

MOSQUITO SURVEY AND TAXONOMIC STUDIES

Principal Investigators : Bruce A. Harrison, MAJ, MSC
Terry A. Klein, CPT, MSC
E. L. Peyton*
Rampa Rattanaarithikul

Associate Investigator : Pattamaporn Kittayarak**

Assistant Investigators : Prajim Boonyakanist
Kol Mongkolpanya

OBJECTIVE : To elucidate the mosquito fauna of Thailand and Southeast Asia, with primary emphasis on the identification of diagnostic characters for the separation of vector species and groups containing vector species of human pathogens.

BACKGROUND : This is a continuation of efforts begun in the early 1960's and currently conducted in partial collaboration with the Medical Entomology Project (MEP), Smithsonian Institution, Washington, D.C. A brief review of the history of these efforts was presented in the 1977-78 annual report (1).

METHODS : Surveys for target species and species groups are conducted at selected sites and habitats throughout Thailand. These surveys involve the collection of immature and adult mosquitoes, with emphasis placed on reared adults with associated larval and pupal skins, and on progeny adults (with associated larval and pupal skins) reared from eggs oviposited by known wild collected females. Specimens are curated and pinned or slide mounted for further study by investigators in the laboratory, or shipped for study to MEP or other world recognized authorities. Studies primarily consist of an analysis of intra-interspecific variations to identify useful characters for separating the species. Useful diagnostic characters, new species records, and new taxa found in Thailand are prepared for publication and described in scientific journals.

RESULTS : Major efforts continued during this period to assist in the monographic revisionary study of the Leucosphyrus Group of *Anopheles* (*Cellia*) by personnel at the Medical Entomology Project (MEP), Smithsonian Institution, Washington, D.C. In the past (2), these efforts resulted in the description of *Anopheles dirus*, a primary vector of human malaria parasites in Thailand and several adjacent countries in Southeast Asia. During this period morphological (also Cytogenetic and Cross mating-see this annual report) studies revealed that

* Medical Entomology Project (MEP), Entomology Department, Hall 27, NHB-165, Smithsonian Institution, Washington, D.C. 20560.

** Department of Biology, Faculty of Science, Mahidol University, Bangkok,, Thailand.

the Taiwan form of *An. balabacensis* deserves specific status. Accordingly, the name *takasagoensis* Morishita, has been elevated from synonymy for this species (3). *Anopheles takasagoensis* is apparently isolated on Taiwan, appears to be most closely related to *dirus*, and has an uncertain status as a vector of human pathogens.

Additional morphological work in this group revealed several good pupal characters to distinguish *balabacensis*, Perlis form, from *dirus* and *takasagoensis*. This work was based on specimens from colonies of these 3 taxa maintained at AFRIMS. These characters are currently being checked on field collected specimens.

Field surveys for members of the Leucosphyrus Group have also revealed the presence of *Anopheles leucosphyrus* sensu stricto, in southern Thailand. Specimens of this species, some confirmed by associated immature skins, were found in provinces adjacent to Malaysia up to Chumphon Province, over 400 km north of the Thai-Malaysian border. *Anopheles leucosphyrus* is a known vector of human filarial and malarial parasites in Sarawak, Malaysia, and simian malaria parasites in Peninsular Malaysia. Its vector status in Thailand is currently unknown.

The monographic study, "The Myzomyia Series of *Anopheles (Cellia)* in Thailand, with emphasis on intra-interspecific variations (Diptera : Culicidae)" was finalized and sent to the publisher in July 1980. This is a comprehensive revision of the Minimus Group, *culicifacies* and *jeyporiensis* in Thailand, with extensive notes on the 5 additional Asian species in the series which do not occur in Thailand. The work (4) is slightly less than 200 pages, contains 24 full page plates and was based on 7½ years work on over 36,000 specimens.

The morphological study of progeny (with associated immature skins) of the Subpictus Group of the Pyretophorus Series, *Anopheles (Cellia)*, in Thailand, has revealed that the currently published key characters for the 3 members, *indefinitus*, *subpictus* and *vagus* are subject to considerable interspecific overlap and not very reliable. Additional adult, pupal and larval characters have been found which will assist in the identification of these species. Although these 3 species are primarily zoophilic and not currently considered of medical significance in Thailand, they are very annoying pest species in areas lacking bovines. In addition, *subpictus* has been incriminated as a vector of human filarial and malarial parasites in other areas of Southeast Asia.

