

REVIEW

FILARIASIS AND ITS CONTROL IN FUJIAN, CHINA

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Abstract. Epidemiological survey of filariasis in Fujian Province, China showed that malayan filariasis, transmitted by *Anopheles lesteri anthropophagus* was mainly distributed in the northwest part and bancroftian filariasis with *Culex quinquefasciatus* as vector, in middle and south coastal regions. Both species of filariae showed typical nocturnal periodicity. Involvement of the extremities was not uncommon in malayan filariasis. In contrast, hydrocele was often present in bancroftian filariasis, in which limb impairment did not appear so frequently as in the former. Hetrazan treatment was administered to the microfilaremia cases identified during blood examination surveys, which were integrated with indoor residual spraying of insecticides in endemic areas of malayan filariasis when the vector mosquito was discovered and with mass treatment with hetrazan medicated salt in endemic areas of bancroftian filariasis. At the same time the habitation condition was improved. These factors facilitated the decrease in incidence. As a result malayan and bancroftian filariasis were proclaimed to have reached the criterion of basic elimination in 1985 and 1987 respectively. Surveillance was pursued thereafter and no signs of resurgence appeared.

DISCOVERY OF FILARIASIS

Fujian Province is situated between 115°50' to 120°43' E and 23°33' to 28°19' N, on the southeast coast of China and belongs to the subtropics. The area is nearly 121,300 km², with 80 counties or cities subordinate to 9 regions. The population of Fujian was about 27,490,000 in 1987. From the 1950s a thorough investigation was made of the epidemiology of filariasis in the province, followed by mass treatment and by 1988 the disease had been basically eliminated in Fujian.

Filariasis in China was first discovered in Fujian. The first elephantiasis of the scrotum was reported by Manson (1872) in Xiamen, in the south of Fujian. In 1876 he found the microfilariae of *Wuchereria bancrofti*, the microfilarial sheath (Foster, 1956) and the mosquito intermediate host (Service, 1878), while in 1880 he also found the female adult of *W. bancrofti* from the lymphocyst in a patient. The following year he and Remine confirmed the nocturnal periodicity of microfilaria in Xiamen and Fuzhou (Rennie, 1881). In 1889 Manson carried out an autopsy of a person who had committed suicide and had a high density of microfilariae circulating in the blood at night

time: he found 1 male and 16 female adult filariae in retroperitoneal lymphocysts and a lot of microfilariae in pulmonary capillaries and glomeruli at 8.30 am (Sasa, 1976).

The first Chinese patient with malayan filariasis who came from Zhejiang province was reported by Feng (1933) in Xiamen. The Fujian malayan filariasis was found by Hu (1937) in Fuzhou. In 1948 Chen also found malayan filariasis in Nanping in the north of Fujian (Chen, 1948). In 1953 pure malayan filariasis endemic areas were discovered by Tang *et al* (1956). In 1958 the distributions of the two types of filariasis were confirmed by thorough investigation.

In the fifties it was confirmed that malayan filariasis only produced elephantiasis of the limbs, especially the legs (Xia *et al*, 1960). The morbidity of malayan filariasis was higher than that of bancroftian filariasis and the clinical manifestations of the two filariases were different (Fujian Anti-Epidemic Station, 1959a). The two kinds of microfilariae in Fujian exhibited nocturnal periodicity. It was confirmed that malayan filariasis was transmitted by *Anopheles lesteri anthropophagus* in the 1970s (Liu *et al*, 1981).

GEOGRAPHICAL DISTRIBUTION

There are thus two types of filariasis in Fujian province. In the hilly and mountainous regions such as Nanping, Shammung and Longyan, including 24 counties or cities, the northern and western parts of Fujian, malayan filariasis is widespread. The size of the region is 42.6% of the whole province and it has enormous areas of rice fields. Bancroftian filariasis is found in the plains of the coast, islands and other places less than 200 meters above sea level, including 27 counties or cities situated mainly in the central and southern parts of the province, the area of which is 11.4% of the province, but the population is concentrated. The other 29 counties comprising 45.2% of the area were found to have both types of filariasis and double infection was characteristic in people of some villages.

