

Arboreal Beetles of Neotropical Forests:
Agra Fabricius, the *Novaurora*
Complex (Coleoptera: Carabidae:
Lebiini: Agrina)

TERRY L. ERWIN

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 608

SERIES PUBLICATIONS OF THE SMITHSONIAN INSTITUTION

Emphasis upon publication as a means of "diffusing knowledge" was expressed by the first Secretary of the Smithsonian. In his formal plan for the institution, Joseph Henry outlined a program that included the following statement: "It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge." This theme of basic research has been adhered to through the years by thousands of titles issued in series publications under the Smithsonian imprint, commencing with *Smithsonian Contributions to Knowledge* in 1848 and continuing with the following active series:

Smithsonian Contributions to Anthropology
Smithsonian Contributions to Botany
Smithsonian Contributions to the Earth Sciences
Smithsonian Contributions to the Marine Sciences
Smithsonian Contributions to Paleobiology
Smithsonian Contributions to Zoology
Smithsonian Folklife Studies
Smithsonian Studies in Air and Space
Smithsonian Studies in History and Technology

In these series, the Institution publishes small papers and full-scale monographs that report the research and collections of its various museums and bureaux or of professional colleagues in the world of science and scholarship. The publications are distributed by mailing lists to libraries, universities, and similar institutions throughout the world.

Papers or monographs submitted for series publication are received by the Smithsonian Institution Press, subject to its own review for format and style, only through departments of the various Smithsonian museums or bureaux, where the manuscripts are given substantive review. Press requirements for manuscript and art preparation are outlined on the inside back cover.

I. Michael Heyman
Secretary
Smithsonian Institution

Arboreal Beetles of Neotropical Forests:
Agra Fabricius, the *Novaurora*
Complex (Coleoptera: Carabidae:
Lebiini: Agrina)

Terry L. Erwin



Smithsonian Institution Press

Washington, D.C.

2000

A B S T R A C T

Erwin, Terry L. Arboreal Beetles of Neotropical Forests: *Agra* Fabricius, the *Novaurora* Complex (Coleoptera: Carabidae: Lebiini: Agrina). *Smithsonian Contributions to Zoology*, number 608, 33 pages, frontispiece, 102 figures, 2000.—The *rufoaenea* and *quararibea* groups (section *Rufoaenea*); the *famula*, *formicaria*, and *phaenicodera* groups (section *Erythropus*); and the *capitata*, *cyanea*, *dimidiata*, *neblina*, *novaurora*, and *poguei* groups constituted the study group for this paper because they share cribriform elytral interneurs, an easily recognizable attribute for selecting specimens for study. They are referred to as the “*Novaurora* complex.” The *pusilla* group, which shares interneur structural features with the *Novaurora* complex but little else, also was included in the key to groups. All of the above are treated in the key and are tersely described at the group level. The following groups are herein revised.

The *novaurora* group is a northern Amazon–Orinoco lineage comprising five species with a composite range extending from Ecuador to French Guiana and south into Brazil. Four specific taxa of the *novaurora* group are described as new (type locality in parentheses): *alinahui* (Ecuador: Napo Province, 20 km E Puerto Napo, Alinahui, 01°00'S, 077°25'W), *orinocensis* (Venezuela: Caño Marcareo, Orinoco Delta), *novaurora* (Ecuador: Napo province, 20 km E Puerto Napo, Alinahui, 01°00'S, 077°25'W), *superba* (Venezuela: T.F. Amazonas, confluence of Rio Negro and Rio Baria, 00°55'N, 066°10'W).

The *dimidiata* group, predominantly northern Neotropical, comprises 16 species with a composite range extending from Mexico to northern Peru, and east to easternmost Venezuela. Thirteen specific taxa of the *dimidiata* group are described as new: *bci* (Panama: Barro Colorado Id., 09°10'N, 079°50'W), *duckworthorum* (Panama: Barro Colorado Id., 09°10'N, 079°50'W), *eponine* (Costa Rica: Puntarenas, Quepos, Parque Nacional Manuel Antonio, 09°24'N, 084°09'W), *falcon* (Venezuela: Falcón, Sanare, Finca Tillerias, 09°39'N, 069°45'W), *hespenheide* (Costa Rica: Heredia, La Selva, 10°26'N, 084°01'W), *hovorei* (Mexico: Vera Cruz, Estacion Biologica Los Tuxtlas, 18°27'S, 095°13'W), *inbio* (Costa Rica: Puntarenas, Mata de Limón, 09°55'54"N, 084°42'42"W), *maracay* (Venezuela: Maracay, 10°15'N, 067°36'W), *paratax* (Costa Rica: Puntarenas, Estacion Biologica Carara, E Quebrada Bonita, 09°46'25"N, 084°36'24"W), *pichincha* (Ecuador: Pichincha, Santo Domingo, Tinalandia, 00°18'S, 079°04'W), *samiria* (Peru: Loreto, Cocha Shinguito, 05°08'S, 074°45'W), *tuxtlas* (Mexico: Veracruz, Estacion Biologica Los Tuxtlas, near 18°27'S, 095°13'W), *zapotal* (Guatemala: Alta Verapaz, San Cristobal Verapaz, Quixal, 15°23'N, 090°24'W).

The *quararibea* group is a southern and western Amazon–Pantanal lineage comprising five species with a composite range extending from the upper Xingu drainage of Brazil west into Peru and Ecuador. Four specific taxa of the *quararibea* group are described as new: *magnifica* (Peru: Madre de Dios, “Avispas” (Avispal), 12°59'S, 071°34'W), *othello* (Ecuador: Napo, 20 km E Puerto Napo, Alinahui, 01°04'S, 077°25'W), *smurf* (Brazil: Amazonas, Taperinha, Santarem, 02°32'S, 054°17'W), *suprema* (Brazil: Mato Grosso, Rosario Oeste, 14°50'S, 056°25'W).

Distributions are dot-mapped and are discussed in general for each of the species in these three groups. Geographical ranges are given for all the groups of the *Novaurora* complex herein discussed.

SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus). OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Annals of the Smithsonian Institution*.

Library of Congress Cataloging-in-Publication Data

Erwin, Terry L., 1940–

Arboreal beetles of neotropical forests : *Agra* Fabricius, the *Novaurora* complex:

Coleoptera:Carabidae:Lebiini:Agrina / Terry L. Erwin.

p. cm. — (Smithsonian contributions to zoology ; no. 608)

Includes bibliographic references.

I. *Agra* (Insects)—Classification. II. Title. III. Series.

QL1.S54 no. 608

[QL596.C2]

590 s—dc21]

[595.76'2]

99-048246

© The paper used in this publication meets the minimum requirements of the American National Standard for Permanence of Paper for Printed Library Materials Z39.48—1984.

Contents

	<i>Page</i>
Introduction	1
Methods	2
Acknowledgments	5
Taxonomy	5
<i>Agra</i> Fabricius	5
The <i>Novaurora</i> Complex	5
Key to Species Groups of the <i>Novaurora</i> Complex	5
<i>Agra</i> Groups	6
01. <i>novaurora</i> Group	8
Key to Species of the <i>novaurora</i> Group	8
001. <i>Agra orinocensis</i> , new species	8
002. <i>Agra crebrepunctata</i> Straneo	8
003. <i>Agra novaurora</i> , new species	9
004. <i>Agra alinahui</i> , new species	9
005. <i>Agra superba</i> , new species	10
02. <i>dimidiata</i> Group	11
Key to Species of the <i>dimidiata</i> Group	11
001. <i>Agra dimidiata</i> Chevrolat	12
002. <i>Agra maracay</i> , new species	13
003. <i>Agra bci</i> , new species	14
004. <i>Agra falcon</i> , new species	14
005. <i>Agra hovorei</i> , new species	15
006. <i>Agra tuxtlas</i> , new species	15
007. <i>Agra zapotal</i> , new species	15
008. <i>Agra hespenheide</i> , new species	16
009. <i>Agra paratax</i> , new species	16
010. <i>Agra samiria</i> , new species	16
011. <i>Agra duckworthorum</i> , new species	16
012. <i>Agra eponine</i> , new species	16
013. <i>Agra inbio</i> , new species	17
014. <i>Agra pichincha</i> , new species	17
015. <i>Agra sternitica</i> Straneo	18
016. <i>Agra biexcavata</i> Straneo	18
03. <i>quararibea</i> Group	18
Key to Species of the <i>quararibea</i> Group	18
001. <i>Agra othello</i> , new species	19
002. <i>Agra smurf</i> , new species	19
003. <i>Agra magnifica</i> , new species	19
004. <i>Agra quararibea</i> Erwin	20
005. <i>Agra suprema</i> , new species	20
Descriptive Biogeography	20
Appendix: Characters of <i>Agra</i> Species and Their States	26
Literature Cited	33



]

 '83/rv.'96

FRONTISPIECE.—Habitus of *Agra suprema* female, Mato Grosso, Brazil.

Arboreal Beetles of Neotropical Forests: *Agra* Fabricius, the *Novaurora* Complex (Coleoptera: Carabidae: Lebiini: Agrina)

Terry L. Erwin

Introduction

This is the tenth contribution to a revision and biogeographic study of the lebiine genus *Agra*. Most species groups are centered at the Neotropical equator; however, the generic range extends from southernmost Texas to northernmost Argentina.

The *rufoaenea* and *quararibea* groups (section *Rufoaenea*); *famula*, *formicaria*, and *phaenocodera* groups (section *Erythropus*); and *capitata*, *cyanea*, *dimidiata*, *neblina*, *novaurora*, *poguei*, and *pusilla* groups constitute the supraspecific groups (herein referred to as the *Novaurora* complex) of interest for this paper. They are easily recognizable by their cribriform (\pm square with angulate corners) elytral punctulae; all other groups have round punctulae or have large foveae in which fine, rounded punctulae are linearly arrayed. At the outset, I did not know if this character was homoplastic across the genus; however, I suspected as much because among these groups females may or may not have antennomeres of equal length (Figure 1), a state earlier regarded (Erwin, 1982a) as an important grouping feature for various taxa within the *cayennensis* complex (Erwin, 1996). Thus, for the purpose of selecting groups for study, I used an easily recognizable external feature that served to group specimens. The traditional placement of some of the included species would have oriented the study toward a complex of groups previously erected by Liebke (1940) and Straneo (1958) that appears to be artificial (see below); thus, it would have defeated the principal aim of my studies, namely, to discover the natural system

(Griffiths, 1974) in the evolution of this large, apparently monophyletic genus, as redefined in Erwin, 1978.

The groups selected, based on a single attribute, were designated a "species-group complex" and will be subsequently tested for relationships within and outside the complex using phylogenetic analysis (Erwin, in prep.).

Both the *rufoaenea* and *quararibea* groups earlier were placed in section *Rufoaenea* (Erwin, 1993), and the *famula*, *formicaria*, and *phaenocodera* groups were assigned to section *Erythropus* (Erwin, 1983). These distinctions were reconfirmed in the present study; hence, the attribute cribriform punctulae no doubt has arisen more than once in the genus, but it needs testing at the group level for the entire genus (Erwin, in prep). It is possible that some other as yet undetected suite(s) of species without such punctulae may belong in this complex, either in the ancestral condition or as reversals. Females with a short antennomere 8 also occur elsewhere in the genus, and inclusion of those in this study will be necessary before homoplasy of that character can be supported or refuted.

The *novaurora* group, a northern Amazon–Orinoco lineage, consists of five closely related species that have a composite range extending from Ecuador to French Guiana and south into Brazil.

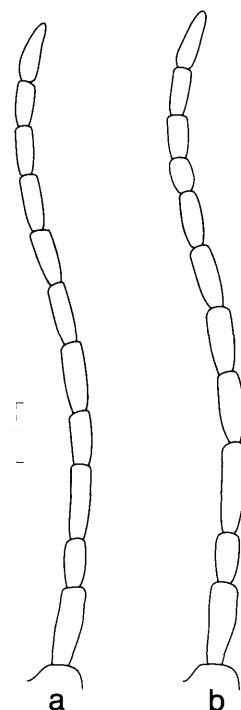


FIGURE 1.—Dorsal aspect of right antenna of *Agra eucera* Erwin, a member of the *cayennensis* complex: a, ♂; b, ♀.

Terry L. Erwin, Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560-0169.

Review Chairperson: John M. Burns, Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560-0127.

Reviewers: George E. Ball, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada T6G 2E9, and two anonymous reviewers.

The *dimidiata* group, predominantly northern Neotropical, consists of 16 species that have a composite range extending from Mexico to northeastern Peru and east to Venezuela. The *dimidiata* group now includes some of those species previously recognized as belonging to the *cayennensis* and the *linearis-brevicollis* groups in the old sense (Liebke, 1940; Straneo, 1958); however, many new species, described herein, have been added.

The *quararibea* group, a southern and western Amazon–Pantanal lineage, consists of five closely related species that have a composite range extending from the upper Xingu drainage of Brazil west into Peru and Ecuador.

Species of the *novaurora* suite of groups, before rigorous phylogenetic analysis, are arrayed in six groups, each hypothesized to be monophyletic in origin. Whether or not there are additional groups that may join this suite awaits further studies. Information about natural history and the introductory material presented previously for *Agra* (Erwin, 1978, 1996) and the *erythropus* group (Erwin, 1982a) apply to these groups as well and need not be repeated herein; however, for the reader's convenience, the methods are repeated below.

The purposes of this paper are to (1) provide a means by which others may identify *Agra* specimens, thereby acquiring and organizing additional data about the species, (2) record known species distributions, (3) add to the species character-state matrix for eventual phylogenetic and biogeographic analyses of the whole (see Erwin and Pogue, 1988; Erwin, 1996), (4) revise and update the group's nomenclature, and (5) describe the new species.

METHODS

General procedural methods for handling specimens are as described previously (Erwin, 1970, 1973, 1974, 1994). Species concepts are outlined in Erwin and Kavanaugh (1981). Descriptions are organized using the "nested" style of providing data. I have extracted all characters that, in my experience with the genus, are useful for this particular set of species and have used them in the nested descriptions beginning with the "complex" and ending at the "species." Important character states are given only at the taxonomic level at which they are useful and are not repeated at lower levels; thus, at the species level only defining autapomorphic states are elaborated under the heading "Recognition." Table 1 provides a character-state matrix for all characters thus far investigated across this and all previously revised *Agra* groups. These data will become more useful when the entire genus has been treated similarly. Character sets are amplified from those previously published (Erwin, 1982a, 1982b, 1983, 1984, 1986, 1987, 1993, 1996). One hundred and nine characters and their states are now referred to in the Appendix. The data set can be used to build a phylogenetic-analysis matrix or may be used for other such investigations where every state of every species is needed.

Measurements for body parts are presented in the species descriptions as measures of single specimens, if only one specimen was examined, or as ranges based on the smallest and largest of all specimens studied for each species. All specimens were measured using a Summagraphics digitizing pad and a camera lucida. The pad sends electronic information to a computer using a program (INPAD) developed by J. Russo of the Smithsonian Institution. Measurements are presented in millimeters and are coded as follows: ABL=apparent body length, that length used by most previous authors as total length, measured by holding a ruler alongside the specimen (see Erwin and Kavanaugh, 1981); SBL=standardized body length, that length introduced by Ball (1972) and modified by Kavanaugh (1979) and which is equal herein to the sum of head length (LH), pronotum length (LP), and elytral length (LE) (see Erwin and Kavanaugh, 1981); TW=total width across the widest portion of the elytra, actually measured as the width of the left elytron and doubled to obtain the value.

Species groups are assigned a two digit number, and species are assigned a three digit number for ease of reference from the key to the text and to other published groups. A secondary purpose of such a numbering system is to allow the entire set of group revisions to be eventually organized and indexed as a single monograph on electronic media.

Unless otherwise specified, illustrations are of specimens from starred (*) localities under each species description, and these locality data are not repeated in every figure caption. Scale bars in each set of illustrations equal 1.0 mm each unless labeled otherwise.

All geographic data, measures, and field data were standardized and then computerized using appropriate programs at the Smithsonian Institution. Locality records given below for each species are enhanced from that given on the specimen labels through geographic research on maps and in gazetteers. All specimens referred to herein have been assigned a unique number in the form "ADP 000000," "BIOLAT 000000," "CRI000-000000," or "FOG 000000." Data concerning each specimen is retrievable from the National Museum of Natural History, Smithsonian Institution, carabid (*Agra*) database archives using that number at <http://entomology.si.edu>.

TERMINOLOGY.—In order to organize and assemble taxa for study in this exceptionally large genus, I have used some informal groupings that may or may not be recognized formally once the system of the entire genus is discovered. As partly explained in the introduction, I have dubbed a selection of species sharing some obvious character a "complex." In practice, a complex contains species groups that share this character and is used only at the beginning of the study because once the characters and relations are known, the character may be homoplastic and thus not indicative of relationship among the selected taxa. A "suite" of species groups is the result of phylogenetic analysis of the complex and will contain a monophyletic assemblage of related groups. A group is a monophyletic assemblage of related species. I have used "section" in the past for a

TABLE 1.—Character matrix for species of the *novaurora*, *dimidiata*, and *quararibea* groups of the genus *Agra*. Characters (numbered 1 to 109) and their states are described in Appendix 1. (m=male, f=female, ?=character state unknown.)

Character	<i>orinocensis</i>	<i>crebrepunctata</i>	<i>novaurora</i>	<i>alinahui</i>	<i>superba</i>	<i>dimidiata</i>	<i>maracay</i>	<i>bci</i>	<i>falcon</i>	<i>hovorei</i>	<i>tuxtlas</i>	<i>zapotal</i>	<i>hespenheide</i>	<i>paratax</i>	<i>samiria</i>	<i>duckworthorum</i>	<i>eponine</i>	<i>inbio</i>	<i>pichincha</i>	<i>sternitica</i>	<i>biexcavata</i>	<i>othello</i>	<i>smurf</i>	<i>magnifica</i>	<i>quararibea</i>	<i>suprema</i>
	f	m	f	m	m	f	m	f	f	m	m	m	m	f	m	f	m	m	f	f	f	f	m	m	m	f
1	2	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
3	2	2	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	1
4	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	1
5	6	17	6	6	3	10	12	5	3	5	6	10	6	20	3	17	5	12	6	12	20	20	10	20	3	20
6	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
15	1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	1	1	1	1	1	1	1	1	1	1	3
16	1	1	1	1	1	2	2	1	1	1	1	1	4	1	4	1	2	1	2	1	4	4	1	1	4	1
17	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	3	3	2	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
21	2	2	1	2	2	2	2	2	2	3	2	2	2	3	2	2	2	2	2	2	2	6	6	6	5	5
22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
23	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
24	3	3	1	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	2	1	2	2	2
25	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
26	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	3	1	1	1	3	3	3	3	3	3	3
27	4	4	4	4	4	2	4	4	4	4	4	4	2	2	4	2	2	4	4	2	4	4	4	4	4	4
28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
29	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	4	4
32	5	5	2	5	5	5	5	5	5	2	2	2	5	1	2	2	2	2	2	5	2	6	7	7	7	6
33	?	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1
34	6	1	1	1	1	2	3	3	1	7	7	7	3	1	4	4	4	4	4	4	4	4	4	4	4	4
35	5	5	2	2	2	2	5	5	1	5	5	2	2	2	5	1	3	2	3	1	5	2	5	5	5	5
36	2	5	3	5	3	2	2	2	2	3	3	3	2	2	2	3	3	3	3	5	2	5	5	5	5	5
37	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2
38	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
39	4	1	1	4	4	4	4	4	4	4	4	4	4	4	4	1	2	2	1	4	4	4	4	4	4	4
40	1	2	2	2	1	8	7	8	3	2	2	2	7	7	2	7	7	2	2	2	2	3	2	2	2	8
41	1	1	1	1	1	1	1	1	1	1	1	5	1	1	1	1	1	1	1	5	1	2	2	2	2	2
42	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6
43	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
44	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	3	3	3	3	3	3
45	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	1	2	1
46	?	7	1	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	5	5	1
47	?	8	11	8	8	9	7	7	7	7	9	9	9	9	7	9	9	9	9	9	9	11	11	11	11	11
48	?	8	11	8	8	9	12	12	7	7	9	9	9	9	13	9	9	9	9	7	9	11	11	11	11	11
49	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
50	16	14	2	14	14	16	9	9	9	9	16	16	16	16	16	16	16	16	16	9	16	11	11	11	11	11
51	8	8	2	8	8	4	6	6	6	6	8	8	4	8	6	6	8	8	8	8	8	9	9	9	9	9
52	?	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	3
53	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
54	?	8	1	1	1	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	1	8	1	8

monophyletic assemblage of species groups. The use of the category "section," which I regard as useful in such a large genus, is suspended until the whole of *Agra* is resolved and reclassified. This technique of assembling study groups is necessary in a genus of more than 2000 species and is simply a way of organizing the vast amounts of specimens and taxa to be studied. One cannot efficiently study them all at once, nor would it be prudent to proceed through them one species at a time because it would take too long to find the natural system and communicate it to others interested in these beetles.

