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# EXTERNAL MORPHOLOGY OF THE EGGS OF SOME LAPPET MOTHS (LEPIDOPTERA, LASIOCAMPIDAE)

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**External Morphology of the Eggs of Some Lappet Moths (Lepidoptera, Lasiocampidae). Dolinskaya I. V. , Pljushch I. G. —** Eggs of 9 species belonging to 5 genera of Lasiocampidae were examined with the use of scanning electron microscopy. Descriptions and comparative morphological analysis are provided for all these species. As a result, all the examined species are divided into 2 groups and 2 subgroups; the diagnostic characters for genera and species are chosen.

Key words*:* Lepidoptera, Lasiocampidae, eggs, morphology, exochorion sculpture, descriptions, diagnostic charcters.

**Наружная морфология яиц некоторых коконопрядов (Lepidoptera, Lasiocampidae). Долинская И. В., Плющ И. Г. —** С помощью электронного сканирующего микроскопа изучены яйца 9 видов Lasiocampidae, относящиеся к 5 родам. Выделены диагностические признаки для родов и видов. Проведена оценка значимости признаков. На основании сравнительно-морфологического анализа все исследуемые виды разделены на 2 группы и 2 подгруппы.

Ключевые слова: Lepidoptera, Lasiocampidae, яйца, морфология, скульптура экзохориона, описания, диагностические признаки.

### Introduction

There is a number of recently published papers concerning the use of SEM (scanning electron microscopy) for the investigation of the surface eggshell structure in Lepidoptera. Hinton (1981) published a voluminous review of various chorion structures of insect eggs, including Lepidoptera. Many works are devoted to the egg morphology of Heterocera, mostly of Noctuidae and Geometridae (Salkeld, 1975; 1976; 1977; 1983; 1984; Hill, 1982; Fehrenbach & al., 1987; Suludere, 1988 a). These and other studies (Peigler and Stephens, 1986; Liu-Yubin, 1992; Dantchenko & al., 1995) show the that the morphological structures of the chorion can be successfully used for taxonomic purposes. However, knowledge of the egg chorion in Lasiocampidae is still poor and fragmentary (Dierl, 1982; Kobes, 1982; Gomez de Aizpurua & Soria Carreras, 1987; Marini, Trentini, 1988).

### Material and methods

The examined material was collected by the authors mostly in Primorski Krai (Far East, Russia) except for *Dendrolimus pini* L. and *Gastropacha populifolia populifolia* Esp. specimens from southern Ukraine, and *G. quercifolia quercifolia* Feld. from northern Kyrghyzstan. The eggs were taken from captured females and examined with the use of the SEM. Both dry egg chorions left by emerged caterpillars and eggs were fixed with glutaraldehyde-osmium tetroxyde or with alcohol. Fixed eggs were dehydrated in ascending acetone concentrations, critical-point dried.

The nomenclature used in the descriptions of the eggs surface structures follows During (1955). The taxonomical arrangement of the Lasiocampidae follows that one proposed by Dubatolov & Zolotuhin (1992) and by Zolotuhin (1992).

## Description

### *Euthrix* Meigen, 1830

Egg oval or spherical oval (fig. 1, 2). Height 1.3–1.65 mm, lenght 1.55–2.3 mm, width 1.3–1.8 mm. Egg not unicolour, but with a pattern of concentric bands at sides (the area fixed to the substrate an the one opposite to it), and with a spot in the center. The egg colouration is a combination of chorion colouration and the egg contents. It varies from pale to bright within the genus. Chorion either white, containing translucent and opaque areas, or bright, opaque and patterned. Exochorion sculpture is not uniform. It is represented either

