

MOSQUITOES COLLECTED IN SOUTH AND EAST KALIMANTAN

P.F.D. Van Peenen¹, Soeroto Atmosoedjono², S. Eko Muljono³,
J.C. Lien¹, J. Sulianti Saroso⁴ and R.H. Light²

Pengumpulan nyamuk dalam waktu singkat disembilan tempat di Kalimantan Timur dan Selatan menghasilkan 57 species dari 11 genera. Species yang terbanyak dikumpulkan ialah dari genus Culex 27 per cent, Mansonia 16 per cent, Anopheles 16 per cent, Aedes 12 per cent, Armigeres 7 per cent, Mimomia 7 per cent, Uranotaenia 7 per cent, Hodgesia, Tripteroides, Heizmania dan Culiseta masing-masing 2 per cent.

Team from the Indonesian Ministry of Health and the Naval Medical Research Unit No. 2 (NAMRU-2), Jakarta Detachment collected adult mosquitoes from localities in South and East Kalimantan during 1971. Localities were visited because they had either recognized or potential disease problems associated with mosquito vectors, i.e. malaria, filariasis, and arbovirus infections.

Mosquito collections were not comparable in terms of technics, personnel, nor time spent in the field. However, all were under the general supervision, and all questionable identifications were re-examined and confirmed. Many mosquitoes of known importance as vectors of human disease were found with surprising regularity, however, primary malaria vectors were not found.

MATERIALS AND METHODS

Localities visited are shown in the follow figure.

Tamban Luar is listed as in South Kalimantan but is immediately within the eastern limits of Central Kalimantan Province.

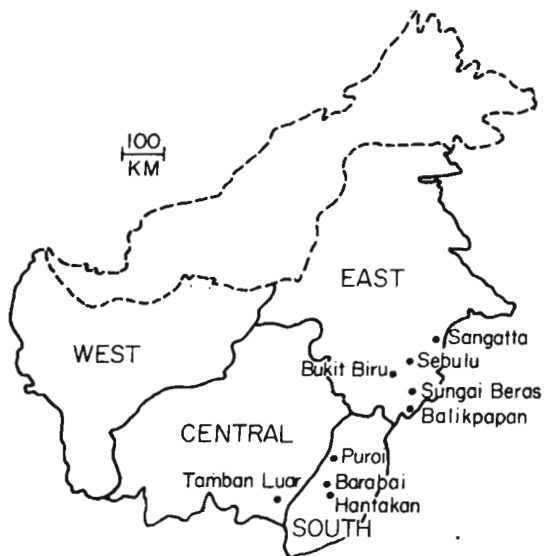


Fig. Map of Kalimantan showing location of areas discussed in the text.

Only adult mosquitoes were collected, using aspirators, sweep nets, or in several areas, electrically-powered CDC light traps (Atmosoedjono *et al*, 1973). Mosquitoes were killed with chloroform, and transferred to pill boxes in the field, then pinned and identified with the aid of astereoscopic microscope in Jakarta and Taipei.

RESULTS

Species collected, by locality, are listed in

*This study was supported by funds provided by the Bureau of Medicine and Surgery, Navy Department for Research Project MF12.524.009-0023B. The opinion and assertions contained herein are those of the authors and are not to be construed as official or as reflecting the views of the Navy Department or of the Naval Service at large.

¹U.S. Naval Medical Research Unit No. 2., Box 14, APO San Francisco 96263.

²U.S. Naval Medical Research Unit No. 2 Detachment, ln. Percetakan Negara I, Jakarta.

³Rumah Sakit Pertamina, Balikpapan, East Kalimantan
⁴Chairman, Institute of Health Research and Development, Jakarta.

Received 2 April 1975.

MOSQUITOES COLLECTED IN SOUTH AND EAST KALIMANTAN

Table 1. Table 2 shows mosquitoes obtained using different techniques, and according to whether collections were made near human

habitation or in forest. A brief description of each area and results of mosquito collections are as follows:

Table 1 Summary of mosquito collections.