ACKNOWLEDGMENTS

I thank the curators of the following museums who generously provided types and other specimens of the *novaurora*, *dimidiata*, and *quararibea* groups from collections in their care: L. Herman, American Museum of Natural History, New York City, New York (AMNH); N. Stork and M. Bacchus, The Natural History Museum, London, England (BMNH; formerly the British Museum of Natural History); D.H. Kavanaugh, California Academy of Sciences, San Francisco, California (CAS); A. Smetana, Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario (CNC); E.G. Riley, Texas A&M University, College Station, Texas (EGRC); A. Newton, Field Museum of Natural History, Chicago, Illinois (FMNH); F.T. Hovore, private collection, Santa Clarita, California (FTHC); H. Hespeneheide, private collection, Los Angeles, California (HESPH); Angel Solis, Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica (INBIO); L. Baert, Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium (IRSN); J. Cope, private collection, San Jose, California (JCC); P. Perkins, Museum of Comparative Zoology, Cambridge, Massachusetts (MCZ); W. Overall, Museo Goeldi, Belém, Brazil (MGB); H. Perrin and J. Menier, Muséum National d'Histoire Naturelle, Paris, France (MNHP); Gerardo Lamas, Natural History Museum at San Marcos University, Lima, Peru (MUSM); G. Onore, Universidad Católica del Ecuador, Quito, Ecuador (PUCE); C. Seabra, private collection, Rio de Janeiro, Brazil (SEABRA); R. zur Strassen, Senckenberg Museum,

Frankfurt am Main, Germany (SNGF); G.E. Ball, Strickland Museum of Entomology, Edmonton, Alberta, Canada (UASM); K. Linsey, University of California at Davis, California (UCD); H.J. Lezama, University of Costa Rica, San José, Costa Rica (UCOR); J. Garcia R., Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay, Venezuela (UCV); R.C. Marinoni, Departamento de Zoología, Universidade Federal do Parana, Curitiba, Brazil (UFPC); S. Ashe, University of Kansas, Lawrence, Kansas (UKLK); H. Brailovsky and S. Santiago, Universidad Nacional Autónoma de Mexico, Distrito Federal, Mexico (UNAM); Department of Entomology, Smithsonian Institution, Washington, D.C. (USNM; collections of the former United States National Museum); and G. Scherer, Zoologische Staatssammlung, Munich, Germany (ZSM).

Heartfelt thanks also go to George Venable, Milagros Ponce de Leon, and Cathy Johnson, who provided illustration services; Michael G. Pogue assisted in various stages of production. David Kavanaugh and Dawn Southard read a late draft and provided many useful suggestions.

Funding for my *Agra* studies was received from the Neotropical Lowlands Research Project (Richard Vari, Principal Investigator), Biological Diversity Programs (Don Wilson, Director), and Department of Entomology, National Museum of Natural History (Robert Robbins, Chairman), all of the Smithsonian Institution. This is paper number 96 in the Biological Diversity in Latin America (BIOLAT) Project Series.

Taxonomy

Agra Fabricius

The *Novaurora* Complex

DIAGNOSTIC COMBINATION.—Elytral interneurs of close-set cribriform punctulae, uni- or biserial, or alternating punctulae slightly offset (Figures 25–27). See habitus illustrations in Erwin (1978, 1982a, 1982b, 1983, 1984, 1986, 1987) for alternative forms of the elytral interneur.

Key to Species Groups of the *Novaurora* Complex

NOTE.—Of the keyed groups, the species of the 01. *novaurora*, 02. *dimidiata*, and 03. *quararibea* groups are revised herein. The remaining groups (unnumbered) will be revised in subsequent contributions.

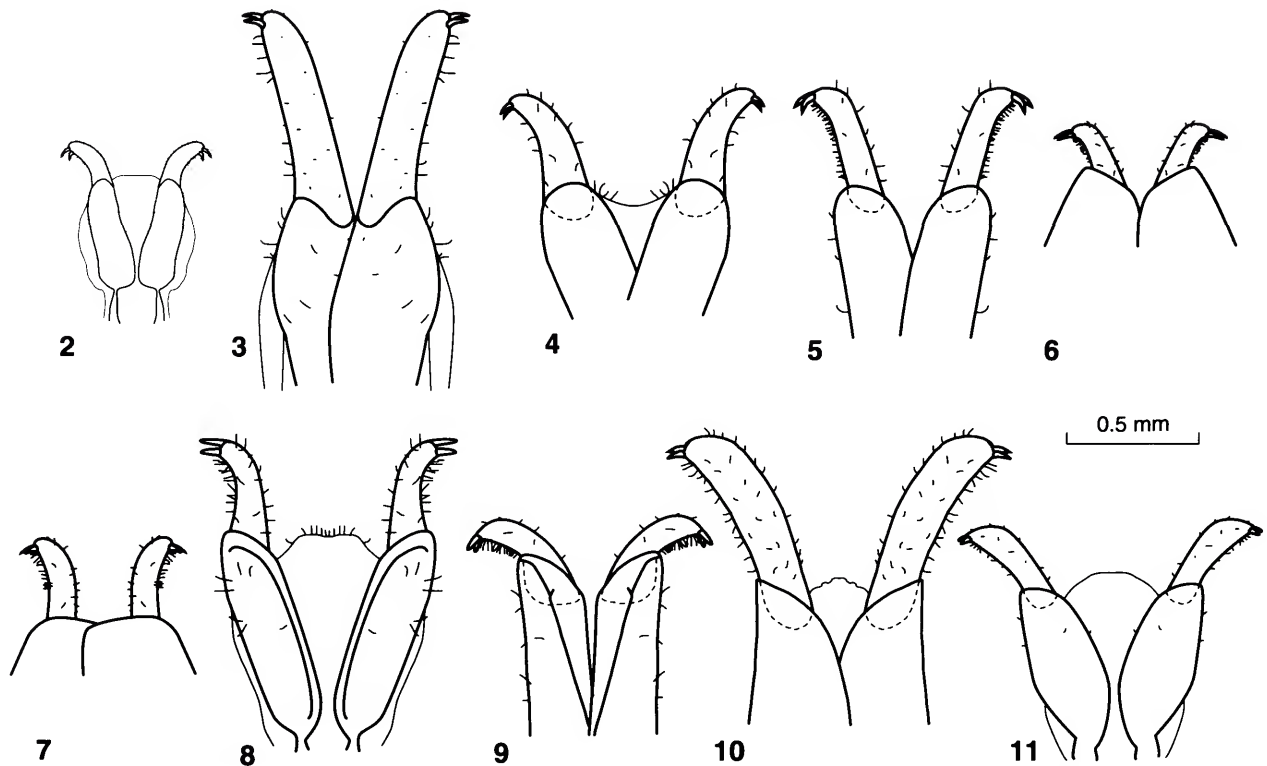
- 1. Prosternum densely setiferous and punctate, setae long, stylus as in Figure 2 *pusilla* group
- 1'. Prosternum glabrous, or with very short and scattered setae, or with fine white pubescence, stylus not as above [Figures 3–11] 2
- 2(1'). Pronotum with numerous coarse punctures. ♀ antennomere 8 coequal in length with antennomere 7 3
- 2'. Pronotum virtually smooth, with few small, fine punctulae. ♀ antennomere 8 less than three-fourths length of antennomere 7 8

- 3(2). Elytral interneurs of uniseriate rows of punctulae 4
- 3'. Elytral interneurs of bi- or triseriate rows of punctulae, OR cribriform punctulae not in line, especially basally 6
- 4(3). Sternum III of ♂ complete, not interrupted by median hyaline margin AND middle femur with dense patch of setae on posteroventral margin; sternum VI of ♀ incised [Figure 31], stylus as in Figure 5. 02. *dimidiata* group
- 4'. Sternum III of ♂ interrupted by median hyaline margin, middle femur with or without dense patch of setae on posteroventral margin; sternum VI of ♀ not incised, somewhat emarginate or medially toothed [Figure 30], stylus as in Figures 7 or 9 5
- 5(4'). Abdominal sterna II–VI of ♂ pubescent AND middle tibia with medial margin of dense setae; sternum VI of ♀ narrowly incised and layered, stylus as in Figure 9 *neblina* group
- 5'. Abdominal sterna III and IV of ♂ pubescent, with central area pilose, AND middle tibia with terminal patch of dense short setae; sternum VI of ♀ medially toothed [Figure 30], stylus as in Figure 7. *cyanea* group
- 6(3'). Middle tibia of ♂ without dense brush of setae on medial margin AND metasternum with scattered setae; sternum VI of ♀ with medium-sized, median blunt tooth, stylus as in Figure 8. *poguei* group
6. Middle tibia of ♂ with dense brush of setae on medial margin AND metasternum pubescent; sternum VI of ♀ emarginate or with small median blunt tooth, stylus as in Figures 4 or 6 7
- 7(6). Sterna III and IV of ♂ complete, not interrupted by median hyaline margin; middle tibia without medial margin brush; sternum VI of ♀ with small median blunt tooth, stylus as in Figure 6. *capitata* group
- 7'. Sterna III and IV of ♂ interrupted by median hyaline margin AND middle tibia with medial margin brush; sternum VI of ♀ emarginate, stylus bispinose, sparsely setiferous, not medially fringed [Figure 4] 01. *novaurora* group
- 7''. Sterna III, IV, and V of ♂ interrupted by median hyaline margin AND middle tibia with medial margin brush; sternum VI of ♀ U-cleft, stylus bispinose, sparsely setiferous, fringed medially [Figure 5] *arrowi* group
- 8(2'). Basitarsus of posterior leg short and broad, broader than tibial apex 03. *quararibea* group
- 8'. Basitarsus of posterior leg long, rectangulate, subequal in width to apex of tibia 9
- 9(8'). Tibiae of all legs with long white setae throughout their length, setae longer than width of tibia *phaenicodera* group
- 9'. Tibiae with normal setation, setae short and amber in color 10
- 10(9'). Labral disc convex; ♂ abdominal sternum III pilose *formicaria* group
- 10'. Labral disc flat; ♂ abdominal sternum III setiferous 11
- 11(10'). Pronotum densely punctate *famula* group
- 11'. Pronotum without punctulae but with fine transverse rugae; stylus as in Figure 10 *rufoaenea* group

Agra GROUPS

pusilla group.—This small group of species (now known from seven species in the collections examined) is known from Peru and Brazil. This lineage contains the smallest individuals in the genus, at 7 mm in length. Several attributes of these species, such as tarsal structure, suggest that they may be basal to the rest of the species of *Agra*.

lycisa group.—This group was defined by Straneo (1965) and included at that time 11 species, although there are many more undescribed species in the collections examined. These beetles are relatively abundant compared to other species in the genus. They are distributed from southern Brazil across the Amazon Basin to the French Guiana coast, west to Ecuador, and north into Central America as far as Costa Rica.



FIGURES 2-11.—Stylomere 2 (dorsal aspect, retracted position) of *Agra* species: 2, *pusilla* group (undescribed species number 1); 3, *cayennensis*; 4, *novaaurora*; 5, *dimidiata*; 6, *capitata*; 7, *cyanea*; 8, *poguei* group (undescribed species number 1); 9, *neblina*; 10, *rufoaenea*; 11, *quararibea*.

erythropus group.—This group was defined earlier (Erwin, 1982a). The 25 included species have an Amazon–Guyana Shield distribution.

palmata group.—This group was defined earlier (Erwin, 1984). The 39 included species have Amazon–Guyana Shield and Middle America–Colombia distributions.

famula group.—This group was defined earlier (Erwin, 1983). The seven included species have an Amazon–Middle America distribution.

formicaria subgroup.—This group was defined earlier (Erwin, 1983). The two included species have an Amazon–South Atlantic Forest distribution.

phaenicoдера subgroup.—This group was defined earlier (Erwin, 1983). The four included species have an Amazon–Middle America distribution.

cayennensis subgroup.—This group was defined earlier (Erwin, 1996; see also Figure 3). The numerous included species have an Amazon–Guyana Shield distribution.

arrowi group.—This group contains 33 species in the collections examined, but it is likely that it will get much larger as studies progress. Neither Liebke nor Straneo defined a group to contain *arrowi* and its relatives; therefore, this is the first definition of the group (see “Key to Species Groups,” above). Its

range extends from Mexico to Paraguay and southern Brazil and across the Amazon Basin onto the Guyana Shield.

rufoaenea group.—This group was defined earlier (Erwin, 1993). The six included species are distributed across the Amazon–Guyana Shield and along the Andes into Central America as far as middle Mexico.

quararibea group.—This group was defined earlier (Erwin, 1993), and I have expanded on that in the present paper.

dimidiata and *novaaurora* groups.—These groups are defined in the present paper.

poguei group.—This is a new group, defined herein (see “Key to Species Groups,” above). It contains eight species in the collections examined and is distributed from the northern and western Amazon Basin north into Mexico.

cyanea group.—This is a new group, defined herein (see “Key to Species Groups,” above). It contains nine species in the collections examined. It is distributed across the Amazon Basin north into Venezuela and onto Trinidad.

neblina group.—This is a new group, defined herein (see “Key to Species Groups,” above). It contains nine species in the collections examined. It is distributed from the southwestern Amazon Basin north into Venezuela.

capitata group.—This is a new group, defined herein (see “Key to Species Groups,” above). It contains three species in the collections examined. It is found in Peru (two species) and Venezuela (one species).

01. *novaurora* Group

DIAGNOSTIC COMBINATION.—Elytron with sutural and posterolateral teeth acute, elongate, not quite spinose (Figures 20–24); interneurs of evenly spaced, round punctulae (Figure 25).

Male: Venter from metathorax through abdominal sternum VI pubescent or densely setiferous, middle femur and tibia densely setiferous along medial margin, tarsomeres with modified adhesive vestiture in two patches on each tarsomere, abdominal sternum III and IV interrupted postmedially by extensive hyaline area, and apex of phallus broadly spade-like and markedly curved apically (Figures 33–35).

Female: Sternum VI emarginate; stylus bispinose, sparsely setiferous, not medially fringed (Figure 4).

TAXONOMIC HISTORY.—The only species previously described in this group is *Agra crebrepunctata* Straneo, 1955:13. Straneo believed that it belonged to the *filiformis* group as defined by Liebke (1940:226) and that it bore resemblance to *A. steinbachi* Liebke. With the discovery of an additional four species, new characters now have been studied showing that the lineage is part of the *novaurora* suite of groups and is not related to the radiation of the *filiformis* complex or to *steinbachi* Liebke, which belongs to the *splendida* complex. Complicating Straneo’s concept was the fact that his type series of three specimens was a mix of two species (see *A. orinocensis* and *A. crebrepunctata*, below).

INCLUDED SPECIES.—

- 001. *orinocensis*, new species (Venezuela);
- 002. *crebrepunctata* Straneo, 1955:13 (Surinam, French Guiana);
- 003. *novaurora*, new species (Ecuador);
- 004. *alinahui*, new species (Ecuador);
- 005. *superba*, new species (Brazil, Venezuela).

Key to Species of the *novaurora* Group

- 1. Elytra bright metallic green, often with coppery highlights 2
- 1'. Elytra brunneous without metallic reflection or piceous with somber dark green sheen 4
- 2(1). Legs reddish, without black knees 003. *A. novaurora*, new species
- 2'. Legs reddish, with contrasting black knees 3
- 3(2'). Head laterad behind eye evenly rounded to neck [Figure 19] 005. *A. superba*, new species
- 3'. Head laterad behind eye abruptly angulate to neck [Figure 18] 004. *A. alinahui*, new species
- 4(1'). Abdominal sternum VI of ♀ with incision shallow [Figure 28], median tooth short and truncate; head laterad behind eye abruptly angulate [Figure 15] 001. *A. orinocensis*, new species
- 4'. Abdominal sternum VI of ♀ with incision deep [Figure 29], median tooth long and bifid; head laterad behind eye rounded-angulate [Figure 16] 002. *A. crebrepunctata* Straneo

001. *Agra orinocensis*, new species

FIGURES 15, 20, 28, 96

RECOGNITION.—Elytra brunneous, without metallic reflection. Abdominal sternum VI of female with incision shallow (Figure 28), median tooth short and truncate; head laterad behind eye abruptly angulate (Figure 15).

Size: ABL=19.82 mm; SBL=17.52 mm; TW=4.92 mm; LH=3.6 mm; LP=4.2 mm; LE=9.7 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 96).—Northern Atlantic coast in the Rio Orinoco drainage system.

SPECIMENS EXAMINED.—*Holotype:* ♀, VENEZUELA, *Without Exact Locality:* Caño Marcareo, Orinoco Delta, Jan (Myers) (MCZ), ADP 90636*.

NOTES.—Straneo (1955), in describing *A. crebrepunctata*, included this specimen. Abdominal sternum VI of the present species is quite different than that of *A. crebrepunctata* (compare Figures 28 and 29); thus, I have described it as new.

ETYMOLOGY.—The specific epithet, from the Rio Orinoco, refers to the type locality.

002. *Agra crebrepunctata* Straneo

FIGURES 16, 21, 29, 33, 96

Agra crebrepunctata Straneo, 1955:13. [Holotype ♀, FRENCH GUIANA, S. Laurent du Maroni (S.L. Straneo, private collection, Milano, Italy). Not seen, but illustrated by Straneo.]

RECOGNITION.—Elytra brunneous, without metallic reflection. Abdominal sternum VI of female with deep incision (Fig-

ure 29), median tooth long and bifid. Head laterad behind eye rounded-angulate (Figure 16).

Size: ABL=20.56–20.86 mm; SBL=19.29–19.62 mm; TW=5.06–5.03 mm; LH=3.90–3.93 mm; LP=4.41–4.91 mm; LE=10.80–10.95 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 96).—Northern Atlantic coast in the Rio Maroni drainage system.

SPECIMENS EXAMINED.—*Paratype:* 1 ♀, SURINAME (Heylaerts) (IRSN), ADP 04357*.

Nontype: FRENCH GUIANA, Rio Maroni, 05°45'N, 053°37'W, 1 ♂ (Leseleuc) (MNHP), ADP 04358*.

NOTES.—Straneo mentioned another specimen, a paratype, that he saw. I have studied this specimen and find it not to be the present species (see 001. *Agra orinocensis*, above).

003. *Agra novaurora*, new species

FIGURES 4, 17, 22, 25, 96

RECOGNITION.—Elytra bright metallic green with coppery highlights. Legs reddish, without black knees.

Size: ABL=19.87–21.78 mm; SBL=18.69–19.84 mm; TW=4.93–5.15 mm; LH=3.57–3.77 mm; LP=4.59–4.73 mm; LE=10.53–11.32 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 96).—Northwestern Amazon Basin, Rio Napo drainage system.

SPECIMENS EXAMINED.—*Holotype:* ♀, ECUADOR, *Napo:* 20 km E Puerto Napo, Alinahui, 450 m, 01°00'S, 077°25'W, Nov–Dec (Ross) (CAS), ADP 05271*.

Paratype: ECUADOR, *Napo:* same data as above, 1 ♀, ADP 05270.

NOTES.—This species, known only from two females, exhibits a very small medial tooth on the apex of sternum VI, whereas the two preceding species possess a well-developed tooth. Unfortunately, the two following species, which are metallic in coloration, as is the present one, are known only from males. Once females are discovered for the following species and males are discovered for the present species, this group may have to be reorganized.

ETYMOLOGY.—The specific epithet, from the Latin *novaurora*, a new dawn, refers to the ever changing, complex rainbow of colors seen within the green sheen on the elytra of these beetles.

