# Mosquito Eggs XXVIII

## *Culex* subgenera *Melanoconion* and *Mochlostyrax*

by

P. F. Mattingly
Department of Entomology
British Museum (Natural History)
Cromwell Road, London, S. W. 7
England

In a previous paper in this series[127] I reviewed the small amount of literature available to me relating to these subgenera. Since then they have attracted growing attention as potential virus vectors and the literature has grown accordingly. I am also, thanks to the generosity of John Davies and Jim Haeger, now in a position to describe the eggs of no less than 8 species which they have kindly sent me. The status of *Mochlostyrax* as a distinct subgenus from *Melanoconion* has been challenged but the most recent opinion[352] favours keeping them apart by reason of differences in their egg laying behaviour. As an ardent oophile I am naturally delighted. Beyond this I cannot claim sufficient acquaintance with either group to express an opinion.

### Subgenus *Mochlostyrax* Dyar & Knab

*C. (Mochl.) pilosus* (Dyar & Knab)

Haeger[352] notes that, as suggested by King et al. [353,354], females of this species lay resting eggs inserted individually in or on moist substrata rather than in coherent masses as do other *Culex*. He also confirms their suggestion that the eggs are resistant to partial drying, remaining viable as long as they are kept moist and hatching when subsequently flooded. They lack the corolla and egg spike found in other *Culex* (see Christophers[11] and my last paper in this series[355]). He suggests that other *Mochlostyrax* will be found to oviposit in a similar fashion and this is in fact the case for the four other members of the subgenus whose egg laying behaviour has been recorded[115,127]. Further details of the behaviour of the present species will be found in Haeger & Hanson[356]. Hair [357] notes that eggs are laid some 18-20 days after the bloodmeal, an unusually long interval though less than in *C. (Mel.) cedecei* (see below). He describes them as laid, in the laboratory, either on hay infusions with hay protruding above the water or on soft, moist mud in rafts about 75 eggs long and only 1-4 eggs wide. He also quotes King et al. [354] for the statement that egg rafts can withstand drying but this is incorrect since they refer, in both their publications, only to "eggs". It seems likely therefore that Hair was dealing not with the present species but with a raft-forming one, perhaps a true *Melanoconion*.

From hatched and unhatched specimens kindly sent me by Jim Haeger I am now able to describe the individual eggs in detail (Fig. 1a). They were obtained in the laboratory from a Florida strain. They are sharply pointed at the posterior, flattened at the anterior, end and markedly flattened ventrally. Dehiscence is apical and incomplete. There is no sign of a corolla. Near the apex of the egg cap there is a very small, circular, translucent area with one edge thickened, presumably associated with the microphyle. The outer chorion is ornamented with relatively sparse, flat, circular papillae varying somewhat in size in all regions but with some distinctly larger on the egg cap.

### Subgenus *Melanoconion* Theobald

Unlike the eggs of *Mochlostyrax*, so far as these are known, the eggs of all those species described below, except *C. aikenii*, are laid in coherent masses. Although, it seems, frequently laid out of water eggs of all those species seen by me have a corolla, though a much smaller one than is general in *Culex* s. str. They also differ from the latter in having at most a very rudimentary egg spike.

#### *C. (Mel.) portesi* Senevet & Abonnenc

Eggs of this species and the following one were kindly sent me by John Davies from Trinidad. The eggs of the present species (Fig. 1b) have a distinct sigmoidal curvature recalling that of some *Eumelanomyia*[355]. The apex bears a very small corolla which arises in relation to a broad, flat endochorionic lobe rather than to an egg spike as such. Both poles of the egg are darker than the remainder but the tip of the lobe is darker still. A minute papilla is sometimes visible in the centre and may be associated with the micropyle. The outer chorionic papillae are smaller and more numerous than those of the preceding species and unlike the latter are conical. They are largest at the apex of the egg, very small on the central areas and larger again at the posterior pole. Only hatched eggs are available for description.

Takahashi[358] obtained eggs from wild caught females by liberating a large number (about 200) in an oviposition cage provided with a black painted glass oviposition jar standing in water and covered by an inverted brown clay flower pot with an additional access hole in the side. Eggs were observed to be laid in rafts mainly on the water surface, occasionally above it on the side of the jar. Maximum oviposition occurred one week after the bloodmeal. The rafts were subcircular "rather than being elongate as in the subgenus *Culex*". Numbers of eggs per raft varied from 15 to 89 with a mean of 56. Oviposition took place between early afternoon and early morning. Hatching took place after about 40 hours. Newly laid eggs were white in colour but changed to black with age.

