Patria: Westjava, Umgebung von Buitenzorg. Type in der Kollection des Herrn Prof. Dr. L. Courvoisier in Basel.

Gerydus courvoisieri phradimon subsp. nova.

♂. Das weiße Gebiet der Vorderflügel noch ausgedehnter als bei der Java-Vicariante, ausgezeichnet durch einen sehr langen, zwischen der hinteren und der Submediana sich hinziehenden weißen Strich. Unterseits mit verminderter Weißfleckung, welche nach vorn nicht über die vordere Mediana hinausgeht.

♀ dem *Gerydus learchus philippus* Stdgr. ♀ genähert, nur die weiße Binde ist etwas länglicher, wodurch sich ein Anklang an gewisse ♀♀ von *G. biggsi* Dist. ergibt. Die Hinterflügel schärfer gewinkelt als bei *philippus* Stdgr. und von diesem ohne weiteres zu unterscheiden durch das Fehlen der graugelben Beschuppung, welche das Discalfeld aller Formen von *learchus* verdunkelt.

Patria: Nord-Borneo, Waterstradt, leg., ♀ West-Borneo, Sintang. März 1910 (Dr. Martin leg.).

Es ist ziemlich sicher, daß sich *G. courvoiseri* auch noch auf Sumatra und der malayischen Halbinsel vorfindet.

Notes on the derivation of winged insects through several lines of descent.

G. C. Crampton, Ph. D.*

The erroneous idea that all winged insects are the descendents of a single type of winged insect, which in turn was derived from some one type of primitively wingless insect, has proven a serious stumbling block to further progress in attempting to derive the Pterygota from ancestors resembling the Apterygota. It is very difficult to understand how such an idea could have arisen, for the evidence gained from a comperative anatomical study of the more primitive representatives of the Pterygota and Apterygota clearly points, not to one, but to several lines to descent, in passing from the one group to the other It is perhaps superfluous to add, that in speaking of the descent of the apterygote insects from apterygote forms, it is not implied that recent Pterygota are the descendents of recent Apterygota, but merely that the ancestors of both groups were very intimately related, or sprang from a common stock.

The marked similarity of structure found in insects belonging to the apterygote group Myrientomata and those belonging to the pterygote group Platyptera (i. e. the Plecoptera and Embioidea — but not the Isoptera and Corrodentia, which are included in the group Platyptera by some systematists) would indicate a community of descent in these two groups. For the sake of convenience, this line of descent may be spoken of as the Myriento-Platyptera line, and the insects therein included may be referred to as the Myriento-Platyptera group.

The great similarity in structure between the apterygote insects called Dicellura (the Japyx-like forms) and insects of the pterygote order Dermaptera, clearly points to the Dicelluro-Dermaptera group as representing another line of descent from the Apterygota to the Ptery-

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*) Contribution from the Entomological Laboratory of the Massachusetts Agricultural College, Amherst, Mass.

gota. Closely associated with the Dicelluro-Dermaptera line, is the Dicelluro-Coleoptera line, leading from the Japyx-like forms to the Coleoptera.

Certain points of similarity between the Thysanura (as represented by *Lepisma* and *Machilis*) and the my-flies, or Ephemeroidea, suggest that there may have been a Thysanuro-Ephemeroidea line of descent from the Apterygota to the Pterygota, in addition to the other lines mentioned above. Furthermore, it is extremely probable that a farther study of the more primitive representatives of the Apterygota and the Pterygota, and the bringing to light to new forms (such as the recently discovered Myrientomata) will disclose still other lines of descent leading from the primitively wingless to the winged insects, so that the group Pterygota may be considered as in a sence a „polyphyletic" one.

It is quite obvious that recent pterygote insects cannot be the descendents of apterygote forms now living, since both groups have diverged from the common stem, and the various members of the two groups have followed their own lines of development, some becoming more profoundly modified than others. On the other hand, it is equally true that a few representatives of each group, although modified in some respects, have nevertheless retained certain very primitive characters, which are of great phylogenetic value in tracing the ancestry of the two groups — a point which is not given sufficient weight by those who seek to discredit all attempts to derive the Pterygota from ancestors similar to the apterygote forms.

As an objection to the theory of the descent of the Pterygota from apterygote forms, it has been stated that certain branches of the Apterygota have reached a higher degree of specialization, or have become more profoundly modified; than the lover Pterygota; but I fail to see wherein this has any bearing upon the fact that still other branches of the Apterygota have remained in a remarkably primitive condition. It is self-evident that an off-shoot from any group of animals may become highly modified, or adapted in a certain direction, while others of that group (usually few in number) may remain but slightly changed from the ancestral type. If this were not true, the evolutionists would have but little material to work upon!

