Vector control in some countries of Southeast Asia: comparing the vectors and the strategies. Meek SR., Ann Trop Med Parasitol 1995 Apr;89(2):135-47 malaria consortium, London School of Hygiene and Tropical Medicine, U.K.

The use of information on malaria vector behaviour in vector control is discussed in relation to the area of Southeast Asia comprising Cambodia, Laos, Myanmar, Thailand and Vietnam. The major vectors in the region are Anopheles dirus, An. minimus, An. maculatus and An. sundaicus, of which An. dirus is the most important. Options for vector control and the biological features of mosquitoes, which would make them amenable to control by these measures, are listed. The methods with the greatest potential for controlling each of the four vector species are described. Experiences of vector control by residual spraying, insecticide-treated nets and larval control and of personal protection against the four vectors are outlined, and it is noted that choice of control strategy is often determined by epidemiological, economic and political considerations, whilst entomological observations may help to explain failures of control and to indicate alternative strategies.

Future research needs include basic entomological field studies using the most appropriate indicators to detect changes related to rapidly changing environmental conditions, such as loss of forest and climate change. Further studies of the efficacy of insecticide-treated mosquito nets, with greater attention to study design, are needed before it can be assumed that they will work in Southeast Asia. At the same time, research to improve sustainable utilization of nets is important, bearing in mind that nets are not the only means to control malaria and should not drain resources from supervision and training, which improve access to diagnosis and treatment of malaria and other diseases. Research is needed to make decisions on whether vector control is appropriate in different environments, and, if so, how to carry it out in different health systems. Researchers need to play a greater role in making operational research (entomological, epidemiological, social, economic and health systems research) of good quality an integral component of implementation programmes.

Entomological and epidemiological investigations of malaria transmission in relation to population movements in forest areas of north-west Thailand. Somboon P., Aramrattana A, Lines J, Webber R., Department of Parasitology, Faculty of Medicine, Chiang Mai University, Thailand.


Transmission of forest-related malaria was observed entomologically and epidemiologically for 2 transmission seasons in 1990 and 1991 in 5 villages of Mae Sariang district, Mae Hong Son Province, north-west Thailand. The entomological study included collections of mosquitoes and determination of infection rate by using enzyme-linked immunosorbert assay in the residential villages and the farm huts. The epidemiological study included fortnightly visits to 30% of the households to interview and record movement activities and illness of villagers. Circumsporozoite proteins, in most cases of Plasmodium falciparum, were detected in Anopheles minimus species A, An. dirus s.l., An. maculatus s.s. and An. sawadwongporni in residential villages and/or farm huts, suggesting transmission could occur there. Movement of people away from their residences occurred throughout the year for several reasons with a sharp peak in July for agricultural activity, mainly ploughing and planting for rice cultivation. The relative risk of infection for people engaged in agricultural activity was 3 times that of people living in the residential villages. Although a higher biting density of vectors was generally evident at the farm huts, the estimated inoculation rates in the 2 settings were similar. Movement for forest activity increased after harvesting rice in the cool dry season and carried the highest malaria risk, suggesting different epidemiological and probably entomological conditions which need further investigation. The significance is discussed of discrepancies between the case classification system used by this study and that used by malaria sector staff.

Study of the malaria situation in forested foothill and nearby plain areas of Myanmar. Myint L., Ye H. Department of Medical Research, Yangon, Myanmar.


A longitudinal demographic-parasitological survey on malaria was conducted at 10 weekly intervals starting from September in one foothill village with the population of 1,095 and one epidemiologically comparable plain village with the population of 962 in Kyauktaga township, Bago division, 120 miles north of Yangon. The objective was to describe and analyse the current malaria situation in a forested foothill area and an adjacent plain area. Ten weekly blood film collections for malaria parasite examination, six monthly sera collections on filter paper for serological examination from the whole study population and ten weekly splenic measurements from 2-9 year children were done. The malaria parasite rate in the foothill area was invariably higher than that in the plain area in all age groups throughout the study period. Moreover, the parasite rate decreased with the increase in distance from the forested foothill area indicating that the deep forest malaria may have some influence on the foothill villages. The total age specific parasite rate in foothill villages was found to be highest in the 5-8 year age group and decreased as the age advanced which may be due to the increasing immunity. The study revealed the presence of local transmission in the foothill village. From these data it is evident that new village sites should be chosen at least 5 miles away from the forest fringe and the malaria control measures in the plain area should utilize chemoprophylaxis and effective chemotherapy focusing on the people who travel into the forest.

