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Filariasis in Sri Lanka

I. Susceptibility of *Culex quinquefasciatus* (Say) to *Wuchereria bancrofti* (cobbold) in Sri Lanka.

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Abstract: Bancroftian filariasis is confined to an endemic belt along the South-Western coast of Sri Lanka, although the vector, *Culex quinquefasciatus* (Say) is common in all urbanized areas of the island. Experimental transmission studies with laboratory bred populations of *Culex quinquefasciatus* from six urban areas outside the endemic belt revealed high levels of susceptibility to *Wuchereria bancrofti* similar to the levels in the laboratory bred population from the endemic area.

1. Introduction

Culex quinquefasciatus, the vector of *Wuchereria bancrofti* is commonly found in all urban areas of Sri Lanka. However, human filariasis due to *Wuchereria bancrofti* has been known to be endemic only on the South Western Coastal belt extending from north of Negombo to east of Matara (Figure 1). As a result, much of the activities of the Anti-Filariasis Campaign is confined to this endemic region.

However, no studies have been carried out in the past to try to elucidate the reasons why Bancroftian filariasis is confined to an endemic belt along the South Western coast, when the vector is common in all urbanised areas of the island. The present study was carried out to compare the susceptibilities of laboratory bred populations of *Cx. quinquefasciatus* within the endemic belt and outside to *W. bancrofti* in order to ascertain whether populations outside the endemic belt are in any way less susceptible to *W. bancrofti* than those in the endemic area.

2. Materials and Methods

2.1 Laboratory Culture

The endemic population of *Cx. quinquefasciatus* used was from Peliyagoda where a high microfilaria positive rate had been recorded. This was compared with six different populations from outside the endemic belt for susceptibility to *W. bancrofti*. They were from Jaffna, Mannar, Trincomalee, Nuwara-Eliya, Badulla and Kataragama. These six localities show certain differences in relation to topography and climatic conditions when compared with one another as well as with the endemic area (Figure I and Table I).

