

Epidemiological Studies on Malayan Filariasis in an Inland Area in Kyungpook, Korea

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It was previously known that *Brugia malayi* is prevalent and transmitted by *Aedes togoi* in Cheju Island, Korea and this phenomenon was thought to be restricted only in this island. In late years, however, there are several reports on epidemiological surveys on this filaria in inland of Korea (Oh, 1929; Senoo, 1951; Song *et al.*, 1964; Hwang *et al.*, 1965; Soh, 1965; Seo *et al.*, 1965; Kim, 1972, 1974; and Seo *et al.*, 1974). Although Kim (1972, 1974) reported on the epidemiological surveys of filariasis and its vector there, the present paper reports the prevalence of malayan filariasis and its active vector in some mountaineous villages in Kyungpook, Korea. The summarised report was already presented at the annual meeting of the Japanese Society of Parasitology on April 3, 1974.

Place and method of investigations

The technique of the blood survey method has been reported in detail by Sasa (1967): taking three 10 mm³ blood smears with a specially designed micropette was adopted at Ir-do and Ih-do, Anjun-myon, Kungpook on September 6 through 8 and December 29, 1973. *Anopheles sinensis* and *Culex tritaeniorhynchus* were abundantly breeding in this area. These villages with rice field were surrounded by mountains.

For the survey of the filarial vector biting collection on cattle and resting one were performed as follows; the resting collection during daytime in cow shed at the some villages on September 7 and 9, 1973. The

mosquitoes collected were dissected as soon as possible on the same day; then identification of the mosquitoes, their physiological age determination and ecological observation were carried out.

Results

(1) Blood surveys

The results of the surveys carried out on September 6 through 8 at Ir-do and Ih-do villages are given in Table 1. This shows that among 127 people examined at Ir-do 3 microfilaria positive cases (2.3%) were found and at Ih-do also 3 microfilaria positive cases (3.7%) were found out of 81 people examined. The second survey carried out at the same place on December 29 indicates that there are 6 positive cases (20.7%) among 29 people tested at the both villages. The positive rate at the second survey was higher than that at the first survey.

(2) Entomological surveys

The mosquitos collected by biting collections on September 6 though 9 are shown in Table 3. Among these mosquitos 5 of *An. sinensis* were found infected by dissection. Table 3 shows also the results of the daytime resting collection performed in the cow sheds at the same villages.

Biting preferences for human and also cattle bait were observed during 8 through 11 P.M.; the results showed that *An. sinensis* was only one species collected, being 27 individuals from the human bait and 47 from the cattle, the number of mosquitos for human bait was more than half of that for

Table 1 Frequency distribution of the number of examined cases by age and sex groups at Ir-do and Ih-do, Anjun-Myon, Kyungpook Korea, Sept. 6 to 8, 1973

(1) Ir-do

Age group	Number of cases examined		Total	Number of positives		Total
	Male	Female		Male	Female	
5- 9	4	3	7	0	0	0
10-19	16	35	51	0	1	1
20-29	1	7	8	0	0	0
30-39	6	7	13	1	1	2
40-49	3	11	14	0	0	0
50-59	9	16	25	0	0	0
60	1	8	9	0	0	0
	40	87	127	1	2	3 (2.3%)

(2) Ih-do

Age group	Number of cases examined		Total	Number of positives		Total
	Male	Female		Male	Female	
5- 9	2	3	5	0	0	0
10-19	17	17	34	1	1	2
20-29	8	5	13	1	0	1
30-39	1	7	8	0	0	0
40-49	0	8	8	0	0	0
50-59	0	7	7	0	0	0
60	0	6	6	0	0	0
	28	53	81	2	1	3 (3.7%)

cattle bait. By the observation of ovarioles where the number of "relics" were counted after their dissection, nulliparous rates in both biting collections were very low, being 5 among 27 mosquitoes in human bait and being also 5 among 47 in cattle bait, in other words 22 parous mosquitoes were found in human bait and 42 were in cow bait. Six infected mosquitoes among 98 dissected were in the 3rd or 2nd physiological ages of ovarioles as shown in Table 4 and 5 and those mosquitoes had 56 filarial larvae which were the 1st to 3rd stages in the amount. Three infective larvae were found out in one anopheline mosquito among those mosquitoes dissected (Table 5), and the larvae 1,000 to 1,100 microns in length and had no significant papillae in the caudal apex but had a small spine in the apex of the head,

as shown in Figs. 1 and 2. Therefore those larvae were identical that of *B. malayi*.

Fig. 3 shows the second larval stage of the filaria which has no structure similar to spine or significant papilla at the both apices of the worm. It is considered that the microfilariae were identical that of *B. malayi*, according to the special characters of the internal structure of this species, especially in the central column of the nuclei, nerve ring, excretory cell, so called G-cells, anal pore, two nucleuses at tail and sheaths of the microfilaria, as shown in Fig. 4.

