

THE INTERMEDIATE SNAIL HOST OF *FASCIOLA HEPATICA* ON THE MEDITERRANEAN ISLAND OF CORSICA

J.A. OVIEDO, M.D. BARGUES & S. MAS-COMA

Departamento de Parasitología, Facultad de Farmacia, Universidad de Valencia,
Av. Vicente Andrés Estellés s/n, 46100 Burjassot - Valencia, Spain

Received 10 October 1996; accepted 15 December 1996

REFERENCE: OVIEDO (J.A.), BARGUES (M.D.) & MAS-COMA (S.), 1996. – The intermediate snail host of *Fasciola hepatica* on the Mediterranean island of Corsica. *Research and Reviews in Parasitology*, 56 (4): 217-220.

ABSTRACT: The intermediate snail host species which transmits *Fasciola hepatica* in Corsica is determined experimentally for the first time. The snail species most frequently found in fresh-water collections in Corsica were tested: *Lymnaea truncatula* (Müller, 1774), *L. peregra* (Müller, 1774), *L. palustris* (Müller, 1774) (Lymnaciidae), *Physa acuta* (Draparnaud, 1805) (Physidae), *Potamopyrgus jenkinsi* (Smith, 1889) (Hydrobiidae), and *Bithynia tentaculata* (Linnaeus, 1758) (Bithyniidae). Triniracial infection assays gave positive results only with *L. truncatula* (infection rate: 57.1-100%; prepatent period: 50.25 days postinfection). Monomiracidial infection assays of *L. truncatula* were also positive (infection rate: 60.0-80.0%; prepatent period: 49.0-50.25 days postinfection).

KEY WORDS: *Fasciola hepatica*, intermediate snail host, *Lymnaea truncatula*, Corsica, France.

INTRODUCTION

The Mediterranean island of Corsica presents an endemic of fascioliasis by the digenean species *Fasciola hepatica* (Linnaeus, 1758) (Trematoda: Fasciolidae) which affects both livestock (GRETILLAT, 1963) and humans (COQUILHAT, 1965; GITARD *et al.*, 1965; GIL *et al.*, 1990, 1991). Despite its veterinary and public health importance, no study has been undertaken up to the present to determine the intermediate snail host species which is involved in the transmission. In fact, the present knowledge on the fresh-water snail fauna is far from being complete. Published papers on this Corsican malacofauna are old or concern only given zones or species (REQUIEM, 1848; MABILLE, 1869; CAZIOT, 1902; BRUMPT, 1930; GERMAIN, 1931; BUTTNER & BOURCART, 1957; GRETILLAT, 1963; DOBY *et al.*, 1965, 1966a, 1966b; GIUDICELLI, 1968; CHABAUD *et al.*, 1969; LEGER & LEGER, 1974; ALBARET *et al.*, 1981; ORECCHIA *et al.*, 1981; HOLYOAK, 1983; ORSINI, 1986; ROCHE, 1989), lacking a modern monographic overview.

Research work carried out on other Mediterranean islands have proved that the insularity phenomenon influences different aspects of the evolution of parasitofaunas. One of these aspects is the capacity of parasitic species to adapt to host species different from the ones known on the mainland. This adaptation results in an enlargement of the host spectrum which in turn enables the parasite to colonize kinds of biotopes different from the usual ones in continental areas (MAS-COMA, 1979; MAS-COMA & FELIU, 1984; MAS-COMA *et al.*, 1987; MAS-COMA & ESTEBAN, 1988).

The island of Corsica is extremely abrupt from the orographic point of view, which is related to a marked physiographic heterogeneity. In such natural conditions, *F. hepatica* has been found in almost all parts of the island, from the plains in the east to the mountainous

inland, from sea level to high altitudes, from typical pasture grasslands to atypical humid dense savannas, beaches, river outfalls, man-made fountains and canals, etc. (MAS-COMA *et al.*, unpublished data).

Studies have been undertaken to understand such an unusual colonization capacity of the liver fluke. At definitive host level, the adaptation of the parasite to an unusual mammal species such as the black rat, *Rattus rattus* (Linnaeus, 1758) (Rodentia: Muridae) has explained its spreading ability in part (MAS-COMA *et al.*, 1987, 1988; VALERO *et al.*, 1997a, b). At intermediate snail host level, no specific study has been carried out up to the present to verify whether in Corsica the liver fluke follows specificity and life cycle patterns similar to those known in the European mainland or not.

