



衛生防護中心
Centre for Health Protection

Scientific Committee on Vector-borne Diseases

Vectors of Japanese encephalitis in Hong Kong

Introduction

Japanese encephalitis (JE) is a zoonotic disease. It is transmitted in nature among the pigs and wild birds by many zoophilic mosquitoes species. The virus has been recovered from about 30 species of mosquitoes belonging to 5 genera, namely Culex, Anopheles, Aedes, Mansonia and Armigeres. Horizontal enzootic maintenance transmission involves more ornithophilic species such as Culex bitaeniorhynchus. The culicines involved in the transmission of JE are primarily zoophilic. Human may get infected through the bite of an infective mosquito.

JE vectors

2. According to WHO publications, five Culex mosquitoes species are considered as the most prominent species playing a significant role during outbreaks of human JE. They are Culex tritaeniorhynchus, Culex gelidus, Culex pseudovishnui, Culex vishnui and Culex fuscocephala.

(i) Culex tritaeniorhynchus

Breed locally in ground pools, water hyacinth ponds, rice fields, slow streams and irrigation ditches.

Adult females are strongly zoophilic, feed mainly on cow and pig at night, but will also feed on birds and man. - Average flight range is 2 km. - Considered as a major JE vector in many areas including China, Indonesia, Malaysia, Singapore, Taiwan, Korea, India and East Timor.



衛生防護中心乃衛生署
轄下執行疾病預防
及控制的專業架構

*The Centre for Health
Protection is a*

*professional arm of the
Department of Health for
disease prevention and
control*

Found locally in Fanling, Sheung Shui, Kam Tin, Yuen Long, Tsing Yi Island, Tsuen Wan, Shamshuipo, Lam Tin and many other places.

(ii) *Culex gelidus*

Breed locally in temporary or semi-permanent fresh ground water, e.g. puddles, small streams and weedy pools.

Adult females are zoophilic and poorly anthropophilic, vicious biters, preferring large domestic animals to human.

In the absence of other suitable hosts, may feed on man.

Considered as a JE vector in Indonesia, Malaysia, Singapore etc.

Has not been found locally for years.

(iii) *Culex pseudovishnui*

Breed locally in ground water habitats, e.g. abandoned rice fields, clear ponds, grassy pools and streams.

Adult females are zoophilic, feed mainly on birds and pigs; less on dog, horse and human.

Considered as a JE vector in India. - Found previously in Ping Yeung of Ta Kwu Ling, Wu Kai Sha and Sham Tseng before the development of these areas.

(iv) *Culex vishnui*

Breed locally in wet cultivations and ponds with floating plants and streams with grassy margins.

Adults are zoophilic, commonly found in pigsties.

Considered as a JE vector in Taiwan, Malaysia, India and East Timor.

Widely distributed locally in the rural areas but not found in the surveys conducted relating to JE cases.

(v) *Culex fuscocephala*

Breed locally in highly polluted pools, water storage pits, rice fields and irrigation ditches.

Highly zoophilic and poorly anthropophilic.

Considered as a possible vector of importance in Taiwan.

Have not been found in recent years including in mosquito surveys conducted relating to JE cases.

3. Even though all of the above five mosquito species are present/have been found locally, the relative significance of their roles as a JE vector in Hong Kong has not been studied. (Appendix 1) However, the advice given by the World Health Organization and the situations in the mainland China may be applicable locally.

Infectivity of vectors

4. Recovery of virus from field-collected mosquitoes alone does not prove that they are good vectors. Detectable virus may remain from the residue of a recent blood meal. Virus may also multiply in the species but infrequently to a high enough level to be efficiently transmitted. The mosquito species may occasionally pick up virus, but generally not feed on important vertebrate host frequently enough to be an important virus transmitter. The main criteria to consider a species of mosquito as a vector are that the population should be high and stable during the epidemic season; long survival rate of the mosquito so that the extrinsic incubation period of the virus (9 to 14 day) is completed; a liberal feeding habit, basically zoophilic in nature having occasional contact with human; repeated isolation of the virus from wild-caught specimens; and finally its competence to support multiplication and successful transmission of the virus in the laboratory.

5. An isolation of an arbovirus from wild-caught mosquitoes indicates that a particular species may be susceptible to infection, and therefore may be classified as a suspected vector, as in the case of *Culex sitiens*. Although in Malaysia and in Australia, they found *Culex sitiens* infected with JE virus, but further studies are needed to confirm the vectorial capacity. The mosquito may acquire the virus from infected birds or pigs. *Culex sitiens* is mainly coastal in distribution where it breeds in brackish tidal pools. In general they do not disperse very far from their breeding sites. They may feed on wild birds for blood meal. It has restricted local distribution and was previously found in Tai Po, Siu Lam, Deep Bay and Silver Strand. A list of potential vectors of JE is shown in the appendix 2.

Conclusion

6. For the control of JE transmission locally, the target species of mosquito control include *Culex tritaeniorhynchus*, *Culex gelidus* and *Culex fuscocephala*. *Culex pseudovishnu* and *Culex vishnui*. Other species, including the potential vectors, will also be controlled and their breeding places eliminated during JE case investigation. Moreover, adult mosquitoes collected, irrespective of species, will be sent to PHLC for virological examination. FEHD has embarked on a one-year study on the distribution of JE vectors in the territory.

