

ENTOMOLOGY.—*A new species of Anopheles from the Solomon Islands.*¹ JOHN N. BELKIN and RALPH J. SCHLOSSER, Sanitary Corps, U. S. Army. (Communicated by ALAN STONE.)

In the Lunga district of Guadalcanal Island, British Solomon Islands Protectorate, a survey of the anophelines was made. Four distinct forms of anophelines were encountered, a species of *Bironella* (*walchi?*), two forms of *A. punctulatus* Dönitz, and a species of *Anopheles*, which is described here-

with. In reports from this area in the past few months this species has been called *A. p. punctulatus* Sw. & Sw. Investigations of the role of *A. p. punctulatus* in the transmission of disease on this island were actually carried out with this new species and not with *A. p. punctulatus* as reported. A summary of these investigations is given at the end of the paper. The senior author was very for-

¹ Received June 29, 1944.

tunate in enlisting the assistance of the junior author in the preparation of the illustrations.

Anopheles (*Myzomyia*) lungae, n. sp.

Adult female.—A medium-sized yellowish, speckled anopheline with the apical third of the labium yellow. Length of wing 4 mm.

HEAD (Fig. 2): Conspicuous white frontal tuft; vertical setae white, followed by one or two rows of white narrow hair-like scales; white scales on top of vertex forming a wide spot narrowed in the center; the rest of vertical scales and the occipital scales dark. Antenna with a few minute white scales on torus and dense white scaling on the first flagellar segment. Palpi ornamented as shown in Fig. 2; ornamentation very constant, the light scales yellowish on the last segment and white on the rest. Labium densely covered with yellow scales on apical third, yellow coloration broken by narrow dark ring just proximad of apex. Labella dull yellow.

THORAX (Fig. 3): White scales on anterior promontory rather short and scarce, central scales elongate, lateral broader. A few dark scales below. Rest of mesonotum devoid of scales, except for very narrow whitish scales in front of wing root; vestiture consisting of numerous golden hairs of varying length. Mesonotal integument light brown with gray pollinose longitudinal lines; dark brown eye spots in front of and behind scutal angle; prescutellar space dark brown. Mesonotal bristles light in color. Pleura darker with a broad blackish longitudinal line dorsally. Spiracular bristles absent, propleurals 6, lower sternopleurals 3, upper sternopleural 6-8, prealar 4-6, subalar 5-6, lower mesepimerals absent.

WING (Fig. 1): As in figure; pale areas light yellow, dark spots often more conspicuous than shown in figure, scales rather broad. Median dark spot includes base of vein 2; a dark spot on costa between basal and median dark spots; subcosta and vein 1 without dark spots in this area; small black spots, shown in figure, between median and preapical black spots sometimes absent.

LEGS (Fig. 4): Front femora swollen in basal half, speckled; middle and hind femora and all tibiae with rather evenly spaced pale spots externally. First segment of front tarsus with several light spots and light apex; second, third and fourth segments with basal and apical light

bands; fifth segment dark basally, remainder light. First segment of middle tarsus similar to corresponding segment of front tarsus; second, third and fourth segments with basal light bands only; fifth segment all dark. First segment of hind tarsus with numerous light spots and light apex, second segment with light apical band and usually one to three light spots in the center; third segment with light apical band and occasionally a few light scales in center; fourth segment with light apical band; fifth segment all dark. Light scales on legs yellowish. Dark scales on middle tarsus much lighter than on other tarsi.

ABDOMEN: Devoid of scales on tergites and sternites; instead, a vestiture of narrow golden hairs similar to those found on mesonotum. Hairs more numerous on posterior segments. Cerci with rather narrow yellow scales.