The epidemiology of Malaria in a Karen population on the western border of Thailand. Luxemburger C., Thwai KL., White NJ., Webster HK., Kyle DE., Maeankirri L., Chongsuphasajiddhi T., Nosten F., Shoklo Malaria Research Unit, Mae Sod, Thailand.


From November 1991 to November 1992 a prospective, descriptive study of malaria epidemiology was conducted in a Karen population on the western border of Thailand. Two study groups were selected at random and more than 80% of the subjects were followed for one year. In Group 1, comprising 249 schoolchildren (aged 4-15 years), daily surveillance for illness was combined with fortnightly malaria surveys. These children experienced 1.5 parasitaemic infections per child-year (95% confidence interval [CI] 1.3-1.7), of which 68% (193/285) were symptomatic (Plasmodium falciparum 84%, P. vivax 16%). The estimated pyrogenic densities were 1460/microL for P.
falciparum and 181/microL for P. vivax. In Group 2, comprising subjects of all age from 428 households, malaria was diagnosed during two-monthly surveys, at weekly home visits, and otherwise by passive case detection. Malaria and splenomegaly prevalence rates were low in all age groups (spleen index 2-9%; P. falciparum prevalence rate 1-4%; P. vivax 1-6%). Group 2 subjects had 1.0 infections per person-year (95% CI 0.9-1.1), most of which were symptomatic (312/357; 87%). Malaria infections clustered in households. [A. Dirus not responsible for this aspect, obviously] Overall, P. vivax caused 53% and P. falciparum 37% of the infections (10% were mixed), but whereas P. vivax was most common in young children, with a decline in incidence with increasing age, P. falciparum incidence rates rose with age to a peak incidence between 20 and 29 years, although the risk of developing a severe malaria decreased with increasing age. There was no death from malaria during the study. P. falciparum infections were more common in males, subjects with a history of malaria before the study, and in those who had travelled outside their village. These findings suggest a higher transmission rate for P. vivax than P. falciparum, although adults still suffered symptomatic malaria due to both species. The 2 malaria parasites found in this area contribute approximately 50% of infections each, but their clinical epidemiology is very different.

**IMMUNITY**

Immunity to non-cerebral severe malaria is acquired after one or two infections

Sunetra Gupta, Robert W. Snow, Christl A. Donnelly, Kevin Marsh & Chris Newbold

Nature Volume 5 Number 3 pp 340 - 343 March 1999

In areas of stable transmission, clinical immunity to mild malaria is acquired slowly, so it is not usually effective until early adolescence. Life-threatening disease is, however, restricted to a much younger age group, indicating that resistance to the severe clinical consequences of infection is acquired more quickly. Understanding how rapidly immunity develops to severe malaria is essential, as severe malaria should be the primary target of intervention strategies, and predicting the result of interventions that reduce host exposure will require consideration of these dynamics.

Severe disease in childhood is less frequent in areas where transmission is the greatest. One explanation for this is that infants experience increased exposure to infection while they are protected from disease, possibly by maternal antibody. They therefore emerge from this period of clinical protection with considerably more immunity than those who experience lower transmission intensities. Here we use this data, assuming a period of clinical protection, to estimate the number of prior infections needed to reduce the risk of severe disease to negligible levels. Contrary to expectations, one or two successful infective bites seem to be all that is necessary across a broad range of transmission intensities.

**ITNS IN THE FOCUS AREA**

Bed nets for the prevention of malaria and anaemia in pregnancy.


