

STRUCTURAL FEATURES OF COCKROACH EGG CAPSULES.

II. THE OOTHECA OF *CARIBLATTA LUTEA LUTEA* (ORTHOPTERA: BLATTIDAE)¹

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In a previous paper (Lawson, 1951), the oothecae of six species of cockroach were described. In this paper the ootheca of the small yellow cockroach, *Cariblatta lutea lutea* S and Z,² is described. This species, along with two others the egg capsules of which are to be described later, were taken on a collecting trip out of Tampa, Florida, in December, 1949.

Cariblatta lutea, as indicated by Blatchley (1920), is probably the smallest of the native North American roaches; of the two varieties, *C. lutea minima* Hebard is reported to be slightly smaller than the one under study here. A large series of collected and reared adult specimens of *C. lutea lutea* averaged only 10 mm in length; egg capsules are of correspondingly small size, averaging about 3 mm in length and 1.5 mm in depth. The female carries the capsule through a very brief period following its completion, after which she abandons it in some almost microscopic hiding place.

EXTERNAL

Side view. The egg capsule is somewhat boat-shaped when viewed from the side (fig. 1); the seam occupies the dorsal margin while the ventral is filled with the caudal ends of the eggs. The seam is slightly but continuously curved over the entire dorsal line, extending as a more sharply curved arc on each end. The curvature of the end profiles is different on the opposite ends; that of the distal end (i.e., that first formed), is compound, with a short, sharp arc from the seam termination merging with a slightly developed reverse-sigmoid curve that leads into the short ventral margin of the ootheca. The proximal end presents an evenly rounded profile which curves continuously and rather sharply into the lower capsule margin. The lower margin of this ootheca is very slightly concave and only about half as long as the upper. Due to the natural inequalities in the curvature of the two ends, the lower margin is slightly off-center as related to the upper outline.

The number and position of the enclosed eggs are indicated by thin lines extending around the sides from the seam base to the lower capsule margin (fig. 2); these are found to have the shape of the letter Y, with an extremely long stem below very short arms. The space between stems and *outside* the arms indicates an egg on the near side of the capsule; that enclosed *between* the arms of each Y represents the sub-seam mesal extensions of eggs of the opposite half of the capsule. This crossing-under characteristic was found also in the capsules of the German, Brown Banded, and Pennsylvania Wood roaches. Each end of the ootheca is occupied by one egg which is unpaired except for its counterpart; the remaining ova are paired but are spaced in slightly off-set positions.

The upper third of the side-wall surfaces of each egg case is marked by minute, evenly spaced horizontal ridges which duplicate the seam base curvature (fig. 3); they extend the entire length of the capsule sides and around a slight lateral portion of each end. The ridges become gradually less prominent near the middle of the side walls and are wanting on the lower third.

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²Determined by Dr. J. J. Friauff, Vanderbilt University, Nashville, Tenn.

End view. The external end view of this ootheca presents a double oval-convex outline, with the sides curving inward dorsally as a rounded arc, then extending upward into the seam, while the lower walls extend more deeply (with a less extensive degree of curvature) and merge caudally to form the narrow rounded wall which surrounds the lower ends of the eggs. The external features of the two extremities are as follows:

The *proximal* end—the cell-bearing hollow portion of the seam terminates rather abruptly in a widened and flattened structure which consists of two broad, only slightly elevated ridges paralleling a faint median groove (fig. 4). This groove disappears as the lateral ridges merge and fade into the end curvature.

The *distal* end—the cell row terminates in a sharp, slightly elevated narrow ridge which extends down the continuation of the broader basal portion of the seam (fig. 5); both the ridge and seam base fade out at the point of mergence with the reversed sigmoid curvature described above. The minute ridges of the side walls which parallel the seam base terminate at the margins of the seam-end elevations, a condition which is found also on the opposite end.

Seam. From the side this structure is extremely small when compared to the total size of the capsule, appearing only as a minute crest along the dorsal margin (fig. 1). The top outline of the keel is regularly produced upward into noticeably rounded elevations which, in the center of the seam, have a length of about one-half that of the slightly concave seam spaces between them; these elevations are spaced more closely at the ends of the seam. A minute lateral ridge extends along the length of each side of the seam (fig. 3), the top of which is just below and parallel to the upper margin of the median ridge; these down-set ridges are quite pronounced along the spaces between elevations but tend to fade out or merge somewhat with the bases.

The structural details and seam contents are revealed in strong transmitted light (figs. 2, 3). Each elevation is occupied by a hollow cell which is located high within the walls of the tooth, giving the impression of being perched on top of the seam proper. Each cell is longer than deep and is evenly oval or egg-shaped in outline. A minute hole penetrates each side wall of the cell, forming a direct outside connection. A hollow tube of exceedingly small diameter curves downward from the distal end of each cell; the tubes extend down to the tops of the enclosed white bodies, which are seen in silhouette in this view. In all capsules there is a cell for each egg enclosed within the capsule; in some, however, additional cells were found in the terminal portions of the seam. Most of the capsules examined contained twelve eggs but in a few of these as many as fifteen cells were present in the seam.

