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Clonorchis and Clonorchiasis

THE WORM *Clonorchis*, and the closely related *Opisthorchis*, follow a classic trematode life cycle from vertebrate hosts through snails and fish and back to the vertebrate hosts. These worms are of special importance in the design of sanitation systems that involve the use of human or animal excreta in aquaculture.

Description of Pathogen and Disease

Clonorchis and *Opisthorchis* worms are found mainly in East Europe and Eastern Asia and are not well known to public health workers in Western Europe, North or South America, or Africa. Most of the literature on these pathogens is not in English, but an important English-language review was published by Komiya (1966).

Identification

Chonorchiasis (or opisthorchiasis) is an infection of the bile ducts by trematodes of the genus *Clonorchis* (or *Opisthorchis*). In light infections, symptoms are likely to be absent or vague. Heavier infections result in diarrhea, abdominal discomfort, and some splenomegaly. Heavy parasite burdens may cause acute pain in the upper right quadrant, liver enlargement and tenderness, edema, an increased erythrocyte count, raised sedimentation rate, and up to 40 percent eosinophilia. There may be bouts of recurrent gall bladder colic. Carcinoma of the bile ducts is a lethal complication (Sonakul and others 1978), and death can also ensue from secondary bacterial infection. Clonorchiasis is a chronic disease, sometimes lasting for 30 years or longer (see, for instance, Attwood and Chou 1978).

Diagnosis is by examining feces microscopically for eggs. Treatment is by oral drug therapy but, although a large variety of drugs have been tried, they are either not freely available, too toxic, or not effective (see, for instance, Jopling 1978). Praziquantel is under trial for clonorchiasis therapy and shows promise. At present, no treatment is advised for those with asymptomatic clonorchiasis.

Occurrence

Clonorchis sinensis occurs in China, Hong Kong, Korea, Taiwan, Japan, and Vietnam (figure 24-1). *Opisthorchis viverrini* occurs in Thailand and southern Laos. *O. felineus* occurs in Poland, various parts of the USSR (especially the Ukraine), and northern Turkey.

Infectious agents

Three closely related trematode species are considered in this chapter: first *C. sinensis*, the Chinese liverfluke; second *O. viverrini*; and third *O. felineus*, the cat liver fluke. *C. sinensis* is also called *O. sinensis*, it being argued that it is not sufficiently different from *O. viverrini* and *O. felineus* to warrant a separate genus. The three species are very similar in their biology but occur in different parts of the world.

The adult worms are flat, transparent, flabby, hermaphroditic organisms that measure 11–20 by 3–5 millimeters (figure 24-2). The eggs are relatively small, measuring 23–35 by 10–20 micrometers.

Reservoirs

A wide variety of fish-eating vertebrates provide the definitive hosts for these trematodes. For *C. sinensis* the main hosts are man and dogs, for *O. viverrini* cats and man, and for *O. felineus* cats. Transmission of *O. viverrini* and *O. felineus* is often maintained in the absence of man, and this is also possible for *C. sinensis*.

Transmission

There can be up to 6,000 worms in the bile ducts, and each worm produces 2,000–4,000 eggs per day. The

