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C. Dard, D. Nguyen, C. Miossec, E. Tessier, K. de Meuron, et al.. Angiostrongyliasis due to A. cantonensis: first evidence in French Territories of America & an up-date in all French Overseas Territories. Société Française de Parasitologie (SFP) Société Française de Mycologie Médicale (SFMM), 2018, Nice, France. hal-02870281

#### HAL Id: hal-02870281 https://univ-guyane.hal.science/hal-02870281

Submitted on 16 Jun2020

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# Angiostrongyliasis due to A. cantonensis. first evidence in French Territories of America & an up-date in all French Overseas Territories

<u>C. Dard<sup>1</sup></u>, D. Nguyen<sup>2</sup>, C. Miossec<sup>2</sup>, E. Tessier<sup>2</sup>, K. de Meuron<sup>2</sup>, D. Harrois<sup>3</sup>, D. Mattera<sup>3</sup>, L. Epelboin<sup>4</sup>, M. Nicolas<sup>5</sup>, P. Desprez<sup>5</sup>, L. Rulquin<sup>5</sup>, S. Tournier<sup>5</sup>, L. Aubert<sup>6</sup>, N. Traversier<sup>7</sup>, M.C. Jaffar Bandjee<sup>7</sup>, O. Belmonte<sup>7</sup>, J. Belmonte<sup>7</sup>, J. Belmonte<sup>7</sup>, D. Belmonte<sup>7</sup>, D. Belmonte<sup>7</sup>, M.C. Jaffar Bandjee<sup>7</sup>, O. Belmonte<sup>7</sup>, J. Belmonte<sup>7</sup>, D. Belmo G. Miltgen<sup>7</sup>, L. Collet<sup>8</sup>, R. Blondé<sup>8</sup>, A. Chamouine<sup>8</sup>, T. Benoit-Cattin<sup>8</sup>, C. Olivier<sup>8</sup>, M. Giard<sup>9</sup>, A. Guerin<sup>10</sup>, F. Ghawche<sup>10</sup>, J. Pasche<sup>10</sup>, S. Darteyre<sup>10</sup>, G. Delvallez<sup>11</sup>, A.C. Gourinat<sup>11</sup>, S. Lastère<sup>11</sup>, N. Desbois-Nogard<sup>2</sup>

<sup>1</sup> CHU Grenoble Alpes, Grenoble, France; <sup>2</sup> CHU de la Martinique, Fort-de-France, Martinique, France; <sup>3</sup> CHU de Pointe-à-Pitre, Guadeloupe, Guadeloupe, France; <sup>6</sup> Santé Publique France; <sup>2</sup> CHU de France; <sup>7</sup> CHU Félix-Guyon, Saint-Denis, La Réunion, France; <sup>8</sup> CH de Mamoudzou, Mamouzdou, Mayotte, France; <sup>9</sup> Bureau de Veille Sanitaire, Direction de la Santé, Polynésie française, France; <sup>10</sup> CH de Polynésie française, France; <sup>10</sup> CH de Polynésie française, France; <sup>10</sup> CH de Polynésie française, Papeete, Tahiti, France; <sup>11</sup> CH Territorial de Nouvelle-Calédonie, Nouvelle-Calédonie, France; <sup>10</sup> CH de Polynésie française, Papeete, Tahiti, France; <sup>10</sup> CH de Polynési

## Introduction

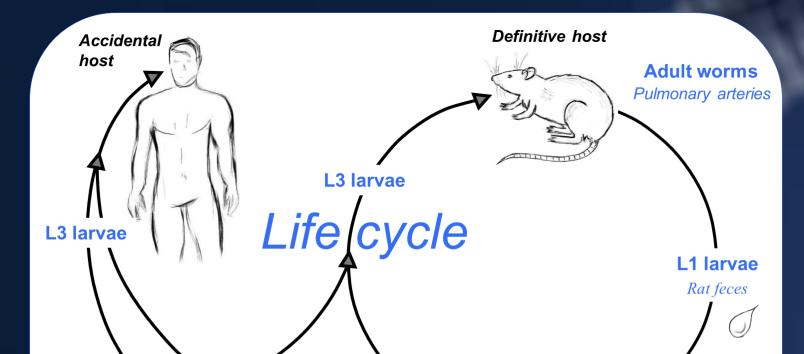
#### Angiostrongylus cantonensis

- A. cantonensis : nematode of rat pulmonary arteries
- Leading infectious cause of eosinophilic meningitis in humans

