Fasciola hepatica

Scientific name:
Fasciola hepatica (common liver fluke)
Phylum: *Helminths*
Subphylum: *Plathelminthes* (flatworm)

Parasite

Characteristics and sources of *Fasciola hepatica*

Main microbiological characteristics

Adult *Fasciola hepatica* (hydrochloric carmine staining)
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Fasciola hepatica, or common liver fluke, is the agent of fascioliasis, a disease mainly affecting ruminants and more rarely humans. It is a non-segmented cosmopolitan flatworm belonging to the group of *Plathelminthes*, class of *Trematoda* and family of *Fasciolidae*. The adult worm measures from 15 to 30 mm long and 10 mm wide and lives in the bile ducts of wild and domestic mammals, as well as those of humans.

The adult flukes lay their eggs in the bile ducts. The eggs are eliminated by the bile and then pass through the bowel into the external environment. In an aquatic or very damp environment, the eggs become embryos in three weeks at 15°C and then hatch when temperature conditions become favourable, releasing a ciliated embryo or miracidium. To continue its development, it swims for a few hours seeking a gastropod mollusc host, which it penetrates. Many mollusc species are receptive, but few can enable the parasite's complete larval development. In France, in practice, an amphibious mollusc, *Galba truncatula* (genus *Lymnaea*), fulfils this role: its presence is therefore essential in the life cycle of the parasite. After maturation and asexual reproduction, new larvae, called cercariae, leave the mollusc, often in the autumn. Just a few miracidia penetrating a receptive snail are enough to produce large numbers of cercariae. Their active aquatic phase is short: they quickly encyst on vegetation. The metacercariae formed can persist and remain infective for months. The parasite's life cycle is summarised in Figure 1.

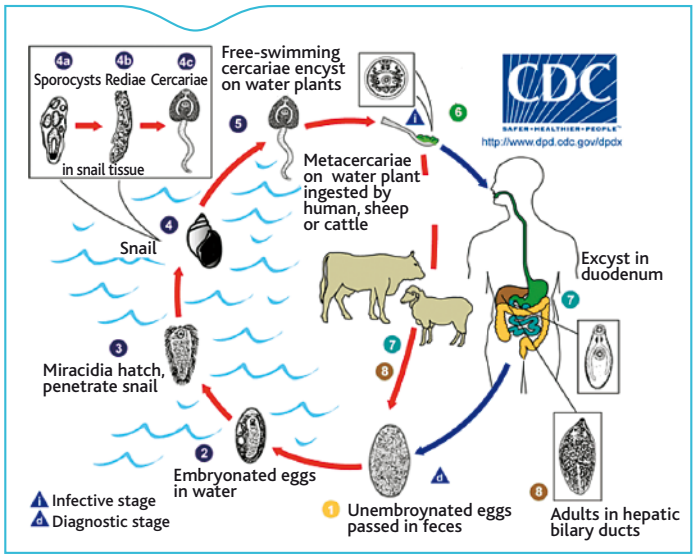

Figure 1. **Life cycle of *Fasciola hepatica***

Hazard sources

Domestic ruminants (sheep and cattle) play the primary role as reservoir of the parasite; humans are not usually a reservoir. The role of wild reservoirs of parasites is mixed: rabbits, although they may harbour adult flukes, play no significant role in epidemiological terms. A new reservoir, the coypu, has been identified in several outbreaks, imposing a change in methods of prevention. Coypu alone are capable of sustaining the animal epidemic, and are a formidable threat to crops grown in damp conditions, such as watercress. Other wild herbivores (deer) can also spread fascioliasis.

Each host can actively disseminate the parasite: mammals by their droppings and molluscs by their movements in damp environments. In addition, the small percentage (only 1%) of infected snails ensures transmission of fascioliasis to herbivores. Humans are poor definitive hosts[1] (eliminated eggs rarely lead to the production of a miracidium). Environmental contamination of *Lymnaea* biotopes resulting from landfarming or slaughterhouse effluent containing eggs cannot be excluded. The regulations therefore prohibit the use of surface water for watercress growing because of the risk of contamination by rainwater runoff containing contaminated faeces.

