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Chorion Characteristics of Sod Webworm Eggs

Ellis L. Matheny Jr.
University of Tennessee

E. A. Heinrichs
University of Tennessee, eheinrichs2@unl.edu

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Chorion Characteristics of Sod Webworm[1] Eggs[2]

Ellis L. Matheny, Jr.,[3] and E. A. Heinrichs[4]

Department of Agricultural Biology, University of Tennesee Agricultural Experiment Station, Knoxville, Tennessee, USA

Abstract

The egg chorion was investigated for 15 species of sod webworm moths (Lepidoptera: Pyralidae: Crambinae) collected in Tennessee. Liquid plastic was used for surface printing of chorion sculpturing. Scanning electron micrographs were utilized in construction of a taxonomic key to eggs of the Crambinae species studied and the characteristics illustrated.

Most sod webworm species lay eggs that are similar in appearance to those of other species and difficult to separate taxonomically. Superficial descriptions of sod webworm eggs have been reported by several investigators, including Felt (1894), Miller (1940), Peterson (1963), and Ainslie (1922, 1923a, 1923b, 1927, 1930). Descriptions of eggs of other insect groups have been reported by Southwood (1956), Myers (1967), Knight et al. (1965), and Koss (1968). Systematic descriptions of eggs of the Crambinae are not available.

The small size of Crambinae eggs makes it difficult to employ conventional techniques in preparing slides and taking chorion measurements; however, Archer's (1950) liquid herbarium plastic greatly facilitated this study. Harlan and Enns (1966) identified grasshopper eggs by surface printing in this plastic. Similar methods were used by Bullock (1960) to investigate mosquito eggs and by Sinclair and Dunn (1961) for surface printing of plant leaves.

The high resolution and 3-dimensional clarity of the scanning electron microscope make it an invaluable tool for studying diagnostic characters of insects. Hinton (1969) used scanning electron micrographs to illustrate respiratory systems of various insect egg shells. Floodwater mosquito eggs recently were investigated in this manner by Horsfall et al. (1970). Our study was conducted to determine egg chorion sculpturing differences among species and to construct a taxonomic key to eggs of Crambinae species collected in Tennessee.

Materials and Methods

Taxonomic and morphological characters were recorded from eggs of 15 Crambinae species. These eggs were obtained from field-collected moths and were deposited singly and nonadhesively. Standard errors of length and width were determined for 50 eggs from each species.

Archer's (1950) liquid herbarium plastic was used for surface printing of egg chorion sculpturing. Techniques followed were similar to those reported by Harlan and Enns (1966). Measurements were taken using an ocular micrometer in a Nikon phase-contrast microscope.

Ten slides, each from different moths and containing ca. 75 egg impressions, were made for each species investigated. Exceptions were 3 slides made from a single *Thaumatopsis edonis* (Grote) and a slide from each of 5 *Crambus decorellus* (Zincken) females. The number of longitudinal carinae and the number of cells encircling the immediate micropylar region (Fig. 9) were determined for 5 eggs from each moth. Three to 4 replications of the following measurements were also recorded for each of 5 egg impressions from each slide: depth of furrows between longitudinal carinae (Fig. 5); distance between longitudinal carinae (Fig. 7); distance between cross striae, traversing furrows (Fig. 11); diameter of aeropyles (Fig. 4).

Scanning electron micrographs of all species were taken at the Engineering Experiment Station, Georgia Institute of Technology. Polaroid type 55 P/N film was used in a Cambridge Stereo-Scan Mark II scanning electron microscope. Egg color development for each species was recorded daily from deposition to hatch. These eggs were incubated at 25°C and 85% RH.

Results

Egg size and chorion sculpturing varied slightly within a species. However, these measurements were reliable taxononiic characteristics in egg identification.

Key to Crambinae Eggs

1. Aeropyles arising on distinct, variously elevated longitudinal carinae; polar areas marked by ridges and depressions of diverse complexity 2

   Aeropyles borne on chorion surface lacking distinct longitudinal carinae; polar areas smooth and round; aeropyles annular (Figs. 1–4) . . *Cbrysoteuchia topiaria*

2(1). Eggs less than 0.47 mm wide 3

   Eggs greater than 0.47 mm wide; aeropyles triangular and connected on wide carinae surface by longitudinal grooves (Figs. 5–8) . . . . *Thaumatopsis edonis*

3(2). Longitudinal carinae distinct in pattern and texture from remainder of egg chorion 4

Texture of longitudinal carinae homogeneous with egg chorion 8

4(3). Longitudinal carinae mottled; aeropyles less than 1.5 μ diam (Figs. 9–12) . . . . *Pediasia trisecta*

Longitudinal carinae lacking mottled appearance ; aeropyles greater than 1.5 μ . 5

5(4). Surface of longitudinal carinae smoothly textured and forming a bluntly rounded ridge enclosing aeropyles (Figs. 13–16) . . . . *Pediasia mutabilis*

Surface of longitudinal carinae roughly textured, with numerous ridges and depressions enclosing aeropyles 6

6(5). Longitudinal carinae and aeropyles defined by linear ridges and depressions (Figs. 17–20) . . . . *Crambus alboclavellus*

