

## Virological and Epidemiological Studies on Encephalitis in Chiang Mai Area, Thailand, in the Year of 1982

### I. Introduction and study design

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**Abstract:** Since the last large epidemic in 1966, number of apparent Japanese encephalitis (JE) in Japan dramatically decreased and annual reported cases were less than 100 during the past 10 years. On the other hand, encephalitis, presumably due to JE virus infection sometimes occurred in other parts of East, Southeast and South Asia in a form of epidemic and constitutes a serious public health problem because of high mortality and grave prognosis with neurological or psychiatric disorders.

We planned to perform virological and epidemiological studies on viral encephalitis in Chiang Mai Area, Northern Thailand, where many cases of viral encephalitis have been reported every year since its outbreak into an epidemic in 1969.

**Key words :** Encephalitis, Thailand, Chiang Mai

### INTRODUCTION

Japanese encephalitis (JE) is an acute viral disease affecting central nervous system with significant mortality and grave prognosis and is transmitted by bites of infective vector mosquitoes (Clarke and Casals, 1965). The disease is known to exist not only in Japan but also in other areas in East, Southeast, and South Asia (Miles, 1960) as shown by the virus isolation or serological studies (Scherer and Buescher, 1959; Buescher and Scherer, 1959; Pond, 1963; Wang, 1964; Kono and Kim, 1969; Carey *et al.*, 1969; Simpson *et al.*, 1970; Hermon and Anandarajah, 1974; van Peenen *et al.*, 1974; Thoa *et al.*, 1974; Kanamitsu *et al.*, 1979). These areas correspond climatologically to Asia

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monsoon area, where growing rice crops in paddy fields constitutes basic common characteristic of the agricultural pattern. This offers ample breeding sites of main vector *Culex tritaeniorhynchus* and some other *Culex* mosquitoes (Mitamura *et al.*, 1938; Hammon *et al.*, 1949; Wang, 1962; Simpson *et al.*, 1970). Another characteristic serving the circulation of JE virus is raising of swine, which has been shown to be very effective "amplifier" vertebrate host of the virus (Scherer *et al.*, 1959; Konno *et al.*, 1966). In Japan, the size of JE epidemic has precipitously decreased since 1966 and the number of annual reported cases has been less than 100 during the past 10 years (Fig. 1, Panel A; Statistics of the Ministry of Health and Welfare of Japan). On the other hand, encephalitis, presumably due to JE virus infection, has been a serious public health problem in other Asian Countries, with ever-increasing number of reported cases and large epidemics. In the case of Thailand, the first large epidemic was reported in Northern Thailand, Chiang Mai Area, in 1969, and virus isolation and some other epidemiological studies were performed (Yamada *et al.*, 1971; Grossman *et al.*, 1973a;

