© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

Entomofauna

ZEITSCHRIFT FÜR ENTOMOLOGIE

Band 35, Heft 15: 309-332 ISSN 0250-4413 Ansfelden, 2. Januar 2014

The processus ventralis and its applicability in the determination of the males of the genus *Eupithecia* CURTIS, 1825 (Lepidoptera, Geometridae)

Vladimír KUBÍN & Josef PROCHÁZKA

Abstract

The processus ventralis situated on the ventral margin of the valvae is applicable as an auxiliary criterion in determining some species of the genus *Eupithecia*. According to its shape, two groups of the genus are recognized, one lacking any ventral processus, the other one with a well-marked, distinctive processus (29,41 %). The discrepancy in this character facilitates the determinative process in the latter group. The valvae are attached to the diaphragma in two points, viz. by a dorso-caudal articulatio costalis with the costa and by a ventro-cranial articulatio lingularis with the juxta. Both articulations are represented by flexibile material. An anatomical terminology is proposed.

Key words: Lepidoptera, Geometridae, *Eupithecia*, European species, Taxonomy, Male genitalia, Valvae.

Zusammenfassung

Der Processus ventralis, der sich am ventralen Rand der Valven befindet, kann als Hilfskriterium bei der Determination einiger *Eupithecia*-Arten dienen. Nach seiner

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

Ausgestaltung können zwei Gruppen in der Gattung unterschieden werden, eine ohne jeden Anhang und eine mit einem ausgeprägten, deutlich unterscheidbaren Processus (29,41 %). Die Unterschiede in diesem Merkmal erleichtern die Determination in der letzteren Gruppe. Die Valven sind an zwei Stellen am Diaphragma befestigt und zwar mit Hilfe einer Articulatio costalis dorso-caudal an der Costa and mit einer Articulatio lingularis ventro-cranial an der Juxta. Beide Gelenke bestehen aus einer Zone flexiblen Materiales.

Introduction

The valvae are the most caudal, largest, movable parts of the male genitalia of Lepidoptera. Their function is to clasp and hold the female abdomen in the course of copulation (NUSS & SPEIDEL, 2005, STOKOLNIKOV, 1967). They are the heftiest paired part of the genitalia. In idle state, they enclose laterally the genitalia proper. The expression „valva" originates from the first half of the 19th century (BURMEISTER, 1832, EYER, 1924). A number of synonyms have appeared since, treated synoptically by several authors (DIAKONOFF, 1954, SIBATANI et al., 1954). At present, the terminus „valva" (pl. valvae) is relevant for all groups of Lepidoptera. Due to the morphological variability, it is very difficult to specify reliable features generally valid for all Lepidoptera (SIBATANI, 1972). In the genus *Eupithecia*, the anatomy of the valvae is relatively simple. Generally, various parts of the valvae, above all, the margins, are highly differentiated individually (ITÄMIES & TABELL, 1997). The most noticeable variability within *Eupithecia* is manifested in the area of the processus ventralis, which is dealt with in the present contribution.

Methods

All studied 85 species of the genus *Eupithecia* are identical with the material used in the previous study (KUBÍN & PROCHÁZKA, 2012). Also the lists of localities, collectors of species used and deposition of preparations included there relate also to the present contribution.

After preparing separated abdomens in a hot 5 % solution of NaOH, all scales were removed with a brush and the genitalia were mechanically dislodged. Valvae in dorsal position, were spread horizontally (using two fine brushes) on a slide in 70 % ethanol. After reversing the genitalia in dorsal position, its tegumen, uncus, rectum, and vinculum were removed mechanically in order to obtain better visibility of the attachment of valvae to the diaphragm. It proved effective to perform this operation on electrophoretic strips (fa. Oxoid) moistened with water, which reduced sliding of the specimen on the glas. Fixation under cover slips in 70 % ethanol ran for 60 to 120 min. After a short exposition in absolute ethanol preparations were enclosed in Euparal. They were photographed with a digital camera, using objective magnification 4x or 10x. After the conventional preparation process, documentation was performed with the scanning electron microscope TESLA BS 300 (KUBÍN, 2003). For work with this device,

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

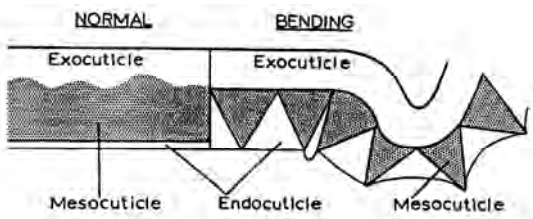
preparations were drained through a rising series of aceton in a CO_2 atmosphere, then plated with gold. They were photographed on the FOMA 100 ASA film (KUBÍN, 2003).

Results

The inner walls of the valves are covered with dense hairs which have dentate surface seen in higher magnification (Fig. 2). In some species, a protrusion may be seen, the processus ventralis (Figs. 1), morphologically so prominent that it can serve as an additional criterion for determination (for example figs. 34, 44). It is depicted in taxonomically oriented papers (WEIGT, 1987, 1988, 1990, 1991, 1993, MIRONOV, 2003, BOLTE, 1990, PETERSEN, 1910). The dorsal margin of the valvae is bordered by a sclerotized band usually referred to as costa valvae (Figs. 1, 5) supporting their firmness (SIBATANI, 1972, DIAKONOFF, 1954, POVOLNÝ, 1956, CHOI, 1997, FÄNGER & NAUMANN, 1998, HAUSMANN, 1994). The ventro-cranial margin of each valva, reaching from the processus ventralis to the articulatio lingularis is called sacculus (Fig. 5), its sclerotization varies. The valvae are movably attached to the lateral margin of the diaphragma in two points (Fig. 5). The attachment is realized dorso-caudally by an articulatio costalis (Figs. 4, 6), ventro-cranially, the valvae are connected with the diaphragma (resp. juxta) through a prominence formed by a little tongue called articulatio lingularis (Figs. 4, 8, 9, FÄNGER & NAUMANN, 1998).

Articulatio costalis

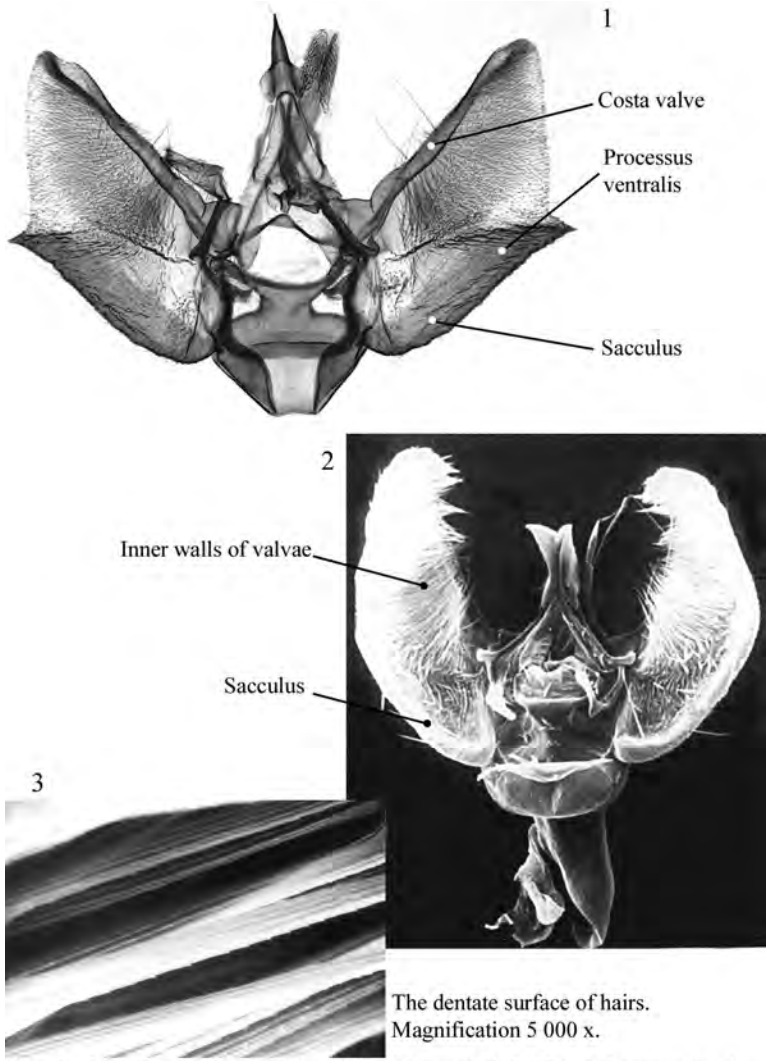
The costa divides into two prominences in cranio-proximal direction (Fig. 6, NUSS & SPEIDEL, 2005), the cranial one merges into the coniunctio intercostalis which connects the costal margins of both valvae transversally (Fig. 4). The valvae are not connected with the diaphragma by a typical anatomical joint, the latter being replaced with flexible material. The name proposed for this formation is iunctura flexibilis (SCHRÖDER, 1900). Its base is fixed to the transtilla and its apex to the costa close to its bifurcation (Figs. 6, 7). Its character corresponds with the arhroidal membranes (HELPBURN, 1985, WIGGLESWORTH, 1956). It represents a sort of a rigid chitin wall in which the mesocuticular layer is conically modified in such a way that beween its cones, similar conical forms of the endocuticular layer, are inserted (graph 1. according to SHARPLIN, 1963).