Davies & Martinez[359] also colonised this species with similar oviposition facilities to those supplied by Takahashi. They note that the eggs are laid in small round or oval rafts, are slightly pointed at one end and turn black a few hours after laying. The rafts contained 22-96 eggs with a mean of 53.

Hatching mainly took place between 48 and 72 hours after laying with a small number of eggs hatching as late as the seventh day. Oviposition took place in a random fashion from 4 to 24 days after the bloodmeal. No indication of autogeny or resistance to desiccation was observed. Davies tells me (in litt.) that about 10% of rafts were deposited on the side of the oviposition jar within half an inch of the water surface.

*C. (Mel.) taeniopus* Dyar & Knab

The eggs of this species have a very remarkable shape (Fig. 1c). They are laid out of water in small masses with the pointed ends directed outwards (Davies, personal communication), an arrangement reminiscent of *Mansonioides*[360] in which it has been thought to be protective against predation. Fig. 1c shows two hatched eggs still attached in what appears to be the normal manner. There is no sign of any glue but, as indicated below, the area of mutual attachment is apparently distinguishable by modification of the chorionic papillae. Three of the eggs are unhatched and in one of these it is possible to see that despite the tapering of the posterior end the narrow anal papillae of the enclosed larva almost reach the posterior pole. It can also be seen that the strongly marked flexure of the posterior part of the egg is directed ventrally. There is a delicate corolla subtended by a translucent circular area surrounding the micropyle the position of which is apparently indicated by a strongly sclerotised lip. The outer chorion is covered with numerous round, flat papillae, largest on the apical cap but also relatively large on the main body of the egg where they are relatively widely scattered and surrounded by other very small papillae. The papillae on the narrow posterior end are smaller than elsewhere and there is an area of very small papillae just posterior to the line of dehiscence. This extends for about one-fifth of the distance from the line of dehiscence to the posterior tip and around the whole of the periphery. It clearly represents the region of attachment of adjacent eggs, confirming my longstanding impression that large chorionic papillae are incompatible with the mutual attachment of adjoining eggs. (Compare my previous descriptions of, e.g., *Culex infantulus* and *dispectus*[355], *Armigeres flavus* and *dentatus*[222] and various *Culiseta*, especially *C. fumipennis*[361]). *Mansonia richiardii* might seem to be an exception but here the large papillae are themselves secondarily ornamented with minute ones[250]. Dehiscence in the present species is apical, incomplete and oblique, the corolla appearing markedly off centre with respect to the apical cap. The edges of the latter, after dehiscence, are very strongly infolded. Davies tells me that the eggs are capable of withstanding desiccation for long periods, hatching thereafter immediately on contact with water.

*C. (Mel.) atratus* Theobald

Eggs of Florida strains of this species and the four following were kindly sent to me by Jim Haeger. The individual eggs are flattened and somewhat expanded apically, sharply pointed posteriorly. Each has a very small, shallow corolla. A few fragments of disintegrated rafts are available. In these there appears to be some glue between adjacent eggs and occasionally partly obscuring the corolla. To be certain of this, however, I should have to see fresh eggs. I know of no other such case in *Culex*. The corolla encloses an area of clear chorion which frequently appears inflated as indicated by the dotted line in the figure. There is no egg spike as such, its place being apparently taken by a heavily sclerotised, flattened disc (or lip). The chorionic papillae are rounded or bluntly pointed and everywhere comparatively small, especially so on the main body of the egg where attachment to other eggs takes place. Mitchell[200] figures an egg raft attributed to this species but according to Howard et al.[226] the species in question was in fact *C. erraticus*. Her figure is accordingly reproduced here under that species.