Longitudinal carinae reticulated with distinct pits and depressions; aeropyles connected by slightly elevated ridges 7

7(6). Aeropyles ovate (Figs. 21–24) . . . . *Pediasia caliginosella*

Aeropyles circular (Figs. 25–28) . . . . *Pediasia luteolella*

8(3). Eggs less than 0.44 mm long 9

Eggs 0.44 mm long, or longer 10

9(8). Distance between longitudinal carinae greater than 55 μ; cross striae traversing median furrows 10–14 μ apart (Figs. 29–32) . . . . *Microcrambus elegans*

Distance between longitudinal carinae less than 55 μ; cross striae traversing furrows 17–23 μ apart (Figs. 33–36) . . . . *Crambus laqueatellus*

10(8). Polar areas with oval tubercules (Figs. 37–40) . . . . *Crambus praefectellus*

Polar areas without oval tubercules 11

11(10). Chorion ridged with 15 or more longitudinal carinae 12

Chorion ridged with less than 15 longitudinal carinae; circular aeropyles interspaced to form 2 longitudinal rows on wide carinae (Figs. 41–44) . . . . *Crambus decorellus*

12(11). Chorion with distinct cross striae traversing median longitudinal furrows . . 13

Chorion lacking distinct cross striae; aeropyles circular and slightly elevated from rounded longitudinal carinae (Figs. 45–48) . . . *Crambus pascuellus floridus*

13(12). Diameter of aeropyles greater than 2 μ (Figs. 49–52) . . . . *Crambus teterrellus*
Diameter of aeropyles less than 2 μ 14

14(13). Distance between longitudinal carinae greater than 50 μ; depth of median furrows between longitudinal carinae greater than 7 μ (Figs. 53–56) . . . . *Agriphila vulgivagella*
Distance between longitudinal carinae less than 50 μ; depth of median furrows between longitudinal carinae less than 7 μ (Figs. 57–60) . . . . *Agriphila ruricolella*

Chrysoteuchia topiaria (Zeller)
(Figs. 1–4)
Shape. Elliptical oval, broadly rounded at both ends. Five–8 cells encircle the immediate micropylar region. Chorion lacking raised longitudinal carinae and cross striae. Polar regions relatively smooth in comparison with eggs of most crambinae species. Aeropyles 3.33 ± 0.35 μ diam, annular and slightly raised from chorion surface. Distance between longitudinal rows of aeropyles 46.18 ± 0.81 μ.
Size. Length, 0.425 ± 0.009 mm. Width, 0.327 ± 0.004 mm.
Color. Pearly white when deposited, changing to salmon orange at eclosion in 7–8 days.

Thaumatopsis edonis (Grote)
(Figs. 5–8)
Shape. Large, elongate oval. Six–8 cells surround the immediate micropylar region. Chorion surface with 13–15 wide, bluntly rounded, longitudinal carinae, 107.83 ± 0.05 μ apart. Median longitudinal furrows recessed 17.38 ± 0.63 μ between carinae. Faint cross striae traversing furrows 24.73 ± 0.44 μ apart. Triangular aeropyles, 2.03 ± 0.03 μ diam, interconnected by grooves on longitudinal carinae.
Size. Length, 0.598 ± 0.002 mm. Width, 0.503 ± 0.001 mm.
Color. Light yellow when deposited, becoming brownish-orange by the 6th day. Eye spots visible the 14th day and cervical shield and head capsule of larvae clearly visible after 15 days. Reddish-brown larvae appeared completely developed after 18 days; however, no larvae hatched during this study.

Pediasia trisecta (Walker)
(Figs. 9–12)
Shape. Elongate oval, polar areas rounded. Five to 9 enclosed cells encircle the immediate micropylar region. Fourteen-19 rounded longitudinal carinae, 59.58 ± 0.97 μ apart, extend nearly to the poles; surface of carinae covered by a mottled pattern. Relatively shallow furrows, 6.75 ± 0.53 μ deep traversed by faint cross striae, 14.95 ± 0.37 μ apart. Aeropyles, less than 1.5 μ diam, located on longitudinal carinae and attached to cross striae.
Size. Length, 0.537 ± 0.009 mm. Width, 0.331 ± 0.007 mm.
Color. Light yellow when deposited, changing to a dull brownish-yellow before eclosion in 6–8 days.

Pediasia mutabilis (Clemens)
(Figs. 13–16)
Shape. Elliptical in outline, bluntly rounded at the ends; one end slightly more pointed. Four–6 enclosed cells encircle the immediate micropylar region. Chorion ridged with 15–20 prominent longitudinal carinae, 52.48 ± 1.42 μ apart. Depth of longitudinal furrows between carinae 11.48 ± 0.64 μ. Distinct striations, traversing furrows, 14.85 ± 0.40 μ apart. Aeropyles 2.63 ± 0.27 μ diam, circumscribed by bluntly rounded ridges.
Size. Length, 0.5l0 ± 0.014 mm. Width, 0.320 ± 0.008 mm.
Color. Pale white when deposited, changing gradually from light yellow to brownish-orange before eclosion in 7–8 days.

