

## **Investigation of a Dengue Fever Infection in Linyuan Township, Kaohsiung County**

### **Introduction**

Major symptoms of dengue fever infection are high fever, headache, joint, bone and muscle pain, retro-orbital pain, and rash. Infection is caused by the subgenus dengue fever virus of the Flavivirus of the Flaviviridae family. The subgenus has four types of dengue fever viruses. The corresponding antigens are named DEN-1, DEN-2, DEN-3, and DEN-4. Infection by one type of virus will result in life-long immunity against the virus. Heterologous immunity is rare. In Taiwan, the virus is primarily transmitted by *Aedes aegypti* or *Aedes albopictus* mosquitoes. An epidemic was reported in 1779-1780 simultaneously in Asia, Africa, and North America, indicating that the virus and the vectors have been in existence for more than 200 years<sup>(1)</sup>. The epidemic recurs in a cycle of every 10 to 40 years. It became a worldwide pandemic starting in Southeast Asia after the Second World War, with infections of several serotypes occurring at the same time. Dengue hemorrhagic fever (DHF) appeared for the first time in Southeast Asia in the 1950's. In 1997, dengue fever became one of the most serious mosquito-borne diseases of man, comparable to malaria in distribution. Epidemic areas cover a population of more than 2.5 billion, and yielding millions of cases each year, with thousands of DHF cases in certain years<sup>(2)</sup>. Fatality of DHF is about 5%. Very often, children and young

adults are victims. The disease significantly affects society and the economy.

## **The Background**

On 12 July 1999, the Kaohsiung Veterans' General Hospital reported a suspected dengue fever case. The case was a 35 years old female schoolteacher, who had not been abroad for the last two months. She was admitted for care on 30 June due to high fever and bone pain. Another suspected case was a 45 years old housewife. On July 1, she began to develop high fever, bone pain, weakness, rash, and itching, and reported to the local health unit for blood testing. Both cases come from Jenai Village, Linyuan Township of Kaohsiung County. Both cases were later confirmed by the Center for Disease Control as dengue fever infection. In a follow-up investigation, three more suspected cases were identified. They were confirmed by laboratory testing as dengue fever infection on 16 July.

## **Survey Methods**

### 1. Interview of Cases

Following the protocol of the Manual for the Control of Communicable Diseases<sup>(3)</sup>, all suspected cases were visited and questioned regarding their backgrounds, clinical symptoms, date of onset, medical care, history of dengue fever infection, places visited two weeks before and two weeks after the onset of infection, and any suspected symptoms of contacts, and laboratory findings.

### 2. Definition of Case

According to the Manual for the Control of Communicable Diseases, a laboratory confirmed case of dengue fever is one that meets any one of the following conditions:

- 1) isolation of dengue virus from clinical specimens;
- 2) serum collected at any time showing dengue virus IgM antibody positive and Japanese encephalitis virus IgM antibody negative; and
- 3) antibody titer of dengue fever of serum in the convalescence period detected by hemagglutination inhibition test (HI test) being four or more than four times higher than that of the acute period.

### 3. Surveys of Households, School and Community

1) Household survey : According to the Manual for the Control of Dengue Fever, at least 20 households within 50 meters of the house of a suspected case must be interviewed to detect any further suspected cases. Specimens are collected at the same time from contacts. For a confirmed case, 50 households in the neighborhood must be interviewed.

2) Survey of clinic : The residence of one case is a clinic. All patients who had visited the clinic in May and June were interviewed to ascertain if they had been abroad, and if there were any suspected cases.

3) Survey of school : The school where the schoolteacher works was disinfected and students given health education. Names of students and staff who had been on leave in May and June were collected to detect any suspected cases.

4) Survey of imported cases : A case imported in early June and living in Taliao Township, was followed-up to determine if any geographic connection with the present cases existed.

### 4. Environmental Survey and Elimination of Breeding Sources

Vector surveys and assessment of species were conducted in 24 villages of the township. Elimination of breeding sources in the entire township was conducted daily by the local health bureau, health unit, environmental protection bureau, the township government and the military between 2 and 7 August. Vector surveys, assessment of species, health education, and epidemiological surveys were conducted at the same time. Later, two more vector index resurveys were conducted.

