STUDIES ON ADULT MOSQUITO VECTORS OF JAPANESE ENCEPHALITIS IN A PIG FARM IN SELANGOR, MALAYSIA

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Abstract. Mosquito collections were carried out for a period of one year from January to December 1992 in a pig farm in Sungai Pelek, Selangor, Malaysia. A total of 41,022 mosquitos belonging to 52 species and 20 genera were collected. Culex tritaeniorhynchus and Cx. gelidus, the important vectors, comprised 63% of all mosquitos collected. Both these species were collected in large numbers during the wet months of May and December. The other predominant species in that area were Cx. fuscocephala, Cx. quinquefasciatus, Cx. sitiens, Aedes butleri, and Armigeres subalbatus.

INTRODUCTION

Japanese encephalitis (JE) virus was isolated in Malaysia for the first time in 1952 (Paterson et al, 1952). Later the presence of JE virus in Peninsular Malaysia and Sarawak was further demonstrated by Pond et al (1954), McCrumb (1955) and Simpson et al (1970). JE virus infection existed in a variety of animals in Malaysia namely pigs, bovines, dogs, goats and sheep (Pond et al, 1954) and in mosquitos (Simpson et al, 1974).

The disease has been monitored by the Institute for Medical Research from 1970 onwards. The number of clinically diagnosed cases notified to the Ministry of Health ranged from 37 to 92 per year and mortality ranged from 2-15 (Sinniah, 1989). JE occurs almost in every state in Malaysia with a greater number of cases occurring in Penang, Perak, Selangor and Johore in West Malaysia and Sarawak in East Malaysia. It has also been noted that there is no definite seasonal pattern and JE cases have been observed all year round (Fang et al, 1989).

However, studies on the epidemiology of JE by JE vector survey have been lacking in Peninsular Malaysia, while in Sarawak extensive studies have been carried out by Simpson et al (1970, 1974), Hill (1970), Macdonald et al (1965, 1967).

In view of the paucity of data, this study was undertaken with the following objectives: 1) to isolate JE virus from naturally infected mosquitos and 2) to monitor the seasonal density of suspected mosquito vectors. The results of the virus isolation attempts will be reported elsewhere. This study describes the results of the entomological surveys carried out in Sungai Pelek Selangor between January and December 1992.

MATERIALS AND METHODS

Study area

The study area is situated in Sungai Pelek, in Sepang District which is about 80 km south of Kuala Lumpur. Pig farming is the main livelihood of the people in this area. The pig farms are situated behind the town and are surrounded by oil palms. The pig sites are built of cement and have a thatched roof. Each pig farm has a few hundred pigs. Close to the pig farms are houses constructed of brick. The surrounding drainage is of poor quality and always filled with sullage water. Besides pigs the other animals present in this area are dogs, goats, chickens and ducks. The people living in this area are predominately ethnic Chinese with some Indian agricultural workers.

Mosquito collections

The study was standardized as follows: a) CDC light traps: CDC battery operated light traps baited with CO₂ were used throughout the study. The traps were operated between 1800 and 0700 hours for three days each month. The traps were placed in or near to the pig sties. Carbon dioxide gas was obtained from dry ice placed in an insulated, sealed wooden box 15 cm × 15 cm × 15 cm suspended adjacent to the light trap. Gas was supplied to the trap through a rubber tube from the box. The tube was placed near to the trap
entrance, close to the light source. The light traps were located at the same site throughout the study. b) Landing catches: Landing catches on human bait were conducted outdoors near to human habitation by a team of three men commencing at 1900 and terminating at 2100 hours. The men using flash-lights actively collected with 50 x 19 mm vials those mosquitos landing on them. After collection the tube was plugged with cotton wool. All mosquitos caught were identified while alive, in the tube, grouped according to species, recorded and then killed by placing them on to dry ice. The trap bags containing mosquitos were placed on dry ice to be killed and then sorted according to species, recorded and pooled. Pools of mosquitos, 50 per tube, were then placed in liquid nitrogen and brought back to the laboratory for virus isolation. The results of virus isolation attempts will be reported elsewhere.

RESULTS

A total of 32,706 mosquitos belonging to 9 genera and more than 50 species were identified from light trap collections and a total of 8,316 mosquitos belonging to 6 genera were caught in human landing catches from Sungai Pelek as shown in Table 1. The species composition seems similar in both catches but more species were obtained in light trap collections.

In light trap collections Cx. tritaeniorhynchus Giles was the predominant species comprising 62.3% of the total catch. This was followed by Cx. gelidus Theobald and Cx. fuscocephala Theobald comprising 16.5% and 3.2% respectively. In the Aedes group Aedes butleri Theobald comprised 3.3% of the total collection. This was followed by Cancrædes sp (1.6%). Armigeres subalbatus comprised 1.7% in the Armigeres group. Mansonia mosquitos were obtained only in small numbers. In the Anopheles group An. kochi and An. separatus were found in larger numbers than other species.

In landing catch, Cx. sitiens was the largest number caught in the Culex group, followed by Cx. quinquefasciatus, Cx. fuscocephala and Cx. tritaeniorhynchus. Overall Ar. subalbatus was caught in large numbers compared to other species. This was followed by Ae. butleri.

