PICTORIAL KEYS TO THE MOSQUITOES OF MEDICAL IMPORTANCE [1]

V. FRENCH INDOCHINA

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This is the fifth in a series of keys repared primarily to help public-health orkers separate and identify rapidly the osquitoes of medical importance in vari- us parts of the world. This series is being roduced under a transfer of funds from e Department of the Army to the Bu- au of Entomology and Plant Quaran- ne. The keys are so constructed that ey separate the important species not ly from each other but also from all hers known to occur, or suspected of curring, in the region. Suggestions and mments will be welcomed, especially om those with first-hand information out the faunas or diseases of the region.

Anopheles minimus is the chief vector f malaria in Indochina. It breeds typi- lly at the edges of clear, slow-running, rtly shaded streams, but has been found clear water at the edges of swamps, rice elds and borrow pits. It is the most nthropophilic of the malaria vectors in ndochina, and its wide distribution in e extensive foothill regions makes it sponsible for the most serious malaria roblems in this country.

Anopheles jeyporiensis candidiensis is nother foothill species, found typically in anding or running, grassy, clear water. is less important as a vector of malaria an *A. minimus* because of its greater reference for non-human blood. *Anophe- s maculatus* is a third species associated ith hilly or mountainous country, breed- ng in many types of water collections, and occurring in large numbers in newly cleared jungle areas. *Anopheles sinensis* is responsible for the transmission of a low-grade malaria, with occasional explosive outbreaks, in the flat rice-growing areas of the northern and southern delta lands. It often occurs in tremendous numbers, and breeding tends to increase with the clearing or cultivation of jungle areas. *Anopheles sundaicus* breeds almost entirely in brackish water along the southern coast of Indochina, where it is found in lagoons, swamps and salt-water fish ponds. It is less important than the foregoing species owing to its restricted distribution and its less definite anthropophilism. *Anopheles aconitus* has variable breeding habits, but is found most often in rice fields and fresh-water ponds in mountainous as well as in plains areas. It has been strongly suspected as a vector in South Annam. Throughout most of Indochina, however, its importance appears to be unpredictable, and it is regarded as a secondary vector.

Other *Anopheles* species and varieties known or assumed to be present in Indochina are *aitkenii aitkenii, aitkenii bengalensis, alongensis, annandalei annandalei, annandalei interruptus, baezai, barbirostris barbirostris, barbumbrosus, annularis, culicifacies, fluviatilis, jamesi, jeyporiensis jeyporiensis, karwari, kochi, leucosphyrus, litoralis, maculipalpis, pallidus, philippinensis, splendidus, stephensi, subpictus, tessellatus* and *vagus vagus*.

Approximately 90 non-anopheline species of mosquitoes have been recorded from this country. Of these, two are important in disease transmission. *Aedes albopictus* breeds principally in plant containers throughout Indochina and is the

[1] Previous keys were for Korea (I), Formosa II), Malaya (III), and Anglo-Egyptian Sudan IV). See Mosquito News, vol. 13, nos. 1, 2, and 1953. Keys to Malaya, the Sudan and French ndochina were drawn by Sally D. Kaicher.

