

The second week after aerial spraying, adult indices in the treated zone diminished to zero, while landing counts in the untreated zone were essentially unchanged. It was reported by Preventive Medicine Personnel at Cannon Air Force Base that adult landing rates had increased in the test zone during the third week following aerial spraying.

CONCLUSIONS. Results of this evaluation

indicate that the aerial application of malathion, when applied by the C-47 spray system under the conditions described in this paper, is effective for the control of desert species of adult mosquitoes for a period up to fourteen days.

Reference Cited

HUSMAN, C. N. 1949. Spray equipment for C-47, UC-64, and L-5 airplanes. *Mosquito News* 9(4):166-170.

OUTLINE FOR THE DETERMINATION OF MALARIAL MOSQUITOES IN ETHIOPIA

PART I—ADULT FEMALE ANOPHELINES

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INTRODUCTION. Existing classification keys to adult female anopheline mosquitoes of the Ethiopian Region (De Meillon, 1947; Evans, 1938; Russell, Rozeboom and Stone, 1943) have proven somewhat inadequate for use by the present Ethiopian Malaria Eradication Service entomology personnel. Occasional misidentification by Malaria Eradication Service workers and the lack of relatively non-technical literature on anophelines of Ethiopia have clearly accented the need for a simple, concise outline to anopheline mosquitoes of this Empire.

The following pictorial key presents a short cut method for reliable identification of anophelines of Ethiopia. It was designed for use by our high school educated entomology staff. Identifying characters shown have been diagrammed from specimens collected within the Empire with few exceptions and which are on file in the Headquarters of the Ethiopian Malaria Eradication Service, Addis Ababa. Characters of seven other recorded species not collected by the Malaria Eradication Service

in Ethiopia have been taken from the literature (Evans, 1938; De Meillon, 1947). To facilitate rapid use of the key, outstanding identifying features mentioned in the diagram captions are emphasized with arrows.

Thirty-four anopheline species make up the key, plus two additional representatives of the *Anopheles coustani* group—*A. coustani tenebrosus* and *A. coustani ziemanni*. (See Table 1.) Repeated searches during the past eighteen months throughout Ethiopia have yielded twenty-seven species, including three not previously recorded from the country: *A. natalensis*, *A. seydeli*, and *A. theileri*. Table 2 indicates anopheline distribution by Ethiopian provinces as recorded to January, 1962. With the expansion of malaria eradication services and intensification of entomological activities it is expected that further records will be forthcoming. *A. erythraeus*, Corradetti, 1939, and *A. amutis*, de Burca, 1943, as well as *A. gingeroi*, Corradetti and Archetti, 1947, have been excluded because of the lack of any information on adult female specimens. The baffling *A. funestus* group consisting of