There was no filariasis in Zherong county which is higher than 700 meters above sea level, nor in the region between the two types of filarial areas and south of the entrance of the Minjiang River. The size of these areas is only 0.8% of Fujian province.

The distributive area of malayan filariasis is 70.4% of the whole province, but the bancroftian filariasis endemic area is in the high density population regions so the numbers of people threatened by the two types of filariasis are about equal.

INCIDENCE

In 1958 there was filariasis in 99.6% of villages in Fujian province and the microfilaria rate was 8.7% (944,611/10,820,610). Based on these data it was estimated that there were about 1.5 million microfilaria cases and about 500,000 clinical cases. The Mf rate had no relation to the human blood groups (Liu *et al*, 1987).

Area: In the area of malayan filariasis the Mf rates were found to be in the range 1.24-29.9% of inhabitants of various counties and cities. Jianyang county was the highest (29.9%) and the highest village (85.7%) was in this county. Of 9,909 cases of malayan filariasis examined randomly, microfilaria density was 1-2213 (average 42.8/60 μ l blood). The clinical manifestation rate

averaged 3.11% (11,344/363,612) in 13 counties. Among 6,707 patients there were 366 cases (5.5%) with elephantiasis of the leg, 9 cases (0.1%) with elephantiasis of the arm, 5 cases (0.07%) involving both leg and arm and 87 cases (1.2%) with lymphangitis. No other manifestations were found.

In the area of bancroftian filariasis the Mf rates were 2.08-16.29%, average 6.45% (234,002/3,628,794). The highest incidence was in Shankou village, Dongshan county (22.51%). Random examination of 3,378 cases of bancroftian filariasis found microfilaria densities from 1 to 1,675 (average 27.5/60 μ l blood). The clinical manifestation rate was found to be 2.08% (9,564/459,176) in 6 counties. Among 17,847 patients there were 326 cases (1.8%) of hydrocele which is a common symptom of bancroftian filariasis, 112 cases (0.6%) of chyluria, 92 cases (0.5%) of elephantiasis of the leg, 8 cases involving both leg and arm, 6 cases involving the arm only, 6 cases involving the scrotum, 4 cases the vulva, 4 cases the penis, 1 case the breast (a rarity). The microfilaria rate had no relation to areas of different fluoride content of drinking water (Lin *et al*, 1959).

In the areas where the two types of filariasis co-existed Mf rates were between 3.0 and 23.11% in various counties or cities, the average was 9.52% (459,985/4,796,493). Sixteen counties/cities had mainly bancroftian filariasis: in 2,788 cases of microfilaria there were 2,236 cases (80.2%) of bancroftian filariasis, 463 cases (16.6%) of malayan filariasis and 89 cases (3.2%) of mixed infections. Thirteen counties/cities had mainly malayan filariasis: in 5,567 cases of microfilaria there were 5,319 cases (95.54%) of malayan filariasis, 225 cases (4.0%) of bancroftian filariasis and 23 cases (0.46%) of mixed infections. Among 7,076 patients with clinical manifestations, there were 660 cases (9.2%) with lymphangitis, 276 cases (3.7%) with elephantiasis of the leg, 10 cases (0.14%) involving the arm, 27 cases (0.4%) involving genital organs, 36 cases (0.5%) with hydrocele and 8 cases (0.17%) with chyluria.