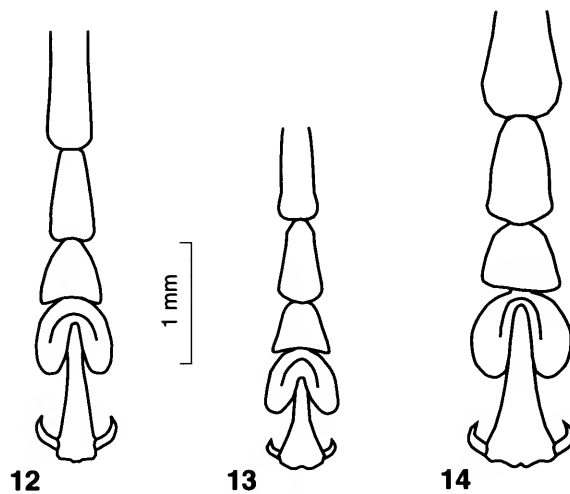
004. *Agra alinahui*, new species

FIGURES 12, 18, 23, 34, 96

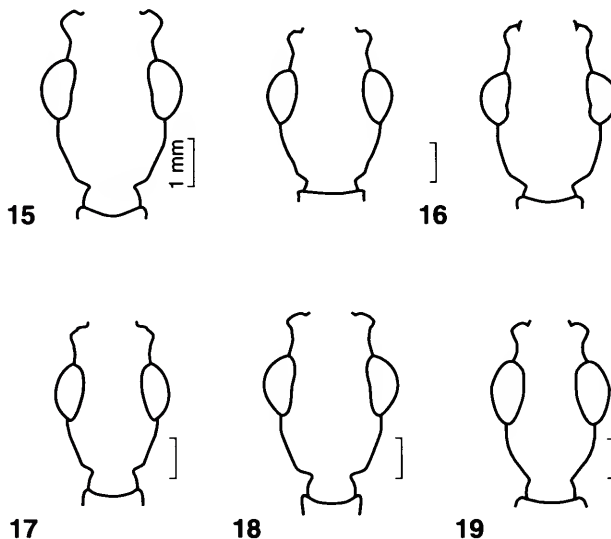
RECOGNITION.—Elytra dark metallic green with coppery highlights. Legs reddish, with black knees.

Size: ABL=21.08–21.68 mm; SBL=19.39–19.58 mm; TW=5.18–5.35 mm; LH=3.93–4.12 mm; LP=4.84–4.86 mm; LE=10.60–10.62 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 96).—Northwestern Amazon Basin, Rio Napo drainage system.



FIGURES 12–14.—Tarsus, left hind leg (dorsal aspect) of *Agra* species: 12, *alinahui* ♂; 13, *dimidiata* ♂; 14, *suprema* ♂.

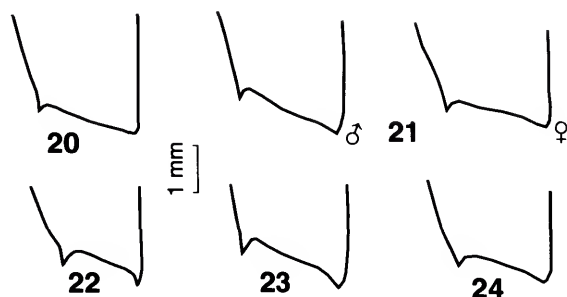


FIGURES 15–19.—Head (dorsal aspects of postcranium) of *Agra* species, *novaurora* group: 15, *orinocensis* ♀; 16, *crebrepunctata* ♂, ♀, respectively; 17, *novaurora* ♀; 18, *alinahui* ♂; 19, *superba* ♂.

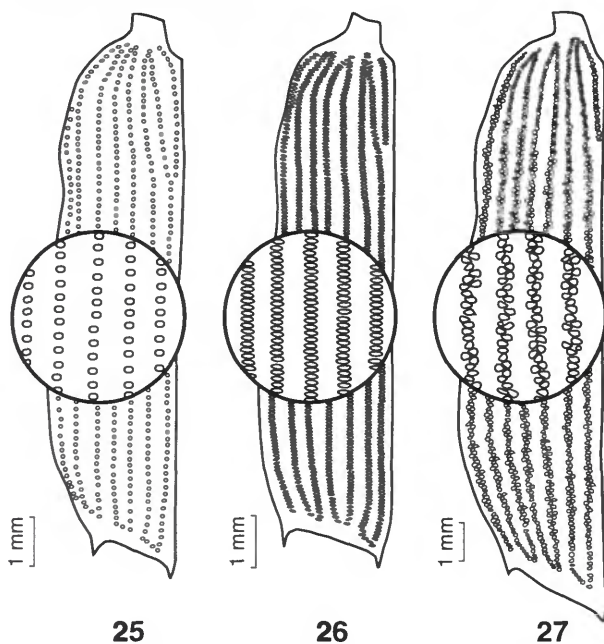
SPECIMENS EXAMINED.—*Holotype:* ♂, ECUADOR, *Napo:* 20 km E Puerto Napo, Alinahui, 450 m, 01°00'S, 077°25'W, Nov–Dec (Ross) (CAS), ADP 05272*.

Paratype: ECUADOR, *Napo:* same data as above, 1 ♂, ADP 05273.

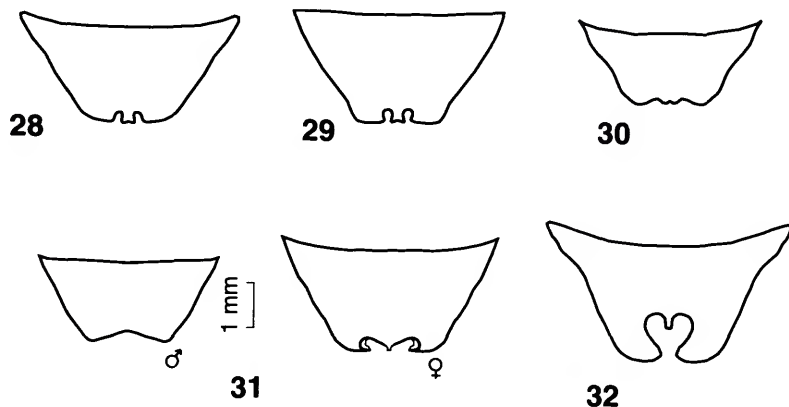
NOTES.—Although much of the area in which the type locality lies has been severely damaged by colonists, the Jatun Sacha Reserve and the property of Cabañas Alinahui have established a large parcel of protected lowland forest. The parcel is



FIGURES 20–24.—Elytron (left side, dorsal aspect of apex) of *Agra* species, *novaurora* group: 20, *orinocensis* ♀; 21, *crebrepunctata* ♂, ♀; 22, *novaurora* ♀; 23, *alinahui* ♂; 24, *superba* ♂.



FIGURES 25–27.—Elytral interneurs (left elytron, dorsal aspect) of *Agra* species: 25, *novaurora* ♀; 26, *dimidiata* ♂; 27, *quararibea* ♂.



FIGURES 28–32.—Sternum VI (ventral aspect of apex) of *Agra* species: 28, *orinocensis* ♀; 29, *crebrepunctata* ♀; 30, *cyanea* ♀; 31, *dimidiata* ♂, ♀; 32, *suprema* ♀.

rich in tree species and is on the edge of the upper Napo River at 450 m. It supplied three new species for this revision alone.

ETYMOLOGY.—The specific epithet, *alinahui*, is an Amerindian word from the “oriente” of Ecuador and is the name of a small private reserve and lodge where E.S. Ross collected the types.

005. *Agra superba*, new species

FIGURES 19, 24, 35, 96

RECOGNITION.—Head spotted. Elytra brilliant metallic green. Legs reddish, with contrasting black knees. Head laterad behind eye evenly rounded to neck.

Size: ABL=20.05–20.32 mm; SBL=18.47–18.67 mm; TW=4.75–5.21 mm; LH=3.82–3.87 mm; LP=4.53–4.67 mm; LE=10.12–10.13 mm.

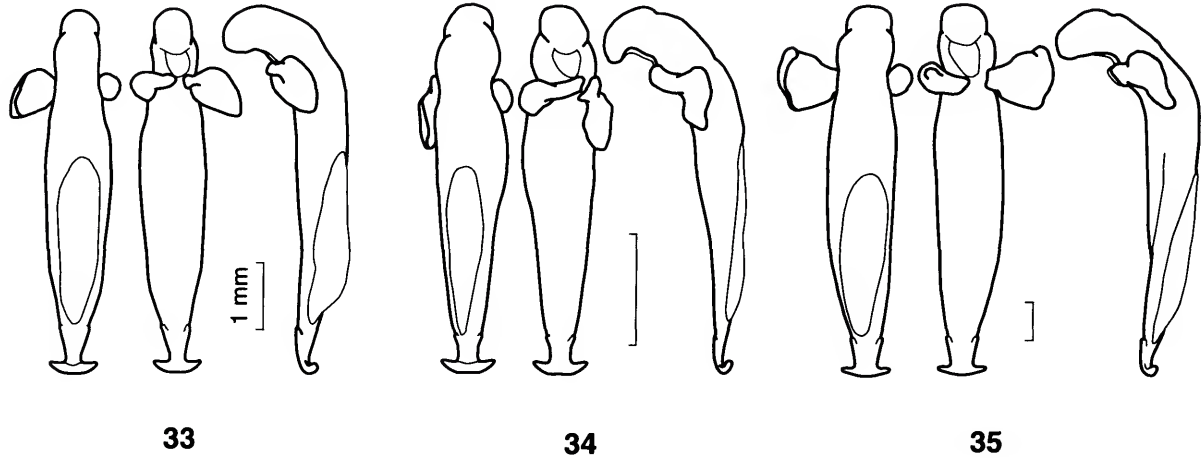
GEOGRAPHICAL DISTRIBUTION (Figure 96).—Northern and eastern Amazon Basin in the Rio Negro and Rio Tapajos drainage systems.

SPECIMENS EXAMINED.—*Holotype*: ♂, VENEZUELA, *Amazonas*: confluence of Rio Negro and Rio Baria, 00°55'N, 066°10'W, Mar–Apr (Padilla) (ZSM), ADP 04326*.

Paratype: BRAZIL, *Para*: Fordlandia, 03°47'S, 055°29'W, 1 ♂, Feb (Pereira and Machado) (USNM), ADP 69362.

NOTES.—The two specimens known for this species are quite similar, although they come from localities quite distant from one another. I note two differences, however, as follows: the Venezuelan holotype has perceptibly longer and narrower elytra, and the prothorax appears to be slightly narrower and prolonged. Females from the same areas may shed light on whether in fact these two specimens represent different species.

ETYMOLOGY.—The specific epithet, *superba*, is a latinized word describing the elegant combination of bright green elytral color and contrasting red and black appendages and forebody. The beetle is so striking that even the name *superba* is hyperbole.



FIGURES 33–35.—Aedeagus (dorsal, ventral, and left lateral aspects) of *Agra* species, *novaurora* group: 33, *crebrepunctata*; 34, *alinahui*; 35, *superba*.

02. *dimidiata* Group

DIAGNOSTIC COMBINATION.—Elytron with sutural and posterolateral teeth spinose (Figures 52–67); interneurs of contiguous cribriform punctulae (Figure 26).

Male: Venter from metathorax through abdominal sternum VI pubescent or densely setiferous, middle femur densely setiferous along medial margin, middle tibia triserially setose with small medial apical patch of setae, tarsomeres with modified setae divided into two patches, abdominal sternum III interrupted postmedially by extensive hyaline area, and apex of phallus broadly lobed apically (Figures 68–80).

Female: Sternum VI deeply incised, with a central spine-like projection (Figure 31); stylus bispinose, slightly elongate, tubular, sparsely setiferous, and medially fringed (Figure 5).

TAXONOMIC HISTORY.—Chevrolat (1856) described *Agra dimidiata* in four lines of text and did not compare it with any known species. Straneo (1958, 1982) described two species (now assigned to this group) and regarded one of them (*A. sternitica* Straneo) as part of his *tuberculata* group and the other (*A. biexcavata* Straneo) as related to *A. crebrepunctata* Straneo, which he previously placed in the *filiformis* group (see “01. *novaurora* Group,” above). Straneo, however, also compared *A. biexcavata* with *A. dimidiata* Chevrolat, in which fe-

males also have the incised sternum VI. Straneo did not see enough species of the following group to formally recognize it as such, but he did recognize the female sternal character as important. In the same paragraph, he further mentioned similarities with *A. erythrocerata* Brullé and *A. regina* Liebke, which in fact have no relationship to the *novaurora* suite of groups.

INCLUDED SPECIES.—

- 001. *Agra dimidiata* Chevrolat, 1856:352 (Mexico, Panama);
- 002. *Agra maracay*, new species (Venezuela);
- 003. *Agra bci*, new species (Panama);
- 004. *Agra falcon*, new species (Venezuela);
- 005. *Agra hovorei*, new species (Mexico);
- 006. *Agra tuxtla*, new species (Mexico);
- 007. *Agra zapotal*, new species (Mexico, Guatemala);
- 008. *Agra hespenheide*, new species (Costa Rica);
- 009. *Agra paratax*, new species (Costa Rica);
- 010. *Agra samiria*, new species (Peru);
- 011. *Agra duckworthorum*, new species (Panama);
- 012. *Agra eponine*, new species (Costa Rica);
- 013. *Agra inbio*, new species (Costa Rica);
- 014. *Agra pichincha*, new species (Ecuador);
- 015. *Agra sternitica* Straneo, 1982:401 (Ecuador);
- 016. *Agra biexcavata* Straneo, 1958:372 (Peru).

Key to Species of the *dimidiata* Group

- 1. Elytral color somber, brunneous or black, OR metallic green, OR rufescent; if the latter, forebody also rufescent; legs various 2
- 1'. Elytral color rufescent, markedly contrasting with black forebody and head; legs black or pale with black knees 15
- 2(1). Elytral color rufescent, concolorous with head and pronotum 3
- 2'. Elytra, pronotum, and head not rufescent 6
- 3(2). Femora testaceous, with black apex [Venezuela] . . . 004. *A. falcon*, new species
- 3'. Femora rufescent, concolorous with rest of body and head [Mexico] 4

- 4(3'). Head large [Figure 40], wider than prothorax 005. *A. hovorei*, new species
 4'. Head smaller [Figures 41, 42], not wider than prothorax 5
 5(4'). Pronotum with sides straight, tapered from base to apex
 006. *A. tuxtlas*, new species
 5'. Pronotum with sides markedly arcuate from base to apex
 007. *A. zapotal*, new species
 6(2'). Elytra metallic green, or black with brassy reflections 7
 6'. Elytra somber, brunneous or black, without brassy reflections 8
 7(6). Elytron bright metallic green 016. *A. biexcavata* Straneo
 7'. Elytron black with brassy reflections in natural light
 010. *A. samiria*, new species
 8(6'). Elytral interneurs of disorganized rows of large punctulae that reflect greenish
 015. *A. sternitica* Straneo
 8'. Elytral interneurs of fine or coarse uniserial rows of cribriform punctulae 9
 9(8'). Legs pale, reddish orange or testaceous, contrasting markedly with body color
 10
 9'. Legs somber, black or infuscated, not contrasting much with body color 13
 10(9). Legs without black knees, but in many specimens base of femur infuscated
 003. *A. bci*, new species
 10'. Legs with black knees 11
 11(10). Punctulae of elytral interneurs large and coarse, their diameter greater than width
 of interval 011. *A. duckworthorum*, new species
 11'. Punctulae of elytral interneurs small and fine, their diameter much less than
 width of interval 12
 12(11'). Antennal scape and pedicel black, contrasting markedly with flagellar antenno-
 meres; tarsomeres and tibial apex black . . . 008. *A. hespenheide*, new species
 12'. Antennal scape and pedicel reddish orange, concolorous with flagellar antenno-
 meres; legs concolorous except knees black 009. *A. paratax*, new species
 13(9). Elytral intervals flat, punctulae of interneurs very small [Figure 25]
 014. *A. pichincha*, new species
 13'. Elytral intervals slightly convex, punctulae of interneurs small [Figure 26] . . . 14
 14(13'). Head laterad behind eye square [Figure 36]; elytral apex as in Figure 52
 001. *A. dimidiata* Chevrolat
 14'. Head laterad behind eye abruptly angulate in ♂, markedly rounded in ♀ [Figure
 37]; elytral apex as in Figure 53 002. *A. maracay*, new species
 15(1'). Legs black; scape, pedicel, and antennomere 1 black, flagellar antennomeres in-
 fuscated apically 012. *A. eponine*, new species
 15'. Legs pale with knees black; antennomeres pale 013. *A. inbio*, new species

001. *Agra dimidiata* Chevrolat

FIGURES 5, 13, 26, 31, 36, 52, 68, 97

Agra dimidiata Chevrolat, 1856:352. [Lectotype ♀, selected herein, MEXICO, Veracruz: "Toxpan" [Tuxpan], 20°57'N, 097°24'W (BMNH).]

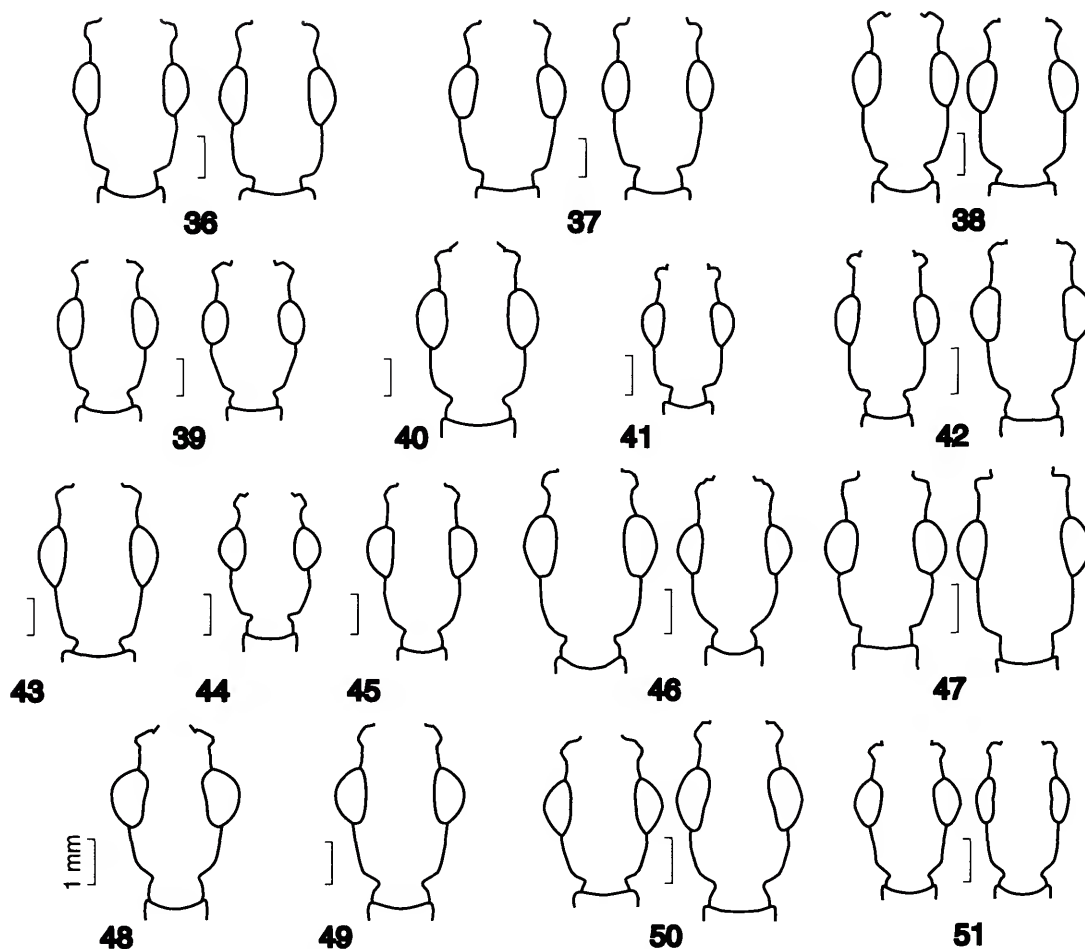
RECOGNITION.—Elytral color somber, brunneous; legs somber, black or infuscated, not contrasting much with body color. Elytral intervals slightly convex, punctulae of interneurs small, cribriform, in fine, uniserial rows. Head as in Figure 36; elytral apex as in Figure 52.