*C. (Mel.) erraticus* (Dyar & Knab)

Mitchell's figure of the raft of "C. atratus" is reproduced by Howard et al.[225] under the present name and is again reproduced here as fig. 2a'. According to Mitchell the rafts were found "in the brick drains around the campus of the Louisiana State University. The eggs were deposited in long rafts, easily distinguishable at a glance. They did not have five or six rows curving up at the ends like other rafts, but were in double or sometimes partly triple row, and, what is more, the rows were zigzagged." The material available to me comprises some loose unhatched eggs and one raft with all but three eggs hatched and the remainder almost all with partly emerged larvae, suggesting that hatching took place on immersion in the preservative as sometimes happens. Individual eggs (Fig. 2a) are cylindrical, flattened on the ventral surface and tapering sharply on the dorsal surface at the posterior end. At the anterior end is a very small, inconspicuous corolla with a raised floor subtended by a translucent circular area with part of the circumference sclerotised. Within this is a small pore, also with a sclerotised lip, presumably the micropyle. The chorionic papillae are everywhere small, somewhat larger on the apical cap.

Newkirk[229] gives a combined description of the eggs of this species and of *Culex pipiens, restuans* and *salinarius*. His description of the anterior end of the egg agrees well with the foregoing. With respect to the posterior end, however, he says "The posterior end of the *Culex* egg usually bore a drop of water. The drop rested on a smooth black mound, which measured 13 microns in diameter at the base and 5 microns in height, and which was marked by an apical light-colored area - possibly a hole with an estimated diameter of 1 micron". I would not expect an apical droplet to be visible in my material even if originally present. Nor is any such modification of the posterior end of the egg visible. It is possible that in this respect his description is based on *Culex* s. str. only. Although the "black mound" to which he refers is normally visible in side view his description is clearly based on a plane view such as would only be visible in an intact egg raft. The only material of the present species to which he refers specifically comprises 93 eggs laid singly on the water. (I presume by a moribund female).

*C. (Mel.) iolambdis* Dyar

Unhatched eggs, only, are available. These are flattened apically, attenuated posteriorly and flattened ventrally (Fig. 2b). They have a small corolla the floor of which is raised round the edges, depressed in the centre and subtended by a sclerotised lip. The chorionic papillae are everywhere small or very small with a few slightly larger ones adjacent to the corolla. Those on the main body of the egg are even smaller than at the poles.

*C. (Mel.) opisthopus* Komp

Probably a synonym of *C. annulipes* Theobald (fide Haeger) though it has not, I believe, as yet been formally sunk. A few hatched eggs are all that are available to me. The individual eggs (Fig. 2c) are flattened ventrally, curved dorsally and taper posteriorly to a fairly blunt point. The apex appears to be more rounded, less flattened, than in other species described in this paper. Dehiscence is apical, incomplete and very oblique, the corolla appearing markedly off centre in relation to the egg cap. There are large papillae on the egg cap and immediately posterior to it on the ventral surface and others, equally large, on the posterior part of the egg. In the intervening area the papillae are much smaller. On the dorsum and most of the lateral surface they form a conspicuous reticular pattern but on the venter this breaks down and the individual papillae become slightly larger. The corolla is very small and surmounts a shallow projection of the inner chorion seen in plane view as a clear area with part of the circumference thickened.

*C. (Mel.) peccator* Dyar & Knab

I have a number of hatched eggs, several of them still attached to one another, and also a few unhatched ones. The latter are more or less cylindrical, flattened and somewhat swollen apically, tapering posteriorly. The posterior end exhibits a marked dorsal flexure (Fig. 2d). The corolla is well developed but very small. It is subtended by the usual clear circular area within which is a small sclerotised lip presumably associated with the micropyle. Dehiscence is oblique and the edges of the apical cap are usually infolded as in other species with the corolla appearing well off centre. In this material, however, the chorion is rather more flexible than usual and the cap can sometimes be seen unfolded as in the figure. Adjacent eggs are attached along a large part of their length and while there are some moderately sized papillae on the egg cap and at the extreme posterior end these are everywhere else minute.

Chapman & Barr[362] note that in the laboratory the majority of eggs are laid on moist paper well above the water line. They were often laid on a damp cloth towel placed outside on top of the cage. The eggs had no apical droplet. Hatching took place in two days and no tendency to delayed hatching was observed. The tendency to lay at the top of the cage is interesting and recalls some similar observations by Bates[93] in *Psorophora ferox*. I have suggested elsewhere[132] that this clearly relates to the attractiveness to that species of the small crevices afforded by the gauze. It would be interesting to know what is the natural substrate in the present instance.