#### Human angiostrongyliasis (HA)

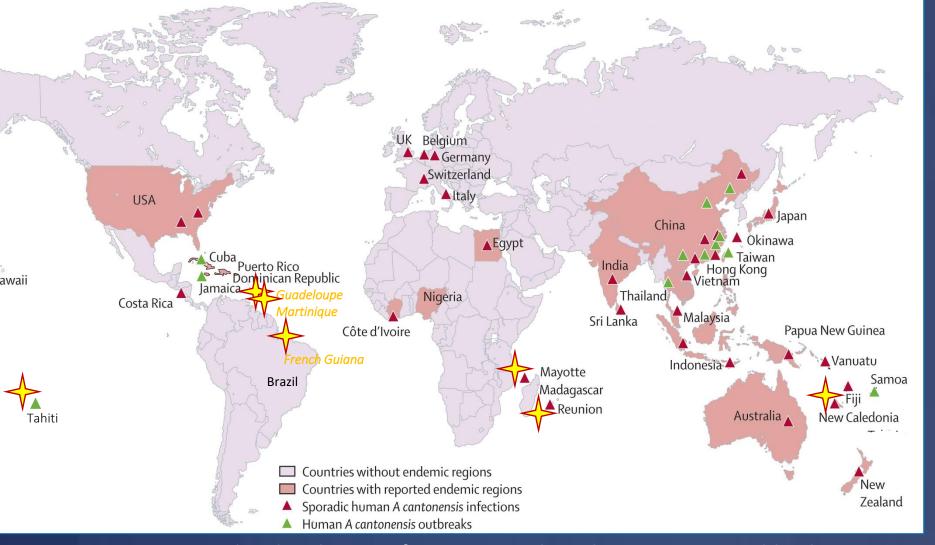
- Commonly a self-limited meningitis syndrome
- Large spectrum of symptoms possible: asymptomatic disease, mild headache, encephalitis, radiculomyelitis, meningoencephalitis with permanent neurological injury or even death

## Life cycle of A. cantonensis (Figure 1)



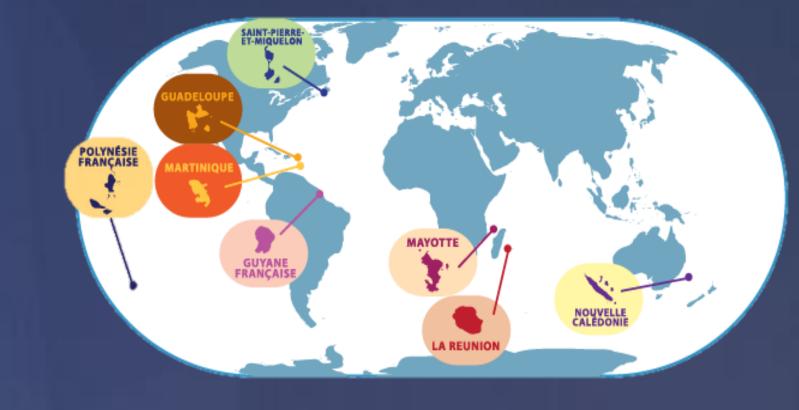
## **Geographic distribution:** (Figure 2)

- Most human cases: Southeast Asia, Pacific Basin
- Also possible in some limited parts of Africa and both American continents
- In the Greater Antilles: recent emergence in Cuba, Dominican Republic, Jamaica
- In South America: recent emergence in Brazil and Ecuador
- In French Territories of the Americas (Guadeloupe, Martinique) and French Guiana): no human cases documented so far

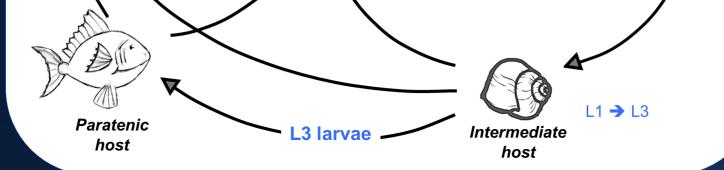


## *Objectives*

- ✓ Report the first cases of human angiostrongyliasis (HA) in the French Territories of the Americas (Guadeloupe, Martinique, French Guiana) & perform an investigation of the environmental presence of A. cantonensis in these territories.
- ✓ Provide an update of this disease in all French overseas territories (French Polynesia, New Caledonia, Mayotte Island, La Réunion Island)



## Material & Methods



#### Figure 1. Life cycle of A. cantonensis.

Rats are definitive hosts. Intermediate hosts (snails and slugs) swallow 1<sup>st</sup> stage larvae excreted in rats feces. Humans become infected through food containing 3<sup>rd</sup> stage larvae. Food items may include uncooked snails or slugs vegetables contaminated with snails, slugs, or mollusc secretions (slime), or infected paratenic hosts (i.e., crabs, freshwater shrimp).

