

Chapter II

MALARIA IN TAIWAN BEFORE 1946

MALARIA SITUATION PRIOR TO 1895

While malaria was known to have been prevalent in Taiwan for many centuries, the impact of its devastation was not documented until 1874 when the Japanese Army invaded southern Taiwan. In 1871 a group of Miyakojima (Ryukyu) residents, shipwrecked by a typhoon, landed on southern Taiwan. Of the 66 crew members driven ashore, 54 were massacred by the indigenous people of Mutan village. In retaliation, Japan dispatched an army of 5,990 men to attack the inhabitants of Mutan village in May 1874 (Morishita, 1976). During a period of only 208 days, there were 16,409 cases of Taiwan Fever, with 561 deaths recorded by the army surgeon of the invading troops, who also recorded that quinine was effective against the fever, and that the average daily consumption of quinine by all troops was 144.89 gm. Detailed symptoms were described by the army surgeon. However, as the association of the disease with its causative parasites had not yet been recognized until Charles Alphonse Laveran did so in 1880, it can only be conjectured that the infections were those caused by *Plasmodium vivax* (*P. vivax*) and by *Plasmodium falciparum* (*P. falciparum*).

Meanwhile, let us look at historic circumstances suggesting that Taiwan may have played an important role in the discovery of mosquito transmission of malaria parasites.

In 1951 a paper entitled "Development of Medical Science in Formosa" was presented at a meeting of the Formosan Medical Association by its president, Tsungming Tu, who stated that the history of western medicine in Formosa (Taiwan) began when an I.L. Maxwell came to Tainan in May 1865 and established a church. In June, Maxwell began to preach and receive patients for medical treatment. In July he recommended Patrick Manson as Medical Officer for a post in the Chinese Imperial Maritime Customs. During his five years in Takao (now Kaohsiung), Manson's chief responsibility was the care of 16 foreigners at the port. At the same time, he gave medical treatment to many native patients. During his leisure time he went into the countryside to investigate leprosy and various tropical diseases. In 1871 Manson left the island upon transfer to the port of Amoy on the mainland of

China. During medical practice in the customs service, he observed and investigated filariasis (also known as elephantiasis). This led to his discovery of the parasite of that disease in the bodies of mosquitoes -- the first observed instance of disease organisms ingested by mosquitoes from infected patients. Although Manson never closed the man-to-mosquito-to-man chain of transmission, his findings were published in 1877. His observations of the mosquito-filarial parasite relationship soon led him to conjecture concerning the possibility that mosquitoes might be associated with the transmission of malaria parasites, which were first described by Laveran in 1880. Manson presented his views in several lectures while on home leave in England, although his theory was not taken seriously by many of his peers. However, Ronald Ross, also on home leave from foreign service (India), was much interested after Manson gave him a demonstration of the parasites reported by Laveran. Who knows what might have been the influence of Manson's five years of observing native patients in Taiwan's countryside with Ross' discovery in 1898 that mosquitoes might be capable of transmitting from one bird to another the parasites responsible for bird malaria.

In 1882 the medical report of the Chinese Customs for Kaohsiung and Anping ports mentioned many fever cases found in Anping. These may well have been malaria infections. A similar report for Tansui and Keelung ports described many malaria cases found in 1886 among the foreign residents. In about the same period, a statistical record of the McKay Hospital showed the number of malaria patients in relation to the total number of patients seen each year at the hospital between July and September (3-month period), 1882 - 1886 (Table 3).

Table 3
*Number of Malaria Patients Seen Between
 July-September (3-months) 1882-1886 at the McKay Hospital*

Year	Total No. of Patients Seen Between July-Sept.	No. of Malaria Patients Seen During the Same 3-Month Period	Malaria Patients %
1882	486	30	6.2
1883	669	40	6.0
1884	629	81	12.9
1885	648	275	42.4
1886	1,274	485	38.1

Source: Morishita, 1976

JAPANESE MALARIA RESEARCH AND CONTROL ACTIVITIES IN TAIWAN (1895 - 1945)

Morishita, in his book *Epidemiology and Prevention of Malaria* published in December 1976, compiled all the information on malaria control activities undertaken by the Japanese during the period 1895 - 1945.

According to the official statistics, the disease was the top-ranking cause of death in the years 1906 - 1911, resulting in more than 10,000 deaths annually when the island's total population was slightly over three million. Even after the initiation of a malaria control program in 1911, the number of deaths due to malaria remained fairly high through 1942 when the entire program was curtailed by World War II. During the period 1911 - 1942, the average annual deaths due to malaria numbered 5,879, ranging from 2,773 to 13,045 (Table 4).