Graph 1. Diagrammatic vertical sections of cuticle

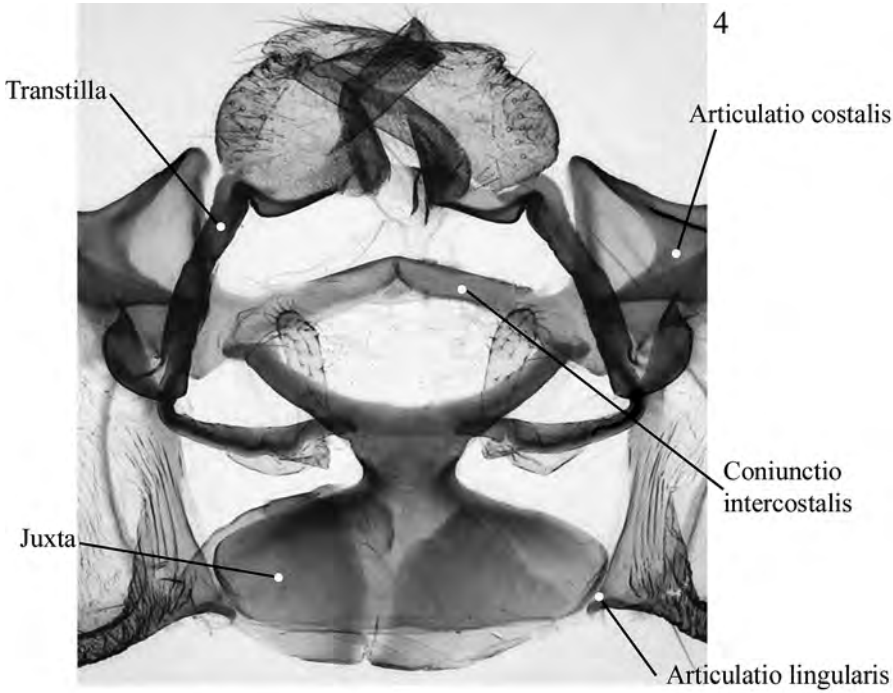
© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

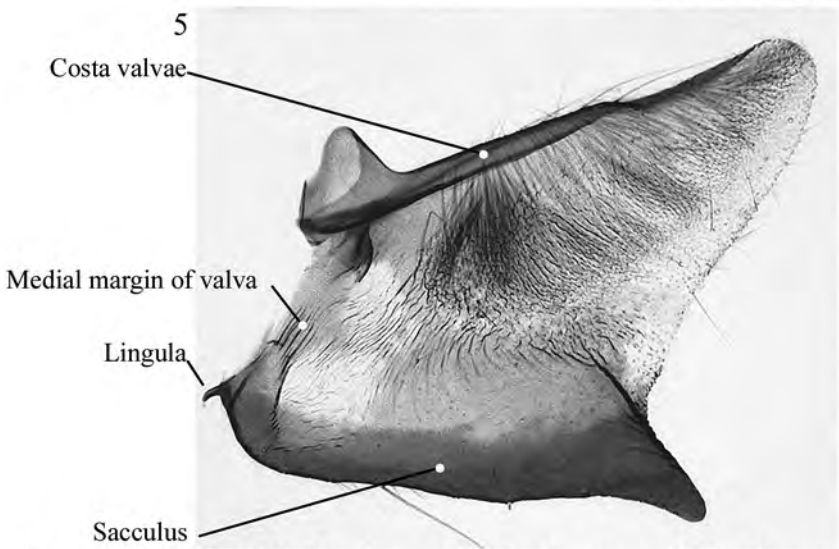
This material offers sufficient flexibility. Similarly modified layers may be found in other parts of the body (e.g. in the attachments of wings or legs, where movability, firmness and flexibility is demanded) (SHARPLIN, 1963, GORB, 2001). The mobility of the valves during copulation is relatively small, which is reflected in the quality of the material described. In the picture acquired in the scanning electron microscope, the iunctura flexibilis appears as a smooth surface of exocuticular layer (Fig. 2), as opposed to the pictures from the optical microscope where a mosaic inner structure of the iunctura flexibilis is visible (Fig. 7, SHARPLIN 1963).



Figs. 1 - 3. 1. The total preparation of the male genital. 2. The total preparation in scanning electron microscope. 3. The detail of hairs high magnification.

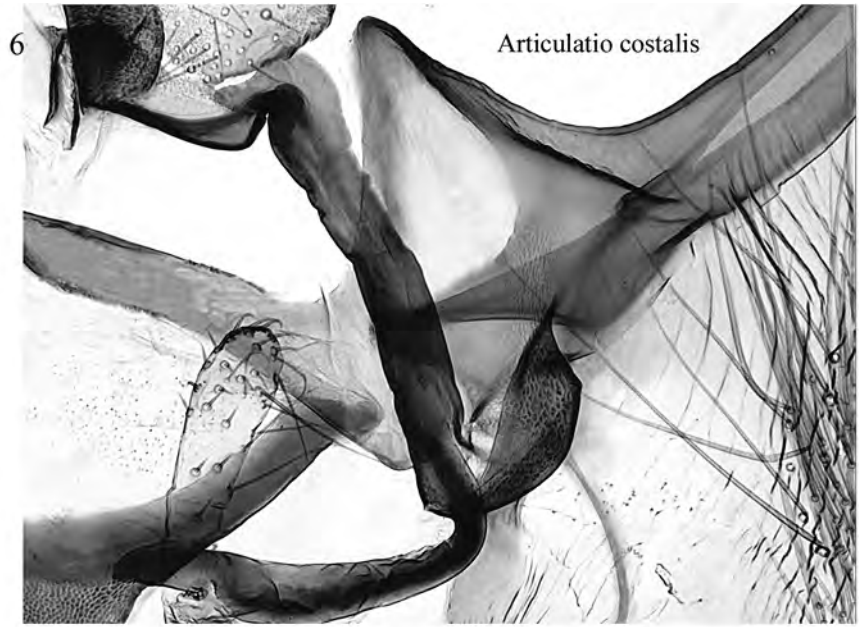
© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

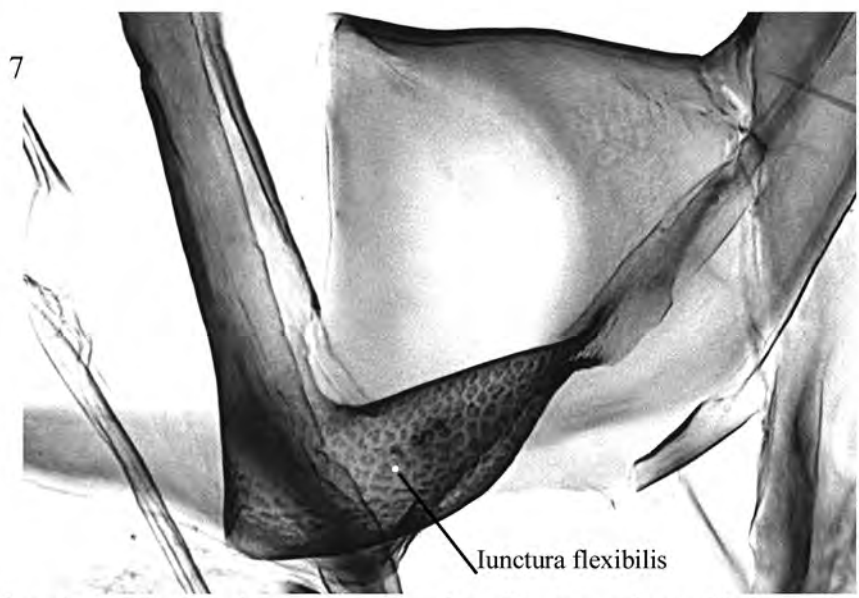




Figs. 4 - 5. 4. The genital after tegumen and vinculum removal (*E. selinata).*
5. Valva with inner margin and both joints (*E. abreviata*).

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



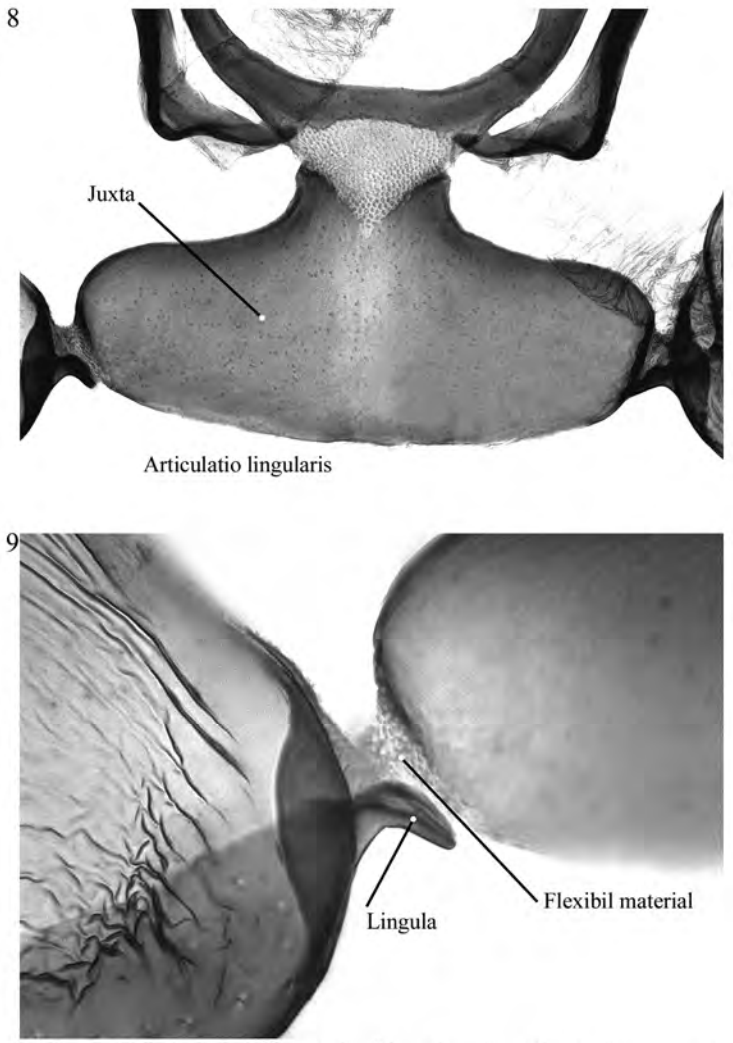


Figs. 6 - 7. 6. Articulatio costalis conjunction with costa and transtilla (*E. intricata*)
7. The detail of iunctura flexibilis of articulatio costalis (*E. intricata*).