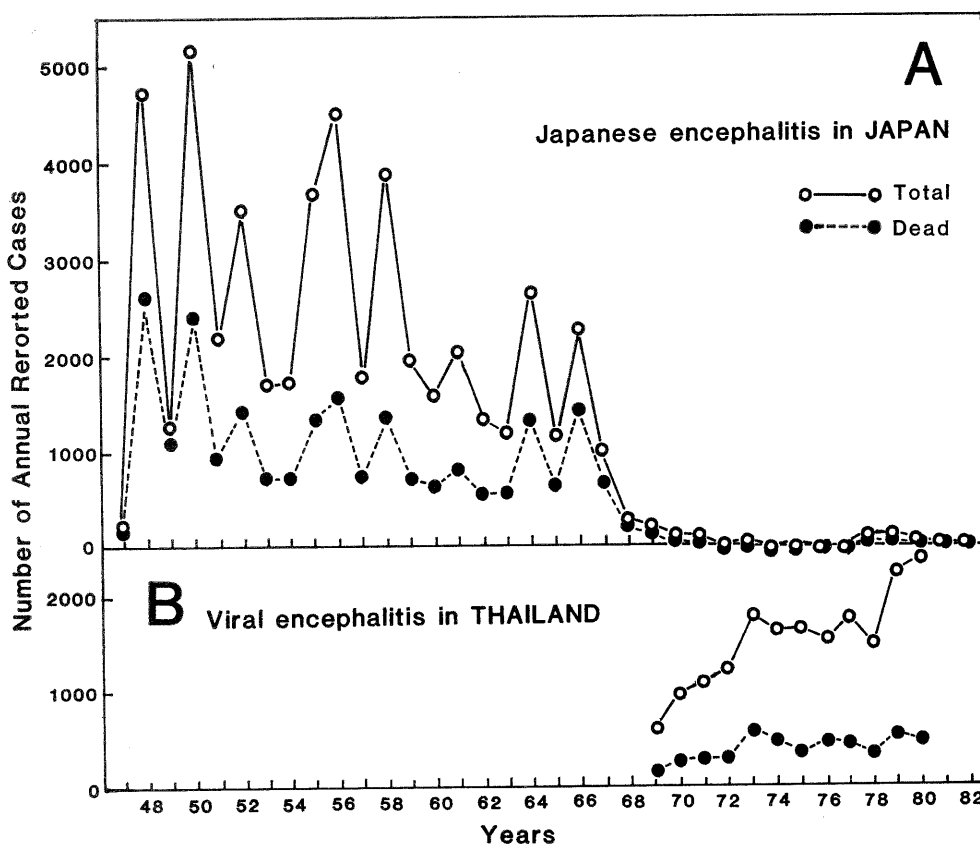


Fig. 1. Changes in the annually reported cases of Japanese encephalitis in Japan and viral encephalitis in Thailand.

b; c; 1974; Gould *et al.*, 1974; Johnsen *et al.*, 1974). As a prophylactic measure against the disease, killed JE vaccine was administrated in some areas in Chiang Mai with ap-

Table 1. Morbidity rate of viral encephalitis in Thailand

| Years | Morbidity rate per 100,000 in regions of |       |           |       |
|-------|--|-------|-----------|-------|
|       | Central                                  | North | Northeast | South |
| 1969  | 0.7                                      | 6.1   | 1.0       | 0.2   |
| 1970  | 1.6                                      | 6.1   | 2.4       | 1.3   |
| 1971  | 1.8                                      | 5.2   | 3.1       | 1.9   |
| 1972  | 2.4                                      | 4.2   | 4.1       | 2.2   |
| 1973  | 2.1                                      | 7.4   | 6.0       | 3.0   |
| 1974  | 1.8                                      | 6.1   | 5.9       | 1.8   |
| 1975  | 2.2                                      | 7.5   | 4.2       | 2.0   |
| 1976  | 2.9                                      | 6.4   | 3.3       | 2.8   |
| 1977  | 2.5                                      | 7.9   | 3.7       | 2.7   |
| 1978  | 1.8                                      | 6.1   | 3.3       | 1.8   |

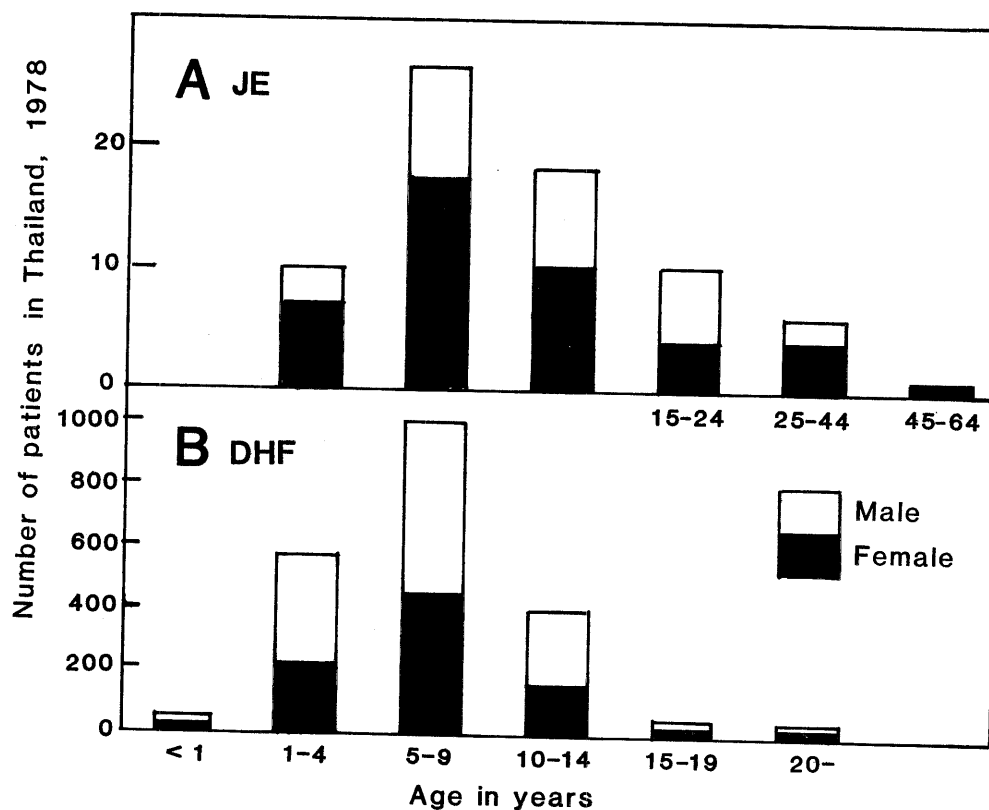


Fig. 2. Age distribution of Japanese encephalitis (A) and dengue hemorrhagic fever (B) in Thailand, 1978,

