Mosquito Eggs VIII

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Genus Aedes, Subgenus Mucidus Theobald

The earliest, and still the best, description is that of the egg of Ae. (M.) alternans Westwood by Colledge[131]. He describes it as shaped like a double cone, partly flattened on one side, jet black in colour and "invested by a delicate membrane which rises in beaded vesicles upon its surface". He makes no mention of any apical collar associated with the micropyle. The eggs are said to be deposited singly on the surface of the water and to float by "the help of the vesicles and adhering film of air" until a little agitation causes them to sink to the bottom of the vessel or pool in which they are placed. "If they lie some time a flocculent algae of the Nostoc variety attaches itself, and helps to anchor them to any object in close proximity". One female laid 64 eggs 5 days after, and another 160 eggs 7 days after, a bloodmeal. Dehiscence is said to take place about one-third of the distance from the apical end. His figures are reproduced here as Fig. 1a. Under favorable conditions hatching was observed to take place 7 days after deposition but diapause ensued when the temperature fell below 70° F. and the eggs would then lie under the water for some months while still remaining viable. Eggs laid in the laboratory were found to hatch at intervals for up to 11 months after oviposition.

It seems from this quite circumstantial account that the eggs were regularly observed to be laid on the water surface instead of above it as in the majority of Aedes[132]. I shall return to this point later. There is some indirect evidence suggesting that the eggs are laid dry in other species of the subgenus. Giles[133] records oviposition by Ae. (M.) scatophagoides (Theobald) in a test tube placed on a slant with water in the bottom and notes that "when transferred to water they did not hatch out". This also might suggest that the eggs were laid above the water line but the account is a secondhand one and the circumstances were clearly very artificial.

Ae. alternans and Ae. scatophagoides are members of Group A (Mucidus s. str.) of subgenus Mucidus and I have eggs of two other species belonging to this group. Eggs of Ae. (M.) tonkingi Gebert were sent to me from Mauritius, by Mr. J. G. Halcrow, in 1954. They were recently described briefly by Tyson[135]. They were badly shrivelled, having been preserved before hardening was complete but the shape appears to be much as described by Colledge (Fig. 1b). They are covered with a delicate chorion bearing unusually

large and numerous papillae. There is no indication of a micropylar collar but this could well have been lost by rubbing. In those eggs which are partially sclerotized the inner chorion can be seen to be reticulated, the outline of the individual cells of the reticulum being markedly irregular as shown in the figure. In addition to the main outer chorionic papilla overlying each cell there are smaller peripheral papillae.

Eggs of Ae. (M.) sp., probably mucidus (Karsch), were kindly sent to me from Mtwara, Tanzania by Dr. G. A. H. McClelland. These eggs cannot be definitely attributed because an undescribed Mucidus sp. is known to occur in that part of East Africa but Dr. McClelland tells me they are definitely not those of Ae. scatophagoides. The shape is much as in Ae. alternans with one surface, presumably the dorsal, flattened and the other strongly arched. Seen from above the arched appearance is lost. There is considerable variation in size and in the degree of arching (Fig. 1c). The outer chorionic papillae are large and conspicuous and there is a well formed micropylar collar at the anterior end. I do not have any hatched eggs but I have one or two detached caps (Fig. 1c") from which dehiscence can be seen to be apical as in other Aedes. The color is very dark brown, almost black. When cleared with diaphanol the inner chorionic reticulum can be seen to be more regular than in Ae. tonkingi but the arrangement of the outer chorionic papillae is similar with the larger papillae centered over each cell of the reticulum and with several peripheral papillae (Fig. 1c').