### 5. Laboratory Testing

Specimens of all suspected cases and specimens collected on epidemiological investigations were sent to the Division of Vector-borne Infectious Diseases of the Center for Disease Control for laboratory testing by RT-PCR, IgM antibody capture enzyme-linked immunosorbent assay, and HI test. All specimens were tested for IgM antibodies. Specimens collected within 10 days after onset were tested with RT-PCR. Reported cases, but not contacts, of unknown date of onset were also tested with RT-PCR. The first specimens of reported cases were tested with HI test to detect secondary infection. Paired sera were also tested with HI test.

In the period between 15 July and 7 September, a total of 2,125 specimens were collected for laboratory testing. Of them, 1,792 were collected from the neighborhoods of the suspected cases; and 333 by hospitals, clinics, and health units.

## **The Investigation**

### **1. Epidemiological Investigation**

Upon receiving the case reports on 12 July 1999, one by the Kaohsiung Veterans' General Hospital and one by the case herself, the health bureau on July 15 immediately began health education activities in the community, and disinfection of the areas within 50 meters of the suspected cases. At the same time, 364 individuals in 100 households in the neighborhood were interviewed, and 208 specimens collected for laboratory testing. On home visits, three more suspected cases were detected. They developed symptoms on 30 June, 5 July, and 8 July respectively. They were all confirmed by laboratory testing as dengue fever infection on 16 July.

There were no confirmed dengue fever cases in Linyuan Township in May and June. There was one confirmed imported case in the neighboring Taliao Township in early June. This imported case lives in Chaoming Village of Taliao Township five kilometers away from Jenai Village of Linyuan Township. The family lives in Pingtung, and the case has never been to Linyuan. Any geographic connection between the two incidents was dismissed.

The residence of Case 1 is a clinic. She is a schoolteacher in a primary school. The Kao-Ping Branch Bureau of the Bureau of National Health Insurance was requested to provide computer information of some 4,885 patients who had visited the clinic in May and June. 1,124 patients of the total diagnosed under disease classification codes A312 and A322, (the physician in charge of the clinic said that suspected dengue fever patients in May and June, were reported to the Bureau of National Health Insurance under the disease codes above) , were chosen and divided into four groups by date of visit (1-15 May, 16-31 May, 1-15 June, and 16-30 June) . The Clinic Physician was requested to review the medical records of these patients. Blood specimens of suspected cases were taken by the local health unit for laboratory testing. In all, 66 patients were found to show suspected symptoms. Blood specimens were then collected from 30 of them for testing; all were negative. 268 patients who

visited the clinic during 10-20 June were telephone-interviewed for any suspected symptoms. None of them had developed any symptoms.

Health education was provided for students of the school where Case 1 works. The 120 schoolteachers and staff were interviewed and blood specimens collected. Names of students on leave in May and June were identified and 153 of them telephone-interviewed. On July 19 blood specimens were collected for laboratory testing by the health unit from 86 of the students who had developed fever during the period between 27 May and 5 June. All were negative.

### 2. Early Reporting Encouraged

Early reporting of suspected cases is essential to the interruption of disease transmission. The Department of Health stipulates in Item 2 of the 1999 Incentive Measures for the Active Reporting of Dengue Fever Cases, that any person who reports a case, which is later confirmed by the Center for Disease Control as a dengue fever infection, will be rewarded NT\$2,500 per case. The woman who reported herself to the local health station was thus awarded. All health units and medical care institutions are asked to display posters to remind doctors and the public of early reporting of any suspected cases.

### 3. Determined Elimination of Breeding Sources. Health Education, and Vector Index Surveys

On 30 July, a group of professionals was dispatched by the 4th Branch Office to do vector index surveys. An increase in vector index was noted. Through discussions with the health bureau, the environmental protection bureau, and the township government, it was decided that an aggressive and comprehensive elimination of breeding sources throughout the township would be conducted. On 2 August, 30 persons a day from the 4th Branch Office, the health bureau, the environmental protection bureau, and the township government, and 80 persons a day from the army began to eliminate breeding sources and to conduct health education in four groups, one village a day per group, for six days. For this activity, the Branch Office dispatched five staff members each day, one for coordination, and four to participate in the health education and the elimination of breeding sources. By 7 August 291 of the 524 neighborhoods in the 24 villages of the township, had been visited. Of the 1,784 water containers found in these neighborhoods, 234 were positive. 167 of the positive containers were chosen for the assessment of species.