Species	Han-takan	Bara-bai Area	Pu-roi	Tam-ban Luar	Bukit Biru	Sebu-lu	San-gatta	Balik-papan	Sungai Beras
<i>Culex</i>									
<i>fatigans</i>	0	0	0	0	0	0	+	+	0
<i>pseudovishnui</i>	+	0	0	0	0	0	0	0	0
<i>tritaeniorhynchus</i>	0	+	0	0	0	+	+	+	0
<i>gelidus</i>	0	+	0	0	0	+	+	+	+
<i>annulus</i>	+	+	0	+	0	+	0	0	0
<i>sinensis</i>	0	+	+	+	0	0	0	0	+
<i>whitmorei</i>	0	0	0	0	0	+	0	0	0
<i>fuscocephala</i>	0	0	0	0	0	+	+	+	0
<i>halifaxiz</i>	0	+	0	0	0	0	0	0	0
<i>(L.) rubithoracis</i>	0	0	0	0	0	0	+	0	+
<i>(L.) aculeatus</i>	0	0	0	0	0	+	0	0	0
<i>(L.) sp.</i>	0	0	0	0	0	0	+	0	0
<i>(C.) fragilis</i>	0	0	0	0	0	0	+	0	0
<i>(E.) malayi</i>	0	0	0	0	0	+	+	0	0
<i>(Culiciomyia) spp.</i>	0	0	0	0	0	+	0	0	+
<i>sp. in vishnui group</i>	0	0	0	0	0	0	+	0	0
<i>(C.) sp.</i>	0	+	0	0	0	0	0	0	0
<i>Aedes</i>									
<i>albopictus</i>	+	+	+	0	0	+	+	+	+
<i>(Finlaya) sp. in niveus subgroup</i>	0	0	0	0	0	0	+	0	+
<i>impemens</i>	0	0	0	0	0	0	+	0	0
<i>sp.</i>	0	0	0	0	0	0	+	0	+
<i>(Neomacleaya) sp.</i>	0	0	0	+	0	0	0	0	0
<i>desmotes</i>	0	0	+	0	0	0	0	0	0
<i>(V.) variatus?</i>	0	0	0	+	0	0	0	0	0
<i>(E.) poicilius</i>	0	0	0	0	0	0	0	0	+
<i>Mansonia</i>									
<i>uniformis</i>	0	+	+	+	+	+	+	+	0
<i>annulifera</i>	0	+	0	0	+	0	0	0	0
<i>annulata</i>	0	+	0	+	0	0	0	0	+
<i>bonneae</i>	0	+	0	0	+	+	+	0	+
<i>dives</i>	0	+	0	+	+	0	+	0	+
<i>indiana</i>	0	0	0	+	0	0	0	0	+
<i>(C.) nigrosignata</i>	0	0	0	+	0	0	0	0	0
<i>(C.) crassipes</i>	0	+	0	+	0	+	0	0	+
<i>(C.) ochracea</i>	0	+	0	0	0	0	+	0	0

Species	Han-takan	Bara-bai Area	Pu-roi	Tam-ban Luar	Bukit Biru	Sebu-lu	San-gatta	Balik-papan	Sungai Beras
<i>Anopheles</i>									
<i>nigerrimus</i>	0	+	0	0	+	0	+	0	0
<i>peditaeniatus</i>	0	+	0	0	0	0	+	0	0
<i>crawfordi?</i>	0	+	0	0	0	0	+	0	0
<i>argyropus</i>	0	0	0	0	+	0	+	0	0
<i>Anopheles</i>									
<i>Pusati? or indiensis?</i>									
sp. in <i>barbirostris</i>									
group	0	+	0	0	0	0	+	0	0
(A.) sp.	0	0	0	0	0	0	+	0	0
(C.) sp.	0	0	0	0	0	0	+	0	0
<i>subpictus</i>	0	0	0	0	0	0	+	0	0
<i>annularis</i>	0	0	0	0	0	0	+	0	0
<i>kochi</i>	0	+	0	0	0	0	0	0	0
<i>Mimomyia</i>									
<i>chamberlaini</i>	0	0	0	0	0	+	+	0	0
<i>hybrida</i>	0	0	0	0	0	+	+	0	0
<i>inzonensis</i>	0	0	0	0	0	0	0	0	+
<i>modesta</i>	0	+	0	0	0	0	0	0	0
<i>Hodgesia</i>									
<i>quasisanquiniae</i>	0	0	0	0	0	+	+	0	0
<i>Uranotaenia</i>									
<i>lagunensis?</i>	0	0	0	0	0	0	+	0	0
<i>lateralis?</i>	0	0	0	0	0	0	+	0	0
sp. near <i>arguellesi</i> &									
<i>pygmaea</i>	0	0	0	0	0	+	0	0	0
sp. near <i>pylei</i>									
<i>aranoides</i>	0	0	0	0	0	0	+	0	0
<i>Armigeres</i>									
<i>malayi</i>	0	+	0	0	0	0	0	0	0
<i>moultoni</i>	0	+	0	0	0	0	0	0	0
<i>aenbesteni</i>	0	0	0	0	0	0	0	0	+
(L.) <i>annulipes</i>									
<i>annulipes</i>	0	0	+	0	0	0	0	0	0
<i>Heizmannia</i>									
<i>indica?</i>	0	0	0	0	0	0	0	0	+
<i>Culiseta</i>									
sp. near <i>marohetti</i>									
<i>marohetti</i>	0	0	0	0	0	0	+	0	0

+ = collected; 0 = not collected.

