

Epidemiology of Bancroftian Filariasis in Hisamatsu Village, Miyako Island, the Ryukyus

1. Results of a survey made in October, 1961¹⁾²⁾

NANZABURO OMORI and OSAMU SUENAGA

Department of Medical Zoology, Research Institute
of Endemics, Nagasaki University

KUNIO NAKACHI

Ryukyu Health Laboratory

宮古島, 久松部落に於けるフィラリアの疫学. 1. 1961年10月の調査結果. 大森南三郎, 末永 敏,
長崎大学風土病研究所衛生動物学研究室. 仲地国夫, 琉球衛生研究所.

Introduction

A filarial survey was made in a village, Hisamatsu, as a part of medical survey which was carried out in Autumn of 1961 at the Ryukyus, especially in Miyako Island by the staff of the Research Institute of Endemics and the School of Medicine, Nagasaki University under the cooperation of Ryukyu Health Laboratory.

Miyako Island is highest in filarial endemicity among the Ryukyus. The Hisamatsu village is one of the highest ones in the endemicity among the Miyako and its adjacent islands. The result of the island-wide survey of filariasis will be reported by the other members. The detailed account of further exami-

nation on the epidemiology of the disease in the village repeatedly made by us in 1962 will be published on the other opportunity.

The place and method of examination

Miyako Island is very flat having only very low hills. Most of the islander are engaging in cultivation mainly of sugar cane and partly of rice plant, while some are in fishery. The farmer is keeping usually a indigenous small horse and several swine and some number of domestic fowls, and several goats in some cases, while in rare cases a cow in place of the horse. There are few special products and no underground resources, and the living standard seems lowest in the Ryukyus. The

1) Contribution from the Research Institute of Endemics, Nagasaki University No. 406 and Contribution No. 112 from the Department of Medical Zoology, Nagasaki University School of Medicine.

2) This investigation was supported in part by a PHS research grant E-3328 (R 1) from National Institute of Allergy and Infectious Diseases, NIH., Public Health Service.

Table 1 Meteorological table at Miyako Weather Station (24.47' N, 125.17' E)
(Average for from 1938 to 1955, excepting for 1954)

Temp. or R.H.	Jan.	Feb.	Mar.	Apr.	May	Jun.	JuI.	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Mean air temp. °C	17.7	17.9	19.4	21.4	24.5	26.7	27.7	27.4	27.0	24.8	22.3	19.4	23.0
Mean Maximum	20.4	20.7	22.4	24.5	27.6	29.5	30.9	30.6	30.3	27.2	24.8	22.0	25.9
Mean Minimum	15.3	15.4	16.9	18.9	22.2	24.5	25.4	25.0	24.7	22.6	20.1	17.2	20.7
Mean R. H. (%)	73.4	76.2	78.5	81.4	86.1	86.8	84.0	84.4	80.9	76.0	75.6	74.0	79.7

climate of this Island is of subtropical. The air temperature and relative humidity at Miyako Weather Station is as given in Table 1.

Hisamatsu village is located near seashore at about 4 km distance south west from the center of Hirara City. The village has about 560 houses and about 3560 persons. It has a primary school of 6 school years and about 650 pupils of 6 to 12 years old, and a junior high school of 3 school years and about 290 pupils of 12 to 15 years old. The special feature in this village is that the houses stand rather close together than in any other farm villages, and that they have no water pipes laid and have a rain water reservoiring concrete tank in each as is usual in some poor farm villages.

Blood examination was made at night from

9 to 12 p.m. About 20mm³ of blood from ear lobe was smeared in three thick films on a slide and stained with Giemsa next day. With the primary school and the junior high school, all pupils could be examined under the assistance of school teachers, while with villagers, a part of them were only examined because it was a hard thing to gather people to examine blood at night in this village.

The mosquitoes were collected in the early morning mainly in houses having one or more microfilarial carriers. They were examined for filariae under the binocular microscope and reexamined after their being stained with Giemsa.