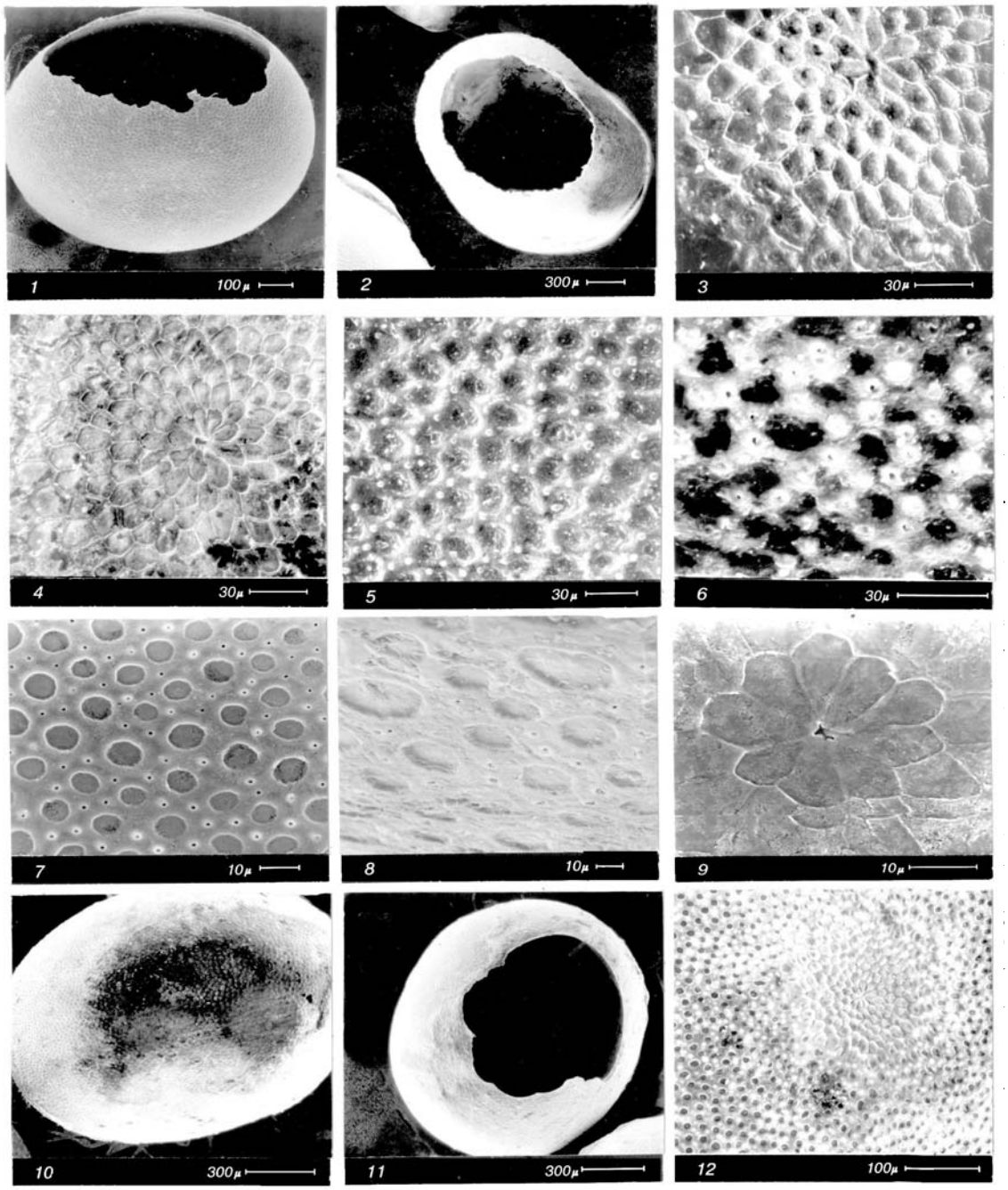


Fig. 1—12. 1. *E. albomaculata* ×92; 2. *E. potatoria* ×49; 3. *E. potatoria* ×1.; 4. *E. albomaculata* ×990; 5. *E. potatoria* ×690; 6. *E. potatoria* ×1200; 7. *E. albomaculata* ×1080; 8. *E. laeta* ×765; 9. *E. laeta* ×1830; 10. *G. quercifolia* ×94; 11. *G. quercifolia* ×80; 12. *G. quercifolia* ×90.

Egg spherical oval. Height 1. 4 mm, length 1.7—1.8 mm, width 1.5—1.6 mm (n=8). Colour brownish-white with bluish-grey concentric bands on sides and spot in center. As egg develops, it becomes brownish pink, and then brownish-orange, and concentric stripes and spot become pale brown slightly visible. These bluish-grey concentric bands (latter becoming pale brown) and the spot correspond to those hyaline areas of chorion in *E. potatoria* and *E. albomaculata*. Chorion is bright, commonly patterned, sometimes unicolour. Colouration is brownish-white or brownish-orange, unicolour or with light-brown to brown stripes on the sides and the spot of same colouration in the center. Micropylar area clearly differing from remaining egg surface, brown to dark brown. Exochorion sculpture different on micropylar area and on remaining egg surface, the first much smoothed, forming 3—5 rows of slightly expressed polygonal cells. Micropylar rosette (35.0—54.3 μm in diameter), with 9—11 cells joined along 2/3—3/4 of their length, number of micropylar openings varies from 3 to 4 (fig. 9). Remaining egg surface is represented by spherical or oval crater-like pits (ca 15.5—