Regarding the number of malaria cases, enough statistical data were available to permit a rough estimate. From 1933 through 1939 an average of 274,418 cases were diagnosed annually by government institutions such as government hospitals, public physicians (government-designated practicing physicians), and malaria stations. This figure, however, did not include those patients seen by private practicing physicians. Only in 1938 did the government send a request to all private physicians to report the number of malaria cases they diagnosed in a one-month period. Unfortunately, it was not clear if the "one month" figure represented an

average of malaria cases diagnosed per month or was merely the number of malaria cases seen in a given month of the year. At any rate, the total number of cases reported by all private physicians for a one-month period was 131,008. Assuming this represents one-twelfth (1/12) of the total cases seen in the year (12 months a year), the total number of cases for the whole year would have been 1,572,096. Adding 311,614 cases reported by government institutions for that particular year, the total malaria cases for 1938 would have been 1,883,710 at a time when the population was 5.6 million.

Table 4
Annual Malaria Death Rate in Taiwan (1906-1942)

Year	Population	Malaria Deaths	Deaths/10,000	Year	Population	Malaria Deaths	Deaths/10,000
1906	2,993,200	10,582	34.5	1925	3,784,000	6,508	17.2
1907	3,010,700	11,715	38.7	1926	3,874,600	5,758	14.9
1908	3,031,300	11,740	38.7	1927	3,962,400	5,083	12.8
1909	3,046,600	10,333	33.9	1928	4,048,500	4,346	10.7
1910	3,090,600	9,104	29.5	1929	4,135,700	4,025	9.7
1911	3,138,800	7,949	25.0	1930	4,266,100	2,844	6.7
1912	3,181,400	6,909	21.7	1931	4,347,700	2,991	6.9
1913	3,238,000	6,572	20.3	1932	4,483,500	3,335	7.4
1914	3,285,100	8,885	27.0	1933	4,629,600	3,021	6.5
1915	3,319,300	13,350	40.2	1934	4,745,300	3,107	6.5
1916	3,334,000	11,346	34.0	1935	4,859,200	3,782	7.8
1917	3,375,400	9,726	28.8	1936	4,996,900	3,337	6.7
1918	3,404,100	8,292	24.4	1937	5,102,700	3,716	7.3
1919	3,434,700	8,106	23.6	1938	5,250,000	3,729	7.1
1920	3,460,000	7,760	22.4	1939	5,380,500	3,931	7.3
1921	3,522,600	7,070	20.1	1940	5,540,200	3,761	6.8
1922	3,574,000	8,916	24.9	1941	5,705,100	3,359	5.9
1923	3,648,400	7,164	19.6	1942	5,792,000	5,882	10.2
1924	3,709,500	7,935	21.4				

Source: Morishita, 1976

In 1900 Robert Koch applied an antiparasite measure with drugs to control malaria in New Guinea, with much success. The method was based on detecting all the parasite carriers in the community and treating them with drugs. Japanese health personnel considered this method worth applying in Taiwan. In 1910 a pilot project was carried out in Peitou, a community near Taipei having a population of about 1,600. During five months, July through November, all residents were examined monthly for malaria parasites; those found to be positive were treated with quinine hydrochloride. The results were satisfactory; slide positivity rate was reduced from 7.2% to 0.71% in five months. Following this pilot project, a large scale malaria control program was launched in 1911, beginning with 12 "control areas." ^{1/} A "control area" meant a village or several villages where many persons were sick with malaria. The size of "control areas" varied, following existing political boundaries. The average population of a control area was about 2,000. Within a "control area" a certain number of residents were exempted from the periodic examination -- those older than 40 years of age (or sometimes 50 years or older) and infants. On the average about 60% to 70% of the population in a "control area" were examined monthly, sometimes twice a month if slide positivity was high (Table 5).

Usually there was an antimalaria station in a "control area," but sometimes an antimalaria station was responsible for more than one "control area." There were one or two, sometimes three or four, technicians and one to two helpers working in an antimalaria station, who were responsible for the collection and examination of blood slides as well as treatment of positive cases. The antiparasite measure applied during 1910 - 1944 was an admirable, laborious task in the malaria control history in Taiwan and one of the few such projects in the whole world in those decades. Although malaria transmission had never been interrupted, the disease had been brought under control for 35 years, having perhaps avoided many serious epidemics and saved thousands of lives. Table 6 illustrates the magnitude of this task.

