

## Commercial watercress as an emerging source of fascioliasis in Northern France in 2002: results from an outbreak investigation

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### SUMMARY

In April 2002, five cases of fascioliasis were diagnosed in Tourcoing. A case-finding and a case-control study were carried out to identify the source of the outbreak and take appropriate control measures. Eighteen cases were identified through the medical laboratories carrying out serology for fascioliasis. Fourteen cases and 23 controls, identified by the physicians of the cases, were interviewed on symptoms of the disease and their consumption of uncooked plants. Cases were more likely than controls to have eaten commercialized raw watercress (OR 86·7,  $P < 0\cdot001$ ) and 13 (93%) of the cases reported its consumption. A single producer common to all cases was identified. The inspection of his watercress beds showed a lack of protection against *Lymnaea truncatula*. This outbreak of fascioliasis due to commercialized watercress indicates that actual sanitary regulations do not allow for the efficient prevention of infestation of watercress production in France.

### INTRODUCTION

*Fasciola hepatica* is the only liver fluke found in France. Its definitive hosts are cattle or sheep, and the intermediate host is an aquatic snail, *Lymnaea truncatula*. Humans are accidental hosts and become infected while eating uncooked aquatic plants on which cercariae are encysted [1, 2]. The larvae penetrate the intestinal wall, enter the peritoneal cavity, invade the liver and migrate into the bile ducts where they mature to an adult worm causing recurrent inflammation, necrosis, and fibrosis. After an incubation period ranging from 2 weeks to 3 months [2], fever, asthenia, allergic reactions, right abdominal pain, liver function abnormalities and eosinophilia

are the signs of the early invasive phase. After migration to the biliary ducts, the flukes may cause biliary colic, angiocholitis or obstructive jaundice (stationary or chronic phase) [3]. Early diagnosis during the invasive eosinophilic phase is confirmed by serological testing [1, 4] while diagnosis at the chronic phase is based on finding eggs in faeces or in bile aspirated from the duodenum [5]. Triclabendazole remains the treatment of choice against *Fasciola hepatica* and is widely recommended for its ease of administration, good tolerability and effectiveness [1, 6, 7].

In France, an estimated 300 persons are infected each year [8] mostly as sporadic cases or small family outbreaks, after having eaten wild or home-grown watercress. In mid-April 2002, the infectious diseases department of the University hospital in Tourcoing diagnosed fascioliasis in five apparently unassociated persons during a 3-week period. Since none of the five

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patients reported the consumption of wild watercress, it was feared that a commercial product could be the origin of infection. An epidemiological investigation was therefore undertaken in order to detect other cases, identify the source of the outbreak and take appropriate control measures.

## METHODS

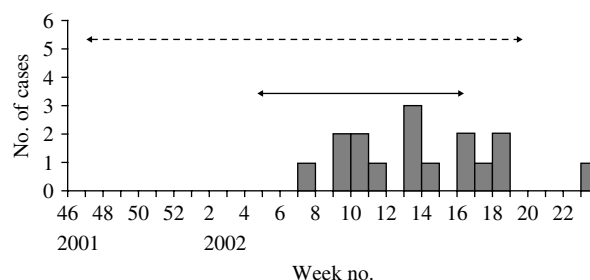
The investigation was limited to the Pas-de-Calais and the Nord districts where all five patients lived. A possible case was defined as any person living in these districts, who had a blood cell count consistent with fascioliasis, with more than  $10\,000/\text{mm}^3$  white blood cells and at least  $1000$  eosinophil cells/ $\text{mm}^3$  since 1 January 2002.

A confirmed case was defined as any person living in the Nord or the Pas-de-Calais district who had tested positive for fascioliasis by agglutination test (Fumouze<sup>®</sup>, Fumouze Diagnostics, Levallois Perret, France; sensitivity 96.1%, specificity 96.6% [9]) with a titre of  $\geq 80$  and in immuno-electrophoresis with at least three arcs, since 1 January 2002 [2].

