

CONSIDERATIONS ON THE TERMINOLOGY OF THE GENITALIA IN LEPIDOPTERA

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The following considerations and suggestions are the result of a study of the terminology of the genitalia in Lepidoptera in order to prepare a contribution to the "Taxonomists' Glossary of Genitalia in Insects" soon to appear. The editor, Dr. S. L. TUXEN, of Copenhagen, kindly allowed me to publish the following notes separately.

RAMBUR apparently was the first lepidopterist to realize the paramount importance of the characters of the skeletal parts of the genitalia for taxonomy; he was the first to use distinct terms for these parts, and to publish his conclusions, concerning southern European Hesperiidæ, as long ago as 1842. It is to be regretted that at present his publication is very rare, and consequently is so little known.

During the more than one hundred years that followed, slowly but gradually the realization of the importance of these characters became general, and at present there are few lepidopterists who would deny this importance or leave these characters out of consideration. An enormous mass of scattered data on the morphology of the genitalia has accumulated, and is continuously increasing. Soon special terms were needed for the description of these structures, and these terms were lavishly created. Generally the study of the genitalia was only an accessory to classification. Every individual investigator would use genital characters without having acquired a proper knowledge of the earlier literature on the subject and of its terminology, simply because previous publications concerned the classification of groups in which he was not directly interested. Thus everybody used to create his own terms as soon as he needed them. Or some paper received unduly wide general attention, and its terminology was followed by other authors during a long time, without its correctness ever having been probed or the possibility of an application of this terminology to a different group of Lepidoptera having been considered. Often subsequent authors erroneously applied previously published terms, by failing either to identify correctly the parts concerned, or simply to read properly those previous publications.

Sometimes one failed to discriminate between the main parts, which, of course, deserve special terms to facilitate description, and the minor structures, which often are complicated, and exceedingly diverse in different groups, and better might remain nameless. Consequently, numerous arbitrary terms have been created for similar minor structures, and these structures were homologized in different groups of Lepidoptera, without any apparent right or reason. It is noteworthy that the less an author was acquainted with the morphology of the genitalia of the group studied by him, the more he seemed to have an urge for the creation of new terms for every structure observed by him; later he often would abandon many of his original terms.

There have been quite a few lepidopterists who published general essays on the subject or tried to summarize the data known at that time. However important some of these papers are, they are either chiefly concerned with ontogeny of the genitalia and with problems of general comparative anatomy (Zander, 1903; Petersen, 1904; Eyer, 1924; Beirne, 1942, 1944; etc.), or represent historical and bibliographical reviews (De Graaf, 1901; Van Eecke, 1915; Viette, 1948). Little attention was paid to a critical examination of the terminology of the genitalia and to compiling a practical list of terms for general use, except by BUSCK and HEINRICH (1921), whose paper is incomplete, and by KUSNEZOV (1915), whose excellent study is in Russian and therefore did not get the attention it deserved.

In view of these facts it is not at all surprising that the terminology of the genitalia in Lepidoptera became chaotic; it apparently is in a worse state of confusion than in any other order of insects. Meanwhile recognition of these characters as an indispensable means of modern taxonomy has become general. Therefore the creation of some order in the already existing terminology and the prevention of further confusion is desirable. The publication before long of the first glossary of genital terms seems to be a suitable opportunity for such endeavour.

Fortunately our problem is less desperate than one might suspect. This is chiefly owing to the monumental studies of the late F. N. PIERCE, who actually was our only "specialist of genitalia", because he studied the genitalia primarily from a morphological point of view. He acquired a greater general knowledge of these structures throughout the order than any other author before and, possibly, up till now after him. Thanks to his well-merited authority the principal part of his terminology already is generally accepted by most taxonomists. Owing to the sound judgement of the most of them the weaker parts of PIERCE'S taxonomy (viz., superfluous terms of his first publication of 1909) have been left out of account. Thus one safely can state that the greatest confusion dates from before and not from after PIERCE'S studies. In order to reach definitive stability it seems sufficient to fixate in some way the now accepted views. But there also are lepidopterists who are inclined to apply a dangerous procedure, the rule of priority in terminology, by trying to substitute obsolete and unfamiliar terms for the generally accepted and familiar ones. And there still are a few who continue to create new superfluous, and often synonymous, terms for every structural detail.

