

Address for correspondence: Laura Tomassone, Dipartimento di Produzioni Animali, Ecologia ed Epidemiologia, Università di Torino, Italy, via L da Vinci 44, 10095 Grugliasco, Torino, Italy; email: laura.tomassone@unito.it

Enzootic Angiostrongyliasis in Shenzhen, China

To the Editor: *Angiostrongylus cantonensis* is a zoonotic parasite that causes eosinophilic meningitis in humans after they ingest infective larvae in freshwater and terrestrial snails and slugs, paratenic hosts (such as freshwater fish, shrimps, frogs, and crabs), or contaminated vegetables. With the increase of income and living standards, and the pursuit of exotic and delicate foods, populations around the world have seen angiostrongyliasis become an important foodborne parasitic zoonosis (1–9).

Shenzhen municipality is situated in the most southern part of mainland People's Republic of China between the northern latitudes of 22°27' to 22°52' and eastern longitudes of 113°46' to 114°37'; it shares a border with the Hong Kong Special Administrative Region, China, in the south. The climate is subtropical, with an average annual temperature of 23.7 °C. The city is 1,952.84 km² and has a population of 10 million.

Since 2006, thirty-two sporadic cases of human eosinophilic meningitis caused by consumption of undercooked aquacultured snails have been documented in Shenzhen (Shenzhen Center for Disease Control and Prevention, unpub. data). To identify the source of these infections and assess the risk for an outbreak of eosinophilic meningitis, we conducted a survey to investigate whether *A.*

cantonensis occurs in wild rats and snails in Shenzhen.

To examine *A. cantonensis* infection in intermediate host snails, 302 terrestrial snails (*Achatina fulica*) were collected from 10 investigation sites across Shenzhen, and 314 freshwater snails (*Pomacea canaliculata*) were sampled from 6 investigation sites. We examined the snails for *A. cantonensis* larvae by using pepsin digestion standardized procedures (3). To survey the prevalence of adult *A. cantonensis* in definitive host rats, we collected 187 *Rattus norvegicus* rats and 121 *R. flavipectus* rats collected from 4 sites where positive snails positive for *A. cantonensis* were found. These rats were examined for the presence of adult *A. cantonensis* in their cardiopulmonary systems.

A. cantonensis larvae were found in 96 (15.6%) of 616 examined snails. Of these, *P. canaliculata* had an average infection rate of 20.7% (65/314), significantly higher ($p < 0.01$) than that of *A. fulica* (10.3%, 31/302), an indication that *P. canaliculata* may be the principal intermediate host for *A. cantonensis* in Shenzhen. *A. cantonensis* adults were recovered from the cardiopulmonary systems of 37 (12%) of 308 examined rats. Infection rate for *R. norvegicus* rats was 16.6% (31/187), significantly higher ($p < 0.01$) than that for *R. flavipectus* (4.9%, 6/121), an indication that *R. norvegicus* may be the principal definitive host for *A. cantonensis* in Shenzhen, possibly due to the rat's preference for eating snails. Infection rates were higher for female rats (25.6% for *R. norvegicus* and 7.8% for *R. flavipectus*) than for male rats (8.9% for *R. norvegicus*, 2.9% for *R. flavipectus*), possibly because female rats eat more snails to supply proteins for reproduction. This report of enzootic *A. cantonensis* infection in wild rats and snails in Shenzhen demonstrates the existence of natural origins of infection with *A. cantonensis* for humans in this city.

Persons in Shenzhen eat raw or undercooked freshwater and terrestrial snails and slugs. This practice provides opportunities for infection with *A. cantonensis*, particularly given that *P. canaliculata* has been aquacultured intensively for human consumption. The prevalence of *A. cantonensis* in wild rats and snails in Shenzhen poses substantial risk for future outbreaks of human eosinophilic meningitis. Moreover, public health officials, epidemiologists, researchers, clinical technicians, medical practitioners, parasitologists, and veterinarians, as well as the general public, should be aware of such risks, and integrated strategies should be taken to reduce or eliminate such risks.

Acknowledgment

We thank Alasdair Nisbet for his assistance in improving the manuscript.

Project support was provided in part by a grant from Shenzhen Municipal Bureau of Science and Technology (grant no. 2007079) to R.-L.Z. and a grant from the Program for Changjiang Scholars and Innovative Research Team in University (grant no. IRT0723) to X.-Q.Z.

**Ren-Li Zhang, Mu-Xin Chen,
Shi-Tong Gao, Yi-Jie Geng,
Da-Na Huang, Jian-Ping Liu,
Yuan-Liang Wu,
and Xing-Quan Zhu**

Author affiliations: Shenzhen Center for Disease Control and Prevention, Shenzhen, People's Republic of China (R.-L. Zhang, M.-X. Chen, S.-T. Gao, Y.-J. Geng, D.-N. Huang, J.-P. Liu, Y.-L. Wu); and South China Agricultural University, Guangzhou, People's Republic of China (M.-X. Chen, X.-Q. Zhu)

DOI: 10.3201/eid1412.080695

References

1. Alicata JE. The discovery of *Angiostrongylus cantonensis* as a cause of human eosinophilic meningitis. *Parasitol Today*. 1991;7:151–3. DOI: 10.1016/0169-4758-(91)90285-V