The two medical laboratories in the districts carrying out serological testing for fascioliasis were asked to notify all positive serological tests for fascioliasis since the beginning of 2002. Since the disease is rare and clinical signs are non-specific, we anticipated that the infection might not have been diagnosed in some patients. Therefore, we asked all 211 medical laboratories in the districts to list the patients meeting the criteria of a possible case. The general practitioner (GP) of each possible case was then contacted to find out whether the patient had had symptoms compatible with fascioliasis. When there was no clear alternative diagnosis and fascioliasis could not be excluded, serological testing for fascioliasis was performed.

A letter of information on the outbreak was sent to all the GPs and hospital infectious diseases departments in the two districts. Information about the disease and the outbreak was communicated to the general public via regional newspapers and national radio channels.

To test the hypothesis that the outbreak of fascioliasis was linked to the consumption of raw commercialized vegetables, we conducted a case-control study. For the investigation, we considered the vegetables usually sold in France during winter to be eaten without cooking, and also known to be a potential source of metacercarial larvae: watercress,



**Fig.** Distribution of cases of fascioliasis by week of onset, Nord Pas-de-Calais, France 2002.  $\leftarrow\text{---}\rightarrow$ , Maximum possible period of contamination;  $\leftarrow\text{---}\rightarrow$ , most likely period of contamination.

dandelion, lamb's lettuce and fresh mint leaves. All confirmed cases identified up to 31 May were included. For each case, two of the GP's patients with recent normal white blood cell counts and no symptoms consistent with fascioliasis were included as controls. The controls were selected among the patients of the GPs of the cases to ensure that they were living in the neighbourhood and might have bought vegetables in the same shops as the cases. Cases and controls were interviewed by telephone using a standardized questionnaire inquiring about demographic data, symptoms, the consumption of at-risk vegetables and the places of purchase since 1 January, with regard to the maximum possible period of incubation (Fig.). The maximum possible period of contamination was assessed using the date of onset of all cases and determined by longest possible incubation period for the first case (2 months [2]) and the shortest possible incubation period for the last case identified (2 weeks [2]). The most likely period of contamination was estimated using all cases included in the case-control study and determined by the shortest possible incubation period for the first of these case (15 days [2]) and the mean incubation period for the last one (6 weeks [2]). Data were analysed using Epi-Info 6 (CDC, Atlanta, GA, USA).

The suppliers of the shops where the cases had bought potential at-risk vegetables were reviewed. Production sites for all producers who supplied the shops where at least two cases were customers were inspected.

## RESULTS

Eighteen confirmed cases were identified. The laboratories notified 505 possible cases from 1 January to 15 May. For 429 (85%) of the cases, another disease could explain the white blood cell count. Fascioliasis

Table. Food consumption by cases and controls, univariate analysis, outbreak of fascioliasis, France, Nord Pas-de-Calais, 2002

Food	Number exposed (%)		OR (95% CI)	P
	Cases (n=14)	Controls (n=23)		
Raw watercress	13 (93)	3 (12)	86.7 (8.55–3854.35)	<10 <sup>-3</sup>
Watercress soup	7 (50)	1 (4)	22 (2.03–1034.72)	0.04
Lamb's lettuce	12 (86)	15 (65)	3.2 (0.49–35.43)	0.17
Dandelion	3 (21)	0 (0)	6.27 (0.48–177)	0.13
Fresh mint leaves	3 (21)	3 (13)	1.82 (0.2–15.77)	0.65

OR, Odds ratio; CI, confidence interval.

could not be excluded for 76 (15%) patients. None of these 76 patients tested positive for fascioliasis.

Eleven (60%) cases lived in the Nord and seven (40%) in the Pas-de-Calais. Onset of symptoms, known for 16 patients, ranged from 15 February to 4 June 2002, suggesting a period of contamination from late January to early March (Fig.). The median duration between the onset of symptoms and diagnosis was 32 days (range 4–103).

Cases were between 20 and 82 years old (median 56 years) and nine (50%) were women. The most common symptoms were asthenia (89%), fever (67%), myalgia (61%), right upper quadrant abdominal pain (61%) and pruritus (39%). No case showed severe cholangitis or jaundice. One case had no symptoms and her fascioliasis was detected during a routine follow-up of a chronic disease.

