COMMUNICATIONS

A re-survey of potential vectors of dengue fever/dengue haemorrhagic fever in Sabah

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THE DATE OF arrival of *Aedes aegypti* (Linnaeus, 1758) in Sabah is unknown, although it may have been present in Malaya about 1890 (Macdonald, 1963). The earliest reliable records date back from 1920 when Stanton (1920) reported its presence in Jesselton (now Kota Kinabalu). A survey made by Ramalingam (1970) reported the presence of *Ae. aegypti* only in Semporna on the east coast. In a first extensive survey that included 39 towns and villages, Macdonald and Rajapaksa (1972) found 15 to be positive for *Ae. aegypti.* It was the first time that such an 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 fever and 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 occurred in Labuan Island, off the West coast in 1969 (Ramalingam, 1970). In view of the geographic 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 *Ae. aegypti* is replacing *Ae. 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 occurring containers as habitats for mosquito breeding and an increase in the artificial containers. This has assisted in the establishment of *Ae. aegypti,* the introduced species, and the displacement of *Ae. albopictus.*

In view of the above, it became increasingly desirable to study the distribution of *Ae. 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. Selection of the localities for the survey was 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 (consisting of shop and kampong houses); 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 – indoor and outdoor 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:-

"Breteau Index": Number of containers positive for *Ae. aegypti* breeding per 100 houses.

Container Index: Per cent of the containers examined which were positive for *Aedes* breeding.

The container index includes both *Ae. aegypti* and *Ae. albopictus* and relative prevalence of the two species were worked out separately.

Fig. 1 shows the location of the surveyed areas where *Ae. aegypti* is present. *Ae. aegypti* was far from rare in Sabah and it showed the expected type of distribution in the absence of control measures. It was recorded from 60 localities out of a total of 96 towns and villages whereas *Ae. albopictus* was found in 75 localities. These represented an increase of 24% for *Ae. aegypti* and 58.7% for *Ae. albopictus* of new localities over four years. Generally the distribution was more continuous than the 1970 survey and more new localities were found. New locality records for *Ae. aegypti* are: Tanjong Aru (in Kota Kinabalu), Kota Belud town, Papar town, Sipitang town, Beaufort town, Batu Arang (formerly 2.5 km N in Labuan Island) and Ice-Box district (in Tawau town). New locality records for *Ae. albopictus* are: Kampong Ayer and Pak Ka (both in Kudat), Mengkabong (in Tuaran), Sungai Bahanan (in Jambongan Island), Sim Sim (in Sandakan town).

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 suburbs 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.

