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STUDIES ON MALAYAN FILARIASIS IN CHE-JU IS., KOREA

1 Epidemiology of malayan filariasis in some endemic areas as revealed by the skin test

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Abstract: The authors confirmed the high incidence of malayan filariasis among the villagers of southern coast of Che-ju Is., Korea. The epidemiological analysis revealed that the inhabitants living in Coast region of Wimi-1-Ri village were much more affected by the filarial infection than those in Inland region not only in mf rate and mf density, but even in the skin reactivities in children. This finding will be explained by the ecological behavior of vector mosquito, *Aedes togoi*, bred in the sea shore. The fall of filarial transmission due to the mass treatment of microfilaria carriers in 1970 resulted in the reduction of average wheal-size in skin-test of children 2 years later.

It has been recognized that malayan filariasis was widely and densely endemic all over Che-ju Is., Korea (Senoo and Lincicome, 1951; Seo *et al.*, 1965, 1968; Soh *et al.*, 1968).

As to the vector mosquito in this island, Lee *et al.* (1964) reported that *Aedes togoi* might be the possible vector of *Brugia malayi* based on the dissection study of several species of mosquitoes. Recently, Omori and Wada (1970) confirmed that *A. togoi* was responsible for the transmission of *B. malayi* in this island. In 1970, 1971 and 1972, the present authors carried out extensive surveys on filariasis in this island. In the present paper, the authors wish to report the results of the blood examination and the skin test on the inhabitants of southern region of the island, with special reference to the epidemiology of malayan filariasis, revealed by the skin test.

MATERIALS AND METHODS

1) Geography and climate: Che-ju Is., of which population is about 363,000, is situating in the northern area of East China Sea off the south-western tip of the Korean Peninsula.

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According to Seo *et al.* (1971), the average annual temperature, precipitation and the average relative humidity of this island are approximately 15 C, 1500 mm and 71–77%, respectively. In addition to the sub-tropical climate of the island, rocky coast around the island is provided with abundant rock-pools which are the proper breeding places of *A. togoi*.

A total of 2,058 inhabitants from 11 areas of the following villages were examined during the period from Aug. to the middle of September of 1970–1972: Wimi-1-Ri, Ha-ka-Ri, Wimi-2-Ri, Ha-ley-Ri, Tae-Hung-Ri and Hae-Ri as shown in Table 1. All the villages except Ha-ka-Ri are located in the southern coastal region of Che-ju Is. Usually, each "Ri (village)" is divided into several "Dongs (hamlet units)" and the latter are composed of several "Bangs (family group units)". In case of Wimi-1-Ri, number of all the Bangs included are 19 as shown in the map (Fig. 1). Both Wimi-1-Ri and Ha-Dong were divided into 2 areas, Inland and Coast, in order to compare the endemicity of filariasis among the inhabitants in each area, with a road running about 300 m far from the sea, in the former village, and 120 m, in the latter, respectively. Ha-Dong of Hae-Ri was located facing to the sea and even the farthest houses standed only 200 m from the sea shore.

2) Blood examinations: Blood samples were obtained from the inhabitants after 9 p.m. at night. The number of microfilariae in 20 cmm blood per one person were counted for the microfilaria density (MFD).

3) Skin test: The procedure of skin test was due to Tada *et al.* (1968) with a *Dirofilaria* antigen, FPT (Tada and Kawashima, 1962). Intradermal injection of 0.02 m*l* antigen solution which included 1 μg FPT was made in every case and the outline of wheal was recorded 15 minutes after the injection on a sheet of recording card. The wheal-size was obtained by measuring 2 diameters of the printed wheal. Those who showed 7.0 mm or more in the average wheal-size were considered positive in skin test. Not only the rate of skin-test positives among several community peoples examined, the intensity of skin reactions should also be considered an important index to represent the endemicity of filariasis. This is the reason why the authors introduced the conception of wheal-size pattern to evaluate the endemicity of filariasis among several communities.

Tada *et al.* (1963) tried to use the cumulative percentage curves of wheal-size distribution to compare the intensity of skin reactions of a group with others in some endemic areas in filariasis. This principle was recently developed by Katamine (1971) who adopted probit-converted regression lines showing the cumulative percentage of wheal-size distribution. This is a convenient way of comparison of the pattern of skin reactions in several community populations with various endemicity. The individual regression line is grossly represented in an equation $Y=aX+b$ (Y, probit of cumulative frequency at wheal size; X, wheal size in mm; a and b, constants).

