Original Article

Prevalence of *Salmonella* spp. in Rice-Field Rats in the Mekong Delta, Vietnam

Tran Thi PHAN^{1*}, Nguyen Thu TAM¹, Ly Thi Lien KHAI¹, Natsue OGASAWARA², Aya NAKADAI²,
Taketoshi IWATA², Toshihiko KAMADA³ and Hideki HAYASHIDANI²

¹ Department of Veterinary Medicine, College of Agriculture, Campus II, Cantho University, 3/2 St., Cantho, Vietnam, ² Division of Animal Life Science and ³ Division of Agriscience and Bioscience, Institute of Symbiotic Science and Technology, Tokyo University of Agriculture and Technology, 3-5-8 Saiwai-cho, Fuchu, Tokyo 183-8509, Japan
(Received 12 September, 2005 / Accepted 27 September, 2005)

Summary

From March to December, 2002, a total of 600 rice-field rats (*Rattus argentiventer*) living in the wild were captured in 5 provinces of the Mekong delta, Vietnam, and examined for the presence of *Salmonella*. Of the 600 cecal samples from the rats that were examined, 116 (19.3%) were *Salmonella*-positive. Of 116 *Salmonella* isolates, 9 serotypes were identified. The most common serotypes of the rats were S. London, S. Weltevreden and S. Derby. These results indicate that the rice-field rat may play an important role as a reservoir for or vehicle for the transmission of *Salmonella* to the surrounding environment in the Mekong Delta, Vietnam.

Key words : prevalence, rice-field rat, *Salmonella*, Vietnam.

Introduction

Salmonella is recognized as an important foodborne human pathogen worldwide, and is found in the intestinal tract of both animals and humans⁶⁾. Animals that carry *Salmonella* play an important role in the spread of salmonellosis^{9, 13)}. Rodents are known to be a reservoir of *Salmonella* in nature. The rice-field rat (*Rattus argentiventer*) is widely distributed in Southeast Asian countries such as Thailand, Indonesia, the Philippines and Vietnam¹⁾. The Mekong Delta, consisting of 12 provinces and a city, is located in the southern part of Vietnam. Rice-field rats are considered the most important pre-harvest pests in rice fields in the Mekong Delta. These rats feed on the tillering, flowerering and seedling rice plants, and have caused significant economic losses to the farmers in this region.

Although there have been a few reports on *Salmonella* in wild rodents associated with domestic animals such as chick-

en and pigs.^{2, 5, 7, 12)}, little is known about *Salmonella* in wild rodents.

This study was conducted to determine the prevalence of *Salmonella* and the distribution of *Salmonella* serovars in rice-field rats in the Mekong Delta, Vietnam.

Materials and Methods

Sample collection

From March to December 2002, a total of 600 rice-field rats (*Rattus argentiventer*) were captured by live trap in 5 provinces in the Mekong Delta, including An Giang, Dong Thap, Bac Lieu, Soc Trang and Camau provinces, Vietnam. These samples were immediately transported to Cantho University. The cecal contents were collected from rats individually and aseptically after evisceration to avoid contamination from external sources.

Method of Isolation and Identification of *Salmonella*

One gram of the cecal contents was put aseptically into a tube containing 9 ml of Enterobacteriaceae enrichment mannitol (EEM) broth (Eiken Chemical Co., Ltd., Tokyo, Japan). After incubation at 37 °C for 24 h, 1 ml of EEM culture was transferred to 10 ml of Hajna-tetrathionate broth (Eiken). The broth was incubated at 37 °C for 24 h, then one loopful of each

* Corresponding address
Hideki HAYASHIDANI
Division of Animal Life Science, Institute of Symbiotic Science and Technology, Tokyo University of Agriculture and Technology
3-5-8 Saiwai-cho, Fuchu, Tokyo 183-8509
Tel & Fax : +81-42-367-5775
E-mail : eisei@cc.tuat.ac.jp

tube was inoculated onto a plate of brilliant green agar (Oxoid Limited, Hampshire, UK) supplemented with 20 µg novobiocin/ml, desoxycholate hydrogen sulfide lactose agar (DHL, Nissui Pharmaceutical Co., Ltd., Tokyo, Japan) and mannitol lysine crystal violet brilliant green agar (MLCB, Nissui). These plates were incubated at 37 °C for 24 h and three suspicious colonies morphologically similar to *Salmonella* spp. on each plate were subcultured for biochemical examination. Their biochemical characteristics were examined on triple sugar iron medium (Nissui), lysine indole motility medium (Nissui) and Voges-Proskauer semisolid medium (Eiken). When typical *Salmonella* reactions were seen, additional biochemical tests were performed as described by Barrow and Feltham³⁾. Serotyping of *Salmonella* isolates was accomplished with commercial O and H antisera (Denka Seiken Co., Ltd., Tokyo, Japan) according to the method of Popoff and Le Minor¹⁵⁾.

