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A REVISION OF SOME GENERA OF THE JAPANESE PLUSIINAE, WITH DESCRIPTIONS OF A NEW GENUS AND TWO NEW SUBGENERA (LEPIDOPTERA, NOCTUIDAE)

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Recently, four Plusiine genera were newly founded by Dufay in his studies on the subfamily Plusiinae from Indo-Australia (Dufay, 1970b) and Madagascar regions (Dufay, 1970a). According to his view, two out of the four new genera, the other two being endemic to Madagascar, may be applied directly or indirectly to some Japanese species of the subfamily. His assertion was reviewed by Sugi (1972) and tends to be introduced to Japanese fauna without criticism. The author, however, cannot always accept Dufay's opinion which was based merely on imaginal characters, particularly on genitalia and abdominal segments of male adults, leaving morphology of developmental stages entirely out of consideration.

The present paper deals with a revision of certain genera related to the Japanese fauna, taking in consideration some information as to the larval morphology studied since the author's monograph of the Japanese Plusiinae (Ichinosé, 1962). It includes also descriptions of a genus newly upgraded, a new genus and two new subgenera.

Genus ***Autographa*** Hübner

Autographa Hübner, 1821, Verz. bek. Schmett., 251.

Type-species: *Noctua gamma* Linnaeus, 1758, fixed by Grote, 1895.

Subgenus ***Sclerogenia*** nov.

Type-species: *Plusia jessica* Butler, 1878, A.M.N.H., 5: p. 201.

Both the imaginal and larval features the same with the typical *Autographa*, as well as its wing pattern, which resembles that of the type-species *gamma* L., but considerably specialized in the male genitalia.

Male genitalia: Hair-pencils well developed. Tegumen low and rounded. Uncus short and slender. Harpe extremely long and strong, and after running along the costal margin of valva bent ventrally until reaching the ventral edge of valva. Juxta strongly sclerotized, extending apically and with a rounded process on the middle. Clavus long and slender.

Female genitalia: Vulva large, goblet-shaped. Bursa copulatrix somewhat narrow with a protuberance sclerotized and striated on the middle of left side, from which ductus seminalis arises.

Larva: Setal plan Type A (*cf.* Ichinosé, 1962). Morphological features agree strictly with the generic pattern of *Autographa*. The feeding habit seems to be considerably narrow, composite plants of *Sonchus* and *Lactuca* groups being presumable host plants.

The subgenus *Sclerogenia* seems to be related to the *confusa* group in view of the female genitalia as already discusséd (Ichinosé, 1962).

Subgenus ***Macdunnoughia*** Kostrowicki, stat. nov.

The larval features of *confusa* group, which are strictly the same as those of the subgenus *Autographa*, will justify the opinion that Kostrowicki's genus *Macdunnoughia*, 1961 (=subgen. *Scleroplusia* Ichinosé, 1962) based on the species *confusa* is to be sunk to the subgeneric rank as well as the subgenus *Sclerogenia*. It is notable that *crassisigna*, a member of *confusa* group, closely resembles the North American *Autographa* (*Autographa*) *biloba* in its wing pattern. Kostrowicki's view that *Macdunnoughia* has much closer relation to *Argyrogramma* group than to the subgenus *Autographa* is wrong because of lack in his knowledge of larval morphology. The female genitalia illustrated by Kostrowicki (1961) under the name *crassisigna* in his fig. 117 (p. 461) are in reality referable to *confusa*, equally in fig. 118. It is also erroneous that the species *aemula*, *bractea* and *excelsa* were placed under the genus *Chrysaspidia* by Kostrowicki (1961), since they are members undoubtedly belonging to the subgenus *Autographa* as shown by Beck (1960) and the author (Ichinosé, 1962).

Genus ***Erythroplusia*** Ichinosé, stat. nov.

Autographa Hbn. Subgen. *Erythroplusia* Ichinosé, 1962, Kontyû 30 (4): 248–251.

Type-species: *Plusia rutilifrons* Walker, 1856, List Lep. Ins. Brit. Mus., 15: 1758.

Similar to *Autographa* in imaginal features. Lateral tufts absent in male abdomen as in *Autographa*. Head, patagia and dorsal tufts reddish brown. In the type-species, however, they will be replaced by pale or greyish brown if reared under low temperature during the larval stage. Discal marks on forewing filled up with silver color.

Male genitalia: Hair-pencils well developed. Shape of tegumen and uncus similar to the preceding subgenus *A.* (*Macdunnoughia*). Right and left valvae strongly sclerotized and characteristically asymmetrical with each other. Typically, they are wide in the middle, bearing an asymmetrical thin plate, and bending inwardly in the tapering apex. In *ornatissima*, however, antlered in shape. Sacculus with one or two projections on the dorsal edge. Clavus well developed. Vesica without large cornuti.

