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Control of Bancroftian filariasis in Ja-Ela, Ceylon

by

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Filariasis control was initiated in Ja-Ela in 1963. At the time it was a small urban council town, situated in the western coastal border of Ceylon, about 12 miles north of Colombo. The extent of the area was ½ sq.mile with a population of 5060, dwelling in 890 houses. This town has since been extended to cover an area of 2½ sq.miles with a population of 11,694. The filariasis control measures have not yet been extended to cover the new areas.

The entire area consists of flat land with a sandy top, and a mixture of gravel and clay below. A small stream which cuts right across this town serves as the outlet for the surface drainage of the area.

Ja-Ela is moderately warm, the mean monthly maximum temperature varying from 85.2°F in October to 88.4°F in March, and the mean monthly minimum temperature from 71.7°F in February to 77.8°F in August. The mean monthly relative humidity percentage during the day varies from 68 in January and February to 78 in July, September and October whereas the night humidity varies from 82 in August to 90 in October and November. The town receives rainfall during both south-west and north-east monsoons, the annual rainfall in 1963 being 161.58 inches with 217 rainy days.

The vegetation consists mainly of coconut palms, the produce of which is used for domestic consumption.

The people (over 90% Catholics) are employed in Colombo as clerical or industrial workers.

INVESTIGATIONS

1. Entomological surveys

An entomological survey carried out in November 1961 revealed the following breeding places of *Culex pipiens fatigans*: Built wells-253; catch-pits-242 ; earth drains-210; burrow pits-181 ; trenches-132 ; pools-117 ; built drains-84 ; cess pools-50 ; marshes and swamps 49; earth wells-4 ; abandoned wells-2 ; channels-2; husk pit-1 and artificial containers-3.

Collection of mosquitoes in dwellings was not carried out throughout the year in 1962 and 1963.

However, the entomological picture in the area prior to the introduction of organised control measures could be reckoned by taking into consideration the findings during 1960, 1961 and 1962. A total of 1265 *C. p. fatigans* was collected in 1808 dwellings (density per house-0.69). Out of a total of 998 *C. p. fatigans* dissected, infection was detected in 13 mosquitoes. (all stages of larvae-1.3% ; mature larvae only-0.40%).

2. Parasitological surveys

House to house survey which was commenced in February 1963 was completed in September 1963. Out of a population of 5,060, it was possible to take night blood samples from 4,001 persons (79.0%). The amount of blood taken was 20 cu.mm., approximately, There were 129 *Mf. bancrofti* positive (3.22%) with an average density of 19.24 Mf. per positive blood film, and the highest number of microfilariae in a blood film was 302.

3. Clinical manifestations

There were 3 cases of elephantiasis of legs: left leg (5 years' duration) ; right leg (5 years' duration) and left leg (2 years' duration) during the period of the first survey. In two other cases, a swelling of the left leg of two years' duration and swelling of the right leg of 1½ years' duration occurred during the second survey. One case of swelling of the right leg with enlargement of right epitrochlear glands and attacks of fever with rigors of 1½ years' duration occurred during the third survey and another case of swelling of right leg associated with fever and rigors occurred thereafter.

CONTROL

The Ja-Ela Urban Council area was taken up by the campaign for the first time with the appointment of a Public Health Inspector to this area with effect from January, 1963. After a week's training at the campaign headquarters the P. H. I. commenced a parasitological survey in February, 1963. All Mf. positive cases were offered domiciliary treatment with diethylcarbamazine citrate, the adult dosage being 100 mg. tds. for 21 continuous days for Mf. carriers and 7 days for their associates (contacts) living in the same house.

The survey was repeated three times during the period October 1963 to June 1965 and all Mf. positives detected were treated and kept under surveillance by examining post-treatment blood films soon after completion of treatment and at 6-monthly intervals thereafter for a period of 24 months.

From March 1963 onwards it was possible to have 208 propaganda talks and 10 film shows, with a view to soliciting the co-operation of the public for blood surveys, adequate treatment and disposal of discarded receptacles which breed *C.p. fatigans.*

The entire urban council area and a half-mile radius around it was taken up by the campaign for vector control with the appointment of one overseer and three labourers and provision of equipment and larvicides with effect from 13.5.63. It must be stated that prior to the introduction of control measures by the Anti-Filariasis campaign, the urban

council employed one labourer from 15.11.55, two labourers from 4.2.61 for spraying larvicide (malathion in oil) on water collections in catch pits ; these two labourers were also placed under the direction and supervision of the campaign personnel, when the larval control was commenced on 13.5.63.

