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A comparative characteristic of the moth eggs of Noctuoidea and “Bombycoid complex” (Lepidoptera) and its significance for the systematics.

by I. V. Dolinskaya & I. G. Pljushch

Abstract. Egg chorion structure is studied and cladistically analyzed. Relationships among families within the superfamilies Bombycoidea, Lasiocampoidea, and Noctuoidea are discussed.

Keywords. Egg chorion - cladistics - Bombycoidea - Lasiocampoidea - Noctuoidea

Introduction

So far, the knowledge of the egg chorion of Noctuoidea, Lasiocampoidea and Bombycoidea is still insufficient and fragmentary. Only eggs of Noctuidae, Notodontidae and Sphingidae are studied more in detail (SALKELD, 1975, 1977, 1984; DOLINSKAYA, 1987 a,b, 1989; DANNER, EITSCHBERGER & SURHOLT, 1998).

Therefore authors in the most taxonomic papers did not take into consideration characters of the eggs. Moreover the literature has few information about diagnostics of Lepidoptera on the egg stage. Thus, aim of our study is partially to fill this gap.

The work consists of original materials which authors collected mostly in Primorski Krai (Russian Far East) and partially by literature data. The work was realised despite of complicated economic conditions on the territory of the former USSR and mainly for personal account. The eggs were taken from captured females in field conditions and examined with the use of SEM. As a result authors, at the first time on the contemporary level, studied eggs of 136 species, belonging to 83 genera of 9 families Lepidoptera. Authors have made more than 700 microphotographs of exochorion sculpture of the eggs.

Taxonomy

Superfamily Noctuoidea

Studied families: Notodontidae, Lymantriidae, Arctiidae and Noctuidae.

Superfamily Noctuoidea has only 1 synapomorphy - eggs of the upright type, with the micropylar area located at the pole opposite to the surface.

Notodontidae are assumed as least heterogeneous and specialised with the complex of plesiomorphic characters (subspherical egg shape, cellular exochorion sculpture, caterpillar nibble out opening at the lateral part of the egg). These characters are met everywhere at the majority of families of the Noctuoidea. For example, subspherical egg shape is characteristic for Arctiidae (Arctiinae) and mainly Noctuidae; cellular exochorion sculpture - for most of Lymantriidae, some Noctuidae and some Arctiidae. The fact of caterpillars nibble out opening at the lateral side of the egg is characteristic for Lymantriidae.

Lymantriidae, Arctiidae and Noctuidae are more heterogeneous and advances with complex apomorphies for everyone of them.

Lymantriidae. Apomorphic characters: 1) egg shape either flatten dorsoventrally or is round out with by keeping flattened apex. Besides the Vapourer moths have a tendency to smooth out of exochorion sculpture, where it is clearly expressed only at the apical part of the egg (analogously many Arctiidae). However, here are kept also primitive characters (cellular exochorion sculpture; caterpillar nibble out opening at the lateral side of the egg) equally with advanced ones.

Arctiidae. Apomorphic characters: 1) exochorion sculpture (for majority species) is reformed into sharply expressed aeropyles without ribs of the cells; 2) caterpillar nibble out opening at the apical (of the micropylar) area of the eggs. From two subfamilies of Arctiidae, the Lithosiinae are more heterogeneous and advanced by the egg characters. Thus Arctiinae keep initial subspherical egg shape, while of Lithosiinae one is reformed in spherical or oblong-ovoid. Besides, in Lithosiinae a decreasing of egg size (correlation with the imago size) as well as thinning of chorion takes place.

Noctuidae. Apomorphic characters: 1) egg shape (for the most species) is round with keeping of the flat base; 2) exochorion sculpture is reformed into sharply expressed longitudinal and cross ribs.

Thus Notodontidae is opposed to the rest three families by the complex of plesiomorphic characters and is regarded as the most primitive. The remaining families are more advanced with apomorphic characters for each of them.

For Lymantriidae, Arctiidae and Noctuidae we did not find any synapomorphies. So it may be supposed that these families are different independent branches of some ancient ancestral form. Lymantriidae, from this group, is least advanced, since here the majority species keep primitive characters (see above). The data received by authors, on the base of study egg characters confirm opinion of FORBES (1923), RICHARDS (1932) and BROCK (1971) about relationship of Noctuoid higher group.

“Bombycoid complex” - superfamily Lasiocampoidea (studied families - Lasiocampidae), superfamily Bombycoidea (studied families - Sphingidae, Bombycidae, Saturniidae and Brahmaeidae).

Brahmaeidae from this group is most isolated and supposedly advanced. Apomorphic characters: 1) egg of the upright type (homoplasy with Lemoniidae, Geometridae, Rhopalocera and al.); 2) subspherical egg shape; 3) caterpillar nibble out opening at the lateral part of the egg.

Lasiocampidae, Sphingidae, Bombycidae and Saturniidae unites only complex symplesiomorphies (egg of the laying type; oval, oval spherical or spherical or rounded egg shape (homoplasy with Tortricidae and most of Tineoidea); caterpillar nibble out opening at the micropylar area of the egg), while the absence of synapomorphies points to the possible remoteness of relationships.