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

Articulatio lingularis

It is a tongue-like protuberance of the margin of the valvae which connects the juxta with the proximal end the valva (Figs. 8, 9, OKAGAKI and al., 1955, BEIRNE, 1942). Its connection to the juxta is realized by flexibile material (Fig. 9, SHARPLIN, 1963), similarly to the articulatio costalis, the only diference is in the fact that this material does not form an anatomicaly defined structure but is spread individually between juxta and lingula valvae.



Figs. 8 - 9. 8. Articulatio lingularis with conjunction to juxta after removal of vinculum. 9. The detail of articulatio lingularis (*E. ochridata*).

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

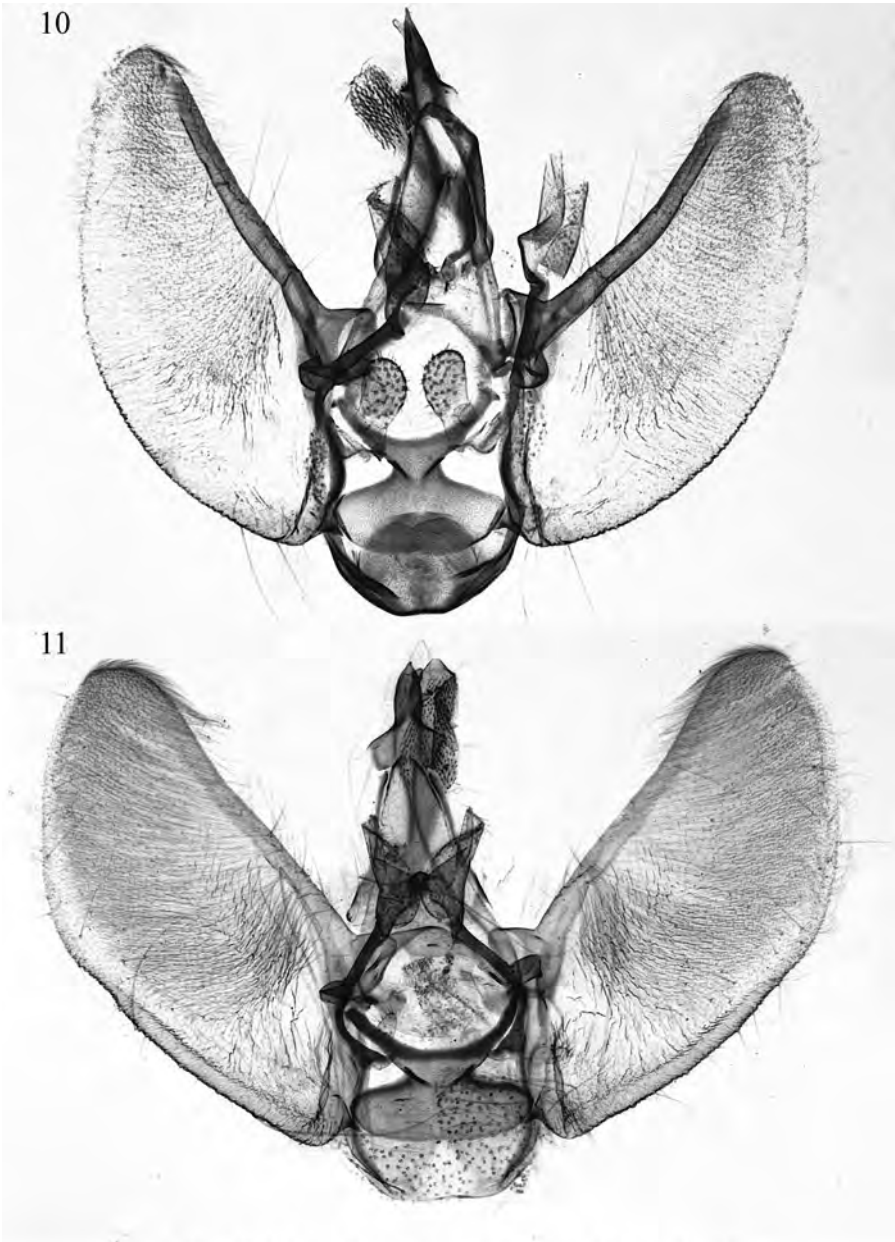
The studied 85 species of the genus *Eupithecia* were classified into two groups according to the morphological formation of the processus ventralis.

Group 1: Processus ventralis totally absent. This is the larger group, including 60 species (60 species = 70,59 % for example Figs. 10, 11).

Group 2: Processus ventralis significant as regards its form, species specific and thus determinatively exploitable (25 species =29,41 % for example 12 - 48).

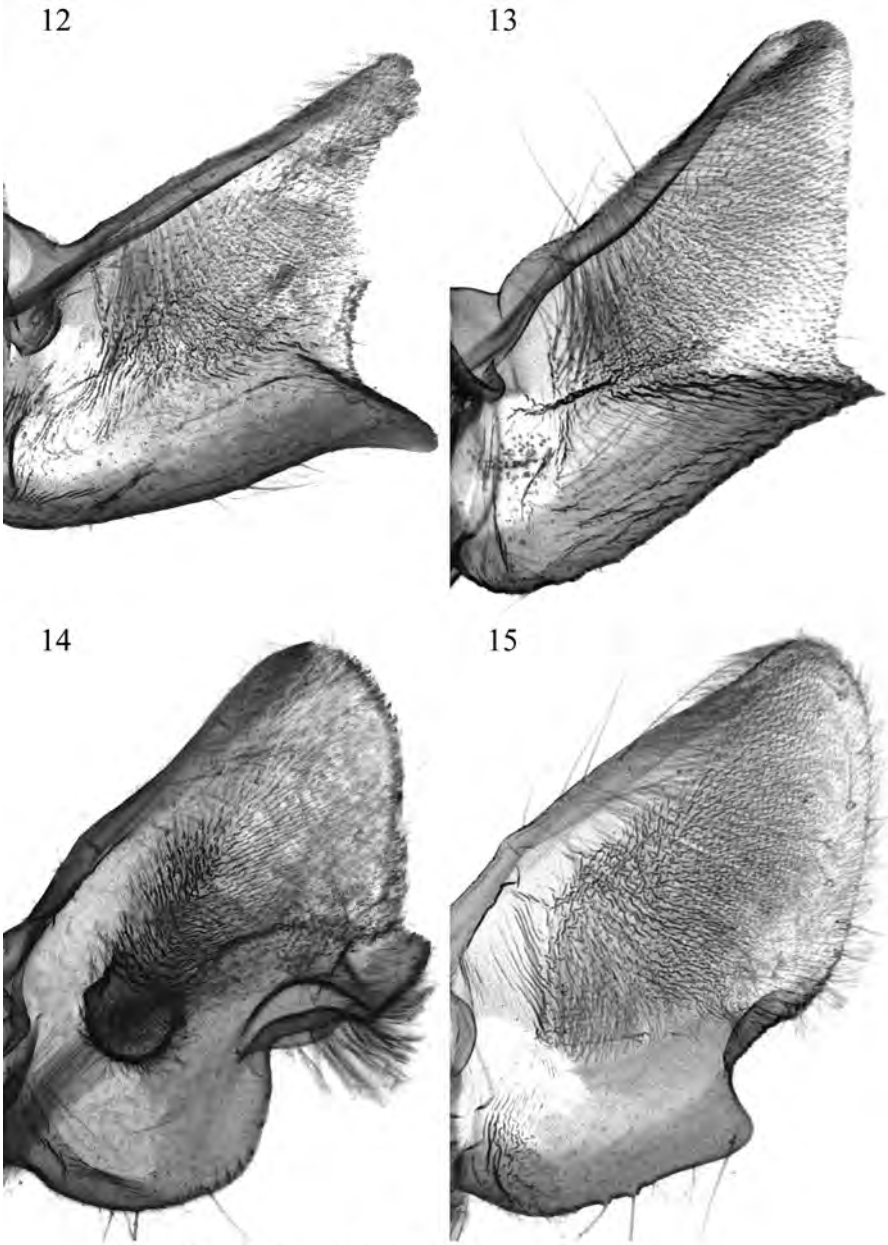
Species	**Group**	**Figs.**
E. abbreviata STEPHENS, 1831	2	12
E. centaureata (DENIS & SCHIFFERMÜLLER, 1775)	2	14
E. denotata (HÜBNER, 1813)	2	15
E. distinctaria HERRICH-SCHÄFFER, 1848	2	16, 18
E. egenaria HERRICH-SCHÄFFER, 1848	2	17, 19
E. ericeata (RAMBUR, 1833)	2	32
E. exiguata (HÜBNER, 1813)	2	20
E. extraversaria HERRICH-SCHÄFFER, 1852	2	21
E. extremata (FABRICIUS, 1787)	2	22
E. gelidata MÖSCHLER, 1860	2	24, 26
E. gueneata MILLIÈRE, 1862	2	23
E. innotata (HUFNAGEL, 1767)	2	25, 27
E. insigniata (HÜBNER, 1790)	2	33
E. lanceata (HÜBNER, 1825)	2	34
E. lariciata (FREYER, 1841)	2	36, 38
E. nanata (HÜBNER, 1813)	2	28, 30
E. ochridata SCHÜTZE & PINKER, 1968	2	29, 31
E. orana (DIETZE, 1910)	2	13
E. oxycedrata (RAMBUR, 1833)	2	37, 39
E. pusillata (DENIS & SCHIFFERMÜLLER, 1775)	2	35
E. quercetica PROUT, 1938	2	40, 42
E. scopariata (RAMBUR, 1833)	2	44, 46
E. silenata ASSMANN, 1848	2	41, 43
E. tantillaria BOISDUVAL, 1840	2	48
E. tripunctaria HERRICH-SCHÄFFER, 1852	2	45, 47

