ++ Moderate, +++ High, ++++ Very high

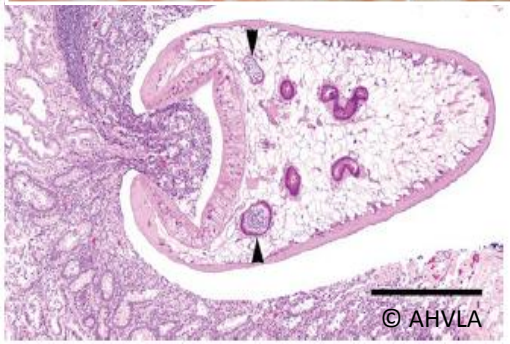
Vet Record, May 25, 2011

How important is it?...

- Topic really divides opinion in veterinary community
- Adult rumen fluke well tolerated on surface of rumen itself
- Disease invariably associated with heavy infestations of immature rumen fluke in the intestine
- 2 reports of disease and death in young stock, one in sheep, one in cattle, in 2012; common denominator – flooded farms!

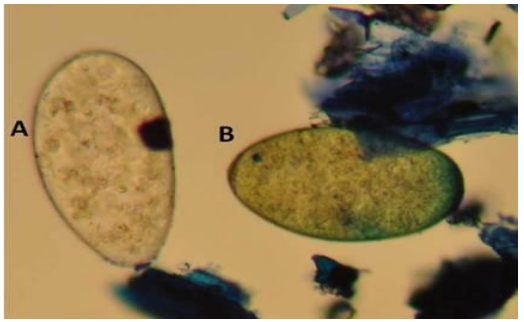
  (Mason *et al*; Millar *et al* 2012, Vet Record)
- Symptoms include anorexia, anaemia, ill-thrift, non-responsive diarrhoea etc…variously described as 'profuse, fetid, projectile, bloody'…



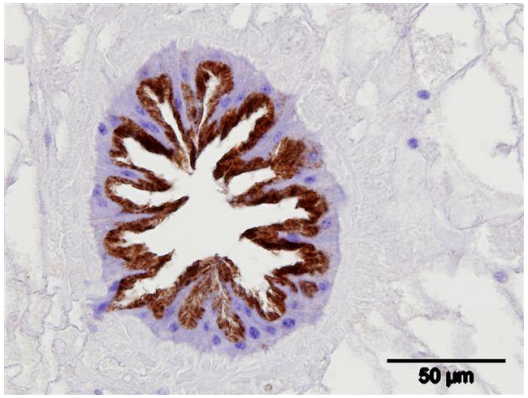


Implications for liver fluke diagnosis?

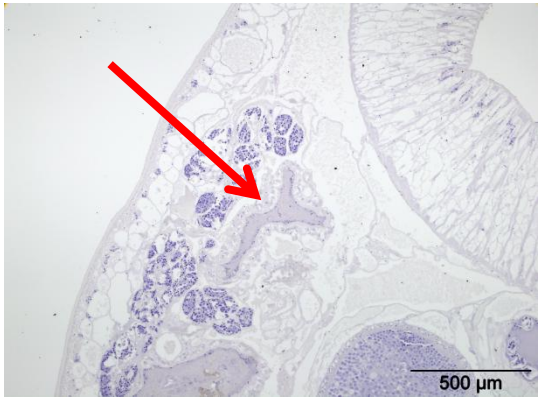
- Faecal egg count – eggs could be confused, leading to mis-interpretation of liver fluke treatment outcome?