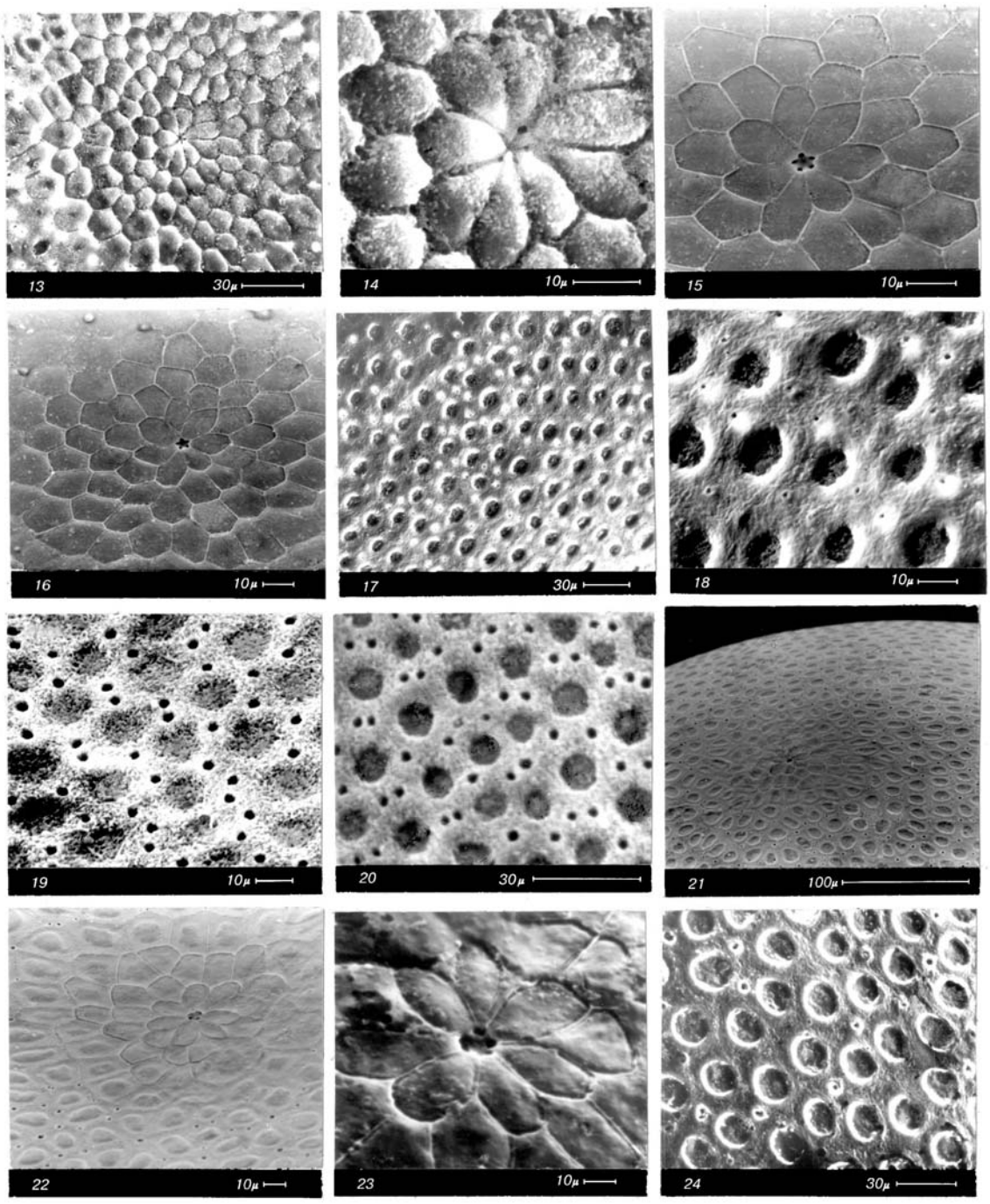


Fig. 13–24. 13. *G. quercifolia* ×800; 14. *G. quercifolia* ×2700; 15. *G. populifolia* ×1410; 16. *G. populifolia* ×880; 17. *G. populifolia* ×560; 18. *G. populifolia* ×1550; 19. *G. quercifolia* ×1480; 20. *G. quercifolia* ×1260; 21. *O. pruni* ×360; 22. *O. pruni* ×660; 23. *O. pruni* ×1500; 24. *O. pruni* ×785.

33.8 μm in diameter) separated by wide pit edges (6.5–28.4 μm in width, commonly reaching 23.2 μm), with round or oval aeropyles (3.3–8.8 μm in diameter) bordered by roller-like edges (fig. 8).

A caterpillar nibbles out an opening at the end opposite to the micropylar area of the egg. Eggs were laid as one-layer tight clusters in a cage.

Comparative remarks. As is evident from the descriptions above, the species of *Euthrix* both share some characters in one or another combination, and possess features