The inhabitants of Wimi-1-Ri and Ha-Dong were examined by skin test in 1970 and 1972, respectively. Most of the microfilaria carriers in Wimi-1-Ri were treated by the staffs of Health Center and Seoul National University with diethylcarbamazine in 1970. For this reason, it could be considered that the filarial transmission by the vector mosquito remarkably reduced in this area. To make clear the effect of the treatment on the reduction of the skin reactivities of the children, those from Wimi

Primary School were re-examined by skin test in 1972.

Results and Discussions

1) The blood examinations:

The results of blood examinations which were carried out in the inhabitants of 11 areas from Wimi-1-Ri, Ha-ka-Ri (1970), Wimi-2-Ri, Ha-ley-Ri (1971), Tae-hung-Ri and Hae-Ha-Ri (1972) were shown in Table 1.

Table 1. Result of blood survey in Che-ju Is., Korea (1970–1972)

		Area examined	No. examined	No. mf positive	Mf rate (%)	MFD* among mf positives	MFD* among all the examined
1970	Wimi-1-Ri	Myong-Yoon-Dong	335	43	12.8	46.3	5.9
		Dae-wha-Dong	517	130	25.2	103.2	26.0
		Seo-Song-Dong	209	48	23.0	64.4	14.8
	Ha-ka-Ri		117	1	0.9	—	—
1971	Wimi-2-Ri	So-Wong-Dong	45	12	26.7	14.3	3.8
		Sang-Wong-Dong	42	9	21.4	43.1	9.2
		Sa-Wong-Dong	52	6	11.5	27.3	3.2
		Tae-Song-Dong	105	17	16.2	28.6	4.6
	Ha-ley-Ri	Man-Chan-Po	84	28	33.3	86.6	28.9
1972	Tae-hung-Ri	3-Ri	138	17	12.3	12.7	1.6
	Hae-Ri	Ha-Dong	314	60	19.1	51.6	9.9

*MFD; Number of microfilariae per 20 cmm blood

Both the microfilaria positive rate (mf rate) and microfilaria density (MFD) among microfilaria carriers were extremely high in Dae-wha-Dong (mf rate, 25.2%) of Wimi-1-Ri and Manchan-Po (mf rate, 33.3%) of Ha-ley-Ri. Both of them faced on the sea with many coastal rock-pools where abundant larvae of *A. togoi* were found. As shown in Fig. 1, higher mf rates were found in Bangs in Wimi-1-Ri near the coast as compared with those of Inland areas. This fact may suggest the existence of more frequent transmission by infected mosquitoes among the inhabitants living near coast. In order to confirm this tendency, the inhabitants in Coast and Inland areas were compared with each other regarding mf rate, MFD and the skin reactions. In Inland area, mf rate showed 13.3% and the average MFD among mf positive and all the examined were 31.0 and 4.1 respectively. On the contrary, those of the Coast area were remarkably high resulting in 26.0%, 102.1 and 26.5, respectively. Furthermore, the incidence of elephantiasis case per 100 inhabitants examined was 1.6 in Inland and 4.4 in Coast area.

As shown in Table 1, in Ha-Dong of Hae-Ri, 60 microfilaria carriers were found out of 314 inhabitants examined. The mf rate was 19.1% and the average MFD among microfilaria carriers and all the examined were 51.6 and 9.9, respectively. In this small village locating near the sea-shore, there was a clear difference in the