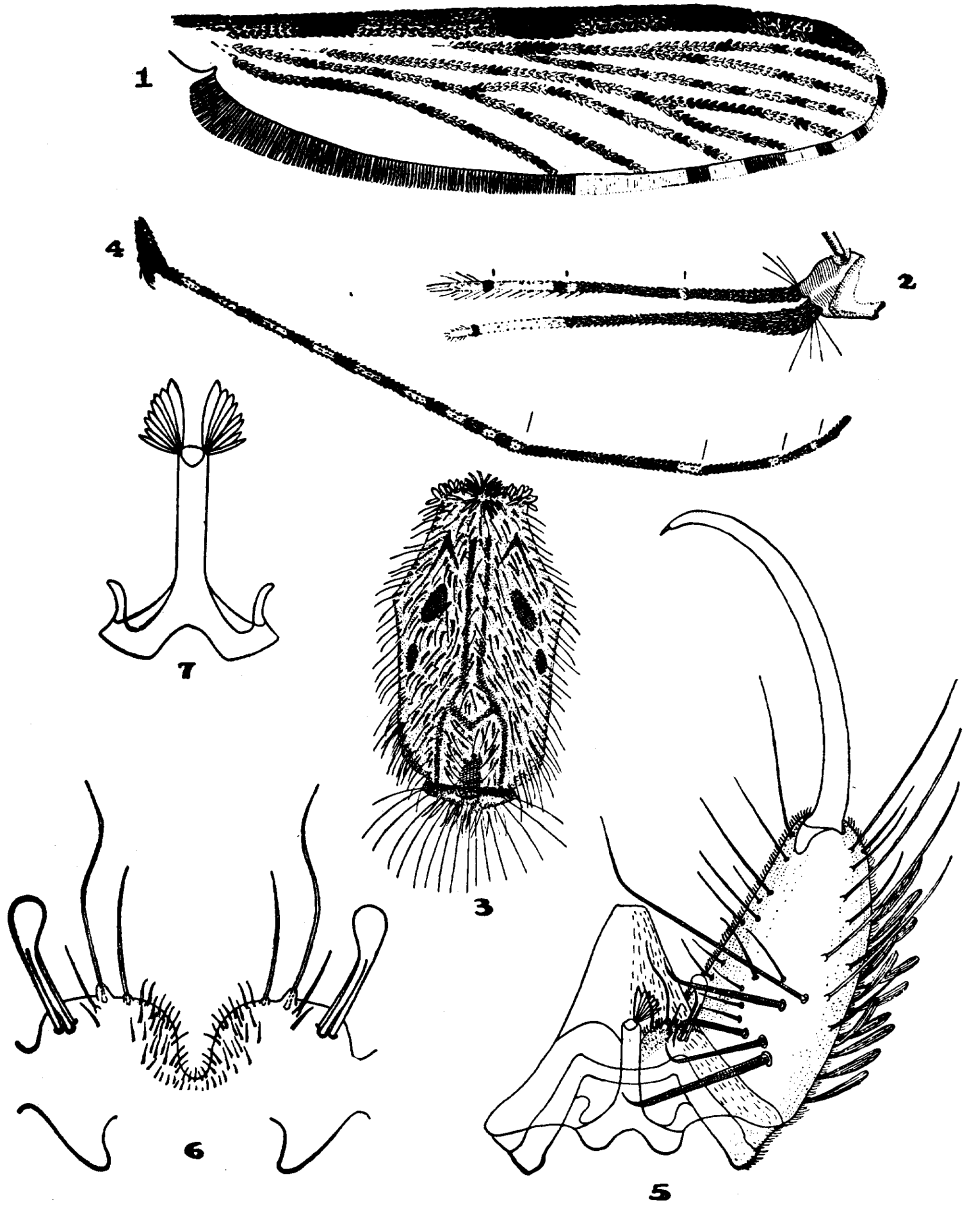
Adult male.—In the main as the female. First flagellar segment with a tuft of long narrow white scales resembling frontal tuft. Palpal ornamentation essentially as in female; segment with 2 yellow scales dorsally in middle; third segment with narrow apical yellow ring and a few yellow scales dorsally in middle; fourth and fifth segments yellow with narrow basal dark rings. Labium all dark except for a few yellow scales at apex, labella dull yellow. Abdomen as in female except for numerous yellow scales on eighth tergite. Side pieces densely covered with yellow scales; black scales present laterally.

MALE GENITALIA (Figs. 5-7): Side pieces broad. Parabasal spines 5, spine 4 separated from 1-3. Claspettes (Fig. 6) with elongate club composed of four fused spines; apical hair almost twice length of club; inner accessory hair as long as club; two small hairs arising near base of apical hair. Phallosome (Fig. 7) elongate with parallel sides; leaflets 7-8, quite broad, the longest about one-fourth length of phallosome, serrations absent (?).

Larva.—**HEAD** (Fig. 8): Inner clypeals widely spaced, quite heavy, but short; outer clypeals extremely short; posterior clypeals similar to outer clypeals. Frontal hairs with branching as shown in figure. Occipitals and orbitals short, bifurcate. Antenna with fairly conspicuous spines on inner surface; antennal hair minute arising one third from base; terminal hair with about five branches arising from base, slightly longer than sabers; basal hair normal; subbasal short, three branched.

