Mosquito Fauna of Thailand

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OBJECTIVE: To collect, identify, catalogue and redescribe all of the mosquito species of Thailand. Information is also assembled on the distribution, larval habitats, and other aspects of the bionomics of the various species. The eventual goal is the production of monographs on the mosquitoes of the area, together with keys, handbooks and other identification aids, for use of workers in public health and associated fields.

DESCRIPTION: Mosquitoes are collected from many areas of Thailand in connection with various studies on arboviruses and malaria. Additional collections of a specialized nature are made to obtain correlated series of larvae, pupae and adults for illustration and taxonomic study. These have consisted mainly of collections of mosquito larvae from all types of habitats; these larvae have been reared individually so as to recover a correlated series of cast skins and adults. All of the reared material is later identified and processed at SMRL in Bangkok. The majority of this material is shipped to the Smithsonian Institution for study by specialists in the Southeast Asia Mosquito Project (SEAMP).

PROGRESS: During this period 938 mosquito collections were made in 8 provinces of Thailand, the British Crown Colony of Hong Kong and the Philippines. These collections resulted in 13,624 pinned adults, 13,365 slide mounts of larvae, larval and pupal skins and 27 slide mounts of terminalia and other structures. The mosquito collections made on Mindoro and Luzon in the Philippines and in the British Crown Colony of Hong Kong provided material for study and comparison with other species of the Anopheles in the minimus complex present in Thailand. Results of mosquito collections made during this period are given in detail in the following sections.

Aedes: The majority of the work on this genus was concentrated on species belonging to the subgenus Stegomyia. Immature stages were collected primarily from bamboo oviposition cups set out in a variety of habitats and from artificial containers in and around houses. Adults were obtained in diurnal and crepuscular collections of mosquitoes attracted to human bait. During the previous reporting period 14 species of Stegomyia were recorded from Thailand, including a possible new species near A. unilineatus. This latter species has subsequently been recognized as a species new to science and has been named Aedes seatoi in honor of this laboratory.** Aedes seatoi closely resembles A. albopictus in the adult stage and its larval stages are very similar to those of A. aegypti. Because of its possible confusion with those two dengue vectors, more knowledge of the ecology and behavior of A. seatoi is urgently needed. Aedes seatoi is currently known from Angthong, Chieng Mai, Chon Buri, Kanchanaburi, Nakhon Sawan, Prachinburi and Saraburi provinces (Fig. 1), however, its distribution is probably much wider throughout Thailand and

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Southeast Asia for it has recently been collected in Malaya.* Adults of A. seatoi have been collected biting man in Saraburi and Prachinburi provinces between 1800—1900 hours. Thus far, all larvae of this species have been collected from water accumulated in nodes of bamboo, except for two collections from the axils of banana plants and one from a clay water jar. Aedes seatoi is most frequently collected in the vicinity of villages surrounded by orchards (jack fruit, mango, papaya and banana) and bamboo groves.

Aedes scutellaris, first recognized in Thailand 4 years ago, has since been collected close to the sea in four provinces (Phuket, Prachuab Khirikhan, Surat Thani and Trat) and inland along the Chao Phaya river in Nonthaburi province (Fig. 1). Two morphologic forms have been noted in a colony of A. scutellaris, established with material from Prachuab Khirikhan, which are distinguished by differences in the mesepimeral scales. Currently, efforts are being made to solve this taxonomic problem by a study of the progeny reared from females of each of the morphologic variants. Little is known of the vector potential of this mosquito in Thailand, although Aedes scutellaris is reputed to be an important vector of dengue viruses in New Guinea.

The utility of bamboo oviposition cups in the collection of Stegomyia mosquitoes was demonstrated during a survey in Angthong province during the dry season this past year. This and 3 adjacent provinces were suffering from a severe drought at the time of the survey, and all natural larval habitats of Stegomyia mosquitoes were dry, except for a few water jars at houses. A total of 227 bamboo cups were set out in 8 areas for a period of 21 days. Eighty one (35.7 per cent) of the cups yielded eggs of five species of Stegomyia, (A. aegypti, A. albopictus, A. gardneri imitator, A. pseudoalbopictus and A. seatoi), indicating that adult females were present in the area even under the adverse conditions existing there at the time (Table 1).

Anopheles: Studies on the distribution, ecology and systematics of Anopheles rpecies in Thailand were continued during this period. Two well known malaria vectors from the Indian subregion, Anopheles culicifacies and An. stephensi, were collected in Amphur Mae Sariang, Mae Hong Son province. The collections of An. stephensi were made in a small village near the Salween river, while An. culicifacies was found in the town of Mae Sariang as well as in rural areas. Previous collections of An. stephensi have been made in Chieng Mai and Chieng Rai provinces, while An. culicifacies has been recorded by SMRL from Ayutthaya, Chieng Mai, Chon Buri, Kanchanaburi, Lampang, Lamphun and Tak provinces.