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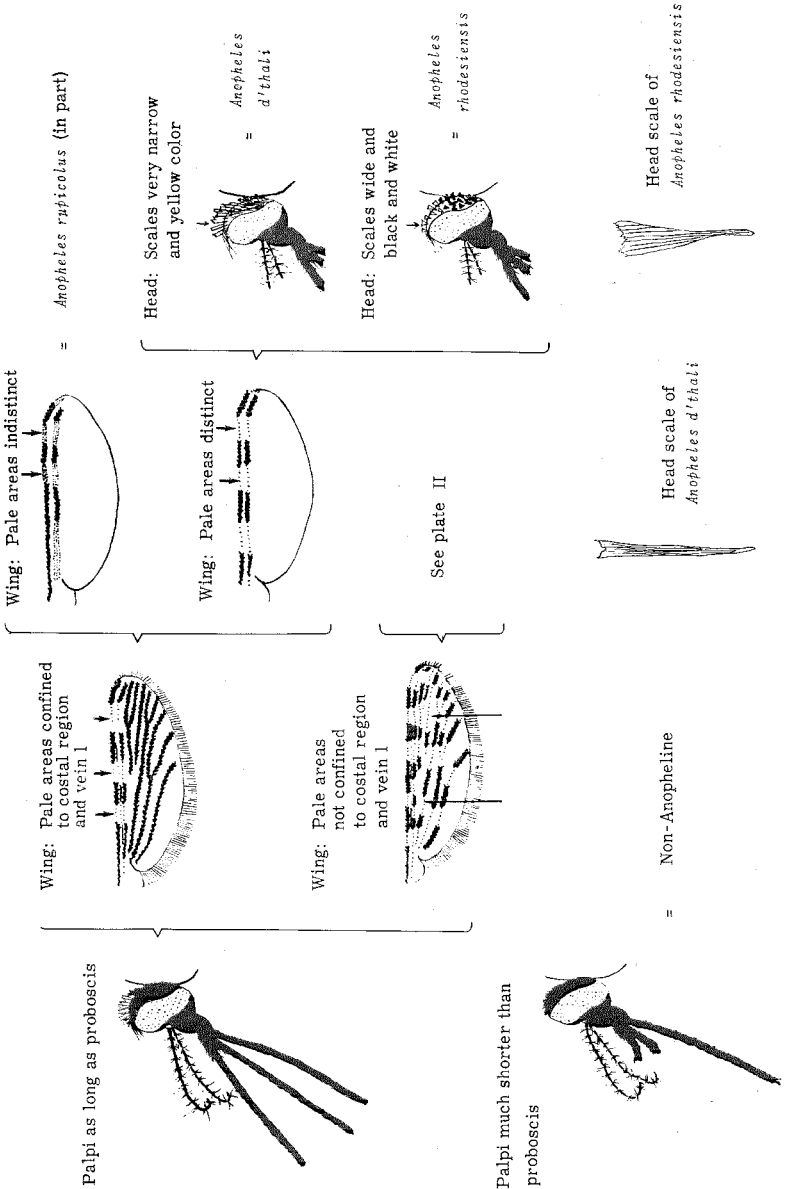
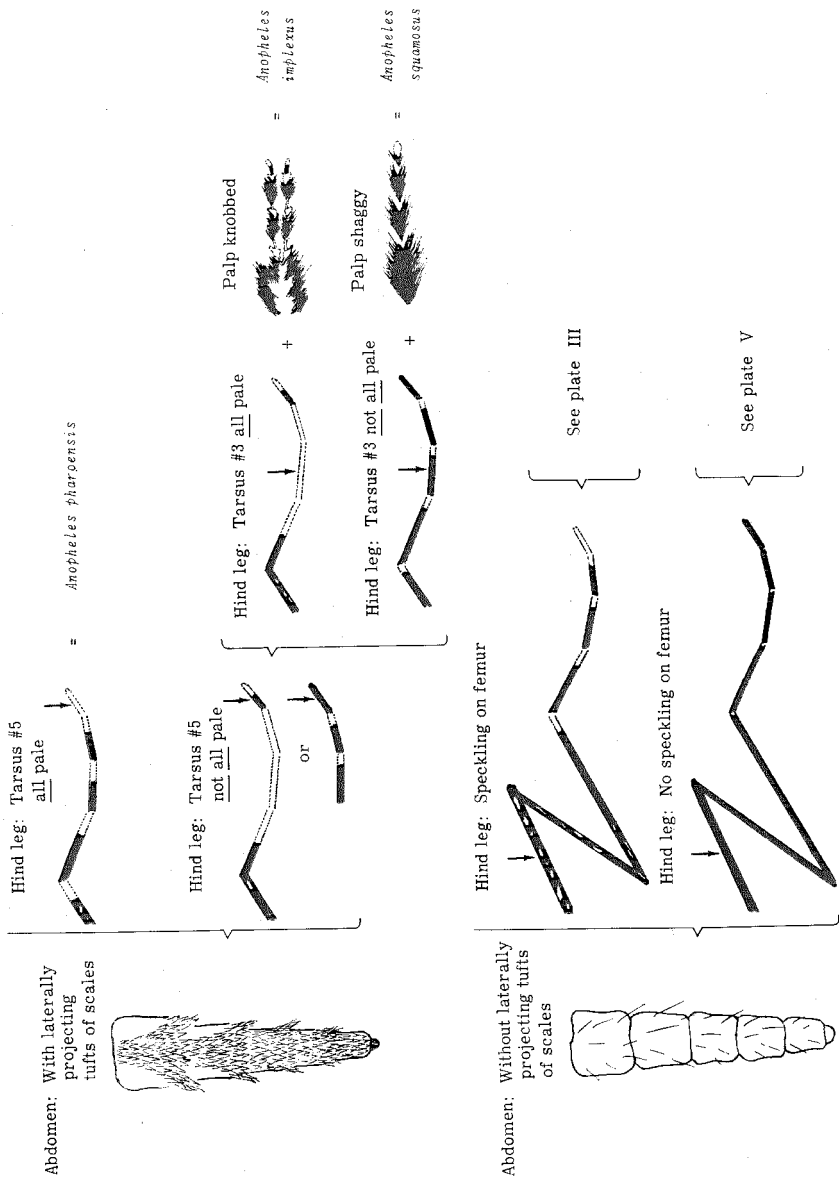
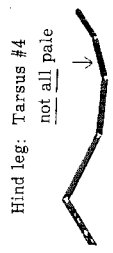
