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SHORT COMMUNICATION

PILOT SERO-EPIDEMIOLOGICAL SURVEY ON JAPANESE ENCEPHALITIS IN NORTH-WESTERN BURMA

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A pilot sero-epidemiological survey of Japanese encephalitis was carried out in three areas of north-western Burma applying the hemagglutination-inhibition test. The existence of Japanese encephalitis infection in these areas was confirmed and its incidences in these areas were estimated and compared graphically.

The Department of Health, Ministry of Health, Socialist Republic of the Union of Burma, was alerted about the possible spread of Japanese encephalitis from India, where there was a big outbreak of the disease in 1978. The Department therefore arranged for the collection of serum specimens randomly from villagers in 3 areas near the Burma-Indian border in the fall of 1978 for surveillance of spread of the disease.

Specimens were collected from the following areas: (Fig 1.)

1. a. Tahan Quarter, Kalemyo Town, Upper Chindwin Subdivision, Sagaing Division
   b. Nat Chaung Village Tract (suburb of Kalemyo Town), Upper Chindwin Subdivision, Sagaing Division
2. a. Tamu Town, Upper Chindwin Subdivision, Sagaing Division
   b. Nan Phalon (suburb of Tamu Town), Upper Chindwin Subdivision, Sagaing Division
3. a. Phalam Town, North Chin Hills Subdivision, Chin Hills State
   b. Requater (suburb of Phalam Town), North Chin Hills Subdivision, Chin Hills State

Area 1 is in the plain of the Neyinzaya river, a branch of the Chindwin river, and is located about 250 km NWW of Mandalay, at N 23°11′, 94°4′. The area is about 135 m above sea level.

Area 2 is in the river bed plain of the Nam Palaw river, also a branch of Chindwin river, and is located at N 24°13′, E 94°18′, about 300 km NW of Mandalay. It is about 150 m above sea level. This area is very close to the Burma-Indian border while area 1 is about 65 km from the border.

Area 3 is in the Chin Hills about 900 m above sea level and surrounded by hills of 2,400 m. It is at N 22°54′, E 93°41′, 270 km

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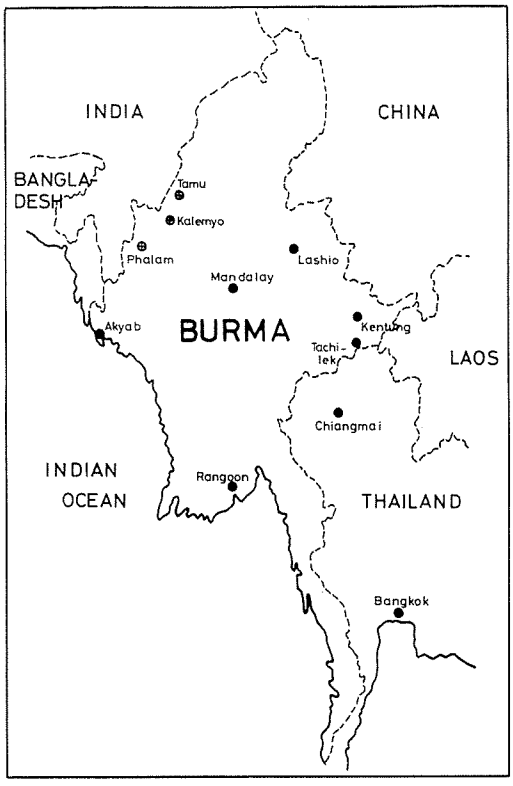


FIGURE 1. Locations of collection areas (⊕) and towns related to outbreak of Japanese encephalitis (●) in Burma.

NWW of Mandalay. It is about 40 km from the border.

The numbers of specimens collected are shown in the second column of Table 1. The specimens were tested for hemagglutination-inhibition (HI) antibody against dengue type 2 (D2), Japanese encephalitis (JE), and West Nile viruses, as representatives of flaviviruses, and also against chikungunya virus, as an alphavirus. HI titration was performed in this laboratory by the method of Clarke and Casals (1958), applying a microtiter technique.

The results of examinations of JE and D2 are summarized diagrammatically with the titer against JE on the abscissa and that against D2 on the ordinate, to estimate the prevalence of JE and D2 in each area. (Fig. 2, 3, 4)

The following conclusions are drawn from these diagrams:

1) In Kalemyo Town (Fig. 2 a), the distribution of antibody titers is markedly shifted towards the D2 side, indicating the existence of both D2/or D and JE infections among the residents and the higher prevalence of D2/or D infection.

2) On the contrary, in Nat Chaung (Fig. 2 b), a suburb of Kalemyo, the shift is clearly towards the JE side, suggesting that JE virus has spread to the inhabitants here.

3) In Tamu, a town close to the border (Fig. 3 a), and its suburb Nan Phalon (Fig. 3 b), the shift is similar to that in Nat Chaung, but some inhabitants still have negative or low HI titers for both D2 and JE.

