

The untenability (=Unhaltbarkeit) of the present imaginal and molecular characterization of the Noctuidae s. Hampson and of the Nolidae s.l., s. Kitching & al.- Genitalmorphological characterization of the Hadeninae s.l., s. Kitching & Rawlins. Subfamily Leucaniinae sfam.n., st.n.- Xylenini st.n. (Lepidoptera: Noctuoidea)

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Abstract

The present imaginal-, molecular-systematic division of the quadrifid Noctuoidea (Fibiger & Lafontaine 2005, Lafontaine & Fibiger 2006) is rejected because being based on wrong suppositions, insufficient molecular-genetical investigations Zahiri & al. 2010-2013 (only 8 gene-sections were used of which two were mitochondrial) and for disconcordance with larval-morphological results, Beck 2009. Contrary, parallel investigations on the Hyponomeutoidea with 27 gene-sections (Sohn & al. 2013) brought congruence with the larval-morphological-chaetotactic results by Hasenfuss 1963!, but not when using only 8 gene-sections. Already in these studies of Hasenfuss the Psychidae are demonstrated to be the oldest ditrysian family as is now confirmed by the molecular-genetical investigations of Sohn & al. 2013.-These two different molecular-genetical results demonstrate that as yet there is, within the Lepidoptera, not to expect an automatical compatibility between exact morphological investigations (either on adults or on larvae) and those by molecular-genetical investigations.- Also the aim of the investigations of the Finnish group around Wahlberg & al. to find convincing morphological characters as well in the adults as in the larvae (talk on the SEL-congress 2013: ‘Phylogeny of ditrysian Lepidoptera – progress report of the morphological study’) prove that there are at present heavy dissonances between molecular-genetical and morphological results.

It is evidenced by larval-chaetotactic investigations (Beck 2009) that as well the classic Noctuidae s. Hampson as also the Arctiidae s. Hampson are monophyletic families; these families are here larvally characterized. The same is due to the Nolidae s. Hampson, s. Beck 2009. Besides the Nolinae s.str. = Nolidae s. Hampson all the other subfamilies of the Nolidae s.l., s. Zahiri & al. 2013 – the Diphtherinae, Risobinae, Collomeninae, Beaninae, Eligminae, Westermanniinae, Chloephorinae – belong to the Noctuidae s. Hampson. By Zahiri & al. 2013 the Sarrothripinae and Eariadinae are combined as tribes with the Chloephorinae in the Nolidae s.l. Here these three groups are treated as subfamilies within the Noctuidae s. Hampson, s. Beck 1999.

For the first time the subfamily Hadeninae of the Noctuidae is unequivocally characterised by the longitudinal fold of the costa and backward processes of this. On this basis the subfamily Xyleninae s. Fibiger is synonymised with the Hadeninae: Xylenini **st.n., comb. nov.**, Xyleninae **syn.n.**- Because the specific genital-morph. character of the Hadeninae is nearly completely reduced at the

Leucaniini and substituted by new characters this tribe is raised to subfamily-status, **sfam.n.**, **st.n.**

The study of the cause of the descendance of the triline hindwing-venation from the quadrifine-one reveals that it is impossible to characterize by this character the two subfamily-groups of the Noctuidae s.Hampson, the ‘trifines’ and the ‘quadrifines’, still more to establish by this the two families Erebidae and Noctuidae s.str.

Taxonomical changes

Noctuidae s. Hampson rev., ‘Erebidae’ syn.n.

Arctiidae s. Hampson st. rev.

Nolidae s. Hampson, s. str., st. rev.

Lymantriidae s. Hampson st. rev.

Leucaniinae sfam.n., st.n.

Hadeninae Xylenini st.n., comb.n., Xyleninae syn.n.

Noctuidae Chloephorinae comb. rev.

Noctuidae Nycteolinae (= Sarrothripinae) comb. rev., st.rev.

Noctuidae Eariadinae comb. rev., st.rev.

Noctuidae Diphtherinae comb.n.

Noctuidae Risobinae comb.n.

Noctuidae Collomeninae comb.n.

Noctuidae Beaninae comb.n.

Noctuidae Eligminae comb.n.

Noctuidae Westermanniinae comb.n.

Introduction

Hence so far the imaginal-systematics (Kitching,1998, Kitching & Yela, 1999, Lafontaine & Fibiger 2006), with exception of Speidel & al. 1996, as yet was unable to prove the monophyly of the Noctuidae s. Hampson (1898-1913) by only one synapomorphy (Lafontaine 2006: ‘The lack of any consistent feature for to characterize the Noctuidae’) and inforced by insufficient moleculargenetical results - which allow as well a so-called LAQ-clade (L = Lymantriidae, A = Arctiidae, Q = quadrifine Noctuidae) as also the classic division of the Noctuoidea - Lafontaine & Fibiger draw the wrong and weighty decision to split the classical Noctuidae s. Hampson into the Erebidae [which comprised the hitherto quadrifine subfamilies of the Noctuidae s. Hampson and simultaneously the Lymantriidae, the Arctiidae and at Fibiger & al. 2009 also the Nolidae s. str.] and into the Noctuidae s. str., s. Fibiger & Lafontaine. These Noctuidae were restricted to the triline subfamilies of the Noctuidae s. Hampson but unlogically include also the quadrifine subfamily Plusiinae.-.

As also demonstrates the example of the position of *Scythocentropus* SPEISER in the system of the classical Noctuidae (see below) the decisions of this splitting has to be removed, too..

The attitude of the imaginal-systematists to combine the quadrifine Plusiinae with the trifine Noctuidae s. str. is inconsequent and simultaneously reveals the unsuitability of the characters trifine and quadrifine for to separate the subfamilies of the Noctuidae s. Hampson in the two groups – Erebidae and Noctuidae s.str. How unsuitable the characters quadrifine and trifine venation of the hindwings are demonstrates the phenomenon within the genus *Autographa* HÜBNER: one half of the larvae of twelve investigated species of this genus (Beck 1999) had on A1 three SV-setae - the commonly acknowledged main larval character for the quadrifine Noctuidae – the other six species only two SV-setae (the main larval character for the larvae of the trifine Noctuidae). What has to be done? Because there are enough other good characters for to avoid a separation of these *Autographa*-spp. into ‘quadrifine’ and ‘trifine’ Plusiinae. such a separation has no sense-

Similarly is the situation within the trifine genus *Agrotis* OCHSENHEIMER: The larva of ‘*Agrotis*’ *militaris* STAUDINGER has three SV-seatae on A1 and therefore theoretically has to be put to the quadrifine Noctuidae.

Because of unsuitable characterization of the Nolidae (Kitching 1984, 1998) the moleculargenetical characterization and the combination of many unequivocal subfamilies of the Noctuidae with the Nolidae s.l. (Zahiri & al. 2010-2013) have to be rejected. The Nolidae s. str. larvalmorphologically are clearly restricted to the Nolidae s. Hampson, s. Beck (Beck 2009).