Crambus alboclavellus Zeller
(Figs. 17–20)
Shape. Ovoid, usually truncate at one end and slightly tapered at the other. Five–8 enclosed cells surround the immediate micropylar region. Chorion ridged with 16–20 longitudinal carinae, 49.90 ± 0.85 μ apart, and coalescing at the poles to form an irregular reticulate pattern. Surface of carinae and aeropyles delimited by linear ridges and depressions. Cross striae, 20.30 ± 0.39 μ apart, traverse furrows which are recessed 9.38 ± 0.59 μ between longitudinal carinae. Aeropyle openings 2.81 ± 0.10 μ diam.
Size. Length, 0.396 ± 0.006 mm. Width, 0.315 ± 0.006 mm.
Color. Pearly white when deposited, changing gradually from light yellow to brownish-orange at eclosion in 10 days.

Pediasia caliginosella (Clemens)
(Figs. 21–24)
Shape. Elliptical, with one end truncate, the other slightly pointed. Four–6 enclosed cells surround the immediate micropylar region. Chorion ridged with 16–20 distinct longitudinal carinae, 39.08 ± 0.93 μ apart, with their surface punctuated by distinct depressions and pits. Moderately deep furrows, recessed 10.05 ± 0.36 μ, traversed by faint cross striae, 19.08 ± 0.54 μ apart. Ovate aeropyles 2.63 ± 0.17 μ diam and connected by slightly elevated ridges.
Size. Length, 0.420 ± 0.007 mm. Width, 0.274 ± 0.006 mm.
Color. Creamy white when deposited, gradually becoming light golden before eclosion in 10 days.

Pediasia luteolella (Clemens)
(Figs. 25–28)
Shape. Elongate oval, one end bluntly rounded, the other slightly tapered. Four–6 enclosed cells surround the immediate micropylar region. Eighteen–22 distinct longitudinal carinae, 38.58 ± 0.68 μ apart, raised 10.48 ± 0.32 μ above furrow median. Cross striations, 19.15 ± 0.26 μ apart, traverse furrows. Longitudinal carinae punctuated by acute depressions and pits. Circular aeropyles 2.24 ± 0.23 μ diam, interconnected on carinae by a slightly elevated ridge.
Size. Length, 0.419 ± 0.008 mm. Width, 0.295 ± 0.004 mm.
Color. Creamy white when deposited, changing to a medium yellow before eclosion in 9–10 days.

Microcrambus elegans (Clemens)
(Figs. 29–32)
Shape. Oval, the ends bluntly rounded. Five–8 cells encircle the immediate micropylar region. Chorion ridged with 12–15 acutely rounded longitudinal carinae, 61.48 ± 0.96 μ apart, and elevated 8.53 ± 0.79 μ from recessed furrows. Numerous cross striae, 12.20 ± 0.33 μ apart, traverse furrows. Circular aeropyles, 2.56 ± 0.17 μ diam, slightly elevated from longitudinal carinae.
Size. Length, 0.422 ± 0.007 mm. Width, 0.275 ± 0.004 mm.
Color. White when deposited, changing gradually from light yellow to yellow-orange at eclosion in 9–10 days.

Crambus laqueatellus Clemens
(Figs. 33–36)
Shape. Ovoid, bluntly rounded on both ends. Five–8 enclosed cells surround the immediate micropylar region. Chorion ridged with 14–18 longitudinal carinae, 49.28 ± 0.99 μ apart, usually merging at each polar end. Distinctly recessed furrows, 14.48 ± 0.29 μ deep, traversed by cross striae, 20.20 ± 0.69 μ apart. Aeropyles slightly elevated from longitudinal carinae, 3.03 ± 0.16 μ diam.
Size. Length, 0.417 ± 0.003 mm. Width, 0.295 ± 0.004 mm.
Color. Creamy white when deposited, slowly turning salmon red before eclosion in 7–8 days.

Crambus praefectellus (Zincken)
(Figs. 37–40)
Shape. Suboval, one end slightly larger and more flattened than the other. Five–8 enclosed cells encircling micropyle. Nineteen to 24 distinct longitudinal carinae, 40.58 ± 0.72 μ apart, becoming obsolete before reaching the poles; oval tubercules, of variable size, cover the polar regions. Furrows of medium depth, 7.33 ± 1.30 μ, and traversed by indistinct cross striae, 20.28 ± 0.40 μ apart. Diameter of aeropyles 2.48 ± 0.26 μ.
Size. Length, 0.485 ± 0.009 mm. Width, 0.321 ± 0.007 mm.
Color. Pure white when deposited, changing from a flesh color to bright red before eclosion in 6–7 days.