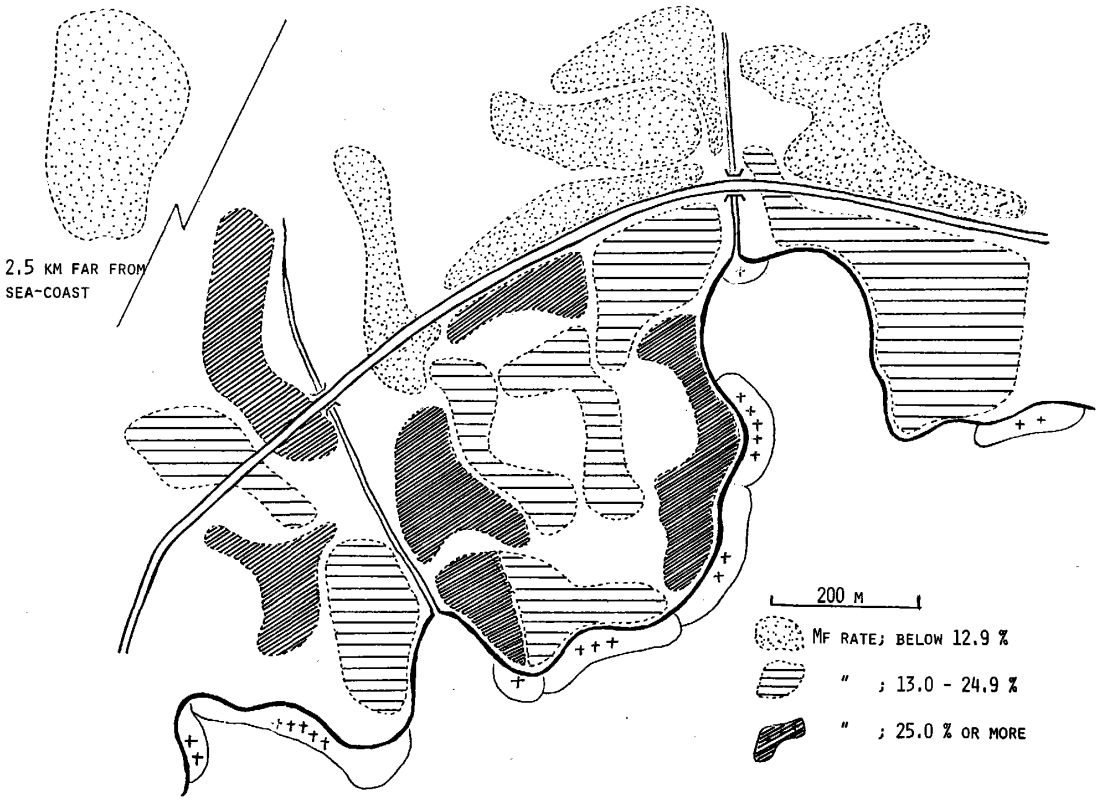

Fig. 1 Map of Wimi-1-Ri, Che-ju Is., Korea showing microfilaria positive rate in each Bang.

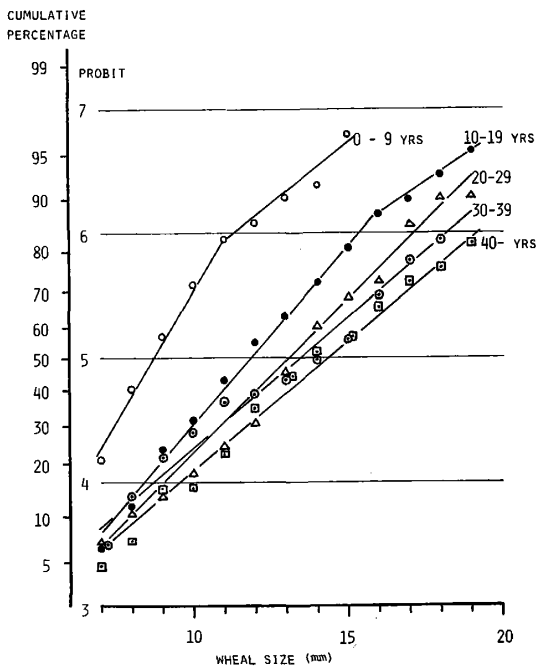

Fig. 2 Regression lines showing cumulative percentage of skin test positives by wheal-size in Inland area of Wimi-1-Ri, 1970.

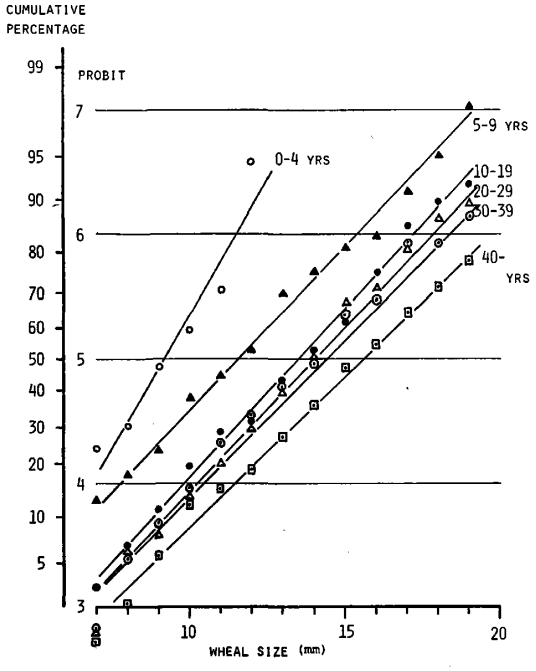

Fig. 3 Regression lines showing cumulative percentage of skin test positives by wheal-size in Coast area of Wimi-1-Ri, 1970.

endemicity of filarial infection between 2 areas, Inland and Coast. The mf rate and MFD among the inhabitants examined were 12.0% and 3.1 in Inland area, and 27.0% and 17.4 in Coast area, respectively.