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



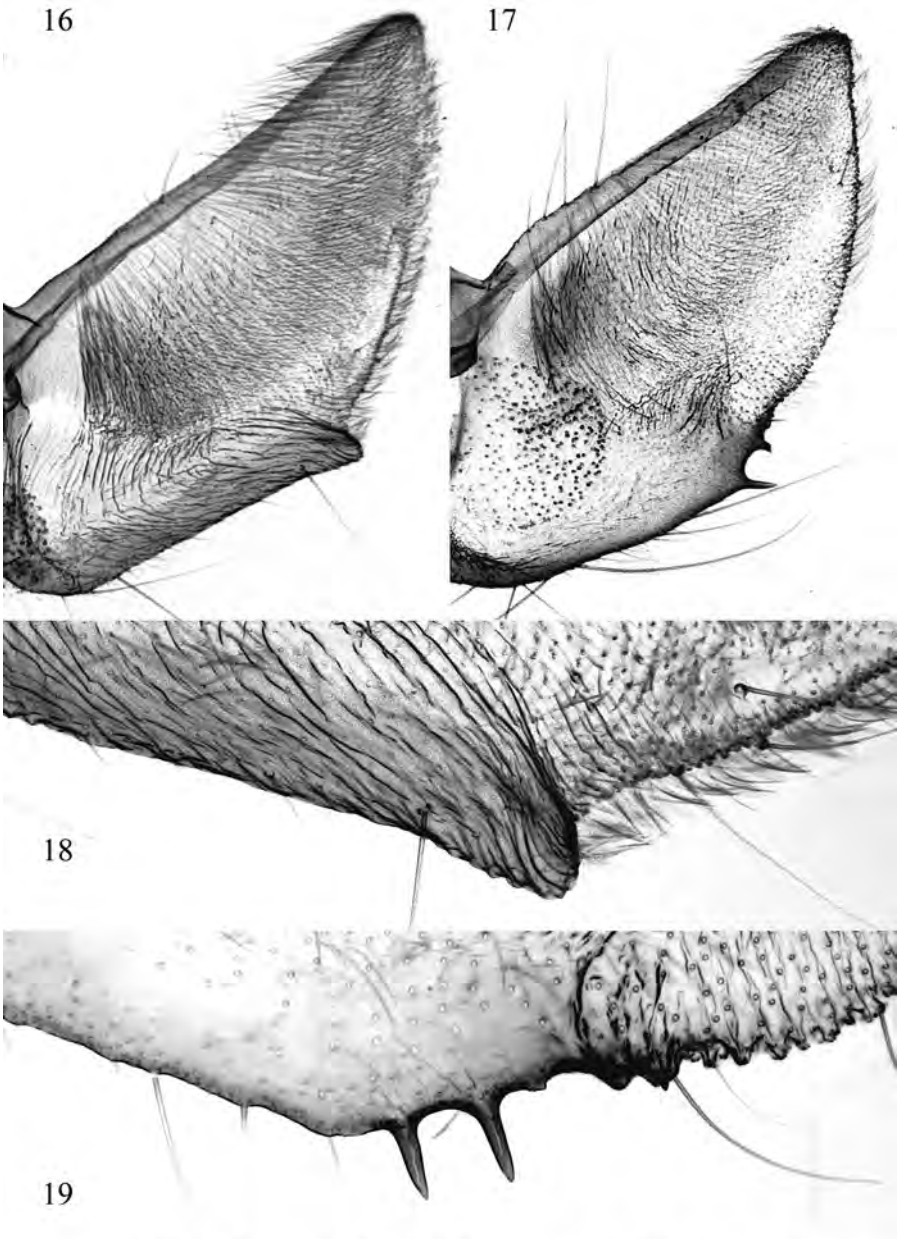
Figs. 10 - 11. **Group 1:** 10. *E. irriquata.* 11. *E. plumbeolata.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



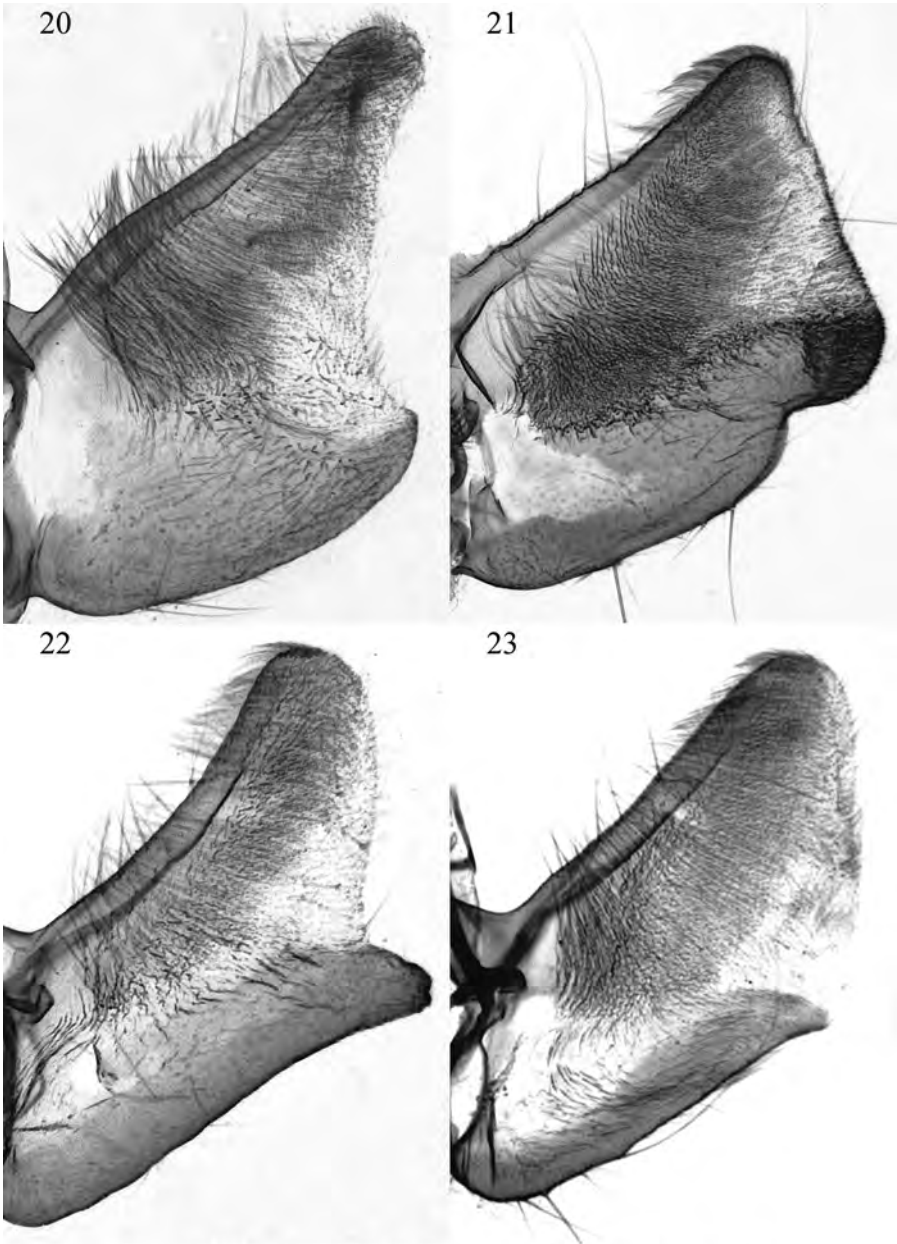
Figs. 12 - 15. **Group 2:** 12. *E. abbreviata.* 13. *E. orana.* 14. *E.centaureata.* 15. *E. distinctaria.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