Size: ABL=17.67–22.38 mm; SBL=15.40–20.15 mm; TW=4.4–6.36 mm; LH=3.07–4.38 mm; LP=3.56–4.58 mm; LE=8.54–11.86 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 97).—Wet forests of southwestern Mexico and southernmost Panama.

SPECIMENS EXAMINED.—*Lectotype*: See synonymy.

Nontypes: MEXICO, Chiapas: Pacific Slope Cordilleras, 800–1000 m, 1 ♂, 1 ♀ (Hotzen) (USNM), ADP 91169, 91168. PANAMA, Canal Zone: Barro Colorado Id., 09°10'N, 079°50'W, 1 ♂, Aug (Silberglied and Aiello) (USNM), ADP 55945; 1 ♂, Jan (Cooper) (MCZ), ADP 10060*; 2 ♂, May (W.D. and S.S. Duckworth) (USNM), ADP 10059*, 10061; 1 ♀, Apr (Ruckes) (AMNH), ADP 44047; 2 ♂, Aug, H. Wolda Project, SM nivel III (Wolda) (USNM), ADP 82439, 91776. Diablo Heights, 08°58'N, 079°34'W, 1 ♀, Feb (Riley) (EGRC), ADP 80613. Fort Clayton, 09°01'N, 079°34'W, 1 ♂, Aug (Johnson) (CAS), ADP 05524. La Chorrera, 08°03'N, 080°50'W, 1 ♀ (BMNH), ADP 05525. Colon: Madden Dam, 09°00'N, 079°37'W, 1 ♀, May (Hovore) (USNM), ADP 70531. Panama: Sajalices, 08°41'N, 079°52'W, 1 ♂, May (Hovore) (FTHC), ADP 70532.



FIGURES 36–51.—Head (dorsal aspects of postcranium) of *Agra* species, *dimidiata* group: 36, *dimidiata* ♂, ♀, respectively; 37, *maracay* ♂, ♀, respectively; 38, *bci* ♂, ♀, respectively; 39, *falcon* ♂, ♀, respectively; 40, *hovoroi* ♂; 41, *tuxtlas* ♂; 42, *zapotal* ♂, ♀, respectively; 43, *hespenheide* ♂; 44, *paratax* ♀; 45, *samiria* ♂; 46, *duckworthorum* ♂, ♀, respectively; 47, *eponine* ♂, ♀, respectively; 48, *inbio* ♂; 49, *pichincha* ♀; 50, *sternitica* ♂, ♀, respectively; 51, *biexcavata* ♂, ♀, respectively.

NOTES.—The disjunct Distribution (southern Mexico and Panama) of this species is curious, and all the recent mass collecting in Costa Rica has failed to turn it up there, suggesting that the range is not an artifact of collecting.

002. *Agra maracay*, new species

FIGURES 37, 53, 69, 97

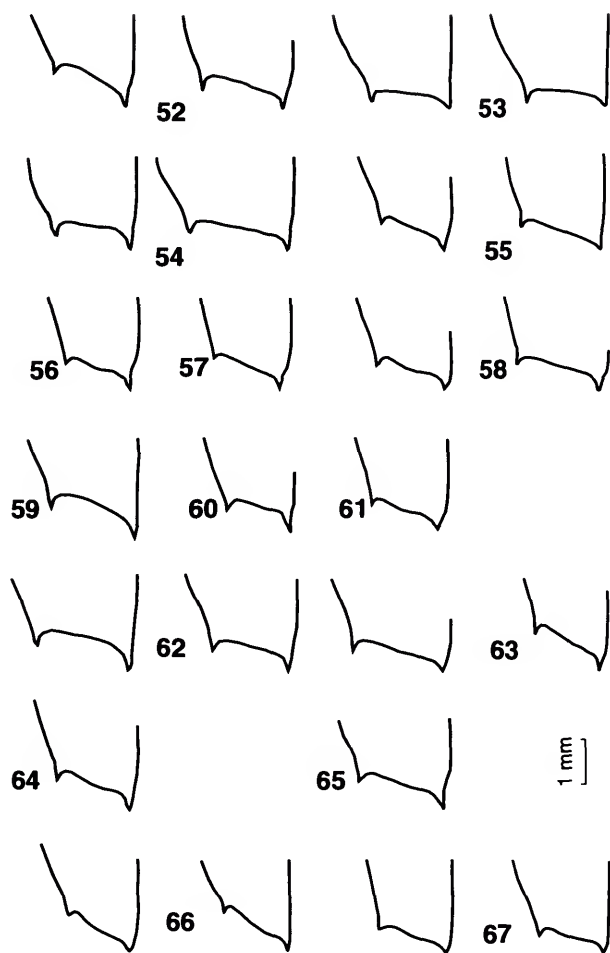
RECOGNITION.—Elytral color somber, brunneous; legs somber, black or infuscated, not contrasting much with body color. Elytral intervals slightly convex, interneurons of fine uniserial rows of very small cribriform punctulae. Head as in Figure 37; elytral apex as in Figure 53.

Size: ABL=15.23–21.87 mm; SBL=13.76–19.29 mm; TW=3.20–5.74 mm; LH=2.92–4.11 mm; LP=3.04–4.62 mm; LE=7.56–10.72 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 97).—Caribbean coast of South America.

SPECIMENS EXAMINED.—*Holotype*: ♂, VENEZUELA, *Aragua*: Maracay, 10°15'N, 067°36'W, Jan–Feb (Vogl) (ZSM), ADP 56779.

Paratypes: VENEZUELA, *Aragua*: same locality as holotype, 5 ♂, 3 ♀, May, Jul, Nov–Feb (Vogl) (ZSM), ADP 56774, 56776–56778, 56781, 56782*, 56783, 56784*; 4 ♂, 1 ♀, 450 m, May, Jun (Kern) (ZSM), ADP 84444, 85341, 85434, 85440, 85443. Tocorón, 10°07'N, 067°36'W, 1 ♀, Apr (ZSM) ADP 85462. El Limon, near Maracay, 10°18'N, 067°38'W, 1 ♀, May (Werner) (MCZ), ADP 90900; 2 ♀, Jun, Aug (Requena) (ZSM), ADP 85431, 85439; 1 ♀, May (Clavijo) (ZSM), ADP 85466; 1 ♂, 3 ♀, Apr, Jun (Rosales) (ZSM), ADP 85429, 85430, 85435, 85445; 4 ♀, May, Jun (Bechyne) (ZSM), ADP



FIGURES 52-67.—Elytron (left side, dorsal aspect of apex) of *Agra* species, *dimidiata* group: 52, *dimidiata* ♂, ♂, respectively; 53, *maracay* ♂, ♀, respectively; 54, *bci* ♂, ♀, respectively; 55, *falcon* ♂, ♀, respectively; 56, *hovorei* ♂; 57, *tuxtlas* ♂; 58, *zapotal* ♂, ♀, respectively; 59, *hespenheide* ♂; 60, *paratax* ♀; 61, *samiria* ♂; 62, *duckworthorum* ♂, ♀, respectively; 63, *eponine* ♂, ♀, respectively; 64, *inbio* ♂; 65, *pichincha* ♀; 66, *sternitica* ♂, ♀, respectively; 67, *biexcavata* ♂, ♀, respectively.

85432, 85486, 85487, 85493; 15 ♂, 10 ♀, Apr, May, Jun, Aug (Fernandez) (ZSM), ADP 85411, 85433, 85436-85438, 85446, 85447, 85450, 85451, 85453, 85456, 85457, 85460, 85461, 85464, 85465, 85467, 85468, 85470, 85471, 85472, 85484, 85488, 85494, 85508. Portuguesa Experimental Station, San Nicolas, 56 km de Guanare, 180 m, 1 ♂, 08°48'N, 069°46'W, Apr (Rosales and Casares), ADP 85449. *Monagas*: Jusepin, 09°45'N, 063°31'W, 1 ♂, 1 ♀, Jun, Aug (Salcedo and Rodriguez) (ZSM), ADP 85409, 85442.

NOTES.—This species and *A. dimidiata*, discussed above, are clearly sister species and in fact are difficult to distinguish. Their distribution, Middle America and the North Atlantic coast of South America (Erwin and Pogue, 1988), supports the hypothesis that these areas once contained a single fauna.

ETYMOLOGY.—The specific epithet, *maracay*, refers to the city of Maracay, near which the holotype was collected.

003. *Agra bci*, new species

FIGURES 38, 54, 70, 98

RECOGNITION.—Elytral color somber, brunneous; legs pale, reddish orange, contrasting markedly with body color, without black knees, although in many specimens base of femur infuscated.

Size: ABL=16.51-21.94 mm; SBL=15.83-19.38 mm; TW=4.16-5.63 mm; LH=3.11-3.93 mm; LP=3.78-4.64 mm; LE=8.73-10.81 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 98).—Wet forests of central-west Costa Rica and southernmost Panama.

SPECIMENS EXAMINED.—*Holotype*: ♂, PANAMA, *Canal Zone*: Barro Colorado Id., 09°10'N, 079°50'W, May (W.D. and S.S. Duckworth) (USNM), ADP 09908.

Paratypes: COSTA RICA, *Cartago*: Turrialba, 09°53'N, 083°38'W, 1 ♀, Feb (H. and A. Howden) (UASM), ADP 54793. PANAMA, *Canal Zone*: same locality as holotype, 2 ♂, Jan (Bottimer) (CNC), ADP 58760, 58764; 1 ♂, ADP 58746; 1 ♀, Jan (Dybas) (FMNH), ADP 58763*; 1 ♀, Mar (Bottimer) (CNC), ADP 58763; 1 ♂, Apr (R.B. and L.S. Kimsey) (UCD), ADP 58816; 1 ♂, Apr (Wheeler) (MCZ), ADP 10063*; 2 ♀, Apr, May (C.W. and M.E. Rettenmeyer) (UKLK), ADP 46854, 56312; 1 ♂, 2 ♀, Mar, Oct, Nov (Wolda) (USNM), ADP 66015, 66379, 77199.

NOTES.—The apparent disjunction in range is likely due to lack of collecting in the canopy habitat of these beetles on the north coast of Panama.

ETYMOLOGY.—The specific epithet, *bci*, is an abbreviation for the island on which these beetles were first discovered, and which is now the type locality.

004. *Agra falcon*, new species

FIGURES 39, 55, 71, 99

RECOGNITION.—Elytral color rufescent, concolorous with head and pronotum; femora testaceous, with black apex.

Size: ABL=15.66 mm; SBL=14.25 mm; TW=3.78 mm; LH=3.00 mm; LP=3.32 mm; LE=7.92 mm.

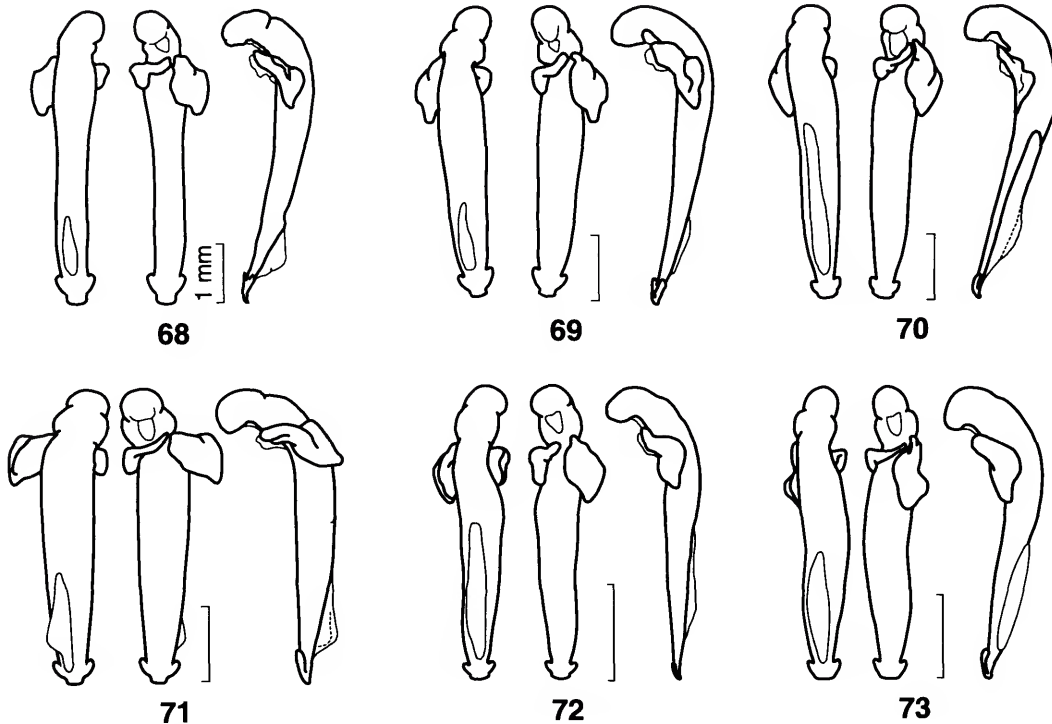
GEOGRAPHICAL DISTRIBUTION (Figure 99).—Caribbean coast of South America.

SPECIMENS EXAMINED.—*Holotype*: ♂, VENEZUELA, *Falcon*: Sanare, Finca Tillerias, 100 m, 09°39'N, 069°45'W, Oct (Clavijo and Chacon) (UCV), ADP 85492*.

Nontype: VENEZUELA, *Cojedes*: El Baúl, 08°57'N, 068°17'W, 1 ♀, May (Bechyne) (USNM), ADP 85441*.

NOTES.—This species and the following one, *A. hovorei*, are clearly sister species and in fact are difficult to distinguish. Their distribution, Middle America and the North Atlantic coast of South America (Erwin and Pogue, 1988), supports the hypothesis that these areas once contained a single fauna.

ETYMOLOGY.—The specific epithet, *falcon*, refers to the state in Venezuela where the holotype was collected.



FIGURES 68–73.—Aedeagus (dorsal, ventral, and left lateral aspects) of *Agra* species, *dimidiata* group: 68, *dimidiata*; 69, *maracay*; 70, *bci*; 71, *falcon*; 72, *hovorei*; 73, *tuxtlas*.

005. *Agra hovorei*, new species

FIGURES 40, 56, 72, 99

RECOGNITION.—Femora rufescent, concolorous with rest of body and head. Head as in Figure 40; elytral apex as in Figure 56.

Size: ABL=17.88 mm; SBL=16.45 mm; TW=4.18 mm; LH=3.39 mm; LP=3.81 mm; LE=9.25 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 99).—Known only from the wet forest of eastern Mexico.

SPECIMENS EXAMINED.—*Holotype*: ♂, MEXICO, Veracruz: Estacion Biologica Los Tuxtlas, near 18°27'S, 095°13'W (Hovore) (UNAM), ADP 06493*.

NOTES.—See “Notes,” under *A. falcon*, above.

ETYMOLOGY.—The specific epithet, *hovorei*, a patronymic, honors my friend and a great collector of beetles, Frank T. Hovore, who often diverts from collecting cerambycids to capturing *Agra* beetles, as in the case of the holotype of this species.

006. *Agra tuxtlas*, new species

FIGURES 41, 57, 73, 99

RECOGNITION.—Femora rufescent, concolorous with rest of body and head. Head as in Figure 41; elytral apex as in Figure 57.

Size: ABL=14.19 mm; SBL=13.33 mm; TW=3.64 mm; LH=2.66 mm; LP=3.06 mm; LE=7.61 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 99).—Known only from the wet forest of eastern Mexico.

SPECIMENS EXAMINED.—*Holotype*: ♂, MEXICO, Veracruz: Estacion Biologica Los Tuxtlas, near 18°27'S, 095°13'W, Jun (Colin and Rojas) (UNAM), ADP 02168*.

ETYMOLOGY.—The specific epithet, *tuxtlas*, refers to the biological station of that name, where the type was collected.

007. *Agra zapotal*, new species

FIGURES 42, 58, 74, 99

RECOGNITION.—Elytron rufescent; femora rufescent, concolorous with rest of body and head. Elytral intervals slightly convex. Head as in Figure 42; elytral apex as in Figure 58.

Size: ABL=15.32–16.74 mm; SBL=15.21–16.02 mm; TW=3.43–4.12 mm; LH=3.09–3.23 mm; LP=3.41–3.70 mm; LE=8.58–9.09 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 99).—Wet forests of eastern and southern Mexico and northern Guatemala.

SPECIMENS EXAMINED.—*Holotype*: ♂, GUATEMALA, Alta Verapaz: San Cristobal Verapaz, Quixal, 15°23'N, 090°24'W, Apr (Freude) (USNM), ADP 83209*.

Paratypes: MEXICO, *Chiapas*: El Zapotal, 3.2 km S Tuxtla Gutiérrez, 16°44'N, 093°09'W, 1 ♀, Jul (Chemsak and Rannels) (UASM), ADP 66261*. *Veracruz*: Estacion Biologica Los Tuxtlas, near 18°27'S, 095°13'W, 1 ♂ (Hovore) (FTHC), ADP 06501.

ETYMOLOGY.—The specific epithet, *zapotal*, is the name of the village near which one of the paratypes was collected.

008. *Agra hespenheide*, new species

FIGURES 43, 59, 75, 98

RECOGNITION.—Elytra and forebody somber, brunneous; antennal scape and pedicel black, contrasting markedly with flagellar antennomeres; legs pale, reddish orange, contrasting markedly with body color, with knees, tibial apices, and tarsomeres black. Punctulae of elytral interneurs small and fine, their diameter much less than width of interval.

Size: ABL=19.28 mm; SBL=17.10 mm; TW=4.84 mm; LH=3.10 mm; LP=4.28 mm; LE=9.71 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 98).—Known only from the wet forest of northeastern Costa Rica.

SPECIMENS EXAMINED.—*Holotype*: ♂, COSTA RICA, *Heredia*: Finca La Selva, 3 km S Pto. Viejo, 10°26'N, 084°01'W, Mar (Hespenheide) (HESPH), ADP 80788*.

Paratype: COSTA RICA, *Heredia*: same data as type except 1 ♀, Apr, ADP 04496*.

ETYMOLOGY.—The specific epithet, *hespenheide*, is a patronymic in honor of Henry Hespenheide, collector of the holotype, whose continued interest in collecting *Agra* has resulted in many fine specimens for my studies.

009. *Agra paratax*, new species

FIGURES 44, 60, 98

RECOGNITION.—Elytra somber, brunneous; antennal scape and pedicel reddish orange, concolorous with flagellar antennomeres; legs concolorous except knees black. Punctulae of elytral interneurs small and fine, their diameter much less than width of interval.

Size: ABL=15.81 mm; SBL=14.73 mm; TW=3.97 mm; LH=2.97 mm; LP=3.25 mm; LE=8.52 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 98).—Dry forests of western Costa Rica.

SPECIMENS EXAMINED.—*Holotype*: ♀, COSTA RICA, *Puntarenas*: Estacion Biologica Carara, E Quebrada Bonita, 50 m, 09°46'25"N, 084°36'24"W, Jun (Zuniga) (INBIO), CRI000-223997*.

ETYMOLOGY.—The specific epithet, *paratax*, is brief for "parataxonomist," D.H. Janzen's term for a participating villager in the national taxonomist infrastructure in Costa Rica.

010. *Agra samiria*, new species

FIGURES 45, 61, 98

RECOGNITION.—Elytra black, with brassy reflections in natural light, forebody somber, brunneous; antennal scape and pedicel markedly infuscated, contrasting with flagellar anten-

nomeres; legs pale, reddish orange, contrasting markedly with body color, with black knees. Head as in Figure 45; elytral apex as in Figure 61.

Size: ABL=15.56 mm; SBL=14.47 mm; TW=4.08 mm; LH=2.93 mm; LP=3.62 mm; LE=7.91 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 98).—Known only from a blackwater-inundation forest of north-central Peru.

SPECIMENS EXAMINED.—*Holotype*: ♂, PERU, *Loreto*: Cocha Shinguito, 05°08'S, 074°45'W, Jun (Erwin and Servat) (MUSM), ADP 67566*.

NOTES.—The single known specimen was collected on Trocha Shinguito from a very large, liana-laden tree labelled "FOG 2 TLE," using insecticidal fogging techniques.