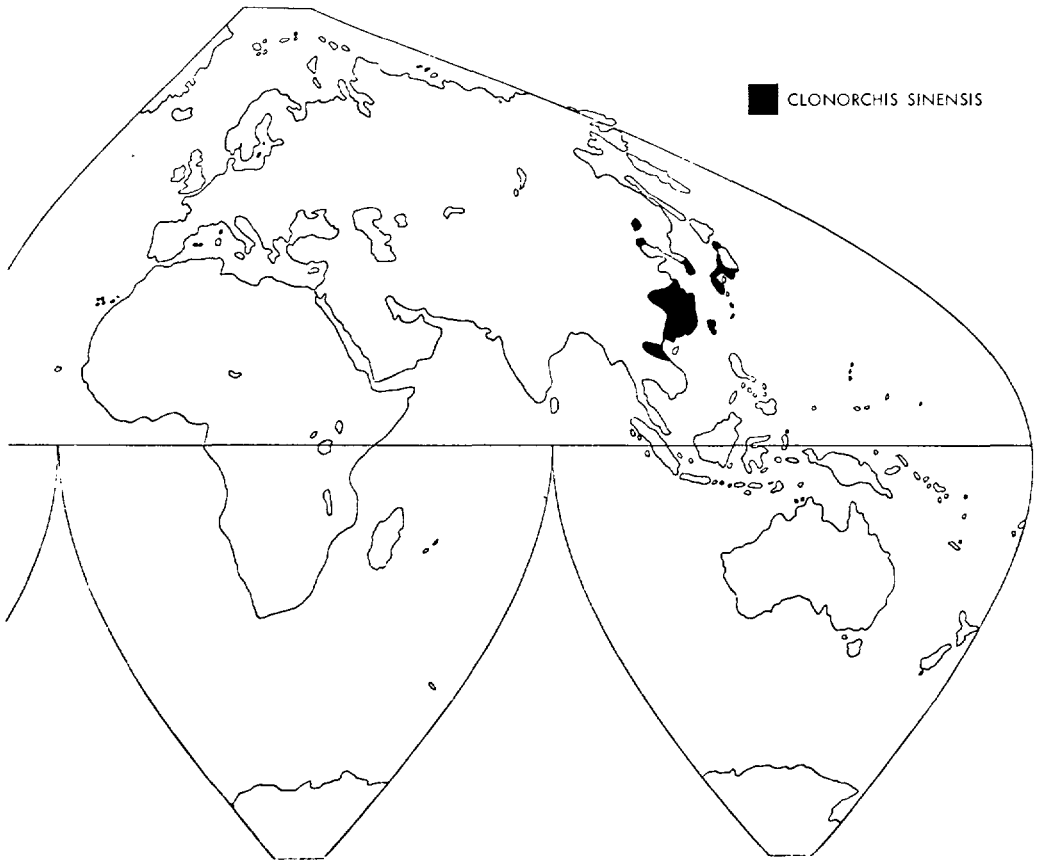

Figure 24-1. *Known geographical distribution of* Clonorchis sinensis. The infection may occur in areas as yet unrecorded

number of eggs produced by *C. sinensis* varies with the species of host and with the duration of the infection.

The eggs, containing fully formed larvae (miracidia), are passed out in the feces and for further development have to reach water and be ingested by particular species of freshwater snails. For *C. sinensis*, snail hosts include *Bulinus fuchsianus* in northern China, *Alocima longicornis* in southern China, and *Parafossarulus manchouricus* in most endemic areas. For *O. viverrini*, snail hosts include *Bithynia funiculata*, *B. laevis*, *B. goniomphalus*, and *B. siamensis*. For *O. felineus*, the host is usually *B. leachii*.

Asexual multiplication occurs in the snail, and many free-swimming cercarial larvae are released 3–4 weeks after ingestion. These live for only 1–2 days in water unless they can penetrate beneath the scales of almost any species of freshwater fish and form cysts (metacercariae) in the connective tissues. Over eighty species of freshwater fish have been incriminated as hosts of *C. sinensis*, and a maximum of 3,000 metacercariae have been found in a single fish. *O. felineus* commonly encysts in carp.

When fish are eaten raw or undercooked by man or other vertebrate host, the larvae hatch out in the duodenum and migrate up the bile ducts. Adult worms can live for 25–50 years. From each cyst ingested, one adult worm may develop and is capable of producing eggs.

Prepatent and incubation periods

Worms reach maturity and start producing eggs 3–4 weeks after the ingestion of cysts. Symptoms may develop slowly or not at all. Acute clonorchiasis with an incubation period of only 10 days has been reported from China (Zhipiao, Huilan and Weiji 1979).

Period of communicability

As long as mature adult worms are present, eggs may be passed in the feces. Adult worms can live for up to 50 years. Eggs can live for 1 month in water. Metacercariae in fish can survive for the life of the fish and for some weeks after its death.

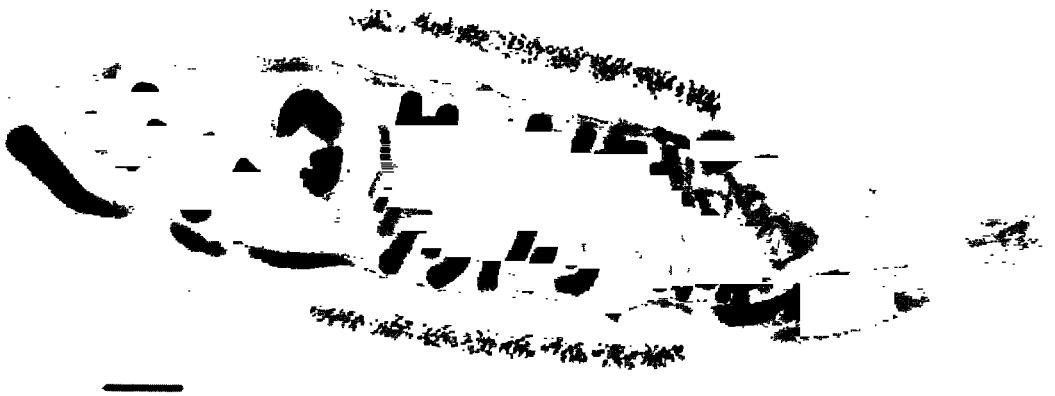

Figure 24-2. *An adult of* Opisthorchis felineus *under a light microscope.* Scale bar = 1 millimeter. (Photo: Wellcome Museum of Medical Science)

Resistance

There is no clear evidence for the development of immunity.

Epidemiology

Infection is normally contracted from eating raw or undercooked fish. The metacercarial cysts are sticky, however, and can be transferred from knives, hands, or chopping boards to other foods or directly to the mouth. Infection is much more common in adults than children and is rare in young children. It is common for adult males to have higher prevalences of clonorchiasis than adult females owing to different dietary customs. In South Korea, for instance, men eat raw fish at rice-wine drinking parties.