*Figure 2.* Geographic distribution of angiostrongyliasis human cases worldwide. Adapted from Wang et al., Lancet Infectious diseases, 2008

+ French overseas territories included in the study (Guadeloupe, Martinique, French Guiana, French Polynesia, New Caledonia, Mayotte Island, La Réunion Island)

Results

Between 1999 and 2017, all cases of eosinophilic meningitis in French Antilles and French Guiana were investigated using real-time-PCR of CSF or by detection of specific antibodies in sera and CSF. Descriptive analysis was conducted for clinical, biological and radiological features.

Concurrently, cases of HA already diagnosed in French Polynesia, New Caledonia, Mayotte Island and Reunion Island were retrospectively included in the study as far as the medical charts were available. Literature review was also performed to complete the data. Descriptive analysis was made for clinical, biological, radiological features and risk behavior related to each territory. Results are found in *Table 1*.

Concurrently, 440 mollusks of 9 species (mainly Achatina fulica snails) were collected between 2014 and 2017 at different locations and periods and analyzed for carriage of parasites using realtime-PCR. Preliminary results are found in *Table 2*.

## 1. Clinical study

	French West Indies		South America	Indian Ocean		Pacific Basin	
	Guadeloupe Island <sup>a</sup>	Martinique Island	French Guiana <sup>b</sup>	Mayotte Island <sup>c</sup>	La Réunion Island <sup>d</sup>	New Caledonia	French Polynesia <sup>e</sup>
ar of first human case	1999	2002	2017	1996	1969	1951	1961
mber of reported cases before our study eriod, years]	0	0	0	23 [1996 – 2012]	8 [1969 – 1998]	72 [1951 – 2008]	303 [1961 – 2012]
es reported during our study iod, years]	4 [1999 – 2017]	8 [2002 – 2017]	1 [2017]	7 [2013 – 2017]	0 (1 from Mayotte) [2017]	11 [2009 – 2017]	37 [2012 - 2017]
n annual incidence (case/ year) Ographic characteristics	0.22	0.47	1	1.4	0.1	1.3	7.4
e (years)	2.2 [0.6 – 5.0]	24.3 [0.87 – 63.6]	10 [10 – 10]	1 [0.5 – 75]	3.5 [0.83 – 50]	36 [0.2 – 73]	29.5 [3-67]*
(male)	25%	75%	100%	76.2%	100%	54.5%	43.8%*
<b>osure risk</b> (contact with snails, shrimps, mental rders)	100%	62.5%	100%	58.3%	100%	100%	92.3%*
in mode of transmission	<i>A. fulica</i> (snails)	A. fulica (snails)	<i>A. fulica</i> (snails)	<i>A. fulica</i> (snails)	ND	<i>A. fulica</i> (snails)	Raw shrimps, « Chevrettes » (Taioro, Mitihue)
nical presentation							
ningeal syndrom	100%	100%	100%	23.5%	25%	0%	18.8%*
I neurological deficit	50%	87.5%	100%	88.2%	62.5%	72.7%	37.5%*
poratory tests							
l WBC count (G/L)	14.1 [12.1 – 16]	10.0 [6.61 – 20.75]	12.3 [12.3 – 12.3]	ND	18.5 [11.3 – 24.0]	ND	ND
philic count in blood (G/L) (% of WBC)	2.6 [2.3 – 3.6] (18.5% [17 – 25.5])	1.72 [0.49 – 6.43] (12.5% [5 – 31])	5.49 [5.49 – 5.49] (44.6% [44.6 – 44.6])	2.5 [0.1 – 8.4] (15.9% [1.0 – 33.3])	2.8 [1.7 – 5.4] (15.0% [15.0 – 22.0])	1.0 [0.0 – 3.1]	0.9 [0.1 – 2.9]*
count in CSF	715 [190 – 3000]	505 [0 – 2280]	550 [550 – 550]	ND	1125 [300 – 1700]	260 [70 – 1100]	600 [1 - 1000]*
ophilic count in CSF (/mm³) (% of WBC)	555 [84 – 2040] (56.5% [30 – 89])	74.5 [0 – 1550] (25.0% [4 – 68])	506 [506 – 506] (92% [92 – 92])	193 [3 – 690] (45% [5 – 76])	374 [0 – 1275] (47% [34 – 75])	70 [7 – 608] (21% [8 – 75])	161 [0 – 670]* 38% [0 – 67])
orachia (mmol/L)	1.3 [0.91 – 2.8]	2.81 [0.1 – 4.3]	4.2 [4.2 – 4.2]	2.3 [1.1 – 3.5]	2.2 [1.9 – 7.0]	2.13 [0.54 – 6.32]	2.22 [1.28 – 3.72]*
einorachia (g/L)	0.66 [0.21 – 1.1]	1.14 [0.33 – 1.71]	0.43 [0.43 – 0.43]	0.73 [0.22 – 1.69]	0.6 [0.3 – 0.65]	0.89 [0.6 – 5.96]	0.86 [0.22 – 3.35]*
ve <i>A. cantonensis</i> PCR in CSF	100%	ND	100%	87.5%	ND	100%	62.5%*
ive A. cantonensis serology in sera	100%	87.5%	100%	ND	100%	100%	ND
tion of A. cantonensis antibodies in CSF	ND	100%	ND	ND	100%	100%	100%*
agement							
<b>th of hospital stay</b> (days)	20.5 [10 – 35]	27 [15 – 66]	38 [38 – 38]	ND	17.5 [17 – 18]	10 [7 – 150]	4.5 [1 – 10]*
osteroids	100%	62.5%	100%	70.6%	40%	44.4%	56.3%*
elmintic therapy (albendazole or ivermectin)	100%	87.5%	100%	88.2%	80%	55.6%	0%*
ome							
eurological sequelae (%)	25%	62.5%	0%	15%	0%	18.2%	25%*
ath (%)	0%	12.5%	0%	25%	20%	0%	0%*