Saturniidae - deviate from this group by 1) large egg sizes (correlation with the imago sizes) and 2) strong opaque chorion (it is apparently specialisation to the egg diapause).

However here the majority species keep initial cellular exochorion sculpture, that is characteristic for Tortricidae and most of Tineoidea.

The remaining three families keep middle egg sizes and hyaline or translucent chorion. However for everyone of these families the specialised characters are characteristic.

Sphingidae. Apomorphic characters: 1) The numerous fibres are developed, which move away from central pit of micropylar rosette; 2) exochorion sculpture is smoothed, slightly expressed.

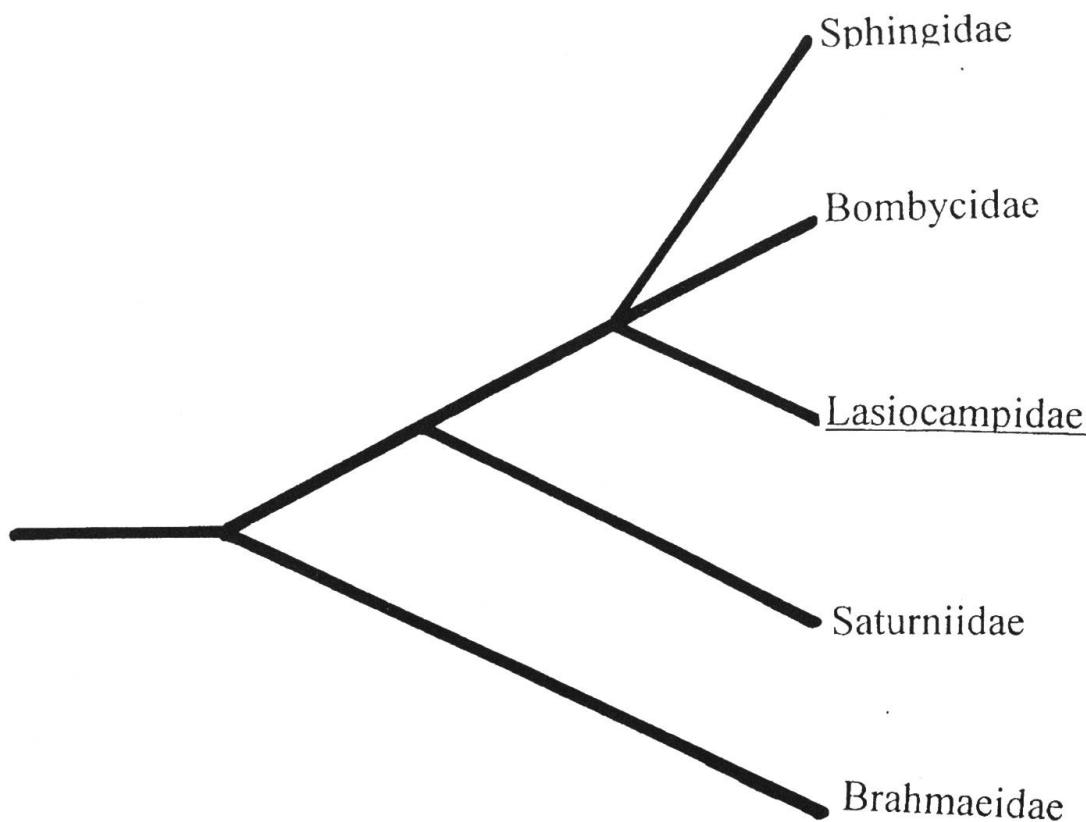


Fig. 1. Preliminary diagram of relationships of “bombycoid complex”, a higher group, built on the base of egg characters.

Bombycidae. Apomorphic characters: 1) exochorion sculpture is reformed in to pits or clearly expressed aeropyles.

Lasiocampidae. Apomorphic characters: 1) exochorion sculpture is reformed in to specific crater-like pits.

Preliminary diagram of relationships of studied families “Bombycoid complex” is adduced (fig.1), built on the base of egg characters. The comparison of our diagram is given with by two large papers about phylogeny of these Lepidoptera: KUZNETZOV & STEKOLNIKOV (1985) and MINET (1994). How it can be seen, our dates are conformed in the separate details either by one or other diagrams.

The conclusions of this paper have just preliminary character. The aim is to show as far as the egg characters can be used for phylogenetic questions.

In the course of the further study on the eggs and comparisons of the member of different families these conclusions should be modified. Moreover, we are going in the near future to begin the study on caterpillars of these families and to conduct theirs comparative morphological analysis in order to elucidate the phylogenetic nature of characters of the different ontogenetic stages. Thus, we have seen, on the example of Notodontidae (DOLINSKAYA. 1990), that caterpillar characters and especially the first age characters have the greatest phylogenetic significance under all ontogenetic stages. We considered that these characters are of leading importance in working-out of the diagram of Notodontid relationships.

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