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Miscellanea.

Anopheles pampanae, a new Species of Mosquito from Cambodia.

By W. BÜTTIKER¹ and P. BEALES².

During recent short term assignments with the WHO Advisory Team for Malaria Eradication No. 3 to various parts of South East Asia, a special study of *Anopheles minimus* and its closely related species was carried out. This investigation led to the discovery of a new species which is described as follows:

Anopheles (Myzomyia) pampanae nov. sp.³.

General.

Very small, greyish to dark brown anopheline, with golden hairs on thorax and abdomen, and grey upright scales and frontal tuft on head; palpi brown to dark brown nearing black and banded cream; wings dark brown and spotted cream; legs pale to dark brown, depending on light; thorax with silvery grey markings. This species closely resembles *A. mangyanus* and also to a certain degree *A. minimus*, the chief characteristics by which it is distinguished being given in the tables 1 and 2. For the key of identification see BÜTTIKER and BEALES (paper in preparation).

Female.

Length 3.5 mm., length of wing 2.8 mm., length of proboscis 1.6 mm.

Palpi (Fig. 1 c): as long as proboscis; brown to dark brown, the scales semi-erect at the base of palps; a very narrow ring of cream coloured scales at apex of second segment, and cream scales at base and apex of 3rd segment; 4th segment completely cream coloured. The apical segment seems to be slightly larger than the 3rd, but only owing to the length of the fairly long tuft of cream scales at tip. White band at apex of 1st segment.

Proboscis (Fig. 1 e): uniformly dark brown with dark brown scales, only the tip being scaleless cream coloured and bristled. No flavescent area however small ventrally or dorsally.

Thorax: Prothoracic lobes dark brown, clothed with narrow scales and bristles. Mesonotum with broad, grey (silvery) median area; its border brown with sparse, golden, curved and hairlike scales. Scutellum simple and sparsely covered with golden hairs; metanotum nude, brown, halteres ocher, distally with a dark brown knob.

Wings (Fig. 1 a): Two pale interruptions very constantly on the base of costa; no fringe spot, as a rule, at vein 6; grey scales on the base of the first longitudinal vein at the area of the humeral pale spot on the costa, such scales are not present in *A. minimus* nor in *A. mangyanus*. The other wing characters

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³ We take great pleasure in dedicating this new species to Dr. E. J. PAMPANA, formerly Director, Division of Malaria Eradication, World Health Organization, Geneva.

