

Watercress cultivation sites and their relationship to fascioliasis in Puerto Rico¹

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ABSTRACT

Watercress, *Nasturtium officinale*, is an edible semi-aquatic plant. It is considered to be the principal source of infection for human fascioliasis in Puerto Rico and elsewhere in the world. Commercially grown and natural watercress areas on the island were examined to determine the existing conditions which would contribute to the dissemination of *Fasciola hepatica*. The factors considered were: 1) the presence of the snail intermediate host (infected and uninfected) in the cress cultivation areas; 2) the presence of parasitized mammals in the area where contaminated fecal matter could be washed into the cress growing sites; 3) the presence of viable metacercariae encysted on watercress; and 4) human consumption of watercress from contaminated sites.

The nine commercial watercress cultivation sites examined were found free of infected snails, free of watercress with viable metacercariae, and free of infected mammals in the area. On the other hand, of the 18 natural, unattended watercress growing sites, seven were found with infected snails, six of the sites had watercress with viable metacercaria, and nine of the sites had susceptible animals in the area.

RESUMEN

Siembras del berro y su relación con la fascioliasis en Puerto Rico

Nasturtium officinale, R. Br. (Gray's Manual) es una planta semiacuática que se consume como ensalada en Puerto Rico. El consumo de berro es un medio de infección de la *Fasciola hepatica* al ingerir metacercarias enquistadas en la planta. Se estudiaron las zonas donde se cultiva el berro comercialmente y silvestre del norte para determinar qué factores contribuyen a diseminar la *Fasciola hepatica*. Se consideraron los factores que siguen: 1) la presencia de caracoles hospederos intermedios infectados o no infectados; 2) la presencia de animales susceptibles y parasitados; 3) la presencia de metacercarias enquistadas en la planta; y 4) el consumo de berro en la comunidad de las zonas contaminadas.

Los resultados de las muestras de caracoles *Lymnaea cubensis*, berro y seis muestras de heces de los nueve viveros comerciales fueron negativos

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a formas larvarias y huevos de la *Fasciola hepatica*; siete de los 18 viveros naturales tenían caracoles infectados. De estos siete, seis fueron positivos a metacercaria. En dos viveros naturales de barro había animales susceptibles, lo cual puede representar una fuente de infección.

INTRODUCTION

Watercress, *Nasturtium officinale*, is a semi-aquatic plant used as a leafy green salad or as garnish. It is known to have high mineral and vitamin content, but is seldom consumed in quantities large enough to be of substantial nutritional value. Ingestion of watercress with vegetation carrying the infective metacercariae can initiate fascioliasis. Watercress is considered to be the principal source of infection for human fascioliasis in Puerto Rico and other areas in the world (1,2,3,6,7,8).

The high prevalence of *Fasciola hepatica* (5) in dairy cattle in Puerto Rico enables this parasite to propagate. This disease is spread when animal fecal matter with parasite eggs is washed into fresh water bodies and eventually into watercress cultivation sites harboring snail hosts. In these environments the parasite miracidiae, capable of penetrating the appropriate snail host, are an important link in maintaining the cycle. Here the molluscan larval stages continue development until the cercariae are released, forming the infective metacercariae. Thus, watercress cultivation sites which harbor *Lymnaea cubensis* and *Lymnaea columella*, the intermediate hosts for *Fasciola hepatica* in Puerto Rico, represent a potential source of infection for the human population which consumes this vegetable.

MATERIALS AND METHODS

Commercial watercress beds in the towns of Caguas, Aguas Buenas, Río Grande and Corozal were examined for factors which would, if present, contribute to the dissemination of *F. hepatica*. The factors considered were the following: 1) the presence of parasitized animals whose fecal samples would be washed into the cress beds; 2) the presence of the snail intermediate hosts sharing the cress bed; 3) the presence of metacercariae encysted on the watercress; and 4) the use of watercress for human consumption.

From each cultivation site, samples of watercress and snails were collected from randomly selected sections of the site and examined in our laboratories. The immediate area of watercress growth site was observed for the presence of cows or goats that would be carriers of *F. hepatica*. Fecal samples were obtained rectally from available animals, and then taken to the laboratory for examination.

Nine commercial and 18 noncommercial watercress beds were visited. Information as to their location was obtained from the vendors and distributors of watercress. The commercial watercress cultivation sites were those which were owned and maintained by specific individuals who har-

vest the plants for sale. The noncommercial watercress cultivation sites were those where cress grew naturally and sporadically, not maintained or owned by anybody. The watercress from these beds was gathered by vendors for sale or taken by passing individuals for personal use.

A survey on the consumption of watercress in a sample of 27 persons with fascioliasis was taken to determine the extent to which watercress was consumed and the source of the plant.

RESULTS AND DISCUSSION

The nine commercial watercress sites examined in 1982 were located as follows: three were in Corozal, two in Río Grande, and one in Gurabo, Aguas Buenas, Canóvanas, and Carolina (table 1). All nine commercial watercress beds were found to harbor one or more snail hosts for *F. hepatica*. *L. cubensis* was found in eight cress beds and *Lymnaea columella* was observed in five. In addition, eight cress beds also harbored *Physa* species. In Puerto Rico, miracidiae of *F. hepatica* penetrate *Physa* species but do not complete development (De León et al., 1971). *Biomphalaria glabrata*, intermediate host for *Schistosoma mansoni*, was found in two of the cress beds: one in Corozal and the other in Gurabo.