4) In the Chin Hills, in Phalam (Fig. 4 a) and Requater (Fig. 4 b), the antibody response dis-

TABLE 1. *Calculation of the synthesized "antibody response vector" for each collection area*

Collection area	Sample Size	Z_x[a]	Z_y[a]	Z[a]	(Z/n)[a]	$\theta°$	tan $\theta°$
1. a. Tahan (Kalemyo)	108	179	220	283.6	(2.63)	50.87	1.229
b. Nat Chaung	124	370	231	436.2	(3.52)	31.98	0.624
2. a. Tamu	121	298	134	326.7	(2.70)	24.21	0.450
b. Nan Phalon	107	239	85	253.7	(2.37)	19.58	0.356
3. a. Phalam	111	96	28	100.0	(0.90)	16.26	0.292
b. Requater	112	119	20	120.7	(1.08)	9.54	0.168

[a] In code units.

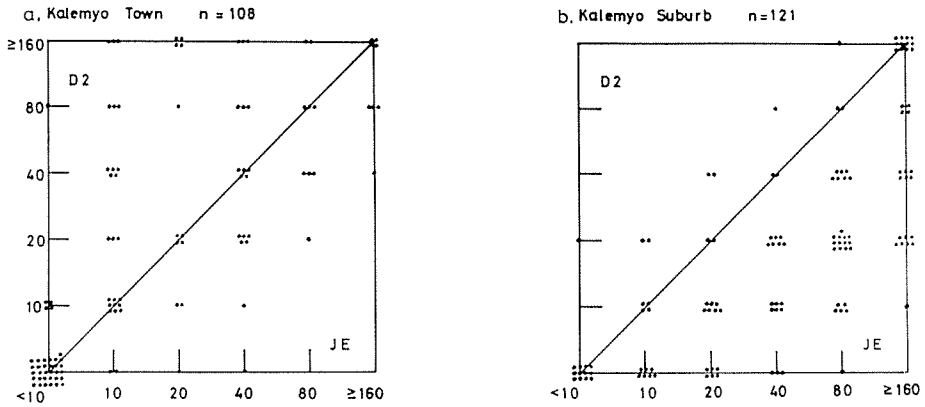


FIGURE 2. Distribution of antibody response (HI titer) to Japanese encephalitis and dengue type 2 viruses in Kalemyo and its suburb, Nat Chaung.

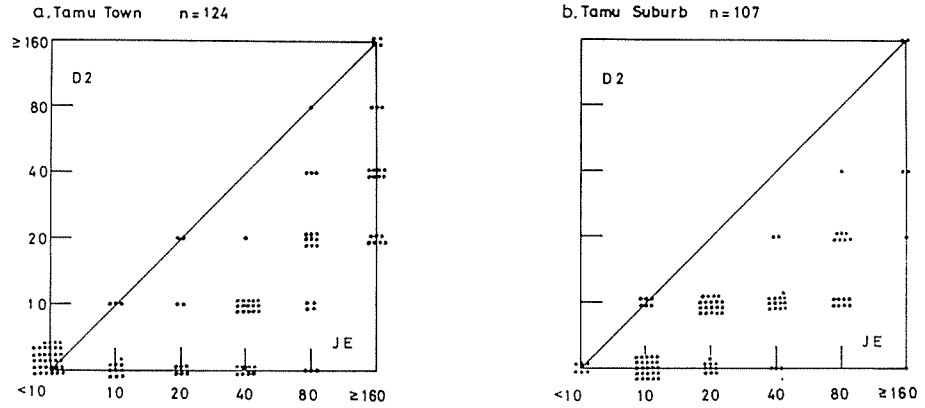


FIGURE 3. Distribution of antibody response (HI titer) to Japanese encephalitis and dengue type 2 viruses in Tamu and its suburb, Nan Phalon.

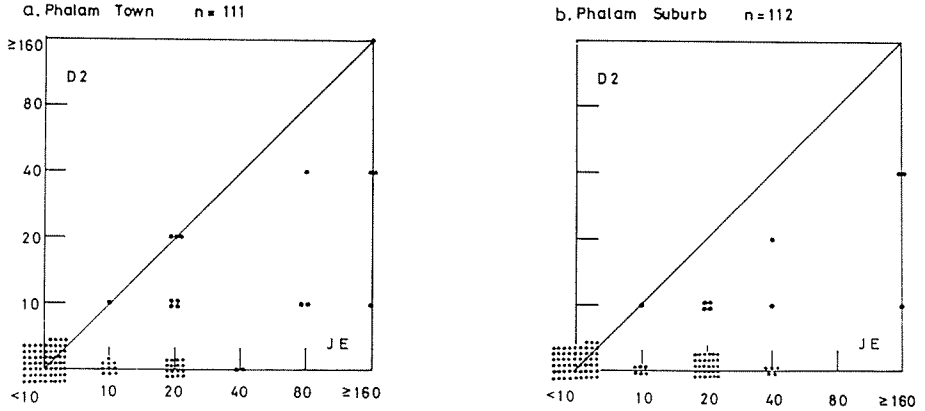


FIGURE 4. Distribution of antibody response (HI titer) to Japanese encephalitis and dengue type 2 viruses in Phalam and its suburb, Requater.

tribution is peculiar: about 1/3 of the specimens have negative titers against both JE and D2, but the shift is exclusively towards the JE side. This suggests that these villages used to be free from flavivirus infection until recently, but that spread of JE virus has just started.

