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## MORPHOLOGICAL CHARACTERS OF THE PUPAE OF SOME TIGER MOTHS (LEPIDOPTERA, ARCTIIDAE) OF FAR EAST RUSSIA

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**Morphological Characters of the Pupae of Some Tiger Moths (Lepidoptera, Arctiidae) of Far East Russia. Pljushch I. G., Dolinskaya I. V.** — Pupae of 6 species representing 5 genera of Arctiidae, were examined. Descriptions and comparative morphological analysis are provided for all these species. As a result, all the examined species are subdivided into 2 groups; the diagnostic characters for species are chosen.

**Key words:** Lepidoptera, Arctiidae, pupa, morphology, descriptions, diagnostic characters.

**Морфологические признаки куколок некоторых дальневосточных медведиц (Lepidoptera, Arctiidae). Плющ И. Г., Долинская И. В.** — Изучены куколки 6 видов Arctiidae, относящихся 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.

**Ключевые слова:** Lepidoptera, Arctiidae, куколка, морфология, описание, диагностические признаки.

### Introduction

This is the sixth paper on morphological studies of the pupae of Lepidoptera — Noctuoidea (Dolinskaya, 1984, 1986, 1989, 1993, 1994). Patočka (1991) studied 16 species of European Lymantriidae and 35 species of European Notodontidae (Patočka, 1990). Nakamura (1976) reviewed and classified pupae of 33 species of Japanese Lymantriidae. The European Arctiidae (44 species) were studied by Patočka (1992). There are series of references dealing with the morphology of the pupae of Arctiidae (Banerjee, Haque, 1983; Goel, Kumar, 1983; Garcia-Barros, 1986; Nardelli, Giandolfo, 1996).

### Material and methods

The examined materials were collected by the authors in Primorskiy Kray (Far East, Russia). The eggs were taken from the collected females and hatched caterpillars were fed to pupae. The terminology used in this paper follows Mosher (1916). The taxonomical arrangement of the Arctiidae follows that of Dubatolov (1996).

### Descriptions

#### *Diacrisia irene* Butler, 1881

Body length 14.9–19.0 mm, width 4.4–7.1 mm ( $n = 4$ ). Pupa dark brown, shining. Anterior ventral part wrinkled or roughly wrinkled. Head sculpture smoother than the sculpture of anterior ventral part. Head with a small tubercle at proximal end of antenna and with some easy broken setae on tubercle. Eye-piece large, smoother than gena, equal or larger than half size of gena. Fronto-clypeal suture indistinct. Labial palpi present as small triangular areas at base of maxilla. Antenna, legs and maxilla distinctly separate. Antenna long, extending to 3/4 of forewing length, or longer than prothoracic leg, reaching or nearly reaching distal end of mesothoracic leg; antennal apices fused or separated. Maxilla extending to 2/3–3/4 of forewing length, not reaching level of antennal apex, separating prothoracic legs and reaching level of mesotho-

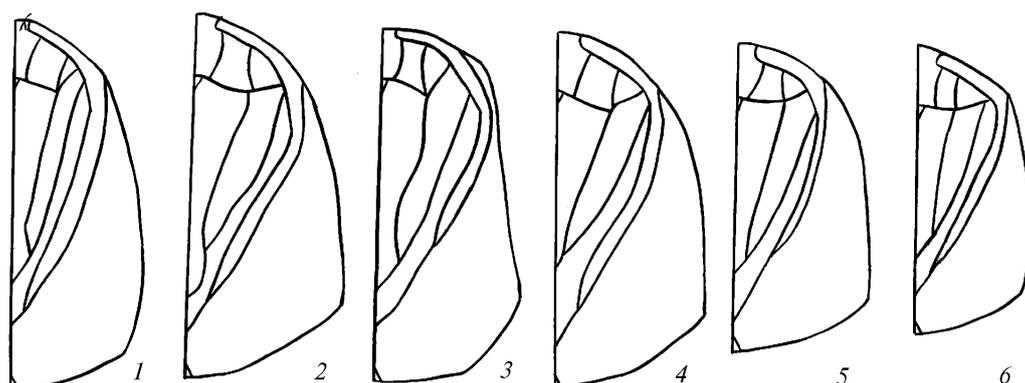


Fig. 1. Anterior ventral part of the pupae: 1 — *D. irene*; 2 — *R. amurensis*; 3 — *C. niveum*; 4 — *S. subcarneum charbini*, *S. luteum*; 5, 6 — *P. amurensis*.

