

REVIEW
THE CARABID BEETLES OF NEW GUINEA
By Philip J. Darlington, Jr.

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The Carabid Beetles of New Guinea.—

Philip J. Darlington, Jr. In 4 parts (suggestions for binding into one volume given by the author in part IV, page 29) spanning 19 years as *Bulletin(s) of the Museum of Comparative Zoology* as follows: Part I, 1962, pp. 321–564 (Cicindelinae, Carabinae, Harpalinae through Pterostichini); Part 2 (II), 1952, pp. 87–252 (Agonini); Part III, 1968, pp. 1–253 (Harpalinae continued, Perigonini to Pseudomorphini); Part IV, 1971, pp. 129–337 (General considerations, analysis and history of fauna, and taxonomic supplement). All parts are now available from the Publications Office, Museum of Comparative Zoology, Cambridge, Massachusetts, 02138, as follows: Part I (Bull. MCZ 126, No. 3) \$5.00; Part II (Bull. MCZ 107, No. 3) \$2.50; Part III (Bull. MCZ 137, No. 1) \$8.50; Part IV (Bull. MCZ 142, No. 2) \$9.50.

Introduction

At no other time in the history of carabid beetle studies have two such important faunal works appeared almost simultaneously. I write of Lindroth's monumental "Ground-beetles of Canada and Alaska" (reviewed by Darlington in *Systematic Zoology* 20(3):367–368, 1971) and the work by Darlington now before me. I venture to go further and state that *no* more important faunal works have ever been done for this family of diverse beetles (with the possible exception of Lindroth's *Die Fenoskandischen Carabidae, 1945–49*, in German and not easily used by most carabidologists).

I believe we can thank the "good taste" of a *Crocodylus* species for giving Professor Darlington more than four months "leave" during which a large collection of carabid beetles was amassed. This collec-

tion, from Dobodura, New Guinea and vicinity, made with one arm in a sling, gave Darlington a core of specimens on which he launched his next 28 years of taxonomic studies on carabid beetles. To this core he added thousands of borrowed specimens and others he collected himself in the Bismarck Range of New Guinea. Aside from field work in New Guinea, Darlington spent a total of 32 months in Australia and 11 months in the Philippines, and has spent much time in the New World tropics. These personal experiences with the living animals in their natural habitat is of primary importance and I shall return to the subject below.

Numerous exchanges of specimens with H. E. Andrewes and C. J. Louwerens, plus six months in residence "at the British Museum (Natural History) during the winter of 1947–48" allowed Darlington to become familiar with the described fauna of Oriental Carabidae. This combination of field work, museum work, and then more field work is the only possible method of doing realistic systematics, and Darlington has used the combination well.

Technical Review

Part II, the first issued part, covers the Tribe Agonini taxonomically and morphologically. This is Darlington's favorite Tribe of Carabidae and he does a careful revisionary study of them. Also briefly included is introductory material concerning localities, methods, measurements, and most importantly *purpose*. The latter is stated (Part II, page 90) as "a taxonomic survey of the Carabidae of New Guinea . . . will give an opportunity for the description of many new species . . . distribute much identified and paratype material for the use of other specialists . . . and . . . *should yield also a few items* of general

zoogeographic and evolutionary interest." (*Italics mine.*) The *yield* Darlington mentioned in 1952 turned out to be nearly 100 pages of faunal analysis in 1971 as Part IV, much of which is new and/or important in the study of carabid beetles and/or zoogeography. At the end of the descriptions are 4 plates with a total of 66 figures. These figures are of three types, namely, beetle habitus (outline) with selected pertinent character states, tarsal-form outlines, and male genitalia (median lobe, parameres, and in some cases, details of the internal sac) outlines.

The taxonomic format is arranged by Tribes. Each Tribe is described as it is represented in New Guinea along with other pertinent information, such as general appearance of members, habitat, geographic range, important genera included, and so on. A key is then presented to the genera. The keys are explicit and easy to use. In the keys of all Parts, a page number is given as each taxon is determined for easy reference to the text about that particular taxon (also in the subsequent species keys). After the key to genera, each genus is described. The genera are arranged in the order of *Coleopterorum Catalogus* (Csiki, 1926-1933).