South Kalimantan

Hantakan ($2^{\circ} 38'S$, $115^{\circ} 27'E$, elev. 50–100 m) – Hantakan is a small village in Hulu Sungai Tengah Regency situated east of Barabai; it is surrounded by rice paddies, corn and taro fields, which are interspersed with plots of secondary forest. Rubber plantations extend south and east. A Dayak communal house, at the edge of virgin forest, was also visited. We encountered no evidence nor reports of unusual disease experience in this area. Few mosquitoes were collected in Hantakan, possibly because of the lack of standing water in the area. Species collected (Table 1) are common elsewhere in Indonesia.

Barabai area (Kambat Utara, Barabai City, Telang; approx. $2^{\circ} 30'S$, $115^{\circ} 24'E$, elev. 20 m) situated along the main north-south road of Hulu Sungai Tengah Regency, dwellings in this area usually extend no more than 75 m on either side of the road. Terrain rises upward gradually through rice paddies and marshes to rubber plantations to the east. Small "islands" of banana, rubber, and hardwoods are scattered within the paddy areas. Land is flat, and one small sluggish stream flows through rubber trees on the east, providing water for all domestic uses. Mosquitoes were abundant, probably because of breeding opportunities in nearby marshes and rice paddies. Anophelines of the *hyrcanus* group, swamp-breeders, were easily found biting man at night. *Mansonia* mosquitoes readily attacked man both indoors and outdoors, day and night. *Culex tritaeniorhynchus*, another swamp-breeder, was abundant.

Puroi ($1^{\circ} 53'S$, $115^{\circ} 40'E$, elev. 100 m) – A tiny village of 12 houses, Puroi is in a river valley of foot-hills of the Meratus mountain range of Tabalong Regency. The village is surrounded by rice fields, but on the northeast, beyond the last rice fields, is high forest, which apparently has never been logged more than 50 m inside its edge. Few mosquitoes were collected in Puroi (Table 1). Swamp-breeders were lacking and only a single *Mansonia* was captured.

Tamban Luar ($3 13'S$, $114 22'E$, elev. 0 m) – Tamban Luar, a recent (one year) settlement of transmigrants from Java said to number almost

500 families, is in the heart of swamp forest in Kuala Kapuas Regency of Central Kalimantan. The entire area was previously uninhabited, and is accessible only by man-made canals. Forest surrounding the settlement, composed of nipa and mangrove, is practically impenetrable because of dense undergrowth, and because of one to five feet of water underfoot.

Survey personnel were subjected to vicious daytime biting by *M. uniformis* in swamp forest. No anophelines were found despite vigorous search.

East Kalimantan

Sangatta ($0^{\circ} 15'S$, $117^{\circ} 35'E$, elev. 50 m) – This is a petroleum company camp located one-half mile inland from the Sangatta river. The camp is surrounded by low scrub and dense secondary forest. Mosquitoes were numerous and included many species.

Sebulu ($0^{\circ} 16'S$, $117^{\circ} 00'E$, elev. 50–200 m) – A lumber concession area in Kutei Regency, Sebulu encompasses more than 100,000 acres north of the Mahakam river. Housing for lumber camp workers is along the north river bank, in a low marshy area. The concession area itself consists of primary rain forest with the uppermost canopy 60–80 m above ground level. Mosquito fauna in the forest resembled that of Sangatta.

Bukit Biru area (Bangunsari, Djahap; approx. $0^{\circ} 30'S$, $116^{\circ} 58'E$, elev. 50–200 m) – Bukit Biru itself is a forested hill, with a heliport in the summit. Hilly slopes have been heavily disturbed by wood cutters. Bangunsari, on the south slope, is a prosperous village of Javanese transmigrants which resembles any village of Middle Java. Djahap is a Dayak settlement. *Mansonia* were abundant, as were some anophelines of the *A. hyrcanus* group.