In order to contribute to a "sanitation" of the terminology of the genitalia in the Lepidoptera I here present a few suggestions for the use of certain terms, for consideration by fellow taxonomists, and wish also to warn against the two last mentioned methods, viz., the application of the rule of priority, and the creation of new terms for minor structures. My ideas are neither revolutionary, nor entirely new, as in formulating them I tried as much as possible to follow the modern general usage. Moreover, some of these views have already been expressed, although perhaps less emphatically, by KUSNEZOV (1915).

Four suggestions, concerning, in my opinion, the most important problems of terminology, are given below, accompanied by examples and discussions.

(1) Latin, latinized or not latinized Greek terms, instead of barbarous terms, should be used for denoting those parts of the genitalia that deserve a special terminology. Only Latin or latinized terms are international; therefore they are to be preferred for establishing stability and uniformity, to any barbarous denominations, in any other language. Of all the terms examined by me there are only a few that appear to have no already existing Latin or Greek equivalents. Carrying into execution of this recommendation would therefore not meet with difficulties.

Examples: *valva* (plur. *valvæ*) Rambur 1842, should be used, instead of "clasp" or "clasper" (English), "valve" (French), "Klappe" (German), etc.; for similar reasons the term *papillæ anales* Kusnezov 1915, is preferable to "lobes of the ovipositor", "Afterklappen", "flaps", etc.

(2) The rule of priority in terminology of genitalia should most emphatically be relinquished, as its application unavoidably results in a great confusion. The following notorious example of confusion in terminology may illustrate the dangers of the application of the rule of priority. In 1881 and 1883 GOSSE published two papers on the male genitalia of Rhopalocera. However elegantly styled and handsomely illustrated (the second paper), they contain serious errors, due to the crude working method of the author (maceration of chitin and sclerotin with KOH not being known at that time, the genitalia were inspected in dry and shrivelled condition, after one *valva* having been removed "with a sharp pen-knife"). Starting with certain Papilionidæ GOSSE correctly described a curved dorsal process of the eighth abdominal segment, and termed it *uncus*; he stated, however, that the *valvæ* articulate with the eighth segment, which is, of course, erroneous. When further studying other species of the Papilionidæ, and species of other families of Rhopalocera, he indicated dorsal processes of a similar shape, with the same term, *uncus*, not noticing, however, that these processes were now attached not to the eighth, but either to the ninth or to the tenth tergite! Curiously enough, most subsequent authors were not aware of this error to the present day. Only SCUDDER (1889) used GOSSE's term *uncus* in a correct sense (*i.e.*, to indicate an apophysis of the eighth abdominal tergite), but this usage remained unnoticed. All subsequent authors who used the term "*uncus* Gosse" applied it to the apophysis of the tenth abdominal tergite! Finally, KUSNEZOV (1915) unravelled this tangle by a reexamination of some of GOSSE's species but, unfortunately, his Russian paper did not attract general attention either, as was already remarked above. (Cf. fig. 1)

It is evident that great confusion would result from an application of the rule of priority to GOSSE's terminology. The generally accepted term *superuncus* Kusnezov 1915, denoting an unpaired dorsal apophysis of the eighth tergite, would have to be changed in *uncus* Gosse 1881. The familiar term *uncus* (*sensu* Peytoureau, 1895), now in general use for what is regarded by most authors as the tenth tergite (by a few, the apical appendage of the

ninth tergite), would have to be changed to some other term; those who are fortunate to be able to consult the rare first paper of RAMBUR, mentioned in the beginning of the present paper, would have to choose for this well-established term (*uncus*) the antedating term *sicula* Rambur 1842, which is hardly known, but those who ever bothered to read the classic "Dissertatio epistolica de Bombyce", would have to propose the term *unguis* Malpighi 1669, which is largely unknown! The notorious term *scaphium* Gosse 1883.