#### 4. Health Education, Organization of Voluntary Workers, and Inspections

To improve the villagers' knowledge of dengue fever control and to encourage them to actively participate in the control program, on 9 August, two meetings on dengue fever, vectors, and vector control were organized for villagers, neighborhood leaders, and village workers. It was also decided that a village would be used as a basic unit for environmental sanitation and elimination of breeding sources. On 31 August, the health bureau asked each of the villages to organize one voluntary team of 20 members. On 24 August, a training course was organized for the teams. Another meeting was organized on 2 September for 75 schoolteachers and local leaders.

An inspection and reporting team was jointly organized by the health bureau, the environmental protection bureau, and the township government on 11 August to inspect and report for punishment any violations of regulations and to enforce control measures. By 2 September, the health bureau had reported eight violations, one refusal to pesticide spraying, and seven with mosquito larvae. The environmental protection bureau reported 446 cases for penalties.

#### 5. Aggressive Cleanup of the Environment and Re-Surveys of Vector Indexes

An aggressive cleanup of the township was conducted on 14 and 15 August. On 18 and 19 August, the military and the environmental sanitation teams joined forces to clean up potential breeding sites in the community. To ascertain the effects of the cleanup, re-surveys of vector indexes were conducted on 16 to 20 August. In some villages, the vector indexes declined. The vector index in Jenai village in particular, where the confirmed cases were located, declined from grade 7 to grade 4. In other villages such as Wangkung, Chungmen, and Linyuan, the grade of vector indexes had declined significantly from 7 to 3, 5 to 3, and 6 to 4 respectively, though they were still within the alert range. Re-surveys of vector indexes were conducted again on 30 August through 2 September to find significant improvement.

### **Results**

Linyuan Township of Kaohsiung County is located to the south of the Hsiaokang District of Kaohsiung City, neighboring Taliao Township to the north, facing Hsinyuan Township and Tungkung Township of Pingtung County across the Kaoping River, and with the Taiwan Strait in the south. The

township has 20,141 households in 524 neighborhoods in 24 villages with a population of 71,746 persons at the end of 1998. In the period between late September 1998 and January 1999, there were 28 indigenous confirmed type 2 dengue fever cases. The neighboring Riuchiu island had a serious outbreak of dengue fever infection in 1981. This was the most serious outbreak in Taiwan since the first outbreak of type 2 in 1942. Almost five-sixths of the populations were infected during this outbreak, yielding an attack rate of 80%. Another outbreak occurred in 1987-1988 in Tungkang and Kaohsiung. In 1987 and 1988, there were 1,123 and 10,420 reported cases respectively. Of them, 527 and 4,389 cases were confirmed<sup>(4)</sup> In 3,832 cases, dengue virus of serotype 1 was isolated. In another five cases, virus of serotype 2; in one case, virus of serotype 3; and in three cases, viruses of serotype 4 were isolated. By 1988, there were already infections of four serotypes of viruses in Taiwan. In the neighboring areas of Linyuan Township, there were infections of serotypes 1 and 2.

In the period between 15 July and 15 September, 1,792 blood specimens, (189 from students and teachers of the Linyuan Primary School and 220 from the Linyuan Junior High School) , were collected. In addition, hospitals, clinics, and the health unit also collected 333 blood specimens. At the same time, 19,859 persons in 4,923 households were interviewed; and 5,380 households sprayed with pesticide. Between 12 July and 31 August, a total of 17 confirmed cases were detected. Their demographic and other information in Table 1. These 17 cases had never been infected with dengue fever before. Of them, one case reported herself for testing; 12 cases were reported by hospitals and clinics; and four were detected on epidemiological investigation. Nine cases came from Jenai village; one from Chungmen village; one from Tunglin village; two from Linyuan village; three from Wangkung village; and one from Chaoming village of Taliao Township. Their age distribution is shown in figure 1. They age range was from seven to 59 years, with most cases (five cases) in the 12-16 age group; and four cases in the 34-38 age group. The date of onset is shown in Figure 2. Two cases became ill on 30 June, to be followed by more cases on 1 July, 5 July, and 8 July; three cases on 29 July; and the last case on 21 August. Cases 1, 3, 4, and 5 often pass through the neighborhood of Case 1. Cases 2 and 6 go to the same market for shopping, and the market is only 100 meters away from the house of Case 4. Case 7 lives only 60 meters away from the Linyuan Primary

