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A RE-SURVEY OF AEDES AEGYPTI AND AEDES ALBOPICTUS IN SABAH, MALAYSIA

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Di Sabah, Malaysia telah diadakan survey nyamuk Aedes aegypti dan Aedes albopictus dari bulan Augustus s/d September 1974 dan Maret-April 1975.
Survey dilakukan pada 5 daerah di Kudat. Pantai Barat, Pedalaman Sandahan danTawan dengan tujuan untuk melihat distribusi dan density dari kedua jenis nyamuk tsb. Hasil survey menunjukkan bahwa nyamuk A. aegypti telah menyebar pada hampir seluruh daerah pantai Sabah, dan ditemukan hampir pada sebagian besar kota2 dan daerah pedesaan di banyak desa. Di bandingkan dengan hasil survey yang pernah dilakukan pada tahun 1970 oleh Ramalingam ternyata terdapat pertambahan 24 persen daerah A. aegypti, dari 58.7 persen daerah A. albopictus selama 4 tahun. A. aegypti sangat biasa terdapat di desa2 pantai sebelah timur, dan ditempat-tempat lainnya menunjukkan Breteau index yang tinggi. Diduga adanya perahu2 dan tempat2 penampungan air merupakan faktor yang penting dalam penyebaran nyamuk. Walaupun tidak terdapat epidemi dengue dan demam berdarah di Sabah, tetapi ada indikasi risiko transmissi yang besar di daerah2 dimana Breteau index lebih dari 50. Dari hasil survey ini strategi pemberantasan A. aegypti dapat dikembangkan untuk mencegah terjadinya epidemi dengue dan demam berdarah.

Introduction of *Aedes aegypti* in Sabah is unknown, although it may have been present in Malaya about 1890 (Macdonald, 1957). The earliest reliable records date from 1920 when Stanton (1920) reported its presence in Jesselton (now Kota Kinabalu). A survey made by Ramalingam (1970) reported the presence of *A.aegypti* only in Semporna on the east coast. In a first extensive survey that included 39 town and villages, Macdonald and Rajapaksa (1972) found 15 to be positive for *A. aegypti*. It was the first time that such and extensive survey had been made in Sabah. The distribution of this species was also found to be discontinuous and although there was no plausible explanation for this, it was concluded "with reasonable confidence that, in the absence of control measures, this mosquito will become more widespread in Sabah" (Macdonald and Rajapaksa, 1972) Since then, no effective measures were taken to control this mosquito, the known vector of dengue/dengue haemorrhagic fever in Southeast Asia and the Western Pacific.

No cases of dengue haemorrhagic fever have yet been reported from Sabah although dengue fever occured in Labuan Island, off the West coast in 1969 (Ramalingam, 1970). In view of the geographical position of Sabah, the proximity of, and regular traffic with, the Philippines, Singapore and Peninsular Malaysia, it was felt that the risk of introduction is high. Moreover, there has been increasing evidence to show that *A.aegypti* is replacing *A.albopictus* at least in some parts of Southeast Asia (Rudnick et al.,1967). It is quite possible that this phenomenon can be brought about by progressive urbanization which tends to cause reduction in the amount of vegetation, outdoor shade and naturally occuring containers as habitats for mosquito breeding and an increase in the artificial containers. This has assisted in the establishement of *A.aegypti* the introduced species, and the displacement of *A. albopictus*.

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In view of the above, it becomes increasingly desirable to study the distribution of *A. aegypti* in the absence of control measures and some quantification of the levels of prevalence of the species so as to assess whether the infection could become established. It was with these objectives that the second statewide survey was conducted in 1974 and 1975 in Sabah.

MATERIALS AND METHODS

The surveys were conducted between August and September 1974 and between March and April 1975. The first period was towards the end, and the second period was in the early part of the south-west monsoon. These are probably the most favourable times of the year for the development of these species which depend upon rainfall to fill the small container habitats with water.

Selection of the localities for these surveys her done on the basis of geographical location but mainly restricted to coastal zones at sea level, nature of locality, e.g. urban (consisting of shop houses which are contiguous to each other, with little or no vegetation), rural (consisting of kampong houses generally scattered with vegetation and/or garden) or mixed; distance from the chief means of communication, such as roads, rail rivers, air and sea so that both the remote and easily accessible areas in the west and east coasts are represented.