Table 1. Clinical presentation of the cases along with the biological, imaging and epidemiological features.

## 2. Environmental survey

		French West Indies	South America	
	Gu	uadeloupe Island	Martinique Island	French Guiana
Number of collected snails	34	105	135	166
Number of species	1	1	9	3
Snails infected with A. cantonensis	11 (32.4%) (Fig. 4)	Currently being analysed (some snails are positive)	Currently being analyzed	Currently being analysed (some snails are positive)

Table 2. First results of environmental evaluation. The evaluation of the prevalence of A. cantonensis in the local mollusk population of French Territories of America is currently underway in Pasteur Institute of Guadeloupe (Dr A. Talarmin, Dr S. Guyomard).

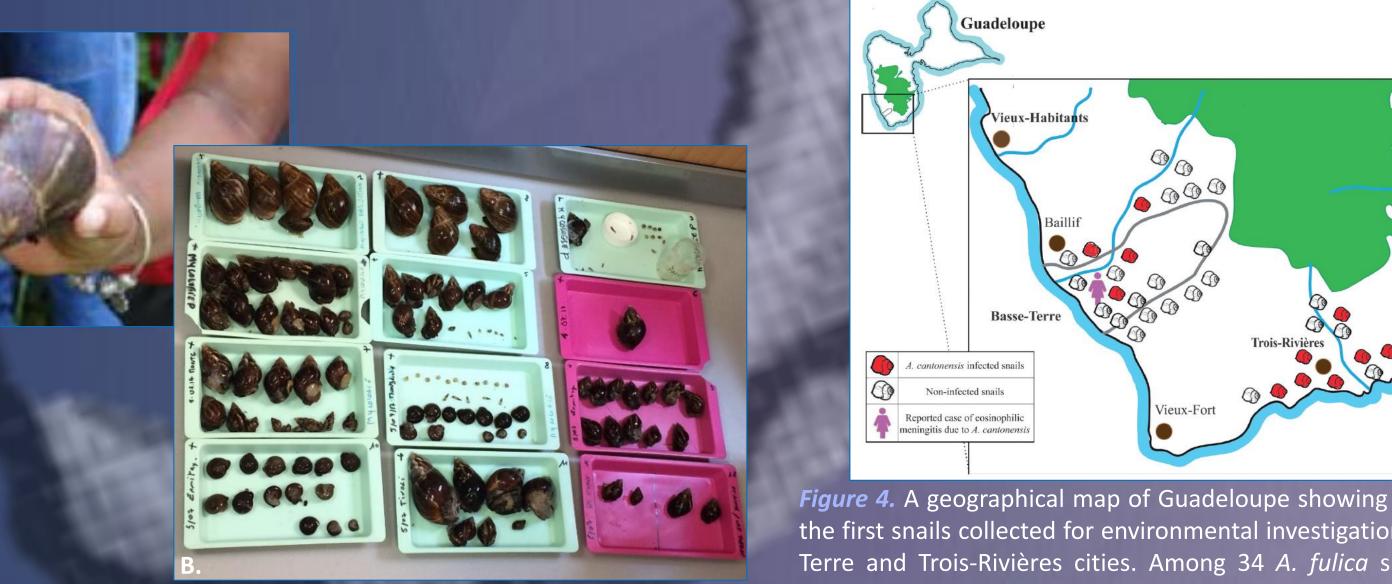


Figure 3. A. A. fulica snail collected in Martinique in June 2017. B. Overview of a part of molluscs collected in Martinique.

Figure 4. A geographical map of Guadeloupe showing the distribution of the first snails collected for environmental investigation in 2014 in Basse-Terre and Trois-Rivières cities. Among 34 A. fulica snails collected, 11 (32.4%) were positive by *A. cantonensis* by PCR. (Dard C. *et al.* AJTMH. 2017)

## Discussion & Conclusion

## This study:

- Reports for the first time of human angiostrongyliasis and environmental presence of *A. cantonensis* in Guadeloupe, Martinique & French Guiana: real emergence in the French Territories of America
- Presents an up-to-date analysis of HA cases in the others French Overseas Territories:
  - > angiostrongyliasis is still a major public health problem in Indian Ocean and Pacific Basin
  - > the incidence of the disease is strongly increasing in French Polynesia

## Angiostrongyliasis disease in French overseas Territories

- Risk factors:
  - children playing in soil and with snails
  - > adults with PICA syndrome and mental disorders; consumption of Taioro and Mitihu (raw shrimps & chevrettes) in French Polynesia