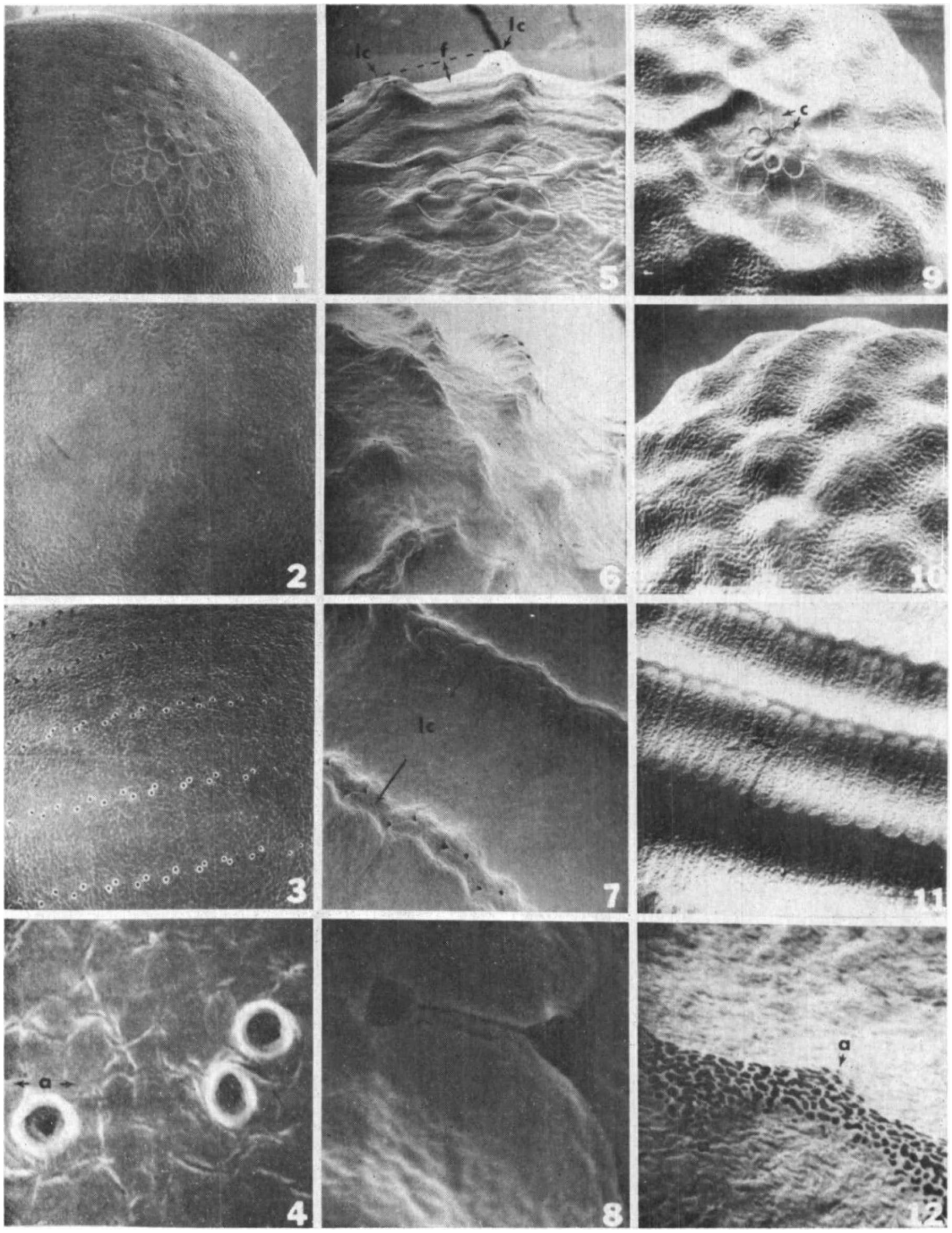
Crambus decorellus (Zincken)
(Figs. 41–44)
Shape. Elongate oval, with ends bluntly rounded. Four–6 cells encircle the micropyle openings. Chorion ribbed with 12–14 wide, bluntly rounded longitudinal carinae, 93.78 ± 2.13 μ apart. Deep median furrows, 22.03 ± 1.17 μ, traversed by cross striae, 17.88 ± 0.67 μ apart. Two rows of circular aeropyles, 2.23 ± 0.09 μ diam, forming triangular patterns on carinae.
Size. Length, 0.582 ± 0.012 mm. Width, 0.413 ± 0.014 mm.
Color. Creamy white when deposited, turning deep orange yellow before eclosion in 10 days.

Crambus pascuellus floridus Zeller
(Figs. 45–48)
Shape. Ovoid, rounded on both ends. Five–9 cells surround the immediate micropylar region. Chorion characterized by slightly rounded longitudinal carinae, 48.73 ± 0.96 μ apart, and an absence of distinct cross striae. Shallow furrows, between the 18–20 carinae, 5.85 ± 0.50 μ deep. Slightly elevated, circular aeropyles 2.14 ± 0.15 μ diam.
Size. Length, 0.471 ± 0.005 mm. Width, 0.356 ± 0.003 mm.
Color. Creamy white when deposited, changing gradually from orange to dark scarlet before eclosion in 8 days.

