THE EGG OF *TRICHOPROSOPON COMPRESSUM* (DIPTERA: CULICIDAE)

JOHN R. LINLEY

Florida Medical Entomology Laboratory, University of Florida, 200 9th St. S.E., Vero Beach, FL 32962

ABSTRACT. The egg of *Trichoprosopon compressum* is described and illustrated from material collected in the vicinity of Sao Paulo, Brazil. The egg is divided longitudinally into non-wettable (dorsal) and wettable (lateral and ventral) surfaces, which differ markedly in structure. On the dorsal, hydrofuge surface, the chorionic cells around the central mid-line contain ridges loosely aligned in the long axis, or in some eggs more organized into two continuous lines. About one-third of the dorsal width of the egg from the central line the chorion is folded on each side into two very prominent longitudinal ridges, which join anteriorly and posteriorly. Around the dorsal margins of the egg are closely spaced, flap-like outgrowths. The ventral, wettable surface is covered uniformly with cells containing broad, flat, spatulate tubercles almost invariably with one or more surface furrows positioned near the mid-line. The tubercles increase progressively in size from the lateral to mid-ventral regions of the egg, except for approximately the anterior and posterior one-sixth.

INTRODUCTION

The sabethine genus *Trichoprosopon* Theobald is currently recognized as containing at least 21 species with distributions ranging from central Mexico through Central America to Ecuador and Argentina (Zavortink 1979a, 1979b, 1981). A few species do not appear closely related to others in the genus, but most can be grouped into four complexes, among which the *Tr. compressum* Lutz complex comprises the nominotypical species, two allopatric taxa, and *Tr. obscurum* Lane and Cerqueira (Zavortink 1981). Additional material of the different developmental stages remains to be collected before the species within these complexes can be clearly defined (Zavortink 1981) and, as expected, the egg stage is least known. The only species for which the egg is described completely is *Tr. digitatum* (Rondani) (Linley et al. 1990). Some early comments on the egg of *Tr. compressum* (as *Joblotia trichorryes* Dyar and Knab) were given by Busck (1908), and these will be considered in the discussion. However, a laboratory colony provided material for the more complete description given here.

MATERIALS AND METHODS

Several hundred eggs were available for study, obtained from a laboratory colony originated from material collected in the vicinity of Sao Paulo, Brazil. Voucher specimens of adults from the colony have been deposited both in the Florida Medical Entomology Laboratory reference collection and with Dr. T.J. Zavortink, Department of Biology, University of San Francisco. The eggs were allowed to embryonate, then fixed in alcoholic Bouin solution and mailed to Vero Beach. After three washings (1 h each) in 80% ethanol to remove picric acid, dehydration was completed and the specimens dried by the critical point method. Individual eggs were placed with a fine artist's brush in required attitudes on stubs covered with sticky tape, then were coated with gold and examined in a Hitachi S-510 scanning electron microscope. Egg dimensions were measured at 80× magnification (means ± SE given in text) with an ocular micrometer. All other structures were measured from micrographs using a digitizing tablet and Sigmascan software (Jandel Scientific, Corte Madera, CA).

DESCRIPTION

Size: Length (n = 10) 1084.9 ± 14.5 μm, width across dorsal surface (widest point) 497.5 ± 12.2 μm, L/W ratio 2.19 ± 0.04, width of ventral surface 343.0 ± 4.9 μm (n = 9).

Color: Eggs dried after fixation in alcohol were greyish-white, but Busck (1908) described live eggs as black.

Shape, overall appearance: Whole egg boat-shaped, more or less oval in dorsal view, anterior end more rounded, posterior somewhat more tapered (Fig. 1), both ends slightly sloped downwards (Figs. 2a;3a). Dorsal surface fairly flat, with 2 closely spaced and sometimes discontinuous or poorly defined central ridges, flanked by 2 very prominent ridges joined anteriorly and posteriorly (Figs. 1;3a). Marginal flap-like extensions protruding well beyond lateral surface of egg (Fig. 2a,b). Lateral and ventral surfaces uniform except that spatulate tubercles much larger and more conspicuous ventrally (Fig. 2a,b). Ventral surface curved (Fig. 2a).