*C. (Mel.) aikenii* Aiken & Rowland

Adames & Galindo[363] found that in their colony oviposition began about 7 days after the bloodmeal. Eggs were laid singly on either side of floating *Pistia* leaves, usually close to the water. Individual eggs often became detached and fell to the water where they hatched. Other eggs hatched in situ. Freshly laid eggs were whitish, changing to black, or in the case of infertile eggs grayish. Hatching took place 2-5 days after deposition and there was no evident resistance to desiccation or egg diapause. From their photograph it would seem that the eggs are laid at random between the ribs of the *Pistia* leaf (Fig. 2e).

*C. (Mel.) cedecei* Stone & Hair

The taxonomic position of this species is doubtful[364]. Hair[357] found that, in the laboratory, eggs were laid in small ovoid rafts, less than 2 mm. in diameter and usually containing from 30-100 eggs (Fig. 2f). Rafts were deposited almost exclusively on the open water surface. No mention is made of any apical droplets. Nor are any such visible in his photograph. The interval between the bloodmeal and oviposition was exceptionally prolonged (20 to 45 days with an average of 30 days). About 95% of the eggs hatched within 36 to 48 hours after laying. Hatching of the remainder was delayed up to the 8th day. No description of the individual eggs is given but they appear from the photograph to have the posterior end flexed and relatively blunt.

*C. (Mel.) abominator* Dyar & Knab and *chrysonotum* Dyar & Knab

For available information on these species and a sketch of the egg mass of *C abominator* (after Coad[110]) see my previous paper[127].

Fungi infesting eggs of *Culex* spp.

Fig. 2g shows a fungus growing on some of my eggs of *C. pilosus*. I do not know whether this is parasitic or merely epiphytic. It is possibly significant that it is to be found only on unhatched eggs but I cannot see any penetration of the chorion in my preparations. I have sent some of the infested eggs to Prof. Couch for an opinion. Jim Haeger has sent me a note of two other fungi found infesting rafts of *C. erraticus*, one an apparent *Aspergillus* and the other, which might be the same as the present one, with "'horns' of conidia extending from individual eggs".

References

352. Stone, A. and J. S. Haeger. 1970. Status of *Culex* subgenera *Melanoconion* and *Mochlostyrax*. Mosq. Syst. Newsletter 2:37-38.

353. King, W. V., G. H. Bradley and T. E. McNeel. 1939. The Mosquitoes of the Southeastern States. U. S. Dep. Agric. misc. Publ. 336.

354. King, W. V., G. H. Bradley and T. E. McNeel. 1960. A Handbook of the Mosquitoes of the Southeastern United States. U. S. Dep. Agric. Hdbk No. 173.

355. Mattingly, P. F. 1975. Mosquito eggs XXVII. Mosquito Systematics, 7:19-26.

356. Haeger, J. S. and C. W. Hansen. 1976. Oviposition habits of the *Culex* subgenera *Melanoconion* and *Mochlostyrax* of eastern North America. Mosquito Systematics, in press.

357. Hair, J. A. 1968. Observations on two species of *Culex* of the subgenus *Melanoconion*. Mosq. News, 28:425-429.

358. Takahashi, M. 1968. Laboratory rearing of *Culex (Melanoconion) portesi* Senevet and Abonnenc. Mosq. News, 28:82-84.

359. Davies, J. B. and R. Martinez, 1970. Observations on the population dynamics, behaviour and maintenance of a laboratory colony of *Culex (Melanoconion) portesi* Senevet & Abonnenc, 1941 (Diptera: Culicidae). J. med. Ent. 7:179-188.

360. Mattingly, P. F. 1972a. Mosquito eggs XIX. Genus *Mansonia* (subgenus *Mansonioides* Theobald). Mosquito Systematics, 4:50-59.

361. Mattingly, P. F. 1972b. Mosquito eggs XXI. Genus *Culiseta* Felt. Mosquito Systematics, 4:114-127.

362. Chapman, H. C. and A. R. Barr. 1969. Techniques for the colonization of many mosquito species. Mosq. News, 29:532-535.

363. Adames, A. J. and P. Galindo. 1972. Colonization of *Culex (Melanoconion) aikenii* (Aiken & Rowland), 1906) in Panama. Mosq. News, 32:196-200.

