

**Proceedings of the 30th Annual Meeting of Kyushu Regional Society of Tropical Medicine
Held in Nagasaki on February 9 and 10, 2007.**

Surveillance of bats as reservoir hosts of emerging zoonotic viruses in Vietnam

Futoshi Hasebe^{1,2} and Le Thi Quynh Mai³

INTRODUCTION

Zoonoses are diseases and infections which are naturally transmitted from other animals, both wild and domestic, to humans or from humans to animals. Zoonotic pathogens are currently considered to be the major sources of emerging and reemerging diseases (73%) [1].

Bats classified in the order Chiroptera are the most abundant and widely distributed non-human mammalian species in the world. The bat species constitute about 20% of all mammalian species, and they are the most diverse in biological and ecological features. Bats fly daily in pursuit of food and many species fly long distances during seasonal migrations. The dietary habits of bats can be divided into insectivorous, frugivorous, carnivorous, omnivorous and sanguivorous. The roosting environment varies from natural to man-made structures. The population size of bats in each colony varies greatly, i.e. from less than 10 to over 20,000,000 bats. An important biological feature of temperate bats is their ability to enter into daily torpor and seasonal hibernation. Bats have a relatively long lifespan. In recent years, microorganism surveillance has been conducted on bats which are increasingly being recognized to be potential reservoir hosts for viruses that can cross species barriers to infect humans and other domestic and wild mammals [2, 3]. The diversity of the bat species and some of their unique biological and ecological features might allow them to become the reservoir host for various important infectious agents.

Nevertheless, the importance of bats as reservoir hosts of zoonotic viruses (Nipah virus, SARS-like CoV., Ebola virus, etc) has been underestimated, except for their role in maintaining and transmitting the rabies virus. Bat meat and blood is still prized as a medicine or a nourishing food in some parts of Asia, as are snake blood, scorpions, lizards, insects, fur seal penises and rhino horns. However, very little surveillance has been conducted to assess the risk of in-

fection of deadly emerging viruses from this habit. We recently started bat surveillance in Vietnam to determine the prevalence of zoonotic viruses in bats, to investigate the status of bat hunting, handling and dietary habits, and to assess the risk of infection from bats to humans and other animals.

SELECTION OF FIELD STUDY SITES FOR BAT SURVEILLANCE



Fig. 1 Karstic landform in Vietnam.



Fig. 2 Field study sites for bat surveillance in Northern Vietnam.

¹ Institute of Tropical Medicine, Nagasaki University

² Center of International Collaborative Research, Nagasaki University

³ National Institute of Hygiene and Epidemiology, Hanoi, Vietnam

The karst rocks in Vietnam are distributed in an area of over 50,000km² at a latitude of 16 ° N. (Fig. 1). There are many karst caves and grottoes in the northern part of Vietnam and a variety of bat species roosting in natural nests. Bac Giang and Hoa Binh provinces were selected for field studies and sample collection (Fig. 2). Bats are hunted for food, and there are restaurants serving bat dishes in both areas.

IDENTIFICATION OF BATS AND SAMPLE COLLECTION

Live bats were obtained from bat hunters, and body



Fig. 3 Blood sample collection from bats in the field.



Fig. 4 Dissection of bats in the BSL-3 laboratory at NIHE.

Table 1. Target viruses and laboratory tests for bat surveillance in Vietnam.

Virus	Serological test	PCR	Virus isolation
Family Paramyxoviridae, genus Henipavirus Nipah virus / Hendra virus			
Family Paramyxoviridae, genus Rubulavirus Menangle virus Tioman virus			
Family Rhabdoviridae, genus Lyssavirus Rabies virus			
Family Filoviridae, genus Ebolavirus Reston Ebola virus			*
Family Coronaviridae SARS Coronavirus (SARS-CoV)			
Family Bunyaviridae, genus Hantavirus Hantaan virus			
Family Orthomyxoviridae, genus Influenzavirus A Influenza A virus			
Family Flaviviridae, genus Flavivirus Japanese Encephalitis virus (JEV) Dengue viruses (serotype 1-4) Yokose virus			
Family Togaviridae, genus Alphavirus Chikungunya virus Sindbis virus			

* BSL-4 laboratory is required for the virus isolation.

FUTURE PLAN

Sixty viral species are reported to be associated with bats [2, 3]. Seventeen RNA viruses were selected for research (Table. 1). Necessary diagnostic assays will be set up at the NIHE-Nagasaki University Friendship Laboratory. Virus isolation techniques and PCR assays are simple and extremely sensitive. These methods provide the opportunity to collect and store a wealth of information from known and unknown infectious agents associated with bat sera and tissue specimens. These data and materials can be used to develop rapid diagnostic assays for emerging and reemerging viruses.

The potential mediator of bat-associated zoonoses to humans could be bat hunters, restaurant or wet market workers who handle bat meat, bat eaters and biologists. Questionnaires and serological surveillance will be conducted on these people and their family members to assess the risk of infection of bat-associated zoonoses.

To better understand the prevalence of infectious agents in bats, active surveillance is preferable. A long-term systematic surveillance of bats is essential to determine the ecological relationship between bats, humans, other animals, arthropod vectors and the environment. This sustained surveillance will lead to the early detection and prediction of emerging and reemerging diseases.

ACKNOWLEDGMENT

This work is part of a collaborative study on emerging and reemerging infectious diseases in Vietnam and supported by the Special Fund for the Promotion of Sciences, Ministry of Education, Culture, Sports, Science and Technology, Japan.

REFERENCES

- 1 . Woolhouse ME, Gowtage-Sequeria S. Host range and emerging and reemerging pathogens. *Emerg Infect Dis* 2005; 11: 1842-1847
- 2 . Calisher CH, *et al.* Bats: important reservoir hosts of emerging viruses. *Clin Microbiol Rev.* 2006; 19 (3): 531-45. Review.
- 3 . Wong S., *et al.* Bats as a continuing source of emerging infections in humans. *Rev Med Virol.* 2006 Oct 16; [Epub ahead of print]