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THE CHORIONIC SCULPTURE OF THE EGGS OF SOME NOCTUINAE (LEPIDOPTERA, NOCTUIDAE) FROM UKRAINE

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The Chorionic Sculpture of the Eggs of Some Noctuidae (Lepidoptera, Noctuidae) from Ukraine. Dolinskaya I. V., Geryak Yu. A. — Descriptions and scanning electron microphotographs of the eggs of 10 species from 7 genera of the subfamily Noctuidae occurring in Ukraine are provided. The diagnostic characters of the genera and species are selected.

Key words: Lepidoptera, Noctuidae, Noctuidae egg, description, diagnostic characters, scanning electron microscopy.

Скульптура хориона яиц некоторых совок подсемейства Noctuidae (Lepidoptera, Noctuidae) фауны Украины. Долинская И. В., Геряк Ю. Н. — С помощью сканирующего электронного микроскопа изучены и проиллюстрированы яйца 10 видов из 7 родов подсемейства Noctuidae, встречающихся в Украине. Выделены диагностические признаки для родов и видов.

Ключевые слова: Lepidoptera, Noctuidae, Noctuidae, яйцо, описание, диагностические признаки, сканирующий электронный микроскоп.

Introduction

Noctuid moths are the largest family of Lepidoptera, with 648 species occurring in Ukraine. The subfamily Noctuidae includes 110 species of 35 genera (Klyuchko et al., 2001). The adult stage is well-studied, so the modern systematics of the family is based mainly on this stage. Immature stages and the eggs particularly have got less attention. Nevertheless, morphological structures of the chorion can be successfully used for taxonomic purposes. So far, the egg chorion in family Noctuidae was insufficiently examined. Detailed line drawings illustrating the eggs of 51 European species of the subfamily Noctuidae were published by E. H. Döring (1955). A more thorough examination of the chorionic structure can be achieved with the use of SEM. E. Salkeld (1975, 1976, 1977, 1984) in her monumental series of Canadian Noctuids illustrated the eggs of 29 species of the subfamily Noctuidae. H. E. Hinton (1981) illustrated the eggs of 3 European Noctuidae species. The eggs of 3 Chilean species of Noctuidae were described and illustrated by Angulo, Olivares (1991).

Material and Methods

This work is based on the original material collected by the authors in Ukraine. The eggs were obtained from females captured in the field. The eggs were examined with the use of scanning electron microscopy (SEM). Both dry egg chorions that were collected after hatching and fresh specimens fixed with alcohol. Eggs of some species (*Noctua pronuba* Linnaeus, *Noctua fimbriata* Schreber and *Noctua interposita* Hübner) withdrawn from abdomen of dry females were examined.

The Noctuidae species were identified by Dr. A. Matov (Zoological Institute, St. Petersburg, Russia) and Dr. Yu. Budashkin (Karadag Nature Reserve, Crimea, Ukraine).

The systematic arrangement follows Fibiger, Hacker (2004).

Terminology of the eggs according to E. Salkeld (1984).

Description

Dichagyris vallesiaca crimea Kozhanchikov, 1930

Egg subspherical (fig. 1), diameter 0.8 mm ($n = 4$). Egg pale citron colour. Chorion white, translucent.

Characteristics. Egg marked on two thirds surfaces by arquate cells. Cells mainly tetragonal, wide and shot, with concave floors. Cell walls broad, clearly expressed. Cells arranged by regular radial lines. The quantity of lines increases to egg base. Aeropyles very small, poorly expressed. All cells weakly pebbled (fig. 2). Micropylar area clearly expressed, represented by 1 row of long and narrow polygonal cells. Rosette elevated, with 17–20 petalled cells (fig. 3). Chorion weakly pebbled everywhere, pebbles more distinct in area of cell walls.

Oviposition. Eggs laid in single-layered, clusters on 4–7 eggs.

Euxoa nigricans (Linnaeus, 1761)

Egg subspherical (fig. 4). height 0.5 mm, diameter 0.7–0.75 mm ($n = 5$). Egg pale yellow. Chorion. white, translucent.

Characteristics. Egg marked on anterior quarter of egg by concave cells and smoothed on the remaining surface, looks like a hardly noticeable cells (fig. 5). Cell walls thin, slightly expressed. Aeropyles small, slightly expressed at walls junctions (fig. 6). Cells arranged by regular radial lines. The quantity of lines increases to egg base. Micropylar area clearly expressed, represented by 1–2 rows of long and narrow polygonal cells. Rosette with 12–16 petalled cells (fig. 7). Central portion of rosette like small depression. Chorion wrinkled everywhere.

Oviposition. Eggs laid as one-layered line bands, where they tightly pressed one to other.

Agrotis exclamationis (Linnaeus, 1758)

Egg subspherical (fig. 8), height 0.5 mm, diameter 0.85 mm ($n = 3$). Egg pale yellow. As egg develops, it becomes with brownish tinge. Then at micropylar area of egg appears vinous spot and the same stripe on perimeter apical part of egg. Before caterpillar emergence egg becoming taupe. Chorion white, translucent.

Characteristics. Chorion faintly ridged. Egg marked on two thirds surfaces. 14–15 of the 43–46 shallow elevated and difficult-to-count longitudinal, broad ridges radiate from pointed outer ends of micropylar cells. Walls concave, columnar cells narrow. Aeropyles clearly expressed at walls junctions (fig. 9). Micropylar area represented by 1 row of indistinct, long, narrow and pointed cells. Rosette slightly elevated, with 12–15 petalled cells (fig. 10). Central portion of rosette like a small round depression with 5–6 micropylar openings. Chorion (except for cells micropylar area) sharply wrinkled.