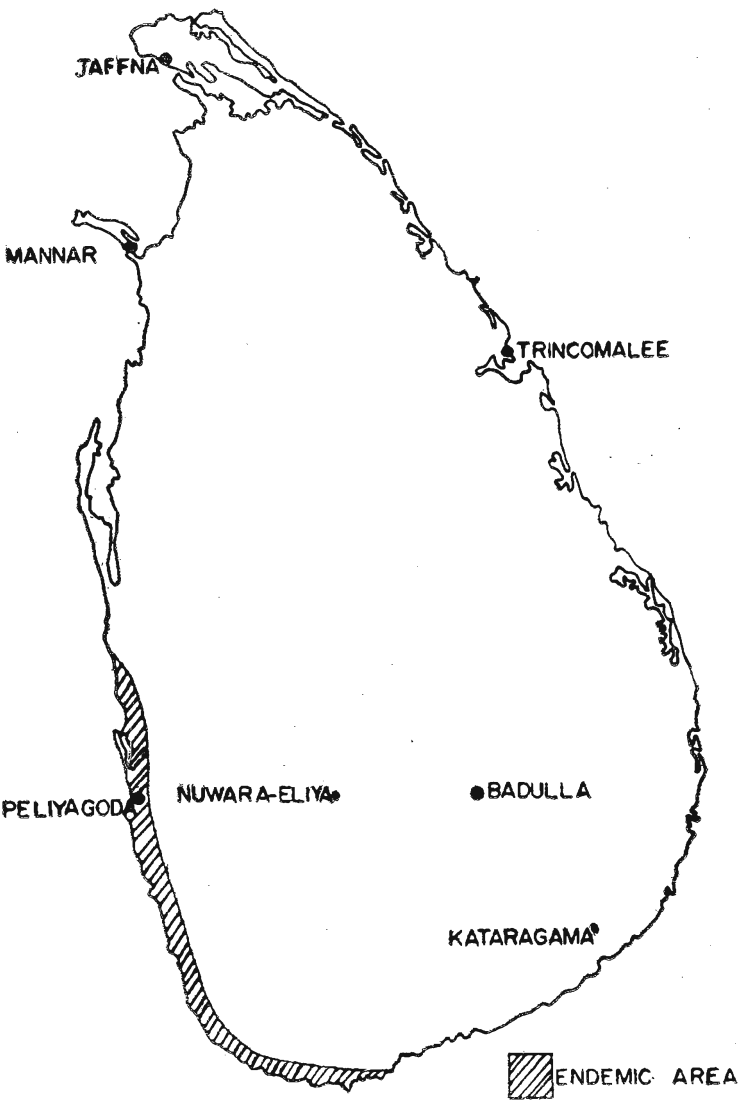

Figure 1. Map of Sri Lanka showing the six urban areas outside the endemic bel fro n where *Culex quinquefasciatus* populations were tested for susceptibility to *Wuchereria bancrofti*.

TABLE 1. Showing Geographical and Meteorological data of the urban areas from which *Culex quinquefasciatus* were tested.

Urban Area	Approx. distance from Peliyagoda (Endemic Area)	Altitude from Pelivagoda (Endemic Area)	Relative Humidity	Mean Temperature	Rainfall in cm
Pelivagoda (Endemic Area)	—	7.6	83%	27.4°C	2.7
Jaffna	307 km.	4.2	82%	29.0°C	4.4
Mannar	225 km.	3.3	82%	28.5°C	4.2
Trincomalee	230 km.	3.1	70%	30.0°C	16.2
Nuwara Eliya	102 km.	1922.0	86%	16.0°C	8.2
Badulla	128 km.	681.1	71%	24.4°C	11.5
Kataragama	166 km.	170.5	74%	28.5°C	0.2

Gorged females from each of these areas were collected from human dwellings and transported to the laboratory. They were maintained in the laboratory in 30cm cube cages draped with wet lint which provided the correct degree of humidity. After 3 days, the gravid mosquitoes were provided with matured guinea-pig dung infusion for oviposition.

Batches of larvae of each population were reared in guinea-pig dung medium. Prawn powder was added daily as a source of food for the growing larvae. All batches of larvae were reared under identical conditions. Healthy adults emerged within ten days after the hatching of the eggs. The newly emerged adults were maintained on sugar solution for 4 days.

2.2 Feeding experiments on the carriers

The microfilarial carriers selected for this experiment had counts ranging from 23 to 51 per 20 cu mm. 5-6 days old adult female mosquitoes were used for experimental feeding. Sugar was withdrawn from the cages 24 hours before the feeding experiment. Mosquitoes were fed on the carriers between 20.00 hours and 22.00 hours. Both hands of the donor were used simultaneously, one to feed the endemic zone population and the other to feed the "test" population. Two "test" populations and the endemic zone population were fed on the same night on the same donor. Two such trials were carried out on the same night using two carriers with different microfilaraemia. The microfilarial count per 20 cu mm for each donor was determined using finger-prick blood before and soon after the feeding experiments.

2.3 Maintenance of Infected mosquitoes

The gorged females of each population were maintained separately in 30 cm cube cages on sugar solution for 12 days. No facilities were provided for oviposition during this period. Mortality of adults, if any, was noted.

2.4 Dissection of Adults

On the twelfth day after the infecting meal, all surviving adults were killed and stored at - 70°C for later dissection. All dissections were done using a stereoscopic microscope. The head, thorax and abdomen of each mosquito was dissected individually in three drops of saline. Infections were noted under the stereoscopic microscope and subsequently checked under a compound microscope. Counts of infective larvae and developing stages were made for each mosquito dissected.

3. Results and Discussion

The results of this study are given in Table 2. The females of all six *Cx. quinquefasciatus* populations from non-endemic areas were capable of supporting the larvae development of *Wuchereria bancrofti* up to the infective stage. The approximate proportion of females positive to infection ranged from 65% to 95%.