The present situation of the systematics of the Noctuoidea by the influence of the moleculargenetics and the larval-morphology. Compatibility between morphological and molekulargenetical systematics?

The present molecular-genetics (Zahiri & al. 2010, 2011, 2012, 2013) is unsuitable for to give unequivocal results for a new order in the system of the Noctuoidea: this demonstrates the removal of the Nolidae s.l. from the Erebidae resp. from the Noctuidae s. Hampson (Zahiri & al. 2012), but also there the combination of these Nolidae with unequivocal subfamilies of the Noctuidae s. Hampson (for Europe the Sarrothripinae, the Eariadinae and the Chloephorinae) Zahiri & al. 2013.- In other words: the morphological imaginal-systematics at present is not able to offer a distinctly defined family Nolidae s.l. for investigation by the molecular-systematists. In spite of pers. communication with Zahiri (Beck 2009, 2012, 2013) and concerning hints that the Nolidae are to be restricted only to the Nolidae s. Hampson, Zahiri & al. (Kitching ...) still are convinced of their completely insufficient definition of the Nolidae by the boat-shaped cocoon. But Wagner (2011: 210) writes of a change of this valuation: „recent molecular studies suggest *Concana* and related genera (= U.-Fam Collomeninae of the Nolidae s.l.) should be reclassified near Bagisarinae (Noctuidae s.str!), pers. comm. of Zahiri to Wagner.

At present the original characterization of the Nolidae s.l. (Kitching, 1984: erected scales on the fore-wing-upperside, retinaculum bar-shaped, cocoon

boat-shaped with vertical exit-slit) is reduced to the latter character: „The most characteristic nolid apomorphy is the boat-shaped cocoon with a vertical anterior exit slit and an unusual two-walled construction“ (Kitching 1998: 388). There the shape of the cocoon is given with the two figs. 19.17 X, Y (Chloephorinae, Nolinae).- But Wagner 2011: 202, 203 shows two pictures of Nolinae (*Nola clethrae* and *Nola triquetrana*), the cocoons of which are spindle-like.- But because such cocoons are spread within the Lepidoptera (e.g. Noctuidae, *Calophasia* STEPHENS –species, Hyponomeutidae) this character is unsuitable for phylogenetical decisions, too.

Also the two-wallness of the cocoon (Kitching, 1998) has differently to be valuated (Sugi 1987, Beck after Sugi 1999 I: 48-49), also because each cocoon principally is two-walled: the outside +/- loosely wall as frame and contact to the surrounding and the tighter inner wall.

No wonder that on this basis the Nolidae s.l. alone in Europe include three real subfamilies of the Noctuidae s. Hampson, the Chloephorinae, the Eariadinae and the Sarrothripinae, which are down-graded at Zahiri & al. to tribes of the subfamily Chloephorinae. But because according to the images of the larvae (Zahiri & al. 2013) also the other subfamilies of these Nolidae s.l. (Diphtherinae, Risobinae, Collomeninae, Beaninae, Eligminae, Westermanniinae), with exception of the Nolinae are real Noctuidae the molecular-genetical investigation must lead to wrong results.- Allone within the Chloephorinae there are representants, e.g. *Arcyophora patricula* HAMPSON and *Bryonycta pineti* STAUDINGER (the latter Fibiger 2009, Noctuidae Europaeae vol. 10 completely unjustified combines with the Amphipyrrinae) which not at all have a boat-shaped cocoon but a spindlelike one. If then the molecular-genetics attest the correctness of such a family Nolidae s.l. this science attests itself its impossibility for a sure and unequivocal characterization of this entity. And just the same it is with the molecular-genetical characterization of the Erebidae and the Noctuidae s. str.-

Because there the imaginal-systematics, with exception of the non-accepted results of Speidel & al. 1996 and completely contrary to the results of the larval-systematics was and is hitherto unable to give a convincing morphological characterization of the Noctuidae s. Hampson, respective contradicting molecular-genetical results are not convincing, too.

The discontentness with the present molecular-genetical results as compared with sure imaginal-morphological results which are possible in early Lepidoptera is stated by the lecture of Kristensen at the SEL-Congress in Bulgaria 2013, “Early lepidopteran evolution in the light of the newly discovered ‚Kangaroo Island Moth“. There Kristensen compares: “...and recent molecular evidence for alternative arrangements has so far not had sufficient support to be considered compelling.“ By other words: Clear imaginal-morphological results in this group are not supported by the molecular-genetics.

In the talk ‘Phlogeny of ditrysian Lepidoptera – progress report of the morphological study’ (Heikkilä & al. SEL-congress Blagoevgrad/Bulgaria

2013) turns out the incontentness between molecular-genetical and previous morphological results, too. -

And therefore here is put the question: Is the present molecular-genetics at all able to contest sure imaginal- and especially larval-morphological results, it means to be compatible with sure either imaginal- or larval-morphological characterizations of taxa on family-level?

I just got informed by Hasenfuss of the paper of Sohn & al. 2013 on the molecular-genetical investigation of the Hyponomeutoidea: In this publication the larval-morphological statement of Hasenfuss 1963! that the Psychidae are the most ancient family of the ditrysian Lepidoptera is finally stated. What got changed in the molecular-genetical investigation as compared with those of Zahiri & al.? Have Sohn & al. used additional gene-sections which are correlated with morphogenetical processes?

This additional molecular-genetical investigation of the Hyponomeutoidea which worked with maximum 27 gen-sections was in concordance with the larval-morphological/chaetotactic studies of Hasenfuss 1963; in the preceding investigation of Sohn & al. with only eight nuclear gene-sections this congruence could not be confirmed. So the results by Mitchell & al. 2006 and Zahiri & al. 2010-2013 with also only eight gene-sections of which two were mitochondrial genes may suffer in the noncongruence with larval-morphological results concerning the systematics either by using unsuitable genes or a too low number of gene-sections.

How cautiously one also has to be to characterize lepidopteran families solely by larval characters based on some genera documents the experience with primary-setosed larvae of Arctiidae (the Arctiidae-larvae usually are secondary-setosed). Kitching & Rawlins (1998: 391) write for the genera *Tyria*, *Utetheisa*, *Amerila* and *Nodozama* in which the larvae are primary-setosed: „D1 and D2 on T2 and T3 are fused to a single verruca and (in position of) seta L3 on A3-A6 are two setae“. In the Arctiidae-genus *Caryatis* (also with primary-setosed larvae and which Beck got for investigation by courtesy of Boppré) there is in the L3-Position of A3-A6 each only one seta (the same as nearly in all investigated Noctuidae-s. Hampson- larvae, exceptions *Diloba* and *Acronicta' alni* LINNAEUS). By these facts Kitching concludes an independent derivation of these characters at the Noctuidae. More convincing because of the close relationship between Arctiidae and Noctuidae s. Hampson is the explanation that these characters in Noctuidae-larvae are reversals.

