Trematode infections of fish

Wetlands supporting susceptible animals

Wildlife ✓
Livestock ✓
Human ✓

Synonyms: Dicrocoeliasis, fascioliasis, foodborne trematode (FBT) infections, fishborne parasitic zoonoses, helminth infection, paramphistomiasis.

KEY FACTS

What are trematode infections of fish?

Trematodes are a group of flatworms (or flukes) that parasitise members of all vertebrate classes but most commonly fish, frogs and turtles; they also parasitise humans, domestic animals and invertebrates such as molluscs and crustaceans. Some are external parasites (ectoparasites); some attach themselves to internal organs (endoparasites); others are semi-external, attaching themselves to the lining of the mouth, to the gills or to the cloaca. Some attack a single host, whilst others require two or more hosts. Some species are zoonotic, causing lung, liver and intestinal fluke diseases in humans, and trematodes have been reported to affect the health of more than 40 million people throughout the world.

The principal human diseases are: (i) trematodiasis (*e.g.* liver fluke diseases such as clonorchiasis, opisthorchiasis and metorchiasis; lung fluke disease such as paragonimiasis; and intestinal trematodiases such as heterophyiases and echinostomiases); (ii) nematodiases (*e.g.* capillariasis, gnathostomiasis, anisakiasis); and (iii) cestodiases (*e.g.* diphyllobothriasis). The trematodiasis group are considered as some of the most medically important parasitic zoonoses where a large number of fish species, both marine and freshwater, are potential sources of infection. Some trematodes are potentially pathogenic and the main pathway for human infection is through consumption of raw or inadequately cooked fish.

Causal agent

Clonorchiasis is caused by *Clonorchis sinensis* (Chinese liver fluke); opisthorchiasis is caused by two species: *Opisthorchis viverrini* (Southeast Asian liver fluke) and *O. felinius* (cat liver fluke), and metorchiasis is caused by *Metorchis conjunctus* (Canadian liver fluke). Infections of the bile duct, gall bladder and pancreas (*e.g.* cholangitis, choledocholithiasis, pancreatitis and cholangiocarcinoma) are the major clinical problems associated with the chronic pattern of these liver fluke infections. They belong to Phylum Platyhelminthes, Class Trematoda and Family Opisthorchidae.

Intestinal trematodiases are caused by intestinal trematode parasites belonging to the families Heterophyidiae and Echinostomatidae and several genera such as *Metagonimus*, *Heterophyes* and *Haplorchis*.

Schistosome species that cause bloodfluke infections are mainly restricted to the tropical and subtropical areas and belong to the genera *Schistosoma* and *Orientobilharzia*. These include both zoonotic and non-zoonotic species and typically occur in cattle, buffaloes, goats and pigs.

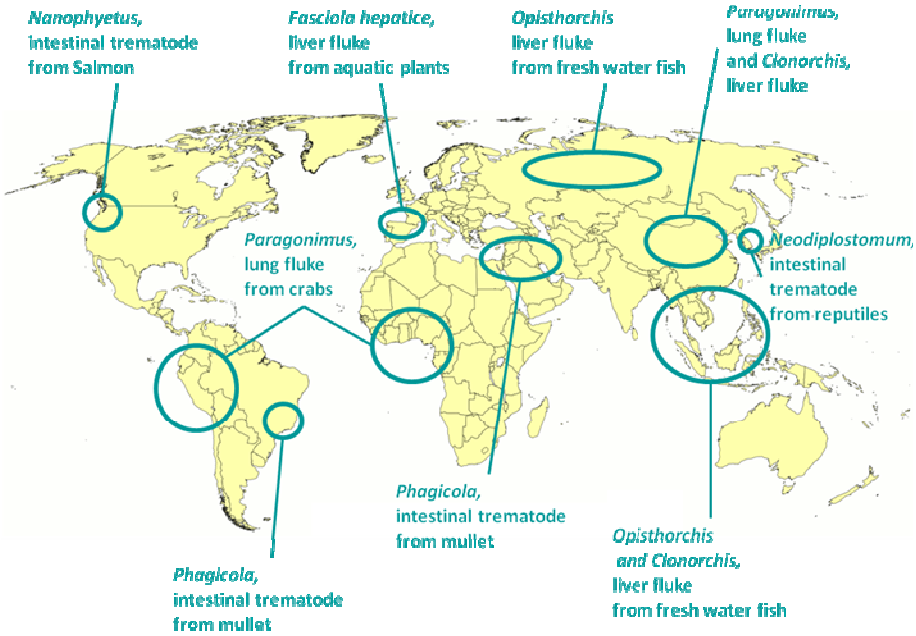
A large number of gastro-intestinal trematode species (paramphistomes) have been described. They are usually thick, short (4-12 mm), fleshy, maggot-like worms. They can infect all ruminants but young calves and lambs are the most susceptible. Not all species are pathogenic but clinical outbreaks of paramphistomiasis have been caused by *Paramphistomum microbothrium* (Africa), *Cotylophoron cotylophorum* (Asia), *P. ichikawar, C. calicophorum* (Australasia) and *P. cervi* (Europe).