The entire area of operation was divided into 5 sections, each of which was again subdivided into 4 subsections, (one for each of the 4 labourers) for the purpose of application of larvicide on the five working days of the week from Monday to Friday ; one labourer was kept as a stand-by to meet absenteeism among the labour force ; Saturday was set apart as a stand-by to meet dislocation of the programme due to public holidays and inclement weather when work for the day could not be done or completed. If it was possible to cover the weekly programme by Friday, then Saturday was utilized for elimination of such breeding places as burrow pits, drains etc.

The larvicide used was 3/4 to 1 oz. of 50% malathion E.C. in one gallon of heavy diesel oil with teepol as a spreading agent. The quantity of larvicide sprayed monthly varied from 300 to 400 gallons depending upon the number of pools occurring soon after rains.

During 1963, 1964 and first half of 1965 it has been possible to convert 61 catch pit latrines into the water-seal type and eliminate 97 burrow pits and 21 earth drains by filling them with earth.

Per capita cost

The cost involved in carrying out a filariasis control programme in the Ja-Ela urban council area is given in table I below :

Table I Per capita cost

Period	Vector Control Rs. cts.	Parasite Control Rs. cts.	Total Rs. cts.
Jan.—Sept. 1963	0.47	0.37	0.84
Oct. '63—Sept. '64	1.80	1.14	2.94
Oct. '64—July '65	1.56	0.75	2.31

RESULTS AND DISCUSSION

The frequency distribution of the Mf. carriers classified according to the method of Sasa & Mitsui (1964) as number of microfilariae per positive blood film is given in table II,

TABLE II *showing frequency distribution of microfilaraemia at the 1st survey.*

Ja-Ela

No. of Mf. in film	Frequency	Cumulative frequency	Cumulative percent	Probit
1	5	5	3.9	3.24
2	15	20	15.5	3.98
3	8	28	21.7	4.22
4	13	41	31.8	4.53
5	9	50	38.8	4.72
6	5	55	42.6	4.81
7	11	66	51.2	5.03
8	6	72	55.8	5.15
9	8	80	62.0	5.31
10	3	83	64.3	5.37
11—20	19	102	79.1	5.81
21—30	7	109	84.5	6.02
31—40	6	115	89.1	6.23
41—50	4	119	92.2	6.42
51—100	6	125	96.9	6.87
101—200	2	127	98.45	7.16
201—300	1	128	99.22	7.42
301—400	1	129	100	—

The cumulative frequencies and percentages and their probit values were calculated. It would be seen that about 50% of the Mf. carriers had 7 or more microfilariae in their blood sample and about 10% had 40 or more.

Figure 1 illustrates the probit values plotted against logarithmic values of microfilaria count. It would be seen that the regression line is almost a straight line indicating that the frequency distribution is almost normal.

The classification of microfilaraemia by wards (sub-divisions of the area) is given in table III.

TABLE III *showing classification of microfilaraemia by wards*

Ja-Ela

Ward No.	No. blood examined	No. Mf. positive	Mf. rate
1	1258	33	2.62
2	1313	37	2.82
3	731	27	3.69
4	699	32	4.58
Total	4001	129	3.22

Graph showing cumulative percentage distribution of cases of microfilaraemia against microfilaria counts in Ja-Ela U.C. area.

