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Contribution to the Description of Pupae of the Western Palaearctic Noctuidae (Lepidoptera: Noctuidae)

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Abstract

The descriptions of pupae of several West Palaearctic species of Noctuidae (subfamilies Plusiinae, Acontiinae, Eublemminae and Bagiarinae) are listed in the paper. The members of four sub-families, four genera, and four species were described and the main morphological characters of pupae were drawn. The main differences were compared related noctuid moth species previously described by the authors with. The systematic status and position of described species in current systems is discussed from the point of view of morphology of their pupae.
KEY WORDS: Lepidoptera, Noctuidae, pupae, comparative morphology, taxonomy

Contribución a la descripción de la crisálida de los Noctuidae del oeste Paleártico (Lepidoptera: Noctuidae)

Resumen

En este trabajo se da la descripción de la crisálida de algunos Noctuidae (subfamilias Plusiinae, Acontiinae, Eublemminae y Bagiarinae) del Paleártico occidental. Se describen los componentes de cuatro subfamilias, cuatro géneros y se dibujan las principales características morfológicas de las crisálidas. Se describen las principales diferencias de las especies de los noctuidos previamente relacionadas. Se discute el punto de vista, la posición y el estatus sistemático de la morfología de sus crisálidas.
PALABRAS CLAVE: Lepidoptera, Noctuidae, crisálida, morfología comparada, taxonomía.

Introduction

This paper continues the work published in PATOČKA (1996) and PATOČKA & TURČÁNI (2005). The taxonomic position of some noctuids is still not quite clear and various authors (e.g. BECK, 2000, vs. KARSHOLT & VAN NIEUKERKEN, 2004) place the same species in different sub-families, tribes or genera. The lepidopteran pupa is the stage in which external morphology is not covered by hairs and/or scales and it is thus relatively easy to find many characters which may be used for identification but also classification (PATOČKA & TURČÁNI 2005). We here mainly describe species which have not been described in previous papers, or which were described incompletely, due to lack of material and/or publishing possibilities. The main aim of this paper is to study external morphology of pupae and apply results in additional study of taxonomy position of species/genera of family Noctuidae. We also discuss suggestions or recommendations for taxonomists specific to noctuids, who may choose to reject these results in future taxonomy concepts of Noctuidae.

Material and methods

Pupal material was loaned from: National Museum of Natural History in Leiden (Naturalis) and

Zoological Museum in Amsterdam (ZMA), both The Netherlands. Additional material was found in the Hungarian Natural History Museum in Budapest (Hungary) or originates from the collection of the senior author. The methodology used is the same as described in PATOČKA (1996) and PATOČKA & TURČÁNI (2005).

Results

Subfamily Plusiinae

Genus *Thysanoplusia* Ichinose, 1973

Identification of genus *Thysanoplusia* described on the base of species *T. orichalcea* using the key to the genera of family Noctuidae in PATOČKA & TURČÁNI (2005) would bring someone to couplet 16. It differs from subsequent genera *Lamprotes* Reichenbach, 1817, *Plusia* Ochsenheimer, 1816 and *Abrostola* Ochsenheimer, 1816 by shape of setae D1 on cremaster mainly. These setae are spur-like, bent frontally and pointed (figs 7, 8) and not rolled to hook-shape.

Description of genus *Thysanoplusia* according to above mentioned investigated species: Pupae medium in size, spindle-like. Prothoracic femora big, prothoracic legs relatively short. Antennae reach to the end of forewings; mesothoracic legs extend beyond them conspicuously and reach to the level of border between segments 4-5. Proboscis + projections of hindwings shortly extend beyond border between abdominal segments 5-6 (fig.1). Metanotum longitudinally shortly furrowed anteriorly. Abdominal segments 2-7 with subdorsal depressions, dorsal lobe-like projection sits between them frontad (fig. 4). Cremaster medium short, tapering and rather pointed. Individual pairs of setae on it different in shape, D1 spur-like and bent frontally (figs 6-8).