Discussion

The project of the second blood survey was planned in order to know whether new positive case could be found out after the

Table 2 Frequency distribution of the number of examined by sex and age group at Ir-do and Ih-do Anjun-Myon, Kyungpook, Korea Dec. 29, 1973

(1) Ir-do

Age group	Number of cases examined		Total	Number of positives		Total
	Male	Female		Male	Female	
5-9	1		1			
10-19	1		1			
20-49						
50-59	1	1	2	1	1	2
	3	1	4	1	1	2

(2) Ih-do

5-9	2	1	3			
10-19	5	2	7	1		1
20-29	1	1				
30-39	1	2	3			
40-49	1	1	2		1	1
50-59	3	1	4		1	1
60	3	2	5	1		1
	16	9	25	2	2	4 (16%)

Table 3 Mosquito collection in cow shed at Anjun-Myon September 6 to 9, 1973

Species	Biting at night		Resting in the daytime
	No. collected	No. infected	No. collected
<i>An. sinensis</i>	71	5	136
<i>An. sineroides</i>			3
<i>C. tritaeniorhynchus</i>	16	0	11
<i>C. pipiens</i>	2	0	1
<i>A. vexans</i>	11	0	15
<i>Armigeres subalbatus</i>	3	0	1

Table 4 A comparison of age composition of *Anopheles sinensis* collected between in house by human bait and in cattle shed by cow bait at night

Bait	Ovarial age	N	1	2	3	Total
Human	Examined	5	12	8	2	27
	Infected	0	0	1	0	1
Cow	Examined	5	18	17	7	47
	Infected	0	0	2	2	4

Table 5 Larval stages of filaria in each infected mosquito

Mosquito No.	Ovarial age	Larval stage of filaria					Total
		1st stage			2nd s.	3rd s.	
		a	b	c			
1	3		4	10	6	3	23
2	3	1	7	1			9
3	2	1	2				3
4	2				8		8
5	3				8		8
6	2	3	2				5
6/98*		5	15	11	22	3	56

* number of mosquitoes dissected

first blood survey or not. Although at the second survey 6 positive cases were found among the people at the ages over 40 in the both villages, three of them were examined for the first time, but none of which had originated from the other endemic areas such as Cheju Island.

Any adult of *A. togoi* or *Mansonia* known as important vectors of *B. malayi* was not found during the investigation period, although their breeding places were carefully checked.

The annual report of the U. S. Army (1968) on mosquitoes in Korea has no record on those important vectors. Kim reported that *An. sinensis* is likely to be the vector of *B. malayi* in the inland areas where *A. togoi* could not be found. From the results of the present investigation, it is considered that *An. sinensis* is one of the important vectors in this area and the density of parous mosquitoes was high among the mosquitoes collected as mentioned as above. Therefore, the lifespan of mosquitoes must be relatively long and the population of mosquito which comes to bite human was relatively abundant. One infected mosquito with the 3rd stage larvae of *B. malayi* was found out among 98 of *An. sinensis* which were observed by collecting human bait and cow bait. This result confirms that the anopheline mosquito is an important vector of the filaria in this area. Whang *et al.*

(1961) also reported similar high density of *An. sinensis* in living room of house. Therefore, it suggests that Korean type of this species may have more anthropophilic character in its biting behavior than Japanese one, in comparison with Ohmori's (1963) data. In brief, those data and informations suggest that the density of the anopheline mosquitoes which were old and infected with filarial larvae should be very high during autumn. In the relation with those conditions of the vector, the fact that one new microfilaria positive case was found in the second blood survey means the transmission of the filaria might be going on, although *An. sinensis* is not one of the vector of this filaria in Japan. Since the vector is *A. togoi* in Hachijo-Koshima Is., only one endemic area in Japan (Hayashi, 1954; Sasa, 1966). With respect to these differences on the biting behavior of the anopheline mosquitoes and the epidemiology between Korean and Japanese type of *An. sinensis*, there are further more some genetic differences which were reported by Kanda and Oguma (1973, 1974) in genetic affinity between these types of mosquitoes.

Summary

Microfilaria blood survey and entomological survey were performed at Ir-do and Ih-do Anjum-Myon, Kyungpook, Korea on

September 6 though 8 and December 29, 1973. Three microfilaria positive cases at the first survey and 6 positive cases at the second survey were found. The biting collection on cattle and human bait during three hours from 8 to 11 P.M. and resting collection in the daytime in cow sheds were carried out at the same villages. Six *An. sinensis* were found to be infected among 98 mosquitoes of this species, but *A. togoi* was not collected. The study of their physiological age determination showed that only 10 individuals out of 74 *An. sinensis* dissected were nulliparous, therefore it was considered to be high population density of parous mosquitoes in those villages. Three filarial larvae were found to be infective among 58 larvae observed in 6 mosquitos of this species.