(1) Definitive host: host in which sexual reproduction of the parasite (adult parasites) takes place.

Data sheet on foodborne biological hazards
October 2011

Transmission routes

Human fascioliasis is associated with the presence of infected mammals (especially on farms) and the consumption of plants grown in damp conditions. Humans become infected by ingesting raw fresh produce carrying metacercariae: mainly watercress, but also wild salad plants.

Recommendations for primary production

- **Among cultivated plants, watercress is the food most frequently associated with transmission of the fluke.**
- **To avoid contamination of watercress beds:**
  - **do not use surface water for cultivation;**
  - **protect crops against incursions of wild or domestic (sheep and cattle) animals and against any runoff from pastures, stockyards, etc.;**
  - **manage ditches effectively to prevent the proliferation of receptive *Lymnaea*.**
- **Health surveillance in industrial watercress beds (Regulations (EC) No. 178/2002[2], (EC) No. 852/2004[3] and (EC) No. 882/2004[4]).**

Human foodborne illness

Nature of the disease

The characteristics of the disease are presented in Table 1.

The ingestion of the larva is followed by a migration and maturation phase that lasts about three months and causes episodes in the host grouped under the name of "toxi-infectious" phase. The flukes, as adults, then live in the bile ducts for several years, constituting the chronic cholangitis phase. In humans they can reach 15 to 30 mm in length.

Susceptible population groups[5]: there is no evidence to date to suggest that there is a population at higher risk of infections or complications.

Dose-effect relationships[6]

Just a few larvae are sufficient to cause disease. However, the severity of the disease depends on the amount of ingested metacercariae, and thus the number of parasites, which remains low in humans.

Epidemiology

Surveillance system

There is no surveillance system, either in Europe or the United States, from which to acquire accurate epidemiological data.

Prevalence

Human fascioliasis appears to have been diagnosed less often in the past two decades. There are several possible explanations: a reduction in the parasitic load in domestic animals, lower consumption of wild watercress, better monitoring of industrial watercress beds, changes in eating habits and food distribution networks, better control of fascioliasis in livestock, etc.

Human fascioliasis occurs most often in outbreaks of varying size, clustered around the consumption of contaminated fresh produce, and includes a few family outbreaks caused by leisure picking, as well as several dozen cases originating from high production operations, distributed to commercial organisations. Several outbreaks have occurred in France: the last one, in 2002 in Northern France, was due to the consumption of raw commercial watercress from a single local producer.

A national retrospective survey covering the years 1950-1982, conducted in 1983, identified 8,898 cases (an annual incidence for that period of 0.5/100,000). From the results of this survey and of nine regional surveys conducted between 1955 and 1995, the average annual number of cases in France was estimated at between 300 and 350.

Role of food

Main foods to consider

In France, human contamination is caused by the ingestion of raw aquatic plants: mainly watercress followed by *Rorippa*, or plants from damp biotopes: dandelion, lamb's lettuce, mint, etc. These are often harvested wild plants, but contamination from cultivated crops is observed from time to time, especially in the event of flooding, following the accidental development of infected snail hosts in crops (watercress beds).

Inactivation treatments in industrial environments

The plants posing a risk are generally of wild origin. There is no treatment available to sanitise a contaminated plant that is consistent with the presentation of a product intended to be consumed fresh.

Table 2. **Efficacy of inactivation treatments in industrial environments**

Heat	Cold
The metacercariae are killed by a temperature of 60°C applied for several minutes. Applicable in industry (cooking).	The metacercariae survive at least 4 months at 4°C and can withstand temperatures of –2°C and –10°C but lose their infectivity at –18°C.
Lyophilisation	**Other processes**
No data available but the process is employed mainly when lyophilised watercress is used as a condiment in hot soup. The effect of freezing combined with a vacuum kills the young fluke in the cyst.	Ionisation: no data on radiation. Vinegar is totally ineffective regardless of the concentration and contact time.

(2) Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.

(3) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs.

(4) Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules.

(5) Susceptible population group: people with a higher than average probability of developing symptoms of the disease, or severe forms of the disease, after exposure to a foodborne hazard [definition used in ANSES data sheets].