The areas surrounding the commercial cultivation sites were examined for the presence of susceptible animals such as cattle, goats or sheep, but none were found in the vicinity at the time. These areas should be inspected periodically to avoid the entrance of infected animals which would deposit parasite eggs.

Snails were present in the commercial cress sites but none were infected with larvae of *F. hepatica* and no watercress could be found with the infective metacercariae attached. Nevertheless, the very presence of snail hosts in the cress beds represents a potential for the development of the cycle.

Natural watercress beds examined presented another picture (table 2). Seventeen of the 18 naturally growing unattended watercress beds were found harboring *L. cubensis*, and in seven of the beds snails infected with *F. hepatica* were found. *L. columella* was found in five of the 18 watercress beds but none were infected with larvae of *F. hepatica*. Metacercariae were found encysted on watercress taken from six of the 18 naturally growing cress beds. Infected cattle were found in the area of 10 of the natural sites.

In barrio Magüeyes of Corozal, Cerro Gordo of San Lorenzo and Río Cañas of Caguas, only a few cows (3, 2, and 3, respectively) were found in the area and were negative for *F. hepatica*. The watercress of these beds had metacercariae cysts and the snails found were free of *F. hepatica*.

In the sector of Cibuco and Palmarejo of Corozal, Jaguar of Gurabo, Barrazas of Carolina, and Higuillar of Dorado, infected cows, infected

TABLE 1.—Commercial watercress cultivation sites

Town	Community	Snail hosts				Watercress	Susceptible animals	Fecal examination
		<i>Fossaria cubensis</i>		<i>Lymnaea columella</i>		Metacercariae present		
		P ¹	I ²	P ¹	I ²			
	Mana	+	0 ³	0	0	0	0	0
Corozal	Cuchilla	+	0	+	0	0	0	0
	Negro	+	0	0	0	0	0	0
Gurabo	Masa	+	0	0	0	0	0	0
Aguas Buenas	Bayamoncito	+	0	+	0	0	0	0
Canóvanas	Cubuy	0	0	+	0	0	0	0
	Guzmán Arriba	+	0	+	0	0	0	0
Río Grande	Guzmán Abajo	+	0	+	0	0	0	0
Carolina	Sabana Abajo	+	0	0	0	0	0	0
Total		8	0	5	0	0	0	0

¹Present.²Infection.³+ =Positive; 0 = Negative.

TABLE 2.—Some natural watercress cultivation sites in Puerto Rico

Town	Community	Snails present				Watercress	Susceptible animals	
		<i>Fossaria cubensis</i>		<i>Lymnaea columella</i>			Metacercariae present	<i>Fasciola hepatica</i> eggs
		P ¹	I ¹	P ¹	I ¹			
	Palmarito	+	- ²	-	-	-	-	
	Magüeyes	+	-	+	-	-	+	
Corozal	Cibuco	+	+	-	-	+	+	
	Palmarejo	+	+	-	-	+	+	
	Jaguar	+	-	-	-	+	+	
Gurabo	Celada	+	+	-	-	-	-	
	Jaguas	+	-	+	-	-	-	
	Jagual	+	-	-	-	-	-	
San Lorenzo	Cerro Gordo	+	-	+	-	-	+	
	Sumidero	+	+	-	-	-	-	
Aguas Buenas	Mula	+	-	-	-	-	-	
Canóvanas	Lomas	+	-	-	-	-	+	
Carolina	Barrazas	+	+	-	-	+	+	
	Jiménez	+	+	-	-	+	-	
Río Grande	Ciénaga	+	-	+	-	-	+	
	Río Cañas	+	-	+	-	-	-	
Caguas	Beatriz	-	-	-	-	-	-	
Dorado	Higuillar	+	+	-	-	+	+	
Total	18	17	7	5	0	6	10	
		94.4%	38.8%	27.7%		33.3%	55.5%	70%

¹P = Present; I = Infection.²+ = Positive; - = Negative.

snails and watercress with metacercariae were all found in the area of the cress cultivation sites. In Canóyanas and Ciénaga of Río Grande, positive cows were found in the area, but the snails and watercress were negative.

In Barrio Jiménez of Río Grande, infected snails and watercress with metacercariae were found but no susceptible domestic animals were seen in the area at the time. Perhaps infected cows, goats and other infected mammals may have passed through the area depositing parasite eggs with fecal matter.

After a rainfall, soil washing drains down to the streams and rivers where watercress grows. If the parasite eggs washed into the cress beds hatch and the miracidiae meet the snail intermediate hosts, then that phase of the parasite cycle begins with the formation of the molluscan larval stages.

According to our survey of 27 persons positive for *F. hepatica*, 23 (85%) admitted to consuming watercress regularly, when it was available. Four of these persons drank water from the river on occasion because it was "fresh". The infected persons interviewed said they generally purchased watercress at the market place and from ambulatory vendors. The snail and ambulatory vendors who generally sell along the roadside or in neighborhoods obtained watercress from the natural unattended cress sites because it was obtained at a lower price or at no cost at all if they gathered the watercress themselves.

In summary, the nine commercial watercress cultivation sites examined were found free of infective snails, free of watercress with the infective metacercariae, and free of infected mammals in the area. On the other hand, of the 18 natural unattended watercress growing sites, seven (38%) of the sites were found with infected snails, six (33.3%) had watercress with metacercariae and ten (55.5%) of the sites had susceptible animals in the area. These naturally growing watercress sites represent a potential source of fascioliasis on the island.

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