THORAX (Fig. 9): Prothoracic hair 1 with heavy basal tubercle, heavy shaft and radiation branching, approximately half as long as hair 2; hair 2 not quite so long as hair 4, with heavy basal tubercle, heavy shaft, and five to six branches on each side; hair 3 small, simple; hair 5 with very thick shaft, minute lateral

branches except near apex where branches are long; hair 6 simple, longer than 5. Prothoracic pleural hairs 9 and 10 long and simple; hair 11 long with three to five branches; hair 12 simple or bifid, about one-third length of long hairs. Mesothoracic pleural hairs 9 and 10 long and simple; hair 11 short, with two or three



MORPHOLOGY OF ADULT ANOPHELES LUNGAE

Fig. 1.—Wing of female. Fig. 2.—Mouthparts of female. Fig. 3.—Mesonotum of female. Fig. 4.—Hind tarsus of female. Fig. 5.—Male genitalia. Fig. 6.—Claspettes. Fig. 7.—Phallosome.

branches, hair 12 minute. Hair 1 on mesothorax with thickened shaft. Hair 1 on metathorax forming a palmate hair with approximately 8 leaflets, leaflets not pigmented.

ABDOMEN (Fig. 9): Palmate hairs very large and heavily pigmented on segments III-VII, somewhat smaller on VII; poorly developed on I; fairly well developed (12 or more leaflets) but lightly pigmented on II. Leaflets (Fig. 11) numbering 16 to 26 on segment III and IV, well-pigmented; filaments short, indentations not numerous. Lateral hair on segment III with approximately six branches on each side, arising well away from base; lateral hairs on segments IV and V usually double; lateral hairs on VI with five to six branches. Anterior tergal plates rather small; posterior tergal plates very small, present on segment IV-VII. Median plate of scoop well developed. Pecten (Fig. 10) with 3-4 long and 6-8 short spines, the serrations at their bases very fine and inconspicuous; the pecten hair with 4-5 branches. Caudal hooks 6-8. Anal gills much longer than anal segment.

Types.—Holotype ♀, allotype ♂, paratypes 20 ♀, 20 ♂ collected resting on tree trunks, Tassafaronga Swamp, Guadalcanal Island, January 28, 1944 (Belkin); paratypes 5 ♀, 4 ♂ reared from larvae collected in Wright's Creek, Guadalcanal Island, November 11, 1943 (Belkin); paratypes 10 ♀, 15 ♂ collected on tree trunks, Burns Creek, Lunga, Guadalcanal Island, March 10, 1944 (Belkin). Holotype and allotype to be deposited in U. S. National Museum.

Identification.—This species can be separated easily from the forms of *A. p. punctulatus* in both the male and female by the very large median dark spot on the wing, the yellowish scales on the wings and palpi, the absence of white scales on most of the mesonotum and the presence in their place of yellow hairs. The larvae are easily distinguished by the very short outer clypeals, simple inner clypeals, the very characteristic prothoracic hairs 1 and 2, the palmate hairs, and the pecten. On pleural hairs this species does not quite agree with other members of the group *Myzomyia* to which it apparently belongs. The combination of characters exhibited by this species is not found in any previously described form. Seventy individual rearings of larvae established the identity of this form.

Distribution.—*Anopheles lungae* is generally distributed along the northwest coast of Guadalcanal Island. It may be present also on some of the other Solomon Islands.

Biology.—The larvae of this species are normally found in the jungle in seepage areas, along the margins of streams, pot holes in stream beds, rock holes, dense jungle swamps, and temporary pools. The species has a decided preference for shade in its breeding places. During the rainy season the larvae are flushed out into the coconut groves on the coastal strip where the species then breeds. The diurnal adult resting places were first discovered by Capt. F. B. Whittington. Adults are usually found resting in partial shade on tree trunks in the jungle. Males, unfed, blooded, and gravid females are all found together. Other resting places have been found under logs, inside crates, boxes, oil drums, foxholes, and nail kegs.

