# Mosquito Eggs XIII

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## Genus Armigeres Theobald

The eggs of the two subgenera currently recognized (Armigeres s. str. and Leicesteria) are very different, more so than those of any other congeneric subgenera of Culicini.

The eggs of Arm. subalbatus s. l. have been described from a variety of standpoints[185-190]. Most descriptions relate to the Southeast Asian form (Armigeres obturbans Auctt.). Barr[185] notes certain differences in egg physiology between this and the topotypical Sino-Japanese form. It seems desirable to confirm their identity by means of crossing experiments which should not be difficult as both mate readily in small cages.

### Arm. subalbatus (Coquillett)

The following notes are intended merely to add some morphological details to the descriptions noted above. They are based on eggs of Malaysian strains kindly sent me by Prof. George Craig and Dr. Shivaji Ramalingam.

Eggs of this species resemble quite closely those of Ae. aegypti [164], differing in the less regular shape, in both plane and lateral view, and the more conspicuous reticulation of the general surface (Fig. 1a). Electronscan photographs of the upper (ventral) surface, by Prof. Hinton, show that the reticular meshes are formed by thickenings of the outer chorion. These enclose large, very conspicuous, rugose papillae corresponding to the chorionic bodies of Christophers. Towards the lower surface they cease to be perceptible at least with the light microscope. The reticular meshes are elongated to a variable extent in the antero-posterior direction towards the posterior end, and similarly distorted in the transverse direction towards the anterior end, on the lower surface. Dehiscence takes place by means of a curious U-shaped slit, the apical cap collapsing from side to side and usually remaining narrowly attached in the midventral line (Fig. 1b). There is a large, translucent apical cup of aedine type and the micropyle is surrounded by a sclerotized disc (Fig. 1c). Sterile eggs, like those of Aedes spp., tend to split longitudinally. The eggs adhere more strongly to the substrate than any Aedes eggs known to me.

### Arm. confusus Edwards

The eggs of this species have not been previously described. Two eggs from Ulu Langat, Selangor were sent by Dr. Ramalingam. One of these has been passed to Prof. Hinton for electronscan study. Overall ornamentation is only partly visible in the remaining egg. In pieces of detached outer chorion the papillae appear to be

even larger than in Arm. subalbatus but the reticular meshes are less conspicuous. The shape of preserved eggs is similar in lateral view in the two species but in plane view the egg of Arm. confusus appears more symmetrical and more strongly tapered towards the posterior end (Fig. 2a, b). The apical cup appears similar in the two species. The micropylar disc, viewed from the inner surface, is shown in plane view in Fig. 2b'.

Arm. maiae (Edwards)

Not previously described. Two eggs from Ulu Langat were sent by Dr. Ramalingam. One has been forwarded to Prof. Hinton. The eggs are pale in colour and, probably therefore, unfertilized. The ornamentation and the shape in lateral view appear similar to Arm. subalbatus. I was unable to ascertain the shape in plane view owing to shrinkage. Examination of detached outer chorion shows the reticular meshwork to be less conspicuous than in Arm. subalbatus, more as in Arm. confusus.

Arm. durhami (Edwards)

Barr[185] notes that the eggs of this species are closely similar to those of Arm. subalbatus. No other information is available.

Arm. joloensis (Ludlow)

Banks[7] describes and figures an egg, from Mailum, Negros, P. I., which he attributes to this species. Larvae from these eggs were apparently reared through to the adult stage. If these are still in existence it may be possible to confirm the identification. Failing this the attribution of the egg in question must remain in doubt. At least 8 species of Armigeres s. str. are known to occur in the Philippines[191,192]. Banks describes the egg as having a general resemblance to that of Ae. aegypti but longer and with the sides more nearly parallel and the ends more obtusely rounded while the meshes of the chorionic reticulum are not elongated transversely. His figure (Fig. 3a) shows chorionic papillae on the more strongly curved surface suggesting that the egg is drawn in plane, rather than in lateral, view and has a bilateral asymmetry much as in Arm. subalbatus.

Arm. milnensis Lee

Steffan[193] notes that the eggs are laid singly but does not describe them.

Macdonald and Traub[194] state that in all species examined in the laboratory (which includes most of the Malayan species) the eggs are laid singly while in those species investigated they remain viable after drying and storage. The general question of egg diapause and drought resistance is discussed in relation to Arm. subalbatus by Barr[185].