Fig. 1

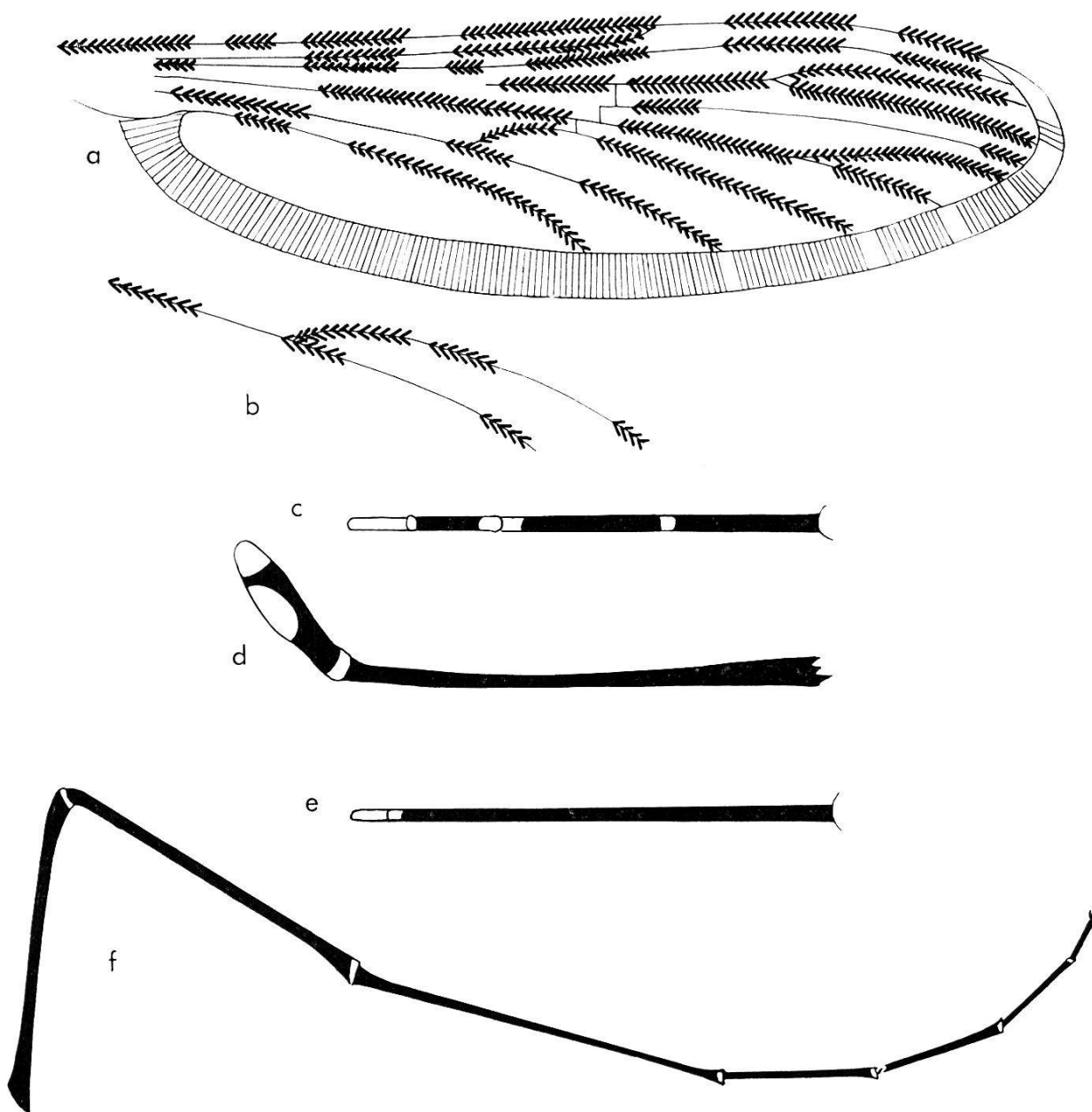


Fig. 1. *A. pampanae*, adult; (a) wing, ♀, coll. specimen No. "X". (b) variation, wing 5th vein, specimen coll. No. "CC". (c) female palp. (d) male palp. (e) proboscis. (f) hind leg. Specimen from Ksim 2, Snoul district (Cambodia).

are too variable to be used in identification. Example of variation of vein 5 is shown in Fig. 1 b.

Abdomen: Uniform dark brown, entirely devoid of scales on ventral and dorsal aspects, even on cerci; golden hairs; the basal segments ventrally slightly lighter.

Legs (Fig. 1 f.): Quite uniformly dark brown to black; femora slightly lighter basally. Colour of tips of hind tarsi dark brown, but in some lights the tarsi appear light (palish) brown, and the bases of all tarsal segments are brighter. No conspicuous banding but obvious small rings of pale cream scaling distally on all leg segments, particularly tarsi, being almost similar to *flavirostris* and *filipinae*, but unlike *A. mangyanus*, *A. varuna*, *A. aconitus* and *A. fluvialis* where there is no such scaling.