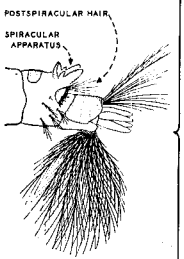
MOSQUITOES OF MEDICAL IMPORTANCE - FRENCH INDO-CHINA

FULL-GROWN LARVAE

IMPORTANT
A SPECIMEN MUST HAVE ALL CHARACTERS LISTED FOR THAT SPECIES

INSECT IDENT., BEPQ, USDA UNDER FUNDS ALLOTTED BY SECRETARY OF ARMY NOVEMBER 1952

NO SIPHON ON *ANOPHELES*



LONG PLEURALS OF 3RD GROUP

BOTH HAIRED

LONG PLEURALS OF 2ND GROUP

BOTH BARE

ONE HAIRED

LONG PLEURALS OF 1ST GROUP

TWO BARE, ONE HAIRED = *ANOPHELES SUNDAICUS*

ABDOMINAL PALMATES: LONG FILAMENTS / NOT

OUTER CLYPEALS: WITH SHORT SIDE HAIRS = *ANOPHELES MACULATUS*

ONE HAIRED

ABDOMINAL PLATES 4 TO 7

NEARLY AS WIDE AS BODY — DOUBLE

HALF AS WIDE AS BODY — SINGLE

INNER CLYPEALS

BARE = *ANOPHELES MINIMUS AND FLUVIATILIS* (LARVAE CANNOT BE SEPARATED)

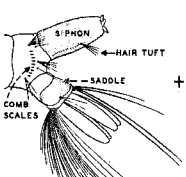
HAIRED = *ANOPHELES ACONITUS*

FAR APART, SPARSELY HAIRED (NOT / OR) = *ANOPHELES JEYPORIENSIS CANDIDIENSIS*

BOTH BARE

OUTER CLYPEALS + PROTHORACIC HAIR 1: 2 TO 7 BRANCHED AT TIP + MESOTHORACIC HAIR 5 (NOT) = *ANOPHELES SINENSIS*

SIPHON ON ALL OTHERS



SIPHON: ONLY 1 TUFT PER SIDE — EVENLY SPACED — ABSENT

ANTENNA: SMOOTH / NOT

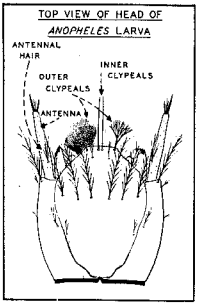
BODY HAIRS: SINGLE TO 4 BRANCHED / NOT

COMB SCALES: COMB SCALES IN ONE REGULAR ROW

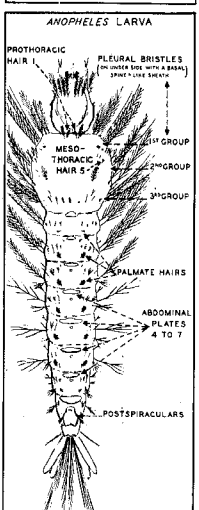
= *AEDES AEGYPTI*

= *AEDES ALBOPICTUS*

TOP VIEW OF HEAD OF *ANOPHELES* LARVA



ANOPHELES LARVA



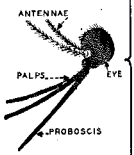
IMPORTANT
A SPECIMEN MUST HAVE ALL CHARACTERS LISTED FOR THAT SPECIES

FEMALES

[MALES HAVE BUSHY ANTENNAE  AND DO NOT BITE]

INSECT IDENT., BEPQ, USDA
UNDER FUNDS ALLOTTED BY
SECRETARY OF ARMY
NOVEMBER 1952

LONG PALPS ON *ANOPHELES*




(WING OF *SINENSIS*)

NO LIGHT SPOT AT CROSS VEIN

PATTERN ON PALP

LAST SEGMENT LIGHT AT TIP, DARK AT BASE

CLYPEUS

PATTERN ON HIND TARSUS

= *ANOPHELES SINENSIS*

PATTERN ON PROBOSCIS

= *ANOPHELES MINIMUS*

LAST SEGMENT ENTIRELY LIGHT, LIGHT BANDS AS WIDE OR WIDER THAN INTERVENING DARK BAND

= *ANOPHELES ACONITUS*


(WING OF *JEYPORIENSIS*)