## Subgenus Leicesteria Theobald

Interest in this subgenus has centered on the remarkable oviposition behaviour of Arm. flavus, first described by Strickland[195] and since observed in some, though not all, other species[140, 196, 197]. Strickland's initial observation concerned a female caught in a rest-house at The Gap, Selangor with an egg mass attached to one

of the hind legs (Fig. 3b). Partial hatching had already taken place and the head of a young larva was seen protruding from each of the eggs. On being provided with water the mother dipped her hind leg and the larvae immediately swam away. The same phenomenon was subsequently observed on two other occasions and on a third occasion a female was captured with a fully hatched egg mass on the hind leg. Ganapathipillai, quoted by Macdonald[140], later observed several other Leicesteria spp. ovipositing on their hind legs in the laboratory and then lowering the egg mass onto the surface of the water. Transportation of the egg mass, as recorded by Strickland, seems, however, to have been observed only in Arm. flavus. Macdonald[140] records several specimens, with egg masses attached, attacking man and the British Museum has a specimen, collected by Pendlebury at Batang Padang, Perak, with an egg mass attached to both first hind tarsal segments immediately below the articulation with the tibia. Egg masses were observed in this position in all Macdonald's specimens[140, 196] though Strickland shows the egg mass attached to the distal end of the first tarsal segment (Fig. 3b). It seems that he may have been dealing with an egg mass which had become reattached after immersion, rather than that, as suggested by Macdonald, dehiscence may have been induced simply by exposure to the atmosphere for a sufficient period.

Strickland suggested that this mode of oviposition might be adaptive to breeding in small bodies of water which would otherwise be inaccessible. This does not, however, appear to be the case. Among species observed to oviposit in this fashion Arm. annulitarsis, balteatus and inchoatus breed in bamboo internodes, entering through the small holes bored by chrysomelid beetles[196], but Arm. flavus and magnus breed in fully accessible containers [197]. At the same time Arm. dolicocephalus, breeding in bored bamboos, lays its eggs directly on the water surface in ribbons[196]. Despite the interest which they have aroused no eggs of this subgenus have yet been described. The following descriptions are based on material kindly sent by Dr. Ramalingam.

Arm. flavus (Leicester)

The egg batch on which this description is based was laid by a female taken biting at 15th mile, Ulu Gombak, Selangor on 6.12.69. The eggs were laid on the hind legs on 11.12.69 and not deposited on the water until 15.12.69. They hatched the same day. The individual eggs (Fig. 3c) are bluntly rounded at the anterior end, more pointed at the posterior. They are pale in colour and very inconspicuously ornamented apart from a strongly sclerotized conspicuous micropylar disc. The outer chorion is delicately reticulated over the whole surface. Each mesh of the reticulum is ornamented with very minute chorionic papillae forming a regular border and even smaller, less regularly arranged papillae in the interior. The individual meshes are elongated in the major axis over most of the surface but shortened to form more regular hexagons at the posterior end. The (presumed) ventral surface is much less strongly curved than the lower (presumed dorsal) surface by which the eggs are attached to the tarsus. Dehiscence is usually incomplete, the apical cap remaining attached ventrally. If the latter does become detached separation takes place entirely in the transverse plane leaving a small longitudinal tear in the main portion of the "shell". The edges of caps detached in this manner tend to curl inwards as shown in Fig. 3c'. The cap is provided with a sclerotized micropylar disc resembling that seen in Armigeres s. str. but more conspicuous and with a narrow, transparent corolla. There is nothing resembling an aedine apical cup. As noted by Christophers in Ae. aegypti, and as seen occasionally in Arm. subalbatus, the interstices of the chorionic reticulum sometimes contain air.

Arm. dentatus Barraud

The following description is based on eggs from Ulu Langat and Ulu Gombak, Selangor. Different batches are variously described as "laid on water surface, in a row attached together", "laid singly on water surface","singly attached together", "laid attached together" and "laid in a small raft". The portion of raft sent to me is only 3 eggs wide (Fig. 4a). One batch of eggs is embryonated and, though heavily parasitized, these enabled the general shape and orientation to be ascertained (Fig. 4b). The chorionic sculpturing is very complex. The basic element is a hexagonal reticulum formed by transversely striated ribbon-like thickenings. On the ventral surface the meshes are more or less regularly hexagonal. On the dorsal surface they are elongated in the antero-posterior direction except at the two ends of the egg. Here the walls of the individual meshes are broadened and tend to stand more or less vertically, enclosing small, irregular papillae and themselves giving the impression of regular, flat-topped, vertically striated papillae when seen in profile. This type of chorionic ornamentation appears to surround the egg entirely at both ends. There is no apical cup of the kind seen in Aedes and in Armigeres s. str. but the micropylar disc is very conspicuous, being heavily sclerotized and sculptured (Fig. 4c). Dehiscence is transverse and complete (Fig. 4d).