Balikpapan ($1^{\circ} 17'S$, $116^{\circ} 50'E$, elev. 10–40 m) – The thriving capital of east Kalimantan Province, but with a population of less than 100,000. Balikpapan is a port with access to inland oil and timber wealth. The city has some modern comfortable housing areas. Forest to the north is heavily disturbed and all second growth. Mosquitoes were typical of any Indonesian city.

Table 2 Mosquitoes Collected in Inhabited Areas and in Forest

	SANGATTA		BALIKPAPAN		SEBULU	
	Inhabited	Forest	Inhabited	Forest	Inhabited	Forest
Aspirator	<i>Culex</i> sp.	<i>C. tritaenior-</i>			<i>C. fuscocephala</i>	<i>Culex</i> sp.
	<i>M. bonneae</i>	<i>hynchus</i>				<i>C. (C.) fragilis</i>
	<i>M. uniformis</i>	<i>C. gelidus</i>				
	<i>M. dives</i>	<i>M. dives</i>	Not done	Not done		
	<i>Ae. albopictus</i>	<i>M. bonneae</i>				
	<i>Mimomyia</i>	<i>M. uniformis</i>				
		<i>Ae. albopictus</i>				
		<i>An. hyrcanus</i>				
		group				
Sweep Net	<i>C. fatigans</i>	<i>C. fatigans</i>	<i>C. fatigans</i>	<i>C. tritaenior-</i>		
	<i>C. tritaenior-</i>	<i>C. tritaenior-</i>		<i>hynchus</i>		
	<i>hynchus</i>	<i>hynchus</i>		<i>C. gelidus</i>		
	<i>C. gelidus</i>	<i>C. gelidus</i>		<i>C. fuscocephala</i>		
	<i>Culex</i> sp.	<i>C. fuscocephala</i>		<i>Culex</i> sp.	Not done	Not done
	<i>C. fuscocephala</i>	<i>C. vishnui</i>		<i>M. uniformis</i>		
	<i>M. dives</i>	group		<i>M. bonneae</i>		
	<i>Ae. albopictus</i>	<i>C. malayi</i>		<i>Ae. albopictus</i>		
		<i>C. (Lophocerao-</i>		<i>An. hyrcanus</i>		
		<i>myia) sp.</i>		group		
		<i>Uranotaenia</i>		<i>An. subpictus</i>		
		<i>lateralis</i>		<i>mal.</i>		
	<i>An. subpictus</i>	<i>Mimomyia hy-</i>				
	<i>mal.</i>	<i>brida</i>				
		<i>M. chameerlaini</i>				
	<i>Tripteroides</i>					
	<i>aranoides</i>					
	<i>M. bonneae</i>					
	<i>M. dives</i>					
	<i>M. uniformis</i>					
	<i>M. nigrosignata</i>					
	<i>Ae. albopictus</i>					
	<i>An. hyrcanus</i>					
	<i>C. (C.) fragilis</i>					
<i>Culex</i> sp.	<i>C. gelidus</i>	<i>C. fatigans</i>	Not done	<i>Culex</i> sp.	<i>C. fatigans</i>	
<i>M. bonneae</i>	<i>Culex</i> sp.	<i>C. tritaenior-</i>		<i>C. (Culomyia) sp.</i>	<i>C. tritaenior-</i>	
<i>M. dives</i>	<i>An. subpictus</i>	<i>hynchus</i>		<i>C. malayi</i> sp.	<i>hynchus</i>	
<i>An. subpictus</i>	<i>mal.</i>	<i>C. gelidus</i>		<i>C. (Lophocera-</i>	<i>C. gelidus</i>	
<i>mal.</i>		<i>C. fuscocephala</i>		<i>omyia) p.</i>	<i>C. fuscocephala</i>	
				<i>C. (L.) aculeatus</i>	<i>Culex</i> p.	
				<i>Uranotaenia</i> sp.	<i>C. whitmorei</i>	
					<i>M. dives</i>	
					<i>M. bonneae</i>	
					<i>Ae. albopictus</i>	
					<i>Uranotaenia</i> sp.	
					near <i>pylei</i>	
					<i>Mimomyia cham-</i>	
					<i>berlaiai</i>	
					<i>Hodgesia quasi-</i>	
					<i>sanquinæ</i>	

Light
Trap

Sungai Beras area (0° 55'S, 117° 00'E, elev. 70 m) — A clearing which houses workmen constructing a road between Balikpapan and Samarinda, this area is in disturbed primary rain forest.

