

MALE GENITALIA OF LEPIDOPTERA: MORPHOLOGY AND  
NOMENCLATURE IV. NOTES ON TUXEN'S "TAXONOMIST'S  
GLOSSARY OF GENITALIA IN INSECTS": SECOND  
ENLARGED EDITION

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I have found that Parts II and III of this series (Okagaki et al., 1955; Ogata et al., 1957) are not referred to in the recently published Second Enlarged Edition of "Taxonomist's Glossary of Genitalia in Insects" edited by S. L. Tuxen (1970). I have also found that the nomenclature which we proposed in one of those papers was not included in the very extensive and useful Glossary but was nevertheless employed to define another term in the same Glossary. The situation is thus a source of further confusion. I therefore wish to rectify this point in the present paper. Also Alexander B. Klots (1970) in his text of Lepidoptera (p. 124) of this new edition commented on the nomenclature for the subdivision of the valva, and referred to Part I of this series (Sibatani et al., 1954). I have a different opinion on his points, and judge that a note on his text may be useful.

The Scaphium and "Sociuncus"

Ogata et al. (1957) proposed that the dorsal appendages belonging to the 10th abdominal segment of male Lepidoptera, which may be subdivided into the median *uncus* (sometimes divided medially) and lateral *socii* should be called collectively the *scaphium* according to the original terminology of Gosse (1882) in the absence of any other suitable name. We made this proposal because we considered the *socii* and *uncus* as two similarly weighted and not mutually exclusive derivatives of a morphological unit structure, and also because sometimes it is difficult to assign portions of this unit to either *uncus* or *socii*. The term *scaphium sensu* Ogata et al. has since been extensively used by Japanese authors (Shirôzu and Yamamoto, 1959; Shirôzu, 1960; Inoué and Kawazoé, 1964, 1965; Kawazoé and Wakabayashi, 1969), but it is not referred to in this sense in Tuxen's Glossary, let alone mentioned in the text. However, the Glossary lists on p. 295:

"Okonze (russian) ♂ Lep. Kusnezov 1924 (!) teste Shirôzu and Yamamoto 1956 in Lycaenidae. Lateral membranous area between tegumen and *scaphium*" (Italic and ! by A.S.).

Shirôzu and Yamamoto (1956) were using the nomenclature outlined by Ogata (1950) in a paper which briefly summarized the conclusion as

published later in this series, and in which the scaphium was defined in the sense of Ogata et al. (1957), and not of Pierce (1909) or of most other authors. The term *okonze* (to be spelled "okontse" according to the currently employed transliteration of Cyrillic) was also mentioned in that paper by Ogata (1950).

Since, however, Tuxen's book has fixed the meaning of scaphium in Pierce's sense (p. 326), the way to minimise the confusion is to drop the use of scaphium as proposed by Ogata et al. (1957), and I so advise those who have so far followed the latter. This does not, however, alleviate the need of a collective term for the morphological unit covering the uncus and socii, as the recent extensive use by Japanese authors of the term scaphium in this sense testifies. I therefore suggest a new term *sociuncus* to replace the scaphium in the sense of Ogata et al. (1957). This is a synthesis of the words socii and uncus, and I hope that it is self-explanatory. It may be argued that the need for such a term would be readily dissolved by an expression like "uncus-socii complex." However, contrary to what such an expression would seem to imply, the sociuncus is a structure of primary morphological significance, and the uncus and socii are its secondary derivatives and not *vice versa*. In this sense, the situation is not comparable with that of frequently used expressions like "harpe + ampulla region" (Shirôzu and Yamamoto, 1956) or "harpe-ampulla complex" (Inoué and Kawazoé, 1965) of the valva, because in the latter case, the harpe and ampulla are of primary significance, which may secondarily become united.

There are several other names proposed in Part III of this series which I think Tuxen's Glossary should have included, and therefore I attach a "Proposed Addenda" to it at the end of this paper. They include two unlisted names (*cochlear* and *fenestrula*) which have been extensively used by Japanese authors, as well as certain other terms which are now involved in confusion for which I am mainly responsible.