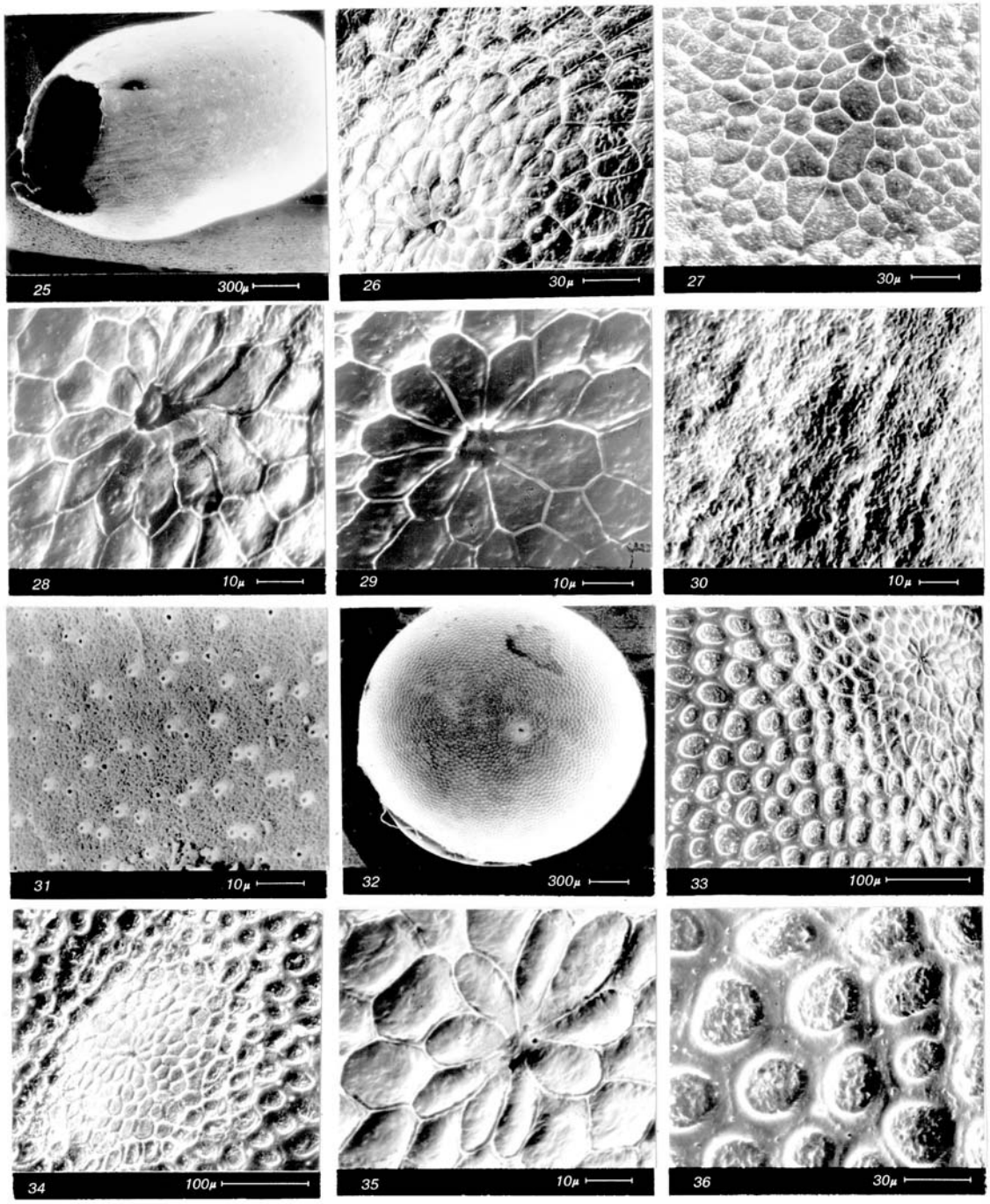


Fig. 25–36. 25. *D. superans* ×60; 26. *D. pini* ×730; 27. *D. superans* ×625; 28. *D. pini* ×1880; 29. *D. superans* ×1930; 30. *D. pini* ×1570; 31. *D. superans* ×1290; 32. *P. plagifera* ×49; 33. *P. plagifera* ×330; 34. *P. plagifera* ×350; 35. *P. plagifera* ×1544; 36. *P. plagifera* ×880.

characterizing *E. potatoria* and *E. laeta; E. albomaculata* egg share its characters either with one or the other species.

1. All the three mentioned species of *Euthrix* share the characteristic uniform pattern of the egg and the chorion, although the egg colouration and degree of chorion pigmentation are different.

2. *E. potatoria* differs from the other two species by the pitted cellular sculpture of the exochorion.

3. Both *E. albomaculata* and *E. laeta* have the pitted sculpture of the exochorion, but with the pits much larger in *E. laeta*.

4. *E. albomaculata* and *E. potatoria*, despite of the difference of exochorion structure, share several characters, such as oval shape and pale colouration of the egg, and the chorion, consisting of opaque white and hyaline white stripes; finally, they share the opening that caterpillars nibbles at the micropylar area, and the eggs being laid singly in a cage.

5. *E. laeta* differs from the other two species by the spherical oval shape and bright colouration of the egg, and a bright opaque chorion. The opening is on the pole opposite to the micropylar area, and eggs laid as one-layer tight clusters in a cage.

6. Further, *E. potatoria* has the largest, and *E. albomaculata* has the smallest eggs.

Based on the foregoing, we propose the character complex from which the species of *Euthrix* could be recognised.

*E. potatoria* — egg pale with pattern. Chorion consists of combined opaque white and hyaline white stripes. Exochorion sculpture is pitted cellular.

*E. albomaculata* — egg pale with pattern. Chorion consists of combined opaque white and hyaline white stripes. Exochorion sculpture is pitted.

*E. laeta* — egg bright with pattern. Chorion opaque, bright colored. Exochorion sculpture is pitted.

As seen from the foregoing, *E. albomaculata* has transitional position between *E. potatoria*, on the one hand, and *E. laeta*, on the other.

***Gastropacha*** Ochsenheimer, 1810

Egg oval or spherical oval (fig. 10), 1.2−1.65 mm high, 1.5−1.95 mm long, and 1.25−1.7 mm wide. The egg colouration combines the colouration of chorion (variously tinged white) and the egg contents, not unicolor, but greenish grey with broad white stripes. There is a pattern of double concentric circles or ovals at the micropylar pole and at the opposite end, and a single circle at sides. There are two wide white stripes running from the circles of micropylar area to the opposite pole. As the egg develops, the greenish grey color turns into deep reddish purple *(G. quercifolia cerridifolia* Feld. & Feld.) or light brown *(G. populifolia* Esp.). Chorion consists of hyaline and opaque stripes. Exochorion sculpture is uniform, it is represented by crater-like pits (where the pit edges are wider than the pit diameter or commensurable) (fig. 17, 18, 20). Micropylar area sculpture differs from the remaining eggs surface (fig. 12) and is clearly expressed; it is represented by 4−5 rows of polygonal cells (fig. 13, 16). Cells of the micropylar rosette wide, 1.2−2.0 times longer than wide, joined along1/2−3/4 of their length. Number of cells in the micropylar rosette reaches 7−8. Central portion of the rosette is depressed only slightly, and there are 5 micropylar openings on it (fig. 14, 15). The remaining part of the egg is represented by spherical or oval crater-like pits separated by wide flattened edges. There are 6−7 more or less expressed spherical or ovals aeropyles of the pit edges area. Aeropyles are bordered by roller-like edges.

Caterpillars nibble out usually a large opening at the micropylar area of the egg (fig. 11), sometimes the opening is made laterally. Eggs were laid solitary in a cage.