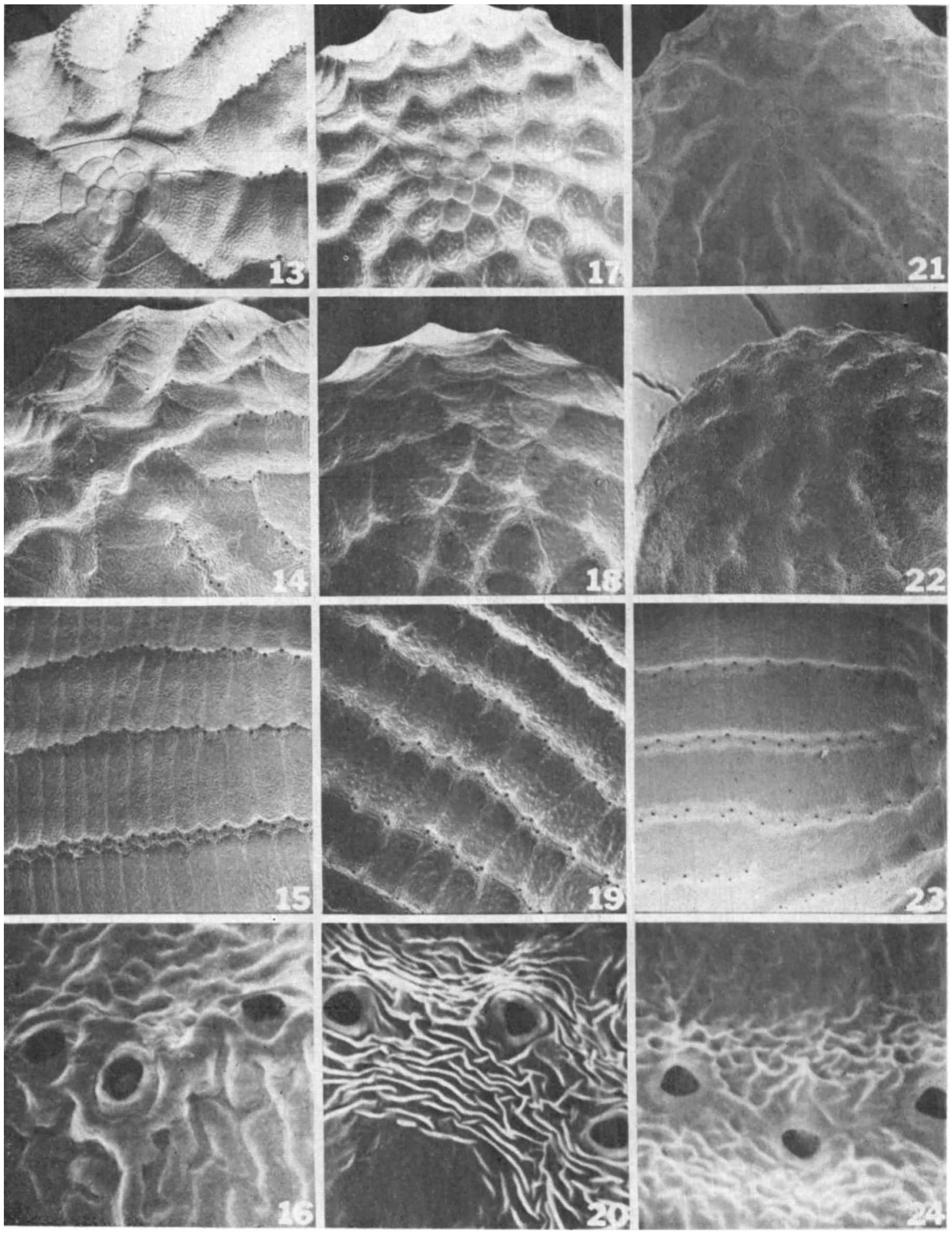
Crambus teterrellus (Zincken)
(Figs. 49–52)
Shape. Elongate oval, with bluntly rounded ends. Four–7 enclosed cells surround the immediate micropylar region. Chorion longitudinally ridged with 16–23 carinae, 44.80 ± 0.92 μ apart and elevated 9.83 ± 0.56 μ from furrows between the ridges. Traversing furrows are cross striae, 16.45 ± 0.46 μ apart. Circular aeropyles 2.63 ± 0.03 μ diam.
Size. Length, 0.525 ± 0.004 mm. Width, 0.305 ± 0.007 mm.
Color. Light yellowish-white when deposited, turning a deeper yellow before eclosion in 7 days.

Agriphila vulgivagella (Clemens)
(Figs. 53–56)
Shape. Ovoid, with bluntly rounded ends. Five–8 enclosed cells surround the micropylar region. Chorion ridged with 16–22 prominent longitudinal carinae, 58.15 ± 1.14 μ apart, and coalescing at the poles. Moderately deep furrows, 9.35 ± 0.61 μ, traversed by distinct cross striae, 20.23 ± 0.54 μ apart. Cylindrical aeropyles 1.47 ± 0.12 μ diam.
Size. Length, 0.503 ± 0.010 mm. Width, 0.367 ± 0.005 mm.
Color. Creamy white when deposited, gradually changing from a flesh color to bright salmon orange before eclosion in 11–12 days.