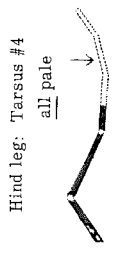
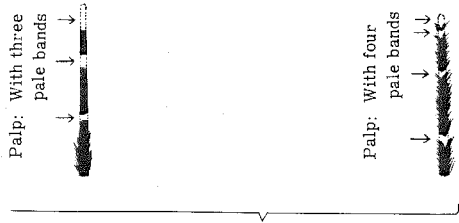
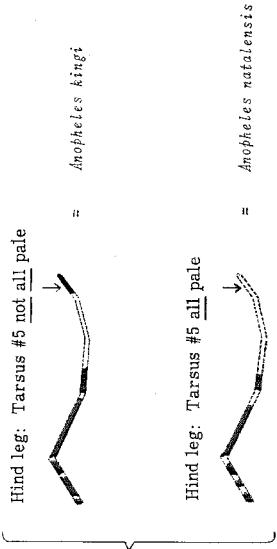
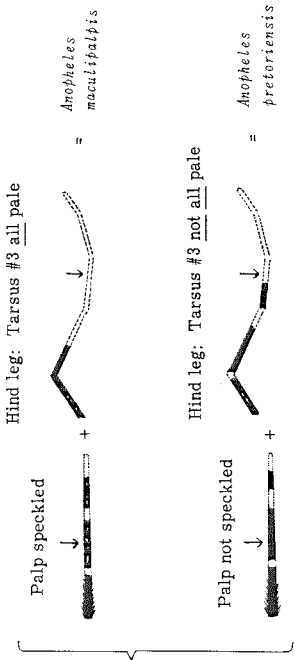
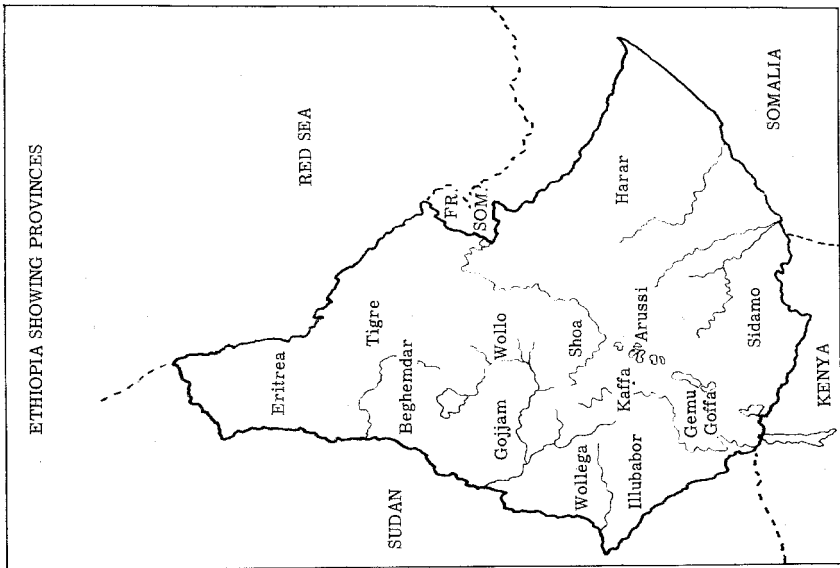