The aim of the present paper is to determine whether one or more fresh-water snail host species play the role of intermediate host of animal and human fascioliasis on the island of Corsica.

MATERIAL AND METHODS

Liver fluke isolate: *F. hepatica* eggs were collected in infected bovine gallbladders at the slaughterhouse of Porto-Vecchio, Corsica. Eggs were washed three times with natural water and maintained at 20° C in total darkness up to full development of miracidium inside.

Fresh-water snail species: The snail species most frequently found in fresh-water collections in Corsica were tested: specimens of *Lymnaea truncatula* (Müller, 1774) (Lymnaciidae) were collected in Monacia d'Aullène and Partinello; specimens of *L. peregra* (Müller, 1774) were from Capu di Padula and Piana; specimens of *L. palustris* (Müller, 1774) were from Camping U Moru, at the mid-route between Sotta and Figari; specimens of *Physa acuta* (Draparnaud, 1805) (Physidae) were from Fior di Spina; *Potamopyrgus jenkinsi* (Smith, 1889) (Hydrobiidae) were from Ortolò river; *Bithynia tentaculata* (Linnaeus, 1758) (Bithyniidae) were

from Fornoli. Snails were transported to the laboratory under isothermal conditions and kept in 2000 ml fresh water in standard breeding containers at 20° C, 90% r.h. and 12 h/12 h light/darkness in a climatic chamber. The water was changed weekly and lettuce added as needed.

Experimental infections of snails: Only 4-5 mm sized snail individuals were used. Trimiracidial infections of at least 5 individuals belonging to each snail species were carried out by exposing each snail to 3 miracidia for 4 hours in a small Petri dish containing 2 ml of fresh water. Monomiracidial infections were carried out following the same experimental pattern. Snails were afterwards returned to the same standard conditions in the climatic chamber until day 30 postinfection, in which they were again isolated in Petri dishes to allow daily following of possible cercarial shedding by snail individuals.

RESULTS

Results obtained in trimiracidial infection assays are shown in Table 1. All experimental infection assays of the species *L. peregra*, *L. palustris*, *P. acuta*, *P. jenkinsi* and *B. tentaculata* failed.

Successful results with final cercarial shedding were only obtained in snail individuals belonging to the species *L. truncatula*: 4 infected individuals among 7 surviving snails in the case of the specimens from Monacia (57,1%) and 8 infected individuals among 8 surviving snails in the case of the specimens from Partinello (100%). The mean prepatent period was of 50,25 days postinfection in both Monacia and Partinello snails.

For verification, monomiracidial infections were afterwards carried out only with 5 specimens of *L. truncatula* from Monacia and another 5 specimens of the same snail species from Partinello. In both cases successful infection was obtained: 3 infected individuals among 5 surviving snails in the case of the specimens from Monacia (60,0%) and 4 infected individuals among 5 surviving snails in the case of the specimens from Partinello (80,0%). The mean prepatent period was of 49,00 and 50,25 days postinfection in Monacia and Partinello snails, respectively.

DISCUSSION

F. hepatica has a preferred snail transmitting species in Europe: *Lymnaea (Fossaria) truncatula* (Müller, 1774) (Gastropoda: Basommatophora: Lymnaeidae) (KENDALL, 1965, 1970; BORAY, 1982). However, there are other different European aquatic snail species of the same genus *Lymnaea* Lamarck, 1799 *sensu lato* (classification following BARGUES & MAS-COMA, 1997 and BARGUES *et al.*, 1997) which have also been found transmitting it under special natural conditions: *Lymnaea (Leptolymnaea) glabra* (Müller, 1774) (BOUX-BUSSON & RONDELAUD, 1985, 1986) and *Lymnaea (Stagnicola) palustris* (Müller, 1774) (DREYFUSS *et al.*, 1994). In the laboratory both *L. glabra* and *L. palustris*, and even *Lymnaea (Lymnaea) stagnalis* (Linnaeus, 1758) and *Lymnaea (Radix) peregra* (Müller, 1774) can be extremely infected if miracidium infection takes place during the first few days of the snail's life, although a high mortality level is obtained (KENDALL, 1970; BORAY, 1978; BROWN, 1978). Experimental infections of young snail individuals enabled even the successful infection of European species belonging to other fresh-water snail genera of the same or other gastropod families such as *Myxas glutinosa* (Müller, 1774) (Lymnaeidae) (VAREILLE-MOREL, RONDELAUD & DREYFUSS, 1994), *Bulinus truncatus* (Audouin, 1827) (Planorbidae: Bulininae) (BARTHE & RONDELAUD, 1986), and *Physa acuta* (RONDELAUD, AMAT-FRUT & PESTRE-ALEXANDRE, 1982; BARTHE & RONDELAUD, 1986; PREVERAUD-SINDOU & RONDELAUD, 1990).

