POPULATION GENETIC STRUCTURE OF *ANOPHELES MACULATUS* IN THAILAND

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Anopheles (Cellia) maculatus Theobald is major malaria vector in southern Thailand and peninsular Malaysia, and previous studies on the population genetics of this mosquito suggested that mountain ranges reduced gene flow among some populations. In this study we examine the genetic variance among 5 populations in southern Thailand by analyzing 7 microsatellite loci. All microsatellite loci exhibited moderated to high genetic variability for all populations with an average of 8.6 (range = 6.3-10.9) alleles per locus. Based on microsatellite analysis, geographic populations of southern populations of *An. maculatus* can be grouped in two clusters; one includes 3 populations located on the west side of the Phuket mountain range between 8^0 and 10^0 north latitude, and the other includes 2 populations east of the Phuket mountain range located between approximately 6.5^0 and 10^0 north latitude. Wright's F_{st} and Slatkins' R_{st} for all seven microsatellite loci indicated very low estimates of differentiation among the 3 populations west of the Phuket range (mean values of F_{st} and R_{st} = 0.0042 and 0.0031, respectively, corresponding to N_m values of 59.3 and 80.2, respectively), suggesting significant gene flow occurs among populations. However, there is some evidence that there is some restriction of gene flow between populations on different sides of the Phuket range (mean values of F_{st} and R_{st} = 0.0346 and 0.0606, respectively, corresponding to N_m values of 7.0 and 3.9, respectively). Populations separated by distances as little as 80 km exhibit restriction of gene flow when separated by geographic barriers, while populations separated by more than 650 km without geographic barriers exhibit greater gene flow.

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REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM APPLICATIONS ON MALARIA RESEARCH IN THAILAND

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Geographic Information Systems (GIS) are powerful tools for studying and mapping the spatial relationships of objects. The spatial data managed by a GIS program may include items such as localities where mosquitoes have been collected, insect densities, distributions of mosquitoes relative to environmental parameters such as climate or vegetation, human artifacts such as political boundaries or roads, boundaries of crop fields, geologic information such as topography and soil type, etc. Similar types of data are typically grouped into individual layers or themes. The display of these layers can be turned on or off and modified as to how data are displayed. An important strength of GIS is that it can simultaneously relate layers of data for the same points in space and can analyze and map out the results. Thailand is the home to approximately 13% of the described mosquito species of the world. Control of malaria requires case detection

and treatment of affected individuals, and for curtailment of malaria transmission, control of mosquito vectors is undertaken. Vector control requires knowledge of the ecology of breeding and resting habitats and behavior of various species of mosquitoes. The life of mosquitoes is influenced by variations in climatic conditions, and hence there is diversity in the distribution and habitats of different vector species. Periodical surveys are essential for arriving at any conclusion for developing vector control strategy. Routine entomological surveys over vast geographic areas are impractical, time consuming and expensive and therefore are confined to limited areas. Malaria transmission by major vector mosquitoes depends on their ecology, on their environmental determinants of distribution, and also on the ecology of humans. The result is a complex interaction among populations of humans, mosquito vectors and pathogens, and between these populations and the environment. The spatial and temporal distribution of malaria is restricted typically by the geological range of humans and mosquitoes (or both), and by their habitat preference. Several new tools such as GIS, Global Positioning System (GPS), remote sensing, and spatial modeling provide new means for data gathering, management, integration, and analysis. The example of how the spatial model (wetness and slope indices) can identify breeding habitats of malaria mosquitoes will be presented.

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SEASONAL DISTRIBUTION, BIOLOGY, AND HUMAN ATTRACTION PATTERNS OF CULICINE MOSQUITOES (DIPTERA: CULICIDAE) IN A FOREST NEAR PUERTO ALMENDRAS, IQUITOS, PERU

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This study was conducted as part of a field ecology study of arboviral activity in the Amazon Basin, Peru, to determine the taxonomy, frequency, seasonal, and vertical distributions of potential mosquito vectors. In addition, the relative efficiency of human-landing collections and dry ice-baited Centers for Disease Control (CDC)-type light traps was determined for collecting mosquitoes. A total of 70 species of mosquitoes from 14 genera were collected from June 1996 through December 1997 at a forested site near Puerto Almendras, ≈20 km west-southwest of Iquitos, Peru. Three species [*Psorophora* (*Janthinosoma*) *albigenu* (Peryassu), *Ochlerotatus* (*Ochlerotatus*) *fulvus* (Wiedemann), and *Ochlerotatus* (*Ochlerotatus*) *serratus* (Theobald)] accounted for 70% of all mosquitoes captured in human-landing collections. Overall, biting activity occurred throughout the 24-h cycle but was higher during the daytime, primarily because of large populations of two day-biting species, *Ps. albigenu* and *Oc. serratus. Oc. fulvus* was active throughout the 24-h cycle but was more frequently collected during the evening. *Oc. fulvus, Ps. albigenu, Culex (Melanoconion) pedroi* Sirivanakarn & Belkin, and a mixture of *Culex (Melaonoconion) vomerifer* Komp, and *Culex (Melanoconion) gnomatos* Sallum, Huchings & Ferreira, accounted for 73% of the mosquitoes captured during darkness)by human collectors. In general, *Ochlerotatus* spp. and *Psorophora* spp. were more commonly captured in human-landing collections, whereas most *Culex* spp. were more frequently collected in the dry ice-baited CDC-type light traps. In general, mosquito populations were lowest from June through