School. Cases 8 and 9 are an uncle and a nephew who live in the same house. The nephew is a student of the Linyuan Primary School and was in the school 011 15 July. He visited his grandmother often during summer time, and the grandmother lives only 200 meters away from Case 7. Cases 10, 11, and 12 are father and children. They live only 30-40 meters away from Case 7 and the Linyuan Primary School. Case 13 works ill the neighborhood. Cases 14 and 15 are mother-in-law and daughter-in-law and also live in the area. Cases 16 and 17 are classmates at the Linyuan Junior High School. Cases 10 and 12 are also students of the High School.

Vector index re-surveys conducted on 16-20 August and again on 30 August-2 September after the elimination of breeding sources on 2-7 August, the intensive cleanup on 14-15 August, and the cleanup of vacant land lots on 18-19 August, showed significant improvement (Table 2) . only six of the villages were still graded 4, the rest villages were in grades 1-3. After some extensive promotion/publicity, most people cooperated in the cleanup of the environment. Vacant IaM lots were the major sources of vector breeding.

## Discussion

From the time of transmission of dengue fever, the incubation period of the infection ranges from 3 to 14 days (more likely 5-7 days) . All infected person is capable of infecting others during the period from the day before and five days after the onset of infection. The virus, after 8-12 days of multiplying in mosquitoes, can infect healthy people<sup>(5)</sup> Therefore, if the index cases are not properly controlled, in 10 to 31 days (20 days on average) , there will be a second cycle of infection. The first five cases of the present investigation were reported to health authorities respectively on the 13th, 12th, 16th, 11th, and 8th days after the onset of infection, they would by then have transmitted the viruses to others, as more confirmed cases followed thereafter. Although all confirmed cases had been medically treated, only four of them were reported to health authorities within five days. Physicians of local medical care institutions seemed lot well acquainted with and less aware of the infection.

During the period, local medical care institutions reported a total of 51 suspected cases. The case positive rate was less than ole-third. Of the positive cases, one was tested IgM negative two days before onset, and tested positive later after onset. Virus of serotype 1 was then isolated from the initial specimen



by RT-PCR. Another case was tested IgM negative five days after onset, and later tested positive on the sixth day. Virus of serotype 1 was then isolated by RT-PCR from the specimen collected on the fifth day. Cases of unknown date of onset are not tested with RT-PCR. Though the IgM titers of the two cases mentioned above were not high enough to be detected, the quantity of viruses was sufficient for typing. By the current standard of screening, these two cases would not have tested positive without the initial specimens. The timing of specimen collection and the testing methods therefore are most important. According to the Manual for the Control of Dengue Fever, at least 20 households in the neighborhood of a suspected case must be interviewed and blood specimens taken. Sometimes, however, local health authorities would place these households under active surveillance, and take relevant control measures only after cases are confirmed. Cases of unknown date of onset were not tested with RT-PCR; nor were blood specimens taken. Some cases may thus be lost.

Investigations of the imported case in Taliao Township and patients of the clinic did not reveal the source of infection. From the low rate of case reporting and the high vector indexes of the area, it is probable that the infection was caused by some unreported cases or cases of silent infection. An investigation by the former National Institute of Preventive Medicine in Tainan City<sup>(6)</sup> of a small-scale outbreak of dengue fever infection in August 1997 showed, from the blood specimens collected in a follow-up survey in March 1998, that the conversion of neutralization antibodies of 12.24% (12/98) of those tested turned positive, though none of them had developed any clinical symptoms in the last six months. Of them, only five (5.10%) showed IgM antibody. Chen WC et al.<sup>(7)</sup> in a study in Kaohsiung City in 1988-1989 also showed that 6.48% of the population would show IgM positive, and IgM antibody of 1.13% of the population would turn positive even in the absence of any outbreak. The IgM positive rate of the general population in Kaohsiung in 1992 was 0.43-0.98%<sup>(8)</sup>; that of the school children of Tungkuang Township, Pingtung County, in 1991 was 0.95-4.86%; and that of the primary and junior high school children of Ryuchiu Township in 1990 was 2.8%. From the fact that no confirmed cases were detected through active surveillance in Pingtung County and Kaohsiung County in 1982<sup>(9)</sup> soon after the serious outbreak in the neighboring Ryuchiu Township in 1981, it was likely that the viruses had always been present as a