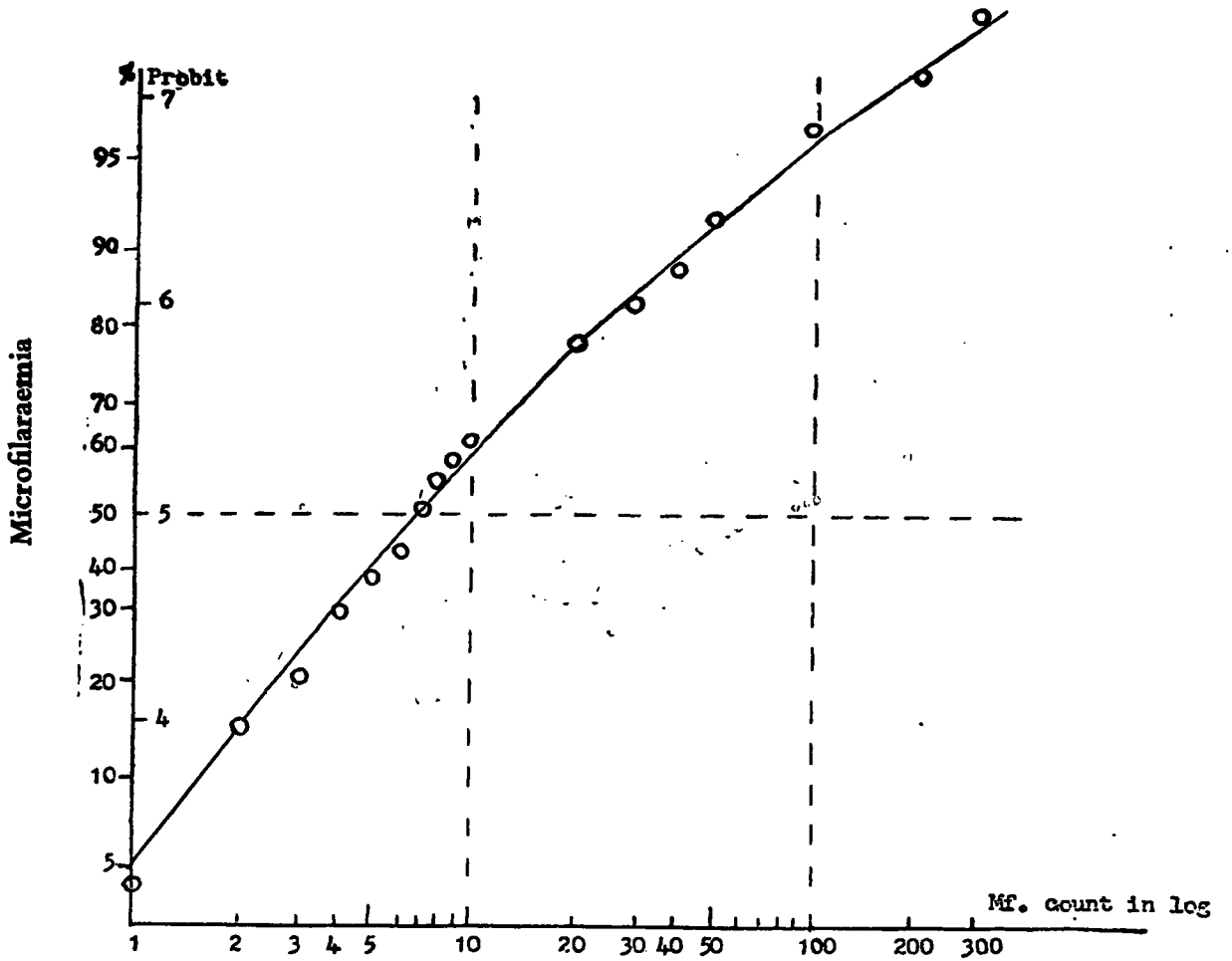
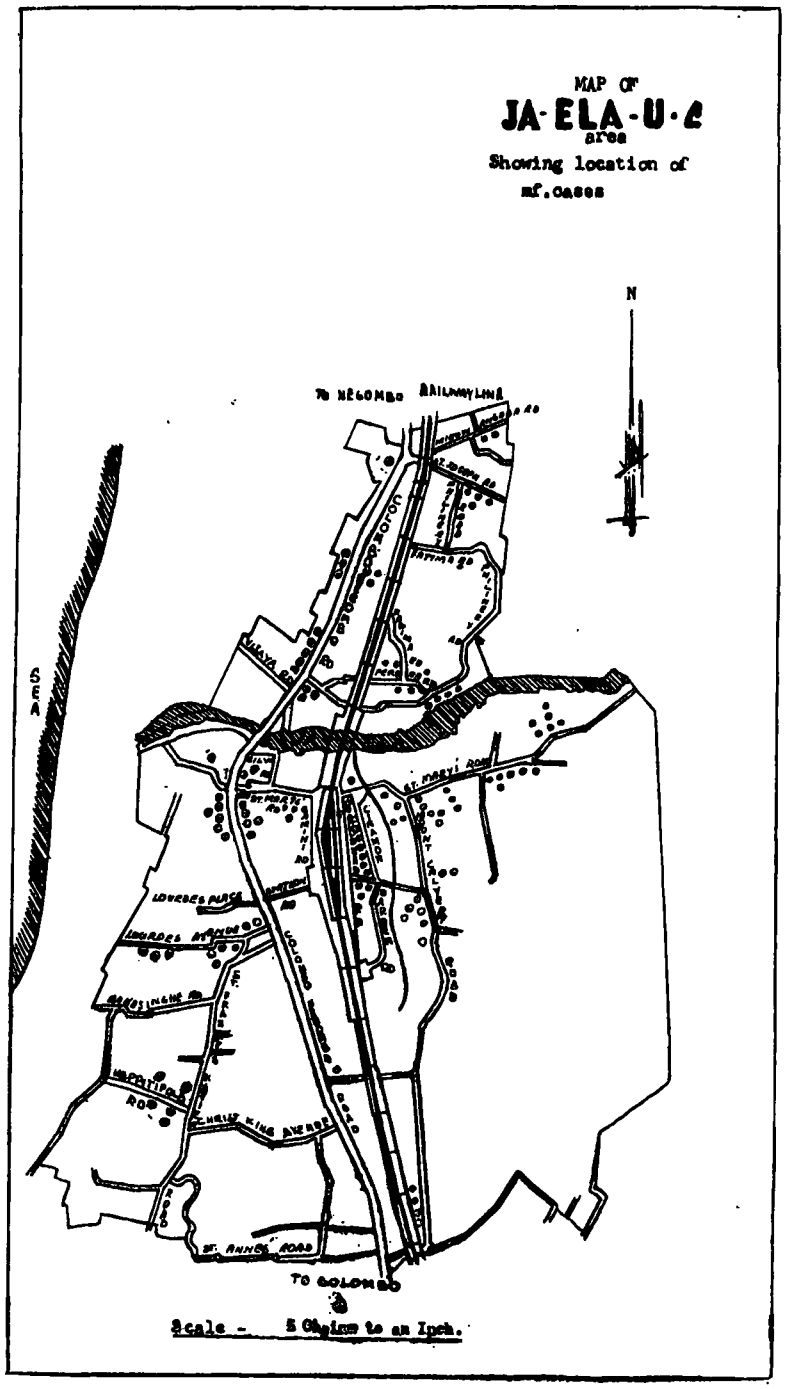