preciable antibody response (Fukunaga *et al.*, 1974), however, its efficacy has not well been followed up, and the number of reported viral encephalitis continued to grow up year by year (Fig. 1, Panel B: Statistics of the Ministry of Public Health of Thailand). High morbidity of the disease between 4 to 8 cases per 100,000 population has been observed in the north region of Thailand followed by the northeast region (Table 1; Sta-

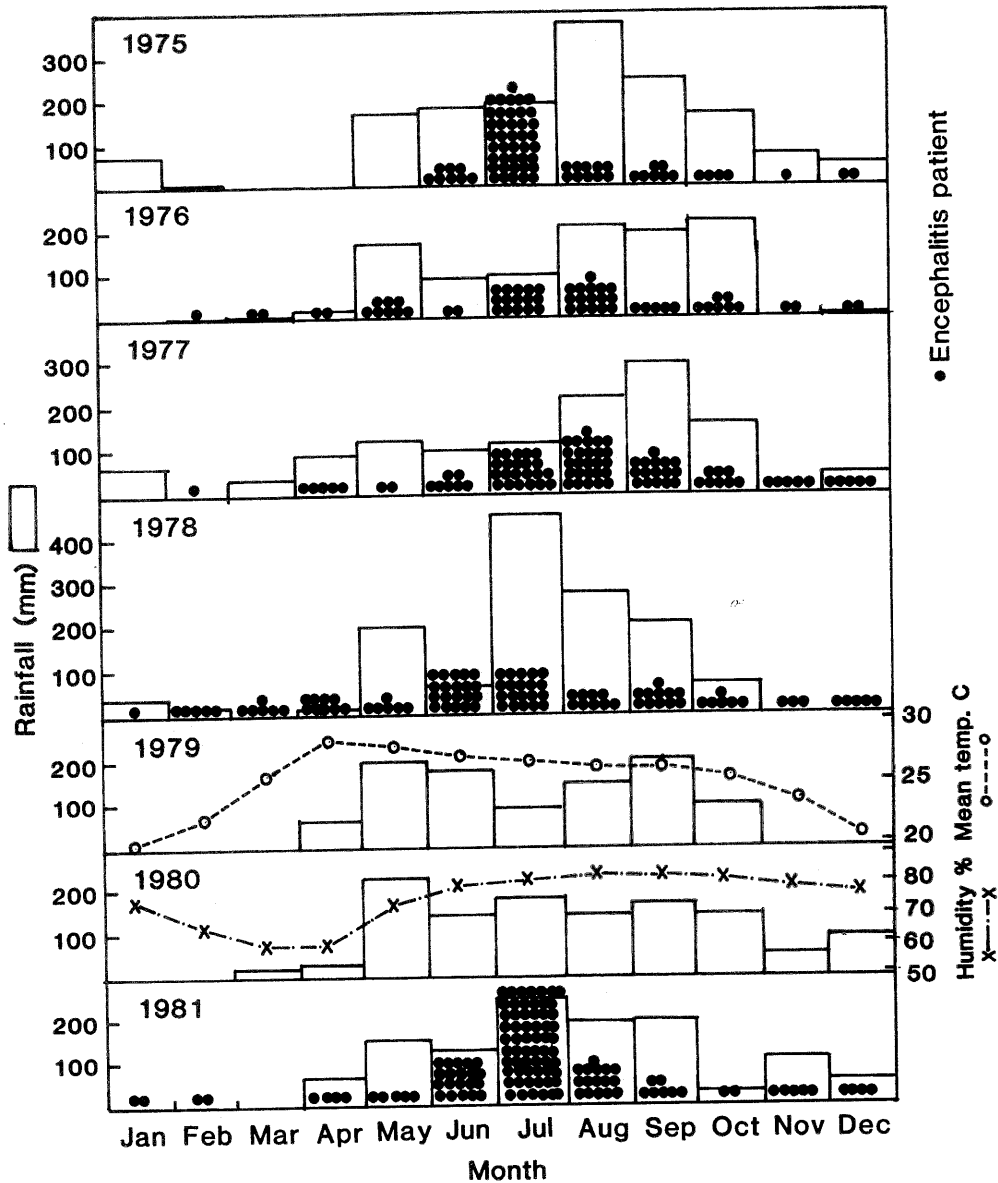


Fig. 3. Monthly reported cases of encephalitis and climatological data in Chiang Mai, Thailand.