***G. quercifolia*** Linnaeus, 1758

Eggs of the two subspecies were examined: *G. quercifolia quercifolia* L. from northern Kyrghyzstan and *G. quercifolia cerridifolia* Feld. & Feld. from Far East Russia (Primorski Krai).

Egg oval or spherical oval, with small excavation at pole opposite to substrate. Egg size in *G. quercifolia cerridifolia:* height 1.2 mm, length 1.5−1. 65 mm, width 1.25−1.3 mm (n=8), in *G. quercifolia quercifolia*: height 1.25−1 3 mm, length 1.75 mm, width 1. 45 mm (n=8). As the egg develops, their greenish grey colour turns into deep reddish purple (*G. quercifolia cerridifolia*).

Chorion hyaline brown, unicolour or with brownish white opaque stripes (*G. quercifolia cerridifolia). G. quercifolia quercifolia* has hyaline white chorion with opaque white stripes. Micropylar rosette reaches 28.0−45.3 μm in diameter. Crater-like pits 8.0−14.6 μm in diameter. Pit edges 7.0−18.0 μm wide. Aeropyles clearly expressed, usually paired (fig. 20),

2.0–4.0 μm in diameter. It is interesting to note that sometimes same egg represents both typically pitted and spherical cellular (where the cell edges width is much narrower than the cell diameter) (fig. 19).

Comparative remarks. Eggs of *G. quercifolia quercifolia* are somewhat larger (see above). The two examined subspecies differ by the chorion colouration (see above). There are no differences found in the sculpture of exochorion.

***G. populifolia*** Esper, 1784

Eggs of the two subspecies were examined, *G. populifolia populifolia* from the Ukraine and *G. populifolia angustipennis* Walker from Far East Russia (Primorski Krai).

Egg oval or spherical oval. Egg size varies: height 1.5–1.65 mm, length 1.85–1.95 mm, width 1.5–1.7 mm (n=8). As the egg develops, their greenish grey colour turns into light brown. Chorion hyaline, grey, with yellowish white opaque stripes *(G. populifolia angustipennis*). Micropylar rosette reaches 40.5–46.7 μm in diameter. Crater-like pits 6.4–19.6 μm in dimeter. Pit edges 6.4–24.0 μm wide. Aeropyles hardly visible, evenly positioned (fig. 17, 18), 1.4–5.2 μm in diameter.

Comparative remarks. Eggs *of G. quercifolia* and *G. populifolia* are quite similar, though there are slight differences between them. *G. populifolia* has eggs somewhat larger, and respectively larger sculpture of the exochorion (sizes of the micropylar rosette, pits, pit edges and aeropyles) (see above). The aeropyles of *G. quercifolia* are much clearly expressed and often are positioned to form pairs. Further, before caterpillars emergence, the eggs of *G. quercifolia* become deep reddish purple, while the eggs of *G. populifolia* become light brown.

***Odonestis pruni rufescens*** Kardakoff, 1928

Egg spherical, 1.6 mm long, 1.4 mm width (n=8). Egg white, with clearly expressed micropylar area; latter is light brown to dark grey or dark brown. Chorion white, opaque. Exochorion sculpture is different in micropylar area and on the remaining egg surface (fig. 21, 22). Sculpture is less expressed on micropylar area; it is represented by 2–3 rows of polygonal cells (fig. 22). Micropylar rosette 37.0–75.4 μm in diameter, with 7–8 cells 1.5–2.0 times longer than wide, joined along 1/3–2/3 of their length. Central portion of the rosette is depressed only slightly, and there 4–6 micropylar openings on it (fig. 23). There is a poorly expressed transitional area between the micropylar area and the remaining egg surface; it consists of 1–2 rows of unclearly visible spherical cells with widened (but less than on the other surface, and bearing no aeropyles) cell edges (5.0–7.2 μm) (fig. 22). The remaining part of the egg is represented by spherical or crater-like pits (fig. 24), 16.2–22.1 μm in diameter. These pits are separated by wide, flat edges 10.4–25.8 μm wide (usually about 16 μm). There are large spherical or oval aeropyles (4.0–11.0 μm, usually 5.0–6.0 μm in diameter) bordered by roller-like edges.

***Dendrolimus*** Germar, 1812

Egg oval (fig. 25), 1.65–1.8 mm high, 2.15–2.35 mm long, and 1.75–2.05 mm wide, light green (as the egg develops becoming greenish grey); their colouration depends on the egg contents. Chorion pale brown, subhyaline. Sculpture of exochorion is clearly expressed in the micropylar area and in the transitional area (if the latter is expressed), and smoothed on the remaining surface. The micropylar area is represented by 3–4 or 7–8 rows of polygonal cells (fig. 26, 27). Cells of the micropylar rosette more or less elongate and widened, 1.5–2.5 times longer than wide. Number of cells in the micropylar rosette varies from 10 to 12. Central portion of the rosette is occupied by rather large (9.0 μm in diameter) deep depression with 10–12 micropylar openings in it (fig. 28, 29). There may be a transitional area expressed between the micropylar area and the remaining egg surface *(D. pini* L. ). The remaining part of the egg is smoothed with more or less expressed aeropyles (fig. 30, 31). Chorion has a shape of small, densely intertwined fibres on the whole egg surface, except for micropylar area of *D. pini*.