Two species occur in Europe and 1 in western part of central Europe.

Thysanoplusia orichalcea (Fabricius, 1775) (figs 1-8)

Material examined: 1 male and 1 female from museum Leiden, The Netherland.

Pupa: 16-18 x 5-6 mm, spindle-like, flattened laterally; brown-black, shiny, ventral part of thorax more-less yellow-brown. Caudal edge of pronotum ochre in colour. Depressions on dorsal side purple. Sculpture medium fine at majority. Front, labrum and oculi were not preserved on investigated pupae. Labium and prothoracic legs visible. Thoracic spiracle is slit-like, bordered darkly. Abdominal segment 1 covered by tubercles anteriorly. Setae present only on segment 8 (D1 and D2) and segment 9 (only D1), these ones conspicuous and yellow in colour. Other setae slightly conspicuous. Abdominal segment 10 merges the base of cremaster slightly obliquely on ventral side. Cremaster medium short, its sides domed and tapering, it is rather pointed at the end. Cremaster domed on ventral side in lateral view. This one longitudinally ribbed everywhere. Its setae D2 short, robust, pointed and bent hook-like anteriorly, D1 short and spur-like, SD1 and L1 medium short, hooked. All setae concentrated in caudal half of cremaster. Larva polyphagous, pest in agriculture. Distributed in Afrotropic region and the south of Western Palaeartic.

Subfamily Acontiinae

Genus *Acontia* Ochsenheimer, 1816

Identification of genus *Acontia* described on the base of *A. lucida* using the key to the genera of family Noctuidae in PATOČKA & TURČÁNI (2005) would bring someone to the couplet 30, which it is necessary to modify as follows:

30. Cremaster with teeth-like structures, and sometimes also hooks, setae or spines 31

– Cremaster with 2-4 pairs of hooks and spines or teeth. Its surface often covered by reticular-rib sculpture 43
– Cremaster slightly differentiated. Abdominal segment 10 with only pair of slightly to each other arch-like bent spines, which sit far from each other. Its surface lacks conspicuous sculpture (figs 9, 15-17)..... *Acontia*

Pupae of genus *Acontia* (on the base of species *A. lucida*) are smaller in size, rather stout, spindle-like (fig. 9). Postclypeus is elevated in the centre and dark in colour. Labium big (fig. 10). Prothoracic femora slightly visible, narrow (fig. 9). Oculus adjacent to proboscis and to mesothoracic legs (fig. 11). Proboscis extends beyond mesothoracic legs; these ones extend beyond antennae (fig. 9). Metanotum with medium deep, arch-like cut-out and pointed elongated and narrow frontal projections, these ones rounded only at the end (fig. 13). Cremaster very short, wide, barely differentiated, widely wedge-like, without conspicuous sculpture. It has only a pair of little to each other arch-like bent spines, which sit on sides far from each other (figs 15-17).
Four species occur in Europe and one in central Europe.

Acontia lucida (Hufnagel, 1766) (figs 9-17)

Material examined: 1 female, museum Amsterdam, The Netherlands.

Pupa: 10.3 x 3.9 mm, spindle-like. Head and end of body (between segments 7-8) separated by deeper incisions in ventral view. Colouration red-brown. Sculpture fine, missing puncturation. Setae barely visible in 50x magnification. Postclypeus black and strongly elevated in the centre. Labrum trapezium-like, its posterior corners rounded. Labium relatively wide. Prothoracic femora narrow and only barely visible. Proboscis significantly extends beyond mesothoracic legs, these ones extend beyond antennae. Prothoracic legs relatively short, metathoracic ones concealed. Thoracic spiracle slit-like, abdominal spiracles elliptical and black. Cremaster tapering to the end and round. Each side of cremaster with a tiny arch-like bent spine laterally. Larva is polyphagous on herbs. *A. lucida* is distributed in Europe.