The top view of the seam (fig. 6) reveals a narrow face bounded laterally by the minute low-lying ridges described above; the center of the face (and the line of dehiscence) is shown by a sharp elevated median ridge which is interrupted at regular intervals by the cell-bearing elements. These are indicated by oval-lateral as well as by upward extensions of the seam walls. A slight groove is found on either side between the median and lateral ridges; these are quite pronounced in the spaces between the elevations but are greatly reduced on the bases of the latter. The lateral outlines of the white bodies may occasionally be seen as irregular lines paralleling the seam face.

INTERNAL

Seam. When one of the seam walls is removed (fig. 2), the lumen contents and the inflexed face of the opposite seam wall are revealed. The latter is relatively thick in the upper portion but tapers to a very thin blade-like extension into the lumen. The mesal surface of each face is engraved with one-half of each cell and tube system. The capsule and seam wall material is relatively thick and is brittle and hard.

The median line of the seam floor is occupied by a row of sponge-like bodies similar in appearance and apparent composition to those found in the oothecae of *Blatella germanica* L., and *Parcoblatta pennsylvanica* DeGeer. They are upright in position and, in most of the capsules examined, extend upward sufficiently so that the dorsal surface of each is in direct contact with the lower margin of the inflexed seam faces and with the top of the seam lumen. Each body is in direct contact with the tube which leads to a hollow cell above; each, also, is in turn associated with the cephalic end of an egg below, apparently by way of a thin mesal extension down to a sub-floor layer which caps the eggs. There is one such structure included within the seam for each egg enclosed in the main body below; the adjoining ends of these structures are firmly anchored to the sub-floor layer through the median (seam floor) slit and into minute pit-like invaginations which are located between the choria of adjoining eggs directly beneath; they are also attached longitudinally to the layer on top of the eggs.

In cross-section the lumen of the seam is found to be triangular in outline with slightly rounded basal angles and with the apical occupied in part by a short, rapidly tapering inverted triangle representing the abutting inflexed seam faces. In the area between cells, the top of this triangle is quite thickened (fig. 7); a section through a cell (fig. 8) reveals an evenly rounded space, enclosed by extremely thin lateral and dorsal walls, perched on top of a thicker seam-wall base.

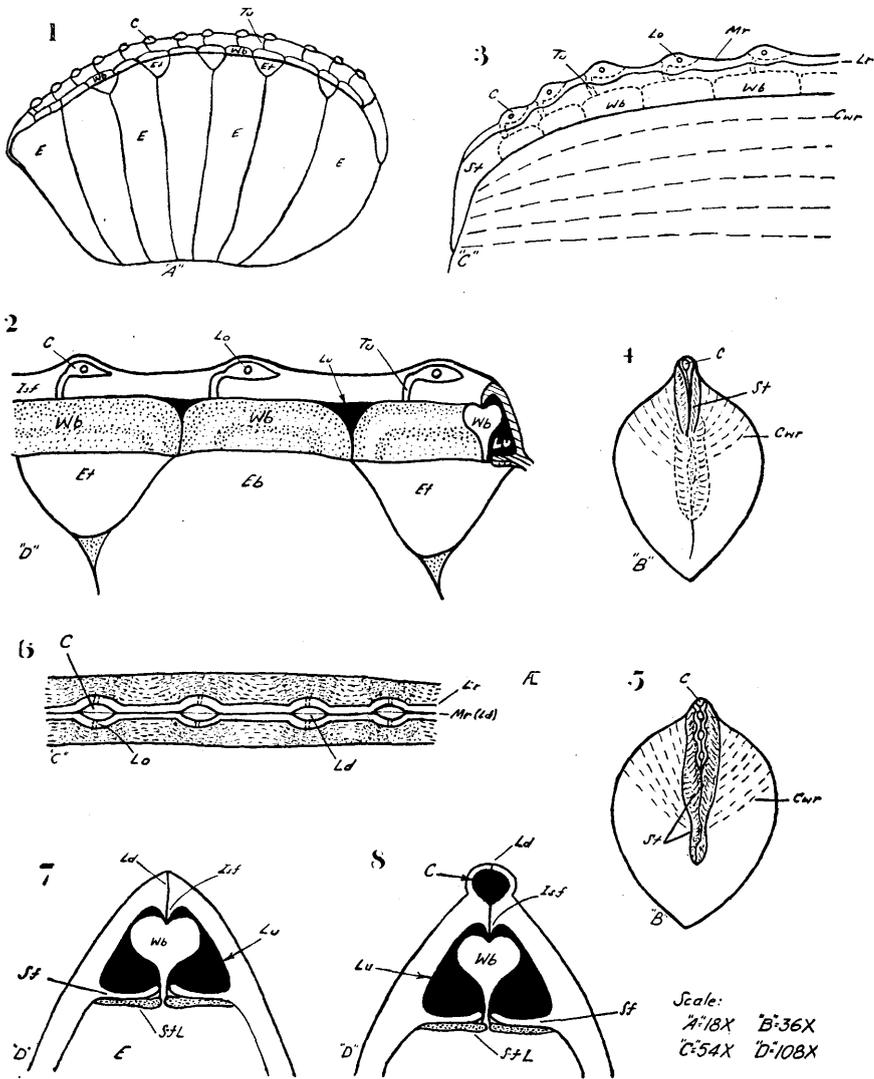
The two halves of the seam floor, or inner laminae of the capsule wall, almost meet on the mid-line (fig. 7); the thickness of each is greatest at its point of separation from the main capsule wall, then tapers irregularly toward the center. The top surfaces are comparatively smooth, while the lower slope upward toward the mesal, slightly upcurved terminations. In this small species the sub-floor layer, which corresponds to that found in *B. germanica* and others, is slightly uneven in thickness and presents an uneven lower or inner outline (fig. 8); in most of the capsules studied, this layer is the same width as the seam floor but occasionally may appear not to extend to the lateral margins of the seam base.

