

REVIEWS

THE SATURNIIDAE OF THE WESTERN HEMISPHERE. MORPHOLOGY, PHYLOGENY, AND CLASSIFICATION. By Charles D. Michener. *Bulletin American Museum Natural History*, vol. 98: pp. 335-502, pl. 5, 420 text figs., 19 tables. 3 March 1952. Available from: American Museum of Natural History, New York 24, N. Y., U. S. A. in paper cover, \$2.25.

It is a little odd that this group (Saturniidae and Citheroniidae, as usually understood) is one of the top families of Lepidoptera in general interest, knowledge of its biology and life history, and popularity in collections; and yet its broader classification has been presented to us only in scraps. For a long time we hoped that ROTHSCCHILD and JORDAN would repeat for this group the kind of work they had done on the Sphingidae, but all that came out was on species and a couple of revisions of small groups. More came from BOUVIER, but again little to draw the work together into an overall pattern, and his series of papers, while eventually covering most of the Hemi-leucinae, were scattered where most American entomologists never saw them. When we heard that a group was at last to do the job, at least for America, with the help and encouragement of FRANK JOHNSON, we all looked forward to the result. But JOHNSON and ZIKAN are dead, COMSTOCK is inactive, and the present work may perhaps be all we shall get.

This is a very careful study of the adult structures of every American genus and major group of the double family, with enough of the related old-world types, so that only three or four more (*Nudaurelia*, *Decachorda*, *Eudaemonia*, and perhaps *Graellsia*) would have given us a world view of the major classification. We have a general discussion of the taxonomically useful structures, organ by organ, followed by page-long descriptions of the fifty genera and fifty further subgenera recognized, with drawings of the venation and genitalia of most of the type species. There is also a phylogeny, summing up what has appeared in previous papers. But this phylogeny must still be taken with great caution, for it is based wholly on the imaginal characters, almost all of which are degenerations; in fact the whole work is largely a study in degeneration. The early stages, which show far more in the way of progressive modifications, are hardly considered at all.

The work will also be of little use in the practical handling of material, for the keys are largely based on characters only uncovered by full dissection, among them the number of segments of the reduced palpi, the cones on the antennae, and the stage of reduction of the tarsal spining.

The concept of the size of genera is interesting; I wonder how some of the groupings will stand the test of further study. On the whole the work is neither "splitting" nor "lumping", but on a first view the scale does not seem consistent. For instance, *Automeris* and *Sysphinx* are subdivided, but *Saturnia* is kept nearly in the traditional sense, with *Calosaturnia*, *Agapema*, and *Eudia* standing as subgenera; and *Telea* does not even remain a subgenus against *Antheraea*, though *polyphemus* at least has a slightly distinct caterpillar. I have just rearranged the Cornell collection according to the new system, and to my eye part of the changes seem right, but part look a little odd and are, I suspect, based on over-emphasis of mere features of degeneration.

As to specific comments: The survival of a couple of spines on the penultimate segment of the female fore tarsus is of biological interest, for various Lepidoptera are known to identify their food-plants before ovipositing, by rasping the food with the fore tarsi (even the nearly vestigial fore tarsi of *Argynnis* and *Limenitis*), though I do not remember seeing this done by the Saturnids.

(P. 353). There seems to be some floating confusion as to the definition of the genitalic terms of anatomy; some workers when they say "uncus" mean only the slender prolongation, others use the term for the whole tenth tergite, when recognizable. MICHENER (and I) have been using it in the latter sense; some authors (among them ZANDER, as cited) limit the term to a free appendage, using the term "tegumen" for the combined 9th and 10th tergites. This explains some inconsistencies of statement. So it is with the "anellus or juxta"; morphologically two separate structures are involved: a sternal plate, with its various appendages, ob-

viously belonging to the body wall and in the proper position for a 9th furcisternum; and a ring about the penis, which is wide-spread in the insects, is developed from the reproductive system proper, and is actually the aedoeagus of embryologists though systematists use the term differently in the Lepidoptera (*i.e.*, for the actual penis). The first of these sclerites is the juxta and the second the anellus, but they are often fused, and many workers confuse them (usually using the term anellus for the juxta, rarely the reverse). Michener also shifts the term gnathos. The transtilla is a structure of the 9th segment, articulating with the posterior (dorsal) process of the valve, while the gnathos is the tenth sternite, articulating with the junction of tegumen and uncus (or 9th and 10th segmental portions of the tegumen, under the more restricted definition of uncus). In fact both structures exist in some Saturnioids: the *g* of MICHENER'S figure 101 (*Asthenidia*) is the gnathos, the *g* of his *Rhesycytis* figures (116, 119) is the transtilla, the gnathos being reduced and not lettered, but shown as a pair of slender bars hanging down from the uncus.

The whole genitalic structure, not only of the early forms but in its manner of further development, is very suggestive of the Eupterotidae, and the connection may be closer than we have realized.