To confirm these impressions, the data were treated more quantitatively. The antibody response of each individual caused by JE or D2 infection was considered to have a vectorial nature. For conversion of the antibody response into a vector form, the HI titers against JE and D2 were coded and shown as points on a lattice by numbers, as shown in Fig. 5.

For example, a specimen with an anti-JE HI titer of 20 and anti-D2 HI titer of 80 was expressed with a code number (2, 4), where 2 is the Z_x fraction (=JE fraction) and 4 is the Z_y fraction (=D2 fraction) of the "antibody response vector" Z. Similarly, the point (4, 3) represents a specimen with JE and D2 HI titers of 80 and 40, respectively.

All individual data were converted to a vectorial form and the vectors were synthesized for the collection site of every specimen. From the synthesized values of Z_x and Z_y the direction (the angle θ with the X-axis, or its tangent) and the magnitued of the synthesized vectors Z were calculated. The results of calculations are shown in Table 1.

The angle θ should be 45° when Z_x equals Z_y; that is the antibody responses to JE and D2 are the same. A θ value of more than 45° means the response to D2 is greater than that to JE, and conversely a θ value of less than 45° indicates that the response to JE is greater in the area. The magnitude of the synthesized vector Z (actually Z/n) indicates the extent of the antibody responses to JE and D2 as a whole in the area.

Figure 6 shows the synthesized "vectors" for each collection area.

The θ or tan θ values in the table are consistent with the impressions described above support the following deduction: (1) JE infection has started and is spreading in rater rural parts of these areas. (2) The direction of

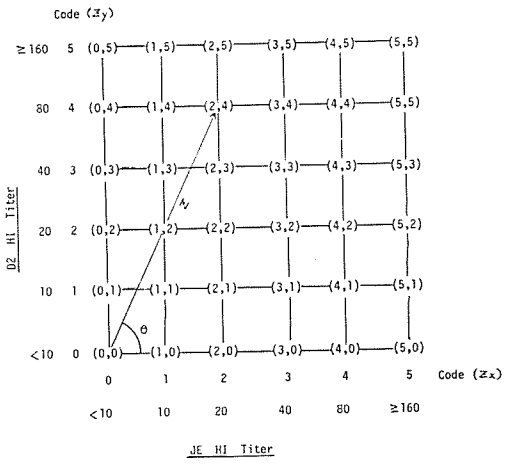


FIGURE 5. Coding diagram of HI titers for vectorial transformation.

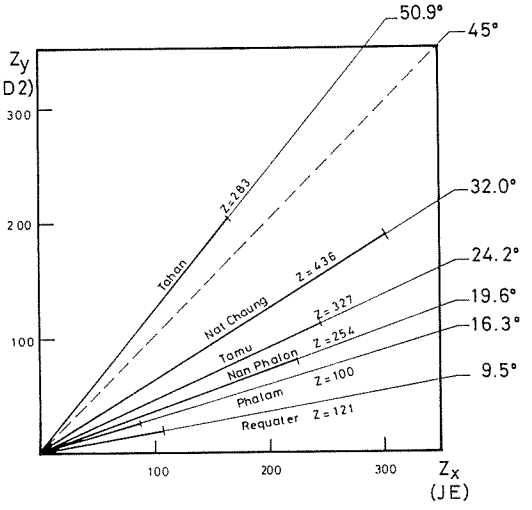


FIGURE 6. Comparison of the directions of synthesized "antibody response vectors".

spread of JE seems to be from the river bed plain to hilly areas. (3) Dengue virus infection does exist in Kalemyo town and its suburb, while it does not exist in Tamu and its suburb and in two villages in the Chin Hills at the moment.

JE antibody was first detected in this country in a serological survey of Rangoon inhabitants in 1968, and then in blood from a slaughter

house in Rangoon in 1973. Since then the existence of JE infection has been reported and confirmed virologically in 1974 (Tachileik), 1975 (Lashio), 1977 (Kentung), and 1978 (Lashio), in the Shan State of north-eastern Burma, which is not far from the JE endemic area, Chiangmai and its suburb, in Thailand (e.g. cf. Yamada, 1971; Fukunaga et al., 1974).

The data described here provide additional proof of the existence of JE infection in north-western Burma, which is far from the Shan State. So far there is no evidence that JE has " invaded " this region from elsewhere.

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