The Thailand Malaria Division considers *Anopheles philippinensis* a secondary vector of malaria, particularly in the northeastern section of the country. However, previous AFRIMS collection records indicate that a very closely related species, *Anopheles nivipes*, is the common Thai species, with *philippinensis* very uncommon. During this year a breakthrough occurred which will have a major role in clarifying the *nivipes-philippinensis* problem in Thailand. A good population of *philippinensis* was located in Rayong Province and sufficient specimens were collected to initiate a colony (see Cytogenetics and Cross mating studies - this annual report). A comparison of the adults, pupae and larvae of *philippinensis*, with numerous reared progeny (with associated immature skins) of *nivipes* revealed that the currently published adult and larval characters used to separate these species were highly variable and unreliable. The only highly reliable characters to separate these species appear to be the pupal paddle characters described by

Reid (5). The current distribution of *philippinensis* in Thailand (Fig. 1) includes : Rayong, Chumphon, Phangnga and Nakhon Nayok (Khao Yai National Park only). All other records (Fig. 2) and specimens (numerous) are *nivipes*, except for several collections from northern Thailand which may represent a third species. The colonization of *nivipes* from the Korat Plateau is currently underway, and when it is established, will allow for comparative malaria susceptibility studies, cytogenetic analyses and cross mating studies for these 2 taxa.

During the year several collections were made which extend or reconfirm current mosquito distribution records for Thailand. A large number of *Anopheles separatus* females were collected biting man just after dusk in Phangnga Province. This is further north than the 2 previous recognized records (Trang and Narathiwat) for this species in Thailand. Immature specimens of the crab hole breeding anopheline, *tigertti*, were collected in Chon Buri and Phangnga Provinces. The Phangnga record is the first for this species from peninsular Thailand, and is only about 250 km from Malaysia. A small number of confirmed females of *An. minimus* were collected biting man in a malarious area of Phangnga Province. This is the first collection of *minimus* from this southern province in many years. A small number of females of *Mansonia dives-bonneae* were collected biting man in the Sai Yok area of Kanchanaburi Province. This represents the northern-most confirmed collections for this species complex in Thailand. Voucher specimens from the above collections have been retained in the AFRIMS collections.

Morphological studies have revealed a new species of *Aedes (Finlaya)* from Chiang Mai Province. This species, based on 71 adults with associated immature skins and 30 whole larvae, came from 5 immature collections in banana axils, a banana stump and a Callocasia axil at high elevation on Doi Pui and Doi Intanon. The species appears most closely related to *Ae. (Finlaya) formosensis*. Adult, pupal and larval characters have been found which will separate this species from all other members of the *Chrysolineatus* Group. A description and 4 full page plates are being prepared for publication.

A 45 page manuscript entitled "A guide to the genera of mosquitoes of Thailand, with illustrated keys, biological notes and preservation and mounting techniques" has nearly been completed. The manuscript contains adult, pupal, larval and male genitalia keys for the 18 mosquito genera found in Thailand, and has 27 full page plates illustrating key characters and general morphology. Mounting and preservation techniques are given for all stages. The biological notes consist of a table of the basic (common) habitats for the mosquito genera and subgenera in Thailand.

Work on the Kochi Group of *Aedes (Finlaya)* is progressing slowly. Numerous interspecific character similarities have been found in the adults and immatures and intraspecific variation is apparently very wide and common. Two females of *flavipennis* collected in Kanchanaburi Province are quite different from specimens from Phangnga. These 2 females are in poor condition and represent the first man-biting records for this species in Thailand. A considerable number of the adults and immatures still need to be examined, however, some illustrations of the known stages for each species have been completed.