Once the area was selected, the single-larva collection method (Sheppard *et al.*, 1969) was adopted. The larval habitats were grouped into six categories—indoors and outdoors jars, drums and miscellaneous containers.

This method allowed the following indices to be measured and compared from one locality with another and from year to year:

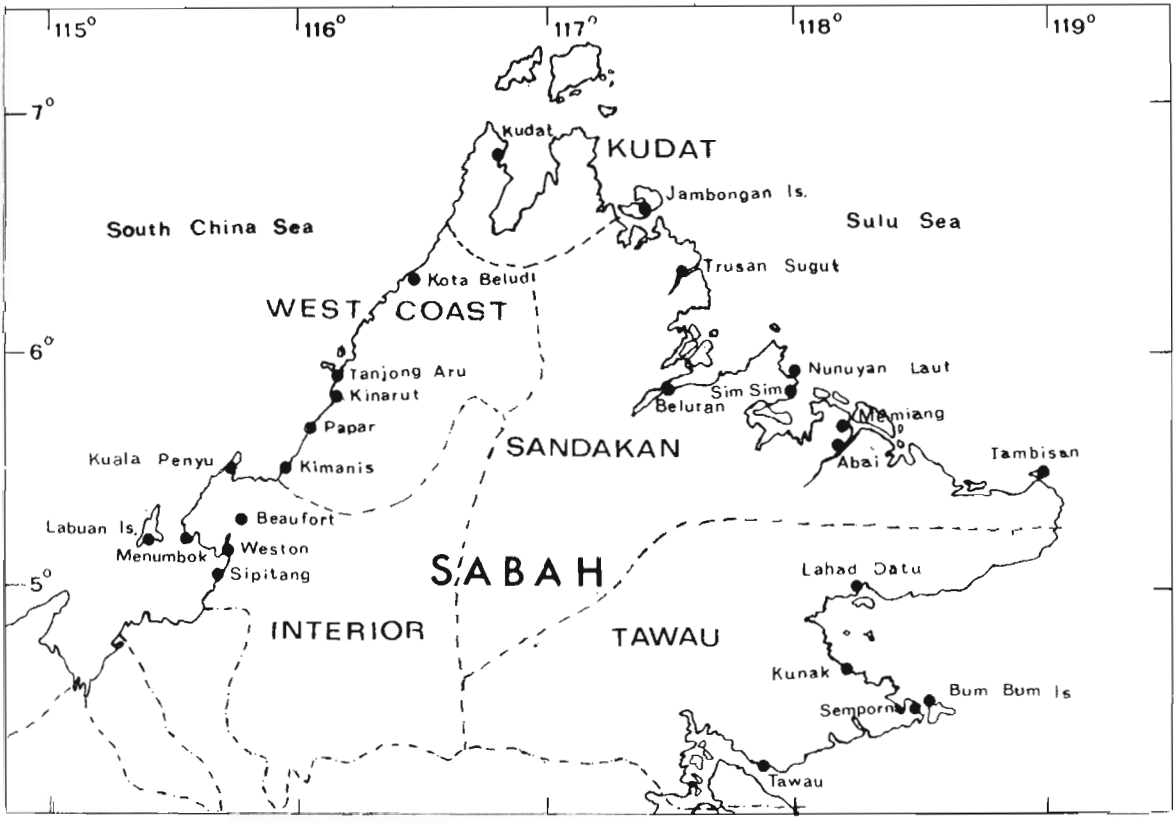

Fig I Distribution of *Aedes aegypti* in Sabah, Malaysia.

"Breteau Index":

Number of containers positive for *A. aegypti* breeding per 100 houses.

Container Index:

Per cents of the containers examined which were positive for *Aedes* breeding.

The container index includes both *A. aegypti* and *A. albopictus* and relative prevalence of the two species has been given separately.

RESULTS

Fig.I shows the location of the surveyed areas by residencies. Major coastal townships and respective surrounding kampungs were represented in each of the five residencies, viz. Kudat, West Coast, Interior, Sandakan and Tawau. Road, sea and air commnunications are generally well established to the main centres of these residencies. On the west coast there is a railway line connecting Kota Kinabalu to Beaufort and to Tenom (both in the Interior Residency). The annual rainfall throughout the state ranges between 60 to 160 inches depending on localities.