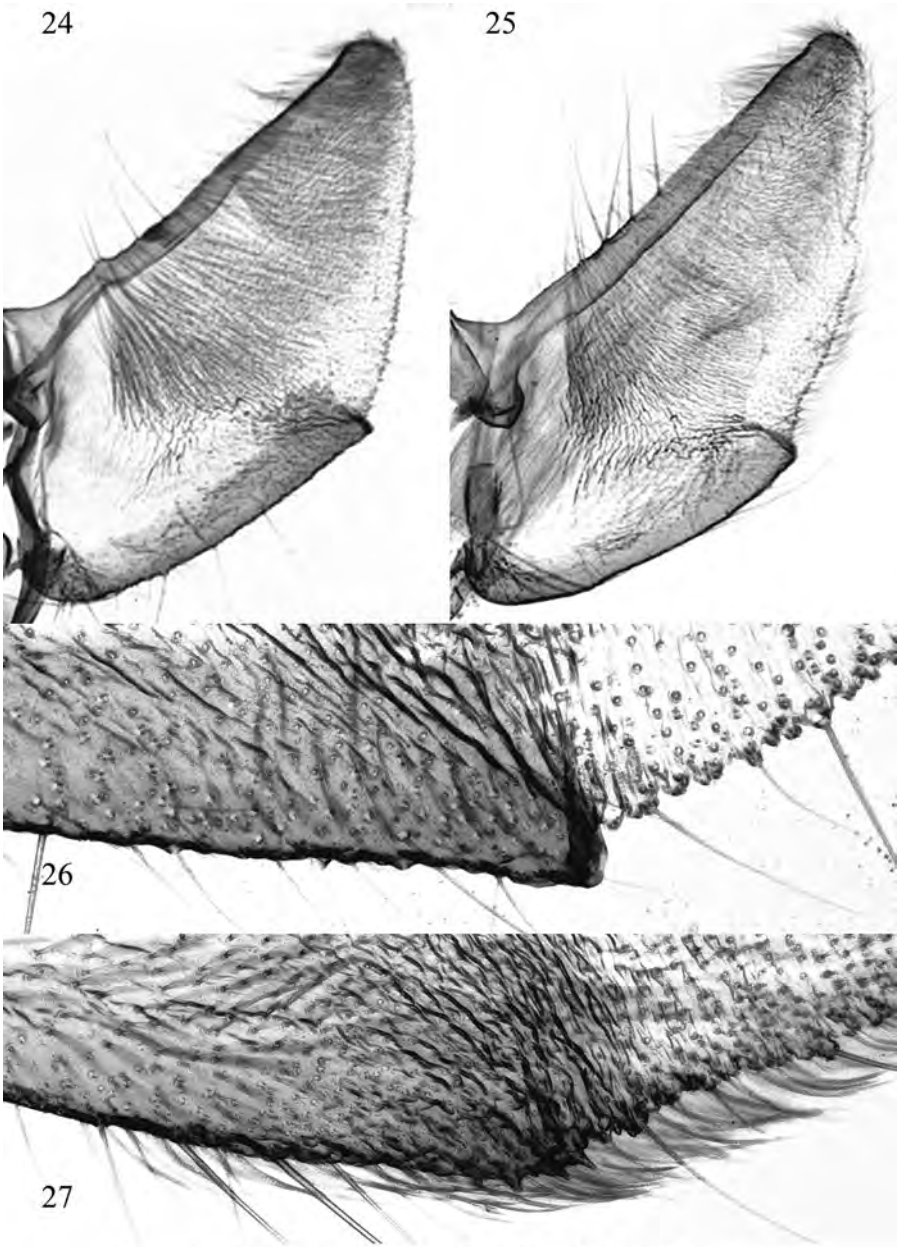
Figs. 16 - 19. **Group 2:** 16, 18. *E. denotata.* 17, 19. *E. egenaria.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



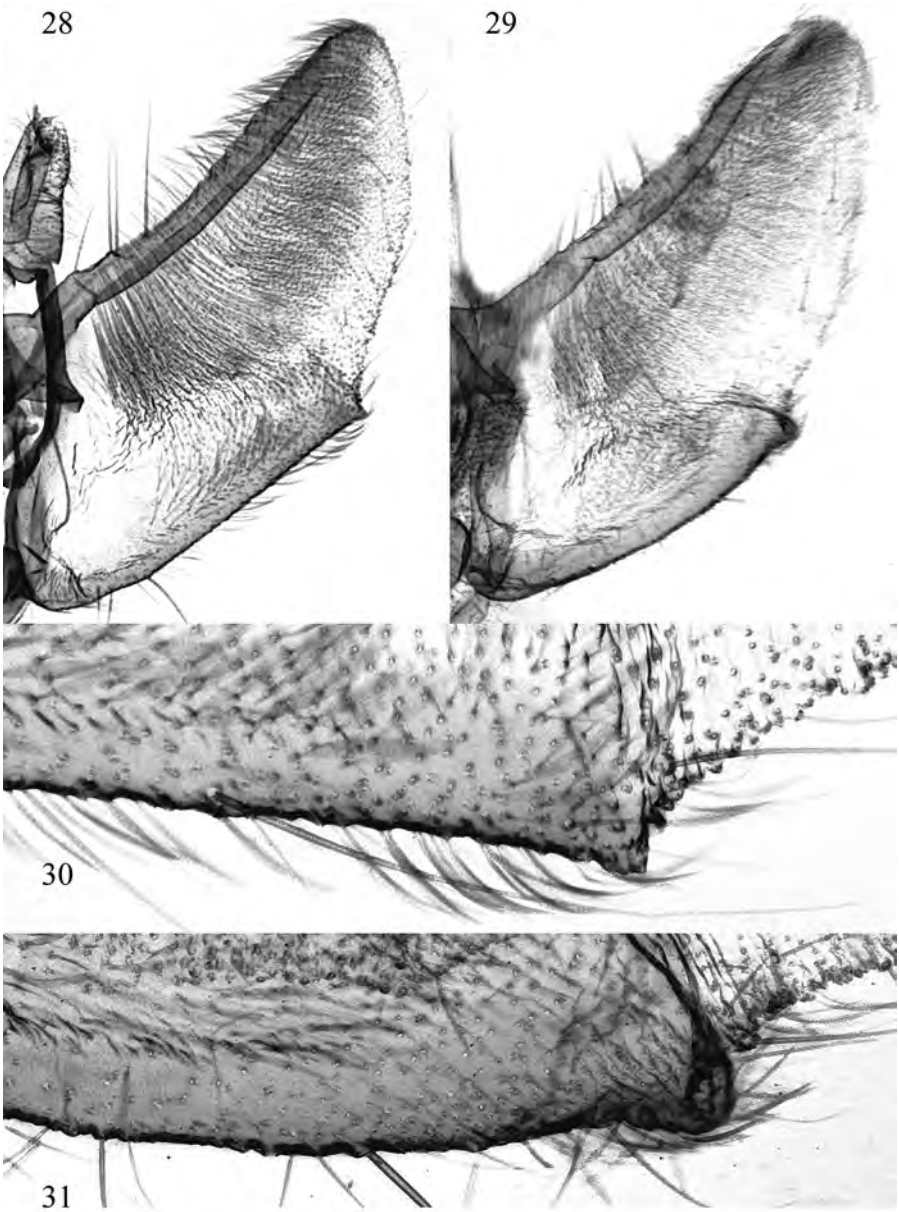
Figs. 20 - 23. **Group 2:** 20. *E. exiguata.* 21. *E. extraversaria.* 22. *E.extremata.* 23. *E. gueneata.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



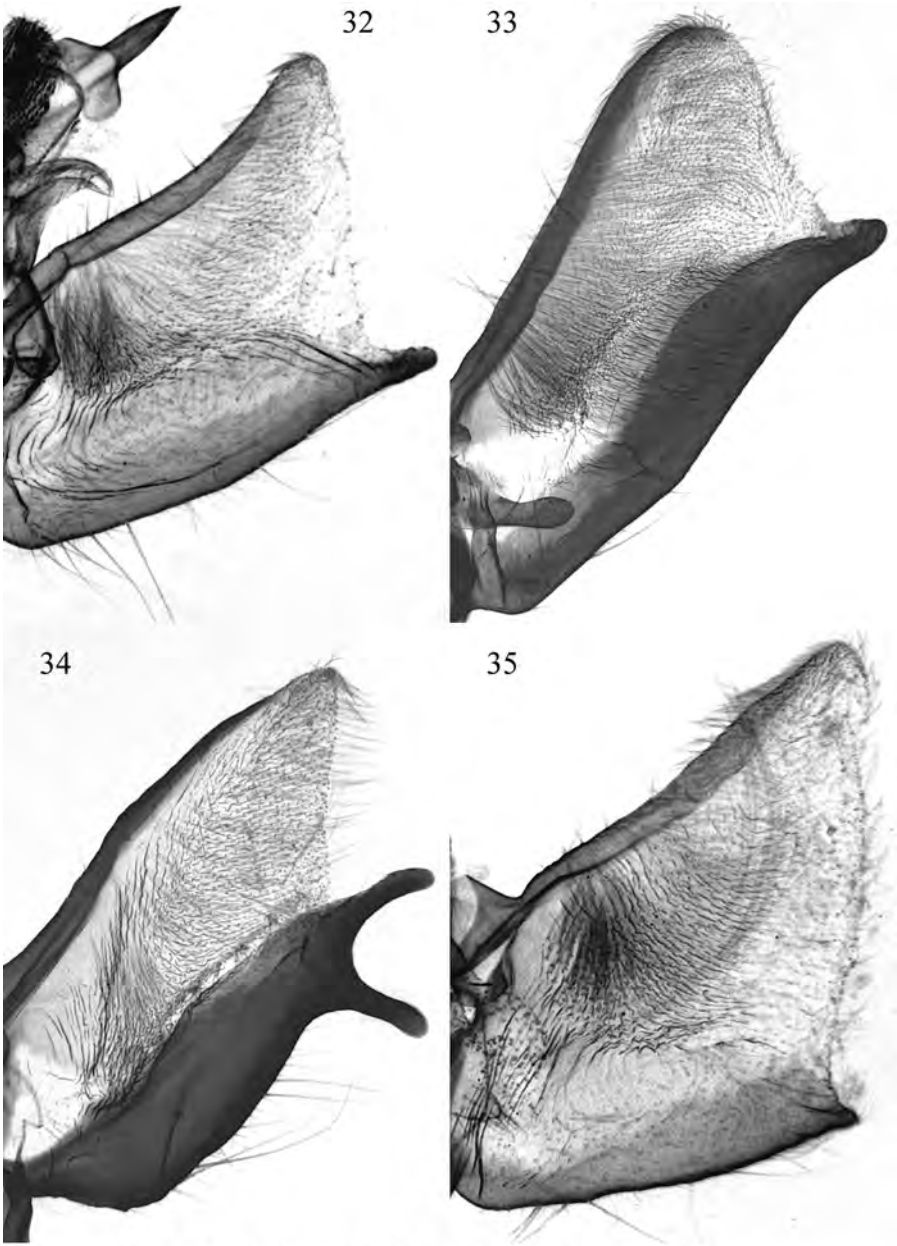
Figs. 24 - 27. **Group 2:** 24, 26. *E. gelidata.* 25, 27. *E. innotata.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