A prospective comparison of the antimalarial efficacy of bed nets was conducted with 341 pregnant women living in a mesoendemic malarious area of the Thai-Burmese border. Women in 3 adjacent study sites were allocated at random to receive either a single size permethrin-impregnated bed net (PIB), a non-impregnated bed net (NIB), or to a control group who used either their own family size non-impregnated bed net (FNIB) or no net. In one study site, but not the other 2, PIB significantly reduced parasite densities and, together with FNIB, reduced the incidence of malaria in pregnancy from 56% to 33% (relative risk = 1.67, confidence interval = 1.07-2.61, P = 0.03, allowing for parity). Anaemia proved a more sensitive marker of bed net antimalarial efficacy than parasite rates. The incidence of anaemia (haematocrit < 30%) at all study sites was significantly lower at delivery in the PIB (27%) and FNIB groups (21%) than in the NIB group (41%) or those using no net (56%). This suggests that a significant proportion of the malaria in pregnancy in this mesoendemic area was sub-patent. Both patent Plasmodium falciparum parasitaemia and anaemia were associated with a reduction in birth weight. Infant mortality was high (16%) and strongly associated with prematurity, low birth weight and maternal anaemia. PIB were well tolerated and had no apparent adverse effect on the pregnancy or infant development. Although the overall effect of bed nets on patent parasitaemia was marginal, they were associated with a significant reduction in maternal malaria-associated anaemia. [I need someone to explain the link - apparent contradiction of this sentence to the rest of the report.]

Hyperendemic malaria in a forested, hilly Myanmar village.

Tun-Lin, W., M. M. Thu, S. M. Than, and M. M. Mya.


A 1-year longitudinal study of hyperendemic malaria was carried out at Tha-byewa village, Oktwin township, situated in the forested Bago mountain range in south-central Myanmar. Mosquito infectivity was assayed using specific, sporozoite enzyme-linked immunosorbtent assays. Anopheles dirus was the predominant vector in the postmonsoon season (October); during the cool-dry season (January), both An. Dirus and Anopheles minimus were vectors. Members of the Anopheles culicifacies complex were caught in the hot-dry season (April) but none was infective. The entomological inoculation rate was estimated to be at least 13.7 infective bites/person/year. Infective An. dirus were caught feeding on cattle as well as on humans. Three of the 4 positive An. dirus and both positive An. minimus were caught biting humans indoors in the second quarter of the night when most people were sleeping. This suggests that use of insecticide-impregnated bednets in this area could interrupt transmission.

The effect of pyrethroid impregnated mosquito nets on field malaria vector populations in experimental huts and in individual local houses.

Prasittisuk M, Prasittisuk C, Pothichiti V, Aum-aung B, Mongklangkul P.


Department of Communicable Disease Control, Ministry of Public Health, Nonthaburi, Thailand.

Studies were carried out in Tak Province, northeast Thailand to determine repellency and killing effects of four commercially...
Available pyrethroids etofenprox, deltamethrin, lambdacyhalothrin and permethrin treated mosquito nets on field malaria vector populations in experimental huts and local houses. The studies reveal that all four test pyrethroids have a highly repellency effect. Repellency ratio between lifted and torn nets also showed some different among the four pyrethroids. Mosquito net treated with 0.3 g/m2 permethrin was most toxic to mosquito followed by 0.02 g/m2 deltamethrin, etofenprox 0.3 g/m2 and 0.02 g/m2 lambdacyhalothrin. However, careful consideration for future use should also include problem of cross-resistance, persistence of chemicals and also type of mosquito net material. [Does not look at the vectors, proves what exactly?]

Permethrin-impregnated bed nets for the prevention of malaria in schoolchildren on the Thai-Burmese border.