Beyond, this example demonstrates how difficult, still more, how impossible it is to find in a very speciose taxon as in the family Arctiidae and still more in the Noctuidae (the most speciose family of the Lepidoptera and one of the five most speciose families of the world-fauna) only one character as synapomorphy for all species of the concerning family. This is just the experience which made Lafontaine with the adults of the Noctuidae and which led him (and Fibiger) to split the Noctuidae s. Hampson into the Erebidae and Noctuidae

Importance of the larval-morphology for the systematics, especially in the Lepidoptera

Kitching 1984, 1987, 1998, 1999, who for a long time was concerned with the systematics and characterization of the Noctuidae/Noctuoidea contested, that the Noctuidae (imaginally) have been notoriously difficult to characterize. 1998 (in the hand-book of zoology, Lepidoptera Noctuoidea) he remarks: „Features of the immatures have been much more informative, but resolution of phylogenetic problems has been hindered by the absence of vouchered immatures for the vast majority of world genera“. Kitching did not give a specific argument for this opinion, especially for the larval-stage, only in DeVries & Kitching 1985 he emphasizes the importance of the larvalmorphology for the systematics of the Nymphalidae, Danaini.

Thus Kitching rendered the responsibility for the characterization of the Noctuidae s. Hampson to the larval-systematics. These proved with the dissertation of Beck 1960 (Die Larvalsystematik der Eulen/Noctuidae) that the characterization of the subfamilies of the Noctuidae by Hampson (1898-1913) was artificial and based on unsuitable characters.

Though Beck investigated in his dissertation only about one percent of the world-Noctuidae-fauna known at that time and only of taxa of Central-Europe his results were accepted [Merzheevskaya, 1967 Russian, 1989 English; Fibiger & Hacker 1990(91), Kitching & Rawlins 1998] and were since then enforced by world-wide investigations on further ca. 3000 species of the Noctuidae [USA, Crumb, independantly from Beck, 1956, Godfrey 1972, Rawlins 1998, Wagner 2005, 2011] and further investigations, see below.-

But similar to the fact that a worldwide revision of the subfamily-systematics of the Noctuidae was possible by this sample of Central-Europe, Kitching expects and hopes for a similar revision of the Noctuidae, resp. Noctuoidea by worldwide sampling. And again this is possible by the investigation of about 1100 species, now of Europe (Beck 1999-2000 and unpublished on material of the following years), supplemented by material, investigations and results of Ahola & Silvonon 2005, 2008, 2011 and further ca. 3-4000 species of collections from N-America (Crumb 1956, Godfrey 1972a, MacKay 1972, Rawlins 1998, Wagner 2005, 2011; the collection of BRC's Holdings of Immature Lepidoptera, Biosystematics Research Centre Agriculture Canada), Japan (Ichinose 1958, 1962; Mutuura, Yamamoto & Hattori 1965, Sugi, 1987), India (Gardner 1947-1949).

Whilst Beck 1999-2000 was especially concerned with the ‚internal‘ systematics of the European Noctuidae s. Hampson, Beck 2005, on the SEL-congress at Rome, reported on the larval characterization of the Noctuidae s. Hampson as a monophyletic family as compared with the Arctiidae. It was just the moment of the issue of Esperiana 11 (2005), in which the classical Noctuidae s. Hampson had been split into the Erebidae and Noctuidae s.str. by Fibiger & Lafontaine 2005 and Lafontaine & Fibiger 2006.-

The publication on the lecture of Beck 2005 was rejected over years by the editorial board of the *Nota lepidopterologica*, the journal of the SEL. After its final rejection in 2009 it was offered to the SHILAP and there published in the same year.

The SEL with its periodical congresses is the optimal platform for the concerning discussions and its organ, the *Nota lepidopterologica* consequently the place for the concerning publications. This is due to the organization of this society the president of which for a long time was professor N.P.Kristensen, editor and coauthor for the Lepidoptera in the 'Handbuch der Zoologie', and in which society the (most) important scientists for the Lepidoptera and of course for the Noctuidae-, resp. Noctuoidea-systematics (Kitching, Fibiger, ceased 2011 and Lafontaine) regularly are present on its congresses.

The repeated rejection of the article of Beck by the chief of the editorial board of the *nota lepid.* was argued in part as follows: „Why should the character 'seta' be more worth than all the other characters (esp. of the adults)?" This remark, which emphasizes the rivalry between the larval- and imaginal-systematists, Beck used for his lecture and started with an introduction in the suppositions for the chaetotaxy (which is extremely important for the systematics), into the setal map = the schematic distribution of the setae (= bristles) on the integument of primary setosed larvae. The importance of the chaetotaxy is based on the very stable position of the setae on the integument (Hasenfuss, 1963) and also on the basal neural connection of these ((Hasenfuss, 1973); the latter is also the guarantor for the stability of this system. Specific differences in the distribution and the number of setae at the concerning positions (loci) are especially of importance for to characterize families and subfamilies; also the superfamily Noctuoidea is characterized by one chaetotactic feature: the presence of two MD1-microsetae on the thoracic segment 3 (=T3), instead of one as usual: an important synapomorphy for the Noctuoidea.- Because setal characters are easily to be controlled in short time a lot of species and respective numbers of specimens are investigated in short time, contrary to investigations on adults.