ETYMOLOGY.—The specific epithet, *samiria*, refers to the Rio Samiria, which is near the oxbow lake where the type was collected.

011. *Agra duckworthorum*, new species

FIGURES 46, 62, 76, 100

RECOGNITION.—Elytral color somber, brunneous; legs pale, reddish orange or testaceous, contrasting markedly with body color, with black knees. Punctulae of elytral interneurs uniseriate, organized, large and coarse, their diameter greater than width of interval.

Size: ABL=17.79–19.80 mm; SBL=16.68–19.58 mm; TW=5.03–5.66 mm; LH=3.41–4.12 mm; LP=3.77–4.68 mm; LE=9.50–10.78 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 100).—Known only from the Canal Zone of Panama.

SPECIMENS EXAMINED.—*Holotype*: ♂, PANAMA, *Canal Zone*: Barro Colorado Id., 09°10' N, 079°50'W, Apr (W.D. and S.S. Duckworth) (USNM), ADP 09979*.

Paratype: PANAMA, *Canal Zone*: same data as holotype except 1 ♀, May, ADP 09909*.

ETYMOLOGY.—The specific epithet, *duckworthorum*, a patronymic in the plural, honors the collectors of the holotype, W. Donald and Sandra Duckworth.

012. *Agra eponine*, new species

FIGURES 47, 63, 77, 100

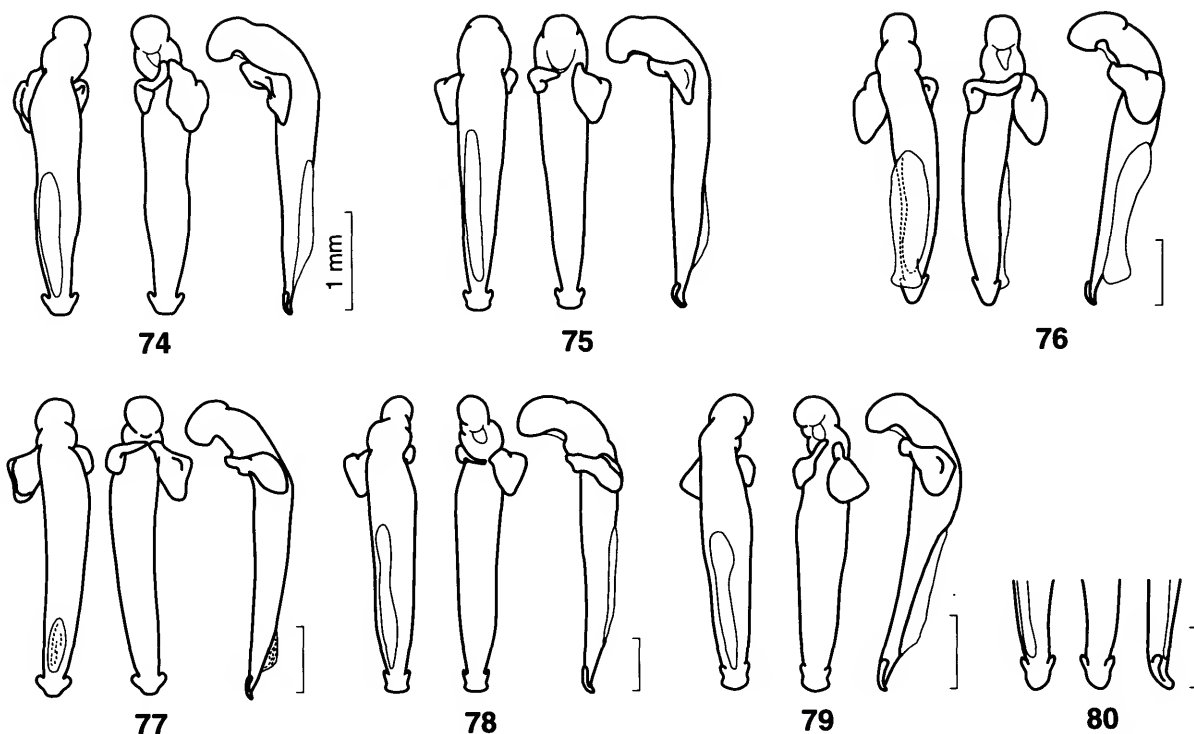
RECOGNITION.—Elytral color rufescent, markedly contrasting with black forebody and head; antennal scape and pedicel and antennomere 1 black, flagellar antennomeres infuscated apically; legs black.

Size: ABL=17.94–18.50 mm; SBL=16.32–16.96 mm; TW=3.70–4.30 mm; LH=3.26–3.43 mm; LP=3.52–3.76 mm; LE=9.43–9.77 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 100).—Dry forests of western Costa Rica.

SPECIMENS EXAMINED.—*Holotype*: ♂, COSTA RICA, *Puntarenas*: Quepos, 80 m, Parque Nacional Manuel Antonio, 09°24'N, 084°09'W, Apr (Zuniga) (INBIO), CRI000-601649.

Paratypes: COSTA RICA, *Guanacaste*: 3 km NW Nacome, 100 m, 10°10'05"N, 085°22'25"W, 1 ♂, May (Janzen and Hall-



FIGURES 74–80.—Aedeagus (dorsal, ventral, and left lateral aspects) of *Agra* species, *dimidiata* group: 74, *zapotal*; 75, *hespenheide*; 76, *duckworthorum*; 77, *eponine*; 78, *inbio*; 79, *sternitica*; 80, *biexcavata* (specimen damaged).

wachs) (INBIO), CRI000-033569*. 5 km NW Cañas, 10°25'N, 085°07'W, 1 ♂, Jun (J. Cope) (JCC), ADP 93512. Parque Nacional Santa Rosa, 300 m, 10°50'N, 085°37'W, 1 ♂, May (Lezama and Arias) (UCOR), ADP 56359. *Puntarenas*: same data as holotype except 1 ♀, Feb (Varela), CRI001-304466.

ETYMOLOGY.—The specific epithet, *eponine*, is the name of the unfortunate street urchin in Victor Hugo's *Les Misérables*, who, in the Broadway version of the story, personified tragic beauty. Such is the state of the tropical forests where these beetles live.

013. *Agra inbio*, new species

FIGURES 48, 64, 78, 100

RECOGNITION.—Elytral color rufescent, markedly contrasting with black forebody and head; antennomeres pale; legs pale, with black knees.

Size: ABL=16.59–16.80 mm; SBL=15.45–15.79 mm; TW=3.95–4.33 mm; LH=3.13–3.19 mm; LP=3.56–3.66 mm; LE=8.75–8.94 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 100).—Dry forests of western Costa Rica.

SPECIMENS EXAMINED.—*Holotype*: ♂, COSTA RICA, *Puntarenas*: Mata de Limón, 09°55'54"N, 084°42'42"W, Apr (Kazan) (UCOR), ADP 07610*.

Paratypes: COSTA RICA, *Guanacaste*: Parque Nacional Barro Honda, 100 m, 10°09'07"N, 085°21'25"W, 1 ♂, Jul (Reyes) (INBIO), CRI002-002880. *Without Exact Locality*: San Miguel, vic. Preussen S.G., 1 ♂ (SNGF), ADP 58880.

NOTES.—The locality San Miguel could not be located precisely in Costa Rica because there are too many possibilities.

ETYMOLOGY.—The specific epithet, *inbio*, refers to the organization in Costa Rica that is involved in the national biotic inventory of the country.

014. *Agra pichincha*, new species

FIGURES 49, 65, 97

RECOGNITION.—Elytra, head, and pronotum somber, black; legs somber, black or infuscated, not contrasting much with body color. Elytral intervals flat, punctulae of interneurs very small, cribriform, in fine uniserial rows.

Size: ABL=18.26 mm; SBL=13.50 mm; TW=4.04 mm; LH=3.41 mm; LP=3.75 mm; LE=6.34 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 97).—Western lowlands of Ecuador.

SPECIMENS EXAMINED.—*Holotype*: ♀, ECUADOR, *Pichincha*: Santo Domingo, Tinalandia, 700 m, 00°18'S, 079°04'W, Apr (Venedictoff) (PUCE), ADP 81101*.

ETYMOLOGY.—The specific epithet, *pichincha*, refers to the province in Ecuador where the holotype was collected.

015. *Agra sternitica* Straneo

FIGURES 50, 66, 79, 100

Agra sternitica Straneo, 1982:401. [Holotype ♀, ECUADOR, *Pichincha*: Chimbo, 02°14'S, 079°07'W, Sep (de Mathan) (MNHP), ADP 59388*.]

RECOGNITION.—Elytral color somber, brunneous; legs pale, reddish orange or testaceous, contrasting markedly with body color, with black knees. Elytral interneurs of disorganized rows of large punctulae that reflect greenish.

Size: ABL=16.71–20.15 mm; SBL=16.54–18.57 mm; TW=4.61–4.64 mm; LH=3.49–3.51 mm; LP=3.72–4.10 mm; LE=9.31–10.99 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 100).—Western lowlands of Ecuador.

SPECIMENS EXAMINED.—*Holotype*: See synonymy.

Nontype: ECUADOR, *Pichincha*: 16 km SE Santo Domingo, Tinalandia, 500 m, 00°18'S, 079°04'W, 1 ♂, Jun (Peck) (CNC), ADP 58691*.

016. *Agra biexcavata* Straneo

FIGURES 51, 67, 80, 98

Agra biexcavata Straneo, 1958:372. [Holotype ♀, PERU, *Loreto*: Pebas, 07°42'S, 041°55'W, Oct (de Mathan) (MNHP), ADP 05527*.]

RECOGNITION.—Elytron bright metallic green; head and pronotum shiny black; legs testaceous, with black knees.

Size: ABL=14.44–17.01 mm; SBL=14.37–14.38 mm; TW=3.22–3.83 mm; LH=2.80–3.24 mm; LP=3.05–3.26 mm; LE=8.07–8.32 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 98).—Northwestern Amazon Basin, Rio Napo and upper Rio Amazonas drainage system.

SPECIMENS EXAMINED.—*Holotype*: See synonymy.

Nontype: ECUADOR, *Without Further Locality*: 1 ♂ (USNM), ADP 58545*.

NOTES.—The aedeagus of the holotype was damaged during dissection by a previous worker.

03. *quararibea* Group

DIAGNOSTIC COMBINATION.—Elytron with sutural and posterolateral teeth acute, elongate, not quite spinose (Figures 86–90); interneurs of contiguous cribriform punctulae, offset in places along length of elytron, not quite biserial (Figure 27).

Male: Venter from metathorax through abdominal sternum VI sparsely setiferous; middle femur and tibia densely setiferous apically along medial margin; tarsomeres with modified setae divided into two patches; abdominal sterna III and IV not interrupted postmedially by extensive hyaline area; and apex of phallus broadly truncate and rolled apically, dorsally concave, shaft with dense patch of short setae dorsally.

Female: Sternum VI deeply incised (Figure 32); stylus (Figure 11) bispinose, straight, moderately elongated, tubular, and sparsely setiferous.

TAXONOMIC HISTORY.—This group was established (Erwin, 1993) for a single species, *A. quararibea* Erwin, and was placed in section *Rufoaenea* because of the female antennae and styli, in addition to features of pronotal and head structure. I now recognize five species due to the arrival of additional specimens and four other species that better helped to define the group.

INCLUDED SPECIES.—

- 001. *othello*, new species (Ecuador);
- 002. *smurf*, new species (Brazil);
- 003. *magnifica*, new species (Peru);
- 004. *quararibea* Erwin, 1993:25 (Peru);
- 005. *suprema*, new species (Brazil).

Key to Species of the *quararibea* Group

1. Elytron bicolored, piceous alternating with orange rufous 005. *A. suprema*, new species
- 1'. Elytron somber, of a single dark color 2
- 2(1). Elytron dark metallic blue 3
- 2'. Elytron piceous 4
- 3(2). Elytral interneurs of bi- or (in part) triserial rows of contiguous cribriform punctulae 004. *A. quararibea* Erwin
- 3'. Elytral interneurs of uniserial or slightly offset cribriform punctulae 003. *A. magnifica*, new species
- 4(2'). Elytron with sutural and lateral apices prolonged, spinose; lateral tooth also prolonged, spinose; body, head, and appendages rufopiceous 002. *A. smurf*, new species
- 4'. Elytron with sutural apex dentate, not prolonged; lateral tooth small; body, head, and appendages black 001. *A. othello*, new species

001. *Agra othello*, new species

FIGURES 81, 86, 95, 101

RECOGNITION.—Elytron black, forebody and appendages also black; sutural apex dentate, not prolonged, lateral tooth small.

Size: ABL=28.37–29.79 mm; SBL=26.33–27.28 mm; TW=7.38–8.02 mm; LH=5.42–5.57 mm; LP=5.28–6.09 mm; LE=15.51–15.96 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 101).—Southern Andean flank of the Amazon Basin.

SPECIMENS EXAMINED.—*Holotype*: ♀, ECUADOR, *Napo*: 20 km E Puerto Napo, Alinahui, 450 m, 01°04'S, 077°25'W, Nov–Dec (Ross) (CAS), ADP 05302.

Paratypes: ECUADOR, *Napo*: same data as holotype, 3 ♀, ADP 05301, 05315, 05314*. “SC” Station Yasuni, 400 m, 00°32'S, 076°24'W, 3 ♂, Nov (Itapia) (PUCE), ADP 56352, 56353*, 56354. Jatun Sacha Reserve, 450 m, 01°03'S, 077°37'W, 1 ♂, 1 ♀, Sep (Hovore) (USNM), ADP 56356, 56357. Onkone Gare Camp, 219 m, 00°39'S, 076°26'W, 1 ♂, Oct (Ball and Shepley) (UASM), ADP 56358.

ETYMOLOGY.—The specific epithet, *othello*, honors the complicated Shakespearian character whose stage image is a large male singer with a dark complexion. *Agra othello* is very large, black, and belongs to a formerly complicated species group (see note under “Taxonomic History,” above).

002. *Agra smurf*, new species

FIGURES 82, 87, 92, 101

RECOGNITION.—Elytron piceous, concolorous with forebody and appendages; sutural and lateral apices prolonged, spinose; lateral tooth also prolonged.

Size: ABL=26.55 mm; SBL=24.84 mm; TW=6.81 mm; LH=5.36 mm; LP=5.53 mm; LE=13.95 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 101).—Eastern Amazon Basin in the Rio Tapajos drainage system.

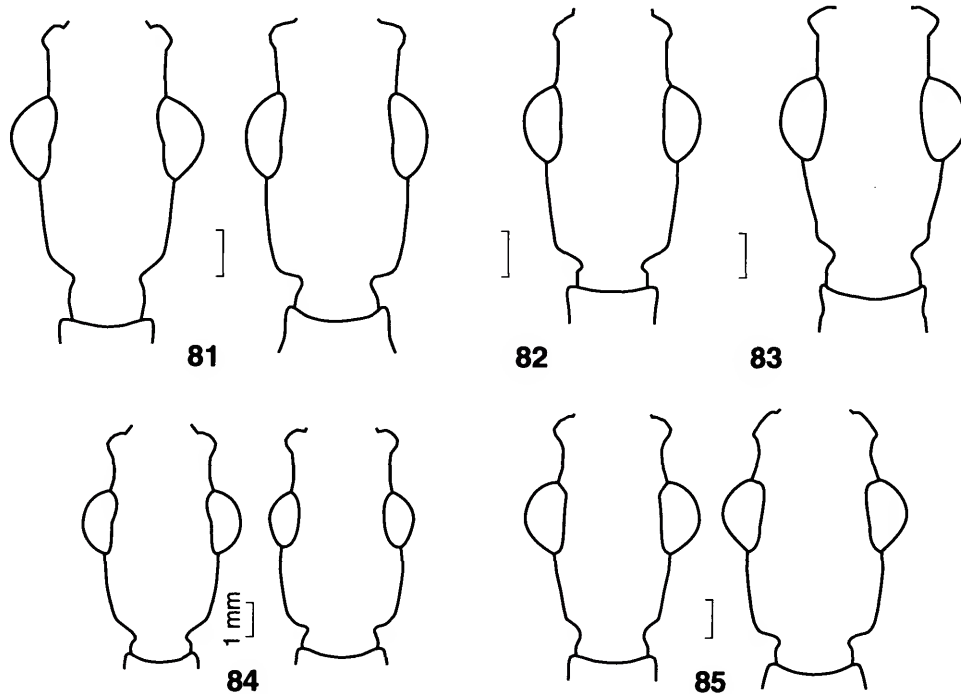
SPECIMENS EXAMINED.—*Holotype*: ♂, BRAZIL, *Amazonas*: Taperinha, Santarem, 02°32'S, 054°17'W (Fassi) (MNHP), ADP 58546*.

ETYMOLOGY.—The specific epithet, *smurf*, is just for fun in that the weird head shape of this species reminded me of the Saturday-morning television cartoon characters of that name.

003. *Agra magnifica*, new species

FIGURES 83, 88, 93, 101

RECOGNITION.—Elytron dark metallic blue, contrasting with piceous forebody and appendages. Elytral interneurs of uniserial or slightly offset cribriform punctulae.



FIGURES 81–85.—Head (dorsal aspects of postcranium) of *Agra* species, *quararibea* group: 81, *othello* ♂, ♀, respectively; 82, *smurf* ♂; 83, *magnifica* ♂; 84, *quararibea* ♂, ♀, respectively; 85, *suprema* ♂, ♀, respectively.

Size: ABL=25.69–28.44 mm; SBL=24.21–26.49 mm; TW=6.04–8.05 mm; LH=5.40–5.65 mm; LP=5.33–5.51 mm; LE=13.23–15.59 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 101).—Southern Andean flank of the Amazon Basin.

SPECIMENS EXAMINED.—Holotype: ♂, PERU, *Madre de Dios*: “Avispas” (Avispal), 400 m, 12°59'S, 071°34'W (Peña) (MCZ), ADP 90968*.

ETYMOLOGY.—The specific epithet, *magnifica*, captures, in a word, the facies of members of this species, with their midnight blue metallic elytra, large size, robust legs, and large head.

004. *Agra quararibea* Erwin

FIGURES 11, 27, 84, 89, 94, 101

Agra quararibea Erwin, 1993:25. [Holotype ♂, PERU, *Madre de Dios*: Pakitza, Zone 2, 356 m, 12°07'S, 070°58'W (Erwin and Farrell) (MUSM), BIOLAT 8462*.]

RECOGNITION.—Elytron dark metallic blue, contrasting with piceous forebody and appendages. Elytral interneurs of bi- or (in part) triserial rows of contiguous cribriform punctulae.

Size: ABL=29.62 mm; SBL=27.27 mm; TW=7.17 mm; LH=5.71 mm; LP=6.00 mm; LE=15.56 mm.

GEOGRAPHICAL DISTRIBUTION (Figure 101).—Southern Andean flank of the Amazon Basin.

SPECIMENS EXAMINED.—*Holotype:* See synonymy.

Paratype: PERU, *Madre de Dios*: Rio Tambopata Reserve, 12°50'S, 069°20'W, 1 ♀ (Erwin et al.) (USNM), FOG 0029016*.

ETYMOLOGY.—The specific epithet, *quararibea*, is the name of the genus of tree (family Bombacaceae) from which the holotype was collected.

005. *Agra suprema*, new species

FRONTISPIECE, FIGURES 14, 32, 85, 90, 91, 101

RECOGNITION.—Elytron bicolored, piceous alternating with orange rufous. Elytral intemeurs in pairs, infuscated, each pair separated by wide, moderately convex interval.

Size: ABL=23.94–26.61 mm; SBL=22.79–24.06 mm; TW=5.95–6.63 mm; LH=4.78–5.03 mm; LP=4.65–5.11 mm; LE=13.06–14.29 mm.