A double-blind controlled trial was undertaken from August 1990 to February 1991 among Karen children on the Thai-Burmese border to evaluate the effects on malaria incidence and prevalence of permethrin-treated bed nets. Three hundred and fifty schoolchildren, aged 4 to 15 years, were allocated at random to receive either a permethrin-impregnated net or a non-treated net. The incidence of malaria infections, confirmed by a blood film, was assessed during 6 months. Three surveys were conducted, on admission and 3 and 6 months later, to measure the prevalence of infections and spleen rates. Compliance was assessed by monthly home visiting. The use of permethrin-treated bed nets reduced the number of parasitic Plasmodium falciparum infections by 38% and the number of symptomatic episodes by 42%. The number of P. vivax malaria attacks was similar in each group. The prevalence of positive blood films in the 2 groups did not change significantly during the study. [As above, what is the link? 2nd clue] A reduction in spleen rate by 50% in both groups at the end of the study period could not be related to the overall use of nets. Compliance was high and no side-effect was reported. The long-term effects on morbidity and mortality need to be assessed after distribution of permethrin treated bed nets at the village level.

Entomological evaluation of community-wide use of lambdacyhalothrin-impregnated bed nets against malaria in a border area of north-west Thailand.


Department of Parasitology, Faculty of Medicine, Chiang Mai University, Thailand.

This paper reports 2 studies. (i) After a year of baseline data collection, lambdacyhalothrin-treated bed nets were introduced into 3 of 5 villages in north-west Thailand, the remaining 2 being treated with placebo. Human bait collections were carried out in each village on 2 nights per month, for 8 months of each year, and the biting densities were compared between the first year and the second year. The treated bed nets did not have any significant impact on the density or parous rates of Anophelles sawadwongporn and A. maculatus s.s. populations. The results for A. dirus s.i. were not conclusive because of the low number caught. Significant reductions in biting and parous rates of A. minimus species A were observed in only one of the 3 treated villages, and there was no overall difference between treated and control groups. However, the trial suffered from the washing of nets by villagers and the low rate of reimpregnation. (ii) A short-term study involved 4 villages in a cross-over design, and lasted 48 d. For the first 24 d, residents of 2 villages were given new treated nets while the other 2 villages retained their own untreated nets. For the second 24 d, this situation was reversed. Daily light-trapping revealed no significant difference in the indoor densities or parous rates of A. minimus species A between the periods with treated or untreated nets.

The effectiveness of permethrin-impregnated bed nets against malaria for migrant workers in eastern Thailand.

Kamol-Ratanakul P, Prasittisuk C. Faculty of Medicine, Clinical Epidemiology Unit, Chulalongkorn University, Bangkok, Thailand.


A randomized, double-blind, field trial was carried out to compare the effectiveness of permethrin-treated bed nets with that of untreated nets as a method of malaria control for migrant workers in eastern Thailand. The study was conducted using 261 subjects in eastern rural areas that are known to be highly endemic for multidrug-resistant Plasmodium falciparum infection. One hundred twenty-six subjects used treated nets, while 135 used untreated nets. During the 35 weeks of observation, 23 subjects using treated nets and 33 workers using untreated nets developed 28 and 51 episodes of malaria, respectively (P = 0.092). The reduction in risk per subject due to treated nets was 0.06. The residual effects of permethrin were tested using a World Health Organization standard bioassay. Anti-mosquito activity was found to be present in the nets for more than 16 months. We conclude that because of the failure of the development of safe, effective, long-lasting prophylactic agents, integrating the use of impregnated nets with large-scale primary health care programs may be a partially effective method for controlling malaria in eastern Thailand.

REPELLENTS

Relative efficacy of various oils in repelling mosquitoes.

Ansari MA, Razdan RK. Malaria Research Centre, Delhi, India.