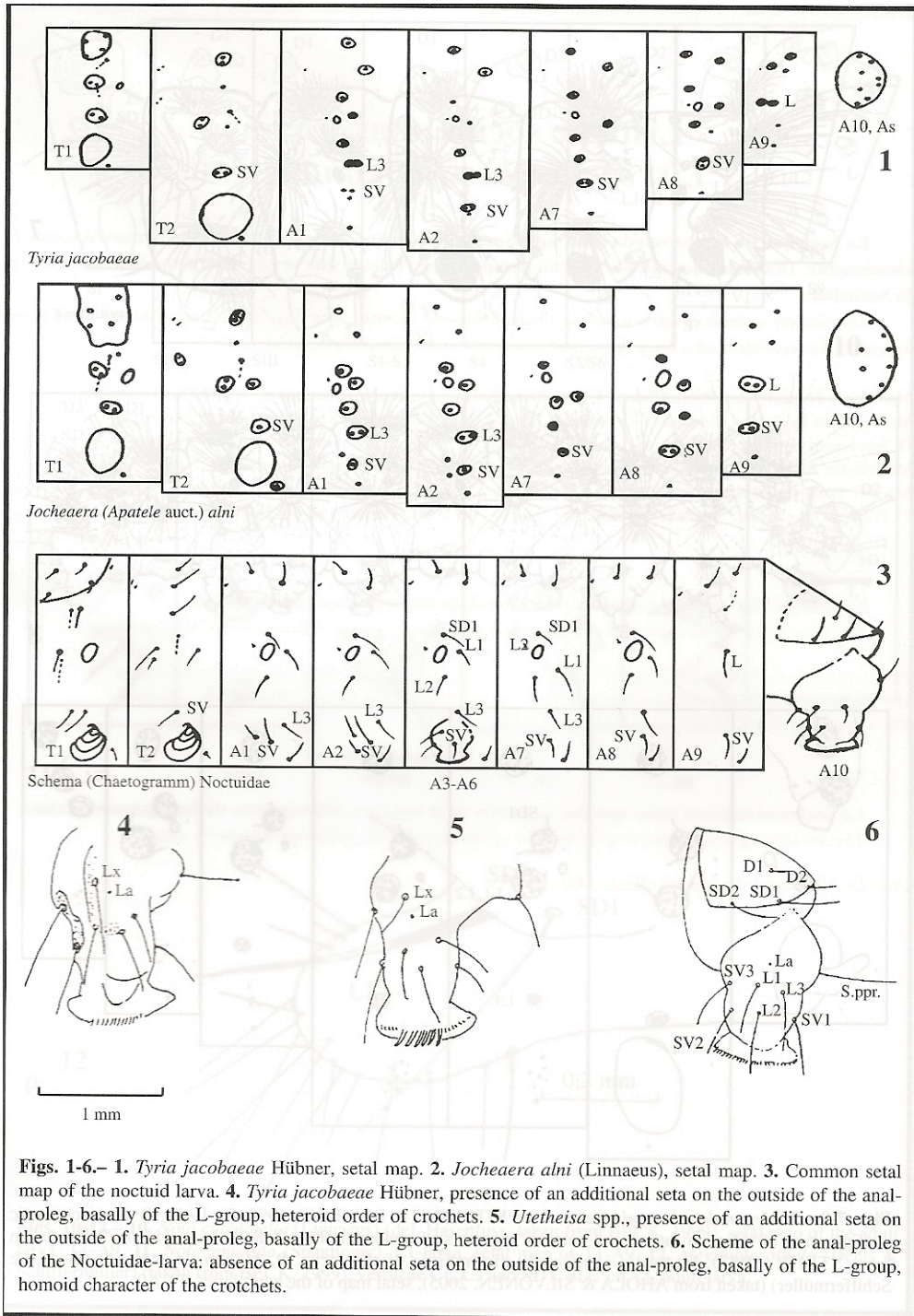
The setal map of primary-setosed larvae of the Noctuidae and Arctiidae

Because the setae serve for the contact with the environment (and its predators) it is sufficient to set the setae on concerning positions of the integument: on the dorsum (=D), the venter (=V) and the lateral (=L) region, and some in between of these areas, SD (=subdorsad) and SV (=supraventrad). The abbreviations for the bristles have been proposed by Hinton 1946 and are now the common-ones used.

Because of the basal neural netting between the setae the touch of one seta allows at once the defense-reaction of the whole larva: either enrolling and dropping down or quickly lateral oscillating movement, but also, if being better, no reaction at all at the larvae of *Catocala*-spp. and allied taxa.

The extraordinary stability of the distribution and the numbers of setae at the concerning loci on the larval body allowed also the reconstruction of the most ancient ditrysian setal map of Lepidoptera-larvae and by this Hasenfuss already in 1963 evidenced the Psychidae to be the most ancient group of the ditrysian Lepidoptera, which now, after more than 50 years, is confirmed by molecular investigations (Sohn & al. 2013). This underlines the importance of exact investigations of the setal maps of primary setosed larvae, but also of secondary setosed larvae of which the L1-instars normally are primary-setosed. Kitching's vision is correct: The larval-systematics is more informative than.... And therefore a satisfying characterization of the Noctuidae s. Hampson by the characters of the setal maps is possible.

Setal maps (textfig.1) of primary-setosed larvae of the Arctiidae and Noctuidae s. Hampson in comparison and the characterization of the Noctuidae and the Arctiidae, each s. Hampson by the features of their primary-setosed larvae.



Textfig. 1

	Arctiidae	Noctuidae	exceptions (= reversals) within the Noctuidae
number of T2,T3/SV-setae	2	1	Some
number of L3-setae on A1-A6 or only on A3-A6	2	1	Some
number of A9/L-setae	2	1	three (<i>J. alni</i> , <i>Ufeus</i> Grote, Agaristinae: <i>Sarbanissa transiens</i> Walker)
number of A7-A9/SV-setae or only A7/SV-setae	2	1	Some
number of A3-A6/SV-setae (on the outside of the prolegs)	4	3	Some
number of L-setae on the anal-prolegs	4	3	None
heteroid order of crochets	often	very rare	2 records (also in some Euteliinae, pers. comm. D. Wagner)
homoid order of crochets	rare	common	
Secondary setation	very often	rare	in Acronictinae with Pantheini, and in Dilobinae, Raphiinae, and in <i>Conistra</i> (<i>Dasycampa</i>) 'Hadeninae'
Primary setation	?rare	common	see the exceptions above

Table 1.– Comparison of the setal maps of the larvae of primary - setosed Arctiidae and Noctuidae

As demonstrates an enlarged comparison with further primary-setosed arctiid-larvae (material by Boppré) the characters in table 1, transverse sections 4-6 are to be corrected.

At larvae of *Amerila*-spec. (Kroder/Boppré, Diplom-paper Kroder, unpublished) there are on A7 and A8 each one SV-seta only; and evenly at *Amerila*-spec. outside of the prolegs of A3-A6 there are only three SV-setae and the seemingly unique character for Arctiidae-larvae – an additional L-seta (=Lx) outside of the anal-prolegs is missing at *Amerila*-spec., though there L1 is heavy basally transferred, basal of porus La.

There are also differences in the number of the L3-setae (second transverse section of table 1): only *Amerila* has each two L3-setae on A3-A6 and *Caryatis*-spec. bears each only one L3-seta.

As compared with the characterization of the Noctuidae-larvae against the Arctiidae-larvae (Beck 2009) now the following characterization of the Noctuidae-larvae is possible:

1. Each one SV-seta on T2 and T3, [some exceptions/reversals: *Syngrapha*-spp./Plusiinae; *Brithys crini* (FABRICIUS), Glottulini/?Glottulinae].
2. Each one L3-seta on A1-A6, resp. on A3-A6 (exceptions/reversals: Chloephorinae, Acronictinae *Jocheaera alni*)
3. Each one L-seta on A9 [exceptions/reversals *Jocheaera alni* (LINNAEUS); Ufeiinae, Agaristinae: *Sarbanissa transiens* WALKER
4. Each one SV-seta on A7 (and perhaps on A8 and A9) [exceptions: *Jocheaera alni*, A8, A9; *Dasypolia* 'ferdinandi' RÜHL, A7, *Parabarovia* spec. A7/Canada (?Noctuinae)]

5. 3 SV-setae on the outside of the prolegs A3-A6 [exceptions/reversals in different subfamilies *Enterpia laudeti* (BOISDUVAL), Hadeninae, Eustrotiinae (with exception of *Protodeltote pygarga* all investigated spp. in Beck 1999), Catocalinae *Clytie (illunaris)*].

6. Anal-prolegs (A10) without an additional seta (L-)seta basally of porus La.

7. Crochets homoid [exceptions/reversals: *Scoliopterix libatrix*, *Gyrtothripa*/Sarrothripinae, resp. Nycteolinae and some Euteliinae (Wagner pers. comm.)].