Eggs of four other species of Leicesteria are available and these will be described in the next paper in the series. The parasitized eggs of Arm. dentatus apparently constitute the first case of egg parasitization recorded in mosquitoes. They will be discussed in more detail in the next paper.

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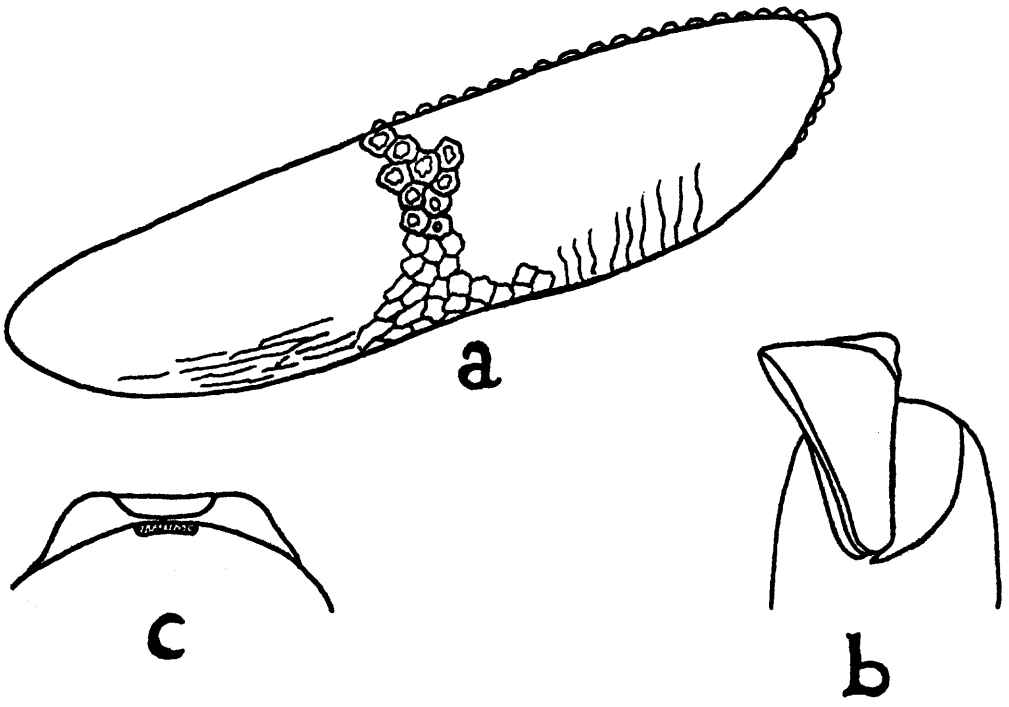


Fig. 1. Egg . Armigeres subalbatus. a. Whole egg from left side, b. Apex of hatched egg in ventral view, c. Apical cup and micropylar disc.