- Still a life threatening disease: sequelae from 0 to 62.5%, mortality from 0 to 25%

## Angiostrongyliasis, an emerging public health problem?

- *A. fulica* is one of the most invasive mollusc species worlwide, particularly in the Americas
- Misknowledge of the disease: probably underestimate prevalence in all French overseas Territories
- Clinicians should strongly consider angiostrongyliasis when determining the causes of eosinophilic meningitis in the French Overseas Territories, particularly in the Pacific Basin

#### Alerte **Consommation de TAIORO** Depuis le début de l'année, plusieurs personnes ont été hospitalisées pou ngite à éosinophile », suite à la consommation de TAIORO. En cause, l'utilisation de chevrettes crues pour faire fermenter le coco râp rettes peuvent contenir un parasite qui se transmet à l'homme ne seule chose à faire pour éviter cela CONGELER les chevrettes au moins 48 heures avant de les utilise NE PAS CONSOMMER du TAIORO fait avec les chevrettes non congel parasite provoque des maux de tête, des vomissements ou des nausées, ur rippal (fièvre, douleurs dans les mains ou les pieds) ; cela peut aller jusqu'à u Les personnes qui, une à deux semaines après consommation de TAIORO.

*Figure 5.* Prevention methods consist in (A) limiting exposure to snails and snails slime (B) avoiding the consumption of uncooked freshwater shrimps (i.e. chevrettes). Picture B is an alert displayed in supermarkets in Tahiti Island to prevent angiostrongyliasis meningitis.

Thanks to Max Sibille & Martin Peju for the pictures.

## Where can A. cantonensis PCR or serology be performed?

PCR. Institut Pasteur de Guadeloupe, Pointe-à-Pitre, Guadeloupe; CH de Polynésie française, Papeete, Tahiti; CH de Mamoudzou, Mayotte, France; CH Territorial de Nouvelle-Calédonie, Nouméa, France; CDC laboratory, Atlanta, USA

Serology. Swiss Tropical and Public Health Institute, Basel, Switzerland

## Acknowledgments