Oviposition. Eggs laid as one-layered line bands, where they tightly pressed one to other.

Axylia putris (Linnaeus, 1761)

Egg subspherical (fig. 11), height 0.45 mm, diameter 0.6–0.65 mm ($n = 6$). Egg pale yellow. As egg develops, it becomes pale pink and then cream coloured with brown stripe on perimeter subapical part of egg and the same spot in micropylar area. Before caterpillar emergence egg becoming taupe with black spot at apical part of egg. Chorion white, translucent.

Characteristics. Chorion ridged. Egg marked on two thirds surfaces. 10–11 of the 33–38 moderately broad, elevated, longitudinal ridges radiate from micropylar area.

Walls of concave, columnar cells moderately broad. Aeropyles clearly expressed at walls junctions. (fig. 12). Micropylar area clearly expressed, represented by 1 row of polygonal cells. Rosette with 9–10 petalled cells (fig. 13). Central portion of rosette like a small round depression with 5 micropylar openings. Chorion weakly wrinkled everywhere.

Oviposition. Eggs laid in single-layer tight clusters where they pressed one to another.

Ochroleura plecta (Linnaeus, 1761)

Egg subspherical (fig. 14), height 0.5 mm, diameter 0.75–0.8 mm ($n = 6$). Egg pale citron colour. As egg develops at micropylar area of egg appears pink spot and the same interrupted stripe on perimeter apical part of egg. Before caterpillar emergence egg becoming pale brown. Chorion white, translucent.

Characteristics. Chorion ridged Egg marked on two thirds surfaces. 27 broad, elevated, longitudinal ridges radiate from micropylar area. Along all surface of ridges densely placed aeropyles. Aeropyles sharply expressed, large, bordered by roller-like edges (fig. 15). Walls of concave, columnar cells narrow. Micropylar area represented by 1 row of polygonal cells. Rosette slightly elevated, with 14–15 petalled cells (fig. 16). Central portion of rosette like a small round or oval depression with 5–6 micropylar openings. Chorion weakly wrinkled everywhere.

Oviposition. 50 eggs were laid solitary.

Noctua pronuba (Linnaeus, 1758)

Egg subspherical, height 0.45 mm, diameter 0.5 mm ($n = 2$). Chorion white, translucent.

Characteristics. Chorion ridged. Egg unmarked below equator and weakly marked in micropylar area (fig. 17, 18). 39–43 moderately broad, elevated, longitudinal ridges radiate from micropylar area. Transverse walls filiform, much less distinct than ridges (fig. 19, 20). Columnar cells concave. Aeropyles bordered by roller-like edges, clearly expressed at walls junctions. Micropylar area represented by 2 rows of indistinct, long, narrow and pointed cells. Rosette slightly elevated, with 11–13 petalled cells (fig. 21). Central portion of rosette with 4 micropylar openings. All cells (except for cells rosette) clearly wrinkled.

Noctua fimbriata (Schreber, 1759)

Egg subspherical, height 0.4–0.5 mm, diameter 0.7–0.75 mm ($n = 2$). Chorion white, translucent.

Characteristics. Chorion ridged. Egg marked on two thirds surfaces. 11 of the 35 moderately broad, elevated, longitudinal ridges radiate from micropylar area. Walls of columnar cells narrower than ridges. Aeropyles weakly expressed at walls junctions (fig. 22). Micropylar area represented by 1 row of indistinct, long, narrow and pointed cells. Rosette slightly elevated, with 11–13 petalled cells (fig. 23). Chorion weakly wrinkled everywhere.

Noctua interposita (Hübner, 1790)

Egg subspherical (fig. 24), height 0.4–0.5 mm, diameter 0.6–0.7 mm ($n = 1$).

Characteristics. Chorion ridged. Egg marked on two thirds surfaces. Broad, sharply elevated, longitudinal ridges radiate from micropylar area. Transverse walls less distinct than ridges. Aeropyles weakly expressed at walls junctions (fig. 25). Micropylar