Eggs. The spacing of the eggs is such that the alternate crossing-under arrangement beneath the seam floor is in agreement with that which has previously been found in the oothecae of certain other species of the sub-family Pseudomopinae. The hatched capsule reveals the alternately placed double row of empty egg shells, a condition which also appears to be typical of the egg cases of this subfamily.

No trabecular pattern was found, however, which represents a major departure from egg cases previously examined. Since this pattern, hexagonal in nature when present, represents the impressions of the ovarian cells which secreted the chorion layers (Wheeler, 1889), the assumption here is that the secreting cells in the ovarian tubes of *C. lutea lutea* are either so small as to leave no impression or that such depressions, if present, are too small for resolution with the ordinary compound microscope. The chorion characteristics were studied after removal of the egg contents with carbon tetrachloride; otherwise the material boiled out and was immediately congealed by the heat of the microscope lamp.

EXPLANATION OF FIGURES IN PLATE

1. Side view of ootheca of *Cariblatta lutea lutea* S and Z.
2. Internal side view of portion of seam, one wall removed.
3. External side view of seam and upper part of capsule wall.
4. End view, proximal.
5. End view, distal.
6. Dorsal view of seam.
7. Cross-section of seam between cells.
8. Cross-section of seam through cell.



KEY TO ABBREVIATIONS

C—Cell
 Cwr—Capsule wall ridge
 E—Egg
 Eb—Egg body
 Et—Egg termination
 Isf—Inflexed seam faces
 Ld—Line of dehiscence
 Lo—Lateral opening

Lr—Lateral ridge
 Lu—Lumen of keel
 Mr—Median ridge
 Sf—Seam floor
 S-f L—Sub-floor Layer
 St—Seam termination
 Tu—Tube
 Wb—White body

Capsule wall. At 440X under a compound microscope the crystalline matrix of the capsule wall was seen; the field, even at this magnification, was full of hundreds of mostly minute square crystals. Scattered sparsely through the field, however, were a few crystals of four to six times the size of the smaller ones.

SUMMARY

The ootheca of *Cariblatta lutea lutea* (S and Z) is described; this variety of a species belonging in the Pseudomopinae produces an egg-case basically similar to that of the common German Roach, *Blatella germanica* L., also of that subfamily.

The capsule is boat-shaped when seen from the side; the seam-bearing dorsal margin is curved, longer than the lower margin, and is connected with the latter by sharply back-curved ends. The seam is very small compared to the remainder of the egg case. The upper walls are marked with minute ridges which parallel the seam base and terminate on the sides of slightly raised structures marking the ends of the seam.

The seam contains hollow cells placed high in the walls; these are punctured laterally by minute holes and are connected with the lumen by way of very fine tubes. Inflexed seam faces carry the tubes down to make contact with spongy white bodies which are aligned in such manner that the position of each corresponds to that of an egg beneath the seam floor. A thin, apparently amorphous layer connects the white bodies with the tops of the eggs.

The eggs are arranged in the manner typical of this group of roaches; i.e., the mesal margin of each extends beneath and slightly beyond the seam floor. When hatching occurs, the seam halves are lifted away with the walls, and the dorsally opened upright egg shells ("pockets") remain in place.

Hexagonal trabecular egg-shell patterns were not found. A few large and great numbers of minute square to rectangular crystals were observed in the matrix of the capsule walls.

These oothecae averaged 1.5 x 3 mm in size.

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