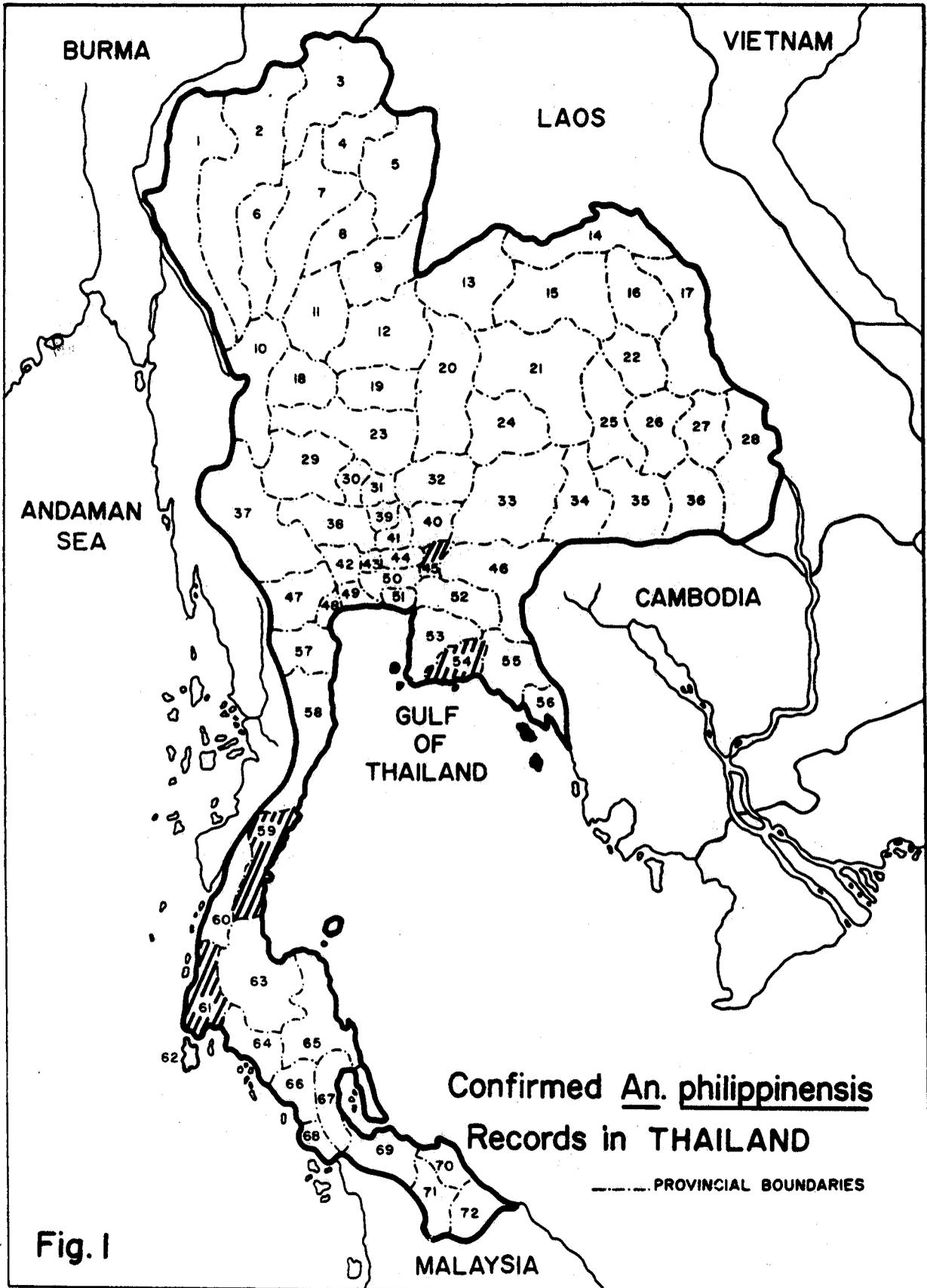
During the past year a total of 164 collections were made resulting in 3,498 adults from biting collections, 1,111 adults reared from immature collections and 3,718 slide preparations. Included in these were 1,422 females of *Anopheles nivipes* and *philippinensis* used to establish colonies, and 866 progeny adults (with associated immature skins) from 18 females of *Anopheles indefinitus*, *subpictus* and *vagus*. A total of 288 adults and 401 slides of members of the Leucosphyrus Group were shipped to the Medical Entomology Project (MEP), Smithsonian Institution. In addition, 228 females and 61 males of various *Anopheles*, *Aedes* and *Culex* were shipped to the Uniformed Services University of Health Sciences, Bethesda, Maryland, for instructional purposes.