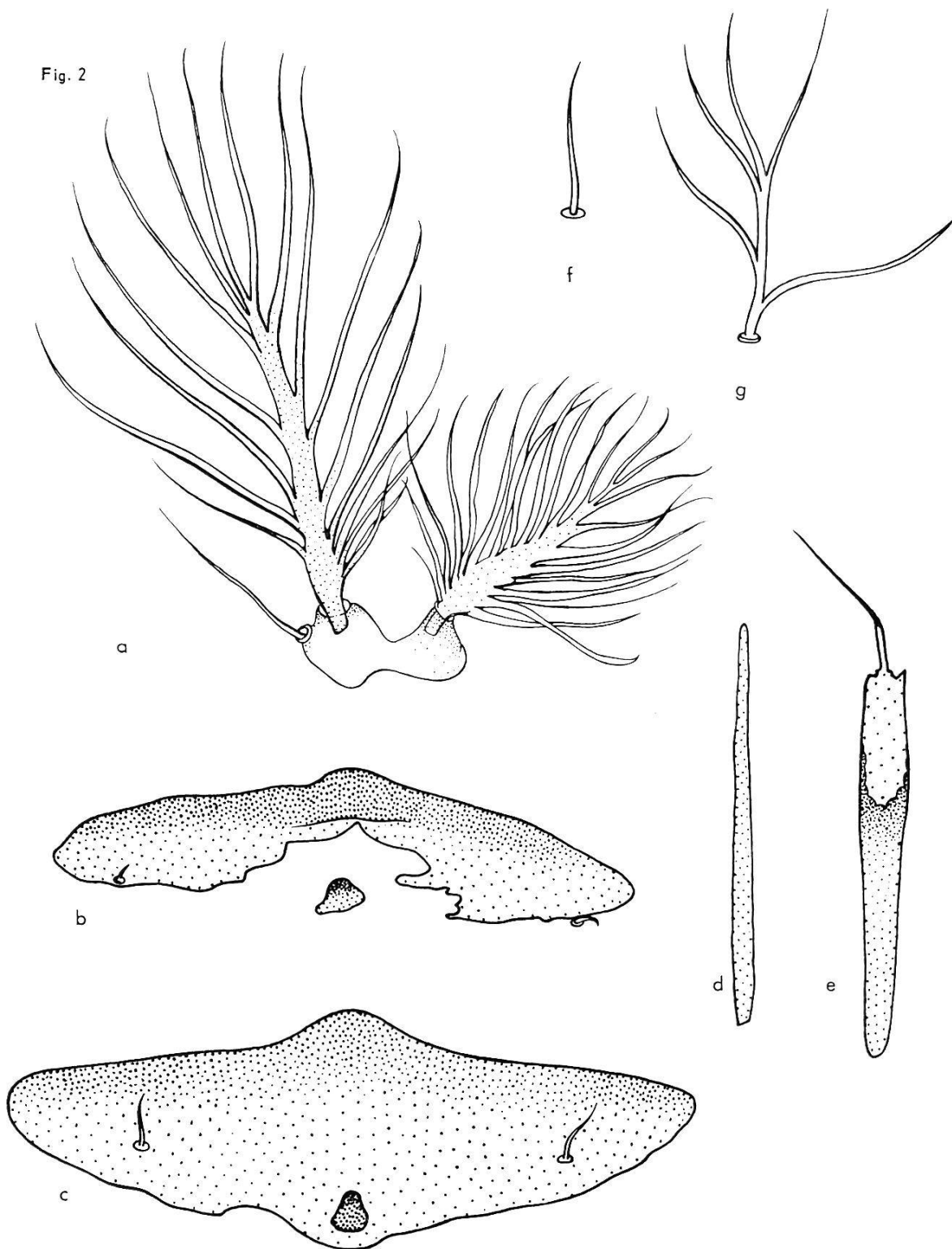


Fig. 2. A. pampanae, 4th stage larva. (a) submedian prothoracic hairs (shoulder hairs). (b) anterior tergal plate on abdominal segment ii. (c) anterior tergal plate on abdominal segment iv. (d) a leaflet on thoracic palmate hair. (e) a leaflet on palmate hair, abdominal segment iv. (f) hair 'O', abdominal segment iv. (g) sutural hair. Specimen from Ksim 2, Snoul district (Cambodia).

Male.

General appearance like female. Length 3.4 mm., length of wing 2.7 mm., length of proboscis 1.6 mm.

Palpi (Fig. 1 d): Dark brown, the ornamentation is given in Fig. 1 d, but slight variation occurs regarding the extension of whole markings. Indistinguishable from male palps of *A. mangyanus* and *A. minimus*.

Proboscis: As female.

Wings: Same as female; main and most constant characteristics are the two pale interruptions at the base of costa.

Legs: White rings or bands, obvious in males too; quite characteristic.

Hypopygium: Very similar to *A. minimus*.

Larva. 4th instar:

Small and dark with large tergal plates; closely resembles *A. mangyanus*, differing only in some minor details.