Female genitalia: Bursa copulatrix bearing minute spinules all over its surface, tubelike typically and from its end ductus seminalis arising.

Larva: Setal plan Type B (*cf.* Ichinosé, 1962). Seta SD1 on A_9 (the 9th abdominal segment) extremely slender. Skin points extremely fine.

In the genus *Erythroplusia*, in parallel with a remarkable specialization in the structure of male and female genitalia, there exist some transitional larval characters. That is, the chaetotaxic features are identical in this genus and *Autographa* group, whereas the structures of seta SD1 on the 9th abdominal segment and of its body surface demonstrate certain phylogenic connections of the genus with *Argyrogramma-Chrysodeixis* group. The species *ornatissima*, which has been placed in *Autographa* (*Macdunnoughia*) by the author, should be included in the present genus on account of its larval morphology in spite of the peculiar male and female genitalia.

Kostrowicki's application of the genus *Argyrogramma* to "*ornatissima*" and "*rutilifrons*" and of the genus *Anadevidia* to "*pyropia*" (Kostrowicki, 1961) is undoubtedly the result of misidentifications of the species as already pointed out by the author (Ichinosé, 1963) and Dufay (1970a). Both the true *rutilifrons* and the true *pyropia* belong to the typical *Erythroplusia*.

Subgenus ***Antoculeora*** nov.

Type-species: *Plusia ornatissima* Walker, 1858, List lep. Ins. Brit. Mus., 15: 1758 [=*Erythroplusia* (*Antoculeora*) *ornatissima* (Walker), **comb. nov.**].

Male genitalia: Strongly sclerotized. Valvae antlered and asymmetrical. Each sacculus with a very long projection (more than two-thirds of valva in length) in its base. Right sacculus, in addition, with another short projection in the proximity of its end. Clavus well developed, but shorter than in the nominate subgenus. Juxta smooth, without process. Aedeagus strongly bent dorsally.

Female genitalia: Sclerotized plates of the 8th abdominal segment cylindrical, fused along the mid-ventral line. Pair of apophyses anteriores asymmetrical. Vulva gigantic, strongly sclerotized, squarish, with a large triangular funnel at the right corner of bottom. Ductus bursae broad and short, about 2.0 mm in length, moderately sclerotized and striated and enters the bursa copulatrix on the dorsal side below apex. Bursa gourd-shaped, constricted below the apical part. The apical part well sclerotized and striated, with a round protuberance pointing anteriorly at the dorsal right side of the entrance of ductus bursae. Ductus seminalis arising from the top of the protuberance.

The structure of the female genitalia seems to have some affinities with that of *Autographa* (*Macdunnoughia*) in the sclerotized apical part. The larvae are successfully reared on *Sonchus* or *Lactuca*, but the natural host plants are unknown.

According to Dufay (1970a) the genus *Diachrysia* Hübner based on *orichalcea* is a synonym of *Plusia* Ochsenheimer since the species illustrated by Hübner (1821) as *orichalcea* is nothing but *chryson* Esper. Consequently, the generic name *Diachrysia* cannot be employed for *orichalcea-intermixta* group having a considerably distant affinity with *Plusia* Ochs. The author proposes a new generic name for this group.

Genus ***Thysanoplusia*** nov.

Type-species: *Phytometra intermixta* Warren, 1913, in Seitz Macrolep. World, 3: 357, pl. 64 g.

The *orichalcea-intermixta* group was quite incorrectly included by Dufay (1970a) in McDunnough's genus *Trichoplusia* which is based on the species *ni*, because the group distinctly differs from *Argyrogramma-Trichoplusia* group in both the imaginal and larval morphology as already revealed by the author (Ichinosé, 1962). The larval morphology of *ni*, the type-species of *Trichoplusia*, is much more related with that of *Argyrogramma-Chrysodeixis* group than of *orichalcea-intermixta* group. The genus *Thysanoplusia* may include the following species in Japan:

Thysanoplusia intermixta (Warren), **comb. nov.**
T. orichalcea (Fabricius), **comb. nov.**
T. daubei (Boisduval), **comb. nov.**
T. ochreata (Walker), **comb. nov.**

Although it is to be confirmed by studying their larval morphology, the species from Madagascar referred to *Trichoplusia* by Dufay (1970a) but presumably belonging to the genus *Thysanoplusia* are as follows: *florina* Guenée, *homoia* Dufay, *ignicollis* Dufay, *semirosea* Dufay, *indicator* Walker and *vietti* Dufay.