Transmission of *C. sinensis* is especially associated with raising fish in excreta-enriched ponds, a practice common in China and elsewhere in East Asia and one that clearly creates ideal conditions for transmission, provided that the ponds are colonized by the appropriate snail species (Faust and Khaw 1927). Infection with *O. felineus* in Poland and the USSR is especially associated with eating recently salted fish.

Clonorchiasis in Taiwan has increased in recent years (Chen and others 1980). Prevalences are up to 52 percent in school staff in some areas. Pigs are commonly infected, and up to 100 percent of some fish species in some localities harbor *Clonorchis* metacercariae. Ong and Lu (1979) studied clonorchiasis in a highly endemic area of Taiwan and found prevalences of 3 percent among primary-schoolchildren, 7 percent of middle-school children, 8 percent of high-school children, and 56 percent of government workers. Prevalences were higher among males than females and higher among those 35–45 years old than among others.

A survey in South Korea during 1967–69 revealed a nationwide prevalence of clonorchiasis of 5 percent, with prevalences rising to 15 percent locally. Prevalence and intensity of infection were higher in males than females and higher among those over 30 years old than in younger persons (Seo and others 1969).

Opisthorchiasis is extremely common in northern and northeastern Thailand. Prevalences range from 10 to 90 percent, and about 4 million people are infected (Harinasuta 1980). In the worst affected areas between 50 and 90 percent of carp are infected and harbor 20–50 metacercariae each. Laotian refugees in Thailand had an opisthorchiasis prevalence of 44 percent, with a peak age-prevalence of 64 percent among 30–34 year olds (Temcharoen and others 1979).

Other surveys of clonorchiasis or opisthorchiasis include those from China (Weng and others 1960), Japan (Yokogawa 1969), Malaysia (Rohde 1967), South Korea (Choi and others 1973), Taiwan (Cross 1969), Thailand (Viranuvatti and Stitnimankarn 1972), and the USSR (Churina 1973; Pantyukhov 1965).

Control Measures

There is no effective and safe drug for mass chemotherapy at present. Praziquantel may well fulfil this role and is undergoing clinical trials. Personal protection is best achieved by not eating raw or partially cooked fish.

Snail control using chemicals is difficult because of the toxic effect that most molluscicides have on fish. Some workers have tried biological control using fish and crayfish, but this requires further study (Nagano 1964). Clearing aquatic vegetation from fishponds may reduce snail populations (Komiya 1966).

Viable eggs in feces must be prevented from reaching bodies of freshwater in which the snail and fish intermediate hosts live. This would be relatively straightforward except for two obstacles. First, in parts of the world where clonorchiasis is endemic, especially China and Taiwan, it is the practice to enrich fishponds with human and other feces in order to improve productivity. Second, there are several reservoir hosts apart from man, so that the control of human feces alone can only have a partial effect on transmission. The solution to the first problem is to treat excreta prior to adding to fish ponds. There is no simple solution to the second problem.

Education is needed to make the population aware of the cause of clonorchiasis and, in endemic areas, to try to change the habit of eating raw or insufficiently cooked fish.

Occurrence and Survival in the Environment

The eggs, miracidia and cercariae of *Clonorchis* and *Opisthorchis* may be found in waters contaminated by feces of animals or man in endemic areas. A few reports exist; for instance, *Opisthorchis* eggs were isolated from river water in the USSR (Goryachev 1947).

Early experiments by Faust and Khaw (1927) showed that *Clonorchis* eggs in an isotonic solution survived for up to 3 months at 2–4°C, 6 months at 4–8°C, 1 month at 26°C, 3 weeks at 37°C, 4 days at 45°C, 1 hour at 50°C, and a few minutes at 58°C. At 6–8°C survival times were 4–5 days in fresh night soil, 2 days in 5-day-old night soil, and 1 hour in 10-day-old night soil. *Clonorchis* eggs were rapidly killed by desiccation. In river water *O. felineus* eggs survived for over 160 days at 0–5°C, and this suggests that they may overwinter in the USSR (Drozdov 1962).

Clonorchis metacercariae in fish persist throughout the life of the fish. Thereafter they survive for months if frozen, for several days if salted, for over 2 weeks if dried, and for several days in soy sauce, vinegar, or wine (Faust and Khaw 1927; Wykoff 1959). They are killed by thorough cooking.

O. felineus metacercariae were killed rapidly at 55–58°C, but in fish of 1–2 kilograms weight they were killed by cooking for not less than 1 hour (Mitrokhin 1962). *O. felineus* metacercariae were still infective to foxes after 7 days drying in fish, but not after 9 days (Mitrokhin 1960). Other Soviet workers have recommended that carp should be soaked in brine for 2–3 weeks and then dried for at least 3 weeks to kill *O. felineus* metacercariae (Yaldygina and others 1970).

Inactivation by Sewage Treatment Processes

No information on *Clonorchis* or *Opisthorchis* eggs during sewage treatment could be located. The nearest parallel is probably that of schistosome eggs (chapter 32).

Inactivation by Night Soil and Sludge Treatment Processes

No specific data are available but *Clonorchis* eggs are rapidly killed by storage in night soil (Faust and Khaw 1927; Komiya 1966). *Clonorchis* eggs should be destroyed after storage for 5 days at 5°C or for 2 days at 25°C.

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