364. Knight, J. W. and J. S. Haeger. 1971. Key to adults of the *Culex* subgenera *Melanoconion* and *Mochlostyrax* of eastern North America. J. med. Ent. 8:551-555.

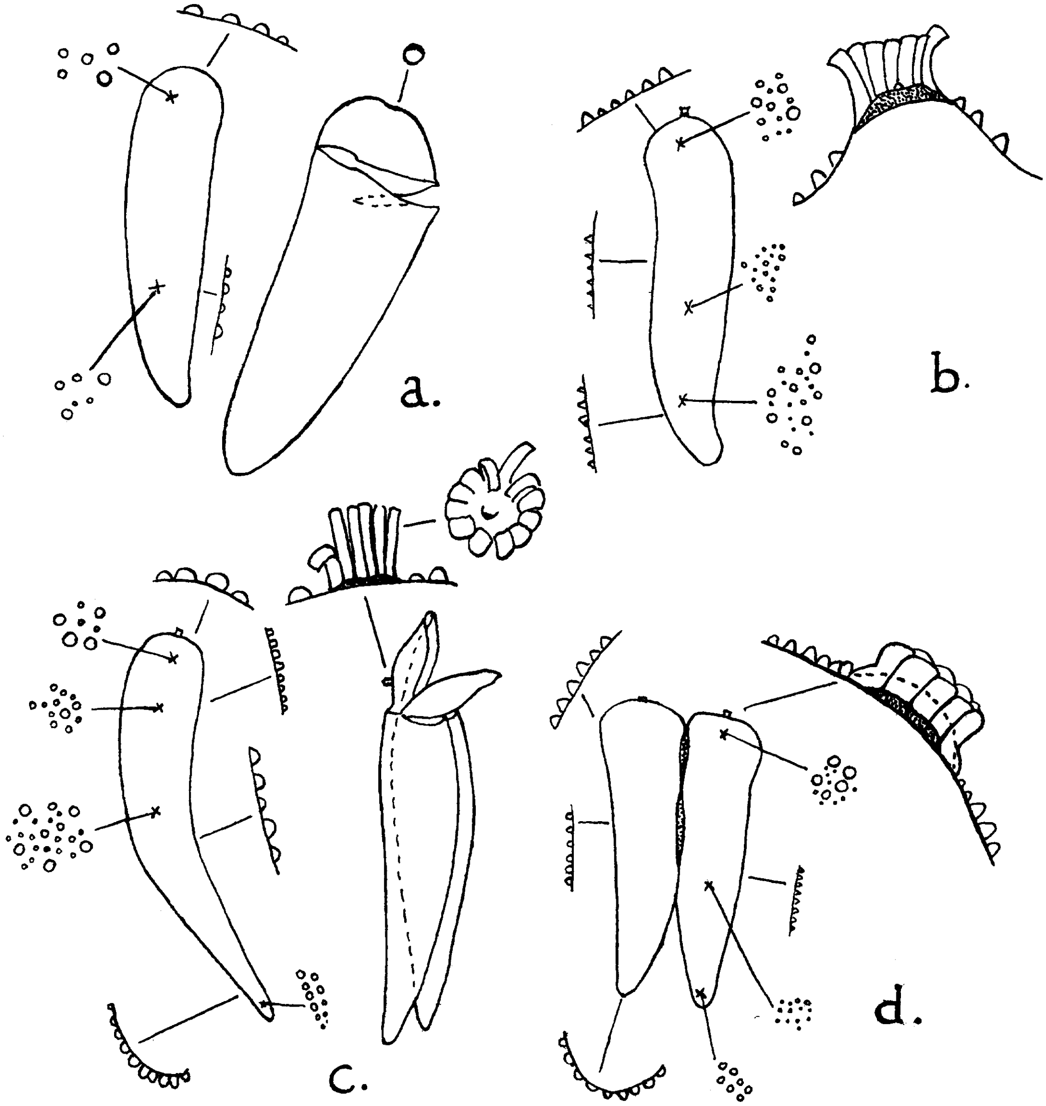


**Fig. 1.** Eggs of genus *Culex*. a. *C. (Mochlostyrax) pilosus*, b. *C. (Melanoconion) portesi*, c. *C. (Mel.) taeniopus*, d. *C. (Mel.) atratus*.

