

A FIELD SURVEY ON THE ROLE OF LOW-DENSITY MICROFILARAEMIA CASES IN THE TRANSMISSION OF FILARIASIS

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INTRODUCTION

In former filariasis endemic areas, where the disease has been controlled, a few cases of low-density microfilaraemia remain. A survey was carried out in Deqing County, Zhejiang Province, from September 1981 to 1986 in order to determine whether such cases play a role in the continuation of transmission.

METHODS AND RESULTS

The survey area, Deqing County, was formerly an endemic area of malayan filariasis. The microfilaraemia rate in inhabitants was 18.3% in 1951; *Anopheles sinensis* was the vector. Following 10 courses of mass treatment with diethylcarbamazine (DEC) using different dosage schedules, the microfilaraemia rate dropped to 0.2%. The survey area covers the two villages of Mingxin and Xinfu with populations of 1406 and 87 respectively, the latter being a solitary islet in a lake.

Microfilaraemia rate

A millipore membrane filtration method requiring 1 ml of venous blood was used in

parallel with two thick blood smears which were each prepared from 60 μ l of ear-lobe blood. The microfilaraemia rate for both methods was 0.5%, the microfilaria (mf) density of the five positive cases being 1–8 mf/60 μ l of blood (mean 4.2 mf/60 μ l). Three of these five cases were former positive cases, while two were newly detected ones. All five cases were left untreated but had undergone reexamination in 1982 and 1983 when 120–240 μ l of capillary blood and 1 ml of venous blood from each case were pooled for milipore membrane filtration; four of the five cases reverted to negative, while the fifth finally became negative in 1985. Another positive case was detected in Xingfu village in 1982 with a microfilaria density of 2 mf/60 μ l of blood, but reverted to negative in 1983. In 1983 and 1986, 936 and 929 people respectively were examined (ear-lobe blood) for microfilaraemia, but no positive cases were detected.

Natural infection of *An. sinensis*

An. sinensis were collected from various habitats for individual dissection. Two infected mosquitoes were found among the 5,484 specimens captured from households and traps in 1981–1982.

Experimental infection of *An. sinensis*

Two volunteers with a microfilaraemia of 3–5 mf/60 µl of blood were exposed to two batches of *An. sinensis* in August 1981. The engorged mosquitoes were dissected eight days later. Of the 107 mosquitos in the first batch which had fed on the first volunteer, 22 (20.6%) were positive for infective larvae of *Brugia malayi*, while infective larvae were found in 14 (13.1%) of 107 mosquitos of the second batch which had fed on the second volunteer. The average number of larvae was 1.2 in the first and 1 in the second batch (see Table). A third volunteer was a microfilaria-cleared case and failed to infect a batch of 72 mosquitos.

Biting rate of *An. sinensis* and human blood index

The human blood index was determined at a definite site every 10 days in July–September 1981–1982 on the basis of outdoor collections on human bait made from 20h00–22h00 and of indoor collections of engorged *An. sinensis* in mosquito nets at dawn. Results showed that each

person was bitten by 18.6 mosquitoes/night in 1981 and by 30.8 mosquitoes/night in 1982, indicating high biting rates despite the low human infection rates.

A separate village was selected for the collection of engorged *An. sinensis* in households and animal sheds. A total of 1132 specimens of stomach blood on filter paper were examined by the ring precipitation test and counter-immunoelectrophoresis and the human blood index was 1.6% (18/1132). It was evident that *An. sinensis* in situ preferred animal blood.

DISCUSSION

The results of parasitological and entomological investigations for two consecutive years revealed that after the implementation of intervention measures, the mean microfilaraemia rate in the population fell to about 0.5% and the mean microfilaria density to about 4.2 mf/60 µl of blood in previously endemic areas of brugian filariasis. Although there were considerable numbers of *An. sinensis* biting humans, infective larvae could be found in only two positive mosquitoes out of

Table
Experimental infection of *anopheles sinensis*.