Species affected

Freshwater snails (Phylum Mollusca; Class Gastropoda) and various fish are intermediate (in some cases definitive) hosts, and human and other vertebrates such as wild animals, livestock (sheep, cattle, goats and pigs) and fowl are usually definitive hosts.

Geographic distribution

Trematode infections have a worldwide distribution but are not notifiable OIE-listed diseases. Trematode infections are reported to affect the health of more than 40 million people throughout the world and are particularly prevalent in South East Asia and Western Pacific Regions.



Geographic distribution of fish-borne trematode infections

Environment

Trematodes have complex life cycles and part of the life cycle takes place in water (freshwater to marine water depending on the species) in both tropical and temperate zones. Habitats of secondary intermediate hosts include freshwater habitats with stagnant or slow-moving water (ponds, rivers, aquaculture, swamps and rice fields).

TRANSMISSION AND SPREAD

Vector(s)

Most trematodes have a lifecycle in which larval stages parasitise one or more species that are different from the host of the adults. Infective larval stages of the parasites include miracidium, redia, cercaria and metacercaria. The vectors include molluscs (*e.g.* snails), fish, crustaceans (*e.g.* crayfish and crabs), herpetafauna (*e.g.* frogs and snakes), terrestrial arthropods (*e.g.* ants), wild and farmed animals (*e.g.* sheep, cattle, goats, pigs, cervids and fowl).

How is the disease transmitted to animals?

The transmission mechanisms of zoonotic trematodes are generally the same, *e.g. C. sinensis* is transmitted through ingestion of trematode eggs by the intermediate host (*i.e.* snail), followed by a free-swimming cercariae encysted stage that adheres to the skin of the host fish.

How does the disease spread between groups of animals?

Some species attack a single host, whilst others require two or more hosts, but the mechanism of spread between groups of animals is essentially the same. Embryonated eggs are discharged in the biliary ducts and through

the faeces and ingested by a suitable snail intermediate host where they undergo several developmental stages (sporocysts, rediae and cercariae). The cercariae are released from the snail and after a short period in a free-swimming stage in the water, they come into contact with a suitable fish where they encyst in the flesh as metacercariae.

How is the disease transmitted to humans?

The mode of transmission to the definitive host is through consumption of raw, undercooked, or improperly pickled or smoked infected fish. Major dietary sources of infection in Asia include the following examples: for *C. sinensis* - (i) morning congee with slices of raw freshwater fish (southern China, Hong Kong SAR) or slices of raw freshwater fish with red pepper sauce (Korea); (ii) half roasted or undercooked fish (China); (iii) raw shrimps (China). For *O. viverrini* – (i) raw fish dishes called 'Koi pla', 'Pla ra', 'Pla som', *etc*.. Men in the 25-55 year age group are a highly affected group; a contributing factor for this is the practice of men eating raw or pickled fish (usually accompanied with alcohol).

IDENTIFICATION AND RESPONSE

Field signs

As many trematodes are endoparasites, it is difficult to diagnose the infection based on gross external examination of the fish. However, heavy infestation can lead to retarded growth.

Recommended action if suspected

Notification is not mandatory since these diseases are not listed as notifiable by the OIE. However, as infections are a serious concern for public health, the recommendations listed in the next section should be adhered to in order to protect the health of households and the local communities in general. Metacercariae can persist in the fish muscle for a considerable time (*e.g.* for weeks in dried fish, a few hours in salted or pickled products) but they may be killed by adequate cooking.

Diagnosis

Parasitological examination, using a microscope to observe the eggs, is one of the reliable techniques used to demonstrate infection; however, this requires well-trained laboratory staff.

Several different diagnostic techniques are available for animals, such as a pepsin digestion method to induce the release of metacercariae from infected animals. The selection of particular techniques is determined by the available resources, the type of animal/products to be analysed, the organ suspected to be infected, the training and experience of the inspector and the degree of certainty required by any inspections.