As this species becomes very abundant early in the rainy season on the northwest coast of Guadalcanal, preliminary investigations were conducted on its feeding habits and its relation to disease transmission in this area. On several occasions areas with a high adult density of this species were visited at night and biting records made. Males and females were observed leaving their daytime resting places between 6:30 and 7:00 P.M.; after 7:30 none could be found resting. Although the biting records were made among the trees where the anophelines were resting, less than two percent of the total anopheline catch was *A. lungae*. In routine night catches for anophelines in the Lunga district of Guadalcanal the percentage of *A. lungae* of the total anophelines collected is a little less than two. Blooded females collected in the jungle near troop areas were dissected. Seventy percent of these showed nucleated red blood cells; the blood found in the remainder was of mammalian origin. Precipitin tests are being made on a small number of blooded females of these species collected by Capt. F. B. Whittington.

It appears from these sketchy observations that in the area in question *A. lungae* is not strongly androphilic and probably is not of primary importance in disease transmission. Nevertheless, during the rainy season when this species is flushed out by the rains and extends its breeding range into the coastal coconut

groves it may become a problem locally. The normal blood supply is believed to be birds and possibly bats. With the great disturbance caused by an influx of humans a change in blood feeding habits may take place.

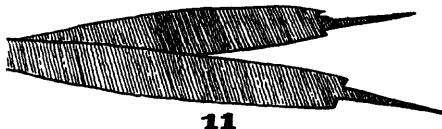
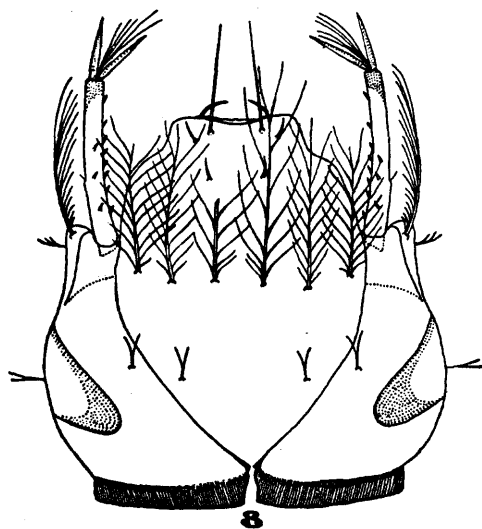
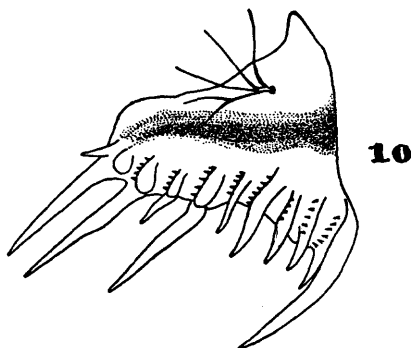
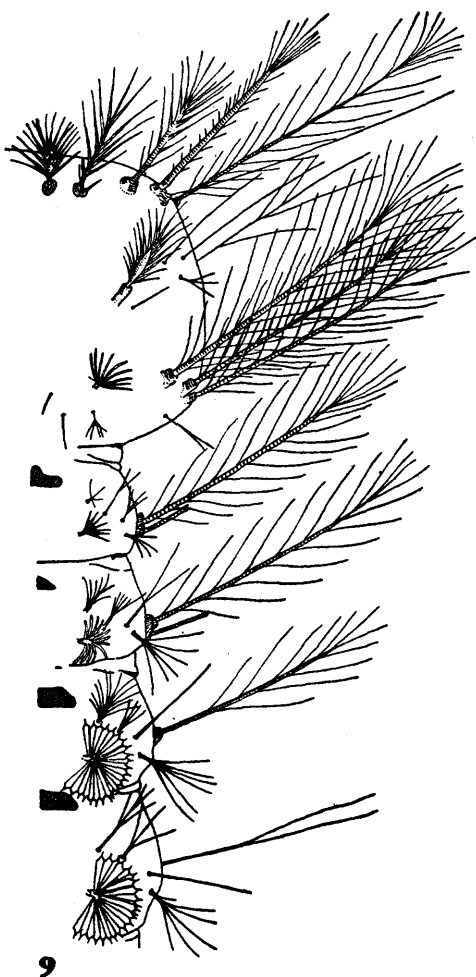
PROVISIONAL KEYS TO ANOPHELINES OF
GUADALCANAL ISLAND

The following provisional keys are included as it is hoped that they may be of assistance in other parts of the South Pacific Area. Large

series of individual rearings connected the larvae with the adults.