silent infection, and the source of infection would have been difficult to detect. The low positive rate of blood specimens collected on epidemiological investigation could have been due to the following reasons: blood was not been collected from all contacts (including individuals without suspected symptoms) ; antibody was not sufficiently high and could not be detected by appropriate testing methods; and no second specimens could be collected. While these reasons cannot be eliminated, serological epidemiological follow-up investigations should always be conducted to determine the rate of silent infection.

### **Recommendations**

In 1998, there was a serotype 2 infection in Linyuan. In July 1999, a case of serotype 1 appeared, two months earlier than usual. Of all townships in Kaohsiung County, Linyuan has the largest number of empty plots of land (200-300 lots) dirty and lacking proper management due to the absence of landowners. They are ideal sites for the breeding of vectors. The local land administration office should be coordinated to identify vacant lots, and eliminate sources of vector breeding to prevent the spread of viruses.

Timely reporting of cases is essential to disease prevention. Although there were several outbreaks for two consecutive years in the township, physicians seemed poorly acquainted with the infection. More should be done to educate physicians, and to encourage the public to self-report cases. In the present outbreak, one woman presented herself for testing, and a mother-in-law and her daughter-in-law asked for dengue fever testing. These cases were confirmed later. Active reporting by the public should help in the control of infection.

From the outbreak of 1987-1988 in Kaohsiung, it was noted, as in the case of the present outbreak, that most victims of the infection were children of 10-14 years<sup>(10)</sup> They attend school, and are likely to be bitten by mosquitoes there. Chances of teachers and students bringing in virus infection from travel overseas to school after the summer vacation are high. Control of vectors in schools is also extremely important. Vector index surveys in schools, elimination of breeding sources, and health education of teachers and school children are some important preventive measures.

Though as many as 2,125 blood specimens were collected during the period from 15 July to 15 September, with a heavy investment of manpower and resources, some cases were missed. At the time of an outbreak, more initial

focus should perhaps be placed on disease control to identify the area of infection, eliminate sources of vector breeding, eradicate vectors, and control the outbreak. The infection rate and prevalence of the outbreak could be studied more systematically later. Serial comparison of RNA could be conducted to determine any geographic connection of the outbreak in any imported cases. Serological epidemiological follow-up investigations could be conducted to ascertain the status and extent of silent infection. Cases of unknown date of onset are not tested with RT-PCR. At the time of epidemiological investigation, efforts should be made to determine the date of onset of every case. The findings of vector index surveys conducted by the staff of the 4th Branch Office were found not comparable to findings of previous surveys. Vector index survey methods and various surveillance methods should be standardized for more effective surveillance.

Elimination of sources of vector breeding is most essential in the control of dengue fever<sup>(11,12)</sup> Although local health authorities of Linyuan Township took timely control measures, due to late case reporting, and high vector indexes, the disease may already have been spread. The unstable weather and heavy rains during this period unfortunately reduced the effects of the intensive cleanup of the community and the pesticide spraying, thus the sources of vector breeding had increased sharply. With the reporting of the first case on 12 July, the local township government only involved armed forces participation on 2 August to assist in the elimination of breeding sources. Only two junior high school students fell ill after the intensive elimination of breeding sources (the school was under reconstruction, the classroom of the two students was close to the construction site, and the construction site was not properly managed for vector control) . For the effective control of dengue fever, local health authorities should, in addition to the surveillance of environment and cases, coordinate through local government the environmental protection, civil affairs, education, land affairs, public works, and police departments for more consolidated control of the infection.