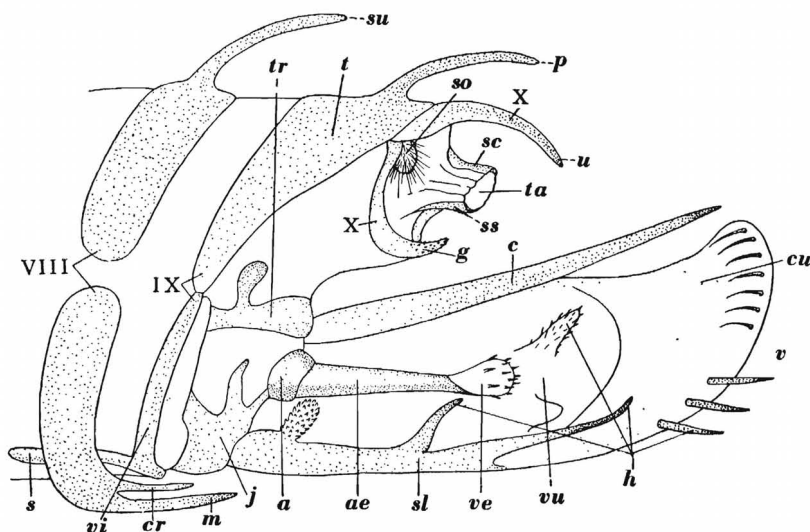


Fig. 1. Diagram of the male genitalia of a lepidopteron, in lateral aspect, with the right *valva* removed. Latin numerals denote the generally accepted homology of the abdominal segments; names and years denote the first author either to create the term or to use it in its generally accepted modern sense: *a* = *anellus* Pierce 1914; *ae* = *aedeagus* Pierce 1914; *c* = *costa* Pierce 1914; *cr* = *ceratum* Pierce 1909; *cu* = *cucullus* Pierce 1909; *g* = *gnathos* Pierce 1914; *h* = *harpe* Kusnezov 1915 (compound term denoting the complex of structures of the inner side and the margin of the *valva*); *j* = *juxta* Pierce 1914; *m* = *mappa* Pierce 1909; *p* = *pseuduncus* Spuler 1910; *s* = *saccus* of modern authors (not *saccus* Baker 1891, which means *saccus* + *vinculum*); *ss* = *subscaphium* Pierce 1909; *sc* = *scaphium* Pierce 1909 (not *scaphium* Gosse 1883, as originally *tegumen* was denoted with that term!); *sl* = *sacculus* Pierce 1914; *so* = *socius*; *su* = *superuncus* Kusnezov 1915 (*uncus* Gosse 1883!); *t* = *tegumen* Pierce 1909; *ta* = *tuba analis* (latinization of "anal tube" Pierce 1914); *tr* = *transtilla* Pierce 1914; *u* = *uncus* Peytoureau 1895; *v* = *valva* Rambur 1842; *ve* = *vesica* Pierce 1909; *vi* = *vinculum* Pierce 1909; *vu* = *valvula* Pierce 1914.

applies in the above example to nothing else but the *tegumen* (the ninth tergite), while with this now well-established and familiar term in the sense of PIERCE (1909), the dorsal sclerite or sclerites of the anal tube (*tuba analis*) are indicated.

Thus, disadvantages of the application of the rule of priority are evident. Furthermore, as it is impossible to review all the existing literature on the

genitalia at once, subsequent exhumation of obsolete terms would necessitate a revision of terminology. Change of opinion of modern authors as to the meaning of a certain old term (as in the example in GOSSE's papers) would have the same result. Finally, a study of the history of terminology, a terminology committee, a code of terminology rules, etc., would be needed.

When abstaining from the rule of priority it is clear that another directive is needed. (3) **PIERCE's terminology is here proposed for general use, after deletion of certain superfluous terms** (see *sub* 4).