- Faecal antigen ELISA – MM3 Mab from commercial Bio-X kit – specific for *F. hepatica*, does NOT cross-react with rumen fluke



A. Liver fluke



B. Rumen fluke

Paper

Specificity of a coproantigen ELISA test for fasciolosis: lack of cross-reactivity with *Paramphistomum cervi* and *Taenia hydatigena*

P-E. Kajugu, R. E. B. Hanna, H. W. Edgar, F. I. Forster, F. E. Malone, G. P. Brennan, I. Fairweather

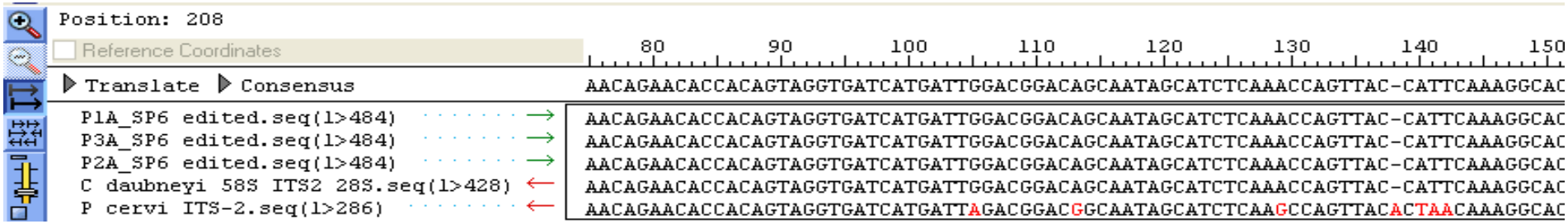
A commercial coproantigen ELISA test for fasciolosis, based on the use of MM3 monoclonal antibody for antigen capture, was investigated for possible cross-reactivity with ***Paramphistomum cervi***, a trematode that commonly infects cattle and sheep grazing in fluke-infested pasture in Ireland. Histological sections of adult and immature ***Fasciola hepatica*** and ***P cervi*** were incubated with MM3 monoclonal antibody, and its binding to tissue-localised coproantigen was subsequently visualised by immunocytochemistry. In a related study, the soluble antigenic fractions derived from homogenates of ***P cervi*** adults and ***Taenia hydatigena*** metacestodes were tested for cross-reactivity with MM3 monoclonal antibody in an antigen-capture ELISA, using known ***F hepatica***-positive and ***F hepatica***-negative ovine faecal samples as natural controls. It was found that, while intense immunocytochemical labelling was located over the gastrodermis and gut contents of adult and immature ***F hepatica***, sections of adult and immature ***P cervi*** were unlabelled. In the ELISA tests, the soluble fractions of ***F hepatica*** reacted strongly with MM3 monoclonal antibody, but those of ***P cervi*** and ***T hydatigena*** gave negative results. These findings support the specificity of the coproantigen ELISA test for fasciolosis in areas where paramphistomosis and cysticercosis are liable to occur singly or as coinfections with ***F hepatica***.