These exceptions at larvae of Noctuidae may be compensated by use and combination of apomorphic characters taken from the positions 1 to 7 above.

The separation of secondary setosed larvae of Arctiidae normally is possible by the combination of the characters: body with numerous secondary setae and prolegs with heteroid series of the crochets

Primary setosed larvae of the Arctiidae with one or some of the characters which occur as exceptions at Noctuidae-larvae may be separated from these by the character of heteroid series of the crochets, because the exceptional Noctuidae-larvae above (positions 1 to 7) do not have heteroid series of crochets at the same time, so not the Acronictinae, *Dasycampa*, *Diloba* and *Raphia*

The general problem to characterize speciose taxa by synapomorphies.

Consequence: monophyly by combination of autapomorphies

How demonstrated above: neither the primary-setosed larvae of the Noctuidae nor those of the Arctiidae are to be characterized by synapomorphies (= new, derived characters which are present in all species)

The character of four L-setae on the anal-prolegs at *Utetheisa* and *Tyria* (Beck 2009) for to characterize primary-setosed Arctiidae-larvae is obsolete too.

Similarly the characterization of all Arctiidae-larvae by the heteroid arrangement of the hooks of the prolegs is not possible, because the Syntominiinae (Arctiidae) have not this arrangement but some Noctuidae-larvae have it.

A sure separation and characterization of both families by larval chaetotactic characters is possible only by combination of apomorphic characters.

Otherwise the classical Arctiidae have to be split, similarly as the Noctuidae s. Hampson have been split by the misunderstanding of the phylogenetic systematics by Fibiger & Lafontaine 2005.

The consequence of this reasoning is that the ideal of phylogenetical characterization of very speciose taxa of higher level by one or some synapomorphies may fail and then, because of otherwise clear relationship of the concerning species, the characterization as monophylum is possible only by combination of autapomorphies to a **combinatoric monophyly**.

Relations between the ,quadrifine' and trifine subfamilies of the Noctuidae s. Hampson

There is no clear separation of the Noctuidae s. Hampson by the venation of the hind-wings into a quadrifine and into a trifine-subfamily group, resp. into the families Erebidae and Noctuidae s.str. (Fibiger & Lafontaine, 2005, 2006).

Cause of ,trifine' venation:

The hind-wing-venation closely depends on the resting-position of the adult: At the quadrifines the fore-wing is large-triangular; therefore the hind-wing has enough place under the fore-wing and gets not folded and all four (quatuor) veins in the centre are present and robust.

If the forewings in this position are held horizontally (in one plane) and the costae of both wings approach to be +/- parallel and these wings are longish rectangularly, the large hind-wings have not enough place under the fore-wings and get folded with all the consequences for the centre of the hind-wing: approaching of veins and reduction or loss of one central vein, resulting in three (= tri, = trifine) central veins. The very contrary shape of the quadrifines as compared with that of the 'trifines' allows a very different behaviour: the trifines being disturbed drop down for to disappear quickly in the herbaceous vegetation similar to disturbed trifine larvae, which roll up and roll into the vegetation for to disappear. At the quadrifines the broad-winged adults flee, flying away; the larva either do not react by contacts or react with quickly oscillating or jumping away.

The trifine larvae especially prefer to live in the herbaceous zone or even hidden in the upper horizon of the soil. How the behaviour of tree- or shrub-living trifine species is to interpret as compared with the preceding behaviour of trifines remains a problem: perhaps these species represent a transitional life-style from the living of the quadrifine species in the top of trees or these secondarily acquired this life-style. There are also a lot of trifine species which live in the early instars in the buds of the trees/shrubs and turn to the soil and its herbaceous plants in the late instars. A similar change in the life-style is to be observed at quadrifine species: instead to live the full development in the top of trees or shrubs the larvae of the concerning species feed only in the herbaceous area (e.g. *Autophila* HÜBNER, *Lygephila* BILLBERG); curiously the adults of these genera also have longish-rectangular forewings and the resting position is the same as at the concerning trifines. As yet the corresponding venation of the hind-wings has not been considered.

The folding of the hind-wing concerns especially the median part of the wing; for that the concerning veins either were moved away from the central longitudinal axis or are there +/- reduced., e.g. the vein m2..

At the 'trifine' Plusiinae the fore-wings are being hold in the resting-position saddle-roof-like, therefore the fore-wings are large and the hind-wings are not folded: the venation is quadrifine. Therefore the Plusiinae in the past often were combined with the quadrifine Noctuidae.

Because of different resting positions within the Noctuidae the hindwing-venation is so complex, that now the term 'pseudoquadri-fin' is being introduced. (Zahiri & al. 2013).

By this the taxonomic value of the hindwing-venation gets further questionable and it turns out that this character is not suitable for the present decision to separate the Noctuidae s. Hampson into the two families Erebidae and Noctuidae.

One and the same taxon either trifine or quadri-fin?

A further phenomenon also discredits the splitting of the Noctuidae s. Hampson into two families:

Depending on chosen characters it is possible to attribute the same taxon either to the trifine or to the quadri-fin Noctuidae (or to the respective families).

Only the consideration of the holomorphs (of as well the imaginal as the larval characters, etc.) allows the correct position as now proves the investigation of the genus *Scythocentropus* SPEISSER, but also of further genera like *Apopestes* HÜBNER and *Militagrotis* Beck 1991, and also of the Xylocampina (Cuculliinae), Beck 1999 and of the Xyleninae s. Fibiger.

The following exemplaric remarks concerning the position of *Scythocentropus* and of *Apopestes* HÜBNER (see BECK 1992) demonstrate that the relations between the 'quadri-fin' and the 'trifine' subfamilies of the Noctuidae s. Hampson are closer than between the Erebidae s.str. and the Arctiidae and Lymantriidae.

Scythocentropus inquinata (MABILLE, 1888)

Köhler 2014 (see the concerning article in the same issue of the 'Atalanta') has found the figured larva on the Canary Islands and asked Beck for identification. The larva has pupated and the adult hatched. The adult could be pre-identified by comparison with the list of the Lepidoptera from the Canaries (PINKER & BACALLADO 1975). In question was, according to a figure in PINKER & BACALLADO and by comparison with the figures in the Noctuidae Europaeae,



Fig. 1. The larva of *Scythocentropus inquinata* (MABILLE, 1888)

Habitually striking and characteristic at the larva of *Scythocentropus inquinata* is the very slender body (quite in contrast to the stout-bodied larvae of the trifine Noctuidae) which remembers by the longish segments A1 to A4 and the relatively short segments A5, A6 of the quadrifine Catocalinae. The posture of the sideward directed prolegs on A5 and A6 and that of the oblique-backward directed anal-prolegs is the same as at the Catocalinae, generally of the quadrifine Noctuidae, the prolegs on A3 and A4 are not visible, perhaps not fully developed (as at quadrifines). The Dorsale is split. All these characters are to be found only with many quadrifines, e.g. at *Colobochyla salicalis* ([DENIS & SCHIFFERMÜLLER], 1775), *Catocala* SCHRANK-spp., *Drasteria* HÜBNER-spp. or at *Dysgonia* HÜBNER-spp.