Microfilarial incidence

The number of microfilarial positives and

Table 2 Microfilarial incidence of primary school pupils of 6-12 years old, in Hisamatsu, in October, 1961

School year	Male			Female			Total		
	Persons examined	Persons positive	% positive	Persons examined	Persons positive	% positive	Persons examined	Persons positive	% positive
1	46	12	26.1	52	15	28.8	98	27	27.6
2	57	14	24.6	46	14	30.4	103	28	27.2
3	64	28	43.8	48	16	33.3	112	44	39.3
4	57	13	22.8	48	17	35.4	105	30	28.6
5	61	16	26.2	59	19	32.2	120	35	29.2
6	58	13	22.4	54	17	31.5	112	30	26.8
Total	343	96	28.0	307	98	31.9	650	194	29.8

the percentage positives by school year and sex for the primary school is tabulated in Table 2. The incidences are generally slightly higher in girls excepting in girls of the third school year. It is most noteworthy that the incidence in the youngest school year is already very high, and that, contrary to our expectation, it is not necessarily lower in younger school year pupils. In fact, the first school year pupils are slightly higher in positive rate than the sixth school year pupils, and the third year pupils are highest. The above seems to suggest that in the village the transmission of the disease have not necessarily occurred equally everywhere but in

some places or foci more active infection must have been taken place than the other places.

In Table 3, the microfilarial incidences of all pupils in the junior high school of this village are tabulated by sex and school year. The incidences are markedly higher than in pupils of primary school and become higher with advance in school year. In this case, however, the first year boys are relatively much lower and the third year boys are higher. This also seems to be due to the maldistribution of the carriers in the village.

Because of very high incidences in pupils of the primary school and much higher in those of junior high school, we thought it

Table 3 Microfilarial incidence of junior high school pupils of 12-15 years old, in Hisamatsu, in October, 1961

School year	Male			Female			Total		
	Persons examined	Persons positive	% positive	persons examined	Persons positive	% positive	Persons examined	Persons positive	% positive
1	57	20	35.1	51	20	39.2	108	40	37.0
2	59	26	44.1	67	30	44.8	126	56	44.4
3	28	15	53.6	28	12	42.9	56	27	48.2
Total	144	61	42.4	146	62	42.5	290	123	42.4

Table 4 Microfilarial incidence of villagers in Hisamatsu including all pupils of primary and junior high schools, by age group and sex, in Oct., 1961

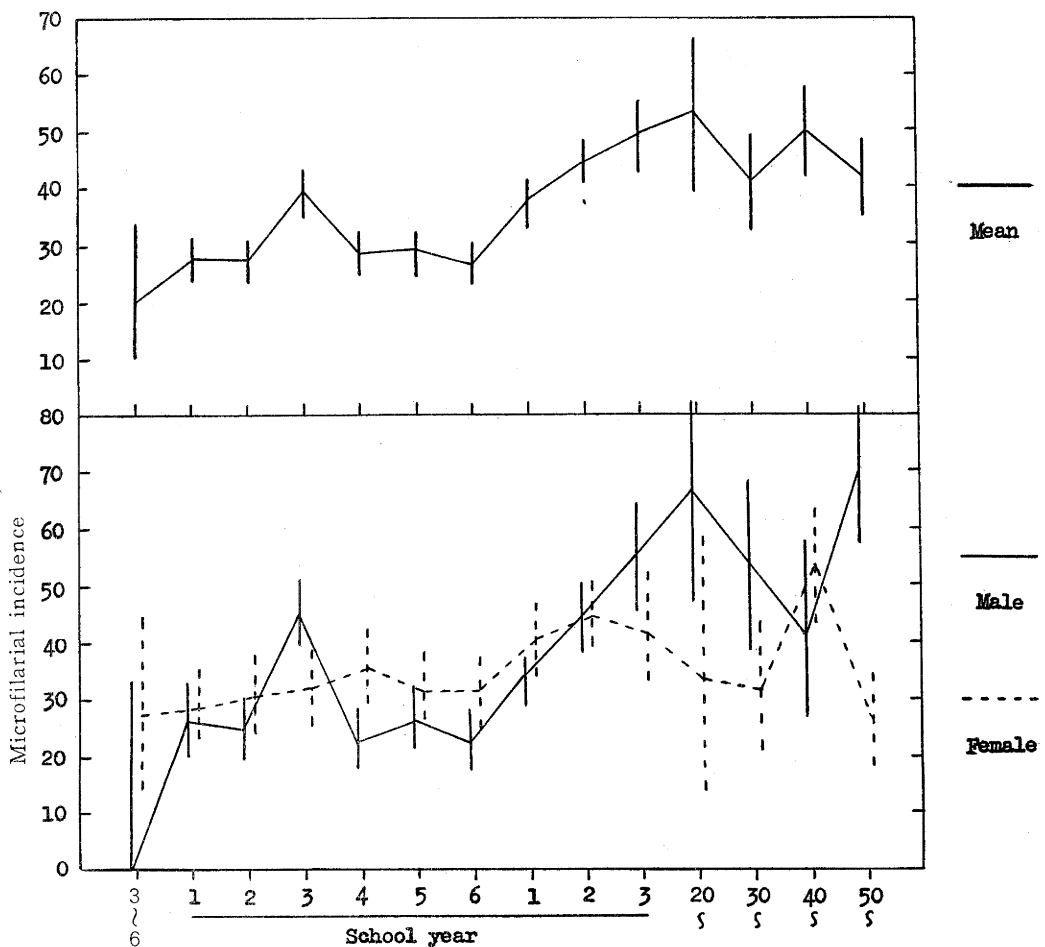
Age group	Male			Female			Total		
	Persons examined	Persons positive	% positive	Persons examined	Persons positive	% positive	Persons examined	Persons positive	% positive
3-9	228	67	29.4	205	65	31.7	433	132	30.5
10-19	264	90	34.1	259	98	37.8	523	188	35.9
20-29	9	6	66.7	6	2	33.3	15	8	53.3
30-39	13	7	53.8	19	6	31.6	32	13	40.6
40-49	12	5	41.7	26	14	53.8	38	19	50.0
50-59	12	9	75.0	22	8	36.4	34	17	50.0
60-67	5	3	60.0	9	0	0	14	3	21.4
Total	543	187	34.4	546	193	35.3	1089	380	34.9

