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 difinite 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 ofjectives : 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 livelyhood 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 CO_2 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 × 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 *Cancraedes* 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 1

Total number of mosquitos captured at Sg Pelek, Selangor January 1992-December 1992.

Species	No. captures		
	Light traps	Landing catch	Total
Culex			
(Culex) bitaeniorhynchus	6	-	6
fuscocephala	1,034	111	1,145
gelidus	5,402	62	5,464
pseudovishnui	42	11	53
quinquefasciatus	966	244	1,210
sinensis	5	1	6
sitiens	666	388	1,054
tritaeniorhynchus	20,391	94	20,485
vishnui	106	41	147
whitmorei	4	-	4
Misc sp	10	1	11
(Culicioniyia) fragilis	11	-	11
nigropunctatus	51	-	51
spathifurca	54	-	54
(Lophoceraomyia) cinctellus	8	-	8
sp	6	2	8
(Lutzia) fuscanus	9	-	9
Culex sp	28,748	955	29,703
Aedes			
(Aedimorphus) caecus	1	2	3
vexans	293	92	385
(Banksinella) lineatopennis	23	98	121
(Cancraedes) masculinus	508	857	1,365
(Lorrainea) amesii/fumidus	40	-	40
(Mucidus) aurantius	8	11	19
laniger	1	1	2
(Parades) collessi	6	31	37
(Rhinoskusea) longirostris	13	-	13
(Stegomyia) albopictus	35	629	644
(Verrallina) butleri	1,083	1,746	2,829
Aedes sp	2,034	3,467	5,501
Armigeres			
(Armigeres) confusus	-	1	1
kesseli	26	352	378
malayi	-	1	1
subalbatus	562	3,042	3,604
sp	20	-	20
Armigeres sp	608	3,396	4,004

Mansonia			
(Mansonia) annulifera	2	25	27
uniformis	216	196	412
Mansonia sp	218	221	439
Coquillettidia			
(Coq) crassipes	1	1	2
Minomyia			
(Etor) luzonensis	22	-	22
Uranotaenia sp	180	-	180
Aedeomyia catasticta	1	-	1
Anopheles			
(Anoph) baezai	173	2	175
barbirostris	30	4	34
lesteri	22	64	86
nigerrimus	1	-	1
sinensis	27	21	48
separatus	232	160	392
umbrosus	15	-	15
hycranus	34	16	50
Misc sp	72	3	75
(Cellia) kochi	282	1	283
sundaicus	2	5	7
tessellatus	3	-	3
vagus	1	-	1
Anopheles sp	894	276	1,170
Total	32,706	8,316	41,022

in Fig 1. *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.

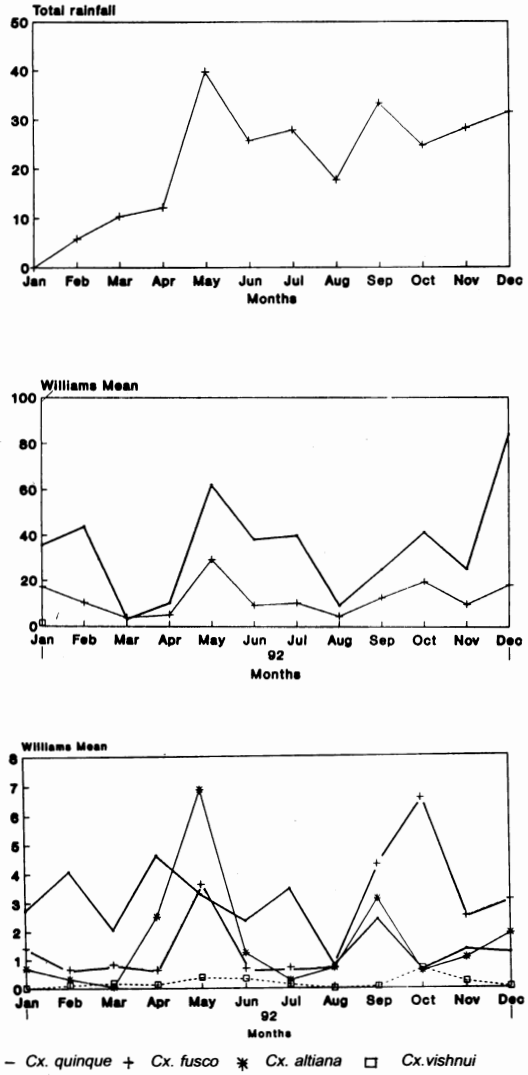

Fig 1—(A) Rainfall in Sg Pelex, Jan - Dec 1992. (B) Seasonal abundance of *Cx. tritaeniorhynchus* and *Cx. gelidus* expressed as Williams means. (C) Seasonal abundance of *Culex* sp expressed as Williams mean.

DISCUSSION

In our light trap collections *Cx. tritaeniorhynchus* and *Cx. gelidus* were the predominant species collected. In Sarawak the greatest number of virus isolates were obtained from *Cx. tritaeniorhynchus* (Simpson *et al*, 1970). In human landing catches the number of *Cx. tritaeniorhynchus* and *Cx. gelidus* caught were very low. Thus light traps baited with CO_2 seems to be an efficient collection method for *Culex* species.

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. bitaeniorhynchus, Cx. pseudovishnui, Cx. vishnui, An. barbirostris, An. hyrcanus, An. subpictus, Ma. annulifera, Cx. gelidus, Cx. fuscocephala* 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 mosquitos 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 mosquitos required before a severe epidemic could occur.

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