Studies on the minimus group of species in Thailand were continued during this period. Eight members of this complex of closely related species, An. aconitus, An. minimus, An. pampanae, An. culicifacies, An. jeyporiensis, An. fluviatilis, An. filipinae and An. varuna, have been recorded from Thailand. The first two species have been incriminated as vectors of malaria in Thailand, while the others have not been shown to be of any importance in malaria transmission here. The members of this complex are separable on the basis of a few morphologic characters which show considerable variation in Thai populations. Some workers doubt that the last three species above really occur in the kingdom, but specimens of these species continue to turn up in SMRL collections. In an effort to determine the degree of variation in morphology existing amongst these species, a study of the progeny from females typical of each member species was undertaken. Approximately 4,000 progeny from An. aconitus and An. minimus females have been reared to the adult stage. Specimens resembling An. filipinae and An. varuna have been found in sibling broods from both An. aconitus and An. minimus parents, while specimens that would be identified as An. fluviatilis with present keys, together with intermediate forms, have been reared from typical An. minimus females. These fluviatilis forms closely resemble the An. fluviatilis collected by SMRL in northern Thailand and in Hong Kong. Adults of An. jeyporiensis resembling both of the subspecies, An. jeyporiensis and An. jeyporiensis candidiensis, were reared from larvae collected in Hong Kong's New Territories, but no morphologic differences were noted in the larval and pupal stages. The above results indicate that five members of the minimus complex may validly be considered to occur in Thailand, An. aconitus, An. culicifacies, An. jeyporiensis, An. minimus and An. pampanai. The last species still remain the rarest member of the complex in

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Thailand. During the past year a few adults of this species were collected biting humans and buffalo in Buriram and Prachinburi provinces. Previous collections by SMRL have been made in Chantaburi, Nan and Prachinburi provinces.

Since colonies of both An. aconitus and An. minimus can be maintained by the forced insemination technique, an attempt to determine the amount of genetic compatibility existing between these two species was made by crossing the two by this method. A total of 122 crosses were made, of which 76 were between An. aconitus males and minimus females and 46 between minimus males and aconitus females. Eggs were obtained from 8 minimus females, of which approximately 170 hatched. All except three of the larvae from these eggs died before the third instar. Two of the three developed into males while the third (a female) developed only as far as the pupal stage. Eggs were obtained from only one of the aconitus females in these experiments, and these failed to hatch. These results are similar to those obtained by Kitzmiller* and his coworkers in crossing attempts involving European and North American species of the Anopheles maculipennis complex.

Culex: During this period special emphasis was placed on a study of the species within the subgenus Culex. This subgenus includes C. tritaeniorhynchus and C. gelidus, vectors of Japanese encephalitis virus in Thailand. Another member of the subgenus C. annulus, which occurs widely throughout Thailand, is a suspect in the transmission of JE virus on Taiwan.** Culex tritaeniorhynchus and C. annulus belong to a complex of species, the vishnui subgroup, which are separable most often in the larval stage only; identification of adults of these species is often impossible, creating serious problems is determining the source of JE virus in pools of these mosquitoes. During October 1969 larval surveys were begun in 5 districts of Chiengmai province that were affected by an epidemic of Japanese encephalitis earlier that year. Three species in the vishnui subgroup, C. annulus, C. pseudovishnui and C. tritaeniorhynchus, were collected in these surveys. The first and third species were commonly encountered in these collections, but larvae of C. pseudovishnui were more rarely encountered. Certain habitat preferences by larvae of Culex species were noted during these collections. Larvae of members of the pipiens group were found more frequently in small to moderate sized oviposition sites, while members of the sitiens group (including the vishnui subgroup) were collected more often in moderate to large bodies of water (Table 2). Furthermore, both C. gelidus and C. quinquefasciatus were collected from polluted water in most instances.

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* Genetics of Insect Vectors of Disease. 1967 p. 151