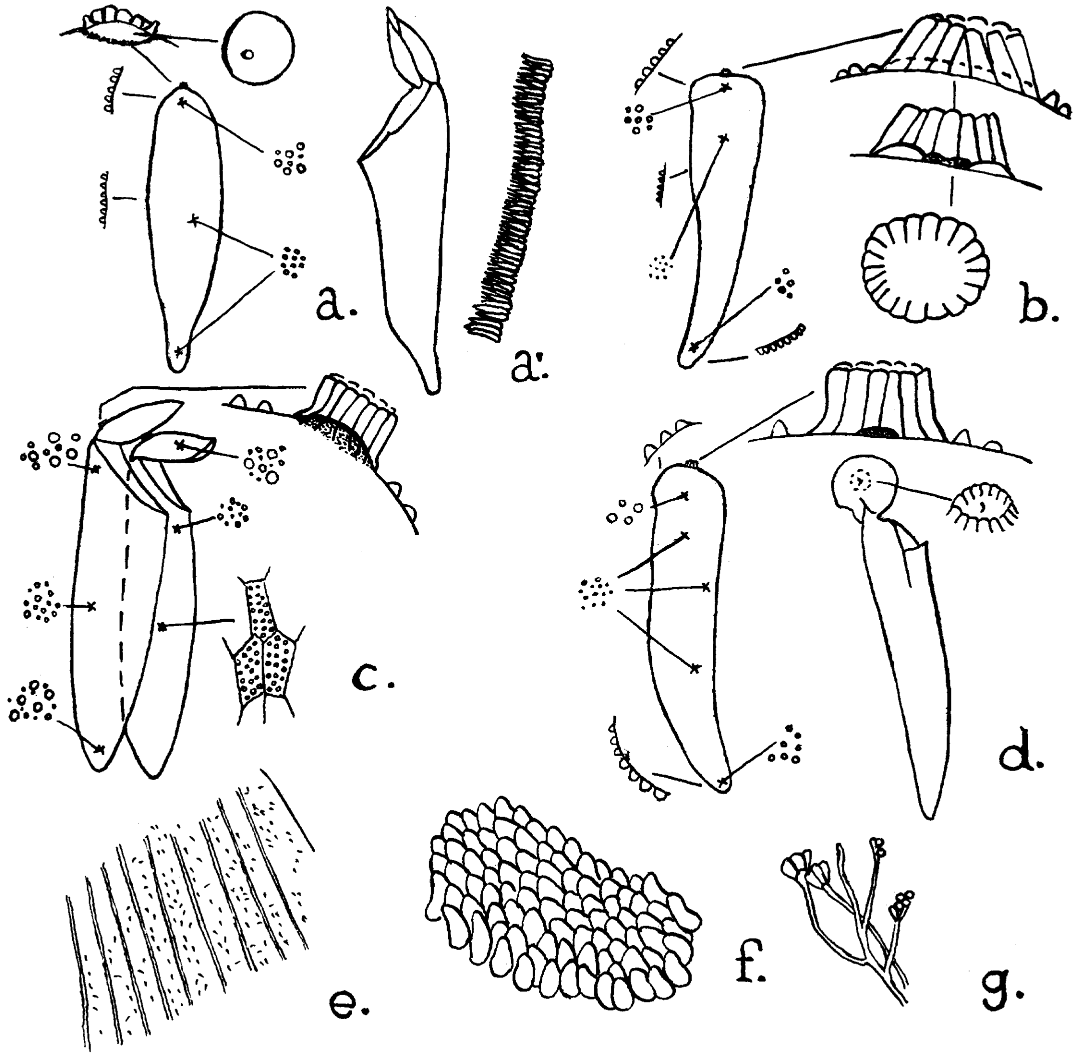


Fig. 2. Eggs of genus *Culex*. a. *C. (Melanoconion) erraticus*, a'. Raft of same (after Mitchell), b. *C. (Mel.) iolambdis*, c. *C. (Mel.) opisthopus*, d. *C. (Mel.) peccator*, e. *C. (Mel.) aikenii*. Distribution of eggs on *Pistia* leaf (after Adames & Galindo), f. *C. (Mel.) cedecei*. Egg raft (after Hair), g. Fungus growing on eggs of *C. (Mochlostyrax) pilosus*.