interesting and necessary to examine persons younger as well as older than these school children. It was, however, very hard thing to gather them and only 149 persons could be examined. Among these, preschool children were 15 in number, 4 boys and 11 girls. All boys were negative. Of 11 girls, a four aged girl had only 1, two six aged girls had 17 and 123 microfilariae. The incidences for boys, girls, and total were 0, 27.3, and 20.0% respectively. No person aged from after termination of junior high school course to nineteen had gathered excepting only one male who was

seventeen in age and negative for filariae. The young persons of these and older ages usually leave their native village to work in Hirara City, Naha City or elsewhere.

Table 4 shows the incidences by sex and age group with all persons examined. The group of 3-9 years old includes 15 preschool children and those under the fourth school year of the primary school. The next group includes all pupils of the fifth and sixth school years in the primary school and all of the junior high school and a boy of seventeen age. The other villagers were divided by age group.

Fig. 1 60% confidence intervals of population percentage number of persons positive for microfilariae for the percentage number of positives in Hisamatsu by sex and school year or age group in October, 1961



As seen from Table 4, the incidences of persons above twenty years old are as high as about fifty percent, though that in the ages 30-39 is relatively lower probably accidentally and in 60-67 ages much lower perhaps owing to the infection immunity. To show the relation between the incidence and age more clearly, the incidences by sex and school year or age group are compared in Fig. 1. As seen in Fig. 1, the mean incidence is already as high as 20.0% in the youngest age group. The incidence become higher in primary school children but in nearly the same level throughout the school years excepting for the third year. They become still higher in junior high school years reaching in the third year the highest percentage or about 50.0%.

That the microfilarial incidences in adults being about 50.0% is very surprising and noteworthy, because this implies reasonably that nearly all adults of this village must have been attacked by the disease, considering that some number of carriers having had very few microfilariae might have been overlooked in the examination of only 20mm³ of blood and that microfilariae often disappear in the blood of chronic sufferers of the disease.

Next, the relation between the incidence and sex is striking. The incidences are generally higher in female till the second school year of the junior high school, while thereafter become lower than in male. This appears to be peculiar to this village but the reason why is now unknown to us.

Microfilarial count in about 20mm³ of blood

The number of microfilariae in about 20mm³ of peripheral blood of the carrier is subjected to a great individual variation. A six aged boy had 312 microfilariae and a girl of the same age had 724 ones. The maximum number of microfilariae found in an individual by sex among all persons examined was 857 in a boy

of eight years old and 1187 in a girl of fourteen years old.