In Table 1, a general comparison of the survey results made in 1970 and 1974/1975 is summarized. *Aedes aegypti* was recorded from 60 localities out of a total of 96 towns and villages (kampungs) whereas *A.albopictus* was found in 75 localities. More localities were reported to be *aegypti* infested in Tawau Residency whereas the Interior and Sandakan Residencies have the same number of infested localities. There were only 5 localities positive for *A. aegypti* in the West Coast Residency in the present survey, whereas none was reported in 1970.

Generally the distribution was more continuous than the 1970 survey and more new localities were found. These new localities where *A. aegypti* and *A. albopictus* were previously absent but now found with these mosquitoes during the present survey are shown in Table 2.

Table 1. Summary and comparison of the survey results made in 1970 and 1974-1975 in five residencies, Sabah.

Residency	No. of localities surveyed		No. of localities positive for : *Ae. aegypti*		*Ae. albopictus*		No. of localities with Breteau Index 50	
	1970	1974/75	1970	1974/75	1970	1974/75	1970	1974/75
Kudat	3	10	3	6	0	8	3	2
West coast	11	24	0	5	10	21	0	0
Interior	9	22	4	15	9	19	2	9
Sandakan	6	18	4	15	3	13	2	12
Tawau	4	22	3	19	3	14	0	13
Total	33	96	14	60	25	75	7	36

Tabel 2 New localities of *A. aegypti* and *A. albopictus*

Residency	*Ae. aegypti*	*Ae. albopictus*
West Coast	Tanjong Aru (in Kota Kinabalu) Kota Belud town Kinarut town Papar town Kimanis town	Kampung Mengkabong (in Tuaran)
Kudat	———	Kampung Ayer (in Kudat township) Kampung Pak Ka
Interior	Sipitang town Beaufort town Kampung Batu Arang (formerly 2.5 km N. in Labuan Island)	———
Sandakan	———	Kampung Sungai Bahanan (in Jambongan Island) Kampung Sim Sim (in Sandakan town)
Tawau	Ice-Box area (in Tawau township)	———

Container Index: The container Index in the present survey ranged from 0.9 to 70.6 In major townships, the range was from 1.3 to 30.1 whilst in mixed rural/urban areas, the range was from 4.9 to 45.2. In residential suburds and rural kampongs close to major townships, the container indices were generally higher than the urban areas and ranged from 0.9 to 70.6 A drop of container indices in seven townships, three mixed urban/rural areas and eight rural kampongs was noted over four years. On the other hand, an increase of this index was seen in ten rural kampongs and four townships.

"Breteau Index": This index showed the widest range. In most of the accessible villages and towns in the West coast, this index was zero. With the exception of the kampongs in Labuan Island and Menumbok (in West coast), the Breteau index was generally above 100 in most of the outlying rural kampongs and coastal localities in the East coast.

A marked decrease in Breteau indices was noted for eight localities, of which four are townships and the other four are kampongs. In the East coast, four localities reported an increase of the index.

A. aegypti was not detected in twelve localities in the 1970 and 1974/1975 surveys. Of these, three localities were shop-type houses and nine were kampong-type houses.

Ten were situated in the West coast and the other two in the East coast. It is thought that the introduction of *A. aegypti* in the West coast is a slower process than in the East cost.

In the present survey, the number of houses surveyed was 3906 compared to 599 houses in the 1970 survey. The total number of collections was substantially increased as can be seen in Table 1. Moreover new localities were surveyed and this could have intensified the extent *A. aegypti* distribution in Sabah. More *A. aegypti* and *A. albopictus* collections were made in Kampong than shops in the present survey.

Distribution of the two species with respect to the accessibility and nature of the localities:

Table 2 shows that localities Nos. 8 to 28, 30 to 34, 38 to 40, 43 to 45, 48 to 51, 58,64 to 66, 74, 80, 82, 83, 88 and 90 are either *A.albopictus* predominant or show a relatively lower infestation level of *A.aegypti* as compared to other localities surveyed. The following factors associated with these localities are thought to be responsible:

(a) Rural nature
(b) Rich vegetation
(c) Poor communications

On the other hand, under different conditions such as poor to fair vegetation, good communications, urban situation and tne practice of storing water in artificial containers *A. aegypti* predominates.