Sex: In a malayan filariasis endemic area, among 246,130 persons examined, the Mf rates in males and females were 16.5% and 14.4% respectively ($t = 13.59$, $p < 0.01$). Morbidity rates were 9.4% and 7.7% respectively. In a bancroftian filariasis endemic area, among 373,735 persons examined the Mf rates were 5.7% and 5.1% respec-

tively ($t = 7.99, p < 0.01$) and morbidity rates were 6.1 and 3.2% respectively. The higher morbidity rates in males reflected the occurrence of hydroceles: 6 out of 246 patients with clinical manifestations in Dazhi village, Changle county, 240 cases were male, 236 of whom had hydroceles, while in 10 cases with elephantiasis of the leg 6 were females.

Age: In a malayan filariasis endemic area, among 257,218 persons examined the highest Mf rate was in the 30-39 years age group (29.01%), whereas it was only 17.68% among those over 70 years; the youngest patient with malayan filariasis was a 7 month old child. In a bancroftian filariasis endemic area, among 285,236 persons the Mf rates rose with age (Table 1). Among 6,312 patients with clinical manifestations of malayan filariasis and 4,627 patients with clinical bancroftian disease the highest morbidity rates, 14.6% and 16.4% respectively, were in the 40-49 age group. The youngest patients were one of 5 years old with hydrocele in bancroftian and one of 7 years with elephantiasis of the leg in malayan filariasis. Fifty-one out of 60 patients with elephantiasis of the leg in malayan filariasis were between 20 and 50 years old in Dongping village, Zhenghe county.

CLINICAL MANIFESTATIONS

The main clinical manifestation of malayan filariasis was elephantiasis of the limbs only. Among 2,312 patients there were 1,487 cases (64.3%) with elephantiasis of two legs, 795 cases

(34.3%) with involvement of one leg, 21 cases (0.9%) involving the arm and 9 cases (0.3%) involving both arm and leg. Among the 795 cases involving one leg, the right leg (61.4%) was more frequently affected than the left (38.6%).

Among 1,442 cases of bancroftian filariasis there were 411 cases (30.5%) with elephantiasis of limbs (arm 23, arm + leg 7), 65 cases being accompanied by hydrocele or chyluria. In cases without elephantiasis, 678 had hydrocele and 232 had chyluria, others had lymphangitis. Among 346 cases of bancroftian filariasis, elephantiasis of the leg occurred in only 164 (47.3%), less than in malayan filariasis. However, the affected legs in bancroftian disease were usually larger than in malayan filariasis, exhibiting gigantism, reflecting greater lymph accumulation. There was a case with one leg enlarged to 119 cm circumference, while the affected leg in malayan filariasis was usually not larger than 60 cm. In a case of elephantiasis of the scrotum in Dongshan county the weight of the hypertrophic connective tissues and fluid removed during operation was as much as 20 kg.

Among 1,261 patients with malayan filariasis who had only lymphangitis the Mf rate was 35.3%, whereas it was only 5.3% in 526 cases with elephantiasis of the leg. In blood samples from 112 cases with hydrocele microfilaremia was found in 10 cases (8.9%). Among 12 cases in which microfilariae were found in the hydrocele, 9 also had microfilariae in the blood. No microfilariae were found in lymph in 11 cases of elephantiasis

Table 1

Age Distribution of Mf-rate in endemic areas.

Age group	Malayan filariasis			Bancroftian filariasis		
	No. examined	Mf-positive		No. examined	Mf-positive	
		No.	%		No.	%
0-	70360	5095	7.25	81078	1045	1.28
10-	50298	6984	13.89	64055	2162	3.37
20-	50719	8407	16.58	43708	3695	8.45
30-	26489	7684	29.01	38334	3616	9.43
40-	27101	6089	22.47	28852	3169	10.98
50-	20905	4261	20.39	16352	2244	13.72
60-	9480	1962	20.76	10279	1526	15.81
70-	1886	328	17.68	2578	460	17.84
Total	257218	40810	15.87	285236	17917	6.28

of the leg in which the examination was made.

Among 338 cases of malayan filariasis examined in detail none had a relapse of lymphangitis and none suffered two or more limbs affected at the same time.