Leukocytosis, known for 14 cases, ranged from 7500 to 23 000 cells/mm<sup>3</sup> (median 10 200 cells/mm<sup>3</sup>) and eosinophilia from 1600 to 14 100 cells/mm<sup>3</sup> (median 4900 cells/mm<sup>3</sup>). Eleven (60%) cases were hospitalized. All patients were followed up for 6 months and fully recovered after a well-tolerated single dose of triclabendazole (10 mg/kg).

Seventeen of the 18 cases reported having eaten raw watercress and 15 had eaten lamb's lettuce. Eleven cases had bought the watercress in supermarkets of chain A, four others in supermarkets of chain B and one case had bought the watercress at a green-grocer's.

Twelve of the 15 lamb's lettuce consumers had bought their lamb's lettuce in supermarkets of different chains and three cases had gathered it in their garden; the case who did not report having eaten watercress was among these three patients.

Fourteen cases and 23 controls were included in the case-control study. The 23 controls were aged

22–73 years old (mean 43, median 50), and 13 were women (57%). Cases were more likely to have eaten raw watercress [odds ratio (OR) 86.7,  $P < 10^{-3}$ ] and watercress soup (OR 22.0,  $P = 0.04$ ). After adjusting for the consumption of raw watercress, the disease was no longer associated with the consumption of watercress soup. No other exposure was significantly associated with fascioliasis (Table).

A common producer was traced back for the watercress consumed by 16 of the cases. Investigation of the producer's watercress beds revealed that one bed had a high risk of contamination with *Lyymaea truncatula*, no protection against flooding, cattle grazing close to the watercress bed, unexplained resurgence of water from the soil and no cleaning of the ditches. This bed had been massively exploited in January and February, but was no longer used at the time of inspection. Many snail shells were found around this bed. The producer had received an authorization to exploit only one bed, and none of his four beds had ever been inspected.

## DISCUSSION

This is the first outbreak linked to commercialized cultivated watercress described in France. Our investigation demonstrated that fascioliasis remains an incompletely resolved problem in France [2, 8]. Because of its rarity and the non-specific symptoms, fascioliasis is rarely suspected especially without a history of eating wild aquatic plants [1, 6, 10, 11]. However, marked eosinophilia and a history of eating uncooked aquatic plants, wild or commercialized, should always raise the suspicion of fascioliasis [3, 4, 10]. We investigated the possibility of fascioliasis in all persons with more than 10 000/mm<sup>3</sup>

white blood cells and at least 1000 eosinophils/mm<sup>3</sup>. The investigation of these possible cases was very time consuming and did not result in the identification of any additional cases. One of the lessons learned from this outbreak is that, in an outbreak setting, information from the general public and GPs may contribute to ensure the diagnosis of cases, and consequently allow the identification of the large majority of cases.

Water from the fields of a neighbouring farm is the most likely source of contamination of the incriminated bed. We did not investigate the *Fasciola* infection status of the animals on this farm, because the farmer, a cattle trader, kept his animals for a few weeks only.

No family cluster was identified despite the cases reporting having eaten watercress during family meals. Watercress is commonly eaten raw in northern France, and the incriminated producer sold all his produce in this area. The limited number of cases, with regard to the number of consumers exposed, and the absence of family clusters suggest a low level of contamination of the watercress bed.

The investigation of this outbreak indicates that current sanitary regulations do not allow the efficient detection of infestation in commercial watercress production. At present, the sanitary regulations do not impose any protection from close breeding farms or resurgent water, or any specific control measures against snails. It was recommended that watercress producers be informed about the parasitic cycle and about ways to protect their beds from snails, by direct intervention of the experts on their sites, and by the distribution of guidelines on safe production of watercress. In addition, the sanitary regulations need to be revised, and should include an obligation to implement protective measures (ditches, walls, distance to cattle, etc.) of production beds, to search for snails in and around the beds, and to screen them for *Fasciola* infestation [12]. Until these recommendations are implemented, the risk of outbreaks continues.

## DECLARATION OF INTEREST

None.

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