A somewhat similar objection raised by the opponents of this theory, is that in certain particular features (e. g. the modified mouthparts) even the most primitive of the Apterygota may be more highly specialized than the lower pterygote forms are, so far as these particular features are concerned. This, however, should not outweigh the fact that in other respects, the lower forms of the Apterygota are far more primitive than the lover Pterygota, and have even retained certain ancestral characters strongly suggestive of the Myriopoda. Throughout the realm of Zoology, we find that animals which have retained certain very primitive characters, may be highly specialized in other regards, since all living things must adapt themselves in some respects at least, to differences of environment. This fact is well illustrated by such forms as *Amphioxus*, which is highly specialized in some respects, yet this fact does not detract from the phylogenetic value of those very primitive characters which it still retains.

In this connection it may be stated that the Apterygota are no more to be regarded as degenerate Pterygota, than *Amphioxus* is to be regarded as a vertebrate; and the fact that certain highly specialized (or even degenerate) features may be found in any otherwise very primitive organism throughout the animal kingdom, should surely be known to those who claim that all apterygote insects are degenerate forms. Furthermore, the remarkable similarities of structure in the more primitive members of the apterygote and pterygote insects are too profound and far-reaching to be explained merely as the result of a parallelism, or a convergence of development in the two groups.

From the foregoing facts, it would seem reasonable to regard tke more primitive members of the Apterygota as the nearest living representatives of the ancestors of the Pterygota — that is to say, they have change the least from the original ancestral condition — and a comparative study of the insects belonging to the various groups included in the lines of descent described above, will furnish valuable clues as to the derivation of Pterygota from wingless ancestors.

It has been already pointed out that there are several separate and distinct lines of development leading from the apterygote forms to the winged insects. On this account, there is no force to the objection raised to the Dicelluro-Dermaptera line of descent on the ground that the more primitive types of fore wings, the segmented caudal appendages, etc., of other winged insects, could not be derived from the hightly specialized fore wings, forceps-like caudal appendages, etc., of the earwigs; for if there are s e v e r a l lines of descent from the Apterygota to the Pterygota, it is self-evident that all other winged insects were not derived from the Japyx-like forms through the earwigs, as this objection would imply.

The Japyx-like forms were themselves derived from ancestors having segmented caudal appendages instead of forceps — an ancestral condition which has been retained in such Dicellura as *Projapyx*. On this account the occurrence of segmented caudal appendages in the immature stages of certain Dermaptera (such as *Dyscritina*) is to be regarded as a case of „atavism“, and the same may be said of similar structures in the Coleoptera larvae. It is merely to be expected that immature forms would retain certain primitive characters, even though these were lost in the adult condition, since this state of affairs occurs everywhere in animal kingdom. Instead of being an argument against the Dicelluro-Dermaptera line of descent, the fact of the presence of segmented caudal appendages in certain immature Dermaptera would therefore seem rather to be an argument in favor of it.

Allowing for differences of adaptation in the two groups, it would be an easy matter to derive the trophi and thoracic structures of the Dicellura and Dermaptera from a common ancestral type, and the marked similarity between the caudal appendages of the two groups, is too profound to be laid to coincidence. The logical inference then, is that they sprang from a common ancestry.

Closely allied to the Dicelluro-Dermaptera line, is the Dicelluro-Coleoptera line, leading from the Japyx-like forms to the Coleoptera. The similarity in structure between certain of the Dicellura and the larvae of such beetles as *Cucujus* and *Pyrochroa* is so striking, that it

is difficult to conceive of any other way of interpreting this fact than on the assumption that they are the descendents of a common ancestor. It is preferable to regard the Japix-like forms as the common ancestors of both Coleoptera and Dermaptera, rather than to attempt to derive the Coleoptera from the Japyx-like forms through the Dermaptera, despite the fact that the earwigs are in many respects much more primitively organized than the Coleoptera.

The Myriento-Platyptera line, leading from the Myrientomata to the Platyptera (i. e. the Plecoptera and Embioidea) is a much more primitive one, or branched off from the common stock much lower than the Dicelluro-Dermaptera line, and includes forms which are, structurally speaking, among the most primitive of the apterygote and pterygote insects. In some respects, the Plecoptera are more closely related to the Myrientomata (such as *Eosentomon*) than the Embioidea are, and may possibly represent a stage of development intermediate between the Embioidea and the Myrientomata (i. e. the lines of development would be expressed as the Myriento Plecoptera and the Plecoptero-Embioidea lines). Provisionally, however, I prefer to consider the Myrientomata as the common ancestors of both Plecoptera and Embioidea, so that it is preferable to express the developmental series as the Myriento-Plecoptera and the Myriento-Embioidea lines of descent.