In the present study only snail adult (and not new-born or young) individuals were tested, because the aim was to find out which snail species acts or act as intermediate host transmitting *F. hepatica* under usual natural conditions on the island. According to the results obtained, it appears to be clear that this epidemiological role is only developed by *L. truncatula*, similarly as on the European mainland. Infection percentages and prepatent period, both in trimiracidial and monomiracidial infections, may be considered as normal at 20° C when compared to si-

Snail species	Geographic origin	No. snails infected	No. miracidia used	% infected snails No. infected/No. surviving
<i>L. truncatula</i>	Monacia	10	3	57,1 (4/7)
<i>L. truncatula</i>	Monacia	5	1	60,0 (3/5)
<i>L. truncatula</i>	Partinello	10	3	100 (8/8)
<i>L. truncatula</i>	Partinello	5	1	80,0 (4/5)
<i>L. peregra</i>	Capu di Padula	5	3	0
<i>L. peregra</i>	Piana	5	3	0
<i>L. palustris</i>	Camping U Moru	5	3	0
<i>P. acuta</i>	Fior di Spina	5	3	0
<i>P. jenkinsi</i>	Ortolo river	5	3	0
<i>B. tentaculata</i>	Fornoli	5	3	0

Table 1.— Results of *Fasciola hepatica* (cattle isolate) infection assays carried out with fresh-water snail species from Corsica.

milar studies carried out with *F. hepatica* isolates and *L. truncatula* specimens from European mainland zones (ROBERTS, 1950; PANTELOURIS, 1965; KENDALL, 1965, 1970; ODENING, 1971; BORAY, 1982; etc.).

This does not mean, however, that in exceptional cases, new-born and very young individuals of the species *L. palustris* and *L. peregra* may also be infected in Corsica, despite the negative results obtained in the adult snail infections of these species in the present study.

Evidence suggests that *P. acuta* and *P. jenkinsi* do not participate in fascioliasis transmission in Corsica. In the case of *P. jenkinsi*, it may even be considered as a potential competitor of the intermediate snail host species *L. truncatula*, according to the observations made by RONDELAUD (1977). *B. truncatus* is present in Corsica, but populations of this species are rare and located in only a very few places. Another European mainland lymnaeid species, *Lymnaea auricularia* (Linnaeus, 1758) is also present in Corsica, but its populations are restricted to a very few locations and laboratory experiments carried out by other authors have already demonstrated the inappropriateness of this lymnaeid species regarding *F. hepatica* infection (see review by ODENING, 1971). *L. stagnalis*, *L. glabra* and *M. glutinosa* are absent in Corsica.

According to the results of the present paper, *F. hepatica* has not enlarged its intermediate snail host spectrum on the island of Corsica. Consequently, more studies are needed to see whether *F. hepatica* has developed other special adaptation strategies at intermediate snail host level which may explain the large colonization capacity of this digenean parasite in Corsica.

ACKNOWLEDGEMENTS

This study was supported by Project No. PB87-0623 of the DGICYT of the Spanish Ministry of Education and Science, Madrid, by Project PDP No. B2/181/125 of the WHO of Geneva, Switzerland, by French-Spanish Acciones Integradas 68/240 (Area 4), 91/89 and HF-121/90, and by the financial aid to the Valencia-Paris VI Interuniversity Agreement. Thanks are given to Dr. M.A. Valero (Valencia, Spain) and to Dr. R. Fons and J.P. Clara (Banyuls-sur-Mer, France) for their technical collaboration in field work, as well as to Dr. J.L. Albaret (Paris, France) and M. B. Roche (Bastia, Corsica) for information concerning Corsican freshwater snails.

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