(P.348). I feel that MICHENER does not do justice to the thorax, which is surprising in a hymenopterist. The pleural and anepisternal sutures of the mesothorax show much more extensive features than indicated, and they should be of great phylogenetic interest, for they are among the very few features of the imago that are not mere degeneration. The character making a primary subdivision of the group into Saturniids and Citheroniids plus Ludiinae, is not the position of the anepisternal suture, nor the condition of its posterior part, but the direction of its anterior part, which is plunging in the Citheroniids and Ludiinae, like the Bombycidae, Lasiocampidae, etc., but transverse in the Saturniids. On the other hand the position of the suture and resulting size of the anepisternum is a very useful character in further subdivision (*e.g.*, very high in *Hemileuca* and *Coloradia*, much lower in some *Automeris*), and the presence or absence of the posterior part may also be a useful character. Incidentally, it is a more convenient character than most of the ones MICHENER cites, for it can be seen merely by denuding a small spot on the thorax, without making a formal dissection. I suspect the sinuosity of the lower end of the pleural suture may also be of use. In the table on p. 356 the reference to the anepisternal suture should read "anteriorly" instead of "posteriorly".

(P.356). In the table, on the primitive side, we read: "Flagellum without bristles". On examination I find the type 2 bristles in every form of which we have a slide. The only thing is that they are often shorter than the diffuse setae and easily overlooked if one does not consider their straightness and large socket. So that the character is merely one of slightly smaller and larger size, and I believe is not phylogenetically significant. Incidentally again, in the case of *Aglia* (p.359) they are not "absent" but rather notably large and strong.

(P.362, middle of first column). In the Cercophanidae it is the base of R_1 , not merely of R , which persists.

(P.364). It seems not generally noticed that the horns of *Aglia* and the Citheroniids are not the same ones; in the Saturniids and Citheroniids which have two pair of enlarged horns they are on the meso- and metathorax, in *Aglia* on the pro- and metathorax. And this makes a possible further link between *Aglia* and *Polythysana*, for I think the latter is the only other Saturnioid, in which the prothoracic horns are the longer (Butler, *Trans. Ent. Soc. London* 1882: 104). If the odd bunch of spines on the "thirteenth segment" is actually on the anal plate, this will make a second and almost conclusive link with *Aglia*.

(P.436, footnote). I think it is hardly correct to call *Jo* an emendation of *Io*. After all, scientific names are supposed to be Latin, even though the vagaries of the code have since 1912 or so distorted this into a very curious pseudolatin in some cases. But in HERRICH-SCHAEFFER'S time they were still Latin, and in Latin as also in the German of those days *I* and *J* were merely different forms of the same letter, hence it would be "impossible for *Io* and *Jo* to be synonyms" indeed, being the identical name. I also wonder about the rule of "tautonymy", for *Io* (*i.e.* *Jo*) cer-

tainly was intended to include the species *io*, even though not formally cited. And by the way, our *io* moth is printed *Jo* by CRAMER.

(P. 469, near middle of second column). Read *pagenstecheri*.

(P. 477). Note that in the *Saturnia* group the larvae again give good evidence. In the true *Saturnia* and a few relatives the larva has bristly knobs, much like *cecropia* and even more like *Eupackardia calleta*. In *Dictyoploca* and *Caligula* they are densely hairy, and should certainly stand as a separate genus, though *Cricula* is somewhat transitional, with both knobs and hair. *Rhodinia*, which seems to belong with them superficially, clearly goes with *Antheraea*, etc., on early stages, with a dense (not lace) cocoon and an unpaired knob on the eighth segment of the abdomen. *Copaxa canella*, as figured by BURMEISTER, shows the long clubbed setae of *Saturnia pyri*, and we have its suitable lace cocoon.

(P. 409). Note that *Aglia* has two species, the Japanese *A. japonica* Leech, with a minute eyespot on the fore wing, being quite distinct from the mainland *A. tau*, with all eyespots very large.

(P. 499). I would certainly list *Callosamia* with three species, since *C. securifera* M. & W. (= *carolina* Jones) shows no sign of intergrading with *angulifera*.

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A REVISION OF THE GENUS *ANNAPHILA* GROTE (LEPIDOPTERA, PHALAENIDAE). By Frederick H. Rindge & Claude I. Smith. *Bulletin American Museum of Natural History*, vol. 98: pp. 187-256, 8 figs. 30 Jan. 1952. Available from: American Museum of Natural History, New York 24, N. Y., U. S. A., in paper cover, \$1.00.

This genus of beautiful little day-flying noctuids is becoming a collector's favorite (see Sala, in *Lep. News*, vol. 4: p. 71; 1951), but accurate determinations were not possible for most specimens until Dr. RINDGE finished this revision after the sad accidental death of Mr. SMITH in 1949. The revision is in the orderly style of all the RINDGE papers, with convenient tables of distribution and flight periods, keys to adult wings, and male and female genitalia, and full synonymies and detailed descriptions of all species and subspecies. *Annaphila* is known only from western North America. In this revision the genus is subdivided into two subgenera, *Proannaphila* (new) and *Annaphila*. Of the nineteen species here recognized, six are described as new, and new subspecies are named for two others. The larvae of only four species are known, all described in this paper for the first time as a result of the careful work of WILLIAM H. EVANS. One new species is appropriately named for Mr. EVANS. Drawings illustrate the ♂ genitalia of eighteen species and the ♀ genitalia of all nineteen.

With this usable revision available there is an added incentive for field lepidopterists to take special care in watching for *Annaphila* in late winter and early spring, especially in western states other than California.

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