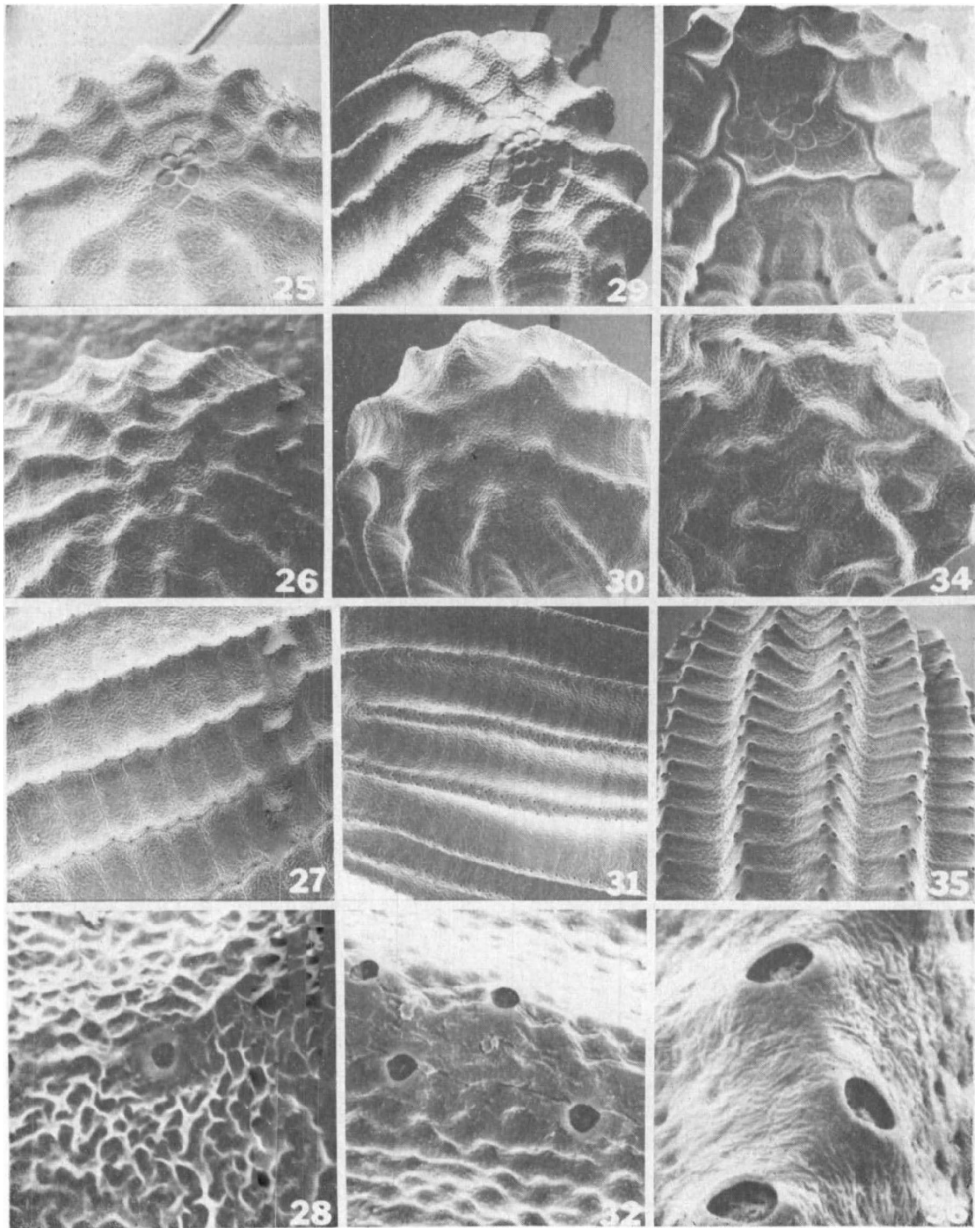
Agriphila ruricolella (Zeller)
(Figs. 57–60)
Shape. Ovoid, with one end bluntly rounded, the other slightly tapered. Five–7 cells encircle the immediate micropylar region. Distance between the 20–30 longitudinal carinae 40.20 ± 1.23 μ. Shallow furrows, 5.88 ± 0.23 μ deep, traversed by faint cross striae 17.35 ± 0.57 μ apart. Diameter of aeropyles 1.46 ± 0.07 μ.
Size. Length, 0.488 ± 0.003 mm. Width, 0.373 ± 0.004 mm.
Color. Light yellow when deposited, changing gradually to deep lemon gold before eclosion in 10–12 days.