The number of carriers belonging to a certain microfilarial level are compared in Table 5 by sex and school year for primary and junior high schools and the percentage distribution of them are compared in Fig. 2. These Table and Fig. show that how many

Table 5 Number of positives belonging to the indicated microfilarial level

Microfilarial level	X = No. Mf	$\sqrt[3]{\bar{X}}$	Primary school		Junior high school	
			♂	♀	♂	♀
1-3	1	1	19	11	13	6
4-15	2	2	20	18	15	9
16-42	3	3	22	18	10	8
43-91	4	4	8	24	12	11
92-166	5	5	12	7	3	16
167-274	6	6	5	8	5	4
275-421	7	7	5	6	1	5
422-614	8	8	3	2	2	0
615-857	9	9	2	3	0	2
858-1157	10	10	0	1	0	0
1158-	11	11	0	0	0	1
Total			96	98	61	62

these school children are suffering from the heavy infection, and when compared the sexes, girls are more heavily infected than boys in both schools, and that as to boys, the primary school boys are infected slightly more heavily than the junior high school boys, while with girls, older girls are markedly more heavily infected.

The above findings are also clearly seen in Fig. 3 in which the mean numbers of microfilariae by sex and school year or age group are compared. Fig. 3 shows that the mean number of microfilariae not necessarily increases with the advance in age but the extreme high counts are rather found scattered especially among the school children. Fig. 3 also

Fig. 2 Frequency distribution of microfilarial level in pupils of primary (left) and junior high school (right)

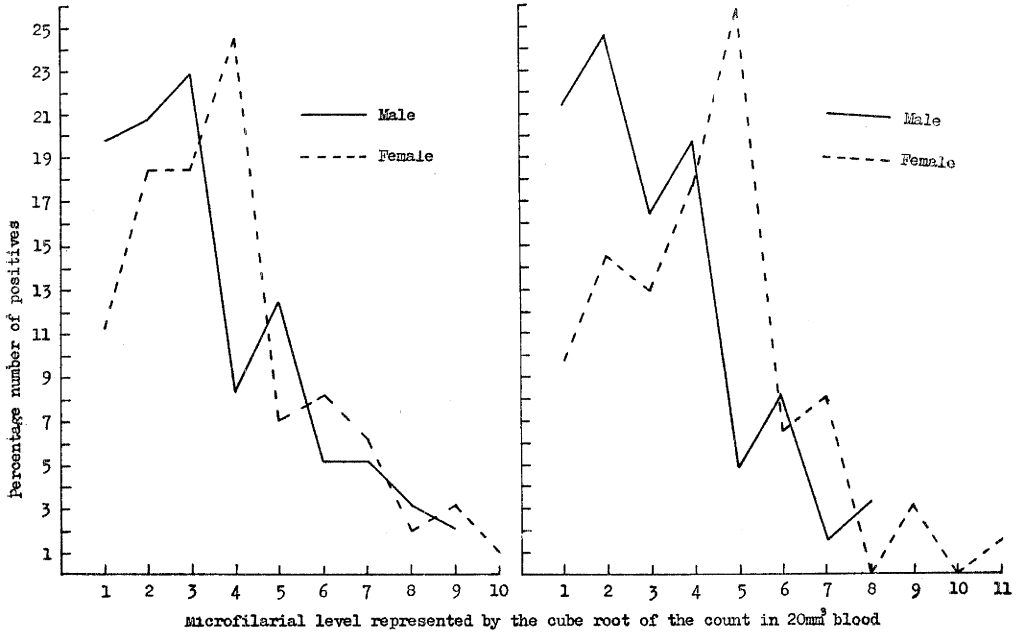
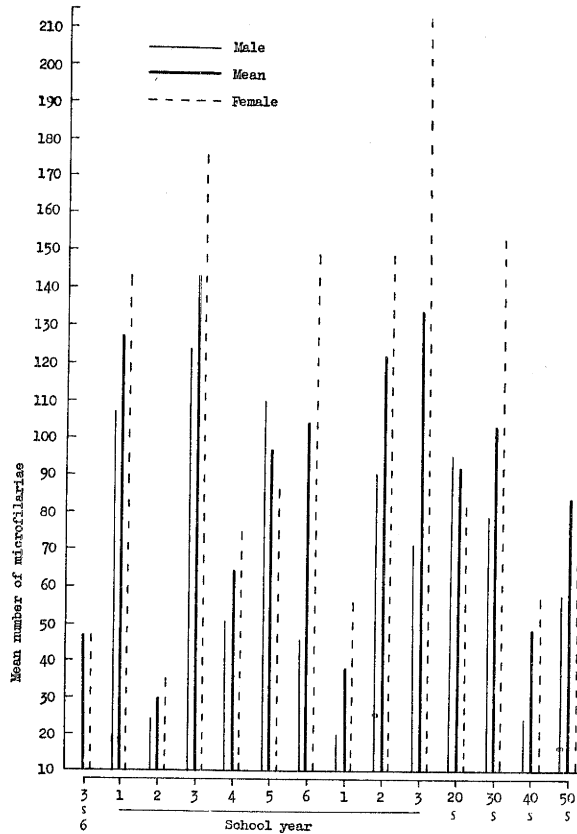