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**Table I The Confirmed Cases in Linyuan Township of Kaohsiung County, July – August, 1999**

No	Sex	Age	Date of Onset	Date Reported	Reported by	Where Infected	Vector Index	Status of Case
1	F	35	88.06.30	88.07.12	KVGH	Jenai		Wife of physician of Clinic XX, schoolteacher of Linyuan Primary School.
2	F	45	88.07.01	88.07.12	Self	Jenai	7/22 1 7/29 5 8/02 7	Housewife, member of Women's Assoc, participates in many activities, frequent shopping at Kainan market.
3	F	21	88.06.30	88.07.15	Epi Survey	Jenai	8/11 4	Works at Clinic XX.
4	F	26	88.07.05	88.07.15	Epi Survey	Jenai	8/16 2 8/17 2 8/30 3	Works at Clinic XX, 6 month pregnant at time of onset, lives 100 meters away from Kainan market.
5	M	34	88.07.08	88.07.15	Epi Survey	Jenai		Lives 20 meters away from Case 1, delivers bread to households around Tantau village.
6	F	47	88.07.19	88.07.19	Chenyau Hosp	Linyuan	7/19 2 7/30 6	Housewife, frequent shopping at Kainan market, farmland around the house.
7	M	16	88.07.17	88.07.23	KCGM	Jenai		Student of Fenglin Senior High had not been to school since summer vacation, moves only around neighborhood, lives 60 meters away from Linyuan Primary School.
8	M	27	88.07.29	88.08.04	KCGM	Wangkung	7/20 7 7/30 7 8/03 7	Uncle of Case 9, truck driver, drives to different places, though more often within Linyuan Township, occasionally to Kaohsiung City.
9	M	7	88.08.02	88.08.04	KCGM	Wangkung	8/09 6 8/11 3 8/30 2	Nephew of Case 8, student of Linyuan Primary School, was in school on 7/15, 3 visits grandmother often during summer vacation, grandmother lives 200 meters away from Case 7.
10	M	13	88.07.31	88.08.04	Chang Clinic	Jenai		Brother of Case 12, student of Linyuan Junior High, goes to school during summer vacation and to cram school.
11	M	44	88.07.29	88.08.04	Chang Clinic	Jenai		Father of Cases 11 and 12, always at home, lives 30-40 meters away from Case 7.
12	M	12	88.07.29	88.08.04	Chang Clinic	Jenai		Brother of Case 10, student of Linyuan Primary School, goes to cram school during summer vacation.
13	F	38	88.08.04	88.08.09	Kuangjen Clinic	Jenai		Works at a furniture shop ( of her sister's ) , shop only 30-40 meters away from Cases 10, 11, 12.
14	F	59	88.08.07	88.08.13	KCGM	Jenai		Mother-in-law of Case 15, runs an eating-place, lives 30-40 meters away from Case 7.
15	F	36	88.08.09	88.08.11	Tajen Hosp	Jenai		Daughter-in-law of Case 15 works at the eating-place.
16	F	13	88.08.17	88.08.24	Chenyau Clinic	Wangkung		Student of Linyuan Junior High goes to school during summer time, and to cram school.
17	F	13	88.08.21	88.08.27	Epi Survey	Wangkung		Student of Linyuan Junior High goes to school during summer time, and to cram school.

Table I The Confirmed Cases in Linyuan Township of Kaohsiung County, July – August, 1999 (Continue)