Рис. 1. Передняя вентральная часть куколки: 1 — *D. irene*; 2 — *R. amurensis*; 3 — *C. niveum*; 4 — *S. subcarneum charbini*, *S. luteum*; 5, 6 — *P. amurensis*.

racic legs link. Metathoracic legs present as small portion (fig. 1, 1). Dorsum of prothorax, meso- and metathorax wrinkled or roughly moderately, sometimes dotted with faintly expressed pits. These body parts as well as abdominal segments with distinct setae arranged around scars of larval verrucae. These setae small, pale brown, easy broken (fig. 3, 1). Abdominal segments dotted with small pits, abdominal segments 5–8 more smooth than the preceding ones, abdominal segment 9 entirely smooth.

Cremaster present as a bunch of setae bent at apex (fig. 2, 1). Pupa in a strong silky cocoon.

#### *Rhyparioides amurensis* (Bremer, 1861)

Body length 17.8–19.5 mm, width 6.2–8.5 mm ( $n = 5$ ). Pupa dark brown, shining. Anterior ventral part wrinkled or smooth. Eye-piece, fronto-clypeal suture and labial palpi are same as in previous species. Antenna, legs and maxilla distinctly separate. Antenna long, extending to  $3/4$  of forewing length or longer, longer than prothoracic leg and sometimes longer than maxilla, but nearly not reaching distal end of mesothoracic leg. Maxilla long, extending to  $2/3$ – $3/4$  of forewing length, reaching level of antennal apex and mesothoracic legs link, separate distal end of prothoracic leg. Metathoracic legs are same as in previous species (fig. 1, 2). Dorsum of prothorax, meso- and metathorax wrinkled or faintly wrinkled; dorsum of metathorax dotted with faintly expressed pits. Abdominal segments with distinct, small, pale brown, easy broken setae. Abdominal segments dotted with small pits, abdominal segments 5–8 more smooth than the preceding ones, abdominal segment 9 entirely smooth.

Apical portion of 10 abdominal segment with medial groove and pale brown setae of cremaster are separated in two groups and bent to the apex (fig. 2, 2).

Pupa in a strong silky cocoon.

Comparative remarks. Setae of the abdominal segments identical those of *D. irene*, but stronger and longer, differing from the latter by the thickening to the apex.

#### *Chionarctia niveum* (Ménétrières, 1859)

Body length 18.5–25.0 mm, width 6.4–9.2 mm ( $n = 10$ ). Pupa dark brown, shining. Anterior ventral part wrinkled or smooth. Eye-piece, fronto-clypeal suture and labial palpi as in previous species. Antenna, legs and maxilla distinctly separate. Antenna extending to  $1/2$ – $2/3$  of forewing length, not reaching level of maxilla apex and reaching or slightly not reaching level of distal end of prothoracic leg. Maxilla extending to  $2/3$ – $3/4$  of forewing length and level of mesothoracic legs link, separate protho-

racic legs, longer than antenna length. Metathoracic legs as in previous species (fig. 1, 3). Dorsum of prothorax and mesothorax wrinkled. Dorsum of metathorax wrinkled and dotted with small pits. Abdominal segments 1–4 are wrinkled or roughly wrinkled, dotted with small pits. Abdominal segments 5–8 are dotted with faintly expressed pits and abdominal segment 9 entirely smooth.

Setae of abdominal segments arranged around scars of larval verrucae, hardly expressed or absent.

Apical portion of 10 abdominal segment with medial groove. Pale brown setae of cremaster separated in two groups and with thickening at apex (fig. 2, 3).

Pupa in strong silky cocoon.

***Spilarctia subcarneum charbini* (Daniel, 1943)**

Body length 14.0–19.5 mm, width 4.5–8.0 mm (n = 10). Pupa dark brown, shining. Anterior ventral part wrinkled, sometimes smooth. Head sculptures smoother than the sculpture of anterior ventral part, with smooth genae. Eye-piece, fronto-clypeal suture and labial palpi as in previous species. Antenna, legs and maxilla distinctly separate. Antenna long, extending to 3/4 of forewing length or longer, longer than prothoracic leg and maxilla, but nearly not reaching distal end of mesothoracic leg. Maxilla extending to 2/3 of forewing length and level of distal end of mesothoracic legs link, separate prothoracic legs. Metathoracic legs are same as in previous species (fig. 1, 4). Dorsum of prothorax and mesothorax wrinkled. Dorsum of metathorax more smooth than preceding ones, sometimes dotted with small faintly expressed pits. Abdominal segments dotted with pits; and also abdominal segments 5–9 more smoothed than pre-