Note: Pupa of *A. lucida* (by shape and mainly by 2 spines at the end of body) is slightly similar to pupa of *Tyta luctuosa* ([Denis & Schiffermüller], 1775), which was placed to the same genus with earlier. However, prothoracic legs adjacent to antennae and ends of metathoracic legs are visible in case of *T. luctuosa*.

Subfamily Eublemminae

Genus *Eublemma* Hübner, 1821

This genus is described in PATOČKA (1996). Forty species live in Europe and about seven ones in central Europe.

Eublemma minutata (Fabricius 1794) (figs 18-27)

Identification of this species using the key to the species of genus *Eublemma* in PATOČKA & TURČÁNI (2005) would bring someone to the couplet 3. *E. minutata* differs from *E. rosea* (Hübner, 1790) by smaller size (below 10 mm), by angular labrum caudally (fig. 20), narrower, rather teeth-like than scale-like setae on abdominal segment 10 (figs 25-27). End of abdomen is wide and obtusely round in lateral view (fig. 26) (*E. rosea* has cremaster conspicuously tapering and obtuse only at the end). The end of abdomen is also more pointed from ventral and dorsal view.

Material examined: 2 males, museum Leiden, The Netherlands.

Pupa: 9.0-9.5 x 2.5-2.6 mm, bright red-brown. Sculpture on head and thorax medium fine, wrinkled, fine on abdomen. Postclypeus transverse furrowed. Mesonotum with big and almost circle-

like wrinkled area, this one bordered by longer furrows. Metanotum and dorsal tops of abdominal segments with slightly elevated mouldings. Setae small and fine. Labrum trapezium-like, its lateral sides slightly domed. Labium conspicuous, prothoracic femora concealed. Ends of metathoracic legs visible, they join to proboscis and mesothoracic legs. Mesothoracic legs slightly extend beyond proboscis and conspicuously extend also beyond antennae. Thoracic spiracle is slightly elevated with wide slit. Metanotum widely arch-like cut-out, its frontal projections relatively narrow and round at the ends. Abdominal spiracles narrow elliptical and shifted to caudal margin of their big elliptical courts. Abdominal segment 10 obtusely round - also in lateral view. It bears a pair of lateral and a pair of dorsal pointed teeth. Anal field close to end of body. Pupa lacks cremaster.

Larva feeds on *Helichrysum arenarium*. This species occur on warmer habitats of Europe with sandy soils.

Subfamily Bagisarinae

Genus *Xanthodes* Guenée, 1852

Identification of this genus using the key to the genera of family in PATOČKA & TURČÁNI (2005) would bring someone to the couplet 2. *Xanthodes* differs from all genera listed there (*Brachionycha* Hübner, 1819, *Asteroscopus* Boisduval, 1828) and also from genus *Brithis* Hübner, 1821 (all these genera have concealed labium) by long proboscis (fig. 28) and by weakly differentiated completely different cremaster (figs 34-36).

Description of genus *Xanthodes*:

Pupae smaller in size, medium slender, spindle-like, obtusely rounded anteriorly, abruptly obtusely pointed caudally (fig. 28). Sculpture fine, punctuation on the base of abdominal segments 5-7 conspicuous (fig. 33). Postclypeus darken, but slightly elevated. Labrum rounded (fig. 29). Labium completely concealed (figs. 28, 29). Oculi adjacent to proboscis shortly, mesothoracic legs to oculi shortly and obliquely (fig. 30). Proboscis long, touching to visible ends of metathoracic legs (fig. 28). Thoracic spiracle slit-like, oval tomentose mound behind it (fig. 31). Overall elevated and tomentose areas around narrow elliptical abdominal spiracles (fig. 33). Cremaster little differentiated, obtusely pointed with smooth sculpture. Only setae D2 present, this ones obtusely hooked, sitting close to each other at the end of cremaster and diverge from each other (figs 34-36).

Note: Pupa slightly resembles pupae of genera *Acontia* or *Tyta* Billberg, 1820 by habit and shape of cremaster. It differs e.g. by concealed labium.

One species lives in southern Europe; It is reported also from the western part of central Europe and Hungary.

