

THE ANOPHELES OF MALAYA.—PART II.

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*Institute for Medical Research, Kuala Lumpur, Federated Malay States.***Anopheles kochi**, Dönitz.*Anopheles kochii*, Dönitz, Insecten-Börse, xviii, p. 1 (1901).*Cellia kochii*, Dönitz, Theobald, Mono. Culic., iii, p. 110 (1903).*Cellia flava*, Ludlow, Can. Ent. xl, p. 32 (1908).*Christophersia halli*, James, Paludism, i, p. 32 (1910).

This species was first described by Dönitz from specimens taken in Sumatra. About the same time Theobald had prepared from Malayan specimens the description of an Anopheline species for which he proposed the name *ocellatus*, but recognising that Dönitz' *kochii* and his own *ocellatus* were the same species he published his description as that of *Anopheles kochii*, Dönitz.

Some years later, Major James, I.M.S., examined a specimen from the Indian Museum, Calcutta, labelled "*Cellia kochii*," but which he recognised as differing from other species in the genus *Cellia* in the position of the tufts of abdominal scales. Mr. Theobald to whom the specimen was sent for examination was of opinion that it represented a new Anopheline genus; it was accordingly described by James under the name *Christophersia halli*. The peculiar character of the scale-tufts in *kochi* had already been noted by Dönitz, who, referring to the abdominal scale-tufts in the species *pharoensis* and *squamosus*, wrote (Zeit. für Hygiene, xli, 1902) "Diese Büschel sind aber doch etwas ganz anderes als die Schuppenbüschel bei *An. kochi* die an der Bauchseite in der Mittellinie liegen."

Comparison of Malayan specimens of *kochi* with Indian specimens of *halli* showed that they were the same species and the latter was included by James and myself in our list of Malayan species (Trans. Far East Assn. Trop. Med. 2nd Cong., 1912, p. 317). Examination of specimens at the British Museum showed, however, that *halli*, James, was identical with *kochi*, Dönitz, which is the correct name for this Malayan species. In James' system of classification it is named *Christophersia kochi* (Christophers, Ann. Trop. Med. Parasit, vii, p. 60, 1913).

The mosquito described under the name *Cellia flava* by Miss Ludlow from specimens taken in the Philippine Islands is also no other than *kochi*, Dönitz, as has recently been shown by Edwards (Bull. Ent. Res., iv, p. 22, 1913).

The description and illustration of "*Christophersia halli*" given by Strickland in his "Short Key to the Identification of the Anopheline Mosquitoes of Malaya" are incorrect for this species. The number of abdominal scale-tufts does not exceed six and they are found on the second to seventh segments only.

The following descriptions are based on the study of the ova laid by a female in captivity and of the larvae, pupae and imagines which developed therefrom. Twenty days elapsed from the deposition of the ova to the emerging of the imagines.

The Ovum.

The upper surface is narrow, slightly expanded at either end, and the floats do not touch its margin. The narrow striated frill is continuous around the whole of the margin of the upper surface. The thin silvery membrane which covers the under

surface of the ovum and the lateral areas between the floats and the frill, has a reticulated pattern. The floats are oblong in shape and extend over the middle two-thirds of the ovum's length; each float has about twenty corrugations. Length of ovum 0.45 mm., greatest breadth 0.16 m.m.

This ovum does not differ in any detail from that of *A. tessellatus* (Bull. Ent. Res. iv, p. 131).

The Newly Hatched Larva.

When it emerges from the egg the larva of *Anopheles kochi* is peculiar among the Malayan species so far examined in regard to the form of the anterior clypeal hairs. Even those species in which these hairs are much branched in the mature form show only simple bristles in the earliest stage of the larva; in *kochi*, however, the inner pair of anterior clypeal hairs are coarsely pinnate in the newly hatched larva, though they are only very finely so in the mature form.

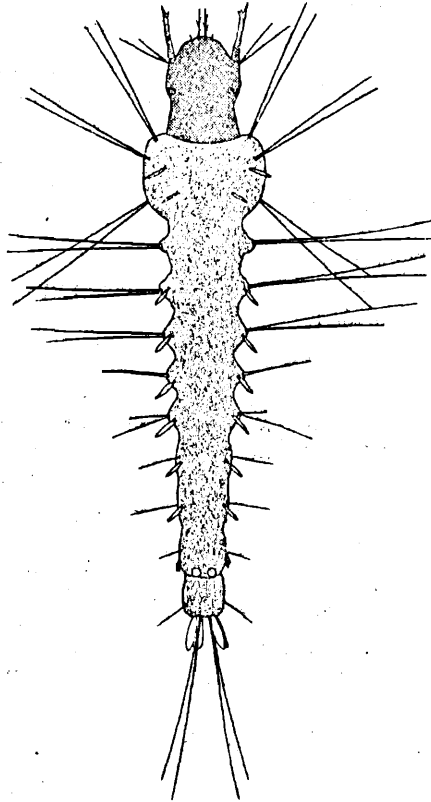


Fig. 1. Larva of *Anopheles kochi*, Dön., after first moult.