tistics of the Ministry of Public Health of Thailand), and the age distribution of the patient showed that the largest number of cases was observed in the age group between 5 to 9 years old, the same as dengue hemorrhagic fever (DHF) as shown in Fig. 2 (Statistics of the Ministry of Public Health of Thailand). Seasonal variation of the disease showed that most of the cases were observed during rainy season of June, July, and August, as shown in Fig. 3 for Chiang Mai Area, where the patient's data in 1979 and 1980 were not available. Although serological examination on the limited number of cases has been performed by the hemagglutination-inhibition (HI) test, the result was not always clear-cut, because of the cross-reactivity with dengue viruses, which have the same seasonal occurrence in rainy season.

In Japan, various aspects of JE virus epidemiology and ecology have extensively been studied, however, the mechanism of "overwintering" of the virus during interepidemic season still remains to be elucidated (Hayashi, 1982). One of the new approaches to solve this problem would be to compare various JE virus isolates using techniques of modern virology in order to prove any geographical and/or chronological differences among these isolates.

#### PLANNING AND OUTLINE OF THE STUDY

Based on the above mentioned background, we set up our objectives to understand present status of viral encephalitis in Chiang Mai Area from virological and epidemiological point of view, hoping that the study will give benefits both to Thailand and Japan in order to improve future preventive measures against the disease and to understand basic mechanism of the virus circulation in nature. Our targets are shown below:

1. Isolation of viruses using *Aedes albopictus*, clone C6/36, cells
  - a) Clinical materials
    - 1) Peripheral blood of hospitalized patients of encephalitis, dengue hemorrhagic fever (DHF), unknown fever (FUO), and other diseases which may be related to JE or dengue infections.
    - 2) Postmortem brains from encephalitis, and livers from DHF cases.
  - b) Field-caught mosquitoes of possible vector species of JE virus.
  - c) Slaughtered swine sera with low HI antibody titers.
2. Serological examination by the HI and enzyme-linked immunosorbent assay (ELISA)
  - a) Clinical materials: same as 1-a)-1).
  - b) Healthy inhabitants, collected by filter paper method.
  - c) Various vertebrates.
3. Entomological study on mosquitoes collected by light traps at pigpens.