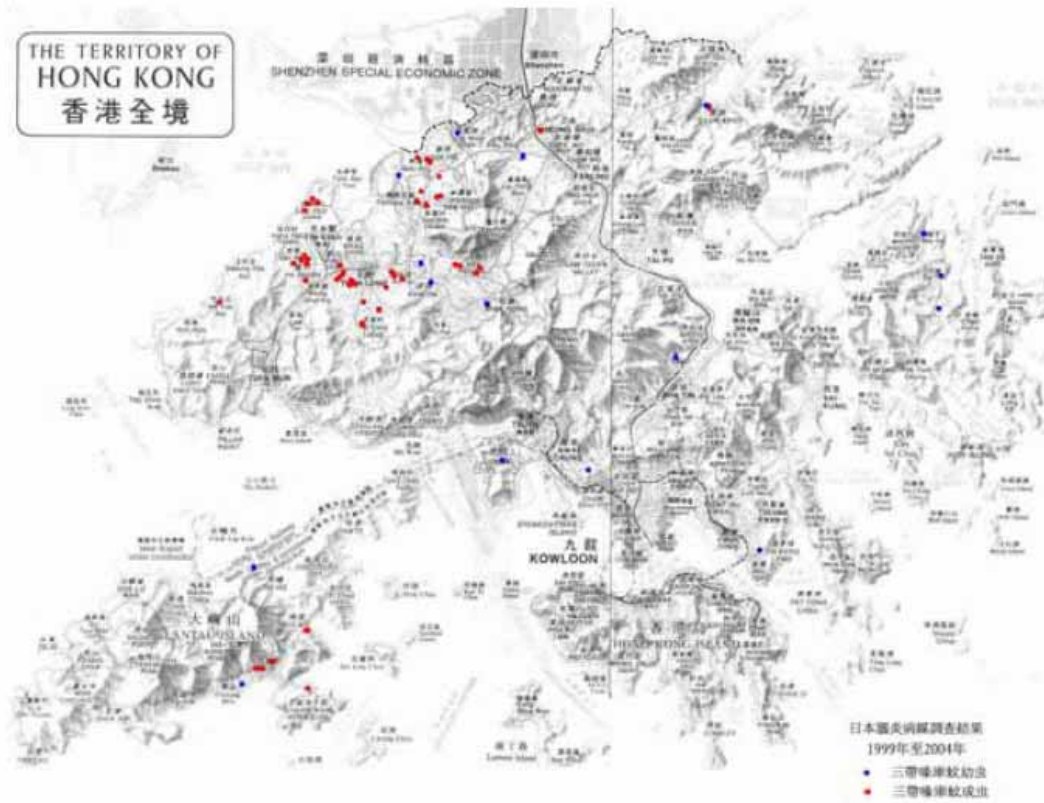
Centre for Health Protection
December 2004

The copyright of this paper belongs to the Centre for Health Protection, Department of Health, Hong Kong Special Administrative Region. Contents of the paper may be freely quoted for educational, training and non-commercial uses provided that acknowledgement be made to the Centre for Health Protection, Department of Health, Hong Kong Special Administrative Region. No part of this paper may be used, modified or reproduced for purposes other than those stated above without prior permission obtained from the Centre.

References:

1. Basio RG (1971). The Mosquito Fauna of the Philippines. National Museum of the Philippines.
2. CHAU GW (1982). An Illustrated Guide to the Identification of the Mosquitoes of Hong Kong. Urban Council, Hong Kong.
3. Kabilan L (2004). Control of Japanese encephalitis in India: A reality. *Indian J Pediatr*, 71:707-712.
4. Lam SK. Japanese encephalitis.
URL: <http://www.vadscorner.com/jelsk.html> accessed on 11 November 2004
5. Medappa N (2000). Japanese encephalitis virus infection in mosquitoes and its epidemiological implications. *Indian Council of Medical Research Bulletin*, 30(4).
6. National Institute of Communicable Diseases.
URL: <http://www.nicd.org/Japanese.asp#6> accessed on 11 November 2004.
7. National Environment Agency, Singapore.
URL: http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=92 accessed on 11 November 2004.
8. Suroso T (1989). Studies on Japanese encephalitis vectors in Indonesia. *Southeast Asian J Trop Med Public Health*. 20(4): 627-8.
9. World Health Organization.
URL: <http://www.who.int/disasters/repo/5362.doc> accessed on 10 November 2004

Distribution of vectors of Japanese encephalitis (1999- Oct. 2004)



List of potential vectors of Japanese encephalitis

1. *Aedes japonicus**
2. *Anopheles annularis*
3. *Anopheles barbirostris*
4. *Anopheles hyrcanus*
5. *Anopheles peditaeniatus*
6. *Anopheles subpictus*
7. *Anopheles tessellates**
8. *Anopheles vagus**
9. *Culex annulus*
10. *Culex annulirostris*
11. *Culex bitaeniorhynchus**
12. *Culex epidesmus*
13. *Culex infula* (Believed to have a role in JE transmission in India)
14. *Culex pipiens pallens* (Considered as a JE vector in Part of Korea)
15. *Culex pipiens quinquefasciatus**
16. *Culex sitiens**
17. *Culex whitmorei**
18. *Mansonia annulifera*
19. *Mansonia Indiana*
20. *Mansonia uniformis**

* Indicates the species have been found in Hong Kong