Plate I





See plate IV



Scales on dorsum of abdomen



= *Anopheles danaticus*

No scales on dorsum of abdomen



= *Anopheles gambiae*

Palp: Smooth with three pale bands



Palp: Shaggy with four pale bands



= *Anopheles ardensis*

Wing: Preapical dark spot on vein 1 with a pale area
= *Anopheles theileri*

Wing: Preapical dark spot on vein 1 with no pale area
= *Anopheles rufipes*

Hind leg: Apex of tibia and base of tarsus #1 with long white areas
OR

= *Anopheles constanti constanti*

Hind leg: Apex of tibia and base of tarsus #1 with short white areas
= *Anopheles constanti ziemanni*

Hind leg: Base of tarsus #1 dark and base of tarsus #3 dark
= *Anopheles constanti tenebrosus*

Hind leg: Base of tarsus #1 dark and tarsus #3 all pale
= *Anopheles paludis*

Palp: Smooth with three pale bands

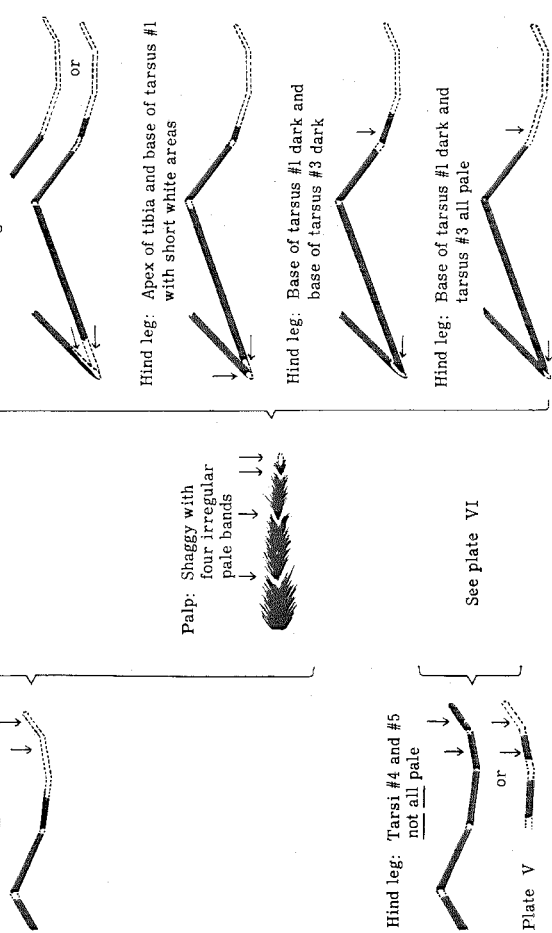
Palp: Shaggy with four irregular pale bands