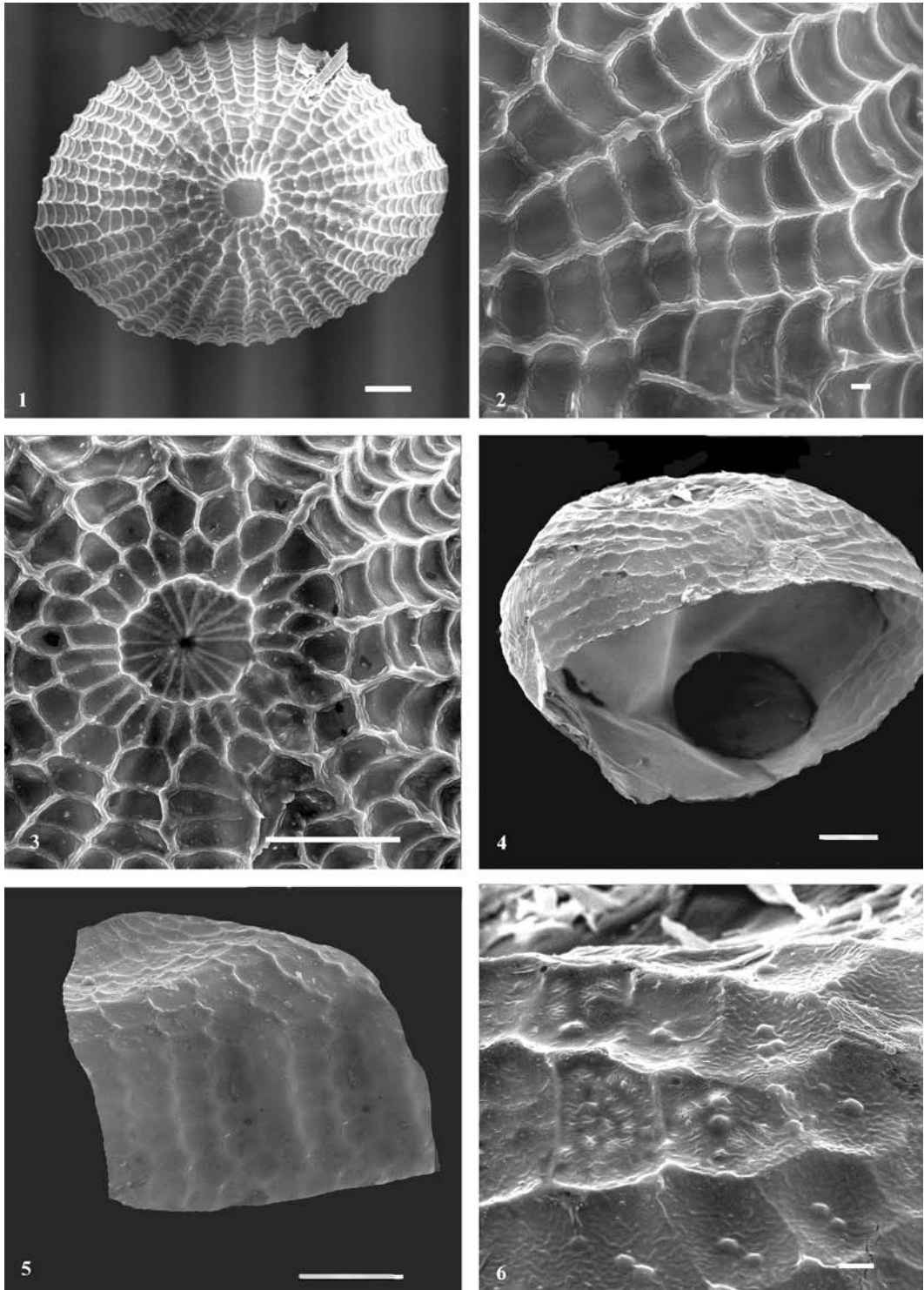


Fig. 1–6. Eggs of Noctuidae: 1 — *Dichagyris vallesiaca crimea*; 2 — *Dichagyris vallesiaca crimea*; 3 — *Dichagyris vallesiaca crimea*; 4 — *Euxoa nigricans*; 5 — *Euxoa nigricans*; 6 — *Euxoa nigricans*. Scales bars: 1, 3–5 — 100 μ ; 2, 6, — 10 μ .

Рис. 1–6. Яйца Noctuidae: 1 — *Dichagyris vallesiaca crimea*; 2 — *Dichagyris vallesiaca crimea*; 3 — *Dichagyris vallesiaca crimea*; 4 — *Euxoa nigricans*; 5 — *Euxoa nigricans*; 6 — *Euxoa nigricans*. Масштабные линейки: 1, 3–5 — 100 мкм; 2, 6 — 10 мкм.