Indian J Malarial 1995 Sep;32(3):104-11

Field studies were carried out to determine the relative efficacy of repellent action of vegetable, essential and chemical base oils against vector mosquitoes. Results revealed that essential oils viz. Cymbopogon martini var. Sofia (palmarosa), Cymbopogon citratus (lemon grass) and Cymbopogon nardus (citronella) oils are as effective as chemical base oil namely myoil. These oils provide almost complete protection against Anopheles culicifacies and other anopheline species. Per cent protection against Culex quinquefasciatus ranged between 95-96%. Camphor (C. camphora) oil also showed repellent action and provided 97.6% protection against An. culicifacies and 80.7% against Cx. quinquefasciatus. Vegetable oils namely mustard (B. compestris) and coconut (C. nucisera) showed repellent action, however the efficacy of these oils was not much pronounced against Cx. quinquefasciatus. Results of statistical analysis revealed significant difference between vegetable and essential oils (p < 0.01) against tested species of mosquitoes. Essential oils were found marginally superior in repellancy than camphor and myiol (p < 0.01) against An. culicifacies and Cx. quinquefasciatus.
Personal protection from mosquitoes (Diptera: Culicidae) by burning neem oil in kerosene.

Sharma VP, Ansari MA. Malaria Research Centre (ICMR), Delhi, India.

J Med Entomol 1994 May;31(3):505-7

The repellent action of neem oil (extracted from the seeds of Azadirachta indica A. Juss) was evaluated on mosquitoes at two villages near Delhi, India. Kerosene lamps containing neem oil were burned in the living rooms, and mosquitoes resting walls or attracted to human bait were collected inside rooms from 1800 to 0600 h. Neem oil (0.01-1%) mixed in kerosene reduced biting of human volunteers and catches of mosquitoes resting on walls in the rooms. Protection was more pronounced against Anopheles than against Culex. A 1% neem oil-kerosene mixture may provide economical personal protection from mosquito bites.

HELMINTHS

Association of helminth infection with decreased reticulocyte counts and hemoglobin concentration in Thai falciparum malaria.

Nacher M, Singhhasivanon P, Gay F, Phumratnanaprin W, Silachamroon U, Looaereeuswan S. Unite INSERM 511: Immunobiologie Cellulaire et Moleculaire des Infections Parasitaires, Faculte de medecine Pitié-Salpetriere, Paris, France. m_nacher@mailcity.com


Following a study showing an association between Ascaris and protection from cerebral malaria, we conducted a cross-sectional study comparing admission hemoglobin concentrations in relation to exposure to helminth infection in 2 separate groups of patients: 111 cerebral malaria cases and 180 mild Plasmodium falciparum malaria cases. Hookworm infections were excluded. Mean hemoglobin concentrations were significantly lower in helminth-infected patients compared to those without helminths, both in the cerebral malaria group (10.1+/-3 [n = 47] versus 11.2+/-2.4 g/dl [n = 64], P = 0.04) and the mild malaria group (11+/-2.5 [n = 89] vs 12.2+/-2.7 g/dl [n = 91], P = 0.004). Median reticulocyte counts, only available in the cerebral malaria group, were lower in helminth-infected patients compared to those without helminths (15,340/23,760 per microL, P = 0.03). Adjustments for confounders such as body mass index did not alter these associations. These data are consistent with a mechanism causing anemia linked to differences in the immune response of helminth-infected patients during malaria.

Association of helminth infections with increased gametocyte carriage during mild falciparum malaria in Thailand.


The objective of this study was to determine whether pre-existing helminth infections could affect sexual forms of Plasmodium falciparum. A cross-sectional case record study compared 120 mild P. falciparum malaria cases with patent gametocyte carriage and 187 without gametocytes for helminth exposure. Relevant crude odds ratios and potential confounders were included in a logistic regression model. Helminth infections were associated with the presence of gametocytes with a crude odds ratio of 1.9 (95% confidence interval = 1.1-3.3) (P = 0.01). A positive linear trend was observed between the odds of having patent gametocytemia and the number of different helminth species (P = 0.003). However, when adjusting for hemoglobin concentration the significance of the association between helminths and gametocytes disappeared (P = 0.15). Pre-existing helminth infections may increase the severity of malarial anemia and therefore increase the likelihood of carrying gametocytes. At a population level, helminth infections may thus have a significant influence on malaria transmission.