Microfilaria in human blood was identified as *B. malayi* and the all three infective larvae which were found in *An. sinensis* also were identified as the species, but another immature larvae could not be identified. As the results it is considered that *B. malayi* is prevalent at the both villages and *An. sinensis* is one of the important vectors in these areas.

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韓国内陸地域慶北道におけるマレーフィラリアの疫学的研究

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1973年9月6日から8日と同年12月29日にこの地域の山村安定面の住民の検血を行なったところ、9月には3名12月には6名のミクフィラリア陽性者を発見した。この2回の検血により5名の陽性者は初回に検行をうけていないために、9月から12月にいたる間の新しい陽性者とは断定しがたい。この地域の媒介者調査として、9月の検血に併わせて行なった。夜間の人、牛の吸血蚊と、日中の畜舎の休止蚊を採集した結果によると、採集蚊は *An. sinensis*, *An. sineroides*, *C. tritaeniorhynchus*, *C. pipiens*, *A. vexans*, *Armigeres subalbatus* の6種であるが、これらの種の内 *An. sinensis* の6頭にフィラリア幼虫58疋内3疋の第3期幼虫を検出した。成虫の生

理的齢を調査したところ、人は吸血蚊27頭中3回経産2頭、2回経産8頭を、牛吸血蚊38頭中3回経産7頭2回経産17頭そして未経産蚊は両群ともに5頭を記録し、フィラリア幼虫保有蚊は2回および3回経産蚊にみとめられた。また人吸血性は牛に比しその半数以上にみられる点疫学的に注目された。

人から検出された *microfilaria* は *B. malayi* と同定され、3疋の第3期幼虫は、*An. sinensis* より検出され *B. malayi* の形態的特徴をもつものであることが知られた。以上のことからこの地方には *B. malayi* が地域的に流行し、その媒介者として *An. sinensis* が大きな役割をなすことが知られた。

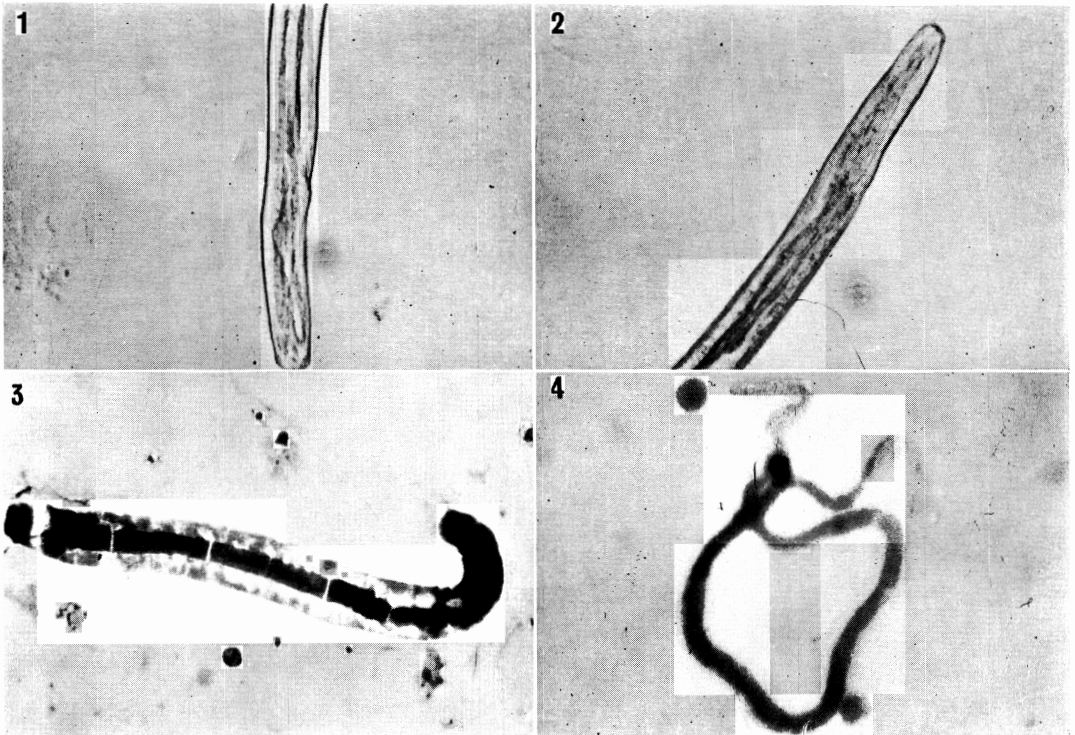


Fig. 1. Tail part of infective larva without any spine or papila.

Fig. 2. Oral part of infective larva with a spine on oral apex and developed vulva opening at the hind part of the oesophagus.

Fig. 3. 2nd stage larva without any spine or papilla on the both apex. Stained with Giemsa stain.

Fig. 4. Microfilaria of *Brugia malayi*.