2) The skin test:

The skin test on the children aged below 9 years in Coast area of Wimi-1-Ri gave a positive rate of 54.7%, while that of 38.8% was shown in the same aged children in Inland area. The regression lines of wheal-size obtained from skin-test positives by age-groups were shown in Figs. 2 and 3. The tendency that wheal-size increases in proportion to the rise in age is clearly recognized in both of the populations examined. However, there is a considerable difference in the constant "*b*" of the regression line between Inland and Coast people. As is shown in Figs 2 and 3, the average wheal-size of the inhabitants from Coast area is bigger than that of Inland people, which would reveal the higher endemicity of filariasis in the Coast area as compared with Inland area. On the other hand, the age-specific lines of wheal-size distribution were almost parallel except in the case of the infant.

As Katamine (1963) described previously, children in endemic areas are the adequate subjects in order to estimate the recent situation of filarial infection by skin test. Fig. 4 shows the comparison of regression lines of wheal-size in children aged below 9 years in Inland and those in Coast areas. The figure indicates the difference in endemicity between 2 areas.

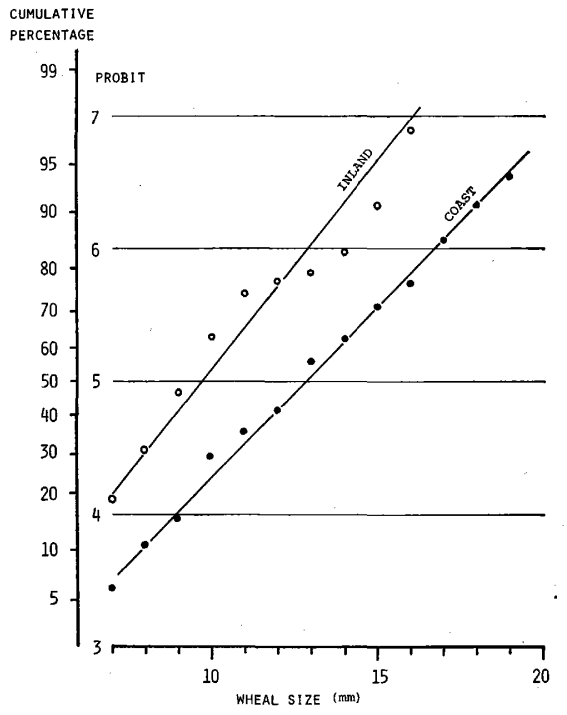

Fig. 4 Regression lines showing cumulative percentage of skin test positives in children aged 6–11 years by wheal-size in Inland and Coast areas of Wimi-1-Ri, 1970.

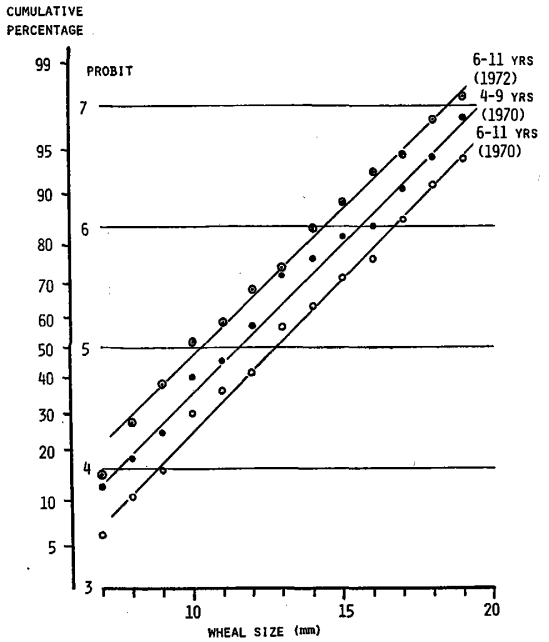

Fig. 5 Regression lines showing cumulative percentage of skin test positives by wheal-size in children in Coast area of Wimi-1-Ri, 1970 and 1972.

As shown in Fig. 5, in case of the children aged from 6 to 11 years in the Coast area, there is a clear difference between 1970 and 1972 in the constant "*b*" of the regression line of wheal-size distribution.