TABLE 2. Results of Susceptibility of populations of *Culex quinquefasciatus* from six urban areas outside the endemic belt and from one from the endemic area to *Wuchereria bancrofti*.

Series	Strain	Carrier	Mean No. of Micro filariae /20 cu mm	No. of Mosquitoes fed on carrier	No. of Mosquitoes Dissected	Percentage Positive for Infection	Mean No. of Filaria Larvae per Mosquito-Dissected	Mean No. of Infective Larvae per Mosquito Dissected
1	Jaffna	5	30	44	39	94.90	11.9	7.10
	Mannar	5	30	43	36	94.40	5.6	3.50
	Peliyagoda	5	30	44	41	87.80	3.8	1.30
	Jaffna	6	51	31	28	92.90	13.1	6.64
	Mannar	6	51	24	23	91.30	9.7	7.16
	Peliyagoda	6	51	27	24	83.30	9.0	3.79
2	Trincomalee	1	23	46	38	92.11	6.7	5.18
	Nuwara Eliya	1	23	36	28	92.86	7.9	5.82
	Peliyagoda	1	23	13	12	92.31	4.8	3.75
	Trincomalee	2	24	8	8	87.50	3.6	2.88
	Nuwara Eliya	2	24	3	3	66.66	3.3	3.00
	Peliyagoda	2	24	5	3	66.66	1.0	1.00
3	Badulla	3	29	29	26	65.38	5.2	2.31
	Kataragama	3	29	19	18	77.78	3.1	1.66
	Peliyagoda	3	29	37	36	69.44	2.9	2.03
	Badulla	4	47	14	12	75.00	9.4	4.50
	Kataragama	4	47	23	21	66.67	4.0	1.81
	Peliyagoda	4	47	23	18	83.33	8.3	1.83

Over 60 percent of the females from all populations tested were capable of surviving the incubation period of twelve days following the infecting blood meal. The mean number of infective larvae per mosquito dissected for each of these non-endemic areas did not indicate any significant difference from that of the endemic area.

Raghavan and Singh[3] have shown the importance of comparing the susceptibility levels of indigenous and genetically manipulated strains of *Cx. quinquefasciatus* to *Wuchereria bancrofti* in relation to developing techniques of genetic control. As there is evidence for genetic variation in *Culex pipiens* in susceptibility to *W. bancrofti*, and for the availability of a refractory strain of *Cx. quinquefasciatus* to *W. bancrofti*,[6] the hypothesis of solving the disease transmission problem by replacement of a susceptible strain of *Cx. quinquefasciatus* to *W. bancrofti* by a non-susceptible one[4] seems plausible.

The present study was carried out to establish whether *Cx. quinquefasciatus* populations existing outside the endemic area show any variation in their degree of susceptibility to *W. bancrofti*. If this were so, perhaps the reason for Bancroftian filariasis to be confined to an endemic belt in Sri Lanka could well be explained on genetic variation in the *Cx. quinquefasciatus* populations in susceptibility to *Wuchereria bancrofti*. Also, if the *Cx. quinquefasciatus* populations in the non-endemic areas proved to be non-susceptible to *W. bancrofti* then these populations could be used in subsequent replacement of the natural vector population in the endemic area which shows a high vectorial capacity. But, the present study has revealed that although only one mosquito population came from the endemic area, all populations showed a similarly high level of susceptibility to *W. bancrofti* when tested in the laboratory. Similar studies carried out by Magayuka and White [2] in Kenya and Tanzania have shown that *Cx. quinquefasciatus* populations from non-endemic areas were highly susceptible to *W. bancrofti*.

Also studies of Thomas and Singh [5] on the comparative susceptibility of *Cx. quinquefasciatus* Delhi strain and of strains cytoplasmically incompatible with it have shown that all strains tested were highly susceptible to *W. bancrofti* and indicated no consistent difference between the strains in their degree of susceptibility.

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