Caterpillars nibble out a large spherical or oval opening at the micropylar area of the egg (fig. 25), sometimes the opening is displaced laterally. Eggs were laid singly or as one-layered, one-rowed bands of up to 20 eggs each in a cage.

***D. pini*** Linnaeus, 1758

Egg size: height 1.8 mm, length 2.25–2.35 mm, width 1.95–2.05 mm (n=5). The micropylar and transitional areas are sculptured, the remaining surface is smoothed. The micropylar area is represented by 3–4 rows of polygonal cells with smooth surface (fig. 26). Micropylar rosette 47.5–48.8 μm in diameter, with 12 cells, 2.0–2.5 times longer than wide, joined along 2/3 of their length. Central portion of the rosette is deeply depressed, and there are 10–12 micropylar openings in it (fig. 28). The transitional area is represented by 5–6 rows of clearly expressed polygonal cells with their surface in the form of small, densely intertwined fibres. The remaining egg surface is also in the form of small, densely intertwined fibres, and with only poorly noticeable cells. Aeropyles poorly expressed (fig. 30), 2.0 μm in diameter. Eggs were laid singly in a cage.

***D. superans sibiricus*** Tschetverikov, 1908

Egg size: height 1.65 mm, length 2.15–2.25 mm, width 1.75–1.8 mm (n=8). The micropylar area is sculptured, the remaining surface is smoothed in the form of small, densely intertwined fibres. The micropylar area is represented by 7–8 rows of polygonal cells (fig. 27). Micropylar rosette 47.8–52.7 μm in diameter, with 10 cells, 1.5–2.0 times longer than width, joined along 2/3–3/4 of their length. Central portion of the rosette is deeply depressed, and there are 10 micropylar openings in it (fig. 29). The remaining egg surface has hardly noticeable cells with poorly expressed and narrow cell edges, and very clearly expressed aeropyles at the cell edges junctions (fig. 31). The cells are 11.5–36.6 μm in diameter, the cell edges are 0.6–1.1 μm wide, and the aeropyles 4.0–5. 4 μm in diameter. Eggs were laid as one-layered, one-rowed bands of up to 20 eggs in each or sometimes solitary in a cage.

Comparative remarks. Eggs of *D. pini* and *D. superans* are very similar, although there are some differences. *D. superans* differs by evenly positioned and clearly expressed aeropyles on the most egg surface, whereas in *D. pini* aeropyles are positioned irregularly and poorly expressed. *D. pini* has the cells of the micropylar area with smooth surface, consisting of 3–4 rows, and also the transitional area consisting of 5–6 rows with the cells covered by intertwined fibres, whereas *D. superans* has the cells of micropylar area forming 7–8 rows covered by intertwined fibres, and without transitional area. Furthermore, the eggs of *D. pini* are somewhat larger.

***Paralebeda plagifera*** Walker, 1855

Egg spherical (fig. 32), large 2.3–2.6 mm long, 2.1–2.5 mm width (n=8). Egg white, with dark grey, sharply standing out micropylar area. Egg colouration depends on the chorion colour. Chorion white, opaque. Exochorion sculpture is different in micropylar area and on the remaining egg surface. Sculpture is less expressed on micropylar area; it is represented by 5–7 rows of poorly expressed polygonal cells (fig. 33, 34). Micropylar rosette 44.4–75.7 μm in diameter with 9–12 cells 1.5–3.0 times longer than wide, joined along 1/3–3/4 of their length. Central portion of the rosette is depressed only slightly, and there are 8–11 micropylar openings on it (fig. 35). The remaining part of the egg is pitted cellular (fig. 36). The pitted cells are separated by flat edges, much narrower than the pit (11. 7–36. 0 μm in diameter) and reaching 11.4–17.7 μm wide. These pit edges are smooth with a groove coming along their middle. There are small spherical or oval aeropyles (2.3–5.9 μm in diameter) at the pit edges junctions.

Caterpillars usually nibble out a large spherical or oval opening at the pole opposite to the micropylar area of the egg, sometimes the opening is displaced laterally. Eggs were laid as one-layered, one-rowed bands of 6 to 15 eggs in each in a cage.

Comparative remarks. *P. plagifera* has pitted cellular sculpture of the chorion, similary to *E. potatoria,* although there are some differences. *P. plagifera* differs by flat, smooth pit edges with a groove and small aeropyles, which in 3–5 times smaller than edges width. *E. potatoria* has relief, rough edges, without groove and much larger aeropyles, which in 1.6–2.0 times smaller than pit edges width, sometimes equal to width or even exceed it.

## Discussion

Basing on the foregoing, we reached the following conclusion.

Eggs of all the studied lappet moths are bilaterally symmetrical (of the "laying" type), with the micropylar area located at the side attached to the substrate. Their shape may be oval (*Dendrolimus),* oval or spherical oval *(Gastropacha, Euthrix*) and spherical (*P. plagifera, O. pruni*). The size ratio of the eggs varies from 1.2 mm high, 1.5–1.65 mm long, 1.25–1.3 mm width (*G. quercifolia cerridifolia*) to 2.3–2.6 mm long, 2.1–2.5 mm width (*P. plagifera*).

Eggs of the studied lappet moths are either unicolour, where their colour depends on the chorion colouration (*P. plagifera, O. pruni*) or on the egg contents (*Dendrolimus).* For instance, *P. plagifera* and *O. pruni* have white eggs with clearly standing out micropylar area of brown or greyish colours. Eggs of *Dendrolimus* primarily are light green, and then, as the egg develops, they become greyish green. Sometimes eggs have clearly expressed pattern, comprised by concentric stripes. In this case the colouration of the egg consists of the chorion colouration and the egg contents (*Euthrix, Gastropacha*). For instance, species of *Gastropacha* have greenish grey eggs (the egg contents) with broad white concentric bands (the white pigmentation of the chorion).