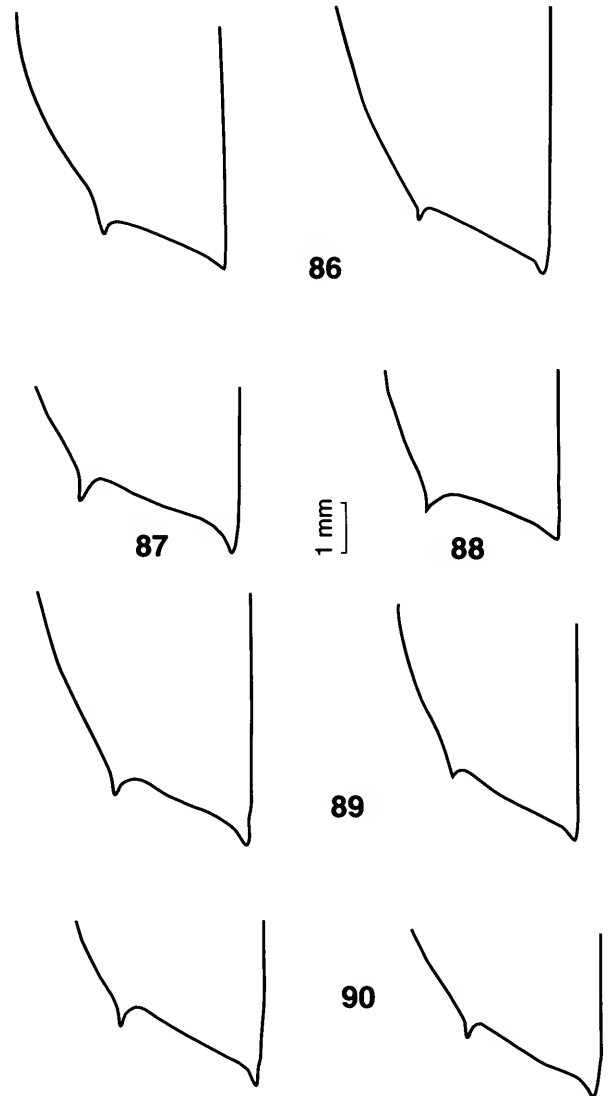
GEOGRAPHICAL DISTRIBUTION (Figure 101).—Mato Grosso plateau of Brazil.

SPECIMENS EXAMINED.—*Holotype:* ♀, BRAZIL, *Mato Grosso*: Rosario Oeste, 14°50'S, 056°25'W, Dec (SEABRA), ADP 09442*.

Paratypes: BRAZIL, *Mato Grosso*: Rio Verde, 400 m, 18°56'S, 054°52'W, 1 ♂ (UFPC), ADP 04364*. Alto Xingu, 1 ♀ (Leonardo Agosto and R. Arlé) (MGB), ADP 56061.

NOTES.—The unusual pairing of elytral interneurs and the underlying dark pigmentation also is found in the *virgata* group (Erwin, 1986).

ETYMOLOGY.—The specific epithet, *suprema*, is hardly adequate to describe this species (Frontispiece).

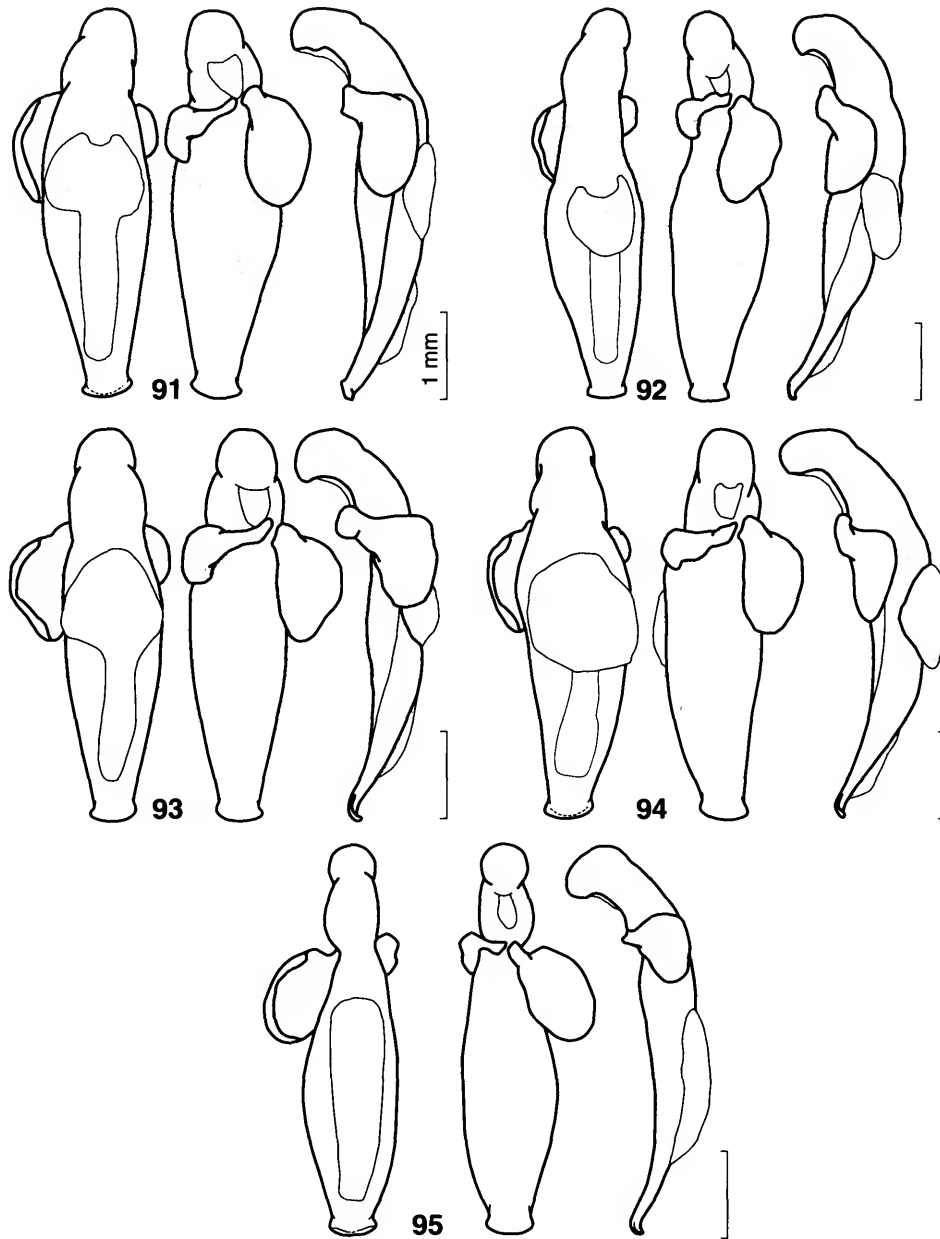


FIGURES 86–90.—Elytron (left side, dorsal aspect of apex) of *Agra* species, *quararibea* group: 86, *othello* ♂, ♀, respectively; 87, *smurf* ♂; 88, *magnifica* ♂; 89, *quararibea* ♂, ♀, respectively; 90, *suprema* ♂, ♀, respectively.

Descriptive Biogeography

The following biogeographic account is necessarily descriptive. An analytical account must await phylogenetic studies of additional lineages of *Agra*, which will provide relational patterns from which vicariant events might be deduced and centers of radiation discovered.

Figure 102 resulted from finding, for each subgroup, the peripheral localities at which individuals were collected and connecting these with a line. Three general patterns emerge: (1) a Central America-centered pattern, including Mexico and northwestern South America, for the *dimidiata* group;



FIGURES 91–95.—Aedeagus (dorsal, ventral, and left lateral aspects) of *Agra* species, *quararibea* group: 91, *suprema*; 92, *smurf*; 93, *magnifica*; 94, *quararibea*; 95, *othello*.

(2) a north Amazonian–Orinoco pattern for the *novaurora* group; and (3) a south Amazonian pattern for the *quararibea* group.

The distribution of members of the *dimidiata* group is thus complementary to that of its apparent southern sister group, *novaurora*. The distribution of *dimidiata* closely mirrors that of the northern section of the amphi-Amazonian *resplendens* subgroup of the *cayennensis* complex (Erwin, 1996).

The distribution of the *rufoaenaea* group (Erwin, 1993) substantially overlaps that of its apparent sister group, *quararibea*; however, there is a degree of complementarity similar to that of the *dimidiata* and *novaurora* groups. Data from Erwin and Pogue (1988) together with that presented herein indicate the middle America–south Amazonia sister pattern is a common one across the genus and bears scrutiny as more species are studied and mapped.

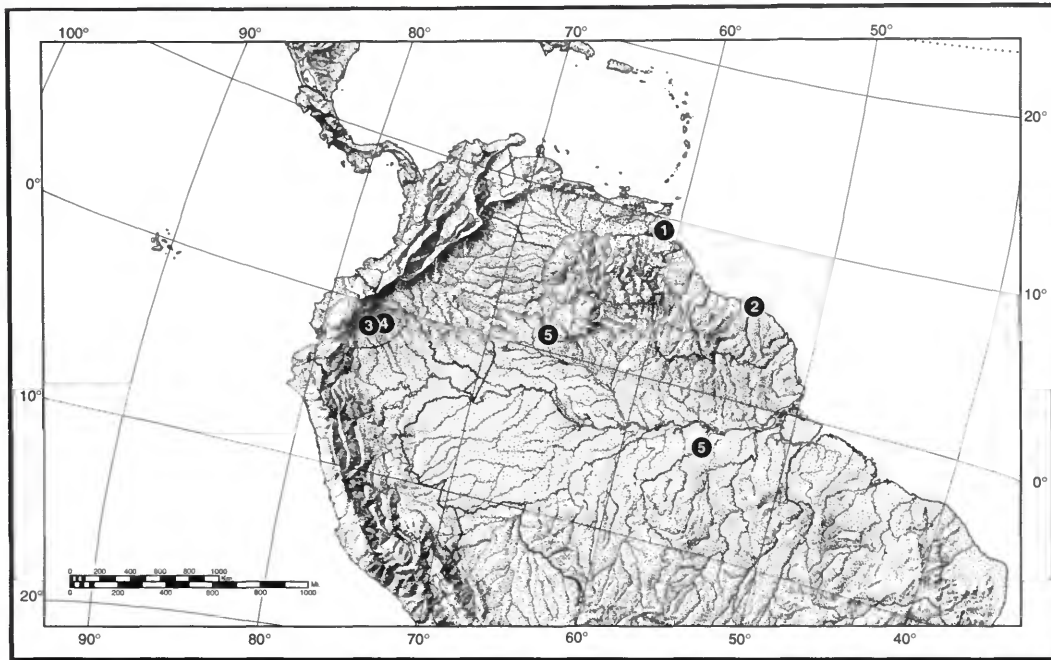


FIGURE 96.—Map showing geographical distribution of members of the *novaurora* group: 1, *orinocensis*; 2, *crebrepunctata*; 3, *novaurora*; 4, *alinhui*; 5, *superba*.

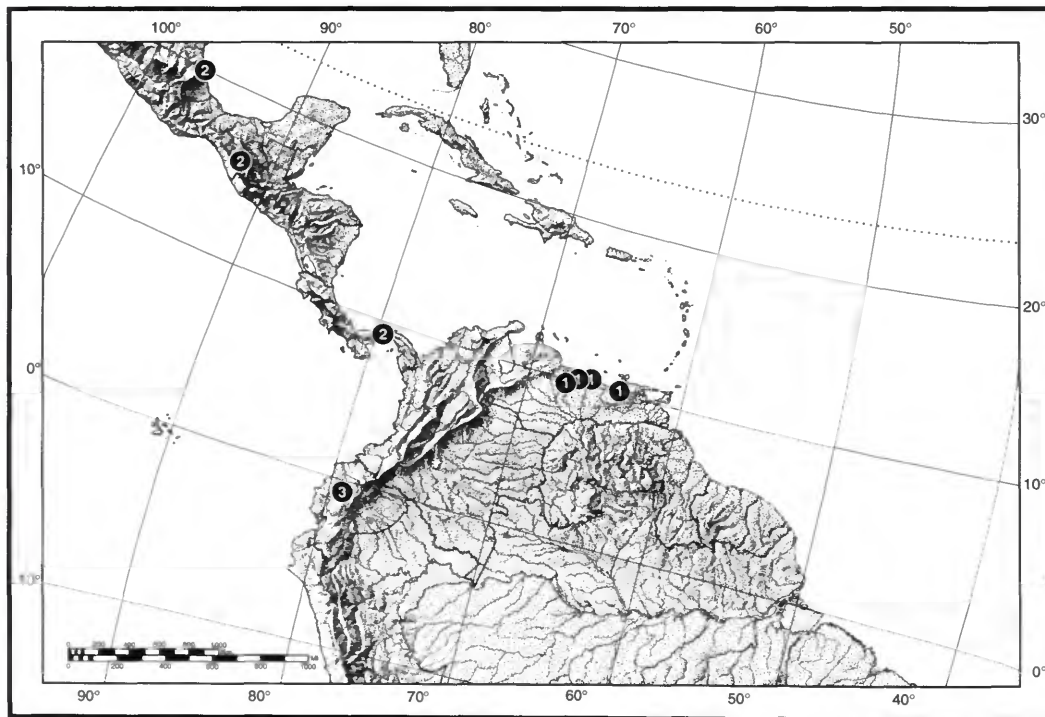


FIGURE 97.—Map showing geographical distribution of members of the *dimidiata* group: 1, *maracay*; 2, *dimidiata*; 3, *pichincha*.

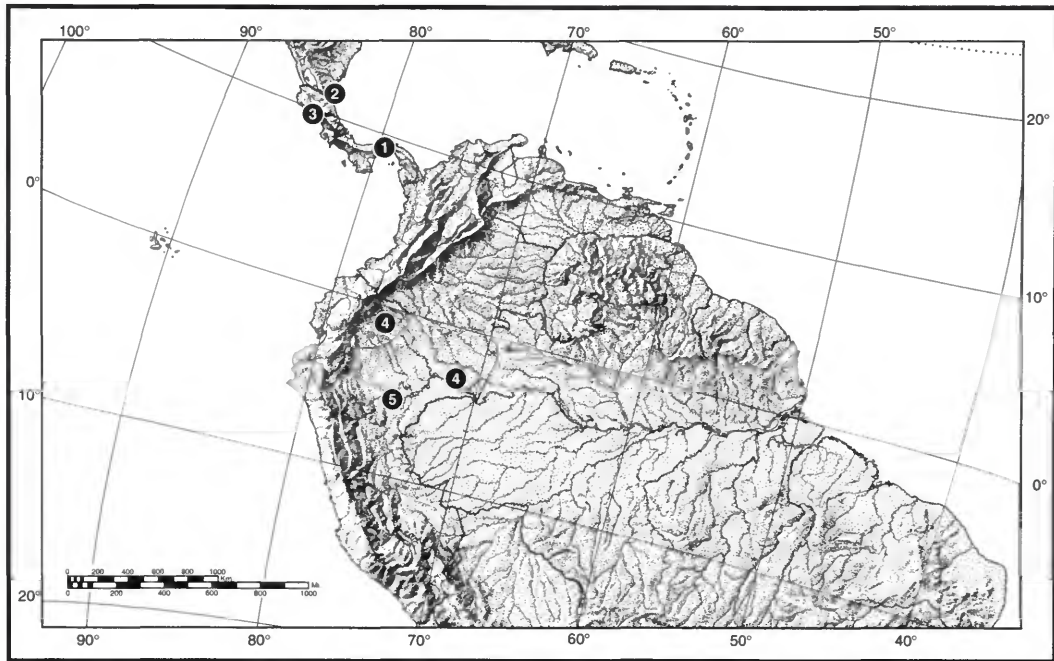


FIGURE 98.—Map showing geographical distribution of members of the *dimidiata* group: 1, *bci*; 2, *hespenheide*; 3, *paratax*; 4, *biexcavata*; 5, *samiria*.

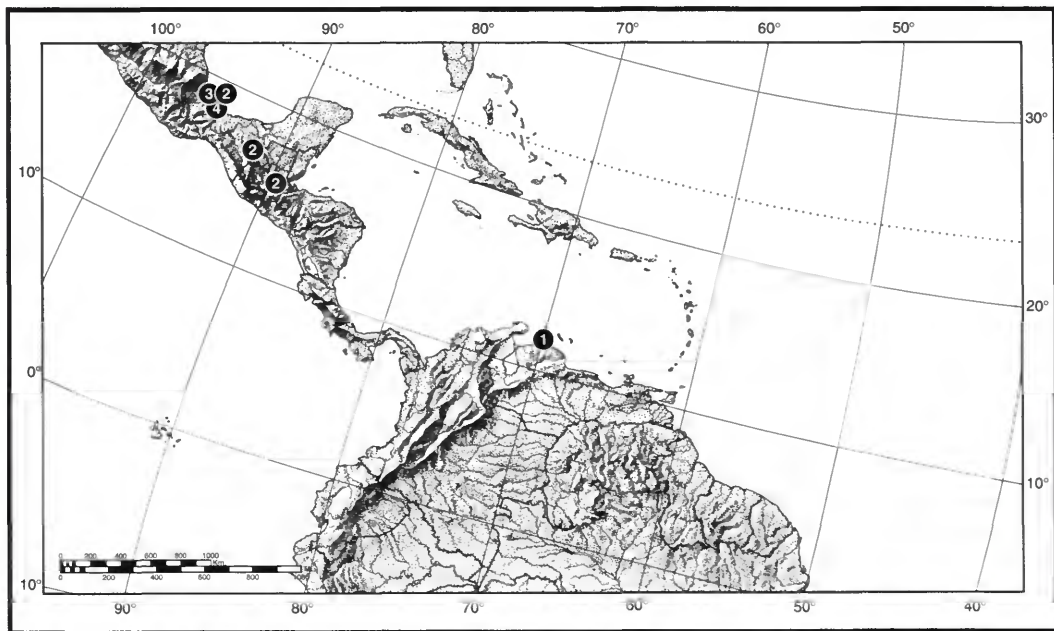


FIGURE 99.—Map showing geographical distribution of members of the *dimidiata* group: 1, *falcon*; 2, *zapotal*; 3, *tuxtlas*; 4, *hovorei*.

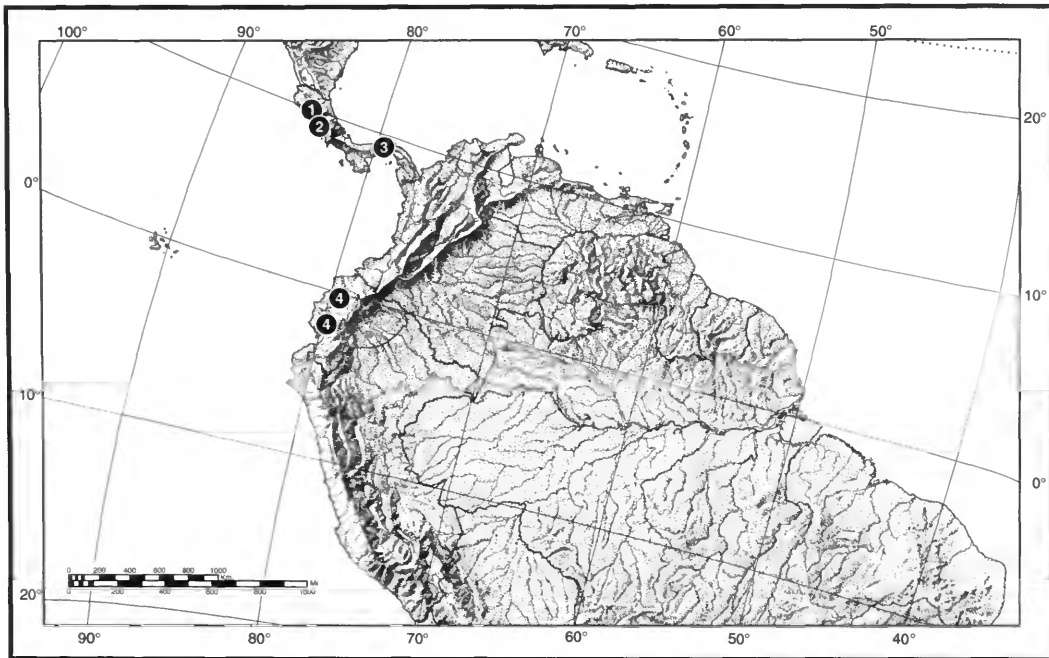


FIGURE 100.—Map showing geographical distribution of members of the *dimidiata* group: 1, *inbio*; 2, *eponine*; 3, *duckworthorum*; 4, *sternitica*.