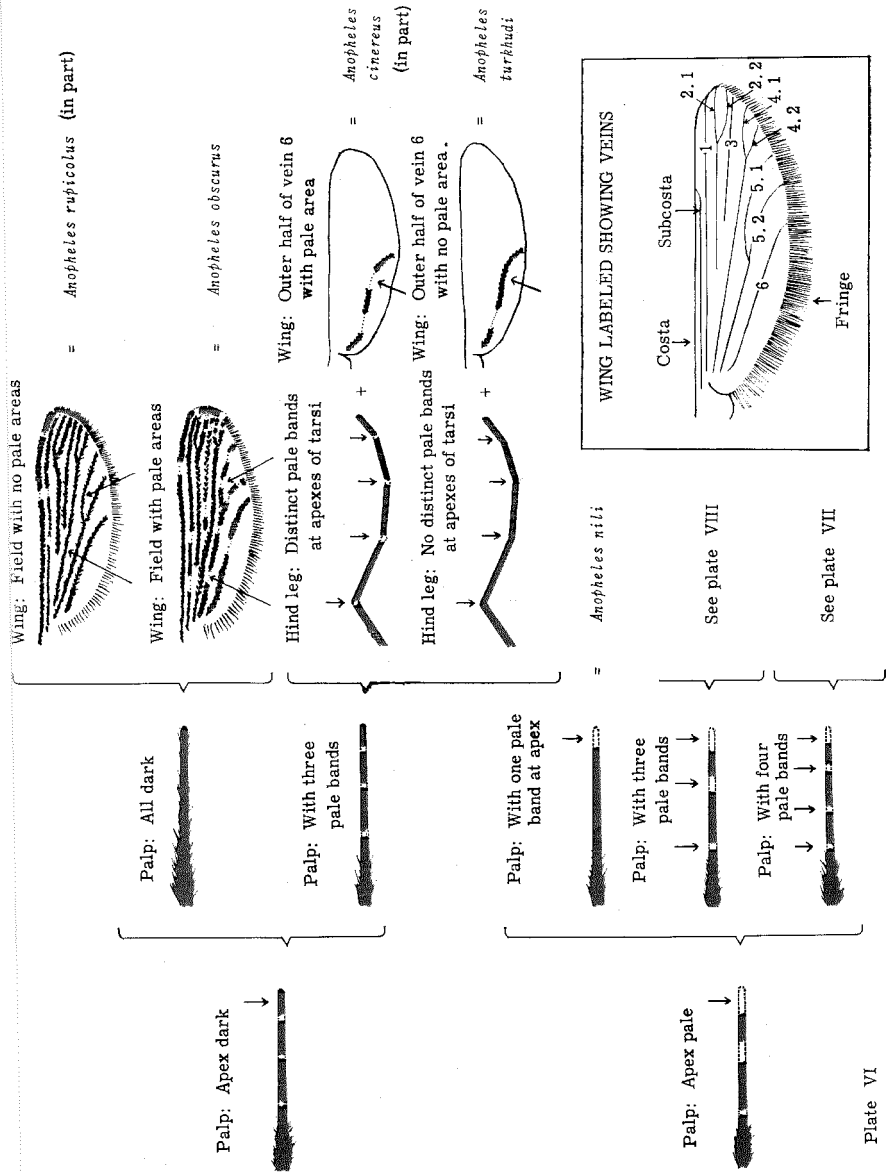
Hind leg: Tarsi #4 and #5 all pale

Hind leg: Tarsi #4 and #5 not all pale

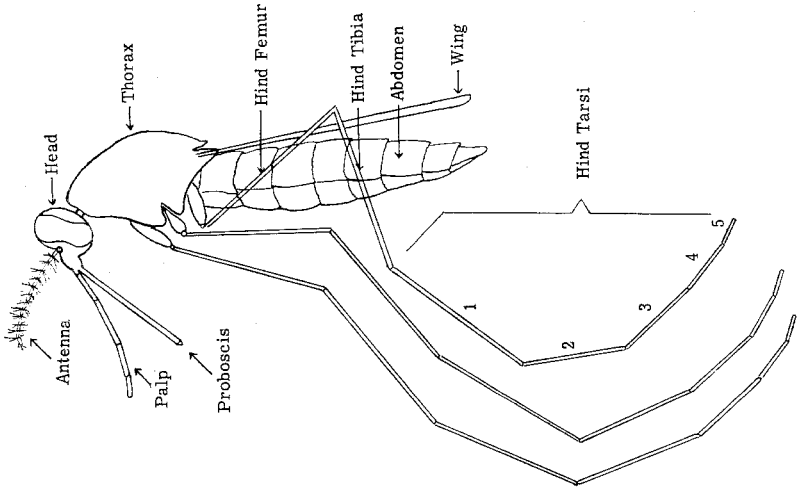
See plate VI

Plate V

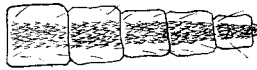




ADULT MOSQUITO WITH LABELED PARTS



Yellow scales on dorsum of abdomen



+

Palp: Shaggy



= *Anopheles christyi*

No scales on dorsum of abdomen

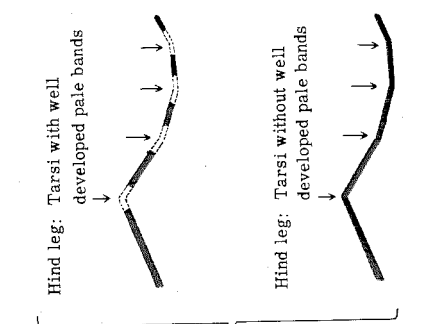
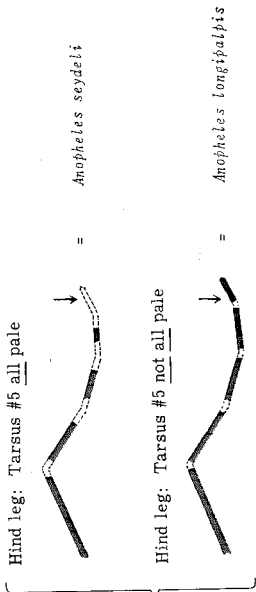
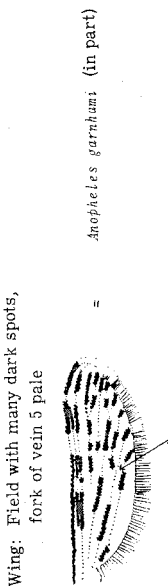
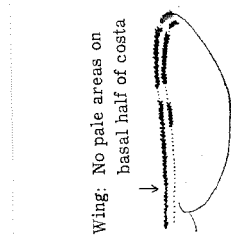
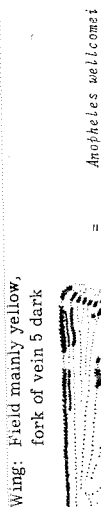