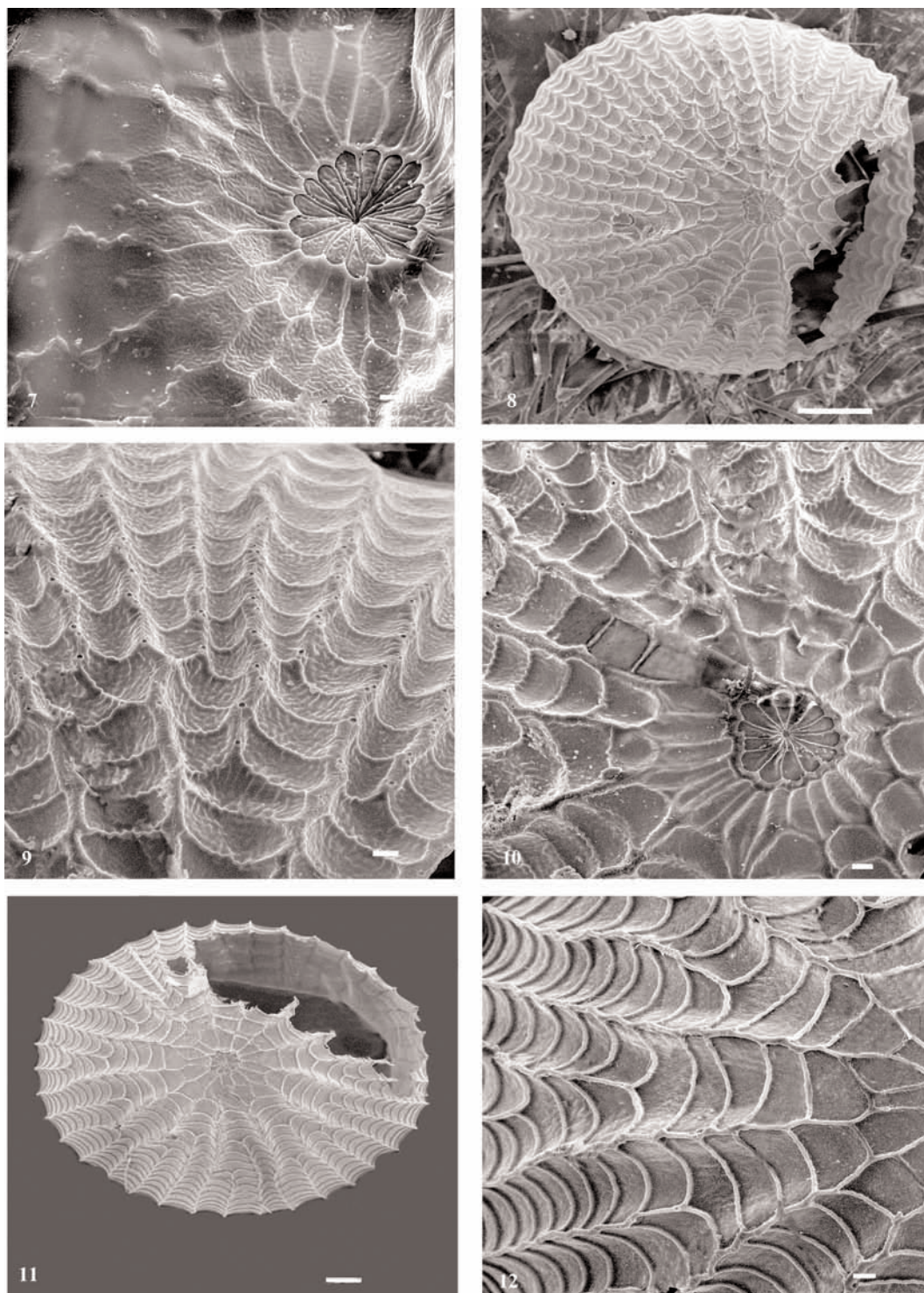


Fig. 7–12. Eggs of Noctuidae: 7 — *Euxoa nigricans*; 8 — *Agrotis exclamationis*; 9 — *Agrotis exclamationis*; 10 — *Agrotis exclamationis*; 11 — *Axylia putris*; 12 — *Axylia putris*. Scale bars: 7, 9, 10, 12 — 10 μ ; 8, 11 — 100 μ .

Рис. 7–12. Яйца Noctuidae: 7 — *Euxoa nigricans*; 8 — *Agrotis exclamationis*; 9 — *Agrotis exclamationis*; 10 — *Agrotis exclamationis*; 11 — *Axylia putris*; 12 — *Axylia putris*. Масштабные линейки: 7, 9, 10, 12 — 10 мкм; 8, 11 — 100 мкм.