Fig. 1


MAP OF
JA-ELA-U-C
area
Showing location of
mf.cases
N
SEA
Scale - 5 Chains to an Inch.

MAP 1

This table shows that the infection rate varied from ward to ward (from 2.62% inWard 1 to 4.58% in Ward 4).

On plotting Mf. positive cases on a map of the area, (Map I) it was found that they were distributed all over with a tendency for aggregation in certain localities.

The results of the first blood survey were also analysed by the number of occupants and Mf. positives in each house. This analysis is given in table IV.

TABLE IV *showing observed and expected number of cases of microfilaraemia per house*

Ja-Ela

No. of occupants per house	Number of positives per house								No. of persons	No. of positives
	0		1		2		3			
	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.		
1	81	178.39	0	2.61	—	—	—	—	81	81	0
2	76	78.67	8	5.24	0	0.09	—	—	84	168	8
3	93	93.36	10	9.33	0	0.31	0	0.00	103	309	10
4	103	99.99	10	13.33	1	0.67	0	0.01	114	456	12
5	93	84.04	6	14.00	0	0.93	0	0.03	99	495	6
6	86	80.51	9	16.09	2	1.34	1	0.06	98	588	16
7	58	59.63	15	13.91	0	1.39	2	0.08	75	525	21
8	43	44.62	11	11.89	4	1.39	0	0.09	58	464	19
9	18	18.61	4	5.58	3	0.74	0	0.07	25	225	10
10	15	13.69	3	4.56	0	0.68	1	0.07	19	190	6
11	7	6.28	1	2.30	0	0.38	1	0.04	9	99	4
12	6	8.10	4	3.24	2	0.59	0	0.07	12	144	8
13	3	2.61	0	1.13	0	0.23	1	0.03	4	52	3
14	1	0.63	0	0.29	0	0.06	0	0.01	1	14	0
15	3	1.84	0	0.92	0	0.21	0	0.03	3	45	0
16	1	1.78	2	0.95	0	0.24	0	0.04	3	48	2
18	3	1.67	0	1.00	0	0.28	0	0.05	3	54	0
21	0	0.50	0	0.35	0	0.12	1	0.03	1	21	3
23	0	0.47	1	0.36	0	0.13	0	0.04	1	23	1
Total	690	675.39	84	107.08	12	9.78	7	0.75	793	4001	129

rate positive = 129.4001 = 0.032242 = p.
rate negative = 1 — p = 0.967 758 = q.

It would be seen that the number of occupants per house ranges from 1 to 23 and the number of Mf. positives from 0 to 3. The total number of persons blood filmed was 4001 of which there were 129 positives with a positive rate of 0.032242. The expected numbers given in the table were calculated on the assumption that cases of microfilaraemia satisfy a binomial distribution.

Chi square tests carried out are given in table V.