+

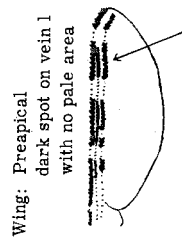
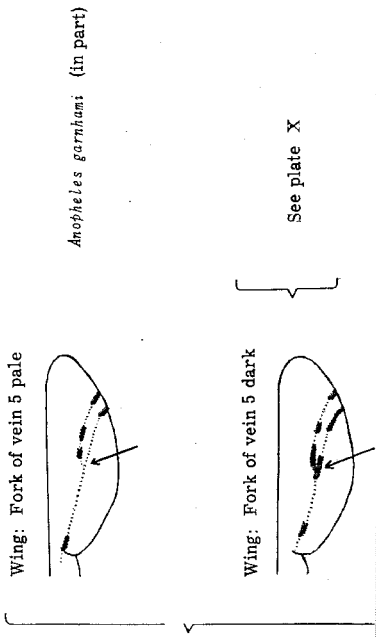
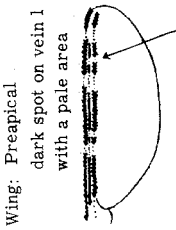
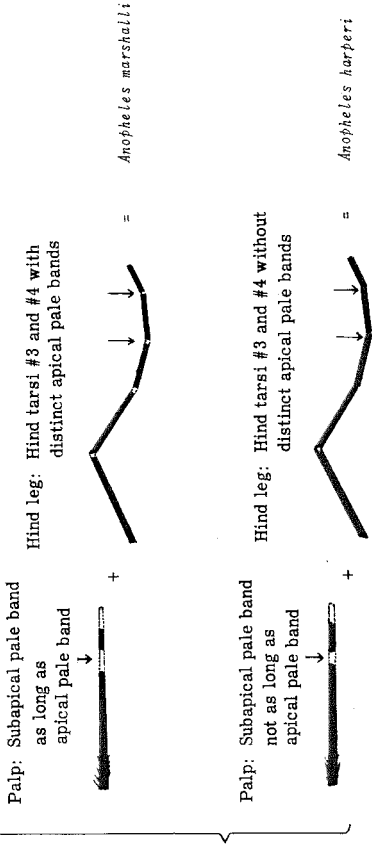
Palp: Smooth



= *Anopheles cinereus* (in part)