These studies were primarily performed in the Faculty of Medicine, Chiang Mai

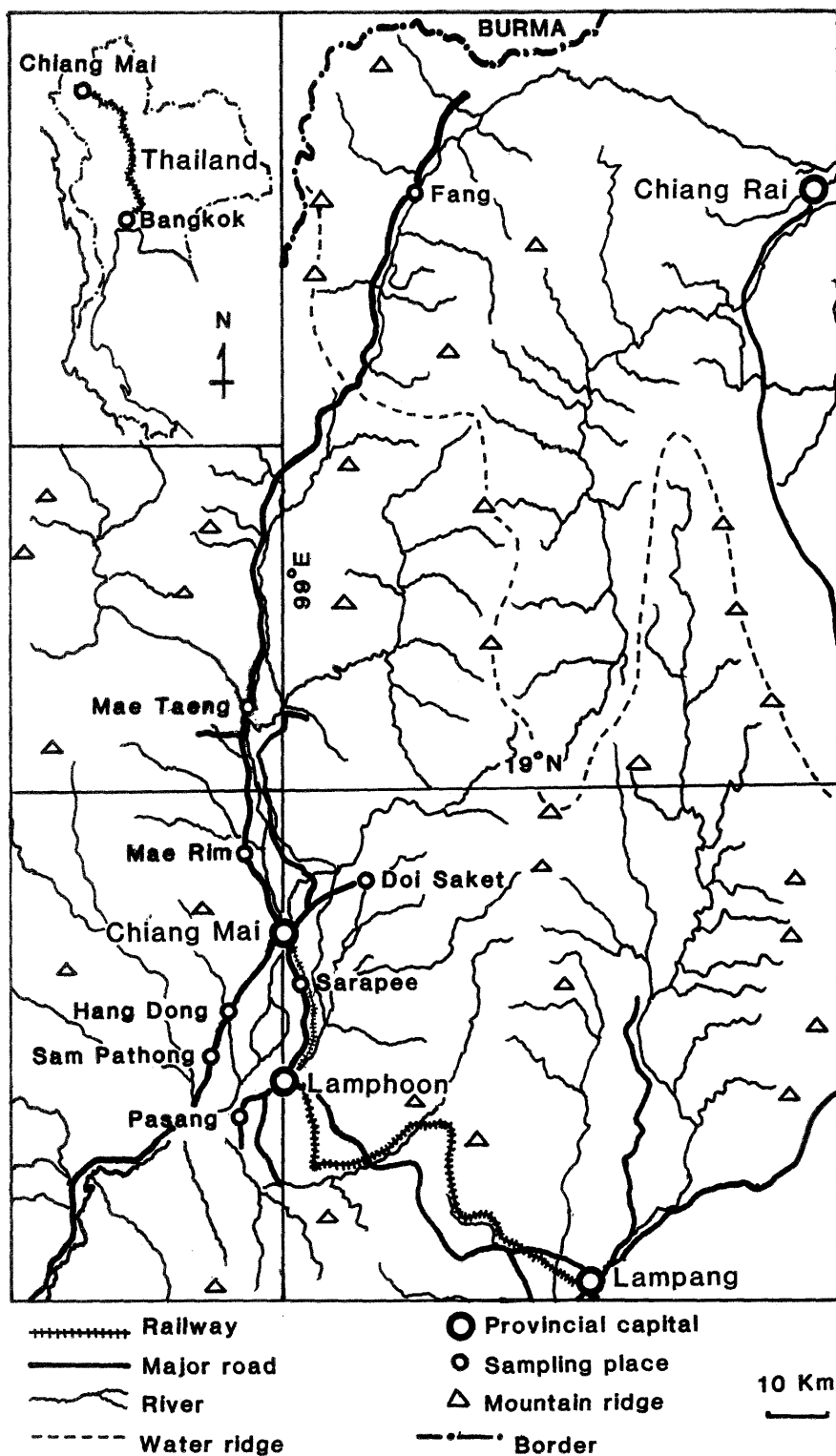


Fig. 4. Study area and sampling places.

University, with active participation by the Ministry of Public Health of Thailand. Following Institutions and Facilities have been involved in this study:

1. Faculty of Medicine, Chiang Mai University  
Departments of Microbiology, Pediatrics, Internal Medicine, Parasitology, and Pathology
2. Ministry of Public Health of Thailand  
Division of Epidemiology  
Virus Research Institute, Department of Medical Sciences.
3. Provincial Health Offices of Chiang Mai and Lamphoon Provinces.  
Provincial and District Hospitals with Medical Doctors, Health Officers, and Public Health Nurses
4. McCormick Hospital and some other private hospitals in Chiang Mai
5. Mae Rim Horse Farm of Royal Thai Army Department
6. Chiang Mai Zoo

Outline of the study area is shown in Fig. 4. Specimens of healthy humans were collected at 5 locations: Fang, Mae Taeng, Doi Saket, and Sarapee in Chiang Mai Province, and Pasang in Lamphoon Province. Mosquitoes were collected at Mae Rim, Doi Saket, Hang Dong, and Sam Pathong.

The Japanese team leader, A. I., arrived in Bangkok on June 27 and the remaining 5 Japanese members on June 30. Discussions and some preparations were made at the Virus Research Institute, Department of Medical Sciences. Two Thai scientists from Division of Epidemiology and Virus Research Institute jointed to Japanese team, and they moved to Chiang Mai on July 6 except A. I., who arrived in Chiang Mai on July 15 after collecting unaccompanied goods sent by air. Discussions on the study planning was held in the Faculty of Medicine, Chiang Mai University, and actual collection of the specimens started from July 19 which continued until August 17. Most of the results reported in this series of papers were obtained in Chiang Mai with some supplementary works done in Japan.

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bodies, to the Research Foundation for Microbial Diseases of Osaka University for purified JE vaccine concentrate, and to the Chemoserotherapeutic Institute of Kumamoto for JE antigen in the HI test and prophylactic vaccine against rabies.

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## 1982年タイ国チェンマイ地区における脳炎のウイルス学的疫学的調査. I. 緒言および調査計画

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1966年の大流行を最後に日本における日本脳炎は激減し、過去10年間は日本における日本脳炎の年間患者数は100名以下という低流行の状況が続いている。一方、日本以外のアジア各地ではしばしば日本脳炎と思われる脳炎が大流行し高い致死率と重篤な後遺症を残す点で公衆衛生的に重大問題となっている。我々は1969年以来、毎年多数の脳炎患者の発生が報告されているタイ国北部チェンマイ地区においてその現状を知る目的で、ウイルス分離、血清学的調査、および媒介蚊の調査を行なった。

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