The eggs of Ae. (M.) aurantius (Theobald), belonging to Group B (Pardomyia), were described in outline by Cheong[136]. Dr. Ramalingam has kindly sent me some of these eggs from Selangor. Their most striking feature is their triangular shape (Fig. 1d), which is, however, sometimes approximated by shrunken eggs of Ae. ? mucidus. Cheong notes the presence of an "operculum" at one corner which he associates with hatching. I was unable to observe this but there is a conspicuous micropylar collar presumably marking the anterior end. The larger outer chorionic papillae are conspicuous but the smaller ones are less conspicuous than in the species of Group A. The inner chorion is very dark, almost black, and the chorionic reticulum is difficult to see by reflected light but Prof. Hinton fortunately obtained an excellent electronscan micrograph from the one egg which I was able to send him (Fig. 1d"). It can be seen from this that, as in Group A, the larger papillae are central to the cells of the underlying reticulum and there are numerous smaller, floccular, peripheral papillae. An interesting feature which has not, I think, been described in any other Aedes is the presence of small but very conspicuous pits along the margins of the cells of the inner chorionic reticulum. The cells themselves are regular in outline and the general appearance seems to me to approximate more closely to electronscan micrographs of the eggs of Ae. (Ochlerotatus) cantans Meigen while the electroscan appearance in Ae. ? mucidus more closely approaches that of Ae. (Stegomyia) vittatus (Bigot) which might suggest that the latter is the more primitive.

Colledge's account of the egg laying behavior also raises some questions of phylogenetic interest. Hopkins[81] suggests that females of Mucidus scatter "their eggs over low-lying ground where they mature and become ready to be washed into temporary pools and swamps by the first heavy rains". He adduces as evidence for this the fact that "larvae are always found in such situations, young and older larvae or pupae are seldom found together and there does not appear to be a succession of generations in one breeding place". I do not think these are valid arguments. The absence of younger larvae is easily explained by the cannibalistic habits for which Mucidus is specially adapted. The implication that the eggs are scattered on the wing also calls for comment. We have no certain evidence of oviposition on the wing anywhere in the Culicini (though it occurs in the Toxorhynchitinae, Anophelinae and Sabethini). It would seem reasonable to look for it, if anywhere, among the more primitive subgenera of Aedes such as the present one. To this extent Hopkins' suggestion is worth bearing in mind. As to the alternative interpretation of "scattering", i.e. that each egg batch is shared between a number of different oviposition sites, as suggested by Colledge, this certainly seems a reasonable suggestion with respect to a cannibalistic group.

Regarding the suggestion that the eggs are laid dry, better evidence seems to be afforded by the observation of Nieschulz et al.[138] (quoted by Hopkins) that larvae of Ae. scatophagoides appear in the breeding places at the same time as those of Ochlerotatus and Neomelaniconion spp., shortly after heavy rain, and are followed only later by those of, e.g., Culex (Lutzia) spp. Certainly a survey of the available records of breeding places of Mucidus would suggest that these are usually, perhaps always, ground pools and often temporary ones.

Oviposition directly on the water surface, though usual, perhaps universal, in other groups of mosquitoes, is rare in Culicini, being known at present only in Mimomyia and one section of Uranotaenia. If Colledge's account is correct it would seem that we may have a spectrum of behavior in Mucidus ranging from oviposition on the water surface to deposition above the water line as in other Aedes. This would support the general belief that Mucidus is the most primitive subgenus of Aedes. It seems very desirable to examine the response of gravid females to alternative oviposition substrates in the laboratory. This should not be difficult. Cheong[136] suggests that Ae. aurantius is a rather rare mosquito. This was certainly not my experience in New Guinea where we were attacked by it in large numbers at ground level after sunset in swamp forest. A quite different impression would, however, be gained in the daytime. Cheong's eggs were obtained from a small number of adults taken in a bird-baited trap but the preferred hosts may well be mammals.

Ae. aurantius is known to feed on domestic animals as well as on man[140]. In West Africa Ae. (M.) grahamii (Theobald) had a similar reputation for rarity until I took it in large numbers feeding on man in the forest canopy after dark[141]. Other African Mucidus also seem to be arboreal, nocturnal and anthropophilic[142,143]

but Halcrow (in litt.) found Ae. tonkingi to be ornithophilic. I have the impression that eggs of Mucidus are more easily deformed in hypertonic solutions than those of other Aedes. The degree of resistance to desiccation certainly calls for investigation. I would think the unusual shape of the egg is another primitive feature. It is matched most nearly by the eggs of some species of subgenus Ochlerotatus Lynch Arribalzaga which would seem to confirm the close relationship between the two subgenera inferred on other grounds.