See plate IX



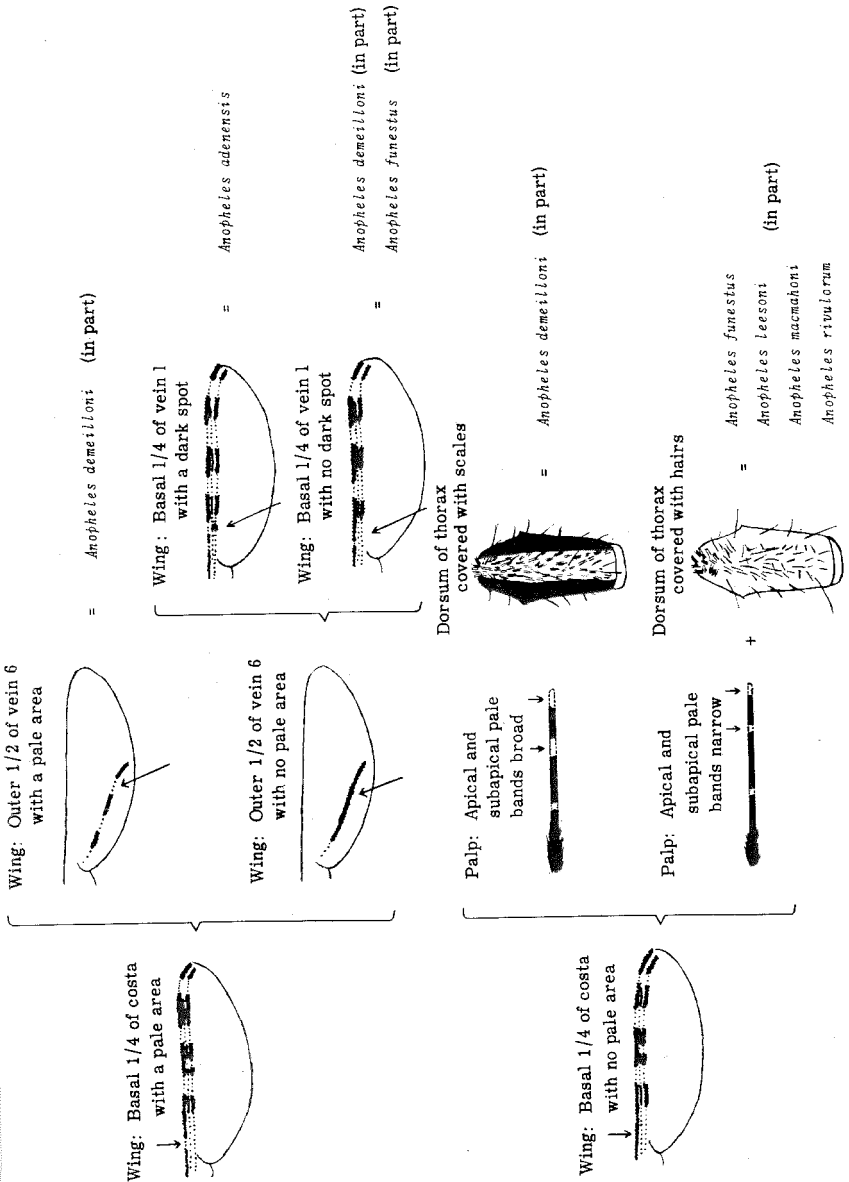


TABLE 1.—Indexed list of anopheline species by plates in the key

<i>A. adenensis</i> * Christophers, 1924—Plate X	<i>A. macmahoni</i> Evans, 1936—Plate X
<i>A. ardensis</i> * (Theobald, 1905)—Plate IV	<i>A. maculipalpis</i> Giles, 1902—Plate III
<i>A. christyi</i> (Newstead and Carter, 1911)—Plate VII	<i>A. marshalli</i> (Theobald, 1903)—Plate IX
<i>A. cinereus</i> Theobald, 1901—Plate VI, Plate VII	<i>A. natalensis</i> (Hill and Haydon, 1907)—Plate III
<i>A. coustani coustani</i> Laveran, 1900—Plate V	<i>A. nili</i> (Theobald, 1904)—Plate VI
<i>A. coustani tenebrosus</i> Donitz, 1902—Plate V	<i>A. obscurus</i> * (Grunberg, 1905)—Plate VI
<i>A. coustani ziemanni</i> Grunberg, 1902—Plate V	<i>A. paludis</i> Theobald, 1900—Plate V
<i>A. dancalicus</i> Corradetti, 1939—Plate IV	<i>A. pharoensis</i> Theobald, 1901—Plate II
<i>A. demeilloni</i> Evans, 1933—Plate X	<i>A. pretoriensis</i> (Theobald, 1903)—Plate III
<i>A. d'thali</i> Patton, 1905—Plate I	<i>A. rhodesiensis</i> Theobald, 1901—Plate I
<i>A. funestus</i> Giles, 1900—Plate X	<i>A. rivulorum</i> Leeson, 1935—Plate X
<i>A. gambiæ</i> Giles, 1902—Plate IV	<i>A. rufipes</i> (Gough, 1910)—Plate V
<i>A. garnhami</i> Edwards, 1930—Plate VIII, Plate IX	<i>A. rupicolus</i> * Lewis, 1937—Plate I, Plate VI
<i>A. harperi</i> * Evans, 1936—Plate IX	<i>A. scydali</i> Edwards, 1929—Plate VIII
<i>A. implexus</i> * (Theobald, 1903)—Plate II	<i>A. squamosus</i> Theobald, 1901—Plate II
<i>A. kingi</i> Christophers, 1923—Plate III	<i>A. theileri</i> Edwards, 1912—Plate V
<i>A. leesoni</i> * Evans, 1931—Plate X	<i>A. turkhudi</i> Liston, 1901—Plate VI
<i>A. longipalpis</i> (Theobald, 1903)—Plate VIII	<i>A. wellcomei</i> Theobald, 1904—Plate VIII

* Not seen by the author.