(6) The relationship between the dose (the amount of microbial cells ingested during a meal) and the effect on an individual.

Table 1. **Disease characteristics**

Mean incubation period	Target population	Main symptoms	Duration of symptoms	Duration of shedding period	Complications	Asymptomatic forms
Silent incubation, 15 days to 1 month	Consumers of at-risk raw fresh produce: watercress and wild plants from damp biotopes (lamb's lettuce, dandelion, mint, etc.)	Foodborne infection: fever, increasingly intense fatigue, abdominal pain, impaired general condition, liver pain (sometimes jaundice), itching, hives, hypereosinophilia. Chronic cholangitis: outbreaks of retention jaundice, violent biliary colic. Possible evolution to cirrhosis.	2-3 months Several years, without treatment	Faecal elimination of eggs from the 3rd or 4th month post-infection and during the lifetime of the flukes (several years)	Calcification of the bile ducts	Occasional, because often a strong inflammatory reaction

Monitoring in food

Prevention is based on controlling the contamination of watercress, when grown and marketed. The monitoring system does not cover cases of illness, whether human or animal, but the risk of transmission from the cultivated watercress. It is based on the application of regulations that make the producer responsible and provide for control by the competent authority (in France the Regional Food Authorities [SRAL]).

Visual screening of infective larvae in food is not feasible (low density, small size [250 to 300 µm], translucent appearance providing no contrast with the medium, lack of a way to dislodge them in order to concentrate them).

However, it is possible to screen for the parasite in the environment by detecting the receptive molluscs and revealing the larvae they are hosting.

Recommendations to operators

- **It is generally plants picked in the wild that pose the greatest risk.**
- **Heat (above 60°C for a few minutes) kills metacercariae.**
- **Packages of watercress for sale must bear the producer's name and address, and the place it was grown. The same information must also appear on the label of goods packed in bundles.**

Domestic hygiene

Essential protection involves avoiding all consumption of raw plants harvested from natural environments, and all sale of such plants for this purpose. Almost all the recent human infections were due to these practices.

Among the cultivated plants, watercress is the only one that can transmit the fluke. Consumer protection is assured by following the regulations, self-inspection by the producer and now verification of production by the decentralised services (SRAL) of the French Ministry of Agriculture. Marketing, particularly in wholesale markets, is controlled by the DGCCRF.

Recommendations to consumers

- **Health education of the population: people should be informed of the risks posed by plants (salad) harvested in uncontrolled situations, when eaten raw.**
- **Essential protection involves strongly advising against all consumption in the raw state of plants harvested from natural environments (i.e. picked in the wild).**
- **Washing of watercress leaves, even with vinegar, is insufficient to eliminate the hazard (metacercariae).**
- **The consumer should reject any products that do not display their origin.**

References and links

General reference

- Mailles A., Capek I., Ajana F., Schepens C., Ilef D., Vaillant V., (2006). Commercial watercress as an emerging source of fascioliasis in Northern France in 2002: results of an outbreak investigation. Epidemiol Infect 2006;1-4.

Useful links

- Centers for Disease Control and Prevention, Division of Parasitic Diseases: http://www.dpd.cdc.gov/dpdx/
- European Union Reference Laboratory for parasites: Istituto Superiore di Sanità (ISS) I-00161, Rome – Italy: http://www.iss.it/crlp/index.php
- National Centre of Reference (NCR) for *Trichinella*, *Fasciola* and *Anisakis* from 1 January 2012: Parasitology Department, Cochin Hospital, 27 rue du Faubourg St Jacques, 75014, Paris. http://cnrdestrichinella.monsite-orange.fr/
- National Reference Laboratory (NRL) for foodborne parasites, except *Echinococcus* sp.: ANSES Maisons-Alfort Laboratory for Food Safety.
- Parasitological and malacological expertise available at the Parasitology laboratory of the Limoges Faculty of Pharmacy (Pr G. Dreyfuss), 2 rue du Dr R. Marcland, 87025 Limoges Cedex.
- Public Health Agency of Canada: www.hc-sc.gc.ca/pphb-dgspsp/msds-ftss/msds67f.html