The average wheal size of this population is reduced approximately 3 mm in its wheal size. As the children aged 6–11 years in 1972 grossly correspond to those 4–9 years of age in 1970, the result of skin test in the latter population was also figured in Fig. 5. As is shown in the figure, the regression line obtained shows increase in constant "*b*". This finding may indicate that; firstly, those aged 10 and 11 years old showing stronger reaction than the younger in 1970 graduated from the school; and secondly weakly sensitized or negative infants who were 4 and 5 years of age in 1970 entered into the school during the period of recent 2 years. Based on the comparison of regression lines of wheal-size distribution between 1970 and 1972, it could be considered that there was an increase of negative and weakly sensitized persons among the community population examined. On the contrary, the counterparts in the Inland area did not show such a change. In order to clarify the differences which was shown between the children in Inland and those in Coast area, the age distribution of positive rate in skin test and that of median wheal-size of 6–11 year old children in these 2 areas were compared with each other. As shown in Fig. 6, in Coast area, the positive rate in skin test increased with age. In the children in Inland, however, positive rate by age was remarkably lower than the corresponding subjects in Coast area. The changes in the median wheal-size of the 2 populations by age were shown in Fig. 7. In the children in Coast area, the median wheal-size also increased with age, while those in Inland area did not show significant rise up to 10 years of age. These facts seem to show that the children in Inland included a number of negative and weaker reactors in skin test from the beginning of examination probably because of the less frequent filarial transmission in comparison with those in Coast area.

In Ha-Dong of Hae-Ri, as mentioned previously, the inhabitants living near the sea were much more affected by filarial infections than those living in Inland

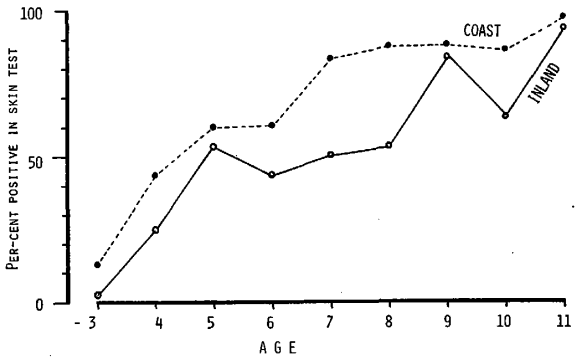

Fig. 6 Age distribution curves of positive percentage in skin test shown in the childen in Inland and Coast areas of Wimi-1-Ri, 1970.

Fig. 7 Age distribution curves showing median wheal-size in the skin test of children in Inland and Coast areas of Wimi-1-Ri, 1970.

area. The frequency of bites by mosquitoes was apparently high in the area neighbouring on the sea.

This seems reasonable because the vector mosquito which was bred in the rock-pools by the sea bites the inhabitants living in coastal side of the village more frequently than those from inner side. This kind of transmission pattern was previously observed in Wimi-1-Ri village. As shown in Table 2, however, there was no difference in the positive rate in skin test between the inhabitants in Coast area and those in Inland area of Ha-Dong. Further, there was no significant difference in the wheal-size distribution pattern between the 2 groups. This result seems to show that the whole inhabitants of Ha-Dong were equally sensitized regardless of the distance between their houses and the sea. This finding may be due to the fact that the size of this village is considerably smaller than that of Wimi-1-Ri.

TABLE 2 Results of blood surveys and skin test surveys in Wimi-1-Ri (1970) and Ha-Dong, Hae-Ri (1972) in Che-ju Is.

Areas examined		Blood examination					Positive rate (%) in skin test	
		No. examined	No. mf positives	mf rate (%)	Average MFD among positives	Average MFD all examined	among all the examined	among childrean below 9 yrs old
Wimi	Inland area	428	57	13.3	31.0	4.1	74.5	38.8
	Coast area	631	164	26.0	102.1	26.5	81.9	54.7
Ha-Dong	Inland area	166	20	12.0	25.8	3.1	77.4	40.0
	Coast area	148	40	27.0	64.5	17.4	81.0	45.5

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韓国済州島のマレー糸状虫に関する研究

1 流行地の皮内反応から見たマレー糸状虫症の疫学

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著者らは1970～1972年の期間に済洲島南岸の地域においてマレー糸状虫症が濃厚に分布していることを確認した。為美1里の場合，海岸部の住民は内陸部側の住民に比べ濃厚に感染を受けていた。この傾向は下洞部落でも同様で，これは伝搬者である *Aedes togoi* の発生地である海岸の岩礁地帯と住民の居住地との距離が重要な役割を果しているものと推定された。しかし，為美のように大きな村では，内陸部住民における皮内反応膨疹サイズは，海岸側に比べ小さかったが，下洞のような小さな部落では，内陸側と海岸側の住民の間には差が見られなかった。これは下洞の場合，海岸からの距離が小さく，海岸に密着しているため，感染蚊による感作という点では，全住民がほぼ一様であったためと思われる。為美1里の mf 保有者は1970年に集団治療を実施したが，1970年と1972年に夫々の時点での6—11才児を皮内反応でチェックした結果，1972年には皮内反応膨疹サイズに縮少が見られた。この事実は，その地域のフィラリア伝搬の低下と関連があると推定される。

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