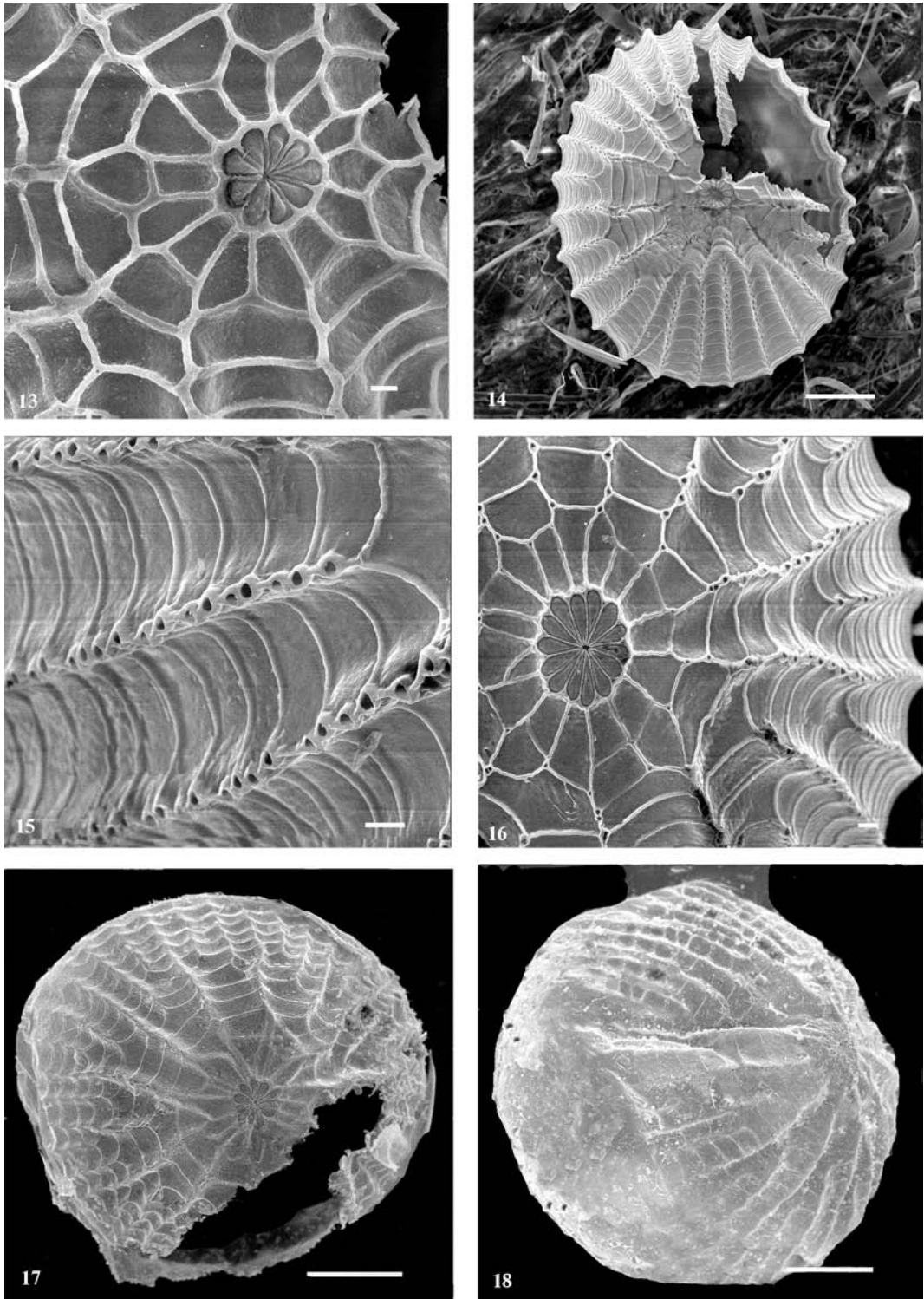


Fig. 13–18. Eggs of Noctuidae: 13 — *Axyليا putris*; 14 — *Ochropleura plecta*; 15 — *Ochropleura plecta*; 16 — *Ochropleura plecta*; 17 — *Noctua pronuba*; 18 — *Noctua pronuba*. Scale bars: 13, 15, 16 — 10 μ ; 14, 18 — 100 μ .

Рис. 13–18. Яйца Noctuidae: 13 — *Axyليا putris*; 14 — *Ochropleura plecta*; 15 — *Ochropleura plecta*; 16 — *Ochropleura plecta*; 17 — *Noctua pronuba*; 18 — *Noctua pronuba*. Масштабные линейки: 13, 15, 16 — 10 мкм; 14, 18 — 100 мкм.

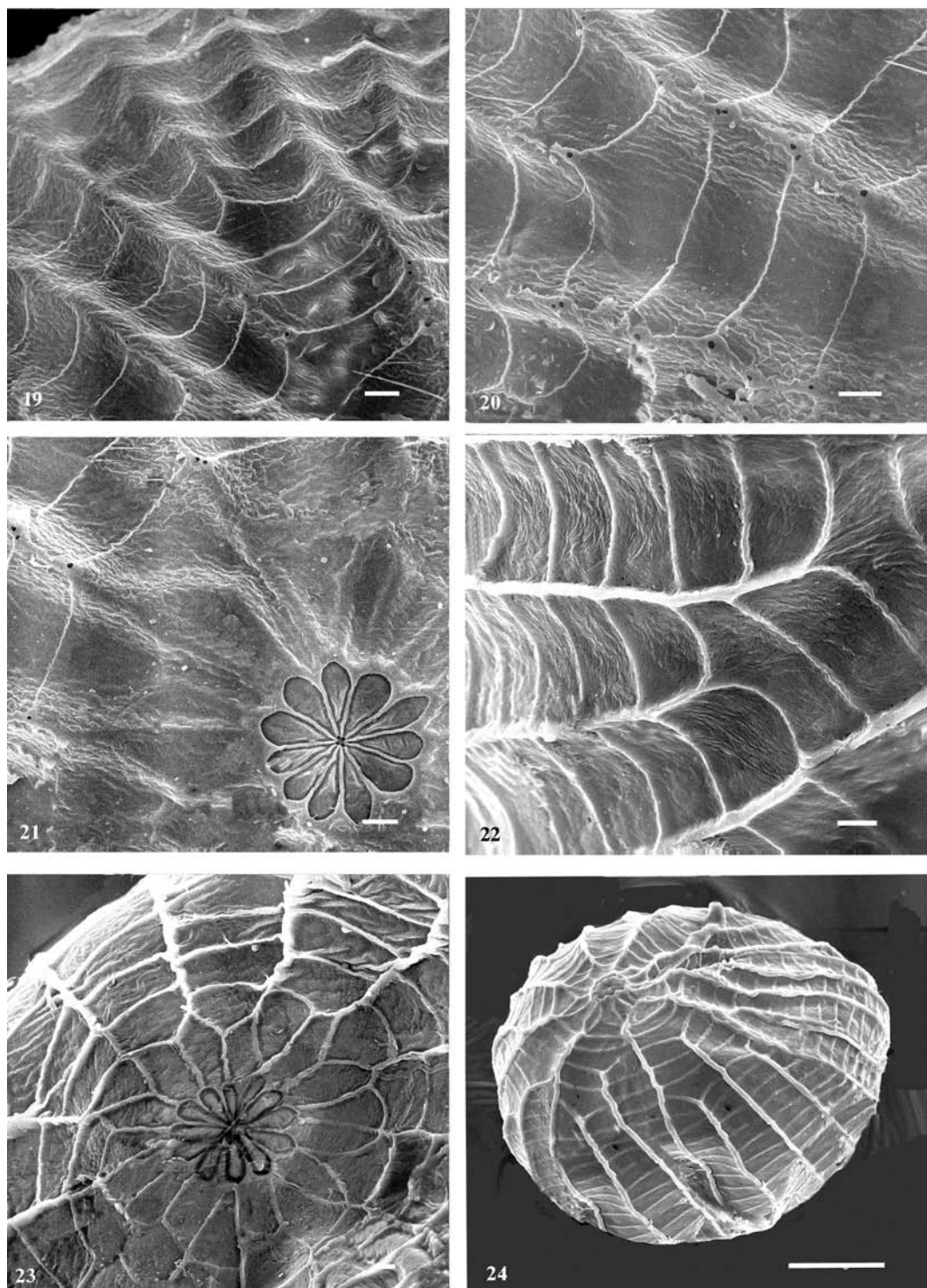


Fig. 19–24. Eggs of Noctuidae: 19 — *Noctua pronuba*; 20 — *Noctua pronuba*; 21 — *Noctua pronuba*; 22 — *Noctua fimbriata*; 23 — *Noctua fimbriata*; 24 — *Noctua interposita*. Scale bars: 19–23 — 10 μ ; 24 — 100 μ .