Fig. 3 Mean number of microfilariae per 20mm³ blood of positives by sex and by school year or age group



shows that the female is always greater in the number of harboring microfilariae than the male excepting only a few cases. This may be due to the female being subjected to a more intense repeated infection than the male probably because of her usual staying in houses at night when the infection must have been set up solely by the domestic house mosquito, *Culex pipiens quinquefasciatus*. However, this may possibly be a special happening only in this village.

**The incidence and count of microfilariae
in the part-time high school student in
Miyako City**

Miyako part-time high school is being attached to the Miyako high school which is situ-

ated in the Hirara City. The students enter the school from all over the Miyako Island: Some are attending school from their own houses in the villages; some are from the place of employment in the city, and the remaining are from their own houses in the city. The microfilarial incidences of the students and the mean number of microfilariae per student by sex and school year are tabulated in Tables 6 and 7. There are no definite trend of increase in the percentage or the count with the advance in age. The incidences are fairly lower and the counts are much fewer in the students than in the junior high school pupils of the Hisamatsu village in spite of the students being older. This may be due to that most of the students seem to be from middle or higher classes in living.

Table 6 Microfilarial incidence of part-time high school students in Hirara City in October, 1961

School year	Male			Female			Total		
	Persons examined	Persons positive	% positive	Persons examined	Persons positive	% positive	Persons examined	Persons positive	% positive
1	13	8	61.5	21	8	38.1	34	16	47.1
2	17	5	29.4	12	5	41.7	29	10	34.5
3	15	9	60.0	13	1	7.7	28	10	35.7
4	13	4	30.0	10	2	20.0	23	6	26.1
Total	58	26	44.8	56	16	28.6	114	42	36.8

Table 7 Mean microfilarial count per 20mm³ blood of positives by sex and school year in the part-time high school

School year	Male			Female			Total		
	Persons positive	Total No. Mf	Mean No. Mf	Persons positive	Total No. Mf	Mean No. Mf	Persons positive	Total No. Mf	Mean No. Mf
1	8	96	12.0	8	182	22.8	16	278	17.4
2	5	255	51.0	5	260	52.0	10	515	51.5
3	9	339	37.7	1	124	124.0	10	463	46.3
4	4	47	11.8	2	5	2.5	6	52	8.7
Total	26	737	28.3	16	571	35.7	42	1308	31.1

**Vector mosquito and its natural
infection with filariae**

In and around the Hisamatsu village, there are no river, reservoir, and rice field to speak of. The mosquitoes found near houses in October during the period of our examination were *Aedes albopictus* and *Culex pipiens quinquefasciatus*. The former was breeding in containers around houses. This day-time biter has no relation in the transmission of human filariasis. The latter was the only one mosquito entering houses at night to feed on man. This house mosquito was rather small in number because of the season being rather dry. By this, in a very few houses mosquito nets were being used at night as shown in

Table 8. The mosquito survey, shown in Table 8, was carried out on such days in the dry season. In many houses a few mosquitoes were only found but in 9 houses or in 64.3% out of 14 ones, infected mosquitoes were found. Out of 74 female mosquitoes 23 or 31.1% of them were found harboring any stage larvae and 3 or 4.1% of them having infective stage larvae. The percentage of mosquitoes naturally having infective larvae or 4.1% is very much higher when compared with that (0.4%) in *Culex pipiens pallens* examined in Japan (Omori, 1961). It is of interest that in a female mosquito, the first and second stage larvae, and in another female the first, second, and also infective larvae were simultaneously found, indicating that these filariae must have been taken up