But there is at *Scythocentropus* the unequivocal typical trifine-hadenine character of the valva (fig. 2): by the very autapomorphic valva (as compared with that of quadrifines) *Scythocentropus* belongs to the Hadeninae s. Kitching as is demonstrated and evidenced in Fibiger & Hacker, 2007.

At Fibiger & Hacker 2005, 2007 *Scythocentropus* is put into the subfamily Xyleninae, which is not a separate subfamily but a tribe of the Hadeninae, Xylenini **st. rev.**

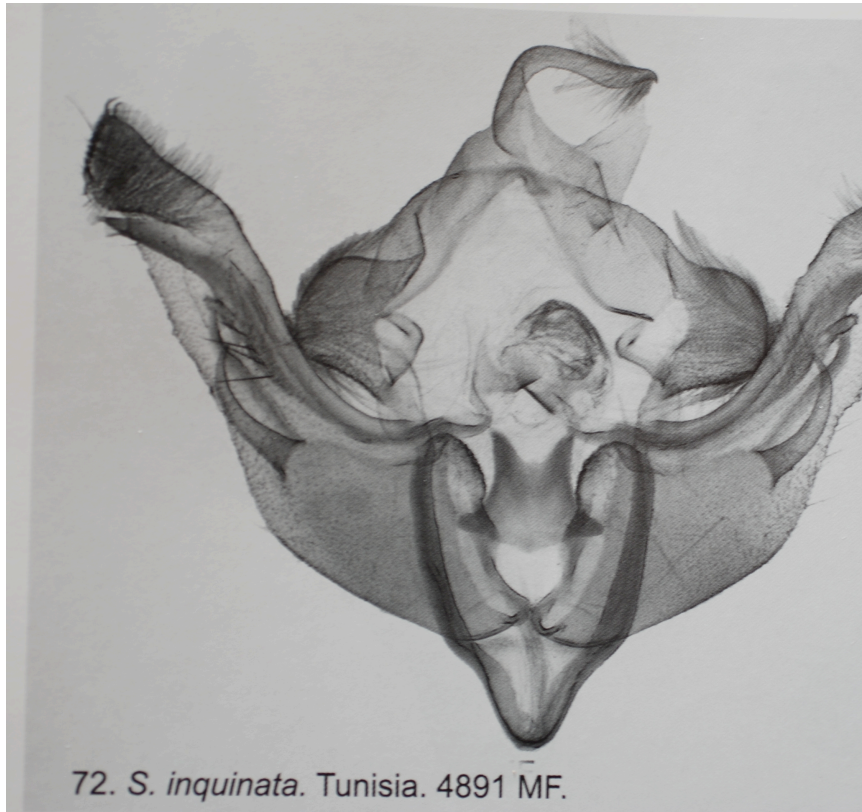


Fig. 2 male apparatus of *Scythocentropus inquinata* (without Aedeagus and Vesica), by Fibiger & Hacker, 2007.

Genitalmorphological characterization of the Hadeninae s. Kitching & Rawlins, 1998.

(As yet an essential aut- and synapomorphic character of the Hadeninae s. Kitching & Rawlins 1998 has and could not be emphasized neither by these authors nor by Fibiger & Hacker, perhaps because then the very derived Leucaniinae **st.n.** had been included in the Hadeninae s. Kitching as Leucaniini (Fibiger & Lafontaine 2005, Fibiger & Hacker, 2005). But now, after separation of the Leucaniinae **st.n.** from the Hadeninae s. Beck this characterization is possible)

The/A main character (synapomorphy) of the Hadeninae s. Beck 2014 is described as follows: It is the special reinforcement of the valva by the folded costa. The costa is folded dorsad in full length and this fold is directed against the ventrad edge of the valva. This fold shows processes (one or some) in the same direction, especially at the distad end of the costa, near the enlacement to the cucullus or into this, the latter extremely (as a strong thorn) at many Apameini, e.g. *Abromias* BILLBERG, *Apamea* OCHSENHEIMER etc. and allied

taxa. Further characters are the distad directed saccular-process, which may be short and blunt (*Hadena*-species) or as at *Scythocentropus* thornlike and strong. The harpe is usually centrad and parallel to the costa, some covered at the basis by the sacculus and therefore sometimes wrongly termed saccular-process. The relation of the volume of the (basal part of the) valva to the cucullus is heavy disproportioned in unfavour of the relative small and narrow cucullus.

Downgrading of the Xyleninae s. Fibiger & Lafontaine 2005, Xylenini st.n.

An overlook of the male genitalic apparatus shows according to the figs in Noctuidae Europaeae Hadeninae 1 Vol. 4, Hadeninae 2 Vol. 5 and Xyleninae Vol. 9, that all taxa have the same construction of the valva with its costal fold as demonstrated above for the Hadeninae s. Beck

The ‚Xyleninae’ termed taxa in Noctuidae Europaeae Hadeninae 2 (Ronkay & al. 2001) with the nominotypical genus *Xylena* have been formally upgraded to subfamily by Fibiger & Lafontaine (2005: 42) on basis of very dubious and weak apomorphies inspite there were also common characters with the remaining Hadeninae.

This characterization omits the feeling for essential morphogenital processes and the causes for these, similar to the use of the terms and characters of trifine and quadrifine venation for to separate by these the subfamily-groups of the Noctuidae s. Hampson into two families. without respect to the cause of the development of these some different venations (Lafontaine & Fibiger, 2006). And with these imaginal-morphological untenable suppositions for characterization of the families Noctuidae s.str. and Erebidae the molecular-genetics shall confirm these!

Leucaniinae sfam.n., st.n.

In continuation of the development of the specifica of the valva of the Hadeninae s. Beck the Leucaniinae **st.n.** have some of these reduced (the fold of the costa and the separation of the harpe) and set new accents with the specific-shaped cucullus, the basal enlarged valva and the combining of the remaining thorn of the costal fold with the harpe. At *Mythimna (Sablia), andereggii/scirpi*-group the saccular-process is very large, long and directed distad.-

Typical for the Leucaniinae is the long cucullus which is heavy tapered towards the valva and which is connected with the valva by a 90°-angle; the harpe is well-developed, hooklike or envillike and paired with the strong ‘thorn’ of the reduced costal fold. The basal part of the valva is heavy belly-like enlarged, the distad part tapered towards the cucullus. Over all there results a proportion of the volumina of both parts (the enlarged basal part of the valva and the distad part of the cucullus) of 2:1 to 1:1.

Consequences for the systematics by the described phenomena

Because the characteristic construction of the valva of the Hadeninae s. Beck is also present at (,Xyleninae'!) and also at many if not at all genera of the ,Xyleninae's. Fibiger & Lafontaine, 2005, e.g. at *Lithophane* HÜBNER, *Agrochola* HÜBNER, etc., we have to synonymize these 'Xyleninae' with the Hadeninae s. Beck, including *Scythocentropus*. - Therefore the catocaloid features of the larva have to be neglected, because being plesiomorph, these have to be treated and valuated as reversals.