PREVENTION AND CONTROL IN WETLANDS

Environment

It is important to ensure that proper hygiene measures are followed to prevent human waste entering, and contaminating, the environment.

Aquaculture

Actions should be directed, firstly, at prevention of the disease in the fish population. Basic farm biosecurity such as good farm hygiene and good husbandry practices, good water quality management, proper handling of fish to avoid stress, regular monitoring of health status, good record keeping (gross and environmental observations and stocking records including movement records of fish in and out of aquaculture facilities). Following these good general practices helps maintain healthy fish.

Use of a hazard analysis and critical control points (HACCP) approach to fish pond management focussing on water supply, fish fry, fish feed and pond conditions will help to eliminate contamination of ponds with parasite eggs and snail vectors.

Irradiation of fish to control infectivity of metacercariae may be considered but economic cost and consumer acceptance may be limiting factors.

A number of farm management measures can minimise or prevent the spread of trematode infections. These include:

- Control of molluscan intermediate hosts can be carried out through: responsible use of chemical molluscicides, environmental manipulation (*e.g.* 'weed' control) and the use of molluscophagous fish.
- Design the farm in such a way that contamination with human faecal matter is avoided.
- The traditional practice of building latrines above carp ponds with direct droppings of fresh faeces and using night soil as fertilisers should be avoided as these will help to maintain the infection in cultured fish populations.
- Avoid the use of water plants as feed (for herbivorous species) if there is a risk of such plants being contaminated with human faecal matter.
- Consider carefully the use of wild fish as feed and make sure they are prepared properly if fed.

Wildlife

Minimise the contact between human waste and wild animals.

Human

Intensive health education should be carried out to emphasise the need to consume only cooked fish, the risks of eating raw fish and the importance of environmental sanitation.

IMPORTANCE

Effect on wildlife

Whilst most wild animals are host to some endoparasitic organisms such as trematodes, the impact of these parasites is usually minimal. Negative impacts on individual animals are only noticed at high parasite loads and even then population level impacts are generally low.

Effect on Agriculture and Aquaculture

Losses to livestock and fish farmers through mortalities are generally low.

Effect on humans

Significant impact on public health, with about 40 million people reportedly infected with trematodes; high prevalence in South East Asia and Western Pacific Regions.

Economic importance

Infections in farmed fish are usually subclinical. However, subclinical infections may be important economically leading to retarded growth and reduced productivity. Infected animals can also become more susceptible to other infections. In livestock, significant costs are involved in control and treatment of infected animals.

FURTHER INFORMATION

Useful publications and websites

- Chai, J.Y., Murrell, D.K. & Lymbery, A.J. (2005). **Fish-borne parasitic zoonoses: status and issues**. *International Journal for Parasitology*, 35: 1233-1254.
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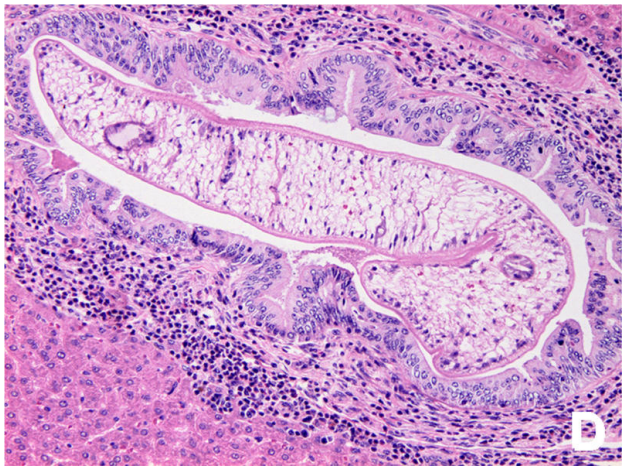
- Over, H. J., Jansen, J. & van Olm, P. W. (1992). **Distribution and impact of helminth diseases of livestock in developing countries**. FAO Document repository. www.fao.org/DOCREP/004/T0584E/T0584E00.htm#TOC [Accessed March 2012].

Photos

An adult *Clonorchis sinensis* (measuring 10–25 mm by 3–5 mm): they reside in the small and medium-sized biliary ducts. In addition to humans, carnivorous animals can serve as reservoir hosts (*Sripa* et al*, 2007*).



Photomicrograph of an adult *O. viverrini* worm in bile ducts of experimentally infected hamster (*Sripa, 2008*).