Table 8 Number of vector mosquito, *Culex pipiens quinquefasciatus* caught in houses in the early morning and the number of the mosquitoes infected with filariae

House Number	Use of mosquito net	No. of mosquitoes caught	No. of mosquitoes	
			with any stage larvae	with infective stage larvae
1	—	2	2	
2	+	8	4	
3	—	25	7	1
4	—	3	0	
5	—	1	1	
6	—	17	2	1
7	—	3	1	
8	—	3	3	
9	—	2	0	
10	—	0	0	
11	—	2	0	
12	—	5	2	1
13	—	3	1	
14	—	0	0	
Total		74	23	3
(%)		(100.0)	(31.1)	(4.1)

by the respective female, prior to their being captured, at two and three different occasions.

This mosquito, thus being very fond of human blood, could not be entirely found in cattle-sheds.

People says that in rainy season from May to July the house mosquito fairly increases in number but not so remarkably and about one third of houses don't use the mosquito net and in dry season they seldom use it. The overflowing water from the sink is absorbed into the porous soil and even in the rainy season the breeding place of the house mosquito may not be much widen and consequently the breeding place of the house mosquito does not seem to increase so much.

In a scientific sense, however, being carelessness of villagers about the mosquito seems to be the most important cause of the spread of the disease.

Considerations on the cause of the high endemicity and a suggestion on the control of the vector mosquito

Owing to the lack of underground water and having no water supply, the villager uses exclusively the rain water collecting it in a concrete tank and they are laid under the necessity of economizing in water, for example, they do washing at minimum by a minimum water, they seldom take a bath, especially in dry season. The foul water is collected in a sink digged in the ground or made rarely of concrete. The sink usually small in area and depth. The foul water stays only in the sink and when runs over it is absorbed into the porous soil. Therefore it scarcely need to cut the waterway. Just the sink is the most favorable breeding place of the vector mosquito, *Culex pipiens quinquefasciatus*. This mosquito is rarely attracted to cattle and very fond of human blood. The other mosquitoes have no concern in the transmission of bancroftian filariasis not only in Miyako Island

but in all Ryukyus.

The breeding number of the vector mosquito from such small sinks is not so numerous and the villagers don't know about the danger of the mosquito and take little care of the biting. Even in the wet season mosquito nets are only used in a half or two-thirds of the houses, much less in the dry season as mentioned above. Moreover, we saw frequently the villagers using the mosquito net as it has ripped.

Even in winter, the mosquito continues more or less its breeding and on warm night it enters houses to bite man and therefore the transmission of filariasis should be considered to take place nearly all year round.

The following facts may be the reasons why the microfilarial incidence is very high in this village: There are very favorable breeding places or the sinks in all houses ; the only vector mosquito is very fond of human blood and is very high in natural infection rate and is probably transmissible all year round; faulty usage of mosquito net; the houses in this village are standing rather close together than in any other farm villages in the Island.

A good control of the vector mosquito must be expected by the drainage of the foul water: For that, the village should have water supply from Hirara City and make concrete waterway from houses to the main drain which should be opened through the village to the seashore for a distance of about one and a half kilometers to drain off the foul water completely.

Summary

A filarial survey was made in a village, Hisamatsu, Miyako Island, the Ryukyus in October, 1961. Blood examination for microfilariae was made at night with all the pupils of the primary school and the junior high school and a part of the villager. Mosquitoes were collected in houses early in the morning and examined for filariae.

The mean microfilarial incidence in pre-school children is already 20.0%. Those in primary school and junior high school pupils are 29.8% and 42.4 % respectively. Those in adults aged above twenty years old are as high as about 50.0% but that in 60-67 ages decreases to 21.4%. It is a striking fact that the incidence in the third school year of the junior high school or 14-15 years old pupils already reaches the incidences shown by adults or about 50.0%. It is of interest that the incidences are generally higher in females till the second school year of the junior high school while thereafter, those are higher in males.

The mean number of microfilariae per about 20mm³ of blood is generally very large in this village. The mean number for school year or age group not necessarily increases with the advance in age but the extreme high counts are found scattered especially among the school children. The female is nearly always greater in the number of harboring microfilariae than the male probably owing to the more intense repeated infection caused perhaps by the usual and longer staying in houses at night.

There is not necessarily found a definite trend of increase in the microfilarial incidence and count with the advance in school year or age group, suggesting the existence of places

or foci where more intense infection must have been taken place than the other places within the village.