TABLE V *showing Chi-square test*

Ja-Ela

No. of Positive persons	No. of houses (f) observed	(F) expected	f—F	$(f-F)^2$	$(f-F)^2/F$
0	690	675.39	+ 14.61	213.4521	0.3160
1	84	107.08	— 23.08	532.6864	4.9747
2 & over	19	10.53	+ 8.47	71.7409	6.8130
Total	793	793.00	0		12.1037

Probability between 0.01 and 0.001

The probability of obtaining a chi square value of 12 with two degrees of freedom is between 0.01 and 0.001. Hence the chances of microfilaraemia occurring on a randomised basis as is expected on a binomial distribution are remote ; and the occurrence of two and especially three positives in a house is higher than expected.

The entomological findings for the period 1960-1965 June are given in table VI.

TABLE VI *showing by years the density and infection rates of* **C.p.fatigans** *collected from dwellings in Ja-Ela for the period* 1960—*June* 1965.

Years	No. of houses surveyed	No. of *C.p. fatigans* collected	Density per house	No. of *C.p. fatigans* dissected	No. and % all larvae	No. and % mature larvae	Remarks
1960	726	587	0.81	373	3 (0.80)	1 (0.27)	—
1961	706	510	0.72	489	9 (1.84)	3	—
1962	376	168	0.44	136	1 (0.74)	0	No work done in November.
1963	227	161	0.71	129	1 (0.78)	1 (0.78)	No work done from January to April
1964	344	178	0.52	171	0	0	No work done in March and April.
1965 January—June	117	78	0.67	78	1 (1.28)	1 (1.28)	No work done in May

These data indicate a low vector prevalence probably due to the effective larval control. The infection rate appears to have dropped after the introduction of parasite control.

The results of blood surveys carried out on all four occasions are given in table VII.

TABLE VII *showing house to house survey results, Ja-Ela*

Period of Survey	Population	No. Blood filmed	% blood filmed	No. with Mf.	% with *Mf.	Average Mf. density per positive film	Remarks
February-September 1963	5060	4001	79.0	129	3.22	19.24	
October 1963-May 1964	5100	4263	83.6	43	0.98	18.94	Imported cases 1
July 1964-January 1965	5140	3852	74.9	37	0.40	15.18	Imported cases 21
February 1965-June 1965	5181	4033	77.8	18	0.32	5.77	Imported cases 5

* Imported cases excluded in computing %

It would be seen that there has been a remarkable decrease in the infection rate as well as Mf. density per positive blood film, thereby indicating the effectiveness of the present method of control adopted in Ja-Ela. Mf. positives which occurred during the second, third and fourth surveys have been classified in table VIII.

TABLE VIII *showing classification of Mf. positives*

Ja-Ela

Survey No.	Total Mf. cases	Imported cases	Absent during previous surveys	Present during previous surveys but negative
Second	43	1	31	11
Third	37	21	0	16
Fourth	18	5	0	13

At the second survey, a total of 31 out of 42 positives (excluding imported cases)were absent during the first survey and eleven were negative ; at the third and fourth surveys, the positives occurred among those who were previously found negative. The findings relating to the absentees reveal the need for greater and greater parasitological coverage of the population. In the case of positives that were negative in the previous surveys, this could have been either due to the later increase in the level of microfilaraemia from unrecognisable levels or due to error of chance or technique.

An analysis of follow-up results of treated cases is given in table IX.

TABLE IX *showing follow up of positives*
Ja-ela

Survey No.	No. of Mf. positives	Blood survey after completion of treatment			
		1 Month	6 Months	12 Months	18 Months
First	129	* 22	13	5	3
Second	43	* 8	1	0	—
Third	37	* 6	1	—	—
Fourth	Treatment not completed in all cases	—	—	—	—

* although tablets were issued, they did not use them.

It would be seen that there was a group of positives who received the tablets, proclaimed that they had swallowed same and later admitted that they failed to take the treatment for various reasons. It was necessary that this group was made smaller and smaller by effective health education. There was also a group that took inadequate treatment, and another very small group in which the drug failed to eradicate the microfilariae and hence showed positivity at a later stage ; the need to keep the positives under surveillance cannot therefore be over-emphasised.

SUMMARY

An evaluation of the filariasis control measures carried out in a small town (Ja-Ela) for the period commencing January 1963 is detailed in this paper. The Mf. positives were scattered throughout the town with a tendency for aggregation in certain localities. Parasitological surveys revealed a remarkable drop in the Mf. rates, from 3.22 % in 1963 to 0.32% in mid 1965 ; further, the average density of Mf. per positive film showed a reduction from 19.24 to 5.77. The need for the largest possible parasitological coverage of the population in case detection and adequate treatment and surveillance is stressed.

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