Since PIERCE was the specialist on this subject who contributed most to our knowledge of the genitalia in Lepidoptera, and since his terse and handy terms are already accepted by most taxonomists, a recommendation of these terms as a fundament of a revised terminology seems to be only natural. However, some of PIERCE's early terms (of 1909), abandoned by himself later, are superfluous, for which matter I refer to the following suggestion. Example: *signum* (plur. *signa*) Pierce 1914 should be used instead of *lamina dentata* (plur. *laminæ dentatæ*) Petersen 1904.

(4) Certain minor details of structure of the genitalia should not be denoted with special Latin or Greek terms, but their complex should be indicated by a compound term only, and, if necessary, these details should further be described in the language of the concerned paper (i.e., not Latin, nor Greek); this in order to prevent confusion and overburdening of terminology by superfluous terms; already existing Latin or Greek terms for similar minor structures should be neglected.

As already remarked above, certain parts of the genitalia in the male, and in the female, often show a great plasticity, resulting in a development of complicated "armatures". A comparison of more or less similar structures of this kind in different species, and erecting of their homologies might sometimes be tempting but generally is entirely problematic and therefore useless, confusing, and objectionable. And since the homology of similar structures cannot at present be ascertained, denoting each of them with an arbitrary Latin or Greek term is undesirable, often resulting in confusion.

As an example of such a confusion is the arbitrary term *fibula* used by BASTELBERGER (1900) for a sclerotized process of the postero-median portion of the inner side of the *valva*, directed upwards and outwards, in *Zonosoma*; by SCHRÖDER (1900) for a clavate and hairy apophysis of the *transtilla*, in *Eupithecia*; by JOHN (1910) for a clavate and hairy apophysis but of the medio-dorsal portion of the inner side of the *valva*, in *Leucanitis*; and finally, by ROEPKE (1938) for a long, rod-like apophysis with a split top, of the *anellus* or of the *juxta*, in *Kallima*. Fortunately the majority of modern taxonomists have already abandoned many of the superfluous terms of this kind, so that also this suggestion is suitable for general usage.

There are several "plastic" areas in the genitalia of the Lepidoptera, but only three of them need to be considered here, forming an especially fertile ground for the making of terms. They are the following.

(a) The inner surface and the margins of the *valva* in the male which may be ornated with processes, crochets, teeth, combs, ribs, brushes of modified hairs, etc. I suggest to denote this entire complex with the compound term *harpe* (Gosse, 1881, in the sense of Kusnezov, 1915), and describe the peculiarities with barbarous (*i.e.*, not Latin nor Greek) terms. By this procedure the following 24 Latin or Greek terms may be cancelled: *ampulla*, "antistyle", *brachiola*, *cercina*, *clavus*, *clinopus*, *clunacula*, *conus*, *corona*, *crista*, *crista obliqua*, *digitus*, *editum*, *fibula*, *flagellum*, *forceps*, *lobulus basalis*, *penicillium*, *peniculus*, *pollex*, *processus inferior valvæ*, *processus superior valvæ*, "pseudostyle", and *pulvinus*.

(b) The sclerites and their apophyses of the *diaphragma* in the male. I suggest to denote the entire complex of these structures with the compound term *fultura penis* (Petersen, 1904), to discriminate three portions only, and to denote these with PIERCE'S terms (1914), as follows: the portion above the *ædæagus* with the term *transtilla*, that around the *ædæagus* with the term *anellus*, and that below the *ædæagus* with the term *juxta*. Sometimes these parts are not sufficiently differentiated; in that case it may be useful to discriminate the dorsal and the ventral portions of the *diaphragma* only; then PETERSEN'S terms (1904), *fultura superior* and *fultura inferior*, are recommended for general use. The following 18 Latin terms then become superfluous: *brachium*, *bucina*, *calcar*, *canaliculus*, *collare*, *crista*, *ductus inferior penis*, *ductus superior*, *ductus superior penis*, *fibula*, *fulcrum*, *furca*, *labis*, *lamina præputialis*, *sternellum*, *suspensorium trulleum*, and *vallum penis*¹.