Each generic topic begins with pertinent references and synonyms where appropriate. A diagnosis follows, along with a description if necessary. Type species are recorded for each genus and a generic distribution is summarized. Finally, under the heading "Notes" other details are discussed (e.g. variation, habitats, dynamics, etc.). Following the generic topic, each species is keyed (if several species are included) and each species is then named (new or with synonyms, authors, etc.) and described. The "Notes" category is used again for each species in the same manner as under genus.

Part I, the second-issued part, covers the generally regarded "more primitive groups" of carabid beetles up to, but not including Agonini. Here he treats briefly the tiger beetles (rightly included, I think,

in the Carabidae), the paussine beetles (regarded wrongly by many as a separate family), and diverse tribes constituting the primitive half of the subfamily Harpalinae. Again, introductory material is included, especially items not discussed previously such as, "stages of faunal taxonomy . . . ecology . . . subspecies . . . (and) variation." Unfortunately, there is no detailed analysis of characteristics (comparative morphology) as in the part on Agonini; species descriptions are just as detailed however. At the end of the descriptions there are 4 plates with a total of 70 figures. These figures are of the same type as in Part II, except outlines of tarsi are replaced by line drawings of tibiae, partial heads, elytra, or pronota.

Part III covers the "higher" Harpalinae, Perigonini to Pseudomorhini. As in the first two parts, the introductory material deals with localities, sources and disposition of material, and methods. Two other categories are added in this part, that of "Findings" and "Type examinations." The former is a brief statement concerning special parts of the faunal analysis (in Part IV) worthy of mention early. The latter ("Type examinations") is a brief statement of philosophy on borrowing and lending type specimens, and usefulness of types in faunal works.

Part IV consists of two sections, one on faunal analysis and the other a taxonomic supplement to parts I to III.

The taxonomic supplement includes descriptions of new species discovered subsequent to those described in parts I to III, new data on species covered before, and additional localities. Sixty-seven outline habitus drawings are included within the text (pages 263 and 312) unlike the other parts where illustrations were bound-in at the end.

Also included is the Bibliography for the faunal analysis. Literature cited for each species (throughout Parts I-III and Supplement IV) is recorded with the species description in shortened form and not repeated at the end of the paper.

"In lieu of (an) index," Darlington gives helpful suggestions (page 337) on the use of the work, as well as justification for not having an index. The detailed tables of contents (all Parts) provided are as good as an index, except for locating particular species. These must be found in the text by first finding the genus in the table of contents and then "thumbing." To correlate the Part IV supplement with parts I-III, the reader must make marginal notes so as not to miss important new data, revised keys, new species, etc. (It took me only 4 hours to do this job for correlation of all parts.)

See under my "Discussion" for comments on the faunal analysis. Here I shall only state that, in the faunal analysis section of Part IV, there are 16 figures (mainly graphs and maps) and 19 tables (summaries of data on species).

Criticisms

Although Darlington justifies the deletion of a tribal key, I feel one should have been included (even though only $\frac{1}{3}$ of the carabid tribes are covered). Andrewes' keys and the one of Sloane's to which Darlington refers users are out of print and not readily available to isolated workers or students; *but* Darlington's new book is readily available. Aside from this, there are many tribes that North American workers (at least) are not used to dealing with, and do not recognize on sight (e.g., Cyclosomini, Helluonini, Amblystomini, as well as those several tens of exotic genera that do not fit our North American concept of the tribe to which they belong).

The fact that there is no index has been discussed. Granted that this would consume much time and energy, an index would be useful, especially in correlating the supplemental work to the main body and to locate particular species and all that is said about them in various sections of the text.

The illustrations of the male genitalia are of only limited value (outlines of

median lobe and parameres, some gross outlines of internal sac) unlike the contemporary work of Lindroth's where almost every species (1110) has the male genitalia illustrated (in half-tone reproduction for a 3-dimensional appearance of the internal sac). The male genitalia is extremely important in carabid classification (and in some cases, identification) and should be well illustrated for every species as a matter of course (but see Part IV, page 152).

In the supplemental taxonomic part, some species are not referred to keys or to their closest relative (e.g., *Tachys convexus*, *T. klugi*), thus the user is at a loss to fit these species into the overall generic concept.