Volunteer No.	Microfilaria density (mf/60 µl of blood)		No. of mosquitoes dissected	No. of infective larvae	Positive rate (%)	Mean No. of larvae per mosquito
	At the time of the field survey	Before artificial infection of mosquitoes				
1	4.3	3.4	107	22	20.6	1.2(1–2)
2	8.1	5.2	107	14	13.1	1.0
Total				36	16.8	1.1

5484 dissected, and no new microfilaraemic cases were detected in the 1983 and 1986 follow-up blood examinations, indicating that transmission had already been interrupted.

It has been suggested that in order to compare the role of microfilaraemic cases in the transmission of filariasis in different areas of the world, observations should be made using identical methods and techniques, blood sources and quantities as well as the same transmitting vector species (Southgate & Hamilton, 1974; Bryan & Southgate, 1976; Kimura, 1985; Southgate, 1984). As the observance of such a protocol will be difficult, study results will unavoidably lack comparability. In Western Samoa where subperiodic bancroftian filariasis is endemic, the application of a membrane-filtration technique revealed that many people were affected by low-density microfilaraemia (10–20 mf/ml of venous blood) and that these people readily infected *Aedes polynesiensis*. In Sri Lanka, ultra low-level microfilaria carriers (<10 mf/ml of venous blood) could infect the vector *Culex quinquefasciatus*.

Certain authors (Garme & Laigret, 1979; McGreevy *et al.*, 1982) have considered the possibility of filariasis transmission through low-density microfilaraemic cases. However, in the field work reported in this paper, even though the infection rate of *An. sinensis* having fed on low-density microfilaraemic cases was as high as 16.8%, the intensity of infection was extremely low, being 1.1 mf/mosquito. Moreover, in other studies, it had already been noted that only 30% of the infective larvae were released during the feeding of an infected mosquito, of which 10% could invade the definite host (Zielke, 1973; Ho and Jung, 1965); in other words, only 3% of the released larvae had the chance of entering the host body, of which only

a few would develop into adults. From the transmission dynamics point of view, infected mosquitoes carrying very few infective larvae have no practical significance in the transmission of filariasis.

From the above, it is clear that the threshold of microfilaraemia at which transmission is interrupted is mainly determined by the microfilaraemia rate and the microfilaria density, the latter factor appearing to be the most important. It is suggested that the treatment of persons with low-density microfilaraemia (with 5 ml/60 μ l of blood) in areas with low microfilaria rates (<1%) need not to be considered as essential.

SUMMARY

In former filariasis endemic areas, where the disease has been basically controlled, a few cases of low-density microfilaraemia remain. A survey was carried out in Deqing County, Zhejiang Province, from September 1981 to 1986 in order to determine whether such cases play a role in the continuation of transmission.

The results of parasitological and entomological investigations for two consecutive years revealed that after the implementation of intervention measures, the mean microfilaraemia rate in the population fell to about 0.5% and the mean microfilaria density to about 4.2 mf/60 μ l of blood in previously endemic areas of malayan filariasis. Although there were considerable numbers of *An. sinensis* biting humans, infective larvae could be found in only two positive mosquitoes out of 5,484 dissected, and no new microfilaraemic cases were detected in the 1983 and 1986 follow-up blood examinations, indicating that transmission had already been interrupted.

Two volunteers with a microfilaraemia of 3–5 mf/60 μ l of blood were exposed to two batches of *An. sinensis* in August 1981. The engorged mosquitoes were dissected eight days later.

Even though the infection rate of *An. sinensis* having fed on low-density microfilaraemic cases was as high as 16.8%, the intensity of infection was extremely low, being 1.1 mf/mosquito. From the transmission dynamics point of view, infected mosquitoes carrying very few infective larvae have no practical significance in the transmission of filariasis.

It is suggested that the treatment of persons with low-density microfilaraemia (with 5 mf/60 μ l of blood) in areas with low microfilaria rates (<1%) need not to be considered as essential.

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