Chorion, dorsal hydrophobic surface: From longitudinal mid-line to outer margin, chorionic cells divisible into 5 regions, corresponding to numbered positions in Fig. 4a, shown more highly magnified in Fig. 4b, and with cell dimensions as in Table 1. Boundaries of cells near mid-line difficult to distinguish (not measured), small tubercles organized into diffuse meshwork, enlarged and fused in some places to form peaked ridges aligned predominantly in long axis of egg (Figs. 4a;5a). In some eggs these ridges form a band across mid-line, in others aligned into 2 low, closely spaced ridges (Figs. 1;3a). Cells in adjacent region 1 considerably longer than broad (Table 1), small tubercles very numerous, many fused to form short, rough lines, thickened slightly to considerably along cell boundaries (Figs. 4b;5b). Chorionic reticulum visible as a narrow (0.2–0.6 μm) gap between cells (Fig. 5b). More laterally, cells in region 2 wider relative to length (Table 1), small tubercles more organized to surround small, shallow depressions (Figs. 4b;5c), reticulum slightly wider (0.5–0.6 μm). Region 3 cells even broader (Table 1), some single tiny to very small tubercles present, but most fused into conspicuous ridges aligned in broad dimension of cell (Figs. 4b;5d), reticulum with very thin central ridge (Fig. 5d). Between regions 3 and 4, chorion elevated to form prominent ridge (Fig. 4a), width 9–14 μm, cell dimensions not measurable, small tubercles in most cells fused into thickened ridges across cell (Fig. 5e). Region 4 cells barely longer than broad (Table 1), surfaces uniform,

Fig. 1. Egg of *Trichoprosopon compressum*. Entire egg, dorsal view, anterior end at top. Scale = 200 μm.

Fig. 2. Egg of *Trichoprosopon compressum*. (a) Entire egg, lateral view, dorsal side at left; (b) ventral view. Anterior end at top in both. Scale = 200 μm.

Fig. 3. Egg of *Trichoprosopon compressum*. (a) Entire egg, oblique dorsal view, anterior end at right; (b) posterior end; (c) detail, outer chorionic tubercles, posterior end; (d) anterior end and micropylar region; (e) detail, micropylar region; (f) detail, micropyle. Scale = 200 μm (a), = 50 μm (b,d,e), = 10 μm (c,f).

small tubercles formed into less distinct ridges, but conspicuous pores now visible between these. Reticulum indistinct, with thin central ridge (Fig. 5f). Cells in region 5 structurally similar to 4, except that ridges longer, more easily discerned (Fig. 4b), and cells now broader than long (Table 1). Along dorsal surface margin, edges of cells in flap-like extensions not easily distinguished, surfaces with many small tubercles, each flap edged with thin, raised wall (Fig. 5g), undersurface smooth with faint longitudinal striations (Fig.

Table 1. Egg of *Tr. compressum*, dimensions (greatest) of outer chorionic cells, dorsal surface. Cell length measured in long axis of egg, regions as numbered in Fig. 4a,b.

		Mean (±SE)	
Region	n	Length (μm)	Width (μm)
1	8	26.2 ± 1.9	0.9 ± 0.6
2	6	28.6 ± 1.2	16.2 ± 0.9
3	6	29.5 ± 1.4	23.0 ± 1.3
4	6	27.5 ± 0.9	25.7 ± 0.8
5	8	23.2 ± 2.1	31.1 ± 2.4

5h). Mean (n = 11) flap length (measured dorsally) 27.4 ± 0.9 μm, width 21.5 ± 2.7 μm.

Chorion, lateral and ventral hydrophilic surface: These surfaces more uniform than dorsal surface, divisible into 3 regions (Fig. 6). Boundaries of most lateral chorionic cells (region 1) discernible (Fig. 6a), mean length 31.0 ± 1.7 μm (n = 9), width 22.4 ± 1.1 μm, not so in more ventral cells. Cells in region 1 each containing numerous (mean 37.2 ± 2.6, n = 13) somewhat irregular, spatulate tubercles (mean length 3.7 ± 0.2 μm, n = 13, width 3.4 ± 0.2 μm), each with one, sometimes 2 central folds (Fig. 6b). Cell floors with conspicuous holes (Fig. 6b). Tubercles increase in size ventrally (region 2), mean length 6.6 ± 0.4 μm (n = 9), width 5.4 ± 0.3 μm, surfaces flatter, with 1–4 central creases (Fig. 6c). Tubercles much larger on most ventral surfaces (region 3), mean length 14.7 ± 1.2 μm (n = 10), width 13.2 ± 0.8 μm, often with several creases about central region. Cell floor with small, button-like tubercles (Fig. 6d).

Anterior end, micropyle: Prominent dorsal ridges join at anterior end to form prow-like prominence raised above lateral extensions, which overhang micropyle (Fig. 3d). Ventral surface tubercles surrounding micropylar region more peg-shaped (Fig. 3e), micropylar region fringed by low parapet (height 2–5 μm)

Fig. 4. Egg of *Trichoprosopon compressum*. (a) Chorion of dorsal surface from approximate mid-line (at left) to lateral margin (right); (b) detail of dorsal surface chorion, mid-line at top, lateral margin at bottom, numbers correspond to regions numbered in (a). Scale = 50 μm.

Fig. 6. Egg of *Trichoprosopon compressum*. (a) Chorion of lateral (top) to extreme ventral surface (bottom); (b) detail of chorionic tubercles in region 1 of (a); (c) in region 2; (d) in region 3. Scale = 50 μm (a), = 10 μm (b,c,d).