Collecting was done at the 45 km and 55 km markers, north of Balikpapan.

Number of mosquitoes collected were few considering that almost one week was spent collecting in the area.

DISCUSSION

Collections were of very short duration, and were not continuous in any given area, so mosquitoes which were not numerous may have been missed. Nevertheless, certain species were encountered regularly (Table 1). Many were common in or near human habitation, but not in forest (Table 2).

Neither *Anopheles sunaicus*, nor *A. aconitus*, considered primary malaria vectors in Java by contemporary World Health Organization workers in Indonesia were found. Furthermore, *Anopheles balabacensis*, *A. maculatus*, and *A. umbrosus*, often excellent vectors in Southeast Asian forests, were not encountered during these surveys. Since malaria is endemic in most areas studied, it is possible that *A. hyrcanus* group, *A. subpictus*, or *A. kochi* may be vectors in Kalimantan, although usually considered of only minor importance elsewhere (Reid, 1968).

However, it should be noted that *Anopheles subpictus* as here identified is *A. subpictus* var. *malayensis*, probably *A. indefinitus* as understood by Reid (1968).

Moreover, one of the authors previous-

ly dissected anopheline mosquitoes from malarious areas in Java and never found the above species infected (Sundararaman, Soeroto and Siran, 1957). The malaria incidence among new inhabitants of Sangatta approximates 100 per cent, therefore efficient vectors must be present in at least some parts of E. Kalimantan.

Aedes aegypti mosquitoes were not found in either the cities of Balikpapan or Barabai. This mosquito, presumed to be the major vector of dengue in Indonesia, is usually easily found inside houses in cities. Perhaps more attention to house collections will reveal its presence in Kalimantan.

Except in Balikpapan, a relatively large city, there was little difference between mosquitoes caught in forest and inhabited areas (Table 2). This may be due to the proximity of dwellings to forest, and/or lack of control measures (except at Sangatta, where intermittent insecticiding has been done).

Some mosquito species collected here were differentiated with difficulty, and future workers might be well-advised to consider them carefully. For example, many *Mansonia* were first identified as *M. dives* (*M. longipalpis* of Dutch workers), but were later found to be *M. bonneae*, a closely related species. The best character for separation of the two is a distinctive patch of scales on the thorax of *M. dives*. Unfortunately, many specimens, particularly those caught in light traps, had lost the scales, so identifications had to be made by details of the male terminalia or female eighth abdominal tergite (Wharton, 1962). Members of the *A. hyrcanus* group (Reid, 1968), including *A. argyropus* and *A. nigerrimus*, are also difficult to distinguish. They are combined in this paper.

REFERENCES

- Atmosoedjono, Soeroto, Van Peenen, P.F.D., Joseph, S.W., Suliarti Saroso, J. and See, R. (1973) Observation on possible *Culex* arbovirus vectors in Jakarta, Indonesia. Southeast Asian J. Trop. Med. Pub. Hlth. 4(1): 108-112
- Bonne-Wepster, J. and Brug, S.L. (1936) Nederlandsch — Indische Culicinen. Geneesk. Tijdschr.v. Ned — Indie 77 (9/10): 515-617
- Bonne-Wepster, J. and Swellengrebel, N.H. (1953) The anopheline mosquitoes of the Indo-Australian Region. Amsterdam: J.H. De

Bussy, 504

Bonne-Wepster, J. (1954) Synopsis of a hundred common non-anopheline mosquitoes of the Greater and Lessers Sundas, the Molluccas and New Guinies. Royal Trop. Inst. Amsterdam Special Pub. 111. Amsterdam, Elsevier Pub. Co., 147

Reid, J.A. (1968) Anopheline mosquitoes of Malaya and Borneo. Studies from the Institute for Medical Research, Malaysia, No. 31, 520

Sundararaman, S., Soeroto, R.M. and Siran, M.

(1957) Vectors of malaria in Mid Java. Indian J. Malar. 11:321-338

Wharton, R.H. (1962) The biology of *Mansonia* mosquitoes in relation to the transmission of filariasis in Malaya. Bull. Inst. Med. Research, Malaya, No 11, 114

Van Peenen, P.F.D., Joseph, S.W., Ansari Saleh, Light, R.H., Sukeri, S, See, R., (1974) The Indonesian Developmental Area Study: Observations on Mammals from South and East Kalimantan (Borneo). Southeast Asian J. Trop. Med. Pub. Hlth., 5 (3): 390-397