Culex pipiens quinquefasciatus which is the only vector mosquito not only in the village but in all Ryukyus, is very fond of human blood and is actually very high in natural infection rate with filariae. It is breeding in the foul water collected in the sink. The transmission of the disease by the mosquito seems to be taken place nearly all year round.

The high incidence of filariasis in this village may be attributable to the existence of very favorable breeding place of the vector mosquito or the sink in each house, to the vector mosquito being very fond of human blood and being very high in natural infection rate, to the faulty usage of mosquito net or carelessness of the villagers for the biting of the mosquito, and to the houses being standing rather close together than in any other villages.

A good control of the vector mosquito is expected by the drainage of the foul water. For this, the village should have water supply and the houses should lay out a concrete drain from their kitchens to the main concrete drain which should be opened through the village to the seashore for a distance of about one and a half kilometers to drain off the foul water completely.

Literatures

1) Bekku, H. : Studies on the *Culex pipiens* group of Japan. 1. Comparative studies on the morphology of those obtained from various localities in the Far East. Nagasaki Med. J., 31 (11):956-966, 1956. (In Japanese with English summary).

2) Fujisaki, T. : Supplements to the findings on the susceptibility of Japanese mosquitoes to *Wuchereria bancrofti*. 2. On the susceptibility of *Anopheles hyrcanus sinensis* and *Culex*

tritaeniorhynchus. Endem. Dis. Bull. Nagasaki, 1 (3) : 278 - 287, 1959. (In Japanese with English summary).

3) Nagatomo, I. : Epidemiology and control of bancroftian filariasis in some villages of Nagasaki prefecture. 1. Incidence of filariasis and natural infection rate of mosquitoes in Nanatugama and Taira villages. Endem. Dis. Bull. Nagasaki, 2 (4) : 296-306, 1960.

4) Nagatomo, I. : Epidemiology and control of bancroftian filariasis in some village of Nagasaki prefecture. 2. Nocturnal feeding

activities of mosquitoes in a filaria endemic section, Kamisikama of Nanatugama village. *Endem. Dis. Bull. Nagasaki*, 2 (4) : 307-320, 1960.

5) Nagatomo, I. : Epidemiology and control of bancroftian filariasis in some villages of Nagasaki prefecture. 3. Epidemiology and mass treatment of filariasis in Amakubo village. *Endem. Dis. Bull. Nagasaki*, 3 (1) : 75-86, 1961.

6) Omori, N. : Experimental studies on the role of the house mosquito, *Culex pipiens pallens* in the transmission of bancroftian filariasis. 1. Development, distribution and longevity of filariae in mosquitoes kept at 27°C and 25°C. *Nagasaki Med. J.*, 32 (11) : 1434-1445, 1957. (In Japanese with English summary).

7) Omori, N. : Experimental studies on the role of the house mosquito, *Culex pipiens pallens* in the transmission of bancroftian filariasis. 4. Development and longevity in days of filariae in mosquitoes kept at a series of constant temperatures. *Nagasaki Med. J.*, 33 (11, Suppl.) : 61-70, 1958.

8) Omori, N. : Experimental studies on the role of the house mosquito, *Culex pipiens pallens* in the transmission of bancroftian

filariasis. 5. On the distribution of infective larvae in mosquito and the effect of parasitism of filariae upon the host insect. *Nagasaki Med. J.*, 33 (11, Suppl.) : 143-155, 1958.

9) Omori, N. : A review of the role of mosquitoes in the transmission of Malayan and Bancroftian filariasis in Japan. Expert Committee on Filariasis, Geneva, 25 July-1 August, 1961. (WHO/Fil/32, 29 June, 1961).

10) Omori, N., Kamura, T., Fujisaki, T., Suenaga, O., Kitamura, S., Katamine, D., Era, E. and Fukamachi, H. : Filaria control experiments in Western Kyushu, Japan. *Jap. J. Paras.*, 8 (6) : 886-894, 1959. (In Japanese with English summary).

11) Osima, M. : Studies On the incidence of bancroftian filariasis and the natural infection of mosquitoes in Western Kyushu, Japan. I. On the incidence of filariasis. *Nagasaki Med. J.*, 30 (11) : 1467-1477, 1955. (In Japanese with English summary).