Fluid aspirated from hydroceles was tested in 58 cases, detailed pathological examination being made in 43 instances. The chemical composition of the fluid was similar to that of serum but different from that of exudate. The tunica vaginalis exhibited pathological changes in chronically infected cases (Liu *et al*, 1983a).

In 2,128 cases of malayan filariasis and 1,321 cases of bancroftian filariasis only 5.8% (124/2,128) and 7.74% (97/1,321) respectively showed swelling of the leg before evidence of lymphangitis. In most cases lymphangitis preceded the leg enlargement.

MICROFILARIAL PERIODICITY

The periodicity of the two types of microfilariaemia was investigated in 7 areas in the south, center and northeast of Fujian province. The periodicities of the microfilariae experimentally transmitted in monkeys and cats, of the microfilariae in humans after using hetrazan and of the microfilariae in a patient infected in Guinea with *Lao lao* who had returned to Fuzhou for 3 years were observed. These studies showed that the microfilarial periodicity was independent of microfilarial size, dilation of patients' pulmonary capillaries or climate.

The nocturnal periodicity of malayan microfilariae persisted for 26 months in *Macaca mulatta*; it also persisted in cats for 9 months but was subperiodic and many microfilariae were found at dusk (Lian *et al*, 1973). The *Loa loa* microfilariae also appeared to have typical diurnal periodicity (Zhang *et al*, 1980). The index of periodicity in both malayan and bancroftian microfilariae was over 92% in the monkey but only 50.8% in the cat. Pan (1985) confirmed that the K value of periodicity in the two types of microfilariae were of the midnight peak type. Microfilariae of both organisms could appear in the circulation during the day time and the index of periodicity dropped down after 0.1g DEC. A few smaller, shorter microfilariae could be found in the day time in patients who had high density microfilaraemia (Wang *et al*, 1958).

RESERVOIR AND ANIMAL FILARIAE

No human filariae were found naturally in monkeys, cats, dogs, cattle, chickens or birds in 8 counties or cities in Fujian, but *Dirofilaria immitis* was found in dogs and *Setaria digitata* was found in cattle. There were 5 different species of microfilariae found in the blood of birds, including *Passer domesticus* (9/213), *Turdus merula mandarinus* (13/187) and *Pycnonolus sinensis* (3/68) in Longhai county (south Fujian), *Acridotheres cristallinus* in Minqing county (2/17), Nanping city (9/40) and Jiangle county (92/234) in central Fujian (Liu *et al*, 1984). Except in the soft tissues of the eyes in chickens no adult filariae were found in birds. *Turdus merula mandarinus* of cattle were the only sheathed animal microfilariae. The microfilariae of *S. digitata* in the intermediate host *An. sinensis* were different from the malayan microfilariae in the size of body, the ratio of the esophagus to total length being 0.77 in the infective filarial larva (Wang *et al*, 1984).

B. malayi were experimentally transmitted to 8 monkeys (*Macaca mulatta*) and microfilariae were found in the peripheral blood of 7 monkeys 82 to 127 days after inoculation. Among them 1 monkey infected with 44 larvae was able to maintain microfilaraemia for 26 months. Transmitted to cats, microfilaraemia persisted in 1 cat for 9 months. Attempts to experimentally transmit *W. bancrofti* to 2 monkeys, 4 golden hamsters, 2 cats, 1 rabbit and 1 dog failed to give microfilaraemia in all animals.

VECTORS

1. ***W. bancrofti***: Feng (1933) dissected 169 *Culex quinquefasciatus* in the town and 46 in the suburbs of Xiamen city and found the natural incidence to be 9% and 15% respectively. In Lianjiang county Tang *et al* (1956) confirmed that the microfilariae could be found in *Cx. quinquefasciatus* (58/312), *Cx. tritaeniorhynchus* (2/7) and *An. sinensis* (1/5) but only the first had infective larvae. In Fuzhou experimental incidence (68.8%), infective larvae rate (65.6%) and mean number of larvae per mosquito (7.1) in *Cx. quinquefasciatus* were higher than those (35%, 12.5% 1.6%) in *An. sinensis*.