Vet Record, Oct 2012

Rumen fluke species identification

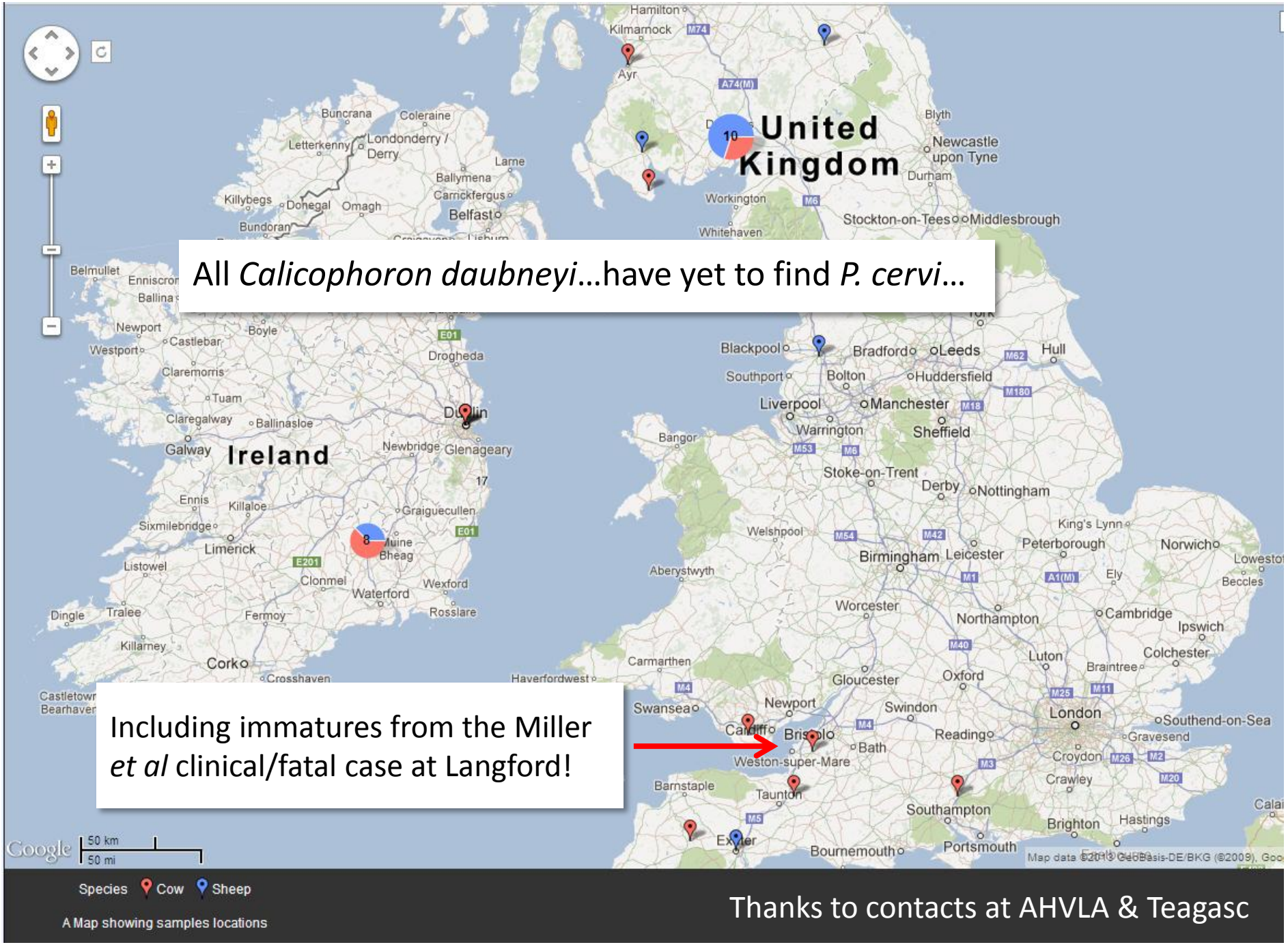
- Presumed to be *Paramphistomum cervi* in UK
- Rumen fluke (adult, juvenile, eggs) from home-bred Scottish cattle and sheep
- PCR and DNA sequencing of ITS-2 region: database searching & sequence alignment…

→ ***Calicophoron daubneyi*** **– the predominant rumen fluke species in mainland Europe e.g. France, Spain, Italy…**