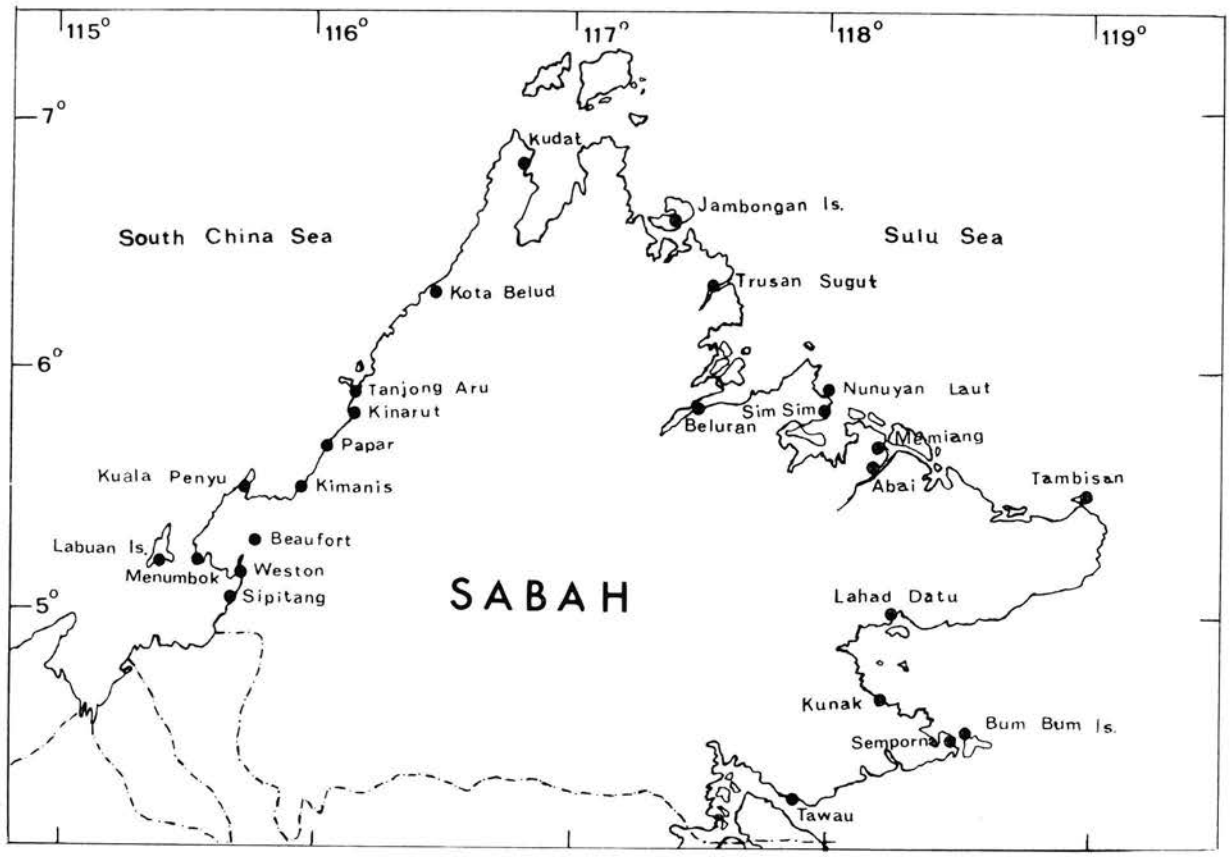

Fig. 1. Distribtuion of Aedes aegypti in Sabah (solid circles, Ae. aegypti present).

The "Breteau" 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.

Ae. 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 *Ae. aegypti* in the West coast is a slower process than in the East coast.

In the present survey, the number of houses surveyed was 3906 compared to 599 houses in the 1970 survey. The total number of collections for both species was substantially increased as can be seen in Table 1. More *Ae. aegypti* and *Ae. albopictus* collections were made in kampongs than shops in the present survey.

In those communities in the east coast where *Ae. 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 *Ae. 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 *Ae. 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 factor, but did not account for the absence of *Ae. 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 all major townships and Kota Kinabalu, it is quite likely that *Ae. aegypti* will spread to Kota Kinabalu and to other places within Sabah.

In contrast to the 1970 survey, the distribution of *Ae. aegypti* approximated close to a continuous 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 the transmission of urban yellow fever (W.H.O., 1971), thirty six localities are now reported to have Breteau indices exceeding 50 whereas there were only eight localities found in the 1970 survey.

There are very strong indication for a systematic control programme to be planned in Sabah as a preventive measure to prevent any outbreaks of dengue and dengue haemorrhagic fever. Such a programme will have to include the International Airport area in Kota Kinabalu, the rural areas as well in addition to the main towns and urban areas. As a preventive measure, use of Abate sand granules by the Vector Control Unit has been considered and

Table I

Relative distribution of larval habitats of *Ae. aegypti* and *Ae. albopictus*

Species and housing	Total No. of collections		Relative distribution					
			Indoors			Outdoors		
	1970	1974/75	Jars	Drums	Miscellaneous	Jars	Drums	Miscellaneous
Ae. aegypti								
Shop	209	286	0.25	0.09	0.51	0.04	0.03	0.08
Kampong	195	2,648	0.15	0.28	0.04	0.05	0.45	0.03
Ae. albopictus								
Shop	103	117	0.11	0.06	0.28	0.12	0.18	0.15
Kampong	98	1,170	0.11	0.06	0.04	0.14	0.50	0.15

when used at a target dosage rate of 1 ppm, this may give a good control up to $2\frac{1}{2}$ to 3 months after treatment (Bang and Pant, 1972).

Acknowledgements

I thank the Director of Medical Services for permission to publish these results. I am very grateful to Professor C.Y. Chow for his encouragement and criticisms, Dr. C.M. Han for his guidance and advice; and the staff of Malaria Control Programme, Vector Control Unit, the Health Department for their active part in the survey work without which this project would not have materialised.

References

Bang, Y.H. and Pant, C.P. (1972). A field trial of abate larvicide for the control of *Ae. aegypti* in Bangkok. *Bull. Wld Hlth Org.*, **46**: 416.

Macdonald, W.W. (1963). *Aedes aegypti* in Malaya. *Proc. Ninth Pacific Sci. Congr.*, **9**: 60.

Macdonald, W.W. and Rajapaksa, N. (1972). A survey of the distribution and relative prevalence of *Aedes aegypti* in Sabah, Brunei and Sarawak *Bull. Wld Hlth Org.*, **46**: 203.

Ramalingam, S. (1970). The occurrence of *Aedes aegypti* in Sabah. *Med. J. Malaya*, **25**: 73.

Rudnick, A., Marchette, N.J. and Garcia, R. (1967). Possible jungle dengue – recent studies and hypotheses. *Japan. J. Med. Sci. Biol.* **20** (Supplement): 69.

Sheppard, P.M., Macdonald, W.W. and Tonn, R.J. (1969). A new method of measuring the relative prevalence of *Aedes aegypti*. *Bull. Wld Hlth Org.*, **40**: 467.

Stanton, A T (1920). The mosquitoes of Far eastern ports with special references to the prevalence of *Stegomyia fasciata F. Bull. Ent. Res.*, **10**: 3.

W.H.O., (1971). *Weekly Epidemiological Record*, **46**: 493.