#### Subdivision of the Valva

The second point I would like to discuss briefly concerns Klots's statement (p. 124) in Tuxen's book:

"... these findings [recognition of "six" (actually seven) fundamental regions by Sibatani et al. (1954) in the valva—A.S.] do not agree in part with the very important conclusions of Forbes (1939) who studied the valval musculature, especially regarding the so-called "*clasper*," which in some groups has a separate musculature which would seem to infer a separate origin. Still more disparate are the conclusions of Birket-Smith (1965) about many structures, particularly of the valvae, based on studies of the structure and their musculature in Lithosiinae. This author introduces a largely new nomenclature, which deserves very careful consideration."

It is hard to understand the first half of this statement. The subdivision of the valva as proposed by Sibatani et al. (1954) was based on an extensive study of the musculature, and as far as the more specialised families of Lepidoptera are concerned, it supported the findings, if not the interpretation, of Forbes (1939). Especially difficult to follow is Klots's comment on the musculature of "clasper" (= *harpe*), because both in Forbes (1939) and Sibatani et al. (1954) the "clasper" or *harpe* was virtually defined by its insertion at the base of Muscle 5 (Flexor of *harpe*), which arises from the base of the valva (usually *sacculus*).

It is true that Forbes mentioned some anomaly of Muscle 5, inserting mostly into *juxta* in place of the *sacculus* in an unidentified and unillustrated species of Geometridae, noting that the "clasper" is missing in this instance. I suspect that here he was dealing with a form of Boarmiinae having the *furca* (Okagaki et al., 1955), in which the *sacculus* is modified into a *juxta*-like structure (= *furca*) and Muscle 5 inserted in the *harpe* has a reversed orientation of the motion transfer as Forbes himself noted. Therefore, I do not see any discrepancy between Forbes (1939) and Sibatani et al. (1954).

In more primitive groups of Lepidoptera (Hepialidae, Incurvariidae, Tortricidae) Muscle 5 is missing. Instead, Muscle 6 (Protractor of aedoeagus) may insert in the base (Tortricinae) or the tip (Incurvariidae and Olethreutinae) of the valva. The origin (or terminus) of this muscle attached to the cephal end of the aedoeagus is very variable even among less primitive families of Lepidoptera, ranging from tegumen or vinculum (the typical case) to various parts of the valva and/or *juxta*. It is therefore conceivable that Muscle 6 may occasionally be mistaken for Muscle 5 or its derivative.

It is also important to notice that the *harpe* (and its Muscle 5) appears predominantly in more specialised groups and not in primitive forms, so that its derivation must be only secondary. This concept would be useful for determining the homology of the valva with more general structures. I shall discuss this subject more fully in a separate paper of this series.

Birket-Smith (1965) divided the valva of Lithosiinae into the following portions: *basis valvae* (including *processus momenti* and *supra-valva*), *ala valvae*, *plica centripetalis* and *valvella*. A careful examination of his text and figures clearly indicates that the musculature in this group is essentially the same as observed by Forbes (1939) and myself (Sibatani, in prep.). Only in minor special groups unusual sclerites like those called the *valvella* with its unusual muscles seem to appear. However, such cases can be recurrently observed in widely scattered groups of Lepidoptera.

The division of the main body of the valva into *basis valvae* and *ala valvae* seems to have been worked out from the particular pattern of sclerotisation of the valva in Lithosiinae, but this should have a more functional rather than fundamentally morphological significance. Thus the following assignment of synonymy is easily made. Assignment similar to that used in the Glossary of Tuxen (1970) is marked with an asterisk.

*Ala valvae* = Sacculus + harpe + their corresponding wall on the outer surface of valval sclerite.

*Basis valvae* (s.str.) = Basal portion of the outer wall of the valva.

*Plica centripetalis* = *Ampulla*.

*Processus momenti* = Unconnected *transtilla*, acting as apodeme for muscular attachment.\*

*Supra-valva* = *Cucullus*.

*Valvella* = A structure peculiar to the group studied.

Therefore, Birket-Smith's new system of nomenclature does not enforce a drastic revision of the nomenclature for the division of the valva applicable to more specialised groups. Since the subdivision proposed by Sibatani et al. (1954) was concerned solely with the structures appearing on the mesal surface of the valva, and if the subdivision of the outer surface is called for, Birket-Smith's terms of *basis valvae* and *ala valvae* might prove useful. However, the variation among different families is so enormous that I doubt that a generally workable system can be derived from his terminology.

#### Proposed Addenda to Glossary

Only those terms which the author and his former collaborators are responsible for naming and interpreting are listed.