Cx. quinquefasciatus are the main mosquitos in

human dwellings in bancroftian filariasis endemic areas and breeding occurs during the whole year in southern Fujian. Its density decreases only in spring and winter. The adult mosquitos were observed to rest in human dwellings, 97.8% (402/411) being man-biting. One third of them were found to rest in cattle pens but of these 74.8% (92/123) still fed on human blood. *Cx. quinquefasciatus* is thus the vector of *W. bancrofti* in Fujian province.

2. ***B. malayi***: In an area highly endemic for malayan filariasis, *An. lesteri anthropophagus* was first found to be a vector in human dwellings in Yanken, Shunchang county in 1958. The natural infective rate of *B. malayi* in this mosquito was 42.86%, higher than that of *An. sinensis* (38.89%), but the numbers of this mosquito were lower than the latter. In Zhongping, Minhou county, Chen *et al* (1964) found that the natural infective rate of *An. lesteri anthropophagus* was 51.61% (48/93), while that of *An. sinensis* was 28.57% (20/70) only. No *An. lesteri anthropophagus* was found in the bancroftian filariasis endemic area. Before 1960 *An. lesteri anthropophagus* was also found in Hantun (Shunchang county), Quchun (Jianning county, Zhima (Guanze county) and Wufang (Ninghua county), four places endemic for malayan filariasis.

An. sinensis was collected in all human dwelling at 436 points in 35 counties or cities in 1974, while *An. lesteri anthropophagus* was found at only 179 points in 14 counties or cities, including Jianyang county (76 points), Chong-an county (41 points) and within the bounds of Puchen, Shaowu and Shunchang counties which are 150-200 meters above sea level and together were a major malayan filariasis endemic area. The number of these mosquitos caught usually reached half of all mosquitos in human dwellings at one third of the points (Lin, 1983). In the above-mentioned 6 villages *An. lesteri anthropophagus* is no longer found now, although it had been found 10 years ago; the malayan filariasis also disappeared naturally (Liu *et al*, 1986).

The microfilarial rates in villages were higher in dwellings in which the natural infection with *B. malayi* in *An. lesteri anthropophagus* was highest, in a study in Jianyang county in 1984 (Table 2). The highest Mf rate (41.2%) and the mean Mf rate in 14.7% of villages occurred in the places where the collected number of *An. lesteri anthropophagus* from human dwellings was 70% of all mosquitos (Zheng *et al*, 1985).

Without treatment of malayan filariasis the Mf rate decreased from 3.2% in 1977 to zero in 1980

Table 2

Comparison of Mf-rates and the natural infection of vectors in the area of *Anopheles*.

Relative number of <i>An. lesteri</i> <i>anthropophagus</i> in human dwellings %	Mf-rate of inhabitants			Natural infection of vector		
	No. examined	Positive		No. examined	Positive	
		No.	%		No.	%
0-	3672	107	2.91	72	3	4.16
10-	6455	276	4.27	60	4	6.66
20-	3216	212	7.59	98	6	6.12
30-	2741	183	6.67	397	34	8.56
40-	3360	327	9.73	920	89	9.67
50-	4161	436	10.47	117	27	15.25
60-	1621	227	14.00	376	53	14.09
70-	6275	926	14.75	86	20	23.26
Total	31501	2694	8.55	2186	238	10.88
Pure <i>An. sinensis</i>	105126	336	0.32	642	2	0.31

in Chanjian village (Nanping city) where only *An. sinensis* could be found in the years after 1977, whereas the Mf rate increased from 5.35% in 1981 to 6.32% in 1982 and was still 5.43% in Chili village (Yongtai county) where *An. lesteri anthropophagus* was present in high density (Liu *et al*, 1985). At that time 5 new patients were found in that village, one of whom was only 4 years old.