(c) Sclerites of the region of the *ostium bursæ* in the female. My suggestion is to denote the entire complex of these structures with the compound term *sterigma* Bryk 1918. Although less generally used till now, this term is, to my knowledge, the only latinized term available. Only two portions of this complex, if necessary, might be denoted with special terms, viz., the portion situated rostrad (ventrad) of the *ostium bursæ* with the well-known term *lamella antevaginalis* Kusnezov 1915, and the portion caudad (dorsad) of the *ostium bursæ* with the term *lamella postvaginalis* Kusnezov 1915. The following Latin terms could then be cancelled: *director penis*, *instita*, *lobuli vaginales*, *pars subvaginalis*, and also a series of confusing barbarous denominations, as, *e.g.*, "antevaginal plate", "genital plate", "plate of ostium", "postvaginal plate", "Subvaginalplatte", "terminal plate", "vaginal armature", etc.

The diversity of these structures is considerable (fig. 2), and though a relatively small number of terms have been used for them up till now, it is to be feared that many new terms might be invented in future. My suggestion is meant as a precaution against such a policy.

The above suggestions cover only a few problems of terminology, although, in my opinion, they are the most important. It is, of course, hardly

¹I make an exception for the term *caulis* Obraztsov 1949, denoting a vertical sclerite which connects the *anellus* with the *juxta*; this term is very useful for descriptions of genitalia in Tortricodea.

practical to present prescriptions for the use of every existing term. Perhaps the best advice for the choice of terms for parts that are not mentioned here, is, as much as possible, following the now established usage; the use of the "Glossary", after having taken counsel with colleague taxonomists; inclusion in publications of figures and of explicit legends of the terms used, and, above all, caution with and economy in the description of new terms.

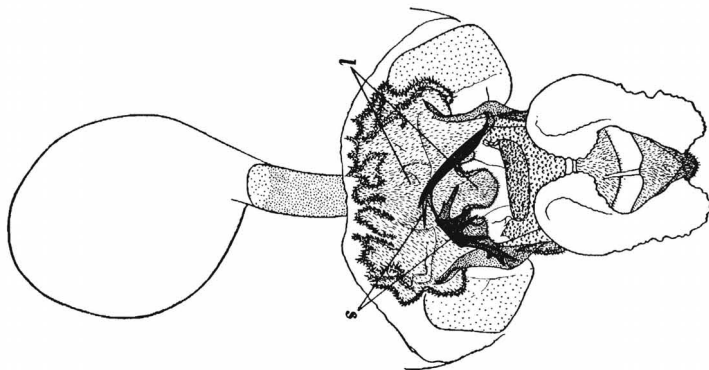


Fig. 2. Female genitalia of *Schœnotenes pachydesma* Diak. (Schœnotenidæ), as an example of complicated structures in the region of the *ostium bursæ*: *l* = *lodix* Pierce 1909 (modified posterior edge of the seventh abdominal sternite); *s* = *sclerites* of the *sterigma* Bryk 1918 (elements of the intersegmental membrane between the seventh and the eighth abdominal sternites). After DIAKONOFF (1954).

Finally I wish to stipulate that the terms for genitalia dealt with in the present paper are those as used in taxonomy. Another category of terms, those of the pure comparative anatomy (as, *e.g.*, gonopodes, parameres, cerci, styli, etc.), was entirely left out of consideration. In 1950 and 1952 a French hemipterist, DUPUIS, published interesting suggestions, when proposing a simplification of the terminology of the genitalia in insects through the substitution of taxonomic terms by those used in comparative anatomy. Without doubt, such a procedure would be beneficial, were it practical. Perhaps this method may lead to good results in the order Hemiptera, in which DUPUIS is especially interested. But for the terminology of the genitalia in the Lepidoptera this suggestion is, alas, exceedingly little promising. It is a fact that the study of the morphogenesis of the genitalia in this order is in a puerile stage. Some six or more authors have contributed to the study of the comparative anatomy and ontogeny of the genitalia in the Lepidoptera, but their results as to the homologies of many parts, if not of every part, including the proposed terminology of these parts, contain contradictory data to such a great extent that recommendation of terms used by comparative anatomists for general usage in taxonomy would only result in profound confusion.

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