The *Argyrogramma-Chrysodeixis* group will possibly be characterized by the presence of a pair of vestigial prolegs on the 3rd and 4th abdominal segments of larvae, as well as by characteristic fine skin points of their body surface. These facts in company with the rich diversity in male genital armature give evidence that the group, composed of tropical or subtropical species, represents the most primitive form of the subfamily apart from the genus *Abrostola*. The uniform larval features and considerably divergent male genitalia may prove that the members of this group have not yet achieved full evolutionary differentiation. This consideration makes the author to hesitate in accepting such a myopic splitting of the group as merely based on imaginal features of one sex. Thus, the *Argyrogramma-Chrysodeixis* group is not so heterogeneous as considered by such workers as

McDunnough (1944) and Dufay (1970a, 1970b). Because the group is homogeneous enough even to be brought under a single genus (Ichinosé, 1962), dividing it into the following two genera seems to be the maximum splitting.

Genus *Argyrogramma* Hübner

Argyrogramma Hübner, 1823, Zutr. z. Samml. exot. Schmett., 2, p. 29.

Type-species: *Argyrogramma omega* Hübner, 1823, a synonym of *Noctua verruca* Fabricius, 1794, fixed by McDunnough, 1944.

Similar to *Autographa* in general imaginal appearance. In the present genus, however, lateral tufts usually present on male abdomen. A comb of fine spines present or absent on first segment of hind tarsus of male.

Male genitalia: Hair-pencils distinctly present. Clavus and harpe well developed, the latter sometimes considerably modified in shape as in *ni*. In certain members of this group, a row of distinct hooks or spines present along the ventral margin of valva, but typically absent. Vinculum either broadened to a large plate (in typical) or tapering apically, but at least not pointed sharply in the apex.

Female genitalia: Resemble those of *Autographa* (*Autographa*). Vulva unprotected. Ductus bursae relatively long, well sclerotized and striated. Bursa copulatrix membraneous without striations or spinules almost all over the surface. Ductus seminalis arising from the somewhat tapering apical top of bursa.

Larva: Pinaculum bearing seta SV2 on A_2 distinctly separated from pinaculum of seta SV1 as in the genus *Abrostola*. Seta D1 on T_2 (the 2nd thoracic segment) not so close to D2, situated on the imaginary line connecting D2 and SD2. A pair of minute hemispherical projections (vestigial prolegs) usually present on the subventral surface on A_3 and A_4, but exceptionally lacking in *agnata* Stgr. Seta SV2 on A_3, like that on A_4, attached to the base of the vestigial proleg. Seta SD1 on A_9 extremely slender as in *Erythroplusia*. Skin points extremely fine.

There seems to be no necessity for restricting the genus within some tropic typical members as once made by McDunnough (1944) and Dufay (1970a). The structure of female genitalia of the type-species *verruca*, emphasized by McDunnough (1944) as an important generic character, appears not so different from that of such species as *ni*, *agnata*, and *albostriata*. The hooks of the ventral edge of valva of male genitalia also show a graded series from their complete absence in *ni* and the African *transfixta*, through a weakly developed state in *albostriata*, to their obvious presence in *agnata-ichinosei* group, indicating that the genus does not include discrete natural groups, but rather is a continuous one. McDunnough's *Trichoplusia*, 1944, and Dufay's *Ctenoplusia*, 1970, which can be undoubtedly included in the genus *Argyrogramma*, should be sunk to the subgeneric rank.

Subgenus *Trichoplusia* McDunnough, 1944, stat. nov.

Argyrogramma (*Trichoplusia*) *ni* (Hübner), **comb. nov.**

Subgenus *Ctenoplusia* Dufay, 1970, stat. nov.

Argyrogramma (*Ctenoplusia*) *agnata* (Staudinger), **comb. nov.**
A. (*Ctenoplusia*) *ichinosei* (Dufay), **comb. nov.**
A. (*Ctenoplusia*) *albostriata* (Bremer et Grey), **comb. nov.**

Dufay founded the new genus *Acanthoplusia*, designating *tarassota* Hamp. as its type in 1970 (Dufay, 1970b). His argument, however, is based merely on the presence of black

scale masses on the outside of valva, number of cornuti in male genitalia and shape of the 5th and 6th tergites of male abdomen, all too trivial to erect the genus. *Acanthoplusia* is here regarded as synonymous with *Ctenoplusia* (**syn. nov.**).

The species *agnata* Stgr. seems to be in the most evolved position among the present genus, because it lacks the vestigial prolegs in the larval stage.