Benzyli isothiocyanate is the chief or sole anthelmintic in papaya seed extracts.

Kermanshai R, McCarry BE, Rosenfeld J, Summers PS, Weretilnyk EA, Sorger GJ. Department of Biology, McMaster University, Hamilton, Ontario, Canada.

Physcohylo 2001 Jun;57(3):427-35

Papaya (Carica papaya) seeds were extracted in an aqueous buffer or in organic solvents, fractionated by chromatography on silica and aliquots tested for anthelmintic activity by viability assays using Caenorhabditis elegans. For all preparations and fractions tested, anthelmintic activity and benzyli isothiocyanate content correlated positively. Aqueous extracts prepared from heat-treated seeds had no anthelmintic activity or benzyli isothiocyanate content although both appeared when these extracts were incubated with a myrosinase-containing fraction prepared from papaya seeds. A 10 h incubation of crude seed extracts at room temperature led to a decrease in anthelmintic activity and fractionated samples showed a lower benzyli isothiocyanate content relative to non-incubated controls. Benzyli thiocyanate, benzyli cyanide, and benznonitrite were not detected in any preparations and cyanogenic glucosides. which were present, could not account for the anthelmintic activity detected. Thus, our results are best explained if benzyli isothiocyanate is the predominant or sole anthelmintic agent in papaya seed extracts regardless of how seeds are extracted.

TRADITIONAL MEDICINE

Ethnobotanical review of medicinal plants from Thai traditional books, Part I: Plants with anti-inflammatory, anti-asthmatic and antihypertensive properties.


A survey of medicinal plants used in Thailand has been made from Thai books on traditional herbal medicine. In this part of the survey, plants with anti-inflammatory, anti-asthmatic and antihypertensive properties including plant part used and methods of preparation and administration are described.

Ethnobotanical review of medicinal plants from Thai traditional books, Part II: Plants with anti diarrheal, laxative and carminative properties.

Panthong A, Kanjanapothi D, Taesotikul T, Taylor WC. Department of Pharmacology, Faculty of Medicine, Chiang Mai University, Thailand.
A survey of medicinal plants used in Thailand has been made from Thai books on traditional herbal medicine. In this part of the survey, 326 plants with antidiarrheal, laxative and/or carminative properties are described. Information provided for each species includes plant part used, methods of preparation and administration and literature references to Thai books, together with indications of usage in other Southeast Asian countries and of phytochemical work which has been performed.

Plants and People of the Golden Triangle: Ethnobotany of the Hill Tribes of Northern Thailand


Although much has been written about the tribal peoples of Southeast Asia, little has been written about the environment that is so essential to their survival. For the half a million people living in the remote mountains of northern Thailand, day-to-day survival is dependent upon the forest and the many treasures it contains, including material for medicinal use, fibers, foods, and bamboos. These people have an intimate knowledge of hundreds of plants that the world cannot afford to lose. Unfortunately, their ancient tribal culture, which includes this valuable legacy of plant lore, is disapppearing rapidly through assimilation by the dominant Thai culture.

To record the wisdom and experience of these tribal people who for generations have lived in a close, balanced relationship with their ambient environment, Dr. Anderson made six trips to Thailand to study the flora. His intriguing ethnobotanical research, which identifies over 1000 plant species used by the six major hill tribes, includes fascinating anthropological material as well. This book, the result of that research, describes the people, their environment, and the plants they use. Individual chapters deal with the most important plants, such as rice, opium, and bamboo, along with farming practices and other less important crops. Additional chapters document products from the forest that yield fibers and dyes, medicines, materials employed for pleasure, and those used for dealing with the spirit world.

A detailed appendix lists all plants used by the hill tribes, the corresponding scientific name, family, use(s) of the plant, tribe(s) that use it, and herbarium collection voucher numbers of each. A second appendix lists all medicinal plants, the ailment treated, the plant part(s) used, and how the medicine is administered. The numerous illustrations and 200 color photographs will assist the reader in better understanding the plants and people of the Golden Triangle.