Results

Salmonella was isolated from 116 (19.3%) of 600 cecal samples from rice-field rats. This pathogen was isolated from the rats in all provinces surveyed in the present study. The *Salmonella* isolation rates from the rats differed among the provinces (Table 1). Of 116 *Salmonella* isolates, 9 serovars were identified. The predominant serovars in rice-field rats were S. London (58.6%), S. Weltevreden (19.0%), and S. Derby (16.4%) (Table 2).

Discussion

Salmonella was isolated at a high rate from rice-field rats living in the wild in the Mekong Delta, Vietnam, in the present study. No previous report on the prevalence of *Salmonella* in the rice-field rats in Southeast Asia countries including Vietnam has been published. Little is known about

Salmonella in wild rodents, although there have been a few reports on *Salmonella* in wild rodents living in urban areas. Kato et al.¹¹⁾ reported that *Salmonella* was isolated from 17 (1.5%) of 1,129 black rats (*Rattus rattus*) and 6 (10%) of 60 brown rats (*Rattus norvegicus*) living in cities in Japan. Hilton et al.⁸⁾ isolated *Salmonella* from urban wild brown rats in West Midlands, UK, and found that 8% of the fecal samples were positive for *Salmonella*. On the other hand, Oboegbulem and Okoronkwo¹⁴⁾ isolated *Salmonella* from 8 (32.0%) of 25 African great cane rats (*Thryonomys swinderianus*) living in the wild in Nigeria. The *Salmonella* isolation rate (19.3%) in the present study seems to be comparable to the rates determined in the previous reports. The fact that this pathogen was isolated from rats in all of the provinces of the Mekong Delta surveyed in the present study suggests that *Salmonella* is widely prevalent in the rice-field rats in this region.

In the present study, the predominant *Salmonella* serovars in the rice-field rats were S. London, S. Weltevreden, and S. Derby (Table 2). These serovars were isolated from domestic animals and river water^{17, 18)}. These were also the predominant serovars in foods including pork, beef, duck meat, chicken meats and shrimp in the Mekong Delta¹⁹⁾. S. Weltevreden is known to be frequently isolated from human diarrhea patients in Southeast Asian countries, and this serovar is the most predominant in human diarrhea patients in Thailand^{4, 16)}. This serovar was also detected in wild rodents in Malaysia¹⁰⁾, and was isolated from human diarrhea patients in the Mekong Delta (unpublished data). These results indicate that the rice-field rat may play an important role as a reservoir for or vehicle for the transmission of *Salmonella* to the surrounding environment in the Mekong Delta, Vietnam.

Rice-field rats are considered to be the most important pre-harvest pests in this region. This rat causes significant eco-

Table 1 Prevalence of *Salmonella* in the rice-field rats in the Mekong Delta, Vietnam

Province	No. of <i>Salmonella</i> positive samples/No. of samples examined (%)	
Ca Mau	26/203	(12.8)
Bac Lieu	31/97	(32.0)
Soc Trang	33/50	(66.0)
An Giang	6/200	(3.0)
Don Thap	20/50	(40.0)
Total	116/600	(19.3)

Table 2 Serovars of *Salmonella* isolates from the rice-field rats

serovar	No. of isolate (%)	
S. London	68	(58.6)
S. Weltevreden	22	(19.0)
S. Derby	19	(16.4)
S. Thomson	2	(1.7)
S. Dublin	1	(0.9)
S. Javiana	1	(0.9)
S. Newport	1	(0.9)
S. Schleissheim	1	(0.9)
S. Worthington	1	(0.9)
Total	116	(100.0)

conomic losses to farmers every year. Some farmers catch rice-field rats to rid their fields of them, and sometimes they sell them to the market for meat. Therefore, from a public health point of view, more attention should be paid to the prevalence of *Salmonella* in rice-field rats in this region.