Рис. 19–24. Eggs of Noctuidae: 19 — *Noctua pronuba*; 20 — *Noctua pronuba*; 21 — *Noctua pronuba*; 22 — *Noctua fimbriata*; 23 — *Noctua fimbriata*; 24 — *Noctua interposita*. Масштабные линейки: 19–23 — 10 мкм; 24 — 100 мкм.

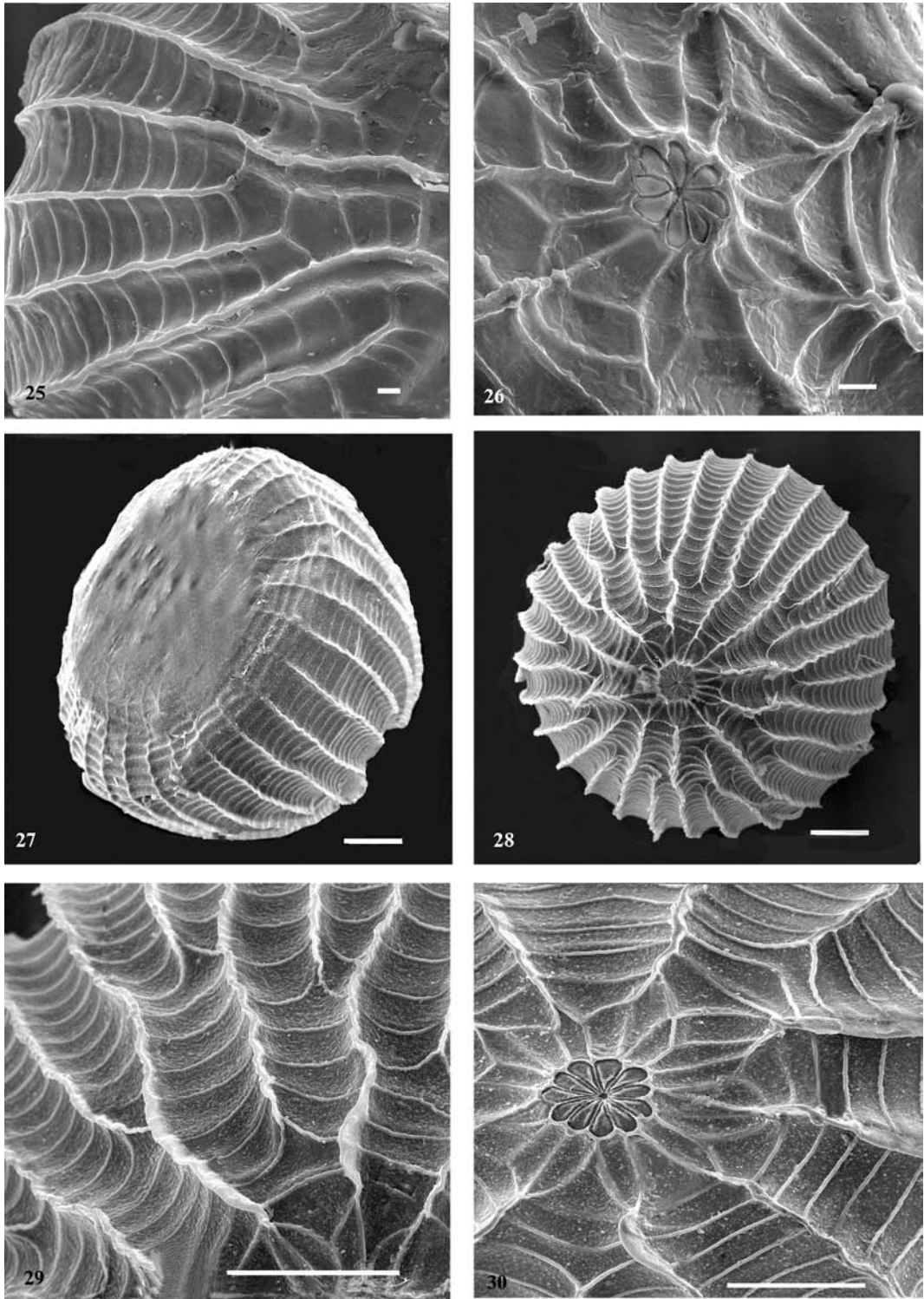


Fig. 25–30. Eggs of Noctuidae: 25 — *Noctua interposita*; 26 — *Noctua interposita*; 27 — *Xestia stigmatica*; 28 — *Xestia stigmatica*; 29 — *Xestia stigmatica*; 30 — *Xestia stigmatica*. Scale bars: 25, 26 — 10 μ ; 27–30 — 100 μ .

Рис. 25–30. Яйца of Noctuidae: 25 — *Noctua interposita*; 26 — *Noctua interposita*; 27 — *Xestia stigmatica*; 28 — *Xestia stigmatica*; 29 — *Xestia stigmatica*; 30 — *Xestia stigmatica*. Масштабные линейки: 25, 26 — 10 мкм; 27–30 — 100 мкм.

area represented by 1 row of indistinct, long, narrow and pointed cells. Rosette slightly elevated, with 7–9 petalled cells (fig. 26). Chorion weakly wrinkled everywhere.