1/ The number of "control areas" was progressively increased, reaching 155 in 1931 and 198 in 1944, the last year when the program was in operation.

Table 5
*Population Subject to Periodic Examination in Relation to
the Total in the Control Areas and the Total in Taiwan*

Year	Total Population in Taiwan A	Number of Control Areas	Population in Control Areas		Population Subject to Exam. Within Control Areas		
			Number B	% B/A	Number C	% C/A	% C/B
1934	5,053,887	164	328,766	6.51	214,515	4.24	65.25
1935	5,169,139	169	341,250	6.60	225,600	4.36	66.11
1936	5,302,560	186	368,680	6.95	241,545	4.56	65.52
1937	5,465,674	168	349,111	6.39	230,341	4.21	65.98
1938	5,605,850	166	441,109	7.87	314,588	5.61	71.32
1940	5,932,961	180	507,702	8.56	302,151	5.09	59.51
1941	6,101,387	180	614,993	10.08	305,231	5.00	49.63
1942	6,276,695	185	614,011	9.78	281,267	4.48	45.81

Source: Morishita, 1976

Table 6
*Number of Blood Smears Examined,
 Positive Cases and Positivity Rates, 1910-1944*

Year	No. of Blood Smears Examined	Number of Positives	Positivity Rate (%)	Year	No. of Blood Smears Examined	Number of Positives	Positivity Rate (%)
1910*	6,946	95	1.37	1928	2,024,786	37,217	1.83
1911	101,064	4,311	4.27	1929	2,188,089	38,504	1.76
1912	218,868	2,786	1.27	1930	2,300,900	33,644	1.46
1913	269,999	6,366	2.36	1931	2,370,553	44,329	1.87
1914	286,334	6,553	2.29	1932	2,430,740	67,265	2.77
1915	218,361	8,389	3.84	1933	2,470,950	72,092	2.92
1916	354,299	11,888	3.36	1934	2,618,670	72,272	2.76
1917	690,369	20,821	3.02	1935	2,578,930	78,698	3.05
1918	942,605	20,073	2.13	1936	2,771,631	83,989	3.03
1919	1,120,535	27,404	2.45	1937	2,811,822	85,575	3.04
1920	1,032,336	20,270	1.96	1938	3,214,736	106,167	3.30
1921	1,103,563	21,460	1.94	1939	3,459,364	116,822	3.38
1922	1,210,432	30,278	2.50	1940	3,595,122	98,047	2.73
1923	1,293,176	32,368	2.50	1941	3,659,154	105,430	2.88
1924	1,636,439	47,232	2.89	1942	3,935,096	141,868	3.61
1925	1,732,182	42,528	2.46	1943	3,384,910	137,923	4.07
1926	1,749,202	37,256	2.13	1944	3,259,051	125,914	3.86
1927	1,927,826	36,523	1.89				

* Pilot project.

Source: Morishita, 1976

The Koch method was the principal malaria control measure applied during 1910 - 1944. In addition, there were certain mosquito control activities and personal protection methods adopted in Taiwan. In 1911, 126 larvivorous fish (*Gambusia affinis*) were brought to Taiwan from Honolulu; in 1913 they were distributed throughout the island. This same species, plus another excellent larvivorous fish (*Poecilia reticulata*), is still found in rice fields, irrigation ditches, ponds, etc. in Taiwan (Pao-Shu Chen, 1997). To eliminate the breeding and the resting places of mosquitoes, village people were urged to drain or fill unnecessary water collections and to cut shrubs and bamboo thickets around human dwellings. Such work was done periodically and inspected by village authorities. Fumigation, using locally

available herbs and commercial fumigants, was done by the villagers, especially in the mountain areas. Screening and site selection for residential houses were in practice only in special communities (commercial companies and military camps), but on a very limited scale in terms of malaria control.



Fig. 2: Taking blood smears in the village
Source: Morishita, 1976



Fig. 3: Cutting and clearing
Source: Morishita, 1976

From 1942 to 1945, a serious malaria epidemic took place over the entire island because of World War II. The dispersion of non-immune populations from cities and towns to malarious rural villages, air raids, adverse living conditions, shortage of food, limited medical supplies (especially scarcity of antimalarial drugs) and many other harmful war-related factors, contributed to a series of outbreaks one after another, extending over virtually the entire population.