Fig. 1 shows the appearance of the larva after the first moult. At this stage it differs from the newly hatched larva only in its greater length and in the elongation of the head. The form and arrangement of the hairs remain as in the newly hatched larva and are as follows:—

Head. The inner anterior clypeal hairs are long and coarsely pinnate. The outer anterior clypeal hairs are short, only about one-fourth the length of the inner, and

simple. The posterior clypeal hairs are placed far back, widely separated from one another, and simple.

Thorax. On the dorsum of the thorax are borne four pairs of simple leaflets, two pairs on the anterior edge of the thorax and two pairs in the position shown in the figure.

Abdomen. A pair of simple leaflets is borne on each segment of the abdomen from the second to the seventh.

The Mature Larva (fig. 2).

Head. The inner anterior clypeal hairs are long and widely separated from one another; these hairs are very finely pinnate, a character that can however be discerned only with high magnifications. The outer anterior clypeal hairs are very short and are placed close to the inner; they are about one-fourth the length of the inner, and simple. The posterior clypeal hairs are placed far back and slightly external to the line of the inner anterior clypeal hairs; they are about equal in length to the outer anterior clypeal hairs and are simple. The position of the posterior clypeal hairs is a character which enables one readily to distinguish the larva of *kochi* from the larva of *rossi* and other species which in some characters it resembles. Of the two pairs of hairs placed behind the row of six frontal hairs and between the eyes the inner are simple and the outer branched.

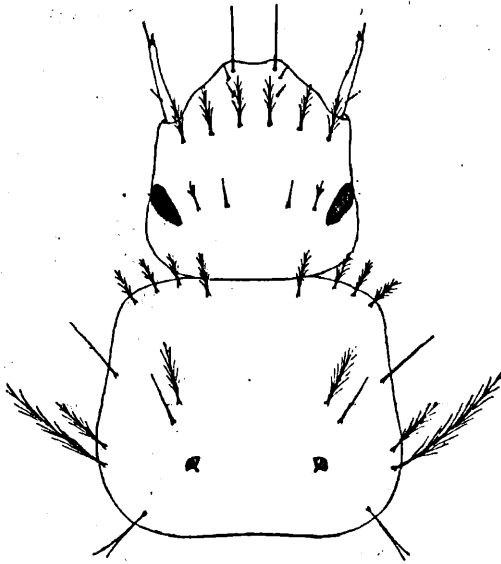


Fig. 2. Head and thorax of mature larva of *Anopheles kochi*, Dön.

Thorax. In addition to the usual stout feathered hairs and bristles, the dorsum of the thorax carries a pair of palmate hairs; each whorl is composed of ten leaflets which are long and narrowly lanceolate in form.

Abdomen. Palmate hairs are borne on the second to seventh segments. On the first two and the last of these segments, the leaflets are narrowly lanceolate, on the

middle segments they are broad and end in a short blunt-pointed filament. The spiracle comb carries fourteen spine-like processes on each side, four of which are of larger size than the others; the basal parts of these processes carry minute teeth.

The Pupa.

The first abdominal segment bears the usual pair of fan-like tufts of branched hairs. Small lateral spines are present on the fourth to seventh abdominal segments; on the fourth segment these spines are minute.

The mature larva of *kochi* so closely resembles that of another Malayan species, *tessellatus*, that there is no easily recognisable character by which they may be distinguished. The presence of a pair of palmate hairs on the second abdominal segment in *kochi* and the absence of this structure in *tessellatus* appears to be constant. There is no very close resemblance between the imagines of these species, apart from certain markings, such as the lighter colour of the apical half of the proboscis in the females of both.

From this and similar observations in other species, it appears that the most that is likely to be gained of practical advantage in malaria prevention from a study of larval forms in *Anopheles* is a separation into groups that may comprise two or more species. These studies do promise however to give us a clearer knowledge of the natural affinities of species than has been gained from a study of the morphology of the adult insects.

I am indebted to Mr. R. W. Blair for the accompanying drawings.