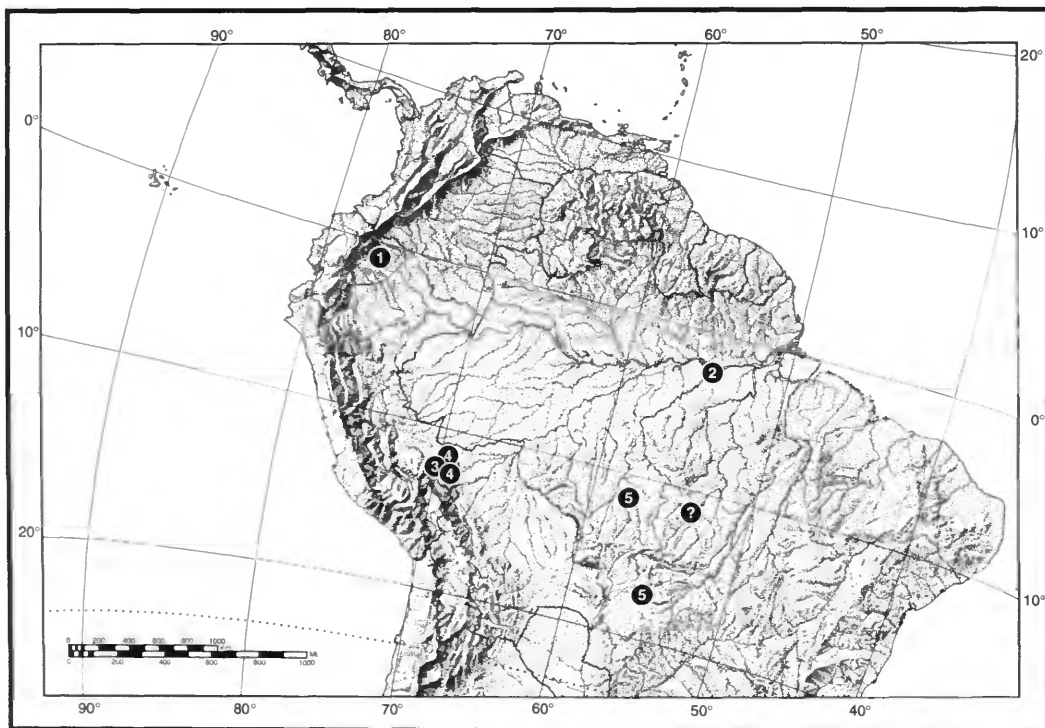


FIGURE 101.—Map showing geographical distribution of members of the *quararibea* group: 1, *othello*; 2, *smurf*; 3, *magnifica*; 4, *quararibea*; 5, *suprema*. (?=only country known.)

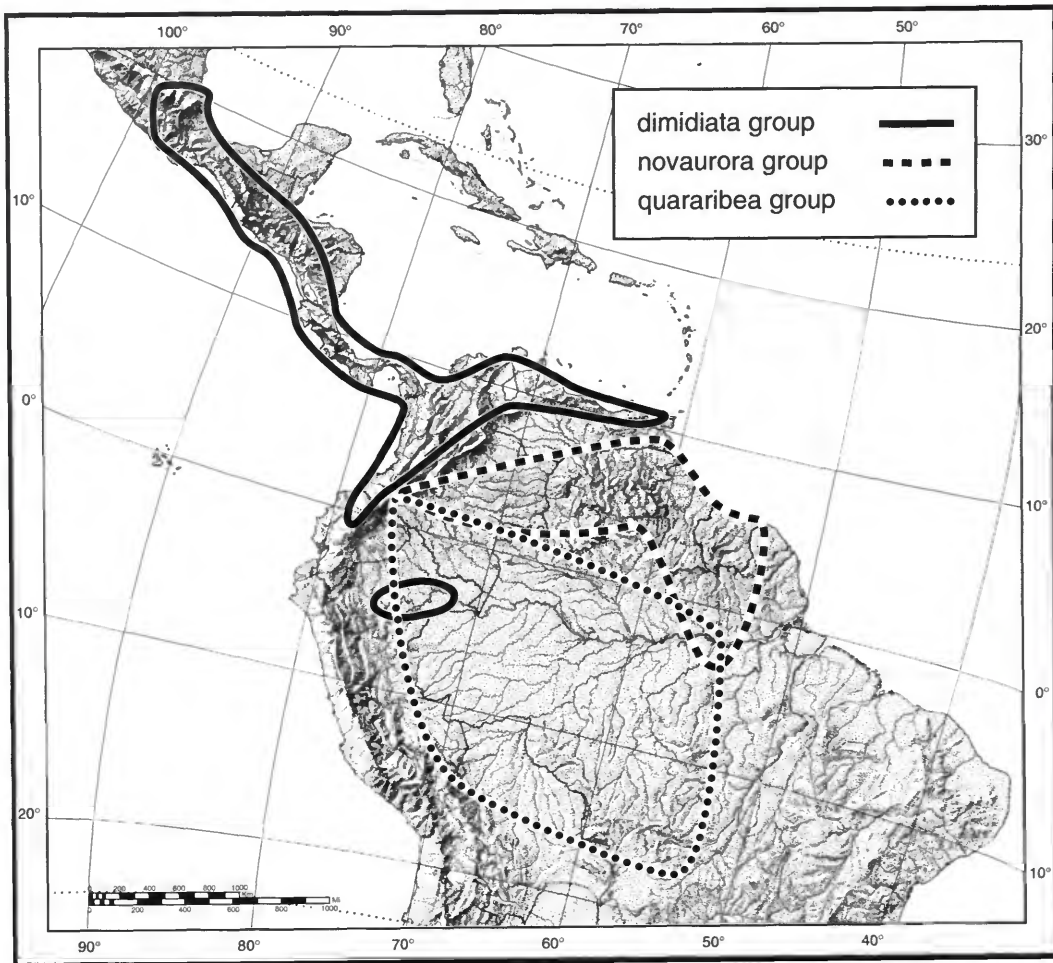


FIGURE 102.—Map showing distribution of groups in the *Novaroua* complex revised herein. Peripheral localities were used to circumscribe the total range of each group in order to detect both areas of overlap and centers of radiation.

Appendix

Characters and of *Agra* Species and Their States

(see Table 1)

The numbered sequences following the character name subjectively hypothesize character-state evolution and polarity (see Erwin, 1994). The notations used signify the following: “~”=hypothesized evolution of one state to another; “;”=separation between two or more hypothesized alternate directions of character-state change. Starred characters (*) are sexually dimorphic in some lineages; therefore, states that do not specifically indicate male and female attributes apply to the sex(s) studied (see species accounts). These characters and states have been discovered on *Agra* species studied to date (see Literature Cited); it is very likely that additional ones will be observed on the numerous groups not yet investigated.

1. Head: condition (1~2)
 1. optical transparency absent
 2. optical transparency present
2. Labral disc: shape (1~3~2)
 1. flat
 2. convex
 3. slightly convex
3. *Labrum: shape of anterior margin (1~2~3; 1~4; 1~5~6~7; 1~8~9; 8~10)
 1. entire
 2. emarginate
 3. V-notched
 4. dentate
 5. rounded
 6. produced
 7. lobed
 8. entire in ♂, emarginate in ♀
 9. emarginate in ♂, rounded in ♀
 10. entire in ♂, rounded in ♀
4. Labrum: setal position (1~2; 1~3)
 1. setae grouped 3~3
 2. setae grouped 1-2-2-1
 3. setae grouped 2-1-1-2
5. *Postcranium: shape (1~)
 1. with nonconstricted neck
 2. tapered to neck
 3. tapered-rounded
 4. slightly tapered
 5. markedly rounded
 6. abruptly angulate
 7. tapered-dimpled
 8. angulate-dimpled
 9. rounded-dimpled
 10. square
6. Postcranium: vestiture (3~2~1; 3~4)
 1. multisetiferous
 2. with fewer than 10 setae
 3. glabrous
 4. pubescent
7. Postcranium: surface (1~2)
 1. plain
 2. dimpled
8. Postcranium: texture (1~2~3)
 1. smooth
 2. shallowly pitted
 3. deeply pitted
9. *Mentum: tooth (1~2~4~3; 2~5)
 1. tooth entire, rounded
 2. tooth entire, acute
 3. tooth bifid
 4. tooth entire, truncate
 5. tooth entire, acute in ♂; entire, rounded in ♀
10. Mentum: lateral lobe shape (1~2)
 1. rounded
 2. acute
11. Mentum: ratio tooth size to lateral lobe size (3~2~1~4)
 1. tooth one-half lateral lobe
 2. tooth one-third lateral lobe
 3. tooth one-sixth lateral lobe
 4. tooth equals lateral lobe
12. Ligula: form (3~1~2)
 1. basally carinate
 2. completely carinate
 3. not carinate
13. Antenna: scape vestiture (4~3~1; 4~2)
 1. multisetiferous
 2. pubescent
 3. with fewer than 10 setae
 4. unisetiferous
14. Antenna: arrangement of setae on scape (2~1)
 1. dorsal and apical-ring setae only
11. variable
12. abruptly angulate in ♂, markedly rounded in ♀
13. square in ♂, markedly rounded in ♀
14. tapered-dimpled in ♂, tapered-rounded in ♀
15. tapered-rounded in ♂, tapered-dimpled in ♀
16. tapered to neck in ♂, tapered-rounded in ♀
17. tapered-rounded in ♂, markedly rounded in ♀
18. tapered to neck in ♂, square in ♀
19. tapered-rounded in ♂, abruptly angulate in ♀
20. tapered-angulate in ♂, square in ♀

2. scattered setae
15. Antennomeres 4 to 7: shape (3~1~2)
 1. long, narrow, length more than 3× width
 2. short, robust, length less than 1.5× width
 3. medium, moderately robust, length 2~2.5× width
16. *Antenna: color of antennal flagellar articles
 1. concolorous with scape
 2. bicolored
 3. concolorous with scape and bicolored in ♀
 4. pale or bicolored, contrasting with dark scape
17. *Labial palp: shape of ultimate article (1~3~4~2)
 1. parallel-sided
 2. triangular
 3. subtriangular
 4. triangular in ♂, subtriangular in ♀
18. Frons: transverse-line shape (1~2~3)
 1. absent
 2. slightly depressed
 3. markedly depressed
19. Prothorax: shape (3~2~1)
 1. elongate, narrow
 2. short, robust
 3. quadrate
20. Prothorax: shape of disc (3~2~1; 3~4)
 1. markedly convex
 2. slightly convex
 3. flat
 4. concave
21. Prothorax: disc sculpture (4~1~2~3; 4~5)
 1. sparsely punctate
 2. moderately punctate
 3. densely punctate
 4. not punctate
 5. transversely striated
 6. transversely striated and sparsely punctate
22. *Prothorax: lateral ridge form (3~1~4~2)
 1. costiform
 2. effaced anteriorly
 3. normally explanate
 4. costiform in ♂, effaced anteriorly in ♀
23. Prothorax: lateral ridge extent (2~1~3~4)
 1. basal only
 2. complete
 3. absent
 4. sulcate
24. Prothorax: subbasal ridge form (4~1~2~3)
 1. complete
 2. interrupted
 3. effaced
 4. absent
25. Prothorax: subbasal sulcus form (3~2~1)
 1. deep
 2. shallow
 3. absent
26. Prothorax: dorsal vestiture (4~3~1; 4~2)
 1. multisetiferous
 2. pubescent
 3. sparsely setiferous
 4. glabrous
27. Prosternum: vestiture (2~4~1; 2~3; 2~5)
 1. setiferous
 2. glabrous
 3. pubescent
 4. sparsely setiferous
 5. setae variable
28. *Prosternal process: shape (1~2)
 1. planular
 2. bifid
29. Prosternum: vestiture of process (2~1; 2~4; 2~3)
 1. setiferous
 2. glabrous
 3. pubescent
 4. setae variable
30. Prosternum: punctures (1~2~5~3; 1~4)
 1. smooth
 2. sparsely punctulate
 3. densely punctulate
 4. microrugose
 5. moderately punctulate
31. Prosternum: proplural vestiture (2~4~1; 2~3; 2~5~6)
 1. setiferous
 2. glabrous
 3. pubescent
 4. sparsely setiferous
 5. unisetiferous
 6. setae variable
32. Prosternum: proplural punctures (1~2~5~3; 1~4)
 1. smooth
 2. sparsely punctulate
 3. densely punctulate
 4. microrugose
 5. moderately punctulate
 6. transversely striated
 7. transversely striated and sparsely punctulate
33. *Metasternum: vestiture (3~1~4~6~2; 1~7~5)
 1. sparsely setiferous in both sexes
 2. pubescent in both sexes
 3. glabrous in both sexes
 4. moderately setiferous in both sexes
 5. pubescent in ♂, sparsely setiferous in ♀
 6. pubescent in ♂, moderately setiferous in ♀
 7. moderately setiferous in ♂, sparsely setiferous in ♀
34. Elytron: color
 1. brunneous
 2. black
 3. nigropiceous
 4. piceous-black
 5. piceous

6. rufopiceous
7. rufous
8. rufonistic
9. light green
10. piceous dark olive green
11. metallic green
12. dark metallic green
13. brassy green
14. brassy copper (aeneous)
15. brassy violaceous
16. testaceous with metallic spots
17. testaceous
18. vivid metallic green
19. brilliant metallic green
20. metallic blue
21. metallic blue green
22. blue brassy green
23. brown brassy
24. dark olive green
25. brown
26. testaceous with brown vittae
27. testaceous with dark vittae
28. testaceous with piceous vittae
29. testaceous with black margin
30. piceous with testaceous spots
31. rufous, margin green
35. Elytron: punctulae (6~4~3~2~5~1)
 1. large, coarse
 2. medium, fine
 3. small, fine
 4. very small
 5. medium, coarse
 6. absent
36. Elytron: punctulae spacing (6~1~5~2~3~4)
 1. widely spaced
 2. contiguous
 3. closely spaced
 4. alternate
 5. unevenly spaced
 6. absent
37. Elytron: punctulae form (5~1~3~2; 1~4)
 1. rounded
 2. cribriform
 3. transverse
 4. longitudinal
38. *Elytron: laterobasal sinus depth (2~3~1)
 1. deep
 2. shallow
 3. deep in ♂, shallow in ♀
39. *Elytron: interval form (1~4~2~3; 4~5)
 1. flat
 2. moderately convex
 3. highly convex
 4. slightly convex
5. slightly convex in ♂, moderately convex in ♀
40. *Elytral sutural apex: shape (5~2~3~7; 2~6~1~4; 6~9; 6~8)
 1. obtuse
 2. acute
 3. acuminate
 4. obtuse, dentate
 5. slightly acute
 6. rounded
 7. spinose
 8. spinose in ♂, acute in ♀
 9. acute in ♂, spinose in ♀
41. Elytral interneur: form (1~2~3; 1~4)
 1. uniserial
 2. biserial
 3. triserial
 4. foveolate
 5. irregular
42. *Elytral interval: form (1~2; 1~3; 1~4; 1~5)
 1. normal
 2. foveate
 3. linearly depressed
 4. normal in ♂, foveate in ♀
 5. with foveolate setigerous pores
 6. with interval 2, 3, 5, and 7 narrow
43. Elytron: interneur form (1~2)
 1. normal
 2. foveate
44. *Elytron: color of any fovea on elytron
 1. same color as elytron
 2. metallic against plain elytron
 3. absent
 4. absent in ♂, metallic against plain elytron in ♀
45. *Elytral apex between sutural and lateral apices: shape (2~6; 2~1~3~4~5)
 1. straight
 2. slightly sinuate
 3. markedly sinuate
 4. round-lobed
 5. dentate
 6. straight in ♂, slightly sinuate in ♀
 7. slightly lobed
46. *Abdominal sternum II: vestiture (3~1~7; 1~2; 1~6~5~4)
 1. sparsely setiferous medially in both sexes
 2. pubescent medially in both sexes
 3. glabrous in both sexes
 4. bilaterally densely setiferous in both sexes
 5. bilaterally sparsely setiferous in both sexes
 6. densely setiferous in ♂, sparsely setiferous in ♀
 7. pilose in ♂, sparsely setiferous in ♀
 8. dense in ♂; very short, sparse in ♀
47. *Abdominal sternum III: vestiture (1~3~5~2~4; 3~7~8; 3~9; 1~11~10~6)
 1. bilaterally unisetiferous in both sexes

2. pubescent medially in both sexes
3. sparsely setiferous medially in both sexes
4. pilose medially in both sexes
5. densely setiferous medially in both sexes
6. pilose bilaterally in ♂, sparsely setiferous bilaterally in ♀
7. pubescent medially in ♂, sparsely setiferous in ♀
8. pilose medially in ♂, sparsely setiferous in ♀
9. densely setiferous medially in ♂, bilaterally sparsely setiferous in ♀
10. densely setiferous bilaterally in ♂, sparsely setiferous bilaterally in ♀
11. sparsely setiferous bilaterally in both sexes
12. densely setiferous in ♂, moderately setiferous across sternite in ♀
48. *Abdominal sternum IV: vestiture (5~2~4~1~3; 5~11~10~6; 2~9~7~8)
 1. pubescent medially in both sexes
 2. sparsely setiferous medially in both sexes
 3. pilose medially in both sexes
 4. densely setiferous in both sexes
 5. unisetose bilaterally in both sexes
 6. pilose bilaterally in ♂, sparsely setiferous bilaterally in ♀
 7. pubescent medially in ♂, sparsely setiferous bilaterally in ♀
 8. pilose medially in ♂, sparsely setiferous bilaterally in ♀
 9. densely setiferous medially in ♂, bilaterally setiferous in ♀
 10. densely setiferous bilaterally in ♂, sparsely setiferous bilaterally in ♀
 11. sparsely setiferous bilaterally in both sexes
 12. pilose in ♂, moderately setiferous medially in ♀
 13. pubescent medially in ♂, sparsely setiferous in ♀
 14. densely setiferous in ♂, moderately setiferous in ♀
49. Abdominal sternum V: texture (2~1)
 1. strigous
 2. smooth
50. *Abdominal sternum V: vestiture (1~2~3~4~6~5; 2~7~8; 2~9~15~14; 1~11~12~13~10; 11~16)
 1. unisetiferous bilaterally in both sexes
 2. sparsely setiferous medially in both sexes
 3. moderately setiferous medially in both sexes
 4. densely setiferous medially in both sexes
 5. pilose medially in both sexes
 6. pubescent medially in both sexes
 7. sparsely setiferous in ♂, moderately setiferous in ♀
 8. densely setiferous medially in ♂, pilose medially in ♀
 9. densely setiferous medially in ♂, sparsely setiferous medially in ♀
 10. pilose bilaterally in both sexes
 11. sparsely setiferous bilaterally in both sexes
12. pilose bilaterally in ♂, sparsely setiferous bilaterally in ♀
13. densely setiferous bilaterally in both sexes
14. pilose medially in ♂, sparsely setiferous bilaterally in ♀
15. pilose medially in ♂, setiferous medially in ♀
16. densely setiferous medially in ♂, sparsely setiferous bilaterally in ♀
17. densely setiferous in ♂, moderately setiferous in ♀
51. *Abdominal sternum VI: vestiture (5~2~4~1~3; 2~6; 5~8; 5~9; 4~7; 5~10)
 1. pubescent medially in both sexes
 2. sparsely setiferous medially in both sexes
 3. pilose medially in both sexes
 4. densely setiferous medially in both sexes
 5. quadrisetose along apical margin in both sexes
 6. pubescent medially in ♂, sparsely setiferous in ♀
 7. densely setiferous medially in ♂, pilose medially in ♀
 8. densely setiferous medially in ♂, sparsely setiferous bilaterally in ♀
 9. sparsely setiferous bilaterally in both sexes
 10. quadrisetose bilaterally along apical margin in both sexes, also with numerous scattered short setae apically
 11. densely setiferous in ♂, moderately setiferous in ♀
 12. moderately setiferous in both sexes
52. *Abdominal sternum VI apical patch: vestiture-patch size (3~1~2; 3~4~7; 3~6; 1~5)
 1. small in ♂, restricted to area of notch; absent in ♀
 2. large in ♂, extended over one-third of sternum
 3. absent in both sexes
 4. large in ♂, fringed apically in ♀
 5. small in ♂, large in ♀
 6. small in ♂, quadrisetose in ♀
 7. large in ♂, small in ♀
53. Abdominal sternum VI: surface texture (2~1)
 1. diagonally strigose
 2. smooth
54. *Abdominal sternum VI with caudal margin: shape (14~4~12~13~2~10; 4~3~5; 4~6~7~9~1~16~8; 6~11; 4~15)
 1. V-cleft
 2. U-cleft
 3. circular
 4. emarginate
 5. lyre-cleft
 6. medially toothed
 7. V-cleft in ♂, medially toothed in ♀
 8. V-cleft in ♂, lyre-cleft in ♀
 9. V-cleft in ♂, U-cleft in ♀
 10. U-cleft in ♂, lyre-cleft in ♀
 11. circular in ♂, medially toothed in ♀
 12. U-cleft in ♂, shallowly emarginate in ♀
 13. U-cleft in ♂, V-cleft in ♀