Xestia stigmatica (Hübner, 1813)

Egg subspherical (fig. 27, 28), height 0.6–0.7 mm, diameter 0.9–1.0 mm ($n = 6$). Egg pale pink. As the egg develops, it becomes pinkish-grey. Before caterpillar emergence egg is becoming taupe. Chorion white, translucent.

Characteristics. Chorion ridged. Egg marked on two thirds surfaces. 11–12 of the 29–33 sharply expressed, elevated, longitudinal ridges radiate from pointed outer ends of micropylar cells. Longest ridges with high comb especially in anterior portions (fig. 29). Transverse walls less distinct and narrow than ridges. Aeropyles weakly expressed at walls junctions. Micropylar area represented by 1 row of indistinct, long, narrow and pointed cells. Rosette slightly elevated, with 11–16 petalled cells (fig. 30).

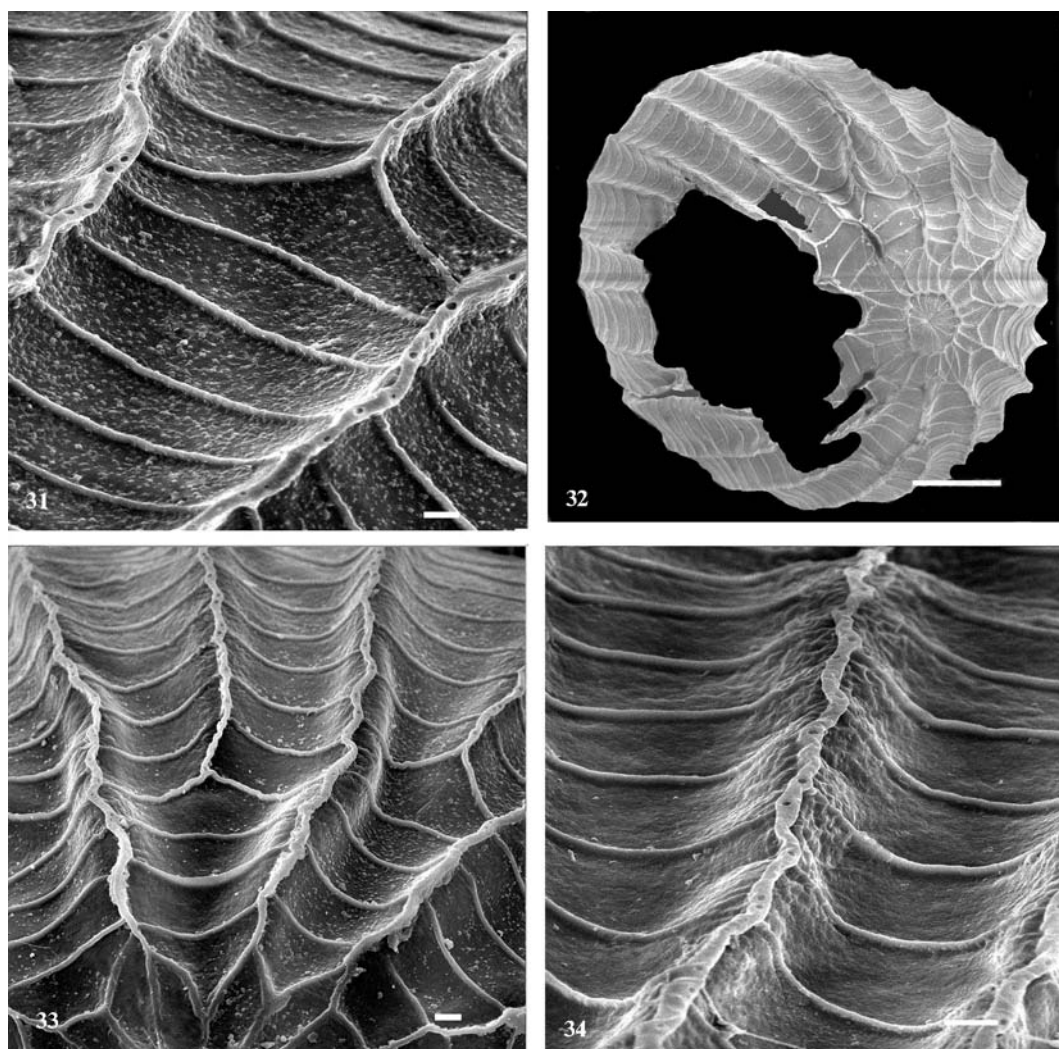


Fig. 31–34. Eggs of Noctuidae: 31 — *Xestia stigmatica*; 32 — *Xestia c-nigrum*; 33 — *Xestia c-nigrum*; 34 — *Xestia c-nigrum*. Scale bars: 31, 33, 34 — 10 μ ; 32 — 100 μ .

Рис. 31–34. Яйца of Noctuidae: 31 — *Xestia stigmatica*; 32 — *Xestia c-nigrum*; 33 — *Xestia c-nigrum*; 34 — *Xestia c-nigrum*. Масштабные линейки: 31, 33, 34 — 10 μ км; 32 — 100 μ км.

Central portion of rosette like a small round depression with 5–6 micropylar openings. Chorion pebbled everywhere (fig. 31).

Oviposition. Eggs laid in single-layer tight clusters where they pressed one to another. Eggs can be laid solitary.