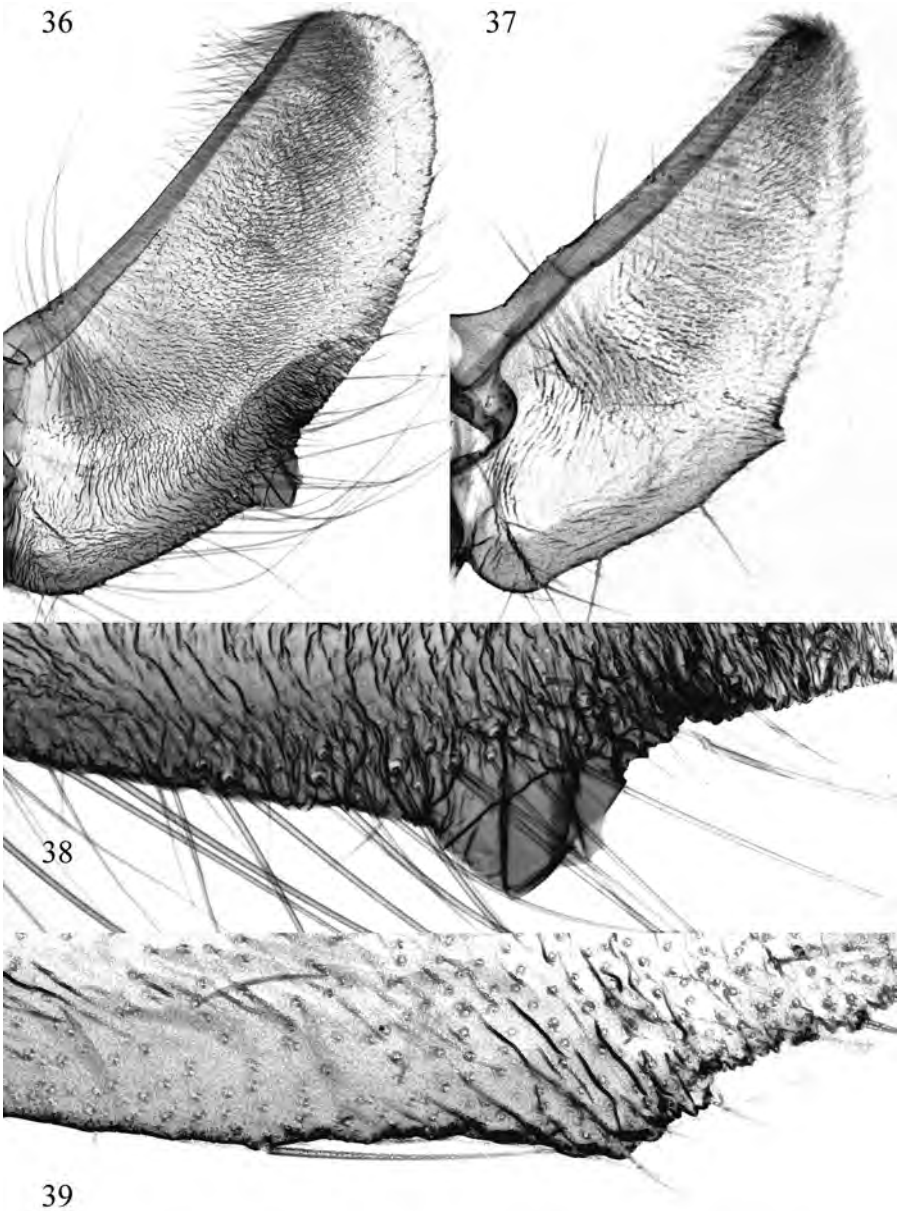
Figs. 28 - 31. **Group 2:** 28, 30. *E. nanata.* 29, 31. *E. ochridata.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



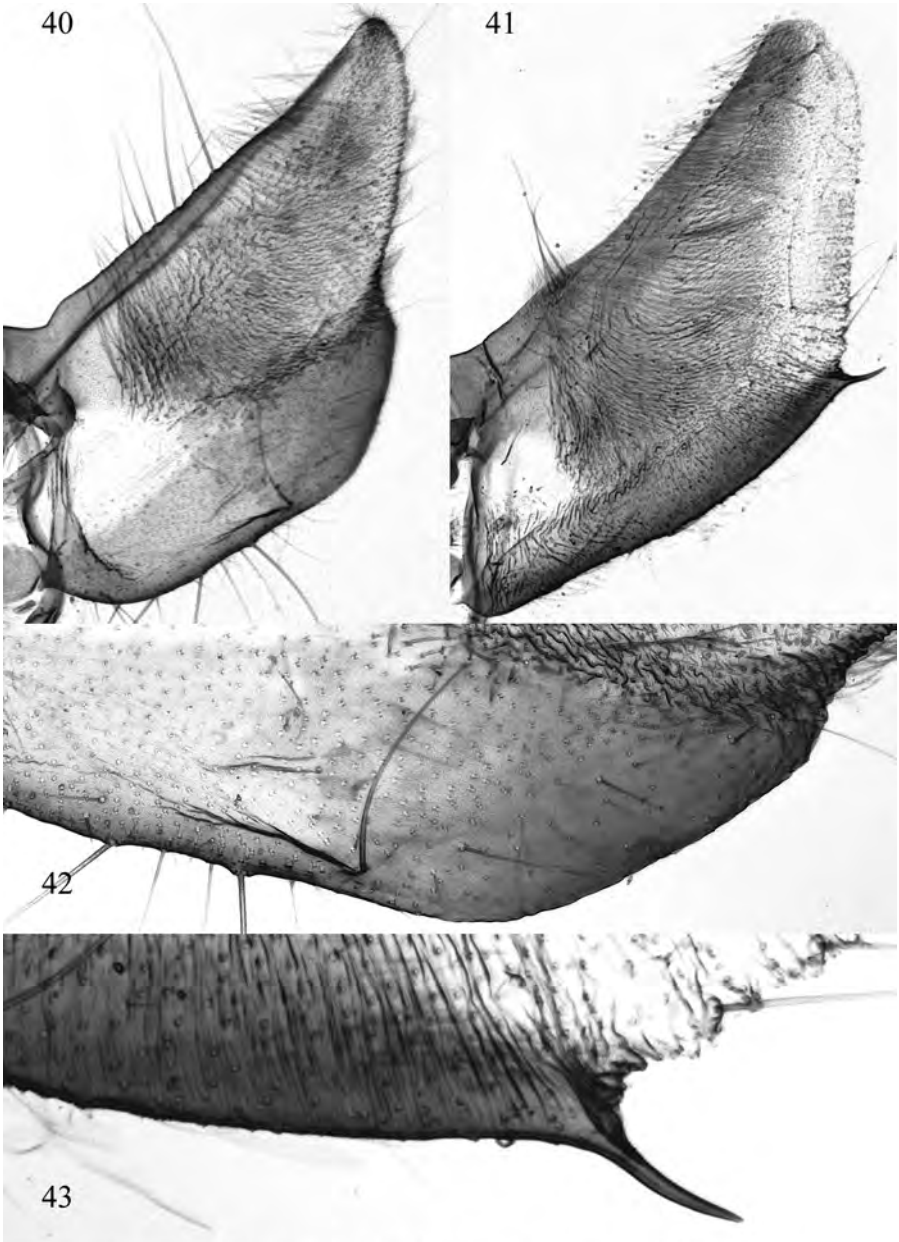
Figs. 32 - 35. **Group 2:** 32. *E. ericeata.* 33. *E. insigniata.*
34. *E. lanceata.* 35. *E. pusillata.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