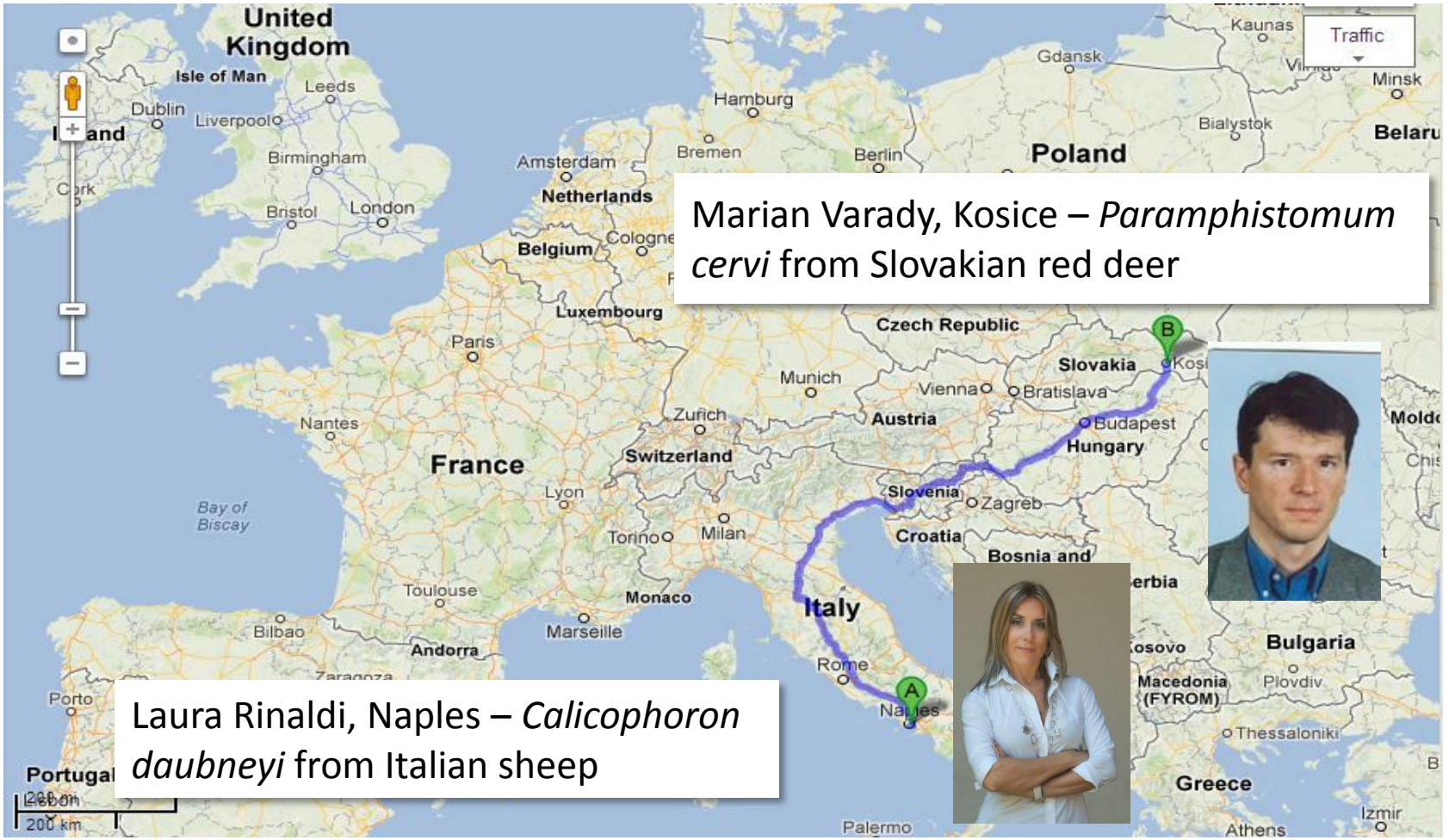


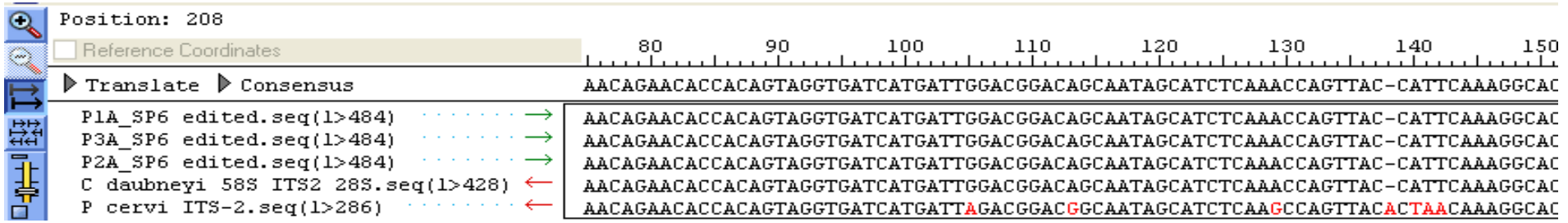
Gordon et al, Vet Para, 2013

- Wanted to broaden our search in UK & Ireland…


All *Calicophoron daubneyi*…have yet to find *P. cervi*…
Including immatures from the Miller *et al* clinical/fatal case at Langford!
United Kingdom
Ireland
10
8
17
Species Cow Sheep
A Map showing samples locations
Thanks to contacts at AHVLA & Teagasc