Genus ***Chrysodeixis*** Hübner

Chrysodeixis Hübner, 1821, Verz. bek. Schmett., 16, p. 252.

Type-species: *Noctua chalcites* Esper, 1789, fixed by Hampson, 1913.

Similar to the genus *Argyrogramma*. Lateral tufts usually present on male abdomen. Typically anal tufting also distinct in male abdomen. Comb of fine spines absent on first segment of hind tarsus of male.

Male genitalia: Hair-pencils considerably reduced and modified. Clavus slender but well developed. Sacculus thin. Harpe usually reduced (typically), but sometimes developed. Vinculum with sharp needlelike elongation characteristically. Aedeagus with bulbous base. Vesica armed with numerous cornuti typically.

Female genitalia. Differ considerably from those of *Argyrogramma* in several points. Vulva unprotected. Ductus bursae usually sclerotized and striated, but variable in length. Bursa copulatrix with a long slender tube in its end, from the top of which ductus seminalis arises. The surface of bursa bearing sclerotized striations or minute spinules.

Larva: The position of seta SV2 on A_2 and structure of seta SD1 on A_9 same as in the preceding genus *Argyrogramma*, but separable by the following two points: (1) Seta D1 on T_2 near to D2, situated just behind the imaginary line connecting D2 and SD2; (2) Seta SV2 on A_3, unlike that on A_4, separated anteriorly from the base of hemispherical projection. Skin points extremely fine. Body more slender than in *Argyrogramma*.

McDunnough's *Pseudoplusia*, with the generic type *oo* Cr., considerably agrees with the present genus *Chrysodeixis* in the genitalia of both the male and the female, particularly in those of the female, except for slight specific features such as the presence of peculiar lobes attached to the lateral bases of tegumen and transtilla in the male genitalia. According to Crumb (1956), the larva of the type-species possesses vestigial prolegs on A_3 and A_4 and threadlike seta SD1 on A_9 as in the genera *Argyrogramma* and *Chrysodeixis*. Although chaetotaxic details of the larvae are still insufficiently known, the genus *Pseudoplusia* seems presumably to be a synonym or a subgeneric group of *Chrysodeixis*.

Genus ***Plusia*** Ochsenheimer

Plusia Ochsenheimer, 1816, Schmett. Eur., IV., p. 89.
Agrapha Hübner, 1821, Verz bek. Schmett., p. 250.

Type-species: *Plusia chrysitis* Linn., fixed by Duponchel, 1829.

The genus *Plusia* Ochs. is also a very homogeneous group, judging from the facts found in both the imaginal and larval morphology. The setal plan of larvae is always of Type F (*cf.* Ichinosé, 1962) without exception as far as examined. These species are the North American *aerea* and *aereoides* studied by Crumb (1956), the European *chrysitis* described by Beck (1960) and the Japanese *nadeja*, *stenochrysis*, *chryson* and *leonina* examined by the author. The genus *Agrapha* Hbn. was resurrected by McDunnough (1944) for reasons of somewhat modified structure of sacculus in male genitalia of the type-species *aerea* Hbn. However, the invagination forming a well-defined pocket in the female eighth abdominal segment supports an important generic character of *Plusia* as well as the larval morphology. *Agrapha* is undoubtedly a synonym of *Plusia* as pointed out formerly by Grote (1895) and

Dyar (1902) and recently by Crumb (1956) and Kostrowicki (1971).

The illustration of the male genitalia erroneouly referred to *Plusia leonina* Oberthür by Kostrowicki (1971) in his fig. 52 (p. 445) belongs in reality to *P. bieti* Oberth.

Splitting of a genus based on a few arbitrarily selected features is not always relevant to account for systematic positions of species, or affinities among species, and to establish their phylogeny. On the contrary, it rather obscures these relationships as if a genealogical tree is cut off into isolated twigs. Such examples are found particularly in the splitting of the genus-group of *Argyrogramma* made by McDunnough (1944) and Dufay (1970a, 1970b). It is not reasonable to split, basing on some differences in the structure of genitalia or abdominal segments of the adult of one sex, the genus *Argyrogramma*, which is well defined by the very uniform female and larval characters. Crumb's and Kostrowicki's treatments of the genus (Crumb, 1956; Kostrowicki, 1961) are valid in this respect.

In the modern taxonomy, classification should be studied integratedly with appropriate evaluation of as many characters as possible. Myopic splitting based merely on some limited features of one aspect may have nothing to do with the progress of systematic science. In the case of this very interesting subfamily Plusiinae, in which uniform and divergent structures exist simultaneously, a reasonable classification will not be expected with the knowledge of the adults alone.

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