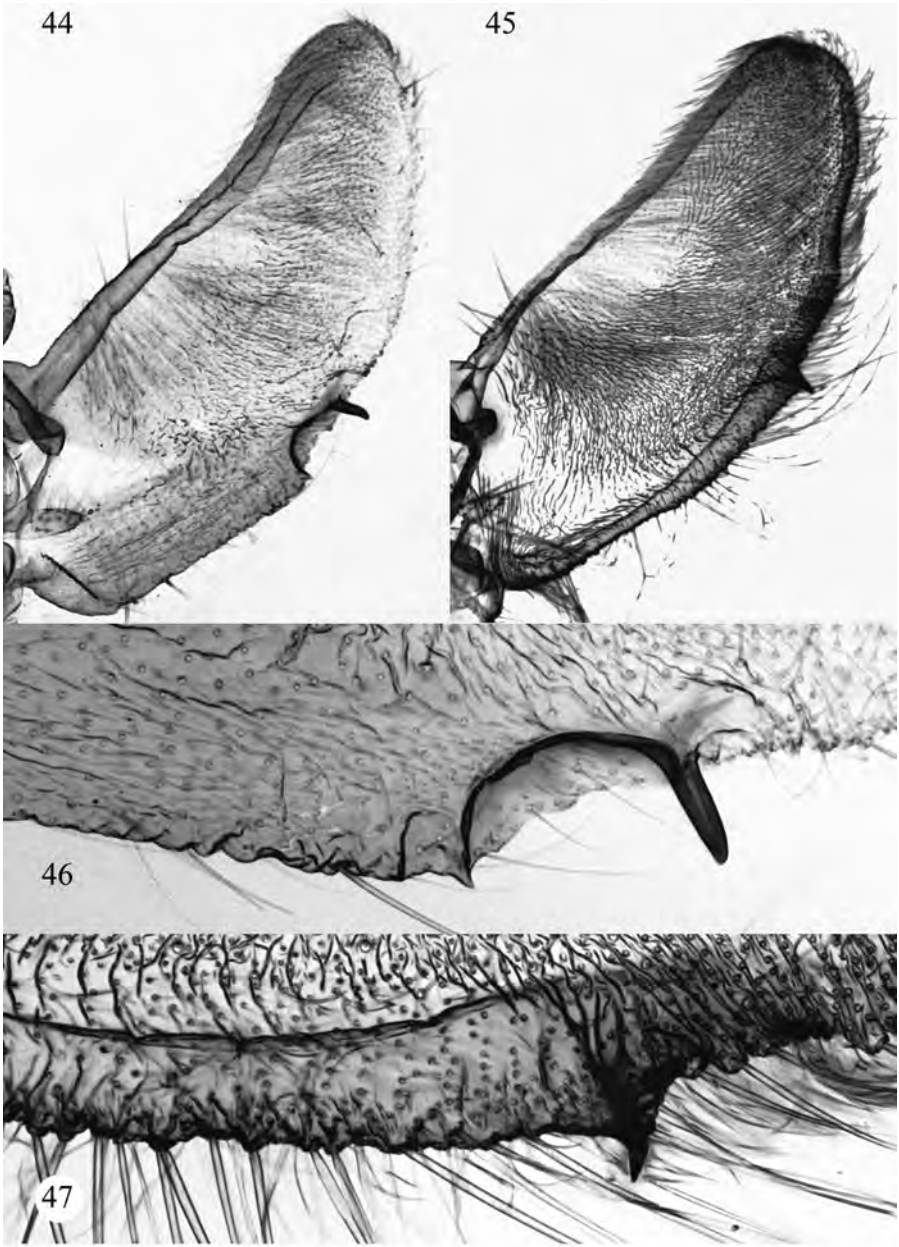
Figs. 36 - 39. **Group 2:** 36, 38. *E. lariciata.* 37, 39. *E. oxycedrata.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



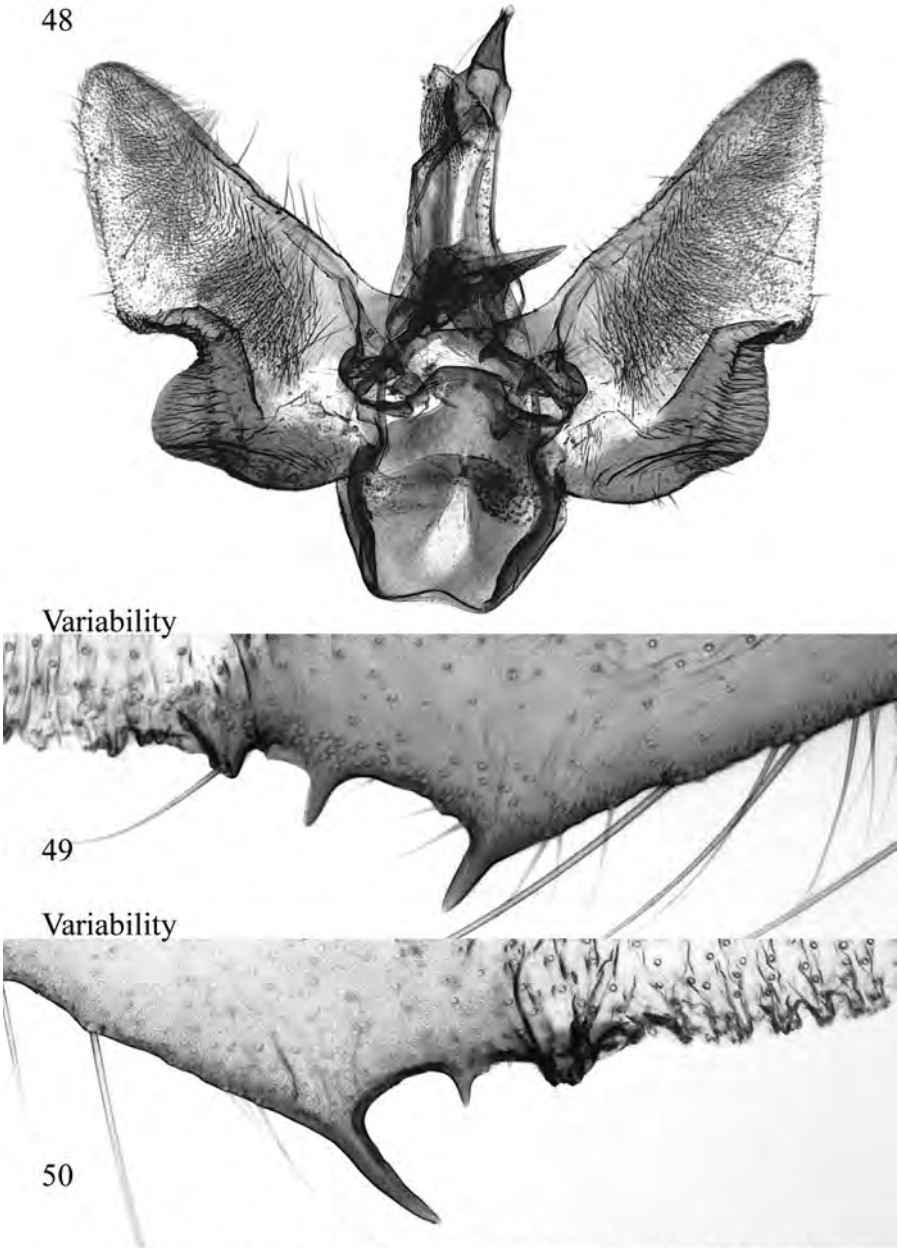
Figs. 40 - 43. **Group 2:** 40, 42. *E. quercetica.* 41, 43. *E. silenata.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



Figs. 44 - 47. **Group 2:** 44, 46. *E. scopariata*, 45, 47. *E. tripunctaria*.

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at



Figs. 48 - 50. **Group 2:** 48. *E. tantillaria.* 49, 50. The morphological variability between the right and left Processus ventralis *E. egenaria.*

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

Discussion

The species determination according to the morphology of the processus ventralis is limited by the fact that a large number of species of the genus *Eupithecia* simply lack any processus ventralis. Only in 29,41 % of the species of this genus (Group 2), a processus ventralis is present and morphologically characteristic. However, it represents an important character in this group which can be used for easy determination. The shape is so typical that not even the high variability can cast doubt upon the reliability of the results (see *E. distinctaria*, Figs. 16, 18). This variability refers mostly to the size of the prominence. The frequent variability between the right and left sides of same individual is interesting (see for example *E. egenaria*, Figs. 49, 50). Nevertheless, the processus preserves its typical appearance. The preparation of the valvae is so simple that even the less experienced workers are not exposed to any substantial problems. No anatomical deformations are caused after the transfer of the valvae into enclosing medium (Euparal or a similar chemical), even after long deposition.

The attachment of the valvae to the diaphragma may be of some anatomical interest. Each valva is connected with the diaphragma in two points. From the anatomical standpoint, neither represents a typical joint due to the relatively limited movability in the course of the copulation. The joints are replaced by flexibile material (SHARPLIN, 1963, GORB, 2001, FÄNGER & NAUMANN, 1998), which is absolutely sufficient for the movements demanded. Similar connections may be found in other parts of the body, e.g. wings, limbs, intersegmental membranes, etc. (GORB, 2001). A histological analysis of these connections would require a separate treatise. The present contribution deals only with the genus *Eupithecia*, but a substantial diversity may be expected in the different groups of Lepidoptera. The connection of the valvae with the diaphragma is described using a Latin terminology (DIAKONOFF, 1954). The names of individual anatomical parts still have working character, and so may be regarded as proposals.

References

BEIRNE, B. P. (1942): The morphology of the male genitalia of the Lepidoptera. – Entomologist`s Record and Journal of Variation **54**: 17-22 and 37-39.

BOLTE, K. B. (1990): Guide to the Geometridae of Canada. VI. Subfamily Laremtiinae.1. Revision of the genus *Eupithecia*. – Memoirs of the Entomological Society of Canada No. **151**: 1-253.

BURMEISTER, H. C. C. (1832): Handbuch der Entomologie. **1**. Allgemeine Entomologie. – Berlin, xvi + 696 pp.

CHOI, S.-W. (1997): A phylogenetic study on genera of Cidariini from the Holarctic and the Indo-Australian areas (Lepidoptera: Geometridae: Larentiinae). – Systematic Entomology **22**: 287-312.

DIAKONOFF, A. (1954): Considerations on the terminology of the genitalia in Lepidoptera. – The Lepidopterists' News **8**: 67-74.

EYER, J. R. (1924): The comparative morphology of the male genitalia of the primitive Lepidoptera. – Annals of the Entomological Society of America **17**: 275-328.

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

FÄNGER, H. & NAUMANN, C. M. (1998): Genital morphology and copulatory mechanism in *Zygaena trifolii* (ESPER,1783) (Lepidoptera, Zygaenidae). – Acta Zoologica (Stockholm) **79**: 9-24.

GORB, S. (2001): Attachment Devices of Insect Cuticle. – Kluwer Academic Publishers, N. York, Boston, Dordrecht, London, Moscow, 305 pp.

HAUSMANN, A. (1994): Morphology and taxonomy of the species belonging to the genus *Myinodes* MEYRICK, 1892 (Lepidoptera, Geometridae). – Nota Lepidopterologica **17**: 31-43.