** J. Med. Ent. 6:327

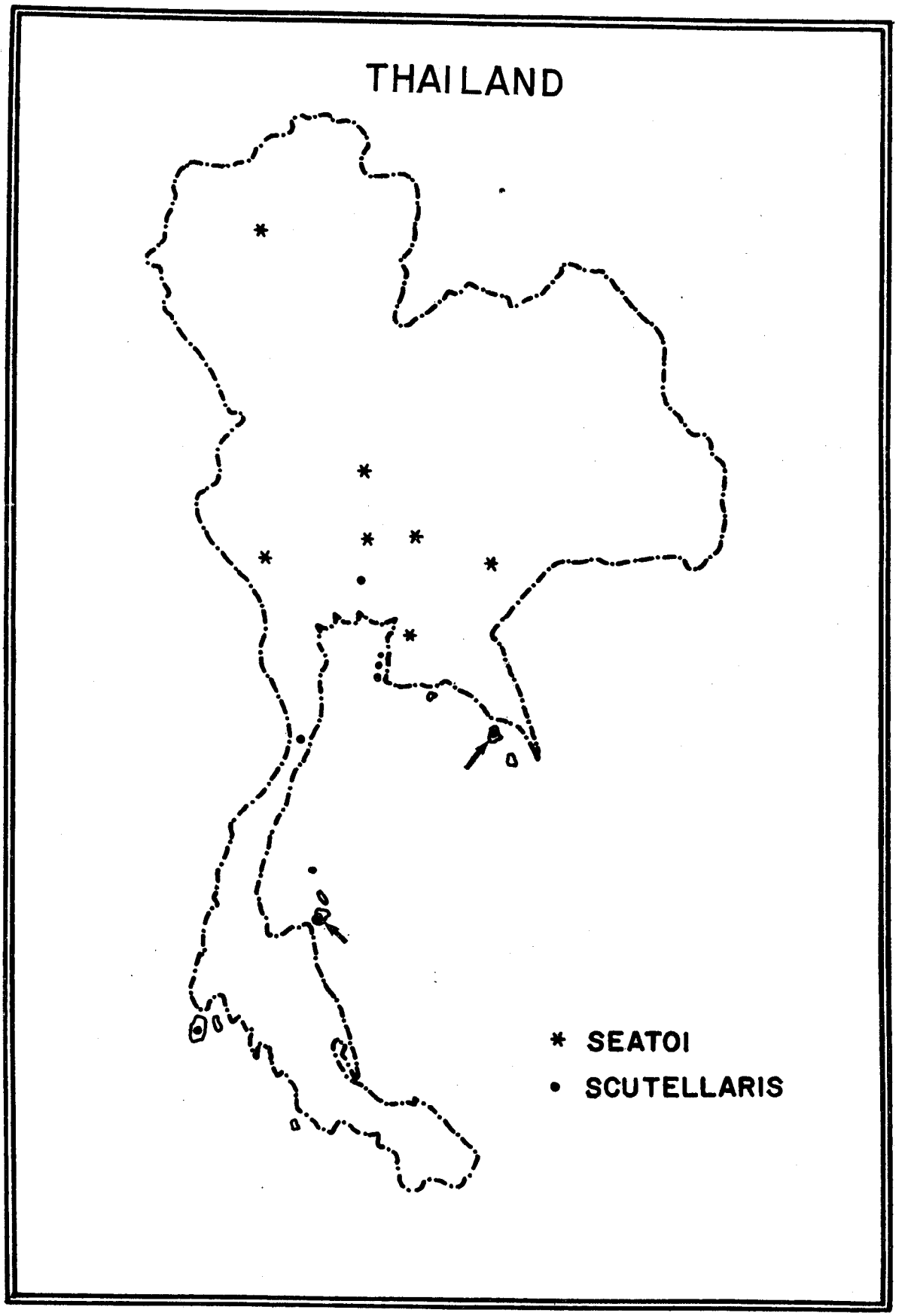

FIG. 1

Table 1. Distribution and association of Stegomyia species in 90 bamboo oviposition cups, Angthong — 1969

Species	Number with cups	Per cent
A. aegypti	2	2
,, seatoi	1	1
,, albopictus	48	53
,, albopictus + aegypti	2	2
,, albopictus + gardnerii imitator	2	2
,, albopictus + pseudalbopictus	2	2
,, albopictus + seatoi	13	14
,, albopictus + Tripteroides	7	8
,, albopictus + aegypti + seatoi	2	2
,, albopictus + g. imitator + seatoi	1	1
,, albopictus + Tripteroides + seatoi	1	1
Species other than Stegomyia	9	10

Table 2. Frequency of Culex (Culex) collections in Chieng Mai province by habitat and size of habitat, 1969–1970

		Small				Moderate			Large					Percent		
		Animal Foot Print	Wheel Track	Stump Hole	Artificial Containers	Well	Ditch	Ground Pool	Pit	Small Pond	Rice field	Swamp	TOTAL	Small	Moderate	Large
pipiens group	fuscocephala	26	1	—	—	1	8	11	2	1	6	1	57	47.4	35.1	17.5
	hutchinsoni	7	—	—	—	1	1	1	—	—	—	1	11	63.6	27.4	9.1
	quinquefasciatus	—	—	1	6	1	5	—	—	2	—	—	15	46.7	40.0	13.3
sitiens group	bitaeniorhynchus	1	—	—	—	—	1	2	—	1	—	—	5	20.0	60.0	20.0
	gelidus	—	—	—	—	—	3	3	1	4	—	—	11	0	60.0	40.0
	tritaeniorhynchus	7	—	—	2	1	12	5	3	4	11	—	45	20.0	40.0	40.0
	annulus	3	—	1	1	1	8	10	1	4	7	1	37	13.5	51.3	35.1
	pseudovishnui	1	—	—	—	1	—	1	—	—	2	—	5	20.0	40.0	40.0