Suncus as a Potential Reservoir of Leptospirosis: The Example of the Shrew
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MICROBIOLOGY DEPARTMENT

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ADMINISTRATIVE INFORMATION

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SUNCUS AS A POTENTIAL RESERVOIR OF LEPTOSPIROSIS: THE BLAMING OF THE SHREW†

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INTRODUCTION

Although the role of the rodent as a source of leptospiral transmission in Southeast Asia and elsewhere has been subjected to considerable study, little attention has been paid to that familiar commensal insectivore, the musk or house shrew, Suncus murinus, family Soricidae.

These ubiquitous little creatures (Fig. 1) are readily found in close proximity to man, in dwellings, outbuildings, villages and grassy areas throughout Asia and the Pacific islands. Because they often come indoors where they may feed on and excrete on their hosts' foods, and because they may in turn serve as snacks for household cats and dogs, they serve as potential sources of infection for man, his pets and his livestock.

It is quite probable that leptospirae have been previously isolated from musk shrews. However, no such reports have been found in the journals, reprints, or references available to the authors. Smith et al. (1961) isolated no leptospirole from kidneys of 42 Malaysian Suncus murinus, but found 2 of 26 sera positive for antibodies.

Aragon et al. (1965) isolated no leptospirae from kidneys of 105 Suncus luzoniensis, the Philippine variety of S. murinus. They did not test sera for antibodies.

A preliminary report of our isolations from Philippine shrews as well as from a number of other hosts has recently been reported. (Carlos et al. 1970). Although we consider S. luzoniensis to be synonymy of S. murinus, this report will use luzoniensis as the species name of the Philippine shrews. In the report below evidence is presented of the isolation of leptospirae, two from Suncus luzoniensis trapped in the Philippines and two from Suncus murinus trapped in Taiwan, Republic of China. Results of a limited number of serologic tests for leptospiral antibodies are also shown.

MATERIALS AND METHODS

Shrews were live-trapped at a pig farm in Chu-Nan, about 35 miles southwest of Taipei, Taiwan, and at the U.S. Naval Station.
Sangley Point, on the outskirts of Manila, Republic of the Philippines.

Anaesthetized animals were exsanguinated by cardiac puncture. Bloods were saved for serologic testing. Kidneys were ground up. aliquots of 1:10 were inoculated into Fletcher's medium and observed for 28 days for leptospiral growth. Serologic and isolation procedures were based on the methods of Galton et al. (1962).

Positive cultures were subcultured in Korthof's medium for testing against standard antisera and in Fletcher's medium for use as live antigen for immunizing adult rabbits. Provisional identifications made at NAMRU-2 were subsequently confirmed by the Leptospirosis Unit, National Communicable Disease Center, Atlanta, Georgia, U.S.A.

Sera were tested for the presence of leptospiral antibodies using both the macroscopic slide agglutination test and the microscopic agglutination test. In the former test, agglutination by undiluted serum of any of five pools of 15 formalized leptospiral antigens was the first screen for positives. In the latter test, agglutinin titers at a serum dilution of 1:100 or greater of any of 22 live leptospiral serotypes (L. ballum, canicola, icterohaemorrhagiae, bataeae, grippotyphosa, pyrogenes, manilae, autumnalis, pomona, hebdomadis, australis, tarassovi, wolfii, javanica, cynopteri, djasimuna, butembo, patoc 1, sejroe, medanensis, and pai) were considered positive.

RESULTS

Twenty-eight Suncus murinus (Fig. 1) trapped around the confines of a pig farm in Chu-nan, Taiwan, in January 1968 and eleven Suncus luzonensis trapped in the area of the Officers' Swimming Pool (Fig. 2) at the Sangley Point Naval Station, Republic of the Philippines, in September and October 1969, were tested for leptospiral infection. Results are shown in Table 1.
Table 1

Leptospira in Taiwan and Philippine Shrews, Isolations and Serologic Results.

<table>
<thead>
<tr>
<th>Isolation</th>
<th>Serology*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Taiwan</td>
</tr>
<tr>
<td>Shrews tested</td>
<td>28</td>
</tr>
<tr>
<td>Shrews positive</td>
<td>2</td>
</tr>
</tbody>
</table>

* Agglutinin titer of 1:100 or greater was considered positive.
** Four contaminated sera are omitted from the table.

positive. Characteristics of the positive results are shown in Table 2. The four positive Taiwan sera reacted against L. javanica antigen while the two positive Philippine sera reacted against L. bataviae antigen. The serum of the shrew from which L. grippotyphosa organisms were recovered had a relatively low antibody response against its own isolate. It is felt that this shrew probably had a prior infection of L. bataviae.

Table 2

Characterization of Positive Results.