Sourcing reference specimens…





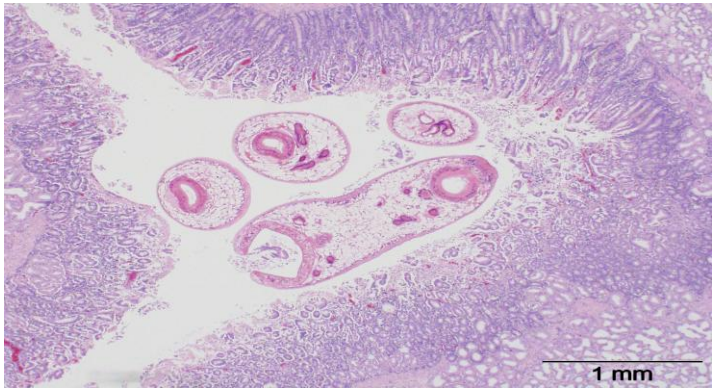
Calicophoron daubneyi - what's in a name?

Q1. How did it get here?

Animal transport? Theories include European water buffalo coming in to S. England – but it's endemic across UK & ROI!?

Q2. How long has it been here?

Extracting DNA from archived clinical material from AHVLA (paraffin wax blocks) – ITS-2 PCR works, sequencing in progress – watch this space!

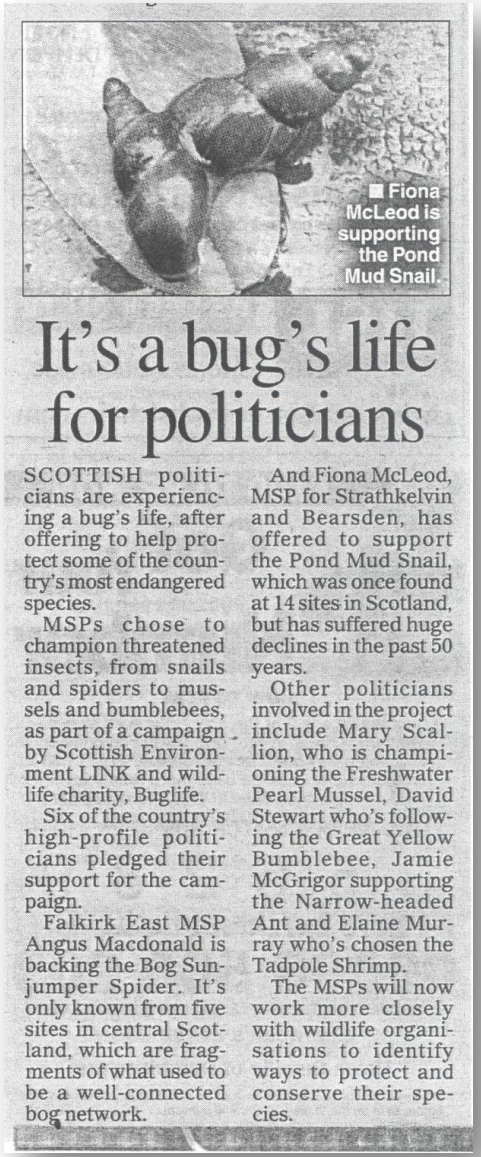


Q3. Implications for epidemiology/ disease?

Pathogenicity?
+/- Wildlife host?
Snail intermediate host?

?

On the subject of snails!…



■ Fiona McLeod is supporting the Pond Mud Snail.

It's a bug's life for politicians

SCOTTISH politicians are experiencing a bug's life, after offering to help protect some of the country's most endangered species.

MSPs chose to champion threatened insects, from snails and spiders to mussels and bumblebees, as part of a campaign by Scottish Environment LINK and wildlife charity, Buglife.