One training course was offered during the year. This course, "Techniques for the Identification of the Mosquitoes of Thailand", was conducted during the period 14 January to 28 March 1980. Participants included: (a) an entomologist for the Ministry of Public Health; (b) an instructor from the Faculty of Science, Mahidol University; (c) a graduate student from the Faculty of Science, Mahidol University; and (d) a Royal Thai Air Force Officer.

These studies are continuing.

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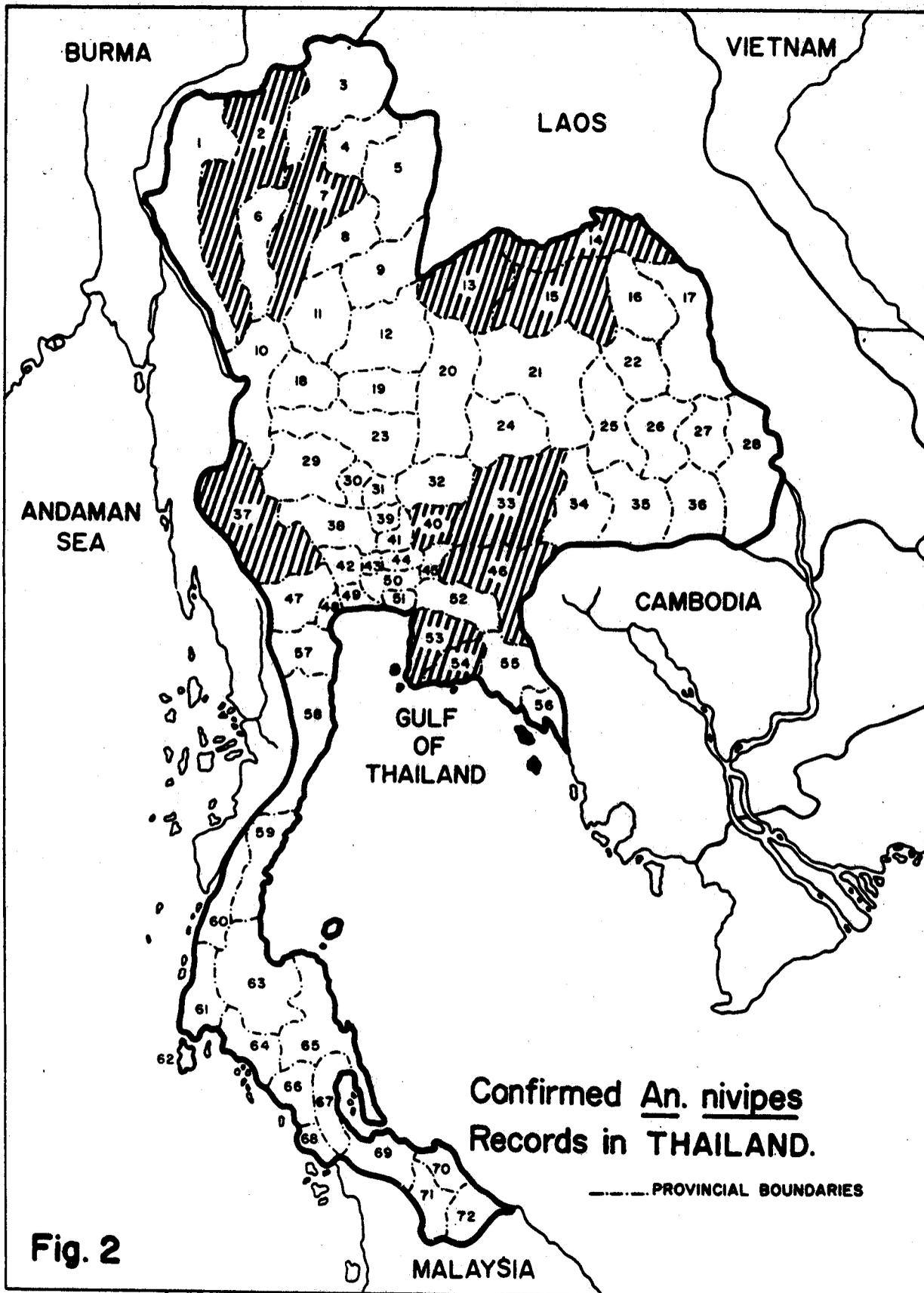


Fig. 2