HELPBURN, H. R. (1985): Structure of the integument. *In*: KERKUL, C. A. & GILBERT, L. L. (eds.) (1985): Comprehensive insect physiology, biochemistry and pharmacology – Oxford etc., Pergamen press, pp 1-58.

ITÄMIES, J. & TABELL, J. (1997): Variation in male genitalia of *Cleophora vaccinilla* H.-S. (Lepidoptera, Coleophoridae). – Entomologica Fennica **8**: 145-150.

KUBÍN, V. (2003): REM Untersuchungen an der Bursa copulatrix einiger *Eupithecia* Arten, pp. 89 - 90. *In*: EBERT, G. (Ed.): Die Schmetterlinge Baden-Württembergs **9**. - Eugen Ulmer Gmbh, Stuttgart.

KUBÍN, V. & PROCHÁZKA, J. (2012): The importance of morphology of abdominal segment A8 for the determination of the males of the genus *Eupithecia* CURTIS 1825 (Lepidoptera, Geometridae). – Entomofauna **33**: 213-272.

MIRONOV, V. (2003) The Geometrid Moths of Europe, **4**. Larentiinae II (Perizomini and Eupitheciini). – Apollo Books, Stenstrup Denmark, 463 pp.

NUSS, M. & SPEIDEL, W. (2005): Introduction pp. 7-15. In: B. GOATER, M. NUSS, W. SPEIDEL, (2005): Pyraloidea I. Microlepidoptera of Europe **4**. – Apollo Books, Stenstrup.

OKAGAKI, H. & SIBATANI, A. & OGATA, M. & OKADA, Y. (1955): Male genitalia of Lepidoptera: Morphology and Nomenclature. II. Morphological significance of sacculus and furca. – Annals of the Entomological Society of America **48**: 438-442.

PETERSEN, W. (1910): Ein Beitrag zur Kenntnis der Gattung *Eupithecia* CURT. – Deutsche Entomologische Zeitschrift Iris **22**: 203- 313.

POVOLNÝ, D. (1956): Zevní pářící ústroje řádu Lepidoptera jako podklad pro studia morfologicko - anatomická. – Práce brněnské základny Československé akademie věd **28**: 315-345.

SCHRÖDER, CH. (1900): Die Untersuchungen der männlichen Genitalanhänge, als Kriterium für die Artberechtigung im Genus *Eupithecia* (Lepidoptera, Geometridae). I. *Eupithecia innotata* HUFN. – Illustrierte Zeitschrift für Entomologie **5**: 305-307.

SHARPLIN, J. (1963): A flexible cuticle in the Wing Bases of Lepidoptera. – The Canadian Entomologist **95**: 96-100.

SIBATANI, A. (1972): Male Genitalia of Lepidoptera: Morphology and Nomenclature IV. Notes on Tuxen´s „Taxonomist´s glossary of genitalia in insects“: Second enlarged edition. – Journal of the Lepidopterist's Society **26**: 117-122.

SIBATANI, A. & OGATA, M. & OKADA, Y. & OKAGAKI, H. (1954): Male genitalia of Lepidoptera: Morphology and Nomenclature. I. Divisions of valvae in Rhophalocera, Phalaenidae Noctuidae and Geometridae. – Annals of the Entomological Society of America **47**: 93-106.

STEKOLNIKOV, A. A. (1967): Functional morphology of the copulative organ in archaic moths and general directions in the evolution of genitalia in Lepidoptera. – Revue d' Entomologie de I'URSS **46**: 670-688.

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

WEIGT, H. J. (1987): Die Blütenspanner Mitteleuropas (Lepidoptera, Geometridae: Eupitheciini). Teil 1. Biologie der Blütemspanner. – Dortmunder Beiträge zur Landeskunde **21**: 5-57.

WEIGT, H. J. (1988): Die Blütenspanner Mitteleuropas (Lepidoptera, Geometridae: Eupitheciini) Teil 2: *Gymnoscelis rufifasciata* bis *Eupithecia insigniata*. – Dortmunder Beiträge zur Landeskunde **22**: 5-81.

WEIGT, H. J. (1990): Die Blütenspanner Mitteleuropas (Lepidoptera, Geometridae: Eupitheciini) Teil 3: *Eupithecia sinuosaria* bis *pernotata*. – Dortmunder Beiträge zur Landeskunde **24**: 5-100.

WEIGT, H. J. (1991): Die Blütenspanner Mitteleuropas (Lepidoptera, Geometridae: Eupitheciini) Teil 4: *Eupithecia satyrata* bis *indigata*. – Dortmunder Beiträge zur Landeskunde **25**: 5-106.

WEIGT, H. J. (1993): Die Blütenspanner Mitteleuropas (Lepidoptera, Geometridae: Eupitheciini) Teil 5: *Eupithecia pimpinellata* bis *lanceata*. – Dortmunder Beiträge zur Landeskunde **27**: 5-108.

WIGGLESWORTH V. B. (1956): The haemocytes and connective tissue formation in an insect, *Rhodinus prolixus* (Himenoptera). – Quarterly Journal of Microscopical Science **97**: 89-98.

Acknowledgements

The authors express their sincere thanks to P. Čila, M. Dvořák, J. Jaroš, J. Liška, J. Marek, I. Novák, J. Skyva, J. Šumpich, B. Vodrlind, for lending of some uncommon species from their personal collections, also to the curators who granted the access to museum collections and lended some useful materials: F. Krampl, National Museum, Prague, Czech Republic, M. Nuss Senckenberg Naturhistorische Samlungen Dresden. We are gratefull to M. Jindra for revising the English, to K. Bumbálková, The Library of the Academy of Science of Czech Republic for the carefull assistence with literature sources, J. Kudrna for technical help with Electron Mickroscope of the Veterinary Research Institute, Brno, Czech Republic, to F. Vegliante, Senckenberg Naturhistorisches Museum Dresden for the consultations and transmission of literature sources.

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

Present addresses of the authors:

KUBÍN Vladimír
V rovinách 14
Praha 4
140 00
Czech Republic
E-mail: morfologievk@seznam.cz

PROCHÁZKA Josef
Za Potokem 372
Nižbor
267 05
Czech Republic
E-mail: prochazka.nizbor@seznam.cz

© Entomofauna Ansfelden/Austria; download unter www.zobodat.at

Literaturbesprechung

WESTHEIDE, W., RIEDER, G. (Hrsg.): Spezielle Zoologie. Teil 1: Einzeller und Wirbellose Tiere. - Springer-Verlag, Berlin-Heidelberg 2013. 3. Aufl., 892 S.

Mit der allgemeinen Zunahme an wissenschaftlichen Publikationen ist es mittlerweile notwendig geworden, auch (klassische) Lehrbücher in immer kürzeren Zeitperioden neu aufzulegen. Die "Spezielle Zoologie" der Einzeller und Wirbelloser Tiere liegt nun bereits in der 3. Auflage vor und hat sich als DAS deutschsprachige Standardwerk der systematischen Zoologie etabliert. Eine veränderte phylogenetisch-systematische Gliederung des Systems der Tiere lässt sich heute vielfach auf molekularbiologische Analysen zurückführen. Aber auch neue Erkenntnisse im morphologischen Bereich ergeben ein immer konkreteres Bild natürlicher Verwandtschaftsverhältnisse der Organismen unserer Erde. Im Bereich der eukaryotischen Einzeller hat die molekulare Systematisierung wieder zahlreiche Umstellungen erforderlich gemacht. Die Großgliederung der Metazoa gewinnt über die Molekularbiologie an Verlässlichkeit.

Begrüßenswert ist die längst überfällige Auflösung der "Articulata", die Auftrennung der Protostomia in Spiralia (Lophotrochozoa) und Ecdysozoa, die Herausnahme der Acoelomorpha aus den Plathelminthes und ihre Zusammenführung mit *Xenoturbella* als Xenocoelomorpha. Die Kapitel über Mollusca, Panarthropoda und Insecta wurden weitgehend neu gestaltet, Abbildungen sind ausgetauscht, verbessert oder ergänzt worden.

Die "Spezielle Zoologie" bleibt spannend und man kann sich schon auf die 4. Auflage freuen.

R. GERSTMEIER

Druck, Eigentümer, Herausgeber, Verleger und für den Inhalt verantwortlich:
Maximilian SCHWARZ, Konsulent f. Wissenschaft der Oberösterreichischen Landesregierung, Eibenweg 6, A-4052 Ansfelden, E-Mail: maximilian.schwarz@liwest.at.

Redaktion: Erich DILLER, ZSM, Münchhausenstraße 21, D-81247 München;
Roland GERSTMEIER, Lehrstuhl f. Tierökologie, H.-C.-v.-Carlowitz-Pl. 2, D-85350 Freising;
Fritz GUSENLEITNER, Lungitzerstr. 51, A-4222 St. Georgen/Gusen;
Wolfgang SPEIDEL, MWM, Tengstraße 33, D-80796 München;
Thomas WITT, Tengstraße 33, D-80796 München.

Adresse: Entomofauna, Redaktion und Schriftentausch c/o Museum Witt, Tengstr. 33, 80796 München, Deutschland, E-Mail: thomas@witt-thomas.com; Entomofauna, Redaktion c/o Fritz Gusenleitner, Lungitzerstr. 51, 4222 St. Georgen/Gusen, Austria, E-Mail: f.gusenleitner@landesmuseum.at

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: Entomofauna

Jahr/Year: 2014

Band/Volume: 0035

Autor(en)/Author(s): Kubin Vladimir, Prochaska Josef

Artikel/Article: The processus ventralis and its applicability in the determination of the males of the genus Eupithecia CURTIS, 1825 (Lepidoptera, Geometridae) 309-332