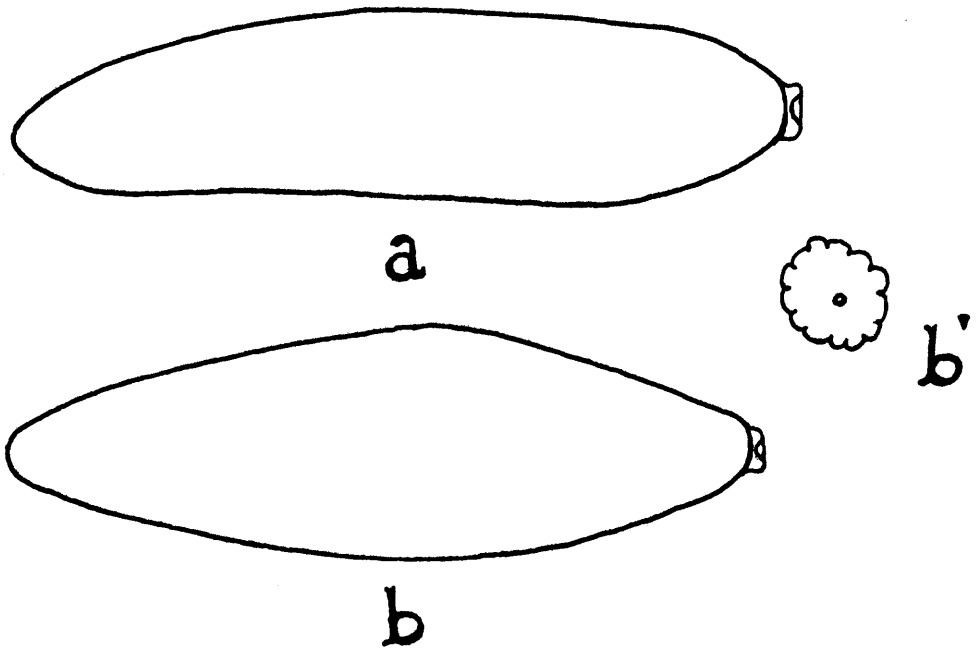


Fig. 2. Outlines of eggs in ventral view. a. Armigeres subalbatus, b. Armigeres confusus, b'. Micropylar disc in plane view.

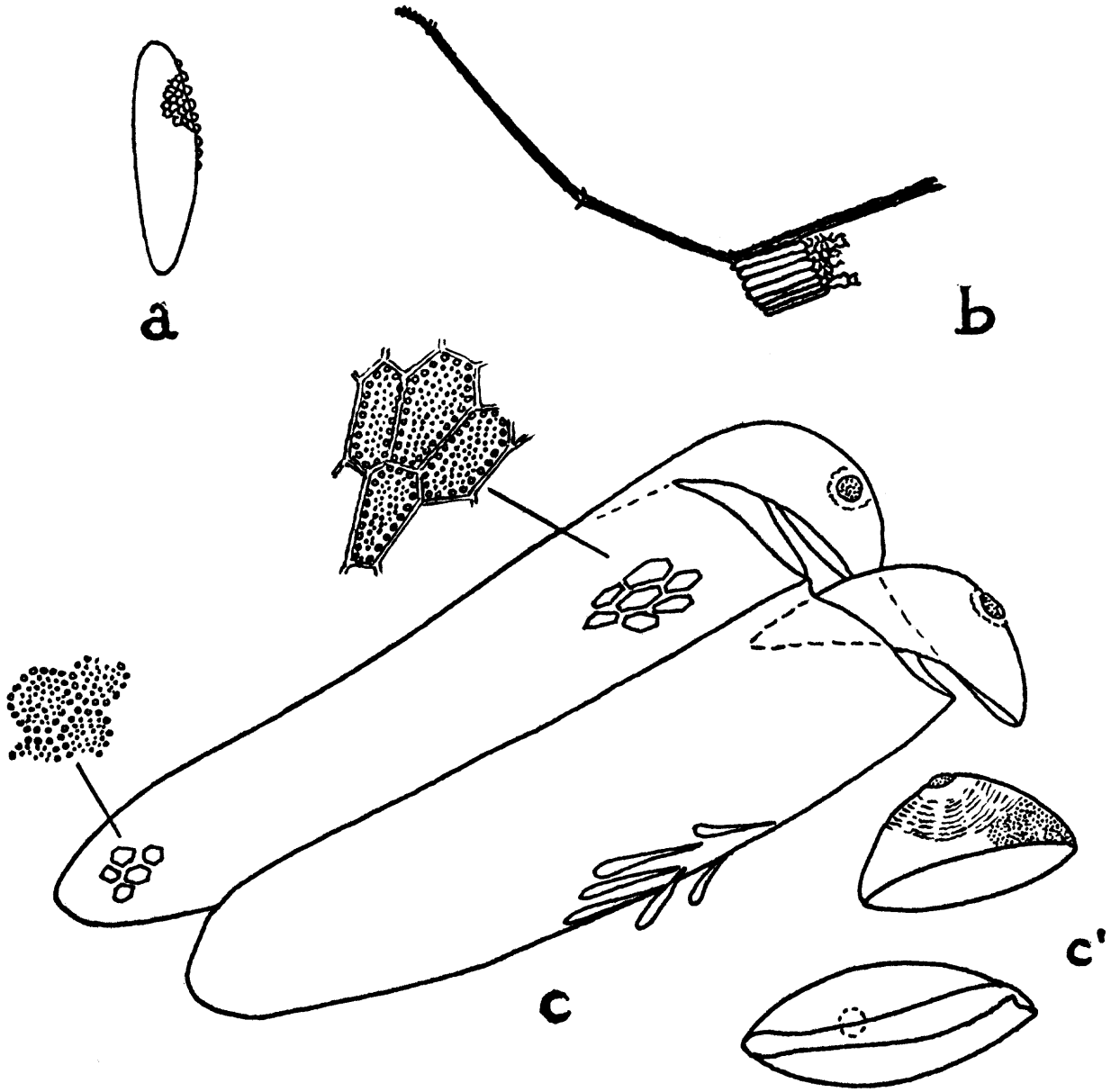


Fig. 3. Eggs of Armigeres spp. a. Arm. (Arm.) ? joloensis (after Banks), b. Hind tarsus of Arm. (Leic.) flavus with egg mass attached (after Strickland), c. Hatched eggs of Arm. flavus. (Detached scales mark the point of attachment to the tarsus), c' Detached apical caps.