In some cases, the sex of the holotype has not been determined (e.g., *Clivina kubor* and *C. alternans*). A simple dissection requiring only a few minutes could have been performed to eliminate this (in my opinion) serious flaw in descriptive procedure.

Perhaps the most serious brick-bat I can throw is aimed at the use of "genera of convenience" (see explanation in Part IV, page 148). My criticism is not at all at the useful concept of "genera of convenience," but rather at the erection of new generic names for them. If it is recognized that a loosely related group of species may be disbanded (after careful revisionary study at say the gamma or third-stage level) there is no need to erect a new name that will be carried forever under our present nomenclatorial code. It would be far better to use an old established name (in this case *Colpodes*) that could house (and did for many of the species!) these species as an informal species group. Darlington then could have stressed in text that the "x-us group" of *Colpodes* is a "group of convenience" and should be studied closely by revisors.

I further differ from Darlington's view point on subspecies for the same reasons as above (this is in connection with his

criteria number 3, page 150, Part IV). He states that three uses of trinomens (that is, subspecies) are justified. For island isolates differing morphologically from island to island, it is traditional and perhaps justified to use trinomens. Biological studies have repeatedly shown that these isolates are indeed, at least, incipient species. Species occurring in discontinuous habitats on one island (or land mass) again may be regarded as subspecies (i.e., geographical isolates); these discontinuous habitats represent a cryptic form of islands. However, Darlington's third criterion includes species which have a more or less continuous range on New Guinea, but which "vary from locality to locality." I believe that this situation (as Darlington well recognizes, page 150, Part IV) is too complex for decisions made on morphological bases. Once these phenas are described with a formal name, that name is carried forever in literature. These phenas should certainly be pointed out, but it is better to do it with informal names and text discussion. Future biological work (third-stage taxonomy) can then determine whether the situation calls for recognition of formal subspecies names.

Discussion

Darlington has laid a carefully prepared taxonomic foundation, then analyzed it for existing zoogeographic patterns, dispersals and geographic origins, and the evolution of the fauna and its components. He considers such topics as mountain faunas, their origins and evolution; parallelism and convergence; mimicry; atrophy of wings (loss of flight); ecological interactions with ants; ecological ranges (a better term for "niche"!); and many, many others. The book must be carefully read to uncover the real depth to which Darlington has probed into these subjects.

The finest part of the book, I think, is the first section of Part IV, that on faunal analysis (of course the taxonomy has to be done first!). This is a perfect example

of a systematist giving the extra effort needed to correlate his 28 years of systematic research into an extremely useful and important faunal analysis—one with many interdisciplinary principles of zoogeographic and evolutionary processes. This, in my opinion, is what ALL systematists should strive for; this is what makes systematics a science and NOT (the closet naturalists') art!

Furthermore, as I mentioned above, personal experiences with the living animals in their natural habitat is of primary importance. As Darlington points out (Part IV, page 145ff.), "The basing of work on large amounts of material, substantial parts of it collected by the taxonomists themselves, gives the latter first-hand knowledge of populations in nature and of the variation, ecology, and distribution of species, and surely should contribute to realistic, useful taxonomy."

Aside from the important zoogeographic and evolutionary points Darlington makes, I noticed some other, more subtly made points (which I believe are extremely important). For example, in Part IV, page 134, he points out that international cooperation on a large scale is necessary to achieve results in a work of this type; and it is important to recognize this help in the disposition of specimens and published results. Also, he justifies the "short description" (Part IV, page 153) a real necessity in this type of work and in this day of exorbitant printing costs.

Most importantly for younger carabidologists interested in the tropics, he provides many tips on collecting specimens in rain forests and other tropical habitats. For example, he points out that general litter is rather poor in numbers of individuals, but raking deep litter beneath the crown of a fallen tree is excellent. My wife and I recently used this technique in Panama and did exceptionally well in this microhabitat. Further, there were a lot more species there than just carabid beetles!

Does this book then, finish off the work

on the New Guinea Carabidae? Not at all! Darlington points out that he covers 667 species, but that this may only represent a small fraction of the total fauna (mountain forms especially are lacking). This book gives the essential beginnings for study of this group in this area. It is up to the next generation of explorative-carabidologists to grasp the taxonomy, tips, and hypotheses Darlington has so clearly provided and do third-stage studies on this exciting fauna!—T. L. ERWIN.