On the other hand these characters, as well the larval plesiomorphic ones as the imaginal apomorphic ones, emphasize the close relationship between the quadrifine and trifine subfamilies of the Noctuidae s. Hampson as already emphasized by Beck 1992.

Beck 1992 demonstrated by *Apopestes spectrum* (ESPER, [1787]) that this genus belongs to the Cuculliinae on the basis of the larval autapomorphic characters.

Contrary the imaginal-systematics puts *Apopestes* on the basis of the plesiomorphic genitalia to the Catocalinae. But already Boursin 1964 and, following Boursin, Hartig & Heinicke, 1973 put this genus into the field between the quadrifine and trifine subfamilies, i.e. in the 'beginning' of the 'Amphipyrynae' = 'Ipimorphinae', resp. now the Hadeninae s.l. - Beck 1992, 1996, 1999 puts *Apopestes* to the Cuculliinae s.l., s. Beck)

Consequences: Neither the imaginal-systematics nor the larval-systematics alone are always able to find the correct position of certain taxa in the system. Therefore there is urgent need of cooperation of both.

The larvalmorphology is at the higher evolved Lepidoptera (Ditrysia) more suitable to solve taxonomic problems than the imaginalmorphology (and – systematics) especially on higher taxonomic levels, as at subfamilies, families and still higher taxa.

A possible priority of the larval-systematics depends at primary-setosed larvae especially on the valuation of the setal-maps.

On the SEL-Kongress at Blagoevgrad/Bulgarien, 2013 Beck pointed out in his lecture 'Rivalry or cooperation between imaginal- and larval systematists concerning the systematics of the Noctuoidea' that setal maps of naked larvae (with the very stable positions of the primary setae on the integument, Hasenfuss, 1963) are more suitable for to solve problems in the systematics of higher taxonomic grades, e.g. of families than the imaginal-systematics with their very difficult investigations of the adults, of which the body is covered with scales and hairs, hidening the ectomorphology under this cover.

At the same time Beck emphasized that it is impossible in (very) speciose taxa, e.g. the family Noctuidae – one of the five most speciose families of the world-fauna and the most speciose family of the Lepidoptera – to find only one synapomorphy for all species (compare Lafontaine & Fibiger 2006).

In all these exceptions of otherwise (fundamentally) suitable characters we have to examine the character of these exceptions as reversals, which then as

repetition of plesiomorphic conditions, according to Hennig, are not allowed to be used for systematic decisions in a phylogenetical system.

It turned out in the larval characterization of the Noctuidae that some very rare exceptions of good characters resp. 'autapomorphies' corresponded with the normal condition of this character in the chaetogram (= setal map) of the Arctiidae. By this phenomenon is emphasized the close relationship of the Noctuidae with the Arctiidae but not the 'right' to combine both in one family, because similarly with the Noctuidae s. Hampson there are also in the Arctiidae exceptions of such character-states (autapomorphies). So, similarly to the present treating of the systematics of the Noctuidae, these Arctiidae would have to be split to several families, too.

Cause of hurried splitting of the classical Noctuidae s. Hampson by Lafontaine & Fibiger 2005/2006

Lafontaine was present at the lecture of Beck. He admitted that he, together with Fibiger, could not find any consistent character for to characterize the Noctuidae s. Hampson as monophyletic. So both drew the consequence to split these Noctuidae, the more because at the same time the molecular-systematists Mitchell & al. (2005)2006 had discovered the LAQ-clade (L= Lymantriidae, A = Arctiidae, Q = quadrifine Noctuidae) on which Lafontaine and Fibiger relied and which seemed to allow the combination of these three groups to one family – the Erebiidae.

In a private discussion with Lafontaine afterwards Beck discussed as example for such decisions in the systematics the treatment of the trifine Noctuidae *Agrotis militaris* STAUDINGER, 1888 for which Beck introduced the genus *Militagrotis* Beck 1992(1991), type *militaris* and which as yet is not acknowledged by the imaginal-systematists, because the genitalic configuration of the male genitalia is congruent with that of *Agrotis* OCHSENHEIMER-spp. The present taxonomical treating of the otherwise very different appearance of the adults (and larvae) (Fibiger, 1997) is no reason for not to split this genus, Contrary (Fibiger & Lafontaine 2005, Fibiger & Hacker 2005) now there are included in *Agrotis* a lot of formerly recognized good genera (e.g. *Powellinia* OBERTHÜR), which itself exists of different genera, Beck in prep.). The imaginal taxing of this large genus is alone determined by the so stable male genitalia. Influenced by Beck 1991, Fibiger 1997 recognizes instead of the new genera of Beck respective species-groups, but which also prove his helplessness, e.g. with the species-group 'trux' which includes habitually so different species as *trux* (HÜBNER), *exclamationis* (LINNAEUS), *ippsilon* (HUFNAGEL) and *schawerdae* BYTINSKI-SALZ; all four species belong to very different species-groups resp. subgenera s. BECK; by the meanwhile knowledge of the larva of *schawerdae* it is clear that this species belongs to the genus *Putagrotis* BECK, which is also confirmed by the appearance of the adult.- A systematics which is established on only one seemingly apomorphic character (the valva and the curious vesica)

under neglect of all other characters has no chance to persist. None of the coauthors of the Noctuidae Europaeae ever reclaimed these unbearable behaviour and also each of them acted alike – there are no principles for correct scientific treating in the series Noctuidae Europaeae besides the one: on species-level to split (to produce, resp. to recognize as many species as possible, a lot of which species hardly are to be discerned and which better would be taxed as subspecies or only as forma) and on genus-level to lumb.



Fig. 3: Two males of *Militagrotis militaris* STAUDINGER



Fig. 4 *Militagrotis militaris* (STAUDINGER, 1888): male genitalic apparatus, below detail of the extremely long vesica, both are within the range of the resp. structures of the *Agrotis*-spp. s.l. Prep. P. Gyulai.

By the imaginal-systematists *Militagrotis militaris* is put into the genus *Agrotis* OCHSENHEIMER s.l. because of the so uniformous male genitalic structures. But the appearance of the species is alike of that of *Yigoga*-spp.- this is an apomorphic feature, a sign that the evolution leads from *Agrotis* to *Yigoga* NYE what taxonomically has to be honored (assisted by some larval characters) by an adequate step of upgrading. – But besides that the larva has an important quadrifine character: three SV-setae on A1 (trifine larvae have there only 2 SV-setae). What can we do? Shall we *Militagrotis* put into the quadrifine Noctuidae under neglect of all the very convincing ‘Agrotini?’-characters? This is impossible. So we have to neglect this quadrifine character as a plesiomorphic reversal but have to keep it in mind as argument of the descendance of the ‘trifine’ Noctuidae from the quadrifine ones. It is an additional argument not to split the Noctuidae in the two families s. Fibiger & Lafontaine. And Beck by this further argumentated: Similarly as at *Militagrotis* this number of SV-setae on A1 has to be neglected in the same way in the higher systematics (the order of the families in the Noctuoidea) reversals are not allowed to be used for wrong taxonomic decisions.- The reversal with the SV-setae on A1 at *Militagrotis* is evidence that the trifines and the quadrifine subfamilies of the Noctuidae s. Hampson are not to be exactly separated: the former subfamilies are clearly derived from the latter. So there is no justification to erect for the two subfamily-series of the Noctuidae s. Hampson two separate families, the Noctuidae s.str. s. Fibiger & Lafontaine and the Erebidae which over all shall include the distinct families Arctiidae and Lymantriidae.

