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THE ROLE OF ARTHROPODS IN THE TRANSMISSION OF LEPROSY[1]

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As Kirchheimer (1973) has pointed out, the unsatisfactory state of knowledge of the transmission of Hansen's disease is apparent from the disagreements about the portal of entry of Mycobacterium leprae into the human body. Weddell and his associates (1963) have cast doubt upon the belief in the prevalence of the dermal route of infection subscribed to by most leprologists. Furthermore, it is worth noting that not even the protagonists of the hypothesis of dermal entrance are in agreement among themselves on the nature of the infecting event. Some like Khanolkar (1963) have stressed the necessity of persistent and intimate contact with human cases of leprosy in an infectious state. Dungal (1960, 1961) on the other hand, comes out in favor of accidental infection by ectoparasites or parasites of the skin.

In the past, several workers (Munoz Rivas, G., 1942, McCoy and Clegg, M. T., 1949, Spickett, S. G., 1961) have reported the occurrence of acid-fast bacilli in the alimentary tract of arthropods. At the time these reports were made, and in fact until Shepard (1960) discovered that Mycobacterium leprae multiplies in typical fashion in mouse footpads it was not possible to either identify these bacteria as M. leprae or prove their viability. In consequence, the significance of these findings for the transmission of leprosy could not be assessed.

In view of the lack of knowledge of the mode of transmission of leprosy and because arthropods were thought to provide a possible mode of transmission, a joint study between Carville and the Jawaharlal Institute of Postgraduate Medical Education and Research was initiated in Pondicherry, India (1969). The specific objectives of the project are:

1. Determination of the species of arthropods found in endemic areas and likely to transmit the disease by virtue of their being able to pierce the skin.

2. Establishment of rate of occurrence of viable M. leprae in various species of arthropods, and their distribution in the body of the arthropods.

3. Determination of the length of survival of leprosy bacilli in the body of various arthropods. For this purpose the arthropods concerned were bred in the laboratory, fed on patients with lepromatous leprosy and studied at various intervals after feeding.

[1]Discussion.

4. Determination of infestation rate in arthropods most likely to be involved in the transmission of leprosy on account of their biological characteristics, carrier-rate and length of survival of the leprosy bacilli within the arthropod.

At this stage of the investigation one can give the following answers to these queries. In the endemic Pondicherry area, Anopheles, Culex, Cimex and Pediculus capitis occur very frequently. All these arthropods have been shown to be carriers of non-cultivable acid-fast bacteria (Narayanan, et al. 1972a).

Laboratory-bred Culex fatigans and Cimex hemipterus were found to be able to frequently take up leprosy bacilli from the blood of patients with untreated lepromatous leprosy and that the bacilli stay alive for at least several hours (Narayanan, et al. 1972).

It has been shown by Narayanan, et al. (1972a) that some Culex fatigans mosquitoes in the field in the leprosy endemic area of Pondicherry and surroundings harbour viable M. leprae.

Distribution of single lesions of tuberculoid leprosy correlates with skin areas exposed to insect bites in accord with differences in male and female clothing patterns (Bedi, et al. 1975). Tables 1 to 5 give numerical data of these findings.

Table 1. Acid-fast bacilli seen in pools of arthropods.

	Patients' Collections	Random Collections
Anopheles	0/218	19/246
Culex	4/111	20/292
Culex + Anopheles	8/36	—
Cimex	3/62	9/98
Pediculus	4/54	0/44
Sarcoptes	1/1	2/3

Table 2. Mycobacterial growth on Lowenstein-Jensen medium.

	Patients' Collections	Random Collections
Number arthropod pools	384	584
Pools microscopically positive	23/384 (6)*	50/584 (8.6)
Number positive cultures	6/384 (1.6)*	5/584 (0.9)

*Numbers in parentheses are percentages of positive findings.

Table 3. Mouse foot pad growth of acid-fast bacteria from Culex fatigans pools.

	Patients' Collections	Random Collections
Number of pools	15	32
Number of times mouse foot-pad growth positive	1/15	1/32

Table 4. M. leprae bacteremia in leprosy.

	No. of cases	No. of cases with bacteremia
Lepromatous leprosy (untreated)	38	38(100)*
Lepromatous leprosy (DDS < one year)	43	18(41.9)*
Lepromatous leprosy (DDS > one year)	70	16(22.9)*
Borderline leprosy (not further classified)	20	5(25)*
Tuberculoid leprosy	15	0

*Numbers in parentheses are percentages of bacteremia.

Table 5. M. leprae in Culex fatigans and Cimex hemipterus following blood-meal from untreated lepromatous patients.

	No. of feedings	No. of feedings M. leprae found
Culex fatigans	38	27(70)*
Cimex hemipterus	35	18(50)*

*Numbers in parentheses are percentages of positive findings.

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