12) Osima, M. : Studies on the incidence of bancroftian filariasis and the natural infection of mosquitoes in Western Kyushu, Japan. II. On the natural infection of mosquitoes. *Jap. J. Sanit. Zool.*, 7 (1) : 9-18, 1956. (In Japanese with English summary).

摘 要

昭和36年10月、琉球宮古島の久松部落でバンクロフト糸状虫症の疫学調査を実施した。本部落は旧平良市の西南4km地点にある海岸近くの農村部落で戸数約560戸、人口約3560名で、生徒数650名の小学校と290名の新制中学とがある。採血は約20mm³の耳朶血を、夜9-12時の間に行ない、蚊の自然感染状況は早朝人家内で採集したものについて行なった。検査は小・中学生全員と就学前の小児15名、20才以上の成人154名について行なった。

小児(3-6才)の平均仔虫保有率は既に20.0%で、小学生及び中学生の平均は夫々29.8%及び42.4%と頗る高く、20才以上の成人では約48%(40.6-53.3%)となるが、60-67才では21.4%と低下する。小学生では学年に関係なく約30%であるが3年生男子だけが43.8%と特に高い。中学生では大体高学年程高率となるが、3年生では48.2%となって20才以上の成人の平均に達する。20才以上の成年では各年令層及び男女によって31.6%から75%と異なるが、採血が約20mm³を只一回行なった事と高令者では感染免疫のため仔虫の消失するものもあり得る事を考えると本部落の成年は殆んどがフィラリア症の経験者であると考えられる。

以上の感染状況から本部落が如何に高侵襲地であるかが判る。この部落では、僅かの例外を除けば、中学2年迄は女子に仔虫保有率が高く、以後は逆に男子に高くなるがこの意味は今不明である。

平均仔虫数は、一般に非常に高く、興味のある事はその平均数が学年或いは年齢層の増加とは全く無関係に、寧ろ小・中学生の数学年に平均数の最高群が散在することである。この事実及び先に述べた小学3年生が特に高く1年生も6年生以上に高い事実は本部落内に幾つかの高侵淫焦点の散在する事を思わしめる。更に一つ興味のある事は、1、2の例外を除けば平均仔虫数が常に女子に高い事である。この事は女子が夜間屋内で多く長く居て重感染を受ける機会の多い事を思わしめるが、この事については更に今後吟味する必要がある。

本部落内外には河川、貯水池、水田が全くなく、水源に乏しいので、天水をコンクリート水槽に溜めてすべての家庭用水として使用しているために村民は非常な節水を余儀なくされ、従って排出される下水の量も少ない。下水は地中に掘った穴か、稀にはコンクリート製の下水溜にたまるが、溢れた水は多孔性の土砂中に吸収されるので雨期中でさえ下水溜以外には溜らない。この下水溜がネッタイエカ、*Culex pipiens quinquefasciatus* の唯一の好適発生場所となっている。その他の蚊類としてはヒトスジシマカが人家近くの容器に発生しているのみで夜間は人家へネッタイエカのみが吸血にくるが、畜舎では全く蚊は採集されない事は特記すべき事である。本調査を行なった10月は乾期であったので早期14戸の人家を調べて74個体のネッタイエカ♀を得たが、可成り多数発見できた家が稀にあった以外は、一般に非常に少なく大部分の家では蚊帳を使用していなかった。然し14戸の内9戸から感染蚊が発見され、74♀中23♀(31.1%)に各期幼虫の感染が、又、3♀(4.1%)に感染幼虫が発見され、蚊帳を殆んど使用していないために、蚊の数は少ないとは云え極めて能率的に感染が起こされているものと思われた。

本部落で仔虫保有率が特に高い原因としては、唯一の伝播蚊であるネッタイエカの好適発生下水溜が各家庭にある事、本種が専ら人家へ侵入して人血を好み、自然感染率も非常に高い事、部落民がフィラリア症の感染経路について殆んど無知である事、従って防蚊対策に無関心である事、及び本部落内の各家屋が非常に接近しているために伝播が極めて活潑に起こるのである事などが挙げられる。

本部落に水道を敷設して各家庭にはコンクリートの下水溝を作り、主排水溝を村の一端から中央を通して海岸迄約1.5キロの間コンクリートで作り、下水を完全に排水できる様にする事によって伝播蚊の完全な発生防止が可能であろう。