The chorion of the studied lappet moths is not uniform; it is either white and opaque (*P. plagifera, O. pruni*), or unicoloured, subhyaline, pale brown (*Dendrolimus).* Sometimes the chorion is patterned and opaque. In this case, it is bright, brownish orange with brownish, variously tinged bands (*E. laeta*). Species of some genera (*Gastropacha, E. albomaculata, E. potatoria*) have a chorion pattern consisting of its opaque areas interspersed with the hyaline ones. For instance, the two latter species have the chorion consisting of white opaque and hyaline bands.

Most of studied lappet moths have a peculiar exochorion sculpture represented by the spherical or oval crater-like pits (where either the pit edges width and the pit diameter are commensurable, or the pit edges is wider than the pit) (*Gastropacha, O. pruni, E. albomaculata, E. laeta*). The pit diameter varies from 7.2–14.6 μm *(E. albomaculata, G. quercifolia*) to 15.5–33.8 μm *(E. laeta*). The pits are divided by wide, flat and smooth edges, width of which varies in the range of 9.6–13.2 μm (*E. albomaculata*) to 10.4–25.8 μm (*O. pruni*). The pit edges width reaches 16.0 μm in most cases. There are more or less clearly expressed aeropyles (commonly 6–7) in the area of the pit edges. The aeropyles are spherical or oval, from 1.4–5.2 μm (*E. albomaculata, Gastropacha*) to 4.0–11.0 μm in diameter (*O. pruni*), bordered by roller-like edges.

Some species (*E. potatoria, P. plagifera*) have pitted cellular sculpture, and we consider it as a transitional type from the pitted sculpture to the cellular one. Herein, on the one hand, in contradistinction to the typical pitted sculpture, the pit edges width is much narrower than the pit diameter. For instance, the pit diameter lies in a range from 11.7 to 36.0 μm, whereas the pit edges width is 11.4–17.7 μm in *P. plagifera*. On the other hand, the sculpture is comprised by spherical or oval pits with unclear corners., not by the polygonal cells where there are the clearly expressed corners. (like in the micropylar area in the Notodontidae) (Dolinskaya, 1987 a; 1987 b; 1989).

The exochorion sculpture can be smoothed (*Dendrolimus*), with the cells poorly shown by very thin, hardly visible cell edges of 0.6–1.1 μm width. There are more or less clearly expressed aeropyles (2.0–5.4 μm in diameter) at the cell edges junctions; the surface of the exochorion is rough, covered by densely intertwined fibres.

The micropylar area is represented by the rosette and some rows of polygonal cells. The micropylar rosette size varies from 28.0–45.3 μm *(E. potatoria, G. quercifolia*) to 37.0–75.7 μm (*O. puni, P. plagifera*). Most species have the micropylar rosette size varying in the range 40.0–50.0 μm. Number of the rosette cells varies just slightly, from 7–8 *(Gastropacha, O. pruni*) to 9–12 *(Dendrolimus, P. plagifera*). This character is the subject to intraspecific variability. For instance, the number of the rosette cells varies from 9 to 11 in *E. laeta* and

from 9 to 12 in *P. plagifera*. The central part of the rosette, commonly slightly impressed in most studied lappet moths, takes form of large (ca (9.0 μm in diameter) pit-like depression, There are micropylar openings in the central part of the rosette; their number varies from 3–4 *(O. pruni, E. laeta*) to 8–12 (*P. plagifera, Dendrolimus*). This character also is variable intraspecifically. For example, the number of the micropylar openings varies from 8 to 11 in *P. plagifera*, and from 10 to 12 in *D. pini*. A similar picture is observed in other lepidopteran families (Arbogast et al., 1980; Pucci & Forcina, 1984; Suludere, 1988 b). The rosette cells are polygonal, sometimes spherical in their distal portion, more or less elongate, 1.5–2.0, sometimes 1.5–3.0, times (*P. plagifera*) longer than wide, joined along 1/3–3/4 of their length. The number of the rows of the micropylar area varies from 2–3 (*O. pruni*) to 7–8 *(D. superans sibiricus*).

There are no aeropyles in the micropylar area of Lasiocampidae (similarly to Notodontidae) (Dolinskaya, 1989), whereas there are well developed aeropyles even on the rosette in Geometridae (Salkeld, 1983).

A distinct border between the micropylar area and the remaining egg surface could be observed in studied lappet moths. They differ in the sculpture, and it may be smoothed in the micropylar area (*P. plagifera, O. pruni, E. laeta*) or distinct (*Gastropacha, E. albomaculata, E. potatoria*). In some cases, the sculpture is clearly expressed in the micropylar area only, whereas the remaining surface is smoothed *(Dendrolimus*).

Sometimes there is transitional area between the micropylar area and the remaining egg surface with the cells of peculiar shape. For instance, there is the transitional area consisting of 1–2 rows of poorly expressed spherical cells (*O. pruni*); these cells have the edges much wider comparing to the cells of micropylar area, but never as wide as the edges on the remaining egg surface. The transitional area cells forms 5–6 rows in *D. pini*; having their surface in form of small, densely intertwined fibres, whereas the cells of the micropylar area have the smooth surface.

