ST. LOUIS ENCEPHALITIS IN PANAMA

III. INVESTIGATION OF LOCAL MAMMALS AND BIRDS AS POSSIBLE RESERVOIR HOSTS

ENID DE RODANICHE AND PEDRO GALINDO

Gorgas Memorial Laboratory, Panama, Republic of Panama
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Gorgas Memorial Laboratory, Panama, Republic of Panama

In 1958 a focus of infection with the virus of St. Louis encephalitis (SLE) was encountered in the Province of Darién near the Colombian border of Panama. Details concerning the isolation of the virus and the immune status of the local population appeared in previous publications.\textsuperscript{1,2} The present report summarizes results of a survey of the fauna of the region for antibodies against SLE virus and attempts to recover virus from avian blood. Birds have been strongly incriminated in the epidemiology of this disease. The virus was isolated from natural infections in a nestling dove by Downs et al.\textsuperscript{5} and in a flicker by Ranzenhofer et al.\textsuperscript{6} Furthermore, high levels of serum antibody have been demonstrated in avian blood during field surveys\textsuperscript{4,6} and experimental infections have been readily produced.\textsuperscript{7-11}

MATERIALS AND METHODS

Blood samples were collected during a period of about 2 months from the end of February to the middle of April, 1959. Animals were obtained by shooting or trapping and were bled in the field by cardiac puncture. The blood specimens were then packed in ice and transported from Paya to El Real by boat and from El Real to Panama by plane.

The great majority arrived in satisfactory condition although a few were discarded because of excessive hemolysis. A total of 248 specimens was examined, 139 from mammals, 107 from birds and 2 from reptiles.

All were tested for neutralizing antibodies against SLE virus. The majority of those giving positive reactions to SLE were retested against yellow fever and Ihéus viruses as an aid in the interpretation of the specificity of the result. The limiting factor was the quantity of serum available. In addition, 48 avian sera were injected intracerebrally into suckling mice for possible virus isolation.

Virus strains and techniques were as previously described,\textsuperscript{2} except that preliminary screening of sera was performed with a single concentration of virus, 30 to 50 LD\textsubscript{50} per inoculum. Where sufficient serum was available, specimens giving a positive reaction in the screening test were titrated against higher concentrations of virus.

RESULTS

Results of the neutralization tests are presented in Tables 1 and 2. Except for 2 of 39

\begin{table}[h]
\centering
\begin{tabular}{lrr}
\hline
Species & Total no. & No. pos. \\
\hline
Herons & 10 & 3 \\
Chickens & 22 & 0 \\
Tinamous & 2 & 0 \\
Guans & 6 & 1 \\
Ducks & 7 & 0 \\
Cormorants & 8 & 1 \\
Hawks & 10 & 1 \\
Vultures & 3 & 1 \\
Parrots and macaws & 4 & 0 \\
Kingfishers & 19 & 0 \\
Toucans & 6 & 3 \\
Woodpeckers & 3 & 0 \\
Miscellaneous birds* & 7 & 1 \\
Bats & 23 & 0 \\
Marsupials & 39 & 0 \\
Spiny rats & 39 & 2 \\
Rats and mice & 5 & 0 \\
Pacas & 3 & 0 \\
Kinkajous & 3 & 0 \\
Monkeys & 21 & 0 \\
Miscellaneous animals† & 8 & 0 \\
\hline
Total & 248 & 13 \\
\hline
\end{tabular}
\caption{Results of mouse protection tests with vertebrate sera against St. Louis encephalitis virus}
\end{table}

* Includes one anhinga, one rice grackle, one jay and one jacana.
† Includes one squirrel, one peccary, two agoutis, two anteaters, and two iguanas.

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Table 2

Results of neutralization tests (NT) against yellow fever and Ihléus viruses with sera positive to St. Louis encephalitis

<table>
<thead>
<tr>
<th>Species</th>
<th>Total</th>
<th>No. pos. against SLE and titer*</th>
<th>Results of NT against</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yellow fever</td>
</tr>
<tr>
<td>Cathartes aura (turkey vulture)</td>
<td>2</td>
<td>1 (2.2)</td>
<td>Neg.</td>
</tr>
<tr>
<td>Anhinga anhinga (water turkey)</td>
<td>1</td>
<td>1 (3.1)</td>
<td>Neg.</td>
</tr>
<tr>
<td>Phalacrocorax olivaceus (cormorant)</td>
<td>8</td>
<td>1 (&lt;4.0)</td>
<td>Neg.</td>
</tr>
<tr>
<td>Nycticorax nycticorax (heron)</td>
<td>1</td>
<td>1 (at least 1.3)†</td>
<td>Neg.</td>
</tr>
<tr>
<td>Florida caerulea (heron)</td>
<td>6</td>
<td>1 (3.1)</td>
<td>Not tested</td>
</tr>
<tr>
<td>Butorides virescens (heron)</td>
<td>1</td>
<td>2 (at least 1.3)</td>
<td>One neg., one pos.</td>
</tr>
<tr>
<td>Rhamphastos swainsonii (toucan)</td>
<td>2</td>
<td>1 (at least 1.3)</td>
<td>Pos.</td>
</tr>
<tr>
<td>Rhamphastos sulfuratus (toucan)</td>
<td>3</td>
<td>1 (&lt;4.0)</td>
<td>Pos.</td>
</tr>
<tr>
<td>Penelope cristata (guan)</td>
<td>5</td>
<td>1 (&lt;4.0)</td>
<td>Neg.</td>
</tr>
<tr>
<td>Unidentified Accipitridae (hawk)</td>
<td>2</td>
<td>1 (3.1)</td>
<td>Pos.</td>
</tr>
<tr>
<td>Proechimys semispinosus (spiny rat)</td>
<td>30</td>
<td>2 (2.0 and 1.7)</td>
<td>Not tested</td>
</tr>
</tbody>
</table>

* Titer given as logs neutralized.
† Insufficient serum for further titration.

Proechimys semispinosus, no mammal gave a positive neutralization test against SLE virus. These two Proechimys were also weakly positive to yellow fever. Sera from 11 wild birds (10.3%) neutralized SLE virus, three of these in titer of more than 4 logs. Six also gave positive reactions to Ihléus virus in low titer and three to yellow fever.

Forty-eight of the avian sera were injected intraocularly into infant mice but no SLE virus was isolated. An as yet unidentified virus was recovered twice, however, once from the hawk, Helicocolis hamatus, and once from the woodpecker, Dryocopus lineatus. Birds tested were all adults. No blood specimens were obtained from fledglings.

Discussion

Since SLE virus was not isolated from the blood of any of the vertebrates here described, it is impossible to affirm that the positive neutralization tests obtained against this virus were specific. It is of interest, however, that 6 of the 11 positive avian sera were single positives (if we disregard the low titers obtained against Ihléus virus which, immunologically, is closely related to SLE). In view of the well established evidence incriminating birds in the epidemiology of SLE in other countries, it seems highly probable that they play an important role in Panama also. Contrary to the experiences of others, we did not find any positives to SLE virus among 22 chicken sera. Wild birds seem to be the preferred hosts in this area.

Summary

Two hundred and forty-eight blood samples obtained from 139 mammals, 107 birds and 2 reptiles were tested for neutralizing antibodies against St. Louis encephalitis virus. Eleven, or 10.3%, of the avian specimens and two, or 1.4%, of the mammalian specimens neutralized this virus.

References