No	Activities Two Weeks Before Onset	Activities Within One Week After Onset	Likely Source of Infection
1	At home, teaching at Linyuan Primary School, never been to market, 6/27-28 visited Hsinchu and Tienmu.	At home, Kaohsiung Veterans' General Hospital	Clinic XX (?)
2	At home, visited Kainan market frequently.	At home.	Kainan market (?)
3	At home and Clinic XX.	At home, Clinic XX.	Clinic XX (?)
4	At home and Clinic XX.	At home, Clinic XX.	Clinic XX (?)
5	Visited customers in Linyuan, and delivered goods to Pingtung and Fengshan.	At home, Clinic XX.	Clinic XX (?)
6	Cared daughter at Hsiaokang Hospital visited Kainan market.	At home.	Kainan market
7	Around the house.	At home, Fenglin Senior High, Fuan Clinic, Kaohsiung Chang Gung Memorial Hospital	Linyuan Primary School (Case 1)
8	At home, visited Chingsheui yen.	At home.	?
9	At home, Linyuan Primary School, grandmother's home.	At home, grandmother's home.	Linyuan Primary School (Case 7)
10	At home, visited Kaohsiung City.	At home, Chang Clinic	Case 7
11	At home, Linyuan Primary School, Lungmen Cram School.	At home, Chang Clinic.	Linyuan Primary School (Case 7)
12	At home.	At home, Peita Cram School.	Linyuan Primary School (Case 7)
13	At home, XX furniture shops.	At home, XX furniture shops.	Case 7
14	At home.	At home, Fuan Clinic.	Case 7
15	At home.	At home, Fuan Clinic.	Case 7
16	At home, Linyuan Junior High, Kid Castle Cram School.	At home, Linyuan Junior High, Kid Castle	Linyuan Junior High (Case 10)
17	At home, Linyuan Junior High, Chinghua Cram School, Kaohsiung and Kengting.	At home, Linyuan Junior High, Chinghua Cram School, XX Clinic in Chaoming village, Chenyou Hospital	Linyuan Junior High (Case 10)

Note: KVGH is Kaohsiung Veterans' General Hospital; KCGM is Kaohsiung Chang Gung Memorial Hospital.

Table 2. Grade of Breteau Indexes of Dengue Fever Vector by Village

Date	Jenai	Wangkung	Chungmen	Tunglin	Linyuan	Wenhsien	Kuanying	Kungtsao	Linchia	Peishan	Chungshan	Tungshan
7/1-7/28	1	7	3	3	2	1	5	3	7	5	8	3
7/29-7/30	5	7			6	6						
8/2-8/7	7	7	5	4	6	6	5	5	6	4	7	4
8/9-8/11	4	6			6	7	7					
8/11-8/12	4	3										
8/16-8/20	2		3	4	4					5	4	5
8/17	2											
8/30-9/2	3	2	1	1	2	4	3	3	4	4	4	4

Table 2. Grade of Breteau Indexes of Dengue Fever Vector by Village (Continue)

Date	Hsishan	Chungyun	Fengyun	Hsihsi	Kangtsuei	Kangpu	Tingtsao	Chungtsao	Linning	Tantou	Hsichou	Wufu
7/1-7/28	3	5	6	4	8	4	5	5	5	6	6	6
7/29-7/30												
8/2-8/7	4	7	6	6	6	5	5	3	3	4	4	5
8/9-8/11								5	5	3		
8/11-8/12												
8/16-8/20	4	6	6		3	4						
8/17												
8/30-9/2	5	3	2	2	2	1	4	1	2	2	3	3

Fig.1 Age Distribution of Confirmed Dengue Fever Cases

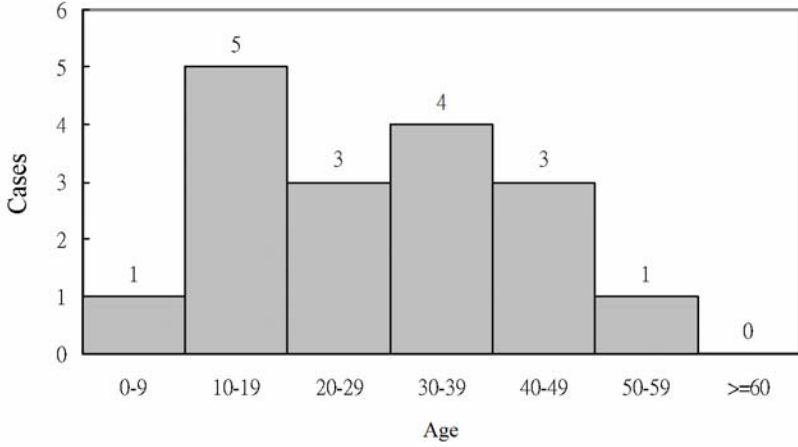


Fig.2 Distribution of Date of Onset of Confirmed Dengue Fever Cases

