

Serum antibody titer to *Rickettsia Tsutsugamushi* in Taiwan Rodents

It has been well documented since long ago that tsutsugamushi disease has been endemic in certain parts of the Taiwan area¹. Although the disease was officially announced as a reportable disease since 1955, only 71 cases have been reported for the past thirty years². The present situation is rather ambiguous due to severe under-reporting. Our recent field investigation of tsutsugamushi disease, with full support of the local clinicians and health authorities, revealed 130 confirmed cases in Penghu in 1985, 2, 7 and 7 cases respectively in Ilan, Hwalien and Taitung Counties in 1986. All these cases were confirmed serologically by indirect immunofluorescent antibody test (IFA). Chigger mite is the vector of tsutsugamushi disease and rodents are one of its main host. We undertook an island-wide field investigation of geographic and seasonal distribution of the mite and its host's serum antibody titer to tsutsugamushi disease during the period from June 1985 to July 1986. The areas selected for study of geographic distribution of the mite were those townships and villages which had never been investigated to avoid duplication. Fenglin, Juisui and Shoufeng townships in Hwalien County were selected specifically for investigation of seasonal distribution of the mite from July 1986 to April 1987. In both studies live traps were used to capture rodents. Peanuts coated with butter were used as bait to increase attractiveness during the cool season, while plain peanuts were used during the hot season to avoid the disturbance of ants. Participants in these studies consisted of three persons. At 3 or 4 p.m. 30 live traps were set out in bushes closed to the animal tracks leading to, or right in front of their burrows in the peanut, sugar cane, maize (Indian corn), or sweet potatoes fields. All traps were recollected early next day at 7 or 8 a.m. For study of seasonal distribution, trappings were undertaken in the same way as mentioned above except that all traps were set out and recollected at the fixed places as monthly routine. The sera used for antibody titer test were from the blood taken from the heart of the animals captured. A special shaped filter paper was smeared with the blood from the heart of animals and let dry naturally. The results of the results of the studies (Table 1) revealed that rodent capture rate as well as positive rate of serum antibody to *R. tsutsugamushi* was higher in *Rattus losea* and *Bandicota indica nemorivaga* than in other rodents trapped on Taiwan. It seems feasible to use these indices to show the endemic level of the disease in the area investigated. Three areas with highest rate of positive serum antibody in the animals *R. losea* plus *B. indica nemorivaga* were noted in Taitung, Hwalien and Nantou Counties (Taichung County was excluded due to the fact that the number of rodents captured was too small to be significant). Taipei, Ilan and Tainan Counties had the second highest rates. The rates for the remaining counties were very low. *R. losea* and *B. indica nemorivaga* are absent in Penghu, an off-shore county which consist of many islands. The county has been shown to be an endemic area of tsutsugamushi disease in many previous studies¹. The titer of serum antibody to *R. tsutsugamushi* in the species present in Penghu was rather high.

These studies were not carried out at the same period of time through out the island, and will not deteriorate the results of studies because it has been proved that the serum antibody of infected animals will last at least one year. Physicians who practise in the areas of high risk, especially in the townships and villages listed in Table 1 from which the positive specimens were obtained, should keep in mind and pay more attention to conduct a thorough physical examination and history taking in order to differentiate tsutsugamushi disease from other febrile diseases. A well alert general practitioner in Chinsan village of Taipei County picked up an indigenous case of tsutsugamushi disease in 1985.

Reported by Divisions of Bacteriology and Medical Entomology, Taiwan provincial Institute of Infectious Diseases

Editorial notes. Tsutsugamushi disease, also known as scrub typhus, is indigenous to a wide area of Asian Pacific Ocean. It is quite common in Taitung, Penghu and Hwalien Counties in the Taiwan area; and is known to be an endemic disease in Penghu island (the Pescadores)³⁻⁵. The prevalence of positive serum antibody to *R. tsutsugamushi* among the inhabitants of Penghu County who are more than 30 years old is > 50%. The disease is caused by *Rickettsia tsutsugamushi* (or *R. orientalis*) which is transmitted to humans by the bite of larval mites of the genus *Leptotrombidium* (*L. deliense* in Taiwan and its surrounding islands). The mites parasitize several species of rodents and birds found in grassy areas. Human being is an accidental host. The diagnosis can be confirmed by inoculating mice with patient's blood and isolating the rickettsia organisms. The most commonly used serological tests are WeilFelix agglutination of *Proteus OXK* strain and IFA test. Both tests have low sensitivity, however, the probability of a correct diagnosis in a patient with both an OXK titer of > 1:320 and an IFA titer of > 1:400 is 96%⁶. Mortality rate as high as 10% were reported before treatment was available⁷, with adequate treatment mortality rate is < 1%. The treatment of choice is 500mg tetracycline qid orally for 10 days. Patients usually response to therapy effectively within 24-48 hours.

The results of this investigation showed Hwalien, Nantou, Taipei, Ilan, Tainan and Pingtung Counties as high risk areas in terms of IFA test of serum antibody titers to *R. tsutsugamushi* in the rodents trapped. Physicians of the above areas, especially those who practise in the townships or villages where positive serum samples were collected, should know the typical symptoms and signs of clinical or subclinical tsutsugamushi disease⁸ well enough to differentiate from the patients with fever of unknown origin, look for eschars, and listen to the history of travelling in detail. If there is any problem of establishing the diagnosis, send different serum samples (2-3 ml) of acute and convalescent stages or two specially cut filter papers smeared thoroughly with adequate blood specimen taken at least 7 days apart, along with a brief clinical history, to the Division of Bacteriology, Taiwan Provincial Institute of Infective Diseases for free serological test; or contact (02) 7856229 for more information.