It is interesting to note, that studied lappet moths caterpillars nibble the chorion out in different ways. They nibble out a spherical or oval opening either in the micropylar egg area (*Gastropacha, Dendrolimus, E. potatoria, E. albomaculata*), or at the pole opposite to it (*E. laeta, P. plagifera*).

Noteworthy also is that the studied lappet moths lay eggs in a cage in the different ways. Eggs may be laid either singly (*Gastropacha, E. potatoria, E. albomaculata*) or as one-layer clusters where the eggs are closely compressed one to another *(E. laeta*), or as one-layered, one-rowed bands of up to 20 eggs in each (*P. plagifera, D. superans*).

The comparative analysis pursued herein allows to evaluate the following characters.

1. The egg shape is not quite a solid character, as it represents a continuum of variability from the oval shape to the spherical one: the oval, the spherical oval, the spherical. Moreover, this character is variable intraspecifically (*Gastropacha* spp.). Therefore, only extremal variants, the oval (*Dendrolimus)* or the spherical (*O. pruni, P. plagifera*) eggs could be recognized from it.

2. The egg size can be used to recognize several species or genera (*Gastropacha* spp., *Paralebeda Aurivillius)*. In the most cases it can be used only as a supplementary character.

*3.* Such characters as the egg and the chorion colouration and pattern, could be useful to recognize genera, species and even subspecies (*G. quercifolia quercifolia* and *G. quercifolia cerridifolia*), and also to recognize groups of genera (*Gastropacha* and *Euthrix; O. pruni* and *Paralebeda)*.

4. The exochorion sculpture allows to recognize with certainty several genera ans species (*Dendrolimus, Paralebeda, E. potatoria*). It is useful also to combine genera into groups (*Gastropacha, Euthrix, O. pruni*).

5. The characters of the micropylar area, such as the number of the micropylar area rows, the number of the rosette cells, and the number of the micropylar openings, similarly to the egg shape, represent a continuous clinal varying and are the subjects to intraspecific variation. Therefore, only the extremes of clines could be useful for diagnostics. Nevertheless, some characters of the micropylar area allow to determine several genera or species confidently. These are the degree of expression of the micropylar area (clearly expressed or smoothed), and the structure of the central part of the micropylar rosette (a deep depression or a shallow pit).

6. The way the caterpillar nibbles out the exit opening could be used as a supplementary character for some species or genera (*Paralebeda, E. laeta*).

As is evident from the foregoing, the characters obtained from the egg mophology can be used for diagnostical purposes. Some characters allow the sure recognition of several genera and species. In general, a complex of characters should be used, because different species or genera often share same characters.

*Euthrix* and *Gastropacha* could be recognized from the chorion pattern, and supplementary diagnostics are based upon the complex of characters. From the comparison of these two genera it is evident that *Gastropacha* is more homogenous genus, as the species belonging here differ in a few characters of a little value.

*Dendrolimus* posseses a number of characters not known for the other already studied lappet moths, namely the egg and chorion colouration, the exochorion sculpture and the peculiar kind of the central part of the micropylar rosette.

1. *Paralebeda* and *O. pruni* differs from other species by the egg colouration and *P.* Eggs with poorly expressed exochorion sculpture, where there is only hardly noticeable cells (*Dendrolimus* spp.).

2. Eggs with clearly expressed exochorion sculpture, either pitted, or pitted cellular (*Euthrix* spp. , *Gastropacha* spp. , *O. pruni, P. plagifera*).

2 a. The exochorion sculpture is pitted — *Gastropacha* spp., *Euthrix* spp., (except *E. potatoria), O. pruni.*

2 b. The exochorion sculpture is pitted cellular — *P. plagifera, E. potatoria.*

The two last subgroups can be divided according to the egg and chorion colouration and pattern in the following way.

2 a. The egg and chorion with the pattern of concentric stripes — *Gastropacha* spp., *Euthrix* spp.

2 b. The egg with the unicolour, white chorion — *O. pruni, P. plagifera.*

*P. plagifera* by larger egg size. Supplementary diagnostics should take into consideration the complex of characters.

From the pursued analysis, all the examined taxa may be divided into two groups with the two subgroups in the second one.

As it is obvious from this analysis, *Dendrolimus* spp. sharply differs from all the other studied taxa by its smoothed exochorion sculpture. The remaining species are subdivided into 2 groups, where *Euthrix* and *Gastropacha* are represented to us more homogeneous group.

It is interesting to note, that the character of this groups mostly coincide with the results of the morpho-functional investigations of V. Kuznetzov and A. Stekolnikov (1985), who studied relationships of bombycoid moths. For example, these authors refer that *Dendrolimus* has extreme specialization of genitalia and reduction of majority muscles and sclerites. Besides that they note also the similarity between *Gastropacha, Euthrix* and *Odonestis* Germ. Nevertheless some differences have place. Thus, according to our investigations of egg characters the genera *Euthrix* and *Gastropacha* have more common morphological characters in comparison with *Odonestis*, whereas the above mentioned authors note that *Odonestis* and *Euthrix* are more relation one to another than to *Gastropacha*. Besides that according to our investigations *Paralebeda* and *Dendrolimus* sharply distinguish one of other whereas the above mentioned authors note the morphological resemblance of genital structures proposing their genetical relationship.

In future studies it will be necessary to further investigate all ontogenetic phases in order to derive theoretical conclusions concerning those species described here.

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