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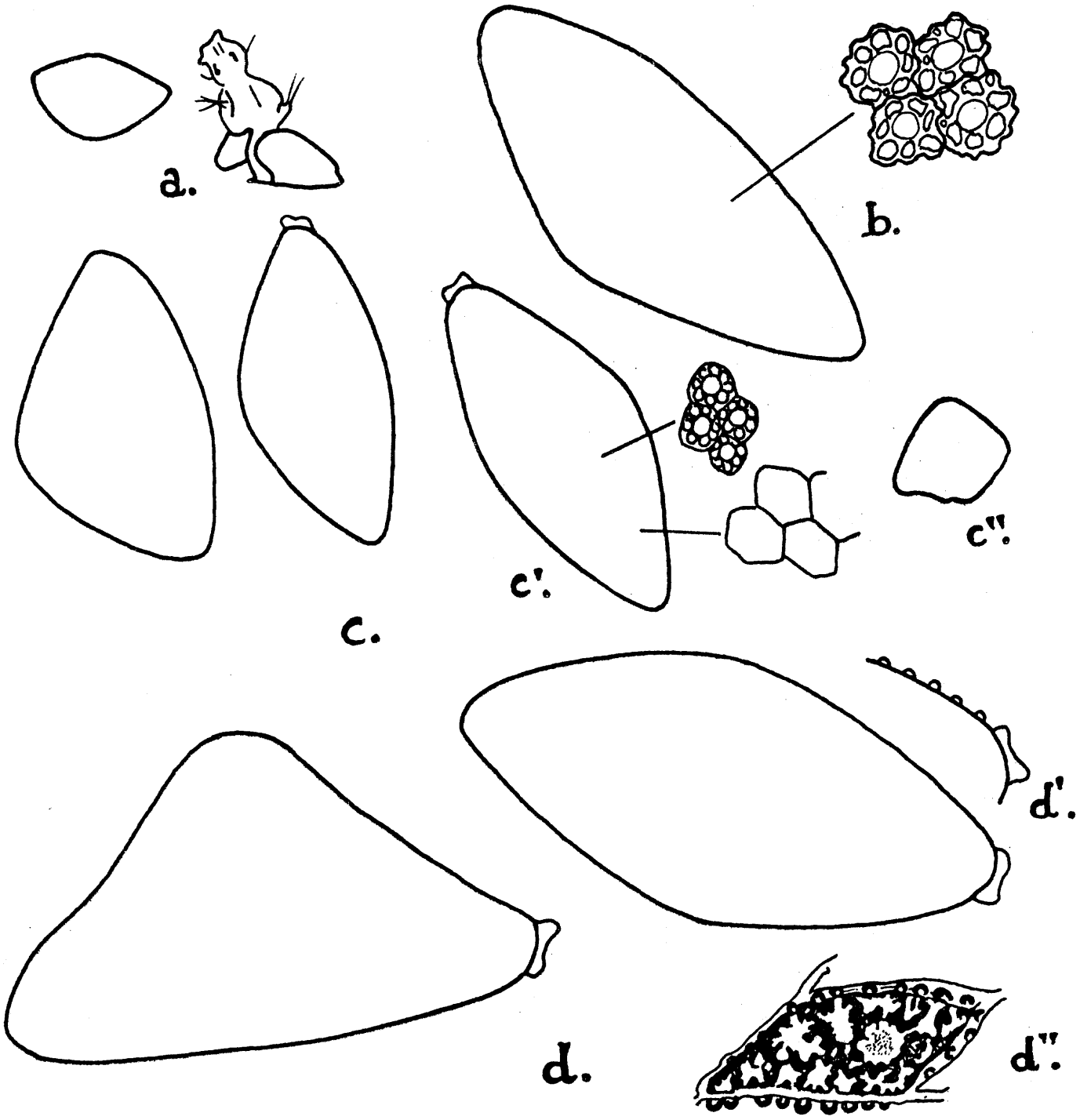

Fig. 1. Eggs of Aedes subgenus Mucidus. a. Ae. (M.) alternans after Colledge, b. Ae. (M.) tonkingi, original, showing surface ornamentation by transmitted light, c. Ae. (M.) ? mucidus, original, showing variation in size and in degree of arching of the ventral surface. c'. Dorsoventral view showing surface ornamentation by reflected, and inner chorionic reticulation by transmitted, light. c". Apical cap. d. Ae. (M.) aurantius, original, showing lateral and dorsoventral aspects. d'. Apical collar and outer chorionic papillae. d". Detail of surface ornamentation from an electronscan micrograph.