An. lesteri anthropophagus mainly rested in human dwellings, 95.7% (88/90) sucked human blood; 86.7% (348/420) were found between 2100 and 0200 hours, only 8.5% could be collected before 2000 hours. *An. sinensis* collected from human dwellings represented only 6.1% (46/759) of those mosquitos collected in cattle pens; 43.33% of those collected in human dwellings had sucked cattle blood, only about 3% could suck human blood and less than 0.1% could do so twice and so transmit filariasis. More than half of this species of mosquito could be found before 2000 hours and only 38.6% (212/548) could be collected between 2100 and 0200 hours.

The natural infective rates of *B. malayi* in *An. lesteri anthropophagus* were assessed between June and September in Jiayang county. The highest rate was 18.3% in July. The rate of infective filarial larvae was 6.2%, while natural infection in *An. sinensis* was not found in or after September. Therefore it is concluded that *An. lesteri anthropophagus* is the vector of malayan filariasis in Fujian and there is still doubt that *An. sinensis* is a vector in China.

After 1975 *An. tessellatus* was collected elsewhere in Fujian province, its density was very close to that of *An. sinensis* and it could suck human blood and rest in human dwellings. Experiments showed that the ability to cultivate infective malayan and bancroftian filarial larvae approximated that of *An. sinensis*. However, no filariae were found naturally in *An. tessellatus*. *An. minimus* was not found to be a bancroftian filariasis vector in Fujian province.

CONTROL

Good results were obtained with a large dose of diethylcarbamazine (DEC) in Minqing county

(malayan filariasis high endemic area) and in Minhou county (bancroftian filariasis middle endemic area) in 1958. For patients with malayan filariasis 1g DEC was given on one day only, for bancroftian filariasis 2g for 2 days. About 1,000 medical personnel were trained and then mass survey and treatment of filariasis were carried out everywhere in the province (Epidemic Prevention Department, 1959). From then until 1960 blood samples of 22,462,651 persons were examined and 1,125,428 cases were treated. As a result the Mf rates and microfilarial densities in blood in the population decreased. However, it was difficult to continue treatment with the large dose DEC, because patients with high densities of microfilaria had severe reactions and children who were infected with *Ascaris lumbricoides* had abdominal pain, ascaris induced intestinal obstruction and appendiceal perforation. Sixteen cases died in remote mountainous areas (Fujian Anti-epidemic Station, 1959b).

After 1962 small dose DEC for a longer course was introduced to avoid the above-mentioned problems (Fujian Provincial Institute of Parasitic Diseases, 1966). Patients with malayan or bancroftian filariasis were given 2.5g or 4.2g DEC over 10 days, respectively. In 1964-67 blood samples from 7,367,943 persons were examined and 370,914 cases were treated. There were no deaths. The microfilarial rates and densities decreased throughout Fujian province; Mf rates in 896 villages were below 1%.

In 1973-87 examination for and treatment of filariasis was repeated many times. In this period yearly examinations were carried out on between 658,382 and 3,414,279 persons, with treatment of 7,733 to 221,906 individuals. In that period patients with lower densities of microfilariae in blood were given small dose DEC, ie 5g over 5-8 days.

From 1958 to 1987 a cumulative total of blood samples from 83,969,739 persons were examined, microfilariae were found in 3,871,638 and 3,216,526 were treated.