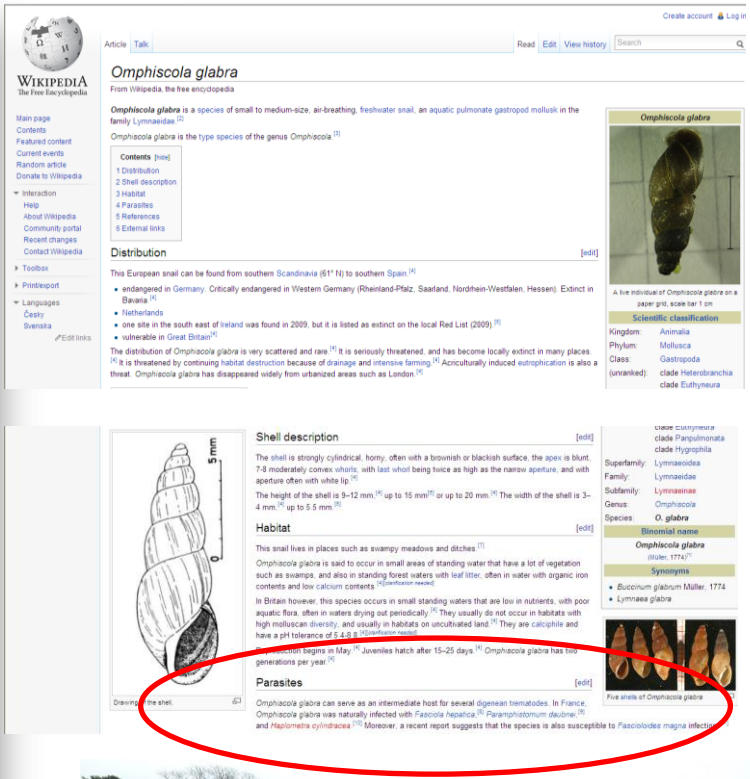
Six of the country's high-profile politicians pledged their support for the campaign.

Falkirk East MSP Angus Macdonald is backing the Bog Sun-jumper Spider. It's only known from five sites in central Scotland, which are fragments of what used to be a well-connected bog network.

And Fiona McLeod, MSP for Strathkelvin and Bearsden, has offered to support the Pond Mud Snail, which was once found at 14 sites in Scotland, but has suffered huge declines in the past 50 years.

Other politicians involved in the project include Mary Scallion, who is championing the Freshwater Pearl Mussel, David Stewart who's following the Great Yellow Bumblebee, Jamie McGrigor supporting the Narrow-headed Ant and Elaine Murray who's chosen the Tadpole Shrimp.

The MSPs will now work more closely with wildlife organisations to identify ways to protect and conserve their species.



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Omphiscola glabra

From Wikipedia, the free encyclopedia

Omphiscola glabra is a species of small to medium-size, air-breathing, freshwater snail, an aquatic pulmonate gastropod mollusk in the family Lymnaeidae.[2]

Omphiscola glabra is the type species of the genus *Omphiscola*.[3]

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Distribution

This European snail can be found from southern Scandinavia (61° N) to southern Spain.[4]

- endangered in Germany. Critically endangered in Western Germany (Rheinland-Pfalz, Saarland, Nordrhein-Westfalen, Hessen). Extinct in Bavaria.[5]
- Netherlands
- one site in the south east of Ireland was found in 2009, but it is listed as extinct on the local Red List (2009).[6]
- vulnerable in Great Britain[4]

The distribution of *Omphiscola glabra* is very scattered and rare.[4] It is seriously threatened, and has become locally extinct in many places.[4] It is threatened by continuing habitat destruction because of drainage and intensive farming.[4] Agriculturally induced eutrophication is also a threat. *Omphiscola glabra* has disappeared widely from urbanized areas such as London.[4]

Omphiscola glabra

A live individual of *Omphiscola glabra* on a paper grid, scale bar 1 cm

Scientific classification

Kingdom:	Animalia
Phylum:	Mollusca
Class:	Gastropoda
(unranked):	clade Heterobranchia
	clade Euthyneura
	clade Panpulmonata
	clade Hygrophila
Superfamily:	Lymnaeoidea
Family:	Lymnaeidae
Subfamily:	Lymnaeinae
Genus:	*Omphiscola*
Species:	***O. glabra***