LIGHT SPOT AT CROSS VEIN

PATTERN ON PALP

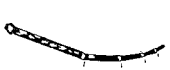
1 BROAD AND 2 NARROW WHITE BANDS

PATTERN ON HIND TARSUS

PATTERN ON PALP

= *ANOPHELES JEYPORIENSIS CANDIDIENSIS*

PATTERN ON HIND TIBIA



= *ANOPHELES SUNDAICUS*

= *ANOPHELES MACULATUS*

SHORT PALPS ON ALL OTHERS

PATTERN ON THORAX

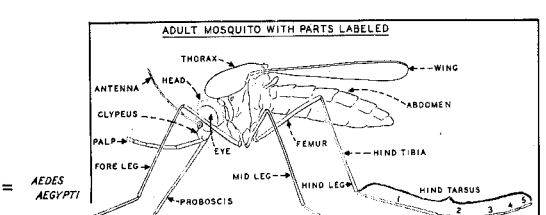
= *AEDES ALBOPICTUS*

+

PATTERN ON HIND TARSUS

= *AEDES AEGYPTI*

ADULT MOSQUITO WITH PARTS LABELED



chief vector of dengue fever. *Aedes aegypti* breeds principally in artificial containers near human habitations. It is included in the key because of its role in the transmission of dengue and its ability to transmit yellow fever, the introduction of which is a serious and constant threat to the entire Orient.

TESTS WITH GRANULATED BHC AND DIELDRIN FOR CONTROLLING SAND FLY LARVAE

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The salt-marsh sand fly, *Culicoides furens* (Poey), breeds abundantly in the densely foliated tidal marshes bordering the Florida Intracoastal Waterway, and often causes severe annoyance to the inhabitants of the adjacent areas. Since preliminary tests with bentonite granules impregnated with an insecticide showed great promise against *furens* larvae, tests were conducted on a practical scale to evaluate the method further.

Recent studies have shown that applications of certain insecticides to marsh breeding areas provide effective control of sand fly larvae for several months (Goulding *et al.* 1953). Treatments may be made with ground equipment, but this is time-consuming and extremely costly where it is necessary to cut extensive access trails through dense mangrove. Treatments may also be applied as aerial sprays, but so much material is lost by impingement on the vegetation, principally red and white mangrove, that excessive amounts must be applied to insure the proper amount reaching the ground. Since similar problems of penetrating vegetation for the control of mosquito larvae in rice fields and salt marshes had been overcome by applying granulated insecticides (Whitehead 1951, Keller *et al.* 1953), it was thought that this method might also be suitable in sand fly control.

On January 16, 1952, 325 acres of marshland infested with sand fly larvae north of Fort Lauderdale, Fla., were treated by airplane with bentonite granules (16/30 mesh) impregnated with BHC (36 percent gamma isomer). The average rate of application was 2 pounds of the gamma isomer per acre. Comparative treatments were made a month later with an oil spray containing sufficient BHC to give 0.5 pound of the gamma isomer per gallon, which was applied to a 24-acre plot at the rate of 4 gallons per acre. An 8-acre plot was treated with 5 percent of dieldrin on bentonite granules at the rate of 1.25 pounds of dieldrin per acre. An isolated, untreated 80-acre plot was utilized as a check.

The granulated BHC was prepared in a cement mixer by spraying melted BHC on the bentonite while the mixer was in operation, adding 2.8 pounds (containing 1 pound of gamma isomer) to 9.7 pounds of bentonite. The granulated dieldrin was a commercial product.

[1] This unit is under the technical supervision of the Orlando, Fla., laboratory of the Bureau of Entomology and Plant Quarantine. It is supported by funds allotted to the Bureau by the Department of the Army; by the Anti-Mosquito Districts of Dade, Broward, and Palm Beach Counties and the Indian River Mosquito Control District; and by the Division of Entomology of the Florida State Board of Health.

[2] The writers acknowledge the advice and direction of W. V. King, W. C. McDuffie, and J. C. Keller in this work; the assistance of W. C. Byrum, F. W. Hardin, J. A. Parker, H. Edwards, and H. H. Taylor; and the cooperation of J. H. Bertholf, director of the Broward County Anti-Mosquito District.