Fig. 5. Egg of *Trichoprosopon compressum*. (a) Outer chorionic cell detail in mid-dorsal line: (b) in region 1 of Fig. 4; (c) in region 2; (d) in region 3; (e) of prominent longitudinal ridge between regions 3 and 4; (f) in region 4; (g) of marginal flaps; (h) ventral surface of marginal flaps. Scale = 20 μm (a,h), = 10 μm (b,c,d,e,f,g).

ventrally and laterally, by a high wall (height about 15 μm) dorsally (Fig. 3e). No distinct, raised collar present, area surrounding micropyle 60–70 μm wide, with polygonal depressions, surface roughened by tiny papillae (Fig. 3f). Micropyle at center of slightly raised mound, 17—19 μm in diameter, boundary indistinct, with radial ridges and furrows (Fig. 6f). Micropylar orifice 3.0 μm in diameter.

Posterior end: Dorsal surface structure same as at anterior end (Fig. 3b), ventral surface tubercles stud-like, holes visible between tubercles (Fig. 3c).

DISCUSSION

The structure of this egg, which is laid singly on the water (Busck 1908), indicates that it floats horizontally with the dorsal, hydrofuge surface uppermost. In contrast, the structurally different and more complex egg of *Tr. digitatum* (Linley et al. 1990) floats vertically and possesses three specialized longitudinal strips (the so-called embrasures) that improve adhesion of eggs in rafts brooded by the females (Lounibos and Machado-Allison 1986). The chorionic tubercles along most of the length of each embrasure are greatly elongated and elaborated into hooks that interlock and bind contiguous eggs in the raft (Linley et al. 1990). According to Mattingly (1974), another undescribed *Trichoprosopon* has an egg similar to that of *Tr. digitatum*, but Mattingly provided only the barest description, with simple line drawings. No structural detail was discerned and no mention was made of embrasures. Thus, the eggs of only two species are presently known at any level of detail, and the egg of *Tr. digitatum* may be structurally specialized in connection with egg brooding and may not be mimicked elsewhere in the genus. The simpler egg of *Tr. compressum* is of a general design advantageous for eggs that float on water and in some respects resembles the eggs of *Anopheles*; the flap-like marginal extensions of the dorsal surface being the functional equivalent of the anopheline frill. In *Tr. compressum*, these extensions increase the circumference of the hydrofuge area and so improve flotation as well as stability. The weight of the egg must cause formation of a meniscus around the egg opposite in curvature to that along the walls of the oviposition site, so causing eggs to be repelled (Hinton 1981) away from the walls and any predators thereon.

In his comments on the egg, Busck (1908) alluded to the presence of four longitudinal fringes of short, white hairs, which cause the egg to float. Since no hairs as such are present, it must be presumed that perhaps the two prominent longitudinal ridges and margins of the egg appear pale in living eggs. Busck also noted that if eggs were flooded and sank, they nevertheless hatched successfully.

ACKNOWLEDGMENTS

I am grateful to Dr. Akemi Suzuki of the Arbovirus Section, Instituto Adolfo Lutz, Sao Paulo, Brazil, for sending a very large sample of eggs for study. Dee Duzak skillfully printed the micrographs. This paper is Institute of Food and Agricultural Sciences, University of Florida Experiment Station Journal Series No. R-01770.

REFERENCES CITED

Busck, A. 1908. Report on a trip for the purpose of studying the mosquito fauna of Panama. Smithson. Misc. Collect. 52:49–77.

Hinton, H.E. 1981. Biology of insect eggs. Vol. 1. Pergamon, Elmsford, NY.

Linley, J.R., L.P. Lounibos and P.A. Linley. 1990. Fine structure of the egg of *Trichoprosopon digitatum* (Diptera: Culicidae) and its relationship to egg raft formation. J. Med. Entomol. 27:578–585.

Lounibos, L.P. and C.E. Machado-Allison. 1986. Oviposition and egg brooding by the mosquito *Trichoprosopon digitatum* in cacao husks. Ecol. Entomol. 8:475–478.

Mattingly, P.F. 1974. Mosquito eggs XXVI. Further descriptions of sabethine eggs. Mosq. Syst. 6:231–238.

Zavortink, T.J. 1979a. A reclassification of the sabethine genus *Trichoprosopon*. Mosq. Syst. 11:255–257.

Zavortink, T.J. 1979b. Mosquito studies (Diptera: Culicidae) XXXV. The new sabethine genus *Johnbelkinia* and a preliminary reclassification of the composite genus *Trichoprosopon*. Contrib. Am. Entomol. Inst. (Ann Arbor) 17(1):1–61.

Zavortink, T.J. 1981. Species complexes in the genus *Trichoprosopon*. Mosq. Syst. 13:82–85.