Binomial name
Omphiscola glabra
(Müller, 1774)[1]

Synonyms
- *Buccinum glabrum* Müller, 1774
- *Lymnaea glabra*

5 mm

Shell description

The shell is strongly cylindrical, horny, often with a brownish or blackish surface, the apex is blunt, 7-8 moderately convex whorls, with last whorl being twice as high as the narrow aperture, and with aperture often with white lip.[4]

The height of the shell is 9–12 mm,[4] up to 15 mm[5] or up to 20 mm.[4] The width of the shell is 3–4 mm,[4] up to 5.5 mm.[5]

Habitat

This snail lives in places such as swampy meadows and ditches.[7]

Omphiscola glabra is said to occur in small areas of standing water that have a lot of vegetation such as swamps, and also in standing forest waters with leaf litter, often in water with organic iron contents and low calcium contents.[4][clarification needed]

In Britain however, this species occurs in small standing waters that are low in nutrients, with poor aquatic flora, often in waters drying out periodically.[5] They usually do not occur in habitats with high molluscan diversity, and usually in habitats on uncultivated land.[5] They are calciphile and have a pH tolerance of 6.4–8.2.[4][clarification needed]

Reproduction begins in May.[4] Juveniles hatch after 15–25 days.[4] *Omphiscola glabra* has two generations per year.[5]

Five shells of *Omphiscola glabra*

Parasites

Omphiscola glabra can serve as an intermediate host for several digenean trematodes. In France, *Omphiscola glabra* was naturally infected with *Fasciola hepatica*,[8] *Paramphistomum daubneyi*,[9] and *Haplometra cylindracea*.[10] Moreover, a recent report suggests that the species is also susceptible to *Fascioloides magna* infection.

How important is rumen fluke?..

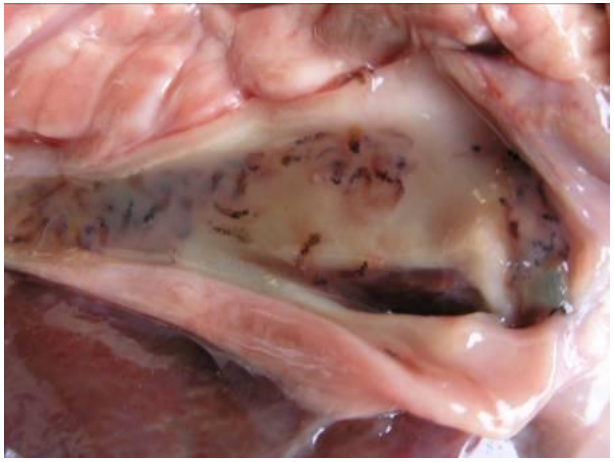
- Important to keep rumen fluke in perspective – th… becoming more common, BUT clinical disease … iver fluke remains the biggest threat to UK livestock!

Fluke and CAP reform dominate NSA UK Policy and Technica…
Tuesday this week (26th February) saw the NSA UK Policy and … which meets four times a year to discuss key policy areas, gather in London. There was an extensive … items drawing passionate comment from our English, Scottish, Welsh and Northern Irish representative… Defra's attitude to CAP reform. There was real strength of feeling about the damage caused by liver fl… derstanding about the different products available – and specifically that triclabendazole products are th… mature fluke but care needs to be take not to cause resistance to the drug. As always, NSA recommer… w.scops.org.uk, but we are also working in a number of other areas to ensure the need for new tools is … e wider industry.