Table 1: Serum antibody titer to *K. tsutsugamushi* in Taiwan Rodents⁺ (June 1985 - July 1986)

Result Species County or City	Rattus rattus	Suncus murinus	Mus caroli	Rattus norvegicus	Apodemus agrarius russellianus	Mus musculus	Rattus cochinchinensis	Apodemus semitus	Rattus cultratus	Bandeirana indica nemorisage	Rattus losea	Rattus losea plus B indica	Grand Total	Name of Places investigated
Taipei County										4/9	13/24	51.5% (17/33)	51.5% (17/33)	Juifan, Kungliao*, Sanchai*, Wanli*, Chimsan*
Hsin County	1/2*		0/1	2/2						6/14	4/17	32.2% (10/31)	36.1% (13/36)	Toucheng, Chiaochi, Yuanshan, Taitung*, Lotung*, Siao*, Chuanwei*
Tainan County		0/2	0/2		3/23	0/3				2/11	2/11	18.2% (4/22)	13.5% (7/52)	Yangmei, Luchu, Tayan, Lungtang*, Hsinwu*, Kuanwei*
Hsin Chu City					0/1					0/2	0/1	0% (0/3)	0% (0/4)	
Hsin Chu County		0/1	0/9		0/11					1/13	1/23	5.6% (2/36)	3.5% (2/57)	Chupeh, Hukow*, Hsinfang*, Hsinpu, Kuanhsi, Chienshih, Wufeng
Miaoli County		0/2	0/2		0/21					0/2	0/3	0% (0/5)	0% (0/30)	Hsi-hu, Miaoli, Yuanli, Tungshiao, Houlung
Taichung County		0/8			2/2					1/1		100% [△] (1/1)	27.3% (3/11)	Chingshui, Shalu, Shenlang*, Ta-an*
Changhua County		0/9	0/1		0/13					1/6		16.7% (1/6)	3.4% (1/29)	Lukang, Homei, Erlin, Hsienhsi, Shinkang, Fuhshing, Fennyuan, Pitou, Changang*
Nantou County				0/1		1/2	1/2			4/6	1/1	71.4% (5/7)	58.3% (7/12)	Puli*, Chichi, Luku*, Yuchi, Hsin-i*, Jen-ai*
Yulin County		0/6	0/1	0/4	1/1					0/2		0% (0/2)	7.1% (1/14)	Mailiao, Tungshih, Shuhu, Kouhu*
Chiayi County			0/7	0/1						0/4		0% (0/4)	0% (0/12)	Hsinkung, Tungshih, Taipao, Shuishang
Tainan County		0/1	0/1		0/2					3/8	1/4	33.3% (4/12)	25% (4/16)	Nanhwa, Nanhsi, Yuchin*, Hsuechia*, Chiali, Matou*, Paiho
Kaohsiung County		0/10	1/2	0/5				3/13	1/2	0/2	1/9	9.1% (1/11)	14.0% (6/43)	Livuan, Chienting, Yuan-an, Miao, Tzukan, Lukou*, Chiahsien, Shantlin, Neimen, Taoyuan*
Pingtung County										9/26	1/2	35.7% (10/28)	35.7% (10/28)	Lai-i*, Wantan*
Tainan County		0/10								5/5	4/4	100% (9/9)	47.4% (9/19)	Chengkung*, Changping*
Hualien County		0/6				0/1					15/18	83.3% (15/18)	60% (15/25)	Fenglin*, Juisui*
Penghu County	1/1	2/8	4/4										53.8% (7/13)	Hsiyu*, Huhsi*, Makung*
Total	2/3	2/63	5/30	2/13	6/74	1/6	1/2	3/13	1/2	36/111	43/117	34.6% (79/228)	23.5% (102/434)	

Notes: +: The result was regarded as positive if the antibody titer of any one of the three antigens (Karp, Gilliam and Kato) checked by indirect fluorescent antibody test was \geq 1:40

*: No. of positive/No. of IFA tested

△: Name of the places where positive specimens were collected

△: It was excluded from the assumption of using two specific types of rodent as an index of endemic level of *tsutsugamushi* because the number of captured specific rodents were too small to be significant

Table 2:
Seasonal serum antibody titer to *R. tsutsugamushi* in two specific rodents - Juisui township, Hualien county⁺.
(July 1986 - April 1987)

result Species	1986						1987			
	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr.
(<i>Bandeirana indica nemorisage</i>)	1/1*	1/1		2/2			1/1			1/1
(<i>Rattus losea</i>)	7/7	12/12	6/6	6/6	8/8	2/2	2/2	3/3	5/7	5/5
Total	8/8 (100%)	13/13 (100%)	6/6 (100%)	8/8 (100%)	8/8 (100%)	2/2 (100%)	3/3 (100%)	3/3 (100%)	5/7 (71.4%)	6/6 (100%)

Note: +: The result was regarded as positive if the antibody titer to any one of the three antigens (Karp, Gilliam and Kato), checked by indirect fluorescent antibody test was \geq 1:40

*: No. of positive/No. of IFA tested

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