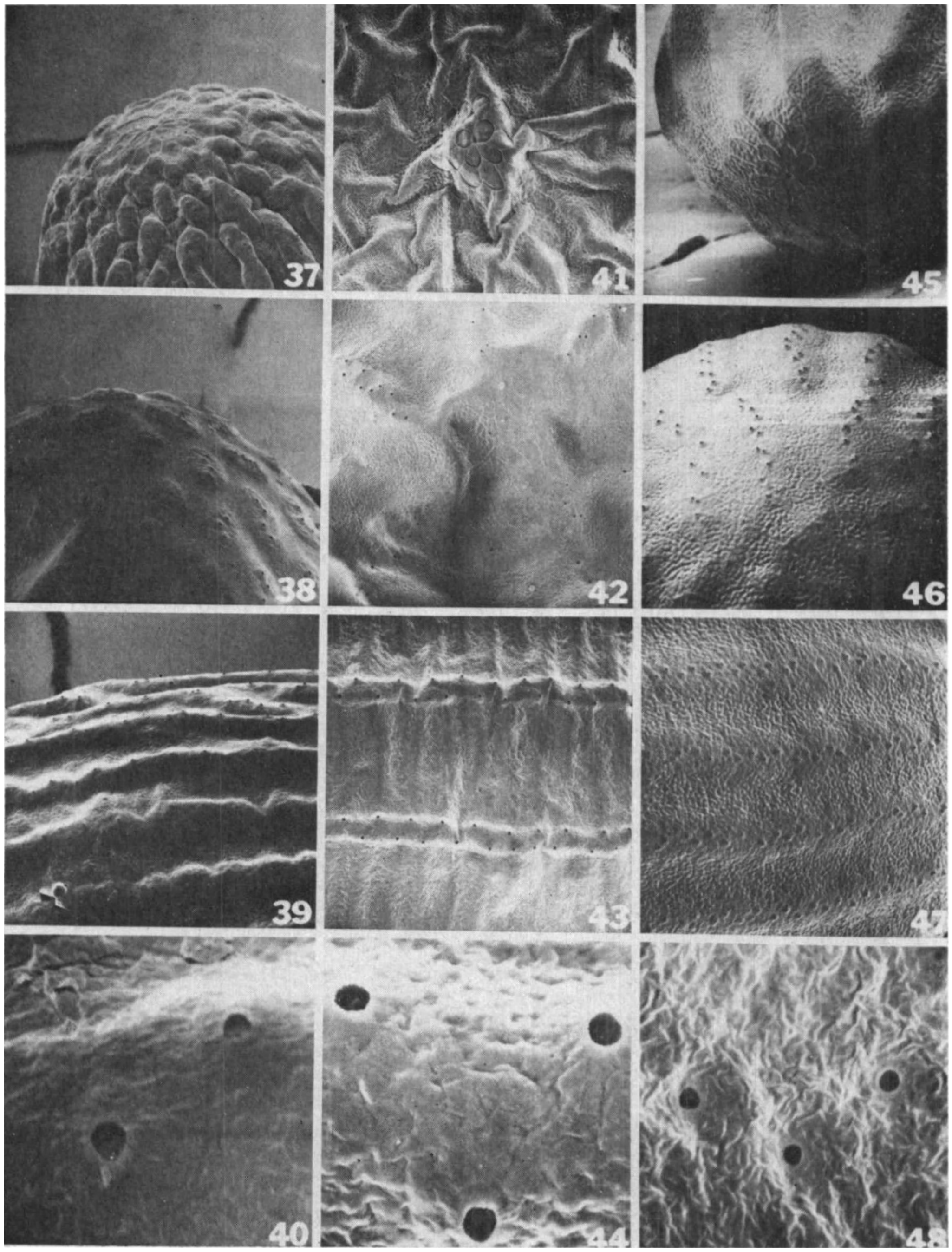
Figures 1–12. Eggs of Crambinae. 1–4, *C. topiaria*. 1, Micropylar end; 2, nonmicropylar end; 3, side view; 4, side view indicating aeropyle, a diameter measurement. 5–8, *T. edonis*. 5, Micropylar end indicating depth of turrows, f, as measured between longitudinal carinae, lc; 6, nonmicropylar end; 7, side view indicating measurement of distance between longitudinal carinae, lc; 8, aeropyles. 9–12, *P. trisecta*. 9, End view showing cells, c, encircling the immediate micropylar region; 10, nonmicropylar end; 11, side view indicating measurement of distance between cross striae, cs; 12, aeropyles, a. Figs. 4, 8, and 12 are 3400×; all others 340×.