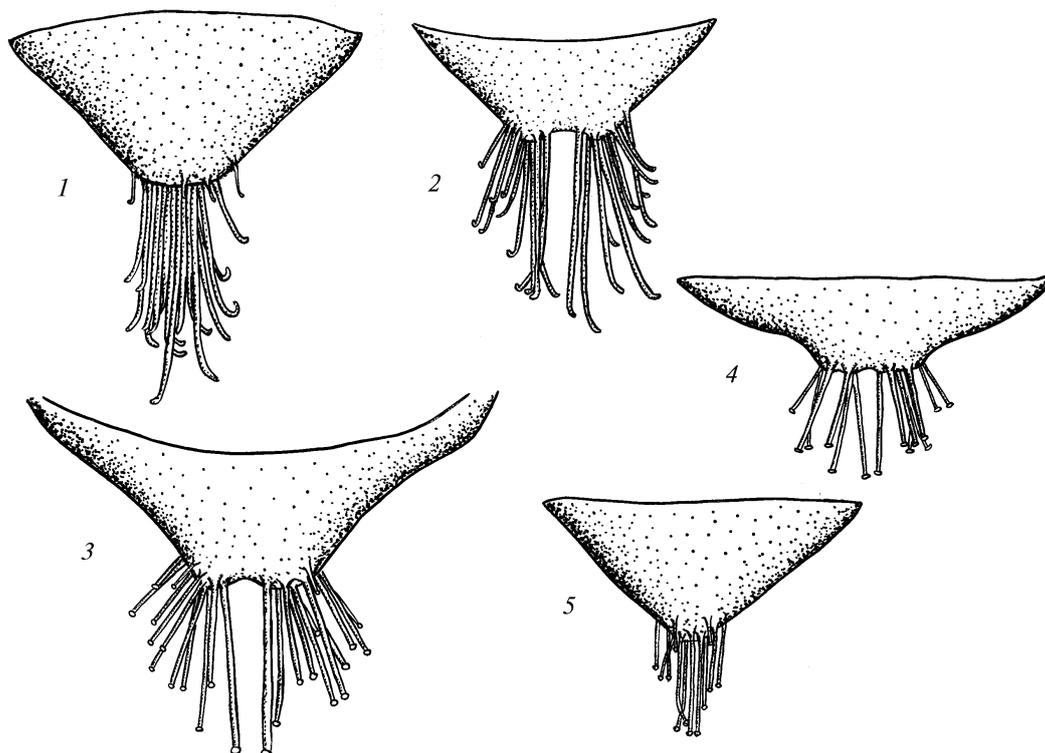
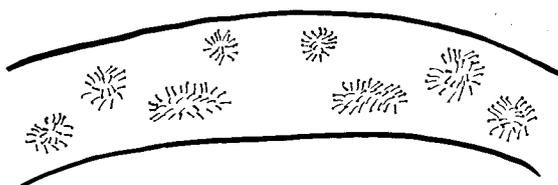


Fig. 2. Cremaster of the pupae: 1 — *D. irene*; 2 — *R. amurensis*; 3 — *C. niveum*; 4 — *S. subcarneum charbini*, *S. luteum*; 5 — *P. amurensis*.

Рис. 2. Кремастер куколки: 1 — *D. irene*; 2 — *R. amurensis*; 3 — *C. niveum*; 4 — *S. subcarneum charbini*, *S. luteum*; 5 — *P. amurensis*.

Fig. 3. Third abdominal segment of *R. amurensis* and *D. irene*.Рис. 3. Третий абдоминальный сегмент *R. amurensis* и *D. irene*.

ceding ones. Abdominal segments sometimes with very small setae arranged around scars of larval verrucae. Apical portion of 10 abdominal segments with little faintly wavy projections. Pale brown setae of cremaster divided into two groups and with thickening at apex (fig. 2, 4).

Pupa in strong silky cocoon.

Comparative remarks.

We have additional material connected with *S. luteum japonicum* Rothschild (1910). They are smaller than *S. subcarneum*: length 1.15–1.7 mm, width 0.32–0.7 mm (n = 10). No differences were found in the sculpture of the pupa.