Conclusions

By this reasoning, arguments and evidence the concerning decisions of Fibiger and Lafontaine, 2005, Lafontaine & Fibiger 2006 and also those of the molecular-genetists (Mitchell & al. 2006, Zahiri & al. 2010, 2011, 2012, 2013) for to divide the classical Noctuidae s. Hampson into the families Noctuidae s. str. and into the Erebidae have to be tacked back. Further: the Nolidae s. Zahiri & al. have to be restricted to the Nolidae s. Hampson; all the other subfamilies within the Nolidae s. Zahiri, s. Kitchiug are subfamilies of the Noctuidae s. Hampson, s. Beck.

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Concerning selling the books of Dr. Herbert Beck:

BECK, H. (1999): The Larvae of the European Noctuidae - revision of the systematics of the Noctuidae (Lepid., Noctuidae). *Herbipoliana* 5, Vol. 1 (pp. 859) and Vol. 2 (pp. 447, 1021 figs. with many detail-figs.), both in German. Verlag Dr. U. Eitschberger, Marktleuthen.
BECK, H. (2000): The Larvae of the European Noctuidae - revision of the systematics of the Noctuidae (Lepid., Noctuidae). *Herbipoliana* 5, Vol. 3: 99 colour-plates with about 1600 photos of living larvae of about 900 species of the Noctuidae of Europe. Revised 'Systematic list of the European Noctuidae', state 2000. 336 pp. German-. Vol. 4: Further discussions about the controversy of some positive and heavy negative efficiencies of the imaginal-systematics of the Noctuidae in the gone two decades as compared with the results of preimaginal studies; bilingual (German-English) short-descriptions of about 900 species. 512 pp.- Verlag Dr. U. Eitschberger, Marktleuthen.

The selling of these books - which, as my contrahents know, have been financed by own power - has much suffered by the negative activities of these against Beck, e.g. by Fibiger and Hacker. Both startet as amateurs and developed to scientists. Hacker 2002 writes in his acknowledgements to vol. 4 of the *Noctuidae Europaeae*: "This project (the series *Noctuidae Europaeae*) is one of the best and most successful multi-volume taxonomic and faunistic projects of the world of highest scientific standard".- The skillness of Fibiger and Hacker to make modern genitalic preparations of both sexes led these to the hybris of Hacker as quoted above. Still more, Fibiger, together with Lafontaine, believed to have all wisdom concerning the systematics of the Noctuidae s. Hampson, resp. of the quadrifid Noctuoidea. Under neglection of the larval-systematics and without consulting these (the use some contributions of the larva-man Ahola, the friend of Beck, should simulate such consultations. But in contrary opinions of Ahola on genus-level Fibiger & al. did take no respect to these) they made their own systematics of the quadrifid Noctuoidea.- The rivalry between the imaginal-systematists and the larval-systematist Beck turned out in the damnation of Beck (Fibiger, 1997, p. 22): „Most if not all of the..... taxonomical changes of Beck (1991) have to be rejected!" And concerning the splitting of the genus *Noctua* LINNAEUS by Beck, Ahola & Kobes 1993, Fibiger (1997 p. 150) reacted: The construction of the vesica and the very conservative female genitalia forbid the splitting of *Noctua*! All the other characters which Beck & al. took in consideration – besides the size, the shape, the pattern of the adults, also the eggs, the pattern and morphology of the larvae were considered and a especially the so different and apomorphic valvae – but Fibigers horizon knows and valuates only the characters of the vesica and the female organ and these also ad libidum. Contrary to his references to the prionciples of the phylogenetical systematics he uses plesiomorphic characters (the conservative character of the female-organ for to maintain the genus *Noctua* s. Linnaeus

unrevised But already Tams (pers. comm.. to Beck, 1955) had recognized that *Noctua* matches only *pronuba* LINNAEUS (and the very similar *atlantica* WARREN)

But on the SEL-congress at Rome 2005 Fibiger (pers. comm.) withdraw his damnation of Beck's taxonomic changes in the Apameini: "In the next volume of the Noctuidae Europaeae, vol. 8, Apameini, we (the authors of vol. 8) have acknowledged all your taxonomical changes in this tribe!", perhaps because of the influence of the scientific coauthors Dr. Ronkay and Dr. Zilli? – But Fibiger never officially distanced from his remark of 1997, though the taxonomical changes in the other groups - tribes and subfamilies - of the Noctuidae s. Hampson had been done by Beck by the same principles. Still more: Some changes of Beck, 1991, which interimly had been acknowledged, e.g. Beck's splitting of the so heterogeneous genus *Amphipyra* OCHSENHEIMER has been withdrawn by Fibiger & Hacker 2007. These were clear acts to disprove the activities of Beck. Still more: To prevent Beck from further (necessary) taxonomical work they 'forbade' him to make any taxonomical revisions if not considering all known taxa of a genus worldwide. For these they (and all authors of the Noctuidae Europaeae) put all worldwide known species of a genus in front of the genera they treated in the Noctuidae Europaeae, thus making the volumes of this series thicker and thicker.

Of course the price for Beck's books is relatively high (but also the price for the volumina of the Noctuidae Europaeae), but the quality of these books written by the most experienced specialist of the larval-sytematics of the Noctuidae in the world, justifies these costs. The price for the four volumes in DM was 1028.- DM and is now, as recomended by the change of the currency from DM to €, the half = 514 €.

The great importance of these books for science, especially for the zoological systematics is expressed in the second title of these books **'The revision of the systematics of the Noctuidae (Lepid., Noctuidae).**

But it is still more: It is the revision of the phylogenetical systematics at all as now is evidenced in the present paper by the need to take in consideration the reversals and to allow monophyletic units by combination of autapomorphies.

And this is documented in the present paper of Beck.

In no other group of animals with metamorphosis the use of larval characters is more necessary than in the Lepidoptera, the adults of which have the external morphology hidden under scales and hairs-

And as the (moleculargenetical) paper of Sohn & al. 2013 proves: the larval-morphology with the setal-maps (of primary setosed larvae) is more worth than all the characters of the adults. E.g., the great larval-systematist Hasenfuss evidenced already in 1963 that the family Psychidae is the most ancient of the ditrysian Lepidoptera, which now after 50 years is acknowledged by the molecular-genetical investigations by Sohn & al. 2013.

This underlines the importance of larval-morphological studies in the Lepidoptera and by this the special worth of the books of Beck 1999-2000.