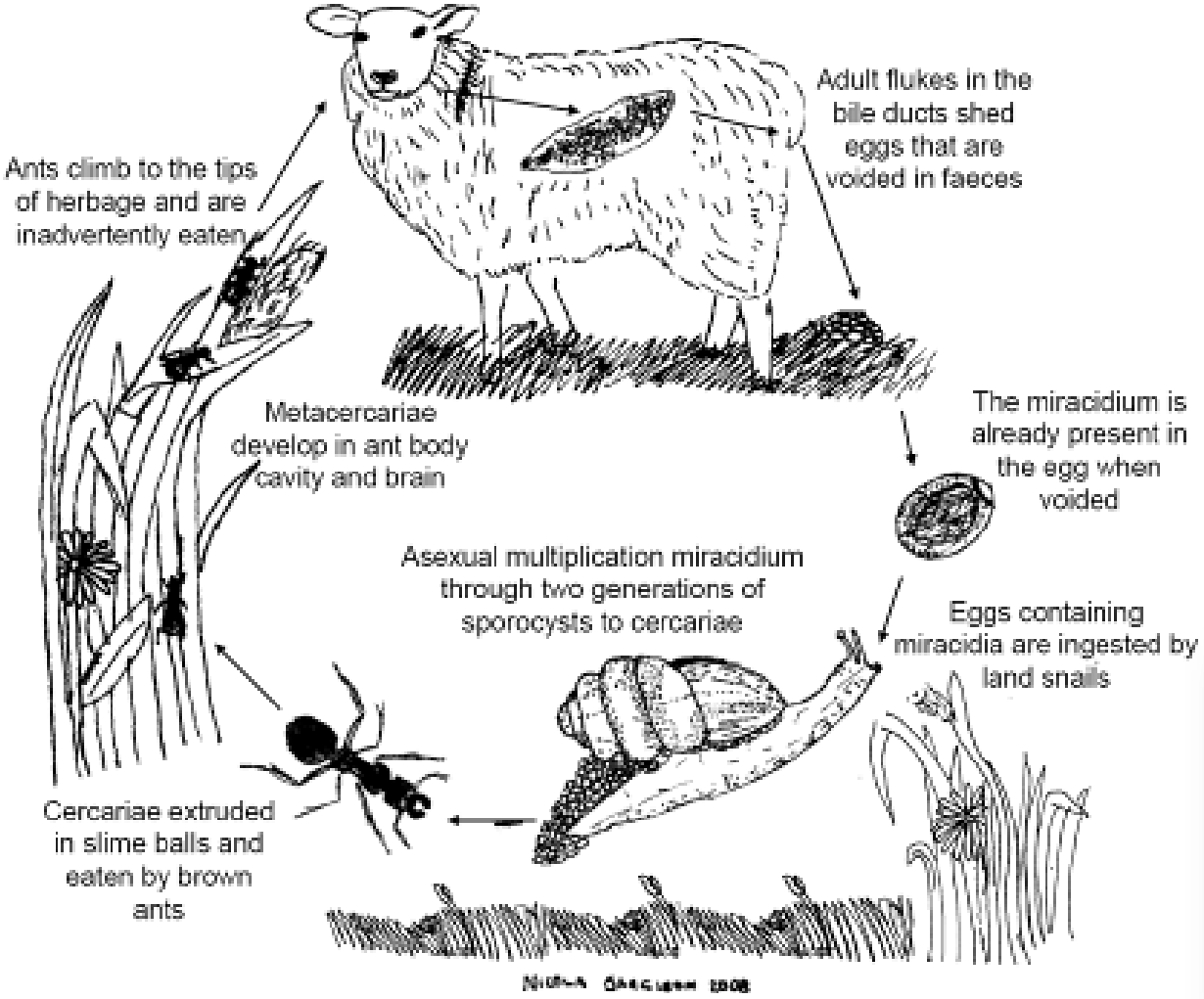
The ‘lancet fluke’, *Dicrocoelium dendriticum*

- Now this really IS rare, but has been found in Cornwall and in a recent case in N. England…

- Heavy infestations cause liver damage and have been implicated in a severe case of ill-thrift and photosensitisation in sheep on the Isle of Coll in the Outer Hebrides (Sargison et al, 2011)



Dicrocoelium dendriticum has the most amazing life-cycle!



Acknowledgements

COWS & Organisers of today's event

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- esp. Danielle Gordon, Naomi Lean, Lydia Roberts, Lisa Imrie, Nicola Sargison & Stuart Dawes

Farmers for all their help & hospitality

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Scottish Government SRP

QMS Grant-in-Aid