Clypeal hairs: simple, fairly short, outer usually $\frac{1}{2}$ or more than $\frac{1}{2}$ length of inner.

Submedian Prothoracic hairs (shoulder hairs): with confluent tubercles (Fig. 2 a). In *A. minimus* and *A. mangyanus* the shoulder hairs are separate usually.

*Anterior Tergal Plates.**Abdominal Segment 1.*

Small plate compared with those on other segments, occupying approx. one fifth of the segment; distal margin convex.

Abdominal Segment 2 (Fig. 2 b).

Plate occupying nearly one half of segment but with distal margin obviously concave and posterior tergal plate (dark spot) lying isolated in the cavity. Hair 'O' arising just inside or outside posteriorly to tergal plate.

Abdominal Segment 3, 4, 5, 6, 7, and 8.

Large plates occupying approx. three quarters of segment, with distal margin convex and posterior tergal plate (dark spot) completely enclosed by anterior tergal plate. Hair 'O' of the 4th anterior tergal plate arising inside of this plate.

For the identification tergal plates of segments 2 and 4 are of particular importance.

Sutural hairs (Fig. 2 g): not dendroid, approaching branched.

*Hair 'O'.**Abdominal Segment 1.*

Hair usually not differentiated.

Abdominal Segment 2.

Hair always simple, short, usually arising outside the anterior tergal plate, but occasionally just arising from the edge.

Abdominal Segment 3.

Hair long, simple, generally arising from within the anterior tergal plate but sometimes just from the edge or outside.

Abdominal Segment 4, 5, 6, and 7 (Fig. 2 f).

Hair long, arising from well within the anterior tergal plate always, simple but occasionally on one side only of one or two segments, forked at the base.

Thoracic palmate hair (Fig. 2 d): never with tapering filaments, apical ends rather blunt, sometimes pointed. Best characteristic to distinguish larvae of *A. pampanae* from *A. mangyanus*: Thoracic palmate hair of *A. pampanae* identical to *A. minimus*.

Pupa. In characters of paddle and general arrangement of spines and main hairs, very similar to *A. minimus*.

Eggs. Unknown.

Bionomics: This species was found breeding and resting simultaneously with *A. minimus* in the type locality Ksim 2 near Snoul in Cambodia. Breeding places consisted of slow-flowing foot-hill streams with sandy or rocky beds, shaded edges and steep river banks covered with dense vegetation. The larvae were particularly abundant at the end of the dry season in the covering roots at the edges of pooled up river sections which were densely covered by roots of various species of riverine trees. From the scanty observations made it would appear that this species tolerates a higher degree of water pollution than *A. minimus*. Before the onset of the monsoon rains this species represented up to 76% of the *A. minimus*-*A. pampanae* population but dropped after the rains to 15% only and was then at the edges in fairly fast running water. Males and females were found in fairly large numbers in natural resting places, such as hollowed riverbanks, exposed roots in undercut banks, overhanging roots of riverine trees etc. During a few night catches using water buffalos as bait animals, observations have shown that this species appears mainly before midnight and is little in evidence after that hour. Four stomach smears from natural outdoor resting places were tested and were all positive for bovines; in Burma (Lashio District, Shan State) also found at daytime in houses.

Relation to malaria: unknown. *Anopheles pampanae* having been regarded as a variation of *A. minimus* probably in several regions of South-East Asia, new investigations on infection rate, longevity, exophily etc., are required for these two species.

Distribution:

A first indication of the existence of this new species was met in the Lashio District, Burma, in 1957. It was then regarded still as a variation of *A. minimus* which we called "*A. minimus* var. No. 3" (BÜTTIKER 1958 a). The re-examination of these specimens in our collection revealed that they belong to *A. pampanae* as described from Cambodia.

1. *Region of Snoul* (106° 37' E. 12° 06' N, 184 meters alt.) *Kratié Province, Cambodia*. Type Locality: Ksim 2 (Prek Chimeang), 10 kms North of Snoul.

Type specimens: 5 ♂ May 1958	} obtained from individual elevages
5 ♀ May 1958	
5 larvae May 1958 (4th larval skins)	
5 pupae	

Larvae and pupae mounted in Berlese's Fluid.