Xanthodes albago (Fabricius, 1794) (figs 28-36)

Material examined: 3 pupae from Croatia.

Pupa: 11-12.5 x 3.8-4.5 mm in size, red-brown, shiny, sculpture glossy, locally weakly wrinkled. A base of abdominal segments 5-7 with conspicuous minute and rather dense puncturation. Setae Sd on metanotum and the base of abdomen and L on medium abdominal segments more conspicuous. Postclypeus in shape of dark, bright stripe on sides. Labrum almost semi-circular and wide. Labium and also prothoracic femora concealed. Prothoracic legs medium in length, mesothoracic ones slightly shorter than proboscis and slightly extends beyond antennae. Thoracic spiracles slit-like, tomentose oval mound behind it. Metanotum very widely and medium in depth cut-out in arch-shape, its frontal projections narrow and round at the ends. Abdominal spiracles with tomentose overall and elevated areas around. Transition from anal field to the base of cremaster steep. Cremaster slightly differentiated with strongly tapering sides, roundly pointed at the end and with concave ventral and convex dorsal side from lateral view. This one only with seta D2, these

ones medium big, slender, obtusely hooked, sit close to each other at the end of cremaster and diverge from each other.

Larva feeds on Malvaceae. *X. albago* occurs at Mediterranean region and it is also reported from the western part of central Europe and Hungary.

Discussion

Pupae of subfamily Plusiinae are adapted to subsequent long life and high mobility of adults. Their proboscis is strongly elongated and it needs more than usual space in pupa. Thus, it not only shifts postclypeus and labium to anterior end of pupa, but it also extends beyond forewings and turns fronted at the end of its elongated shell. Lateral flattening the pupa is unusual in family Noctuidae and slightly resembles pupae of superfamily Papilionoidea. Pupa is in light overgrounds cocoon, what satisfy mainly needs of species with short pupal stage. Elongated cremaster is also adapted to softer cocoon; it is furnished with fixing hooks. We can see analogy with family Arctiidae in this character. It is interesting, that setae on cremaster of investigated species *Thysanoplusia orichalcea* were differentiated in shape and possibly also in function. D1 are spine-like, thus fixing function meets only remaining hooked setae, mainly Sd1 and L1. Strongly robust, short and anteriorly bent setae D2 have possibly also supporting function.

Subfamily Acontiinae is characterised by secondarily suppression of both fixing and supporting functions of cremaster and this one and its setae are strongly reduced. This family partially resembles also small subfamilies Tytinae (genus *Tyta* Billberg, 1820) and Aedeiinae (genus *Aedia* Hübner, 1823), but these taxa may by similar as results of adaptation analogies only and thus similarity of organs probably means conversion. BECK (2000) classified genera *Acontia* and *Tyta* to subfamily Cuculliinae (from the point of view of pupal morphology these groups are slightly related) and genus *Aedia* to unique subfamily Aedeiinae (pupae are morphologically similar to genera *Acontia* and *Tyta* however).

Pupae of sub-family Eublemminae have some, or all setae on abdominal segment 10 transformed to scale-like or spine-like organs. Cremaster is slightly differentiated; supporting function prevails over fixing one gradually. Mesothoracic legs are adjacent to oculi. These characters well describe and separate them from other subfamilies of family Noctuidae. Here described *Eublemma minutata* is the example of species with the most complete transformation of setae to teeth-like or scale-like organs together with *E. rosea*. All setae on abdominal segment 10 (2 pairs) were transformed in case of these two species.

Subfamily Bagisarinae resembles subfamilies Acontiinae and Tytinae by habit. Its solitary European species belongs to a few Noctuidae, with concealed labium in pupal stage. Also knop-like tomentose and elevated fields around abdominal spiracles are found only in this small subfamily in the family Noctuidae. Some Tortricidae (genus *Strophedra* Herrich Schäffer, 1854) and Pyralidae have slightly similar, knop-like elevated field around spiracles. The purpose of this modification of spiracles is not known to us. Unique status of subfamily Bagisarinae in the family Noctuidae is unambiguous what characters on pupa confirmed definitely.