TABLE 2.—Anopheline distribution by province in Ethiopia *
January, 1962

<i>Anopheles:</i>	<i>adenensis</i>	<i>ardensis</i>	<i>christyi</i>	<i>cinereus</i>	<i>coustani</i>	<i>dancalicus</i>	<i>demeilloni</i>	<i>d'thali</i>	<i>funestus</i>	<i>gambiæ</i>	<i>garnhami</i>	<i>harperi</i>	<i>implexus</i>	<i>kingi</i>	<i>leesoni</i>	<i>longipalpis</i>	<i>macmahoni</i>
Arussi	x	..	..	..	..	x	..	..	..	..	..	..	..
Begmedar	x	x	x	..	x	..	x	x	x	x	..	..	..	x	x
Eritrea	x	..	x	x	x	x	x	x	x	x	..	..	..	..	..	..	x
Gemu Gofa	x	..	..	x	..	..	..	..	..	..	..
GOJJAM	x	x	x	..	x	..	x	x	..	..	..	..	..	..	..
Harar	x	x	x	..	x	x	x	x	x	..	..	..	..	..	x
Illubabor	x	..	..	..	x	x	..	..	..	..	..	x	x
Kaffa	x	x	x	..	..	..	x	x	x	x	x	x	..	..	..
Shoa	x	x	x	..	x	x	x	x	x	..	..	..	x	x	..
Sidamo	..	x	..	x	x	..	x	x	x	x	x	..	..	x	x	..	..
Tigre	x	x	..	..	x	..	x	..	..	..	..	..	..	..
Wollega	x	..	x	x	..	..	..	..	..	..	..
Wollo	x	x	x	x	x	x	x	x	x	..	..	..	..	x	x

* As compiled by the Ethiopian Malaria Eradication Service, ICA, Dr. Pierre Jolivet of WHO and the Italian workers.

TABLE 2.—Continued

PROVINCES	<i>Anopheles:</i>																
	<i>maculipalpis</i>	<i>marshalli</i>	<i>natalensis</i>	<i>nili</i>	<i>obscurus</i>	<i>paltadis</i>	<i>pharoensis</i>	<i>pretoriensis</i>	<i>rhodesiensis</i>	<i>rivulorum</i>	<i>ruffipes</i>	<i>rupicolus</i>	<i>scydeti</i>	<i>squamosus</i>	<i>thelleri</i>	<i>turkhuai</i>	<i>wellcomei</i>
Arussi	..	x	..	..	..	..	x	..	..	..	..	..	..	x	..	..	..
Begmedar	..	x	..	..	..	..	x	x	x	..	..	x	..	x	..	x	..
Eritrea	x	x	x	..	..	..	..	x	..	x	..
Gemu Gofa	x	..	..	..	x	..	..	..	..	..	x	..	..	..
Gojjam	..	x	x	..	..	..	x	..	..	..	..	..	..	x	..	..	..
Harar	x	x	x	..	x	..	x	..	x	..	..
Illubabor	x	..	..	x	..	x	x	x	..	x	x	..	x	x	x	..	x
Kaffa	..	x	..	..	..	..	x	x	..	..	..	..	..	x	..	..	..
Shoa	x	..	..	x	x	x	..	..	x	..	x	..	..	..
Sidamo	x	x	..	x	x	..	x	..	..	..	..	..	..	x	..	..	..
Tigre	..	x	..	..	..	..	..	..	..	..	..	x	..	x	..	..	..
Wollega	x	..	..	..	..	..	..	..	..	..
Wollo	..	x	..	..	x	x	x	x	x	..	x	..	..	x	..	..	..

A. funestus, *A. lesoni*, *A. macmahoni* and *A. rivulorum* have been lumped together.

Since the identifying characters of some *A. demeilloni* specimens collected in Ethiopia are easily confused with those of the *A. funestus* group, separation of these groups is by size alone. *A. demeilloni* is considered a "large" mosquito while those of the *A. funestus* group are considered "small."

Much work is yet to be accomplished on the mosquito fauna of Ethiopia. Comments and suggestions from individuals using the key are welcomed.

ACKNOWLEDGMENTS

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