Females

1. Palpi very short, wing scales all dark. *Bironella(walchi?)*
Palpi as long as labium, wing scales light and dark. 2
2. Mesonotum with a vestiture of golden yellow hairs only, except for white and black scales on anterior promontory; median dark wing spot including subcosta, vein 1, and base of vein 2; apical third of proboscis with yellow



MORPHOLOGY OF LARVA OF ANOPHELES LUNGAE

Fig. 8.—Head. Fig. 9.—Thorax and abdomen. Fig. 10.—Pecten. Fig. 11.—Leaflet of palmate hair.

- scales, interrupted by narrow dark ring near apex. *A. lungae*
 Mesonotum with a vestiture of white scales throughout; median dark wing spot not extending to veins 1 and 2. 3
3. Labium all dark except for a few white or yellowish scales at extreme apex. *A. p. farauti*
 Labium with a vestiture of white or creamy scales on apical third, interrupted by a narrow ring of dark scales just before apex.
 *A. p. punctulatus*

Males

The males of the three forms of *Anopheles* in this area have the labium all dark with a few light scales on apex; the labella are dull yellow. The males of *A. lungae* can be distinguished on mesonotal vestiture and wing spotting which are similar to the female. The males of *A. p. punctulatus* and *A. p. farauti* have not as yet been successfully separated.

Larvae

1. Inner clypeals close together. *Bironella (walchi?)*
 Inner clypeals widely separated. 2

2. Outer clypeals extremely short, usually less than one quarter the length of inner clypeals; pecten with two distinct series of spines, spines 10-12 in number; palmate hair on II not pigmented. *A. lungae*
 Outer clypeals at least half as long as inner clypeals; pecten with 14-17 subequal spines 3
3. Clypeal hairs slender, without branches; prothoracic hairs 1 and 2 with rather slender shafts, hair 5 with long lateral branches; palmate hair on II less developed than on III; lateral hairs on IV and V with three to four branches. *A. p. punctulatus*
 Clypeal hairs thickened, with a few fine lateral branches; prothoracic hairs 1 and 2 with thickened shafts, hair 5 with very short lateral branches; palmate hair on II developed as strongly as on III; lateral hairs on IV and V simple or double. *A. p. farauti*

Remarks.—The larvae of *A. p. punctulatus* from Guadacanal agree in every respect with the chaetotaxy represented for this form in Ross and Roberts' "Mosquito Atlas," Part 2, p. 12, 1943. Adults of *A. p. punctulatus* have never been collected attempting to bite humans on this island.

ENTOMOLOGY.—*Some relationships of Anopheles lungae Belkin and Schlosser (Diptera: Culicidae).*¹ ALAN STONE, U. S. Bureau of Entomology and Plant Quarantine.

The foregoing excellent description of *Anopheles lungae* is sufficient to distinguish it from all other described species, but it seems advisable to compare it with certain closely related species that were not available to its describers. This is particularly true since it might be confused with *Anopheles tessellatus* Theobald or *A. longirostris* Brug. These three species have the following characters in common which distinguish them from the related species, *punctulatus* Dönitz, *annulipes* Walker, *farauti* Laveran, and *amicus* Edwards: (1) Scales of the halteres entirely pale, creamy white; (2) scutum with scales on the anterior margin only; (3) outer clypeal hairs of the larva very short, much less than half as long as the inner clypeal hairs.

The females of the two close relatives of *lungae* are distinguished from it by the following characters:

A. longirostris: At least apical half of proboscis pale; proboscis about one-fifth

longer than the palpi, strongly decurved; third palpal segment (antepenultimate) with apical half pale.

A. tessellatus: Third palpal segment with apical half pale.

The larva of *lungae* closely resembles that of *tessellatus*, but prothoracic hair 1 of *tessellatus* has a slender shaft with 2-6 branches. The larva of *longirostris*, as described, shows no differences from *lungae*, but it is quite probable that a direct comparison of the two species will reveal some.

The distribution of these three species is of some interest in view of their close relationship. *A. tessellatus* has a wide Oriental distribution from India to Hong Kong, the Netherlands Indies, the Philippines, with a few records from the Moluccas, and one questionable one from western New Guinea. *A. longirostris* has been collected from several places in New Guinea and from Kavieng, New Ireland. *A. lungae* is confined to the Solomon Islands. The distribution of the three species has not yet been found to overlap.