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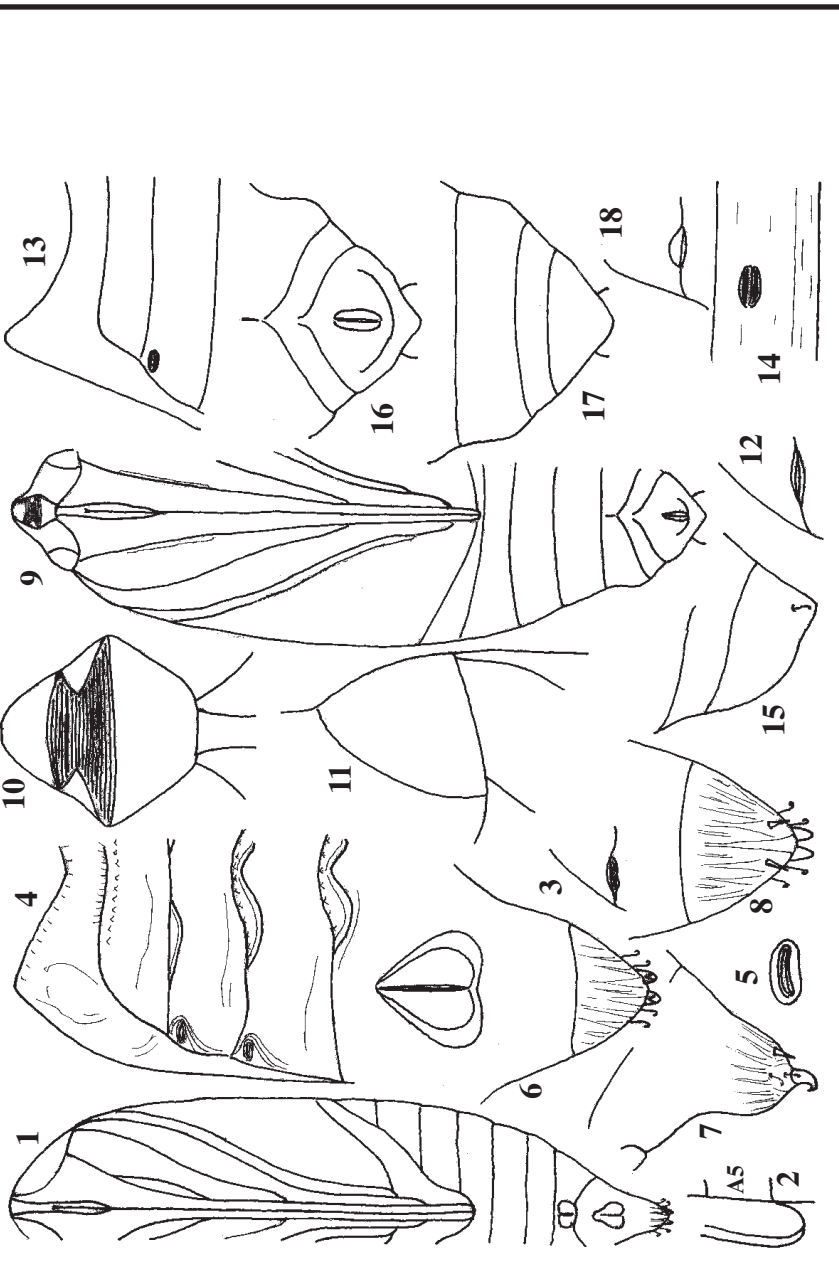
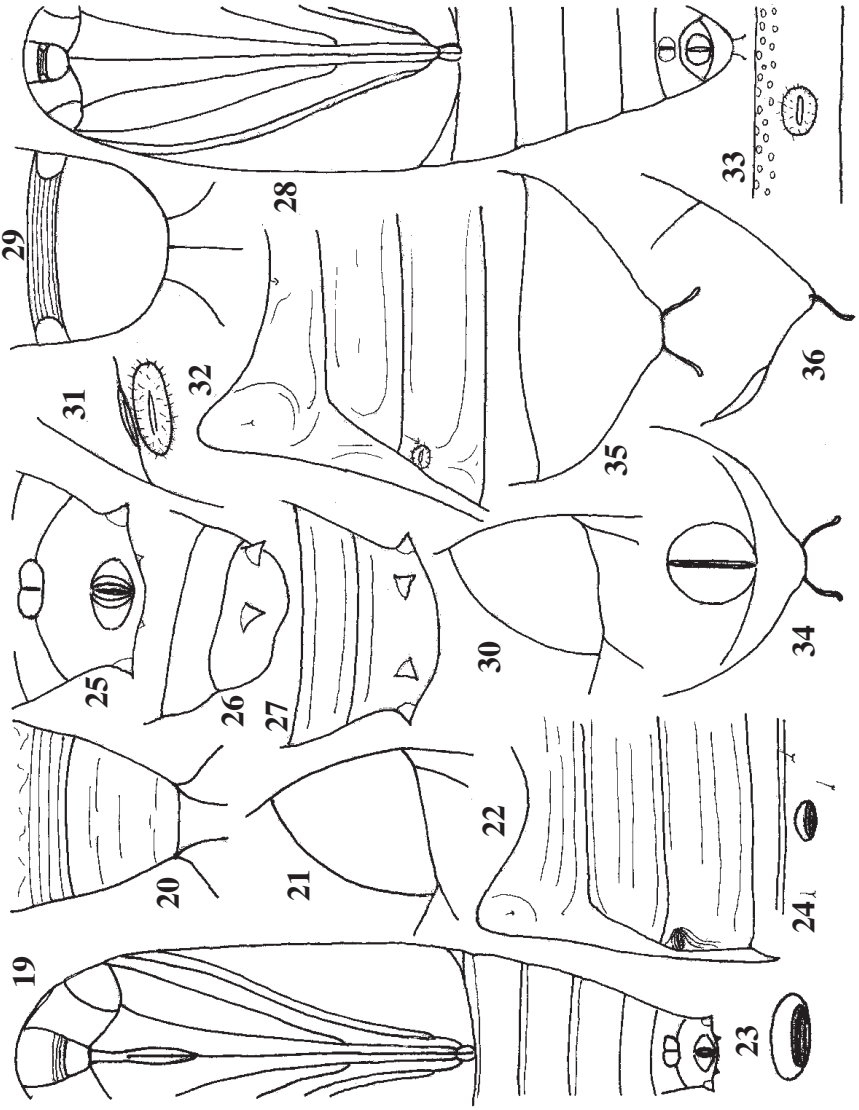


Figs 1-18.– 1-8. *Thysanoplusia orochalcea.* **9-17.** *Acontia lucida.* **18.** *Eublemma minutata.* **1**, **9** - pupa ventrally; **2** - projection of proboscis + hindwings, laterally; **3**, **12**, **18** -thoracic spiracle and vicinity; **4**, **13** - metanotum, base of abdomen, left side; **5** - abdominal spiracle; **6**, **16** - end of abdomen, ventrally; **7**, **15** - laterally; **8**, **17** - dorsally; **10** - labrum and vicinity; **11**- oculus and vicinity; **14** - spiracle on the 5th abdominal segment and vicinity.



Figs 19-31.– 19-27. *Eublemma minutata*. **28-36.** *Xanthodes albago*. **19**, **28** - pupa ventrally; **20**, **29** - labrum and vicinity; **21**, **30** - oculus and vicinity; **22**, **32** - metanotum, base of abdomen, left side; **23** - abdominal spiracle; **24**, **33** - spiracle on the 5th abdominal segment and vicinity; **25**, **34** - end of abdomen, ventrally; **26**, **36** - laterally; **27**, **35** - dorsally; **31** - thoracic spiracle and vicinity.