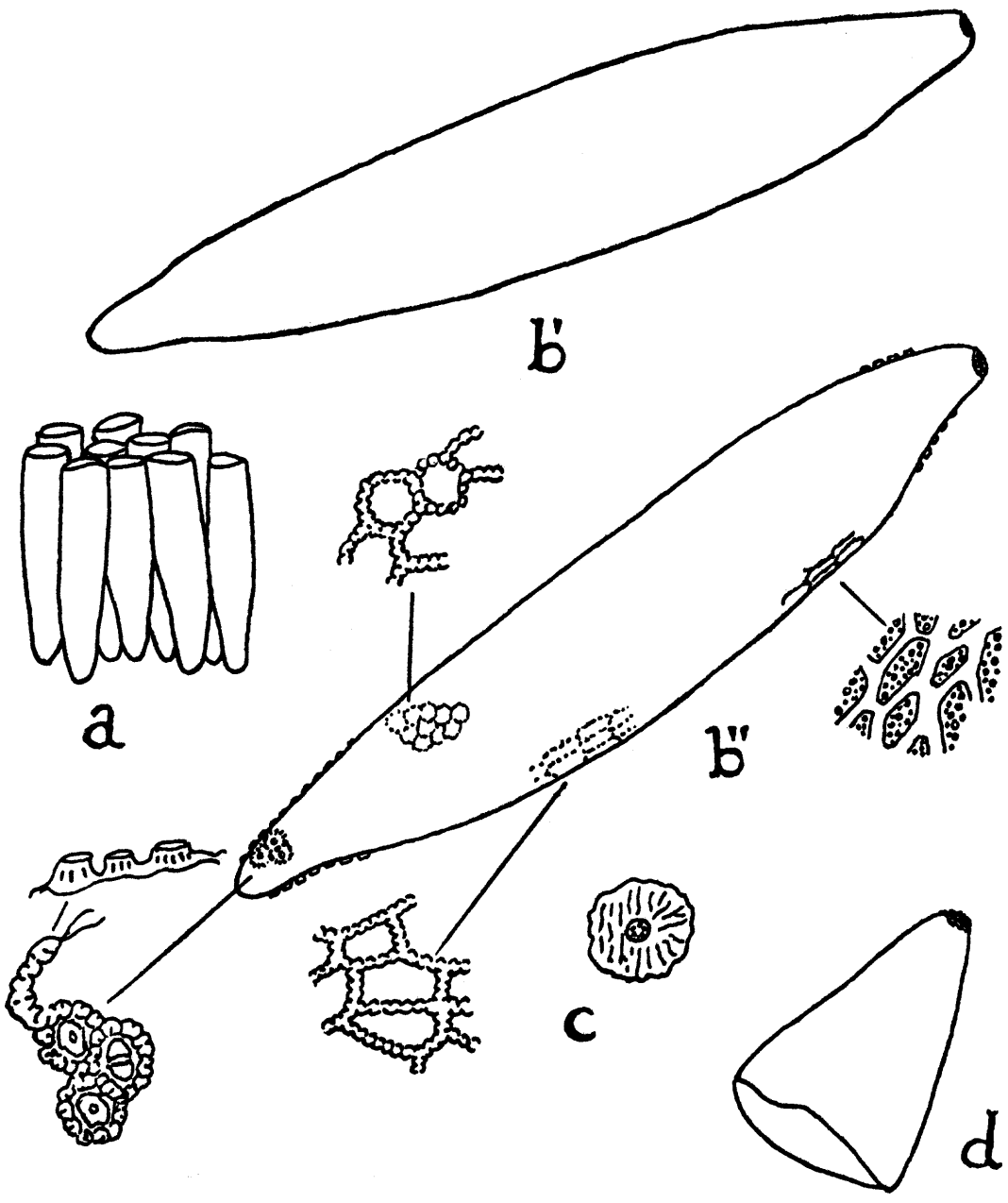


Fig. 4. Egg of Arm. (Leic.) dentatus. a. Portion of hatched raft, b. Whole egg, b'. Ventral view, b". Lateral view with details of ornamentation, c. Micropylar disc, d. Apical cap.