Turning for a moment to the consideration of the higher forms, such as the Diptera, Mecoptera, Trichoptera, Lepidoptera and Hemiptera, a comparative study of the anatomy of these forms suggests a community of descent from ancestors whose nearest living representatives are to be found in the heterogeneous group Neuroptera.* From the ancestors of the Neuroptera, there have been given off several lines of descent. One of these is the Neuroptero-Trichoptera line, which either gave rise to a Trichoptero-Lepidoptera line, or is closely related to a Neuroptero-Lepidoptera line. Another line near these is the Neuroptero-Mecoptera line leading to the Panorpidae, and quite near those mentioned above, is the Neuroptero-Diptera line. To these may be added the Neuroptero-Homoptera line, which is doubtless a composite one, but for the sake of brevity, it may be signated simply as the Neuroptero-Homoptera line, without attempting to resolve it into its component parts.

Thus far, it has been comparatively „smooth sailing“, but when we attempt to trace the Neuroptera to some one of the more primitive types, we at once encounter considerable difficulty. One of the most promising lines to suggest itself, is the Platyptero-Neuroptera line leading from the Plecopteron branch of the Platyptera, to the Neuroptera (it might be more exact to refer to this line as the Plecoptero-Neuroptera line, since it leads from the Plecopteron branch, instead of from the Platyptera as a whole). There may have been a Platyptero-Mantieformia line closely paralleling the latter, and leading from the Embioidean branch of the Platyptera to the Mantieformia

*) The Coniopterygoidea, Sialoidea, Hemeroboidea, Nemopteroidea, Mantispoidea, Raphidoidea, Myrmeleonidea and Ascalaphoidea form a heterogeneous collection which should be split up into other groups. The Ascalaphoidea, for example, should be placed in another order, the Arcyptera (or net-winged forms), and the Myrmeleonidea should perhaps be included with them.

(i. e. the Mantoidea, Phasmoidea and Phylloidea). The Mantieformia approach very closely to the Neuroptera in some respects, and I am by no means certain that the Mantieformia do not represent an intermediate stage between the Neuroptera and the Platyptera.

While I would not insist upon a Platyptero-Mantieformia (or an Embioideo-Mantiformia) line of descent, it is nevertheless true that the Embioidea present many points of similarity to the Mantieformia, and are undoubtedly the more primitively organized of the two. It is not claimed, however, that the Mantieformia are the descendents of the Embioidea, but merely that the Embioidea have departed but little from the ancestral forms common to the to two groups — at least so far as their general structure is concerned. On this account, the fact that no Embioidea have been found earlier than the Tertiary period, while the Mantieformia are geologically much older, has no particular weight. Since the preservation of fossil remains is wholly a matter of chance, it is small wonder that the geological record of the ancestry of such rare insects as the Embioidea is very incomplete, and this would in all probability account for the fact that we know of no fossil ancestral forms connecting them with the Mantieformia. The Blattieformia (Blattoidea and Isoptera) are very closely related to the Mantieformia, and doubtless branched off very near the origin of the Mantieformia line. It must ce admitted, however, that until we have at our disposal more information concerning the anatomical details of a large number of intermediate forms (wheter living or fossil), the discussion of the lines of descent leading from the lower pterygote forms must be regarded as too highly speculative, to be of any great practical value.

By way of summary, the principal points brought out in the present paper may be briefly stated as followes. The marked similarity of structure between insects of the apterygote order Myrientomata and the pterygote order Platyptera would indicate that there has been a Myriento-Platyptera line of descent leading from the ancestors of the Apterygota to those of the Pterygota. Similary, there are indications of a Dicelluro-Dermaptera and a Dicelluro-Coleoptera line of descent from ancestors resembling the Japygidae to the ancestors of the Dermaptera and Coleoptera. To these may be added a Thysanuro-Ephemeroidea line from the ancestors of the Thysanura to those of the mayflies. These, and other lines which will doubtless be added to them, would indicate that the Pterygota are in a sence a „polyphyletic" group, derived, not through one line, but through several lines of descent.

Notes on some parasites of sugar cane insects in Java with descriptions of new-Hymenoptera Chalcidoidea.)*

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Herr P. van der Goot, Entomologist of the Experiment Station of the Java Sugarcane Industry at Pasoeroean, Java, was kind enough to send to me for identification a number of egg-parasites of sugarcane insects upon part of which I report in the following pages.

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