DISCUSSION

Although, as table 1 and Fig. I show, *A.aegypti* was far from rare in Sabah, it showed the expected *type distribution* in the absence of control measures. Whereas high Breteau indices were recorded in Kudat (in the north), in a few coastal areas in the south-west (e.g. Labuan, Menumbok, Weston) and in most townships and kampongs on the east coast, few *A. aegypti* were found in the main towns on the west coast. It is thought that invasion of these areas with generally good communications and water supply is a slower process than those localities that have good boat traffic routes with the main townships in the east coast.In general, all the main towns and suburds in the east coast showed a higher prevalence in relation to the available habitats that might have been expected.

In those communities in the east coast where *A. aegypti* is the predominant species, its local distribution and prevalence were quite uniform. However, in the west coast particularly in newly discovered localities it has not as yet spread to adjacent residential villages where *A. albopictus* was found to be highly prevalent in its place.

New localities which were found in this survey are situated in the fishing and trading routes. It can be deduced that the introduction of *A. aegypti* is largely by fishing and boat traffic which regularly ply between the major townships and small coastal villages. Macdonald and Rajapaksa (1972) also mentioned this speculation, but did not account for the absence of *A. aegypti* in those localities that receive frequent visits from Philippine and Indonesian trading craft. In the present survey, these places were all infested with this mosquito. Thus there is also a correlation between high Breteau indices and a large amount of small-boat traffic in the east coast, northern and to some extent the south-western parts of Sabah. Since there are also regular air services between the major townships and Kota Kinabalu, it is quite likely that *A.aegypti* will spread to Kota Kinabalu and to other places within Sabah.

A series of community clean-up campaigns or "gotong-royong" projects were widely carried out in almost every township and this could have caused a marked decrease in the Breteau indices in several places. The impetus for this campaign was largely due to the 1973/1974 widespread epidemics of dengue and dengue haemorrhagic fever in Peninsular Malaysia. Much attention was placed in these campaigns through health education, mass media and local district councils to stimulate public attention and create an awareness of the dangers of breeding *A.aegypti* mosquitoes in premise. The result were, to some extent

inconsistent. If evaluated on the basis of the present survey. The campaigns were more successful in Sandakan, Kudat, Weston and Labuan townships than in Lahud Datu, Semporna and Tawau towns.

In the east coast, four localities reported an increase of the Breteau indices. This could be correlated with the timber boom which produced an influx of migrant workers and the oreation of makeshift slum-type housing which have limited piped water supply. There was a greater tendency to accumulate water-storage containers in such areas thus providing more available breeding habitats.

In contrast to the 1970 survey, the distribution of *A. aegypti* approximated close to a continous type, and this is chiefly attributed to the capacity of this species to colonise new areas and to the availability of a large number of potential larval habitats in those areas without adequate piped water supply. A high risk of transmission of dengue and dengue haemorrhagic fever is indicated in the present survey applying the *Aedes aegypti* indices to transmission of urban yellow fever (W.H.O., 1971), thirty six localities were reported to have Breteau indices exceeding 50 whereas there were only eight localities found in the 1970 survey.

There are very strong indications for a systematic control programme to be planned in Sabah as a preventive measure to prevent any outbreaks of dengue and dengue hamorrhagic fever. The programme will have to include the International Airport area in Kota Kinabalu, the rural areas as well in addition to the towns and urban areas. As a preventive measure, use of Abate sand granules (Bang and Pant, 1972) has been considered at a target dosage rate of 1 ppm and this may give a good control up to 2½ to 3 months after treatment. In case of epidemics, ULV malathion treatments may be applied by aircraft (Lofgren et al., 1970) or from ground (Pant et al., 1971) can be made and the method of choice would depend upon the specific situation.

SUMARRY

A. aegypti has spreads to all major inhabited coastal regions of Sabah and was recorded in nearly all major townships and many villages surveyed. This represented an increase of 24 percent of new localities for *A. aegypti* and 58.7 percent for *A.albopictus* over a period of four year *A. aegypti* was very common in small coastal villages in the east coast; in others, very high Breteau indices were recorded. If is thought that small boat traffic and the availability of potential water storage containers in those localities without adequate piped water supply are major factors responsible for the spread and the continnous distribution of this species.

Although no major dengue and dengue haemorrhagic fever apidemics have occured in Sabah, there are strong indicatious of a high risk of transmission in those areas where the Breteau indices exceded fifty.

On the basis of this survey, a strategy for the control of *A. aegypti* will be developed to prevent any aouthbreaks of dengue and dengue haemorrhagic fever in Sabah.

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