### *Phragmatobia amurensis* Seitz, 1910

Body length 12.2–17.3 mm, width 4.3–6.7 mm (n = 10). Pupa dark brown, shining. Anterior ventral part smooth or wrinkled. Eye-piece, fronto-clypeal suture and labial palpi as in previous species. Antenna, legs and maxilla distinctly separate. Antenna length various. Antenna extending to 2/3 of forewing length, reaching level of distal end of prothoracic leg, but slightly not reaching level of maxilla apex (fig. 1, 5). Either antenna extending to 3/4 of forewing length, reaching maxilla apex or longer than prothoracic leg and maxilla (fig. 1, 6). Maxilla extending to 2/3–3/4 of forewing and level of mesothoracic legs link, separate prothoracic legs. Metathoracic legs as in previous species. The dorsum of prothorax and mesothorax wrinkled. The dorsum of metathorax smooth, dotted with small faintly expressed pits or wrinkled. Abdominal segments smooth, dotted with faintly expressed pits. Abdominal segments with faintly expressed setae arranged around scars of larval verrucae. Apical portion of 10 abdomi-

Table 1. Comparison of the character states among studied species of Arctiidae

Таблица 1. Сравнение признаков изученных видов Arctiidae

Characters	<i>D. irene</i>	<i>R. amurensis</i>	<i>C. niveum</i>	<i>S. s. charbini</i> , <i>S. l. japonicum</i>	<i>P. amurensis</i>
Head (A — without tubercle; B — with a small tubercle at the proximal end of antennae)	B	A	A	A	A
Antenna (A — extending to 2/3 of forewing, reaching or not reaching distal end of prothoracic leg; B — reaching to 3/4 of forewing, longer than prothoracic leg length; B' — sometimes linked up one to another)	B, B'	B	A	B	A, B
Maxilla (A — reaching antennal apex or longer; B — not reaching antennal apex)	B	A	A	B	A, B
Abdominal segments (A — 1–4 — dotted with small pits; B — 1–4 — wrinkled or roughly wrinkled with small pits)	A	A	B	A	A
The setae of the abdominal segments (A — clearly expressed; B — faintly expressed or absent; A' — setae without thickening at apex; A'' — setae with apical thickening)	A A'	A A''	B	B	B
Setae of the cremaster (A — with apical thickening; B — bent at apex)	B	B	A	A	A
Setae of the cremaster (A — two groups; B — one group)	B	A	A	A	B

nal segments conical rounded and pale brown setae of cremaster are located in one group and with the thickening at apex (fig. 2, 5).

Pupa in a strong silky cocoon.

### Discussion

The comparative analysis provided by the authors allows to evaluate the following characters.

1. The presence of the tubercle on the head may be used to recognize definite species (*D. irene*).

2. The length of antennae and maxillae may be used to recognize species, however these characters sometimes vary intraspecifically (*P. amurensis*).

3. Such characters as shape of setae of the abdominal segments and cremaster allows to recognize with certainty species. It is useful also to combine taxa into groups.

It is evident from the foregoing that the characters obtained from the pupa morphology can be used for diagnostic purposes.

Resulting from the executed analysis, all the examined taxa may be subdivided into two groups of different contents.

1. Apical portion of 10 abdominal segments fluently or conical rounded and setae of the cremaster form a group — *D. irene*, *P. amurensis*.

2. Apical portion of 10 abdominal segments with medial groove or with little faintly wavy. Setae of the cremaster are arranged in two groups — *C. niveum*, *R. amurensis*, *S. subcarneum*, *S. luteum*.

Or

1. Setae of the cremaster with the apical thickening — *S. subcarneum*, *S. luteum*; *P. amurensis*, *C. niveum*.

2. Setae on the cremaster are bent at the apex — *R. amurensis*, *D. irene*.

*Diacrisia irene*. Head with a small tubercle at the proximal end of antenna. Antennae longer than prothoracic legs. Maxilla not reaching the antennal apex. The setae on the abdominal segments clearly expressed, without thickening at the apex. Apical portion of the 10 abdominal segment weakly rounded and setae of the cremaster are situated in one group and bent at the apex.

*Rhyparioides amurensis*. Antennae longer than prothoracic legs length. Maxillae reaching the antennal apices. The setae on the abdominal segments distinctly expressed, with thickening at the apex. Apical portion of 10 abdominal segment with medial groove, setae of the cremaster arranged in two groups and are bent at the apex.

*Chionarctia niveum*. Antennae reach or slightly not reach level of distal end of prothoracic legs. Maxillae longer than antennae length. Groups of setae on the abdominal segments are indistinct or absent. Apical portion of 10 abdominal segments with medial groove. Setae of cremaster arranged in two groups and with the thickening at the apex.

*Spilarctia subcarneum*, *S. luteum*. Antennae are longer than fore legs length. Maxillae not reach antennal apices. The setae of the abdominal segments faintly expressed or absent. Apical portion of 10 abdominal segments with little faintly wavy projection. Setae of cremaster arranged in two groups and with the thickening at the apex.

*Phragmatobia amurensis*. The setae of the abdominal segments faintly expressed or absent. Apical portion of 10 abdominal segments conical rounded and setae of the cremaster are situated one group and with the thickening at the apex.

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