Xestia c-nigrum (Linnaeus, 1758)

Egg subspherical (fig. 32), height 0.5 mm, diameter 0.65–0.7 mm (n = 6). Egg yellowish-white. As egg develops, it becomes white-yellow with pale vinous spot at apical part of egg and the same band on perimeter of its medial part. Before caterpillar emergence egg becoming grey with vinous-grey spot at its apical part. Chorion white, translucent.

Characteristics. Chorion ridged. Egg marked on two thirds surfaces. 11–13 of the 24–26 sharply expressed, elevated, longitudinal ridges radiate from pointed outer ends of micropylar cells. Longest ridges with high comb especially in anterior portions. Transverse walls less distinct and narrow than ridges. Aeropyles weakly expressed at walls junctions (fig. 33). Micropylar area represented by 1 row of indistinct, long, narrow and pointed cells. Rosette slightly elevated, with 15–18 petalled cells. Central portion of rosette like a small round depression with 6–7 micropylar openings. Chorion weakly pebbled everywhere, pebbles more distinct in area ridges (fig. 34).

Oviposition. Eggs laid in single-layer tight clusters where they pressed one to another.

Remark. *Xestia c-nigrum* has longitudinal ridges less high than *X. stigmatica*.

Discussion

Based on the data above, the two types of sculpture, cellular and ridged, are typical for studied species of the subfamily Noctuidae (Table 1 summarizes the distribution of the character states found in my studies of the egg chorionic sculpture of the species of Noctuidae occurring in Ukraine).

The cellular sculpture is represented by the polygonal cells. The cells are arranged in regular lines (Noctuidae), radiating from the micropylar area. The quantity of lines increases to the egg base.

Table 1. Comparative characters of the studied species of Noctuidae

Таблица 1. Сравнительный анализ признаков исследованных видов Noctuidae

Characters	Species									
	1	2	3	4	5	6	7	8	9	10
Egg marked on: A — two thirds surfaces; B — anterior quarter; C — unmarked below equator	A	B	A	A	A	C	A	A	A	A
Chorion A — pebbled; B — wrinkled	A	B	B	B	B	B	B	B	A	A
Exochorion sculpture A — cellular; B-ribbed	A	A	B	B	B	B	B	B	B	B
Cellular sculpture A — cell walls thin, slightly expressed; B — cell walls broad, clearly expressed	B	A	—	—	—	—	—	—	—	—
Longitudinal ridges A — sharply elevated; B — moderately elevated	—	—	B	A	A	B	B	A	A	A
Longitudinal ridges A — more wide transversal; B — of the same width or somewhat more wide transversal	—	—	A	B	A	A	B	A	B	B
Aeropyles A — slightly expressed; B — clearly expressed; C — sharply expressed	A	A	B	B	C	B	A	A	A	A
Oviposition, eggs are laid A — clusters; B — line bands; C — solitary	A	B	B	A	C	—	—	—	A, C	A

Note. 1 — *Dichagyris vallesiaca*; 2 — *Euxoa nigricans*; 3 — *Agrotis exclamationis*; 4 — *Axylia putris*; 5 — *Ochropleura plecta*; 6 — *Noctua pronuba*; 7 — *N. fimbriata*; 8 — *N. interposita*; 9 — *Xestia stigmatica*; 10 — *X. c-nigrum*.

This sculpture is typical for two studied species, *Dichagyris vallesiaca crimea* and *Euxoa nigricans*.

Dichagyris vallesiaca crimea. Cell walls broad, clearly expressed. Rosette elevated.

Euxoa nigricans. Cell walls thin, slightly expressed. Egg marked on anterior quarter egg surface.

The ridged sculpture is represented by longitudinal, elevated ridges. These ridges radiate from pointed outer ends of the micropylar cells. The quantity of ridges increases to the egg base. Transverse walls are expressed less clearly.

Sculpture is typical for five studied species, *Agrotis exclamationis*, *Ochropleura plecta*, *Axylia putris*, *Noctua pronuba*, *N. fimbriata*, *N. interposita*, *Xestia stigmatica* and *X. c-nigrum*. Some species have typical diagnostic characters.

Agrotis exclamationis. Longitudinal ridges wider than transverse, slightly elevated. Chorion sharply wrinkled.

Ochropleura plecta. Aeropyles sharply expressed, large, densely located along longitudinal ridges.

Xestia. Longitudinal ridges with high comb especially in anterior portions.

Xestia stigmatica. 29–33 longitudinal ridges. Combs sharply expressed.

Xestia c-nigrum. 24–26 longitudinal ridges. Combs moderately expressed.

Noctua. It is not revealed by us any typical diagnostic characters for genus. However some species have typical diagnostic characters.

Noctua pronuba. Transverse walls typical: very narrow, filiform. Egg unmarked below equator and weakly marked in micropylar area.

Noctua interposita. Longitudinal ridges sharply elevated.

Noctua fimbriata and *Axylia putris* have similar morphological characters. However, *Axylia putris* differs by more elevated longitudinal ridges.

It should be noted that the cellular radial sculpture in the Noctuidae differs from that in the families Notodontidae, Lymantriidae and Arctiidae by the egg surface cells located not like radial lines but chaotically (Dolinskaya, 1990; Dolinskaya, Pljushch, 1999; Pljushch, Dolinskaya, 2000).

Ridged sculpture among families of Noctuoidea occurs somewhat less frequently than the cellular one. Besides the noctuid-moths it is typical only for Erebidae (Döring, 1955; Salkeld, 1984).

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