These specimens are deposited in the entomological collections, British Museum (Natural History), London.

Co-types, namely 2 ♂ and 6 ♀, 8 larvae skins and 2 whole larvae, mounted and collected from the same locality, were deposited in the Public Health Laboratories, Division of Malaria, Manila, Philippines.

Further specimens were reared and/or collected at Ksim 2 from various natural resting places: 18 ♂, 26 ♀, 69 larvae, May 1958.

- Kbal Trach: 1 ♀, 23. 5. 58; 4 ♀, 29./30. 5. 58; 1 larva, 15. 5. 58.
2. *Region of Kampot: (104° 15' E., 10° 54' N, sea level), Cambodia.*
 Po Phnum Twea (night catch, on water buffalo), 1 ♀, 9./10. 6. 58; 14 ♀, 17./18. 6. 58; 1 larva, 9. 6. 1958. For further details see BÜTTIKER (1958 b).
3. *Region of Lashio: (97°, 49' E., 22° 57' N., approx. 950 meters alt.), Shan State, Burma.*
 Man He: 3 ♀, 19. 9. 57.
 Nama Khaw: 1 ♀, 25. 9. 57; 1 ♀, 26. 9. 57; 1 ♀, 27. 9. 1957; 1 ♀, 30. 9. 57; 1 ♀, 1. 10. 57; 1 ♀, 5. 10. 57.

TABLE 1.
Comparison of the Main Adult Characteristics.

Characteristics	<i>A. m. minimus</i>	<i>A. mangyanus</i>	<i>A. pampanae</i> nov. sp.
Interruption(s), at base of costa	one	two	two
Patch of grey scales first longitudinal vein	missing	missing	present
Banding at segments of each leg	almost none	almost none	pronounced banding ("rings") particularly on fore and hind legs

TABLE 2.
Comparison of the Main Larval Characteristics.

Characteristics	<i>A. m. minimus</i>	<i>A. mangyanus</i>	<i>A. pampanae</i> nov. sp.
Submedian pro- thoracic hairs (shoulder hairs)	tubercles separate (or very rarely with a weak fusion on one side)	tubercles separate	tubercles joined
Posterior border of tergal plate on ab- dominal segment 2	usually convex and including dark spot	concave	concave
Hair 'O' on abdom. segment 4	arising externally to tergal plate	arising internally	arising internally
Shape of hair 'O'	branched; mostly with 3 to 4 branches or at least bifurcate	simple	simple (occasionally on one side only of one or two segments forked at the base)
Sutural hair	dendroid	dendroid	not dendroid
Thoracic palmate hair	no filaments	with long filaments	no filaments

Man Su: 1 ♀, 4. 10. 57.

Anopheles pampanae contributed during our observation period in September 1957 9.1% of the mixed *A. minimus*-*A. pampanae* population.

Bodo (Myitnge Valley), near Mandalay 1 ♀, 15. 11. 57.

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A Yaws Mass Campaign in Liberia; Organization and some Preliminary Results.

By E. G. H. BENDEL ¹.

The Republic of Liberia is located half-way down the west coast of Africa about 300 miles north of the equator. (It is centred about a point 6°30' north of the equator and 9°30' west of Greenwich.) The British Colony of Sierra Leone is on the west boundary and the north and east are French Guinea and Ivory Coast. The Atlantic coastline is 370 miles long and the country extends inland for 100-200 miles. Liberia is estimated to cover about 40-45,000 square miles.

It belongs to the "wet tropics" where a rainy season from May to November and a dry season from December to April can be distinguished. In Harbel the average rainfall is about 150-180 inches and the annual and seasonal variations of the temperature are negligible. It is between 70-95°F in the coastal area, while in the hinterland a greater difference can be noticed. The humidity is about 80-95%.

The Government estimates the population to be two million. Our estimate was no more than 750,000. Americo-Liberians, who are descendants of the originally freed slaves of the United States of America, amount to 16,000. The main part of the population belongs to 20 indigenous tribes divided into three ethnological groups: the Kru, the Mandingo and the Gola.

Because of its rainfall and climate the economy of the country is adapted to a tree-crop agriculture. It was once covered with high tropical forest of

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