DEC-medicated salt was used for mass treatment of bancroftian filariasis in Pili (Luoyan county) in 1978. A total of 10.5g DEC per person was used for one course of 4 months, ie 50mg DEC per person per day in the first month, 100mg in the second to fourth months. Blood examination of

3,815 persons in 4 villages was repeated one month after ending medication. The mean Mf rate dropped from 9.7% to 0.5%. Of the remaining microfilaremia, 75% was found in villages where the mean Mf rate was over 10% (Liu *et al.*, 1983b). Since 1980 this method has been used in 20 counties among 4,868,185 persons for control of bancroftian filariasis and in Jianyang county among 6,778 persons for malayan filariasis. 115 patients with over 10 microfilariae per 60 µl blood were observed every month for one course of DEC-medicated salt. The results showed that the microfilariae elimination rate was 68.7% in the first month (1.5g DEC), 85.1% in the second month (4.5g DEC), 93.9% in the third month (7.5g DEC) and 96.5% in the last month (10.5g DEC). There were 4 cases remaining after treatment. Of these, 3 cases were away from their village for 2-3 months and one used sauce in which the DEC content was lower.

It was difficult to control malayan filariasis by medication alone in areas where *An. lesteri anthropophagus* was present at high density. Here insecticide spraying was used in human dwellings for control of the vectors for 3 consecutive years in 911 villages in 7 counties from 1980 (Xie, 1987). In 1984-85 in a repeat mosquito survey in 97 villages in 7 counties only 1 to 4 mosquitos of this species were collected in 12 villages. Before this vector control program 1,302 *Anopheles* were collected from mosquito nets in 24 villages. *An. lesteri anthropophagus* constituted 45.6% of these, whereas after the control program this species constituted only 1.05% of mosquitos in human dwellings. Malayan filariasis could only be eliminated in Masha village, Jianyang county; the Mf rate dropped from 6.61% in 1979 to 3.33% in 1984.

In 1963 the treatment method of torrefaction and bandaging was used for elephantiasis of the leg in Quanzhou Renmin Hospital (Chen, 1964). The previous year Liu *et al.* (1963) had shown that this method was better than bandaging only, but recovery required a long period of treatment.

EVALUATION AND SURVEY

The criterion of basic elimination of filariasis formulated in China requires that the microfilaremia rate in a village is reduced to below 1%.

In 1974 microfilaremia was difficult to find in Gutian county where the mean Mf rate was only 0.12% (6/4,678) by random cluster sampling and Gutian was the first county in Fujian province in which filariasis (mainly malayan) was basically eliminated. Next malayan filariasis was basically eliminated county by county in the Longyan region where it had been widespread. In 1985 blood samples from 81,905 persons from 91 villages in 10 counties in the Jianyang region were examined, only 65 cases of microfilaremia were found and the highest Mf rate in a village was 0.6%. So malayan filariasis was basically eliminated in Fujian in 1985, bancroftian filariasis in 1987. In the evaluation carried throughout Fujian province blood examination was carried out on 494,050 persons in 645 villages; 762 persons had microfilaremia, with a mean Mf rate of 0.15%. There was no microfilaremia in 368 villages in 7 counties.

In October 1988 the evaluation of filariasis was repeated by the Ministry of Public Health of China. This confirmed that filariasis had been basically eliminated in Fujian province.

Blood examination and survey of mosquitos are conducted every year following basic elimination of filariasis. Mass survey has been carried out for 10 years in Gutian, the first county to achieve elimination. In a total of 18,574 persons examined only 16 cases of microfilaremia were found in 10 villages. Among these 5 cases were old patients who had not been treated previously, 5 cases had previously missed examination and 6 cases came from other regions. 0.23% (8/3,456) *An. sinensis* in human dwellings and 0.5% (4/681) in cattle pens were found to harbor *S. digitata*. No microfilariae were found in 350 *Cx. quinquefasciatus*.

Surveys were conducted in 278 counties or cities of Fujian province for 14 years. In a total of 901,191 persons examined 3,331 cases of microfilaremia were found and the mean Mf rates in a village were kept below 0.5%. In malayan filariasis endemic areas no filarial larvae were found in 34,285 *An. sinensis* and in 628 *An. lesteri anthropophagus*. In bancroftian filariasis areas only 1 to 4 filarial larvae were found in 25 *Cx. quinquefasciatus* and no larvae were found in other species of vector.

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