**Cochlear** (-is, ia) ♂ Lep. Ogata 1950, Ogata et al. 1957. Median process of gnathos. → *Brachia*.

**Fenestrul**a (-ae, -ae) ♂ Lep. Ogata et al. 1957. Dorsal median hyaline part of conjunctival membrane between sociuncus and tegumen. → *Lateral fenestrula*.

Syn. Okontse (= Okonze) Kuznetsov (= Kusnezov) 1916.

— ♂ Lep. Inoué and Kawazoe 1964 in Hesperidae. Entire sclerotised or unsclerotised conjunctival membrane between tegumen and sociuncus. → *Okonze* Ogata 1950 nec Kuznetsov (= Kusnezov) 1916.

**Furc**a (-ae, -ae) ♂ Lep. Okagaki et al. 1955, Pierce 1914 in Geometridae (*Ourapteryx*, *Plagodis*, *Cepphis*, *Epione* etc. nec *Ennomos*). Sacculus becoming an independently movable process between juxta and harpe-valvula area of valva; sometimes asymmetric and even unilateral.

- Okontse** (russian) ♂ Lep. Kuznetsov (=Kusnezov) 1916. = *Fenestrula* Ogata et al., *Okonze* Ogata 1950 (part.).
- Okonze** (russian) ♂ Lep. Kusnezov 1916 = *Okontse* Kuznetsov 1916. — ♂ Lep. Ogata 1950. Entire conjunctival membrane between sociuncus and tegumen. → *Fenestrula*, *Lateral fenestrula*.
- Lateral fenestrula** ♂ Lep. Inoué and Kawazoé 1965 in Riodinidae and Lycaenidae. Lateral hyaline parts of the conjunctival membrane between sociuncus and tegumen at the base of brachia. → *Fenestrula*. Syn. Lateral window Shirôzu and Yamamoto 1956.
- Lateral window** ♂ Lep. Shirôzu and Yamamoto 1956 = *Lateral fenestrula*.
- Scaphium** ♂ Lep. Ogata et al. 1957, Gosse 1882 = *Sociuncus*.
- Sociuncus** (-i, -i) ♂ Lep. Sibatani 1972 (this paper). Dorsal appendages of tenth somite as a morphological unit; probably homologous with pygopods; may be further divided into uncus and socii. Syn. Scaphium Ogata et al. 1957 nec Pierce 1909.

## SUMMARY

A new term "sociuncus" was introduced for the entire dorsal appendage of the 10th somite of male Lepidoptera, of which the uncus and socii are parts. The subdivision of the valva was reexamined in the context of Klots's view in Tuxen's "Taxonomist's Glossary of Genitalia in Insects," Second Enlarged Edition (1970), with the conclusion that no alteration is necessary for the system proposed in a previous paper of this series. The "Glossary" was supplemented by a "Proposed Addenda" to it, which lists some names treated inadequately or missing therein.

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#### ANOTHER LARVAL FOODPLANT FOR *EUPHYDRYAS PHAETON* (DRURY) (NYMPHALIDAE)

During the first week of June, 1971, I was collecting in a meadow in lower Orange County, New York State, where I had collected *Euphydryas phaeton* (Drury) in other years. This year the season was about one week late and very few of the checkerspots were flying. Numerous mature larvae were identified, however, (about two dozen) feeding on scattered bushes of the arrow-wood (*Virburnum recognitum* L.). This shrub was fairly plentiful in this field. Usually there were two to three larvae on a bush, feeding on the uppermost leaves. Though turtlehead (*Chelone glabra* L.) was also present in this field, no caterpillars were seen feeding on it.

It is to be noted that a few days earlier in Andover, Sussex County, New Jersey, a mature larva of this same butterfly was collected on White Ash (*Fraxinus americana* L.).

In 1969, Joseph Muller reported a new larval foodplant for *Euphydryas phaeton*, namely *Pentstemon hirsutis* (L.) (J. Lepid. Soc. 23: 48). Apparently there are several plants which are accepted by mature *phaeton* larvae. As *phaeton* is known to form colonies on turtlehead in its earlier instars, perhaps its diet becomes more catholic with maturity. Perhaps also the requirements of the larger caterpillars may outstrip the availability of the original foodplant, forcing a change.

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