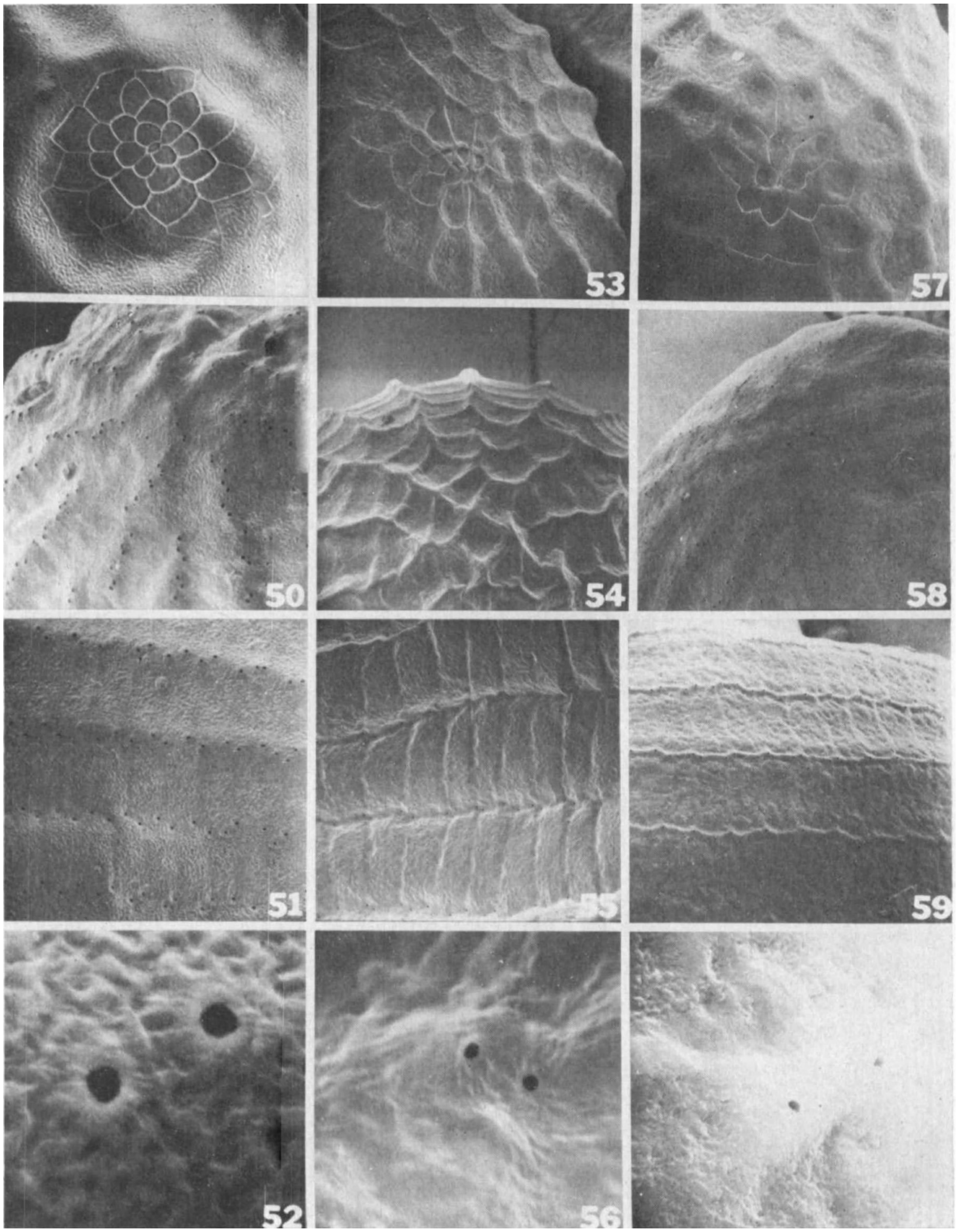
Figures 13–24. Eggs of Crambinae. 13–16, *P. mutabilis.* 13, Micropylar end; 14, nonmicropylar end; 15, side view; 16, aeropyles. 17–20, *C. alboclavellus*. 17, Micropylar end; 18, nonmicropylar end; 19, side view; 20, aeropyles. 21–24, *P. caliginosella*. 21, Micropylar end; 22, nonmicropylar end; 23, side view; 24, aeropyles. Figs. 16, 20, and 24 are 3400×; all others 340×.



Figures 25–36. Eggs of Crambinae. 25–28, *P. luteolella*. 25, Micropylar end; 26, nonmicropylar end; *27,* side view; 28, aeropyles. 29–32, *M. elegans*. 29, Micropylar end; 30, nonmicropylar end; 31, side view; 32, aeropyles. 33–36, *C. laqueatellus*. 33, Micropylar end; 34, nonmicropylar end; 35, side view; 36, aeropyles. Figs. 28, 32, and 36 are 3400×; all others 340×.



Figures 37–48. Eggs of Crambinae. 37–40, *C. praefectellus*. 37, Micropylar end; 38, nonmicropylar end; 39, side view; 40, aeropyies. 41–44, *C. decorellus.* 41, Micropylar end, 42, nonmicropylar end; 43, side view; 44, aeropyles. 45–48, *C. p. floridus*. 45, Micropylar end; 46, nonmicropylar end; 47, side view; 48, aeropyles. Figs. 40, 44, and 48 are 3400×; all others 340×.



Figures 49–60. Eggs of Crambinae. 49–52, *C. teterrellus*. 49, Micropylar end; 50, nonmicropylar end; 51, side view; 52, aeropyles. 53–56, *A. vulgivagella*. 53, Micropylar end; 54, nonmicropylar end; 55, side view; 56, aeropyles. 57–60, *A. ruricolella*. 57, Micropylar end; 58, nonmicropylar end; 59, side view; 60, aeropyles. Figs. 52, 56, and 60 are 3400×; all others 340×.

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Notes

1. Lepidoptera: Pyralidae: Crambinae
2. Part of a thesis presented by the 1st author in partial fulfillment of the requirements of the Ph.D. degree, University of Tennessee at Knoxville. Received for publication May 3, 1971.
3. Biology Department, Motlow State Community College, Tullahoma, Tennessee, USA, 37388
4. Assistant Professor

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