2. Hochberg NS, Park SY, Blackburn BG, Sejvar JJ, Gaynor K, Chung H, et al. Distribution of eosinophilic meningitis cases attributable to *Angiostrongylus cantonensis*, Hawaii. *Emerg Infect Dis.* 2007;13:1675–80.
3. Lindo JF, Waugh C, Hall J, Cunningham-Myrie C, Ashley D, Eberhard ML, et al. Enzootic *Angiostrongylus cantonensis* in rats and snails after an outbreak of human eosinophilic meningitis in Jamaica. *Emerg Infect Dis.* 2002;8:324–6.
4. Slom TJ, Cortese MM, Gerber SL, Jonse RC, Holtz TH, Lopez AS, et al. An outbreak of eosinophilic meningitis caused by *Angiostrongylus cantonensis* in travelers returning from the Caribbean. *N Engl J Med.* 2002;346:668–75. DOI: 10.1056/NEJMoa012462
5. Leone S, De Marco M, Ghirga P, Nicastri E, Esposito M, Narciso P. Eosinophilic meningitis in a returned traveler from Santo Domingo: case report and review. *J Travel Med.* 2007;14:407–10. DOI: 10.1111/j.1708-8305.2007.00152.x
6. Tsai HC, Liu YC, Kunin CM, Lai PH, Lee SS, Chen YS, et al. Eosinophilic meningitis caused by *Angiostrongylus cantonensis* associated with eating raw snails: correlation of brain magnetic resonance imaging scans with clinical findings. *Am J Trop Med Hyg.* 2003;68:281–5.
7. Waugh CA, Shafir S, Wise M, Robinson RD, Eberhard ML, Lindo JF. Human *Angiostrongylus cantonensis*, Jamaica. *Emerg Infect Dis.* 2005;11:1977–8.
8. Lv S, Zhang Y, Steinmann P, Zhou XN. Emerging angiostrongyliasis in Mainland China. *Emerg Infect Dis.* 2008;14:161–4. DOI: 10.3201/eid1401.061529
9. Zhou P, Chen N, Zhang RL, Lin RQ, Zhu XQ. Food-borne parasitic zoonoses in China: perspective for control. *Trends Parasitol.* 2008;24:190–6. DOI: 10.1016/j.pt.2008.01.001

Address for correspondence: Xing-Quan Zhu, Laboratory of Parasitology, College of Veterinary Medicine, South China Agricultural University, 483 Wushan St, Tianhe District, Guangzhou, Guangdong Province 510642, People's Republic of China; email: xingquanzh@scau.edu.cn



Knowledge about Avian Influenza, European Region

To the Editor: Since the first identifications of avian influenza (H5N1) in Europe in late 2005 and early 2006, Eurobarometer survey data obtained during April–May 2006 have provided a unique opportunity to examine the knowledge of respondents across the European Union, Croatia, and Turkey about the risks and transmission of avian influenza. The H5N1 strain of avian influenza virus has caused >240 human deaths in central and Southeast Asia, the Middle East, and Africa (1). Four of these deaths occurred in Turkey in 2006. Understanding gaps in the public's knowledge about avian influenza risks and transmission provides guidance on which issues future public health information campaigns may wish to focus. From a public health perspective, a more informed general public will be less likely to unnecessarily alter their travel and food consumption behavior and more likely to take appropriate preventive actions.

A 2006 Eurobarometer survey asked 29,170 residents of the 27 countries in the European Union, Croatia, and Turkey about their knowledge of avian influenza risks (2). Eurobarometer surveys are undertaken by the European Commission to monitor the EU public's social and political opinions. The survey was conducted on a multistage random sampling basis. Therefore, the sample is representative of the whole territory surveyed. Each country's population was randomly sampled according to rural, metropolitan, and urban population densities. A cluster of addresses was selected from each primary sampling unit by using country-dependent resources such as electoral registers. Addresses were chosen systematically by using standard random route procedures, beginning with a randomly selected initial address. The survey was conducted

by face-to-face interviews in respondents' homes.

Data were collected from March 27 through May 1, 2006. This period is especially interesting when looking at Europeans' knowledge about avian influenza risk because the first European cases of avian influenza (H5N1) were found in October 2005 in Turkey; additional cases were found later that month in Romania, Croatia, and the United Kingdom. Therefore, the period would have included media coverage about avian influenza as well as any targeted public health efforts to inform residents about avian influenza risks. By the end of this survey's fieldwork period, 17 of the 29 countries surveyed had reported influenza virus (H5N1) in birds, 3 in mammals, and 1 in humans (3).

Respondents were asked 7 questions about their knowledge of the risks humans face regarding avian influenza (Table). When we looked at these results with the aim of setting future public health information campaign objectives, we considered incorrect or "don't know" responses to indicate public health information campaign failures. Uncertainty regarding avian influenza risks appeared to involve consumption of eggs and vaccinated, cooked poultry and whether the virus can be transmitted between humans. However, for all questions asked, more than half of the respondents answered correctly except when asked about eating poultry that had been vaccinated against avian influenza. This question also had the highest number of "don't know" responses. Respondents are most knowledgeable about the preventive measure of culling chickens, perhaps because of the media attention these events attract. The large percentage of correct answers for some questions points to successes of previous information campaigns and media coverage, but the 40% of respondents answering incorrectly or "don't know" to questions about poultry and egg consumption