

NATURAL AND EXPERIMENTAL INFECTIONS OF LEPTOMONAD FLAGELLATES IN PANAMANIAN *PHLEBOTOMUS* SANDFLIES

In the course of studies on the leishmaniasis transmission problem in Panama, wild-caught *Phlebotomus* sandflies have been dissected from time to time in the search for natural infections. In January 1961 there were found for the first time infections with leptomonad flagellates indistinguishable morphologically from *Leishmania*. In the following seven months a total of 198 females were found infected out of 3,112 dissected (over-all infection rate 6.4 per cent), representing six species of *Phlebotomus* from four areas in Panama where American cutaneous leishmaniasis is endemic. Five of the six species (*trapidoi*, *ylephiletor*, *gomezi*, *sanguinarius*, *panamensis*) are the most common man-biting forest sandflies. The sixth species, *shannoni*, is occasionally taken in our regular collections on man or horses. In addition, 109 females of 13 other species were negative, as were also 240 males of three common species.

Most of the sandflies dissected were taken at night on man or horses. A few daytime collections from buttresses and tree trunks provided a small sample of those species which are not attracted to man or horses.

The infection rate increased with the onset of the rainy season in May, from 3.8 per cent to 9.4 per cent. This was especially marked in the case of two species, *trapidoi* and *ylephiletor*, with dry-season rates of 5.8 per cent and 5.1 per cent respectively, which increased to 16.5 per cent and 15 per cent, with over-all rates for these two species of 12.5 per cent and 12 per cent.

The source of these infections is as yet unknown. One common species, *panamensis*, with the lowest infection rate (1.95 per cent), is rare in 36-foot platform catches, an indication that the reservoir animal may be chiefly arboreal and hence more accessible to the other species which frequent canopy as well as ground level.

Unlike the classic pattern of growth in the

anterior part of the sandfly midgut in the case of *Leishmania donovani* and *L. tropica*, the flagellates in our natural infections are characteristically found in the hindgut, with occasional heavy infections of the midgut and, in one case, a massive infection of the pharynx. About a third of the infected flies also have flagellates in the malpighian tubules. In a series of sandflies artificially infected by feeding on cultures of human Panamanian strains of *Leishmania*, the same pattern of hindgut infections also occurred, together with heavy growth at the proventricular valve and in a few cases massive invasion of the pharynx.

Pure cultures of the leptomonads have been recovered 44 times from five species of the naturally infected sandflies. Inoculated intradermally into the tip of the nose of hamsters, one strain (from *trapidoi*) has produced a typical infection, a non-ulcerated swelling rich in L-D bodies, the tissue form of *Leishmania*. In these cultures there are at least two morphological types, which suggests the probability that we are dealing with more than one species of *Leishmania* or other leptomonad.

Experimental infections of hamsters have been produced with cultures of human strains of *Leishmania* from Panama, Guatemala, and Peru. Two species of laboratory-reared sandflies have been infected by feeding on hamster lesions produced by strains from all three countries: 244 females fed in 25 trials, 88 infected (*sanguinarius* 55 of 146, *gomezi* 33 of 98). With the Guatemalan strain the flagellates tended to be confined to the midgut, while with the Panamanian and Peruvian strains most of the sandflies had hindgut infections along with moderate to heavy infections of the midgut. This work was supported in part by a research grant (E-1251) from the National Institute of Allergy and Infectious Diseases, N.I.H., U.S.P.H.S.—PHYLLIS T. JOHNSON, ELLIOTT MCCONNELL AND MARSHALL HERTIG, *Gorgas Memorial Laboratory, Panama, R. P.*