References

- 1) Association for International Cooperation of Agriculture and Forestry: Biology and control of tropical rats. Association for International Cooperation of Agriculture and 7 are stry Tokyo, Japan, 1996.
- 2) Barber, D.A., et al.: Distribution of *Salmonella* in swine production ecosystems. J. Food Prot. **65**, 1861-1868, 2002.
- 3) Barrow, G.I., and Feltham, R.K.A.: Cowan and Steel's Manual for the Identification of Medical Bacteria. 3rd ed., Cambridge University Press, Great Britain, 1993.
- 4) Boonmar, S. et al.: *Salmonella* in broiler chickens in Thailand with special reference to contamination of retail meat with *Salmonella* enteritidis. J.Vet.Med.Sci. **60**, 1233-1236, 1998.
- 5) Davies, R, and Breslin, M.: Environmental contamination and detection of *Salmonella* enterica serovar enteritidis in laying flocks. Vet Rec. **149**, 699-704, 2001.
- 6) Doyle, M.P and Cliver, D.O.: *Salmonella*, In Doyle, M.P. ed., Food-borne diseases, 186-204., Academic Press, New York, U.S.A., 1990.
- 7) Henzler, D.J., and Opitz, H.M.: The role of mice in the epizootiology of *Salmonella* enteritidis infection on chicken layer farms. J. Wildl.Dis. **36**, 625-631, 1992.
- 8) Hilton A.C., Willis, R.J., and Hickie, S.J.: Isolation of *Salmonella* from urban wild brown rats (*Rattus norvegicus*) in the West Midlands, UK. Int. J. Environ. Health Res. **12**, 163-168, 2002.
- 9) Humpherey, T.J., Threlfall, E.J., and Gruickshank, J.G., Salmonellosis, In Palmer, S.R., Soulsby, L., and Simson, D.I.H. ed., Zoonoses, 191-206, Oxford University Press, New York, U.S.A., 1998.
- 10) Joseph, P.G., Yee, H.T., and Sivanandan, S.P.. The occurrence of Salmonellae in house shrews and rats in Ipoh, Malaysia. Southeast Asian J. Trop. Med. Public Health. **15**, 326-330, 1984
- 11) Kato,Y., et al.: Detection of *Salmonella* and *Campylobacter* from rats trapped at restaurants and a fish market. J.Jpn.Vet.Med.Assoc., **52**, 194-197, 1999. (In Japanese).
- 12) Matsumoto,A., Miyama,M., and Murakami, S.: Comparison of *Salmonella* isolation rates in different types of egg-layer hen house in Chiba, Japan. Avian. Dis. **45**, 195-200, 2001.
- 13) Nisbet, D.V. and Ziprin,L. : Salmonellosis in Animals. In Huy,Y., Pierson, M.D. and Gorham, J.R. ed., Foodborn Disease Handbook, vol.1 Bacterial Pathogen. 265-284, Marcel Dekker, New York, U.S.A., 2001.
- 14) Oboegbulem, S.I., and Okoronkwo, I.: Salmonellae in the African great cane rat (*Thryonomys swinderianus*). J.Wildl. Dis. **26**, 119-121, 1991.
- 15) Popoff, M.Y., and Le Minor,L.: Antigenic formulas of the *Salmonella* serovars, WHO Collaborating Centre for Reference and Research on *Salmonella*, Institute Pasteur, Paris, France, 1997.
- 16) Thong, K.L., et al.: Genetic diversity of clinical and environmental strains of *Salmonella* enterica serotype Weltevreden isolated in Malaysia. J.Clin.Microbiol. **40**, 2498-2503, 2002.
- 17) Tran, T.P., et al.,: Isolation of *Salmonella* strains from the aquatic environment and comparison with those of animal origin in Tan Phu Thanh, Village Mekong Delta, Vietnam. JARQ **37**, 237-241, 2003.
- 18) Tran, T.P., et al.: Prevalence of *Salmonella* spp. in pigs, chickens and ducks in the Mekong Delta, Vietnam. J. Vet. Med. Sci. **66**, 1011-1014, 2004.
- 19) Tran, T.P., et al.: Contamination of *Salmonella* spp. in retail meats and shrimps in the Mekong Delta, Vietnam. J. Food Prot. **68**, 1077-1080, 2005.

原 著

ベトナムのコメクマネズミにおけるサルモネラの保菌状況

Tran Thi Phan¹・Nguyen Thu Tam¹・Ly Thi Lien Khai¹・小笠原夏絵²・中臺 文²・岩田剛敏²・鎌田壽彦³・林谷秀樹^{2*}¹ Department of Veterinary Medicine, College of Agriculture, Cantho University, Vietnam,² 東京農工大学大学院共生科学技術研究部動物生命科学部門, ³ 同生命農学部門

2002年3月から12月にベトナム・メコンデルタ5省においてコメクマネズミ (*Rattus argentiventer*) を捕獲し、サルモネラの保菌状況を調べた。その結果、捕獲したコメクマネズミ600頭中116頭(19.3%)からサルモネラが分離された。また、分離された116菌株は9血清型に型

別され、S. London, S. Derby および S. Weltevreden の割合が高かった。これらの結果から、コメクマネズミはベトナム・メコンデルタにおいて、サルモネラの保菌動物または媒介者として重要な役割を果たしているものと思われる。

連絡先：林谷秀樹*

国立大学法人 東京農工大学大学院
共生科学技術研究部 動物生命科学部門
〒183-8509 東京都府中市幸町3-5-8
Tel & Fax : 042-367-5775
E-mail : eisei@cc.tuat.ac.jp