<table>
<thead>
<tr>
<th>Serotype of Isolate</th>
<th>Serotype and Titer of Antibody</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philippine Shrew # 1</td>
<td>Grippotyphosa 1:50</td>
</tr>
<tr>
<td>Philippine Shrew # 2</td>
<td>Bataviae 1:400</td>
</tr>
<tr>
<td>Taiwan Shrew # 1</td>
<td>Javanica 1:400</td>
</tr>
<tr>
<td>Taiwan Shrew # 2</td>
<td>Javanica 1:400</td>
</tr>
<tr>
<td>Taiwan Shrew # 3</td>
<td>No isolation</td>
</tr>
<tr>
<td>Taiwan Shrew # 4</td>
<td>No isolation</td>
</tr>
<tr>
<td>Taiwan Shrew # 5</td>
<td>No isolation</td>
</tr>
</tbody>
</table>

DISCUSSION

Although the Philippine shrew bears the name S. ilzonensis it is thought by some to be virtually indistinguishable from S. murinus (Johnson, 1962). The shrew, a native of Asia, has spread, probably due to man, to most of the islands of Southeast Asia (De Vos et al. 1956).

Although their life patterns and habits have not been studied in any great detail they appear to occupy an intermediate ecologic niche between the essentially interior house mouse and the essentially exterior commensal rats. They are found occasionally inside homes but nest and generally forage and scavenge outside in village and farmyard.

In Malaysia they are “confined to the immediate neighborhood of houses” (Harison, 1955), while on Guam they are trapped not only around dwellings but on hilltops, in jungles, marshes and areas at least a half mile from the nearest housing (Barbehenn, 1962).
The average weight of Malaysian shrews was 50 grams (Harrison, 1955). Those on Guam were only 26 grams. (Barbehenn, 1962). Our Philippine shrews averaged 45 grams while the Taiwan shrews averaged 48 grams. Although shrews are primarily insectivores they have been observed to eat baby chicks, grain, fruit, newborn rodents (Barbehenn, 1962; Harrison and Lim, 1950), earthworms, biscuits, flour and rice (Harrison, 1962). However, since it is a poor climber and probably lacks the propensity to gnaw into cartons, it is much less likely to contaminate human foodstuffs than the commensal rats (Barbehenn, 1962).

Their role in the cycle of zoonotic infections has not been intensively studied. Nothing is known of the diseases and parasites of the shrew on Guam (Barbehenn, 1962). Recently rabies virus was isolated from shrews on Guam (J. W. Glosser and E. P. Yarnell, unpublished results). Shrews have been incriminated as being naturally infected with the plague bacillus Pasteurella pestis in India, Taiwan, Cambodia, and China. (Pollitzer and Meyer, 1961). They have apparently not been incriminated as a host for scrub typhus. In a limited study in Indonesia no ickelesiae or Pasteurella pestis were isolated from the spleens of 39 (Kundin, to be published). Fifty fleas were recovered from these shrews, 46 of which were Xenopsylla cheopis. Fifty-three trombiculid mites (not yet identified) were recovered from the ears of 17 shrews examined.

In spite of the apparent lack of incrimination of Suncus in other zoonotic infections, the isolations of leptospirae from shrews trapped in areas where livestock are kept and where people reside (and where they swim) serve to indicate that man may have considerable contacts with this organism through the mediation of the Suncus.

The ease with which the leptospirae were isolated from shrews trapped in two widely divergent islands, tropical Luzon and temperate Taiwan, serves to emphasize not only the ubiquity of the commensal musk shrew but the ubiquity of leptospirae as well. The length of time which a shrew can remain infected and infectious is not known. Since the infected shrews appeared normal at autopsy, it is probable that, as with certain rats, they may remain infectious for life. (Smith et al., 1961).

In our studies we found three different serotypes (javanica, grippophyosa, and bartaviae) in the four isolates and serologic evidence of javanica and bartaviae. In Malaysia Smith et al. (1961) reported antibodies to saxkoebing and autunnalis in two seropositive shrews. It thus appears that the shrew may be host to a wide range of leptospiral serotypes.

SUMMARY

Although the isolation of leptospirae from the mask shrew: Suncus has not previously been reported, the agent was recovered with no great difficulty from two Suncus murinus in Taiwan and from two Suncus taxunensis in the Philippines. The Taiwan isolates were both of the javanica serotype while the Philippine isolates were grippophyosa and bartaviae.

Because the shrew is a commensal creature living in close proximity to man, his pets, his livestock, and his food, it is suggested that this little insectivore may play a hitherto unsuspected role in the transmission of urban as well as rural leptospirosis in Asia and the Pacific islands.

REFERENCES


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<table>
<thead>
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<th>KEY WORDS</th>
<th>LINK A ROLE</th>
<th>LINK B ROLE</th>
<th>LINK C ROLE</th>
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<tr>
<td>Leptospirosis</td>
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<td>Suncus murinus</td>
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<td>Philippines</td>
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<td>Shrew</td>
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