The prevalence of predominant Culex species expressed as Williams Mean is shown graphically

<table>
<thead>
<tr>
<th>Species</th>
<th>No. captures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light traps</td>
<td>Landing catch</td>
</tr>
<tr>
<td>Culex</td>
<td></td>
</tr>
<tr>
<td>(Culex) bitaeniorhynchus</td>
<td>6</td>
</tr>
<tr>
<td>fuscocephala</td>
<td>1,034</td>
</tr>
<tr>
<td>gelidus</td>
<td>5,402</td>
</tr>
<tr>
<td>pseudovishnui</td>
<td>42</td>
</tr>
<tr>
<td>quinquefasciatus</td>
<td>966</td>
</tr>
<tr>
<td>sinensis</td>
<td>5</td>
</tr>
<tr>
<td>sitiens</td>
<td>666</td>
</tr>
<tr>
<td>tritaeniorhynchus</td>
<td>20,391</td>
</tr>
<tr>
<td>vishnui</td>
<td>106</td>
</tr>
<tr>
<td>whitmorei</td>
<td>4</td>
</tr>
<tr>
<td>Misc sp</td>
<td>10</td>
</tr>
<tr>
<td>(Culicimomyia) fragilis</td>
<td>11</td>
</tr>
<tr>
<td>nigropunctatus</td>
<td>51</td>
</tr>
<tr>
<td>spathifurca</td>
<td>54</td>
</tr>
<tr>
<td>(Lophoceraomitya) cinctellus</td>
<td>8</td>
</tr>
<tr>
<td>sp</td>
<td>6</td>
</tr>
<tr>
<td>(Lutizia) fuscanus</td>
<td>9</td>
</tr>
<tr>
<td>Culex sp</td>
<td>28,748</td>
</tr>
</tbody>
</table>

Aedes | |
| (Aedimorphus) caecus | 1 | 2 | 3 |
| vexans | 293 | 92 | 385 |
| (Banksinella) lineatopennis | 23 | 98 | 121 |
| (Canraedes) masculinus | 508 | 857 | 1,365 |
| (Lorraiæa) amesi/fumidas | 40 | - | 40 |
| (Mucidus) aurantius | 8 | 11 | 19 |
| laniger | 1 | 1 | 2 |
| (Parades) collesi | 6 | 31 | 37 |
| (Rhinostusao) longirostris | 13 | - | 13 |
| (Stegomyia) albopictus | 35 | 629 | 664 |
| (Verrallinia) butleri | 1,083 | 1,746 | 2,829 |
| Aedes sp | 2,034 | 3,467 | 5,501 |

Armigeres | |
| (Armigeres) confusus | - | 1 | 1 |
| kesselti | 26 | 352 | 378 |
| malaviy | - | 1 | 1 |
| subalbatus | 562 | 3,042 | 3,604 |
| sp | 20 | - | 20 |
| Armigeres sp | 608 | 3,396 | 4,004 |
MOSQUITO VECTORS OF JAPANESE ENCEPHALITIS

Mansonia
(Mansonia) annulifera
uniformis
2 25 27
216 196 412

Mansonia sp
218 221 439

Coquillettidia
(Coq) crassipes
1 1 2

Minomyia
(Etor) luzonensis
22 - 22

Uranotaenia sp
180 - 180

Aedeomyia castastica
1 - 1

Anopheles
(Anoph) baecaz
barbirostris
30 4 34
lesteri
22 64 86
nigerirmus
1 - 1
sinensis
27 21 48
separatus
232 160 392
umbrosus
15 - 15
hyrcanus
34 16 50
Misc sp
72 3 75

(Cellia) kochi
282 1 283
sundaicus
2 5 7
tesselatus
3 - 3
vagus
1 - 1

Anopheles sp
894 276 1,170

Total
32,706 8,316 41,022

DISCUSSION

In our light trap collections Cx. tritaeniorhynchus and Cx. gelidus follow the rainfall pattern. The numbers of both species increased with the rise in rainfall in May and December. During the dry months of March and April both species were found in low numbers. The other species of Culex although found in smaller numbers, also seem to follow the rainfall pattern. However Cx. quinquefasciatus appears to decrease with heavy rainfall.

In Sarawak JE virus has also been isolated from Cx. gelidus, Ma. uniformis, Mansonia species and Anopheles species (Simpson et al, 1970), while in India JE virus has been isolated from Cx. tritaeniorhynchus, Cx. pseudovishnui, Cx. vishnui, An. barbirostris, An. hyrcanus, An. subpictus, Ma. annulifera, Cx. gelidus, Cx. fuscoccephala and Cx. quinquefasciatus (Chakravarti et al, 1981; George et al, 1987; Rodrigues et al, 1980; Mourya et al, 1989). It is interesting to note that most of these
species were present in our study area.

Macdonald et al (1967) showed that Cx. tritaeniorhynchus bites pigs more readily than man. In our study 25% of this species of mosquito caught in light traps were blood fed. Also in landing catches the Cx. tritaeniorhynchus was caught in small numbers compared to other species. All night catches need to be carried out using a pig baited trap to determine the peak biting time and the man : pig biting ratio.

The abundance of vector species and its seasonal variation has a bearing on disease transmission. Since the incidence of JE virus in this country is low and fairly evenly distributed throughout the year (Fang et al, 1980), further extensive collection have to be carried out over the coming years in order to correlate vector peaks and disease transmission. Virus isolation from mosquitoes will also give some indication of when infection is at its peak.

Cx. tritaeniorhynchus and Cx. gelidus constituted 79% of the light trap collections but the actual number of cases was not known. If these studies continue together with case detection and antibody surveys in pigs then it should be possible to determine the density of vector mosquitoes required before a severe epidemic could occur.

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REFERENCES