14. V-cleft in ♂, entire in ♀
15. V-cleft in ♀, emarginate in ♂
16. V-cleft in ♂, circular in ♀
17. V-cleft in ♂, emarginate in ♀
55. *Abdominal sternum VI apical-notch depth (5~2~3~1; 2~4)
 1. deep, as long or longer than wide
 2. shallow, wider than long
 3. deep in ♂, shallow in ♀
 4. shallow in ♂, deep in ♀
 5. emarginate
56. *Abdominal sternum VI apical notch: width (2~3~1)
 1. broad, greater than one-third width of apex
 2. narrow, less than one-third width of apex
 3. broad in ♂, narrow in ♀
57. *Abdominal sternum VI apical corners: shape (3~1~2~6; 1~4; 1~5)
 1. rounded
 2. acute
 3. obtuse
 4. rounded in ♂, acute in ♀
 5. acute in ♂, rounded in ♀
 6. acuminate
58. *Abdominal tergum VI caudal margin: shape (1~4~3~2; 4~5~7; 1~9~8; 1~10; 1~6~11)
 1. entire
 2. U-notched
 3. V-notched
 4. emarginate
 5. emarginate in ♂, V-notched in ♀
 6. V-notched in ♂, entire in ♀
 7. emarginate in ♂, U-notched in ♀
 8. entire in ♂, V-notched in ♀
 9. entire in ♂, emarginate in ♀
 10. emarginate in ♂, entire in ♀
 11. V-notched in ♂, emarginate in ♀
59. *Abdominal tergum VI notch: depth (1~2~3; 1~4~6; 1~5)
 1. absent
 2. shallow, wider than long
 3. deep, longer than wide
 4. shallow in ♂, absent in ♀
 5. absent in ♂, shallow in ♀
 6. deep in ♂, shallow in ♀
60. Legs: color
 1. concolorous with prothorax
 2. pale, contrasting with prothorax
 3. two-tone, femora dark, tibiae light
 4. with dark knees
 5. red, contrasting with forebody
 6. two-tone, femora light, tibiae dark
 7. variable
61. *Metacoxa: vestiture (3~1~4~2; 1~7~5~6; 3~8)
 1. sparsely setiferous in both sexes
 2. pubescent in both sexes
 3. unisetiferous in both sexes
 4. moderately setiferous in both sexes
 5. pubescent in ♂, sparsely setiferous in ♀
 6. pubescent in ♂, moderately setiferous in ♀
 7. densely setiferous in ♂, sparsely setiferous in ♀
 8. bisetiferous in both sexes
62. *Trochanter: vestiture (7~3~1~4~2; 1~5~6)
 1. sparsely setiferous in both sexes
 2. pubescent in both sexes
 3. unisetiferous in both sexes
 4. moderately setiferous in both sexes
 5. moderately setiferous in ♂, sparsely setiferous in ♀
 6. pubescent in ♂, sparsely setiferous in ♀
 7. glabrous
63. *Trochanter: shape in ♂ (1~3~2)
 1. normal
 2. apically acuminate
 3. apically elongate, pointed
64. Antennal comb: size (2~3; 2~1~4)
 1. small, depth less than one-half width of tibia
 2. medium, depth one-half width of tibia
 3. large, depth three-fourths width of tibia
 4. minute, depth one-fourth width of tibia
65. Anterior tibia cross section: shape (1~2~3~4)
 1. rounded
 2. slightly compressed
 3. moderately compressed
 4. markedly compressed
66. Middle tibia cross section: shape (1~2~3~4)
 1. rounded
 2. slightly compressed
 3. moderately compressed
 4. markedly compressed
67. Middle tibia mesal margin: surface texture (1~2~3)
 1. smooth
 2. microserrate
 3. macroserrate
68. *Middle tibia mesal face: shape (1~8~7~6; 1~5~9~10; 1~2; 1~3~4)
 1. straight in both sexes
 2. medially clavate
 3. apically clavate
 4. apically markedly clavate
 5. slightly concave medially
 6. mesally macromucronate in ♂
 7. mesally medimucronate in ♂
 8. slightly swollen mesially in ♂
 9. mesoapically excavate in ♂
 10. medially planate in ♂
 11. slightly arcuate
 12. slightly swollen apically in ♂, straight in ♀
69. Middle tibial shaft: shape (1~4~2; 1~3; 1~5)
 1. straight
 2. moderately arcuate
 3. twisted

4. slightly arcuate
5. slightly bent
70. Middle tibia apex: shape (1~2)
 1. not produced
 2. laterally produced
71. *Middle tibia vestiture: σ (1~2~3; 1~4)
 1. normal, triserially setose with mesoapical patch
 2. medially pilose, setae short
 3. medially pilose, setae longer than tibial width
 4. quadriserially setose with mesoapical patch
 5. triserially setose without apical patch
72. *Posterior tibia cross section: shape (1~6~2~3~4; 1~7~5)
 1. rounded
 2. slightly compressed
 3. moderately compressed
 4. markedly compressed
 5. markedly depressed
 6. slightly compressed in σ , rounded in φ
 7. moderately depressed
73. Posterior tibia mesal margin: texture (1~2~3)
 1. smooth
 2. microserate
 3. macroserate
74. *Posterior tibial shaft: shape (1~5~10~2; 1~4~3~7; 1~12~6; 5~9~8; 1~14~11~13)
 1. straight
 2. markedly arcuate
 3. twisted
 4. sinuate
 5. slightly arcuate
 6. angulate
 7. medially concave, twisted
 8. slightly arcuate, medially flat
 9. slightly arcuate in σ ; arcuate, medially flat in φ
 10. arcuate in σ , slightly arcuate in φ
 11. arcuate-excavate in σ , straight in φ
 12. angulate in σ , straight in φ
 13. arcuate-excavate in σ , compressed in φ
 14. slightly arcuate, medially flat in σ , slightly arcuate in φ
75. Posterior tibial apex: shape (1~2)
 1. not produced
 2. laterally produced
76. *Posterior basitarsomere: width (3~1~2, 1~4)
 1. equals tibial apex width
 2. greater than tibial apex width
 3. less than tibial apex width
 4. greater than tibial apex width in σ , equals tibial apex width in φ
77. *Posterior basitarsomere: shape (5~3~2~4~1; 3~6)
 1. triangular, subdepressed
 2. subquadrate, subcubiform
 3. subrectangulate, hemicylindrical
 4. quadrate, subdepressed
 5. elongate, cylindrical
 6. triangular in σ , subrectangulate in φ
78. Posterior tarsomere 5: shape (1~2)
 1. narrow, subcylindrical
 2. plate-like, depressed
 3. triangulate, depressed
79. *Anterior femur: shape (1~3~2)
 1. normal
 2. robust
 3. robust in σ , normal in φ
80. *Middle femur: shape (1~3~4; 3~2)
 1. normal
 2. robust
 3. robust in σ , normal in φ
 4. markedly swollen in σ , normal in φ
81. *Middle femur: σ setae (1~3~2)
 1. sparsely setiferous anteroventrally in σ
 2. pilose anteroventrally in σ
 3. densely setiferous anteroventrally in σ
82. Posterior femur: shape (1~3~2)
 1. normal
 2. concave in σ , normal in φ
 3. medially flat in σ , normal in φ
83. Phallus shaft: shape (1~2~3; 1~4)
 1. straight
 2. slightly arcuate ventrad
 3. markedly arcuate ventrad
 4. arcuate dorsad
84. Phallus shaft: texture (2~1; 2~3)
 1. medioventrally rugose
 2. smooth
 3. circum-medially microtuberculate
 4. microreticulate
85. Phallus shaft: shape (2~1; 2~3)
 1. medially swollen
 2. uniformly narrow
 3. medially depressed
86. Phallus apex: general shape of whole arrowhead (1~2~10~5~7; 5~6~9~3~8; 1~4; 2~11)
 1. narrowed, rounded
 2. slightly lobed
 3. truncated-spade form
 4. acute
 5. rounded-arrowhead form
 6. acute-arrowhead form
 7. subscimitar form
 8. spade form
 9. dentate-spade form
 10. spatulate
 11. markedly lobed arrowhead form
 12. hammerhead-shark form
 13. reduced-arrowhead form
87. Phallus apex: apex of arrowhead (2~1)
 1. tip asymmetric

2. tip symmetric
88. Phallus shaft proximal to apex: shape (1~3~2)
 1. broad, wider than two-thirds width of phallus head
 2. narrow, less than one-third width of phallus head
 3. normal, one-half width of phallus head
 4. wider than apex
89. Ostium bridge: width (3~2~4~1)
 1. markedly wide
 2. narrow
 3. absent
 4. moderately wide
90. Ostium: shape (1~2)
 1. dorsad
 2. sinistral
91. Stylus: shape (2~1~3; 2~7~8; 2~5~4~6)
 1. short, tubular
 2. short, arcuate
 3. short, spatulate
 4. elongate, robust
 5. elongate, flat
 6. elongate, clubbed
 7. medium length, flat
 8. medium length, robust
92. Stylus: apical armature (3~1~2; 1~4)
 1. bispinose
 2. quadrispinose
 3. bisetiferous
 4. unarmed
 5. hexaspinose
93. Stylus: shaft vestiture (1~4~2~3)
 1. glabrous
 2. multisetiferous
 3. fringed medially
 4. sparsely setiferous
94. *Antennomere 8: length (1~3~2)
 1. equals antennomere 7 in both sexes
 2. equals antennomere 7 in σ , one-half of antennomere 7 or less in ♀
 3. equals antennomere 7 in σ , two-thirds of antennomere 7 in ♀
95. *Anterior femur: σ vestiture (1~2)
 1. sparsely setiferous anteroventrally
 2. densely setiferous anteroventrally
96. Parameres: vestiture (1~2)
 1. glabrous
 2. setiferous
97. *Posterior tibia mesal surface: vestiture (6~5~1; 5~2; 5~4~3; 6~7; 5~8)
 1. apically pilose, setae short
 2. sparsely setiferous in σ , pilose in ♀
 3. mesially pilose in σ , setae short; moderately setiferous in ♀
 4. mesially sparsely setiferous in σ , moderately setiferous in ♀
 5. sparsely setiferous in both sexes
 6. triserially setiferous from base to apex
 7. mesially glabrous in σ , moderately setiferous in ♀
 8. mesially pilose, setae long in σ , biserially setose in ♀
 9. triserially setose from base to apex and with dense setal patch in apical one-fifth
98. Antennomeres 4-7: shape (1~2)
 1. cylindrical throughout length
 2. apically more robust than at base
 3. slightly compressed
99. Abdominal sternum II: form (2~1)
 1. separated from abdominal sternum III by transverse suture
 2. fused medially with abdominal sternum III
100. Middle trochanter: form (1~2)
 1. evenly rounded
 2. tuberculate
101. *Metasternum: σ form (1~2)
 1. plain
 2. tuberculate
102. σ anterior tarsomeres 1-3: setae (2~1)
 1. complete adhesive pad
 2. divided anterior pads
 3. paired rows of modified setae
103. σ middle tarsomeres 1-3: setae (2~1)
 1. adhesive pad present
 2. adhesive pad absent
104. σ posterior tarsomeres 1, 2 and/or 3: setae (2~1)
 1. adhesive pad present
 2. adhesive pad absent
105. Ostium: form (1~2)
 1. elongate, extended more than one-half phallus length
 2. short, less than one-half phallus length
 3. length variable
106. *Abdominal sternum III: form (1~2)
 1. posterior midmargin without pigment, hyaline
 2. posterior midmargin with pigment, not hyaline
107. *Abdominal sternum IV: form (1~2)
 1. posterior midmargin without pigment, hyaline
 2. posterior midmargin with pigment, not hyaline
108. Penultimate tarsomere: form (1~2)
 1. symmetrical
 2. asymmetrical (proximal lobe smaller)
109. Aedeagus: vestiture (1~2)
 1. glabrous
 2. pubescent

Literature Cited

- Ball, G.E.
1972. Classification of the Species of the *Harpalus* Subgenus *Glanodes* Casey (Carabidae, Coleoptera). *Coleopterists Bulletin*, 26(4): 179–204.
- Chevrolat, L.A.A.
1856. Diagnoses de six carabiques découverts par M.A. Sallé, au Mexique. *Revue et Magasin de Zoologie*, 8:351–352.
- Erwin, T.L.
1970. A Reclassification of Bombardier Beetles and a Taxonomic Revision of the North and Middle American Species (Carabidae: Brachinida). *Quaestiones Entomologicae*, 6:4–215.
1973. Studies of the Subtribe Tachyina (Coleoptera: Carabidae: Bembidiini), Part I: A Revision of the Neotropical Genus *Xystosomus* Schaum. *Smithsonian Contributions to Zoology*, 140: 39 pages.
1974. Studies of the Subtribe Tachyina (Coleoptera: Carabidae: Bembidiini), Part II: A Revision of the New World-Australian Genus *Pericompsus* LeConte. *Smithsonian Contributions to Zoology*, 162: 96 pages.
1978. Systematic, Natural History, and Zoogeographic Notes on the Genus *Agra* Fabricius, with a Description of a New Species from Panama (Coleoptera: Carabidae: Lebiini). *Coleopterists Bulletin*, 32(4): 261–268.
1982a. *Agra* Arboreal Beetles of Neotropical Forests: *erythropus* Group Systematics (Carabidae). *Systematic Entomology*, 7:39–71.
1982b. *Agra*, Arboreal Beetles of Neotropical Forests: *platyscelis* Group Systematics (Carabidae). *Systematic Entomology*, 7:185–210.
1983. *Agra*, Arboreal Beetles of Neotropical Forests: *famula* and *formicaria* Groups Systematics (Carabidae). *Systematic Entomology*, 8: 263–292.
1984. *Agra*, Arboreal Beetles of Neotropical Forests: *palmata* Group Systematics (Carabidae). *Systematic Entomology*, 9:9–48.
1986. *Agra*, Arboreal Beetles of Neotropical Forests: *mixta*-group, *virgata*-group, and *ohausi*-group Systematics (Carabidae). *Systematic Entomology*, 11:293–316.
1987. *Agra*, Arboreal Beetles of Neotropical Forests: *feisthameli* Group Systematics (Carabidae). *Systematic Entomology*, 12:137–161.
1993 (“1991”). *Agra*, Arboreal Beetles of Neotropical Forests: *rufoaenea* and *quararibea* Group Systematics (Carabidae). *Revista Peruana de Entomologia*, 34: 15–28. [Date on title page is 1991; actually published in 1993.]
1994. Arboreal Beetles of Tropical Forests: The *Xystosomi* Group, Subtribe *Xystosomina* (Coleoptera: Carabidae: Bembidiini), Part I: Character Analysis, Taxonomy, and Distribution. *The Canadian Entomologist*, 126(3):549–666.
1996. Arboreal Beetles of Neotropical Forests: *Agra* Fabricius, the *cayennensis* Complex (Coleoptera: Carabidae: Lebiini: Calleidina). *Annales Zoologici Fennici*, 33(1):17–21.
- Erwin, T.L., and D.H. Kavanaugh
1981. Systematics and Zoogeography of *Bembidion* Latreille, 1: The *carlhi* and *erasum* Groups of Western North America (Coleoptera: Carabidae: Bembidiini). *Entomologica Scandinavica*, supplement, 15: 33–72.
- Erwin, T.L., and M.G. Pogue
1988. *Agra*, Arboreal Beetles of Neotropical Forests: Biogeography and the Forest Refugium Hypothesis (Carabidae). In W.R. Heyer and P.E. Vanzolini, editors, *Proceedings of a Workshop on Neotropical Distribution Patterns, 12–16 January 1987*, pages 161–188. Rio de Janeiro: Academia Brasileira de Ciências.
- Griffiths, G.C.D.
1974. On the Foundation of Biological Systematics. *Acta Biotheoretica*, 23(3–4):85–131.
- Kavanaugh, D.H.
1979. Studies on the *Nebriini* (Coleoptera: Carabidae), III: New Nearctic *Nebria* Species and Subspecies, Nomenclatural Notes, and Lectotype Designations. *Proceedings of the California Academy of Sciences*, 42:87–133.
- Liebke, M.
1940. Bausteine zu einer Monographie der Gattung *Agra* Fabr. (Coleoptera). *Folia Zoologia et Hydrobiologica*, 10(1):85–106, 226–258.
- Straneo, S.L.
1955. Sul genere *Agra* Fabricius (Coleoptera Carabidae). *Bulletin de l'Institut Royal de Sciences Naturelles de Belgique*, 31:1–28.
1958. Su alcune *Agra* del Museo di Parigi. *Revue Française d'Entomologie*, 24:355–379.
1965. On Some Species of the Genus *Agra* F. Coleoptera, Carabidae. *Annales Zoologici*, 19:459–481.
1982. Nuove specie del genere *Agridia* Chaudoir et *Agra* Fabricius Coleoptera, Carabidae, nelle Collezioni del Laboratorio d'Entomologie del Muséum National d'Histoire Naturelle di Parigi. *Annales de la Société Entomologique de France*, 18:391–417.

REQUIREMENTS FOR SMITHSONIAN SERIES PUBLICATION

Manuscripts intended for series publication receive substantive review (conducted by their originating Smithsonian museums or offices) and are submitted to the Smithsonian Institution Press with Form SI-36, which must show the approval of the appropriate authority designated by the sponsoring organizational unit. Requests for special treatment—use of color, foldouts, case-bound covers, etc.—require, on the same form, the added approval of the sponsoring authority.

Review of manuscripts and art by the Press for requirements of series format and style, completeness and clarity of copy, and arrangement of all material, as outlined below, will govern, within the judgment of the Press, acceptance or rejection of manuscripts and art.

Copy must be prepared on typewriter or word processor, double-spaced, on one side of standard white bond paper (not erasable), with 1¹/₄" margins, submitted as ribbon copy (not carbon or xerox), in loose sheets (not stapled or bound), and accompanied by original art. Minimum acceptable length is 30 pages.

Front matter (preceding the text) should include: **title** page with only title and author and no other information; **abstract** page with author, title, series, etc., following the established format; table of **contents** with indents reflecting the hierarchy of heads in the paper; also, **foreword** and/or **preface**, if appropriate.

First page of text should carry the title and author at the top of the page; **second page** should have only the author's name and professional mailing address, to be used as an unnumbered footnote on the first page of printed text.

Center heads of whatever level should be typed with initial caps of major words, with extra space above and below the head, but no other preparation (such as all caps or underline, except for the underline necessary for generic and specific epithets). Run-in paragraph heads should use period/dashes or colons as necessary.

Tabulations within text (lists of data, often in parallel columns) can be typed on the text page where they occur, but they should not contain rules or numbered table captions.

Formal tables (numbered, with captions, boxheads, stubs, rules) should be submitted as carefully typed, double-spaced copy separate from the text; they will be typeset unless otherwise requested. If camera-copy use is anticipated, do not draw rules on manuscript copy.

Taxonomic keys in natural history papers should use the aligned-couplet form for zoology and may use the multi-level indent form for botany. If cross referencing is required between key and text, do not include page references within the key, but number the keyed-out taxa, using the same numbers with their corresponding heads in the text.

Synonymy in zoology must use the short form (taxon, author, year:page), with full reference at the end of the paper under "Literature Cited." For botany, the long form (taxon, author, abbreviated journal or book title, volume, page, year, with no reference in "Literature Cited") is optional.

Text-reference system (author, year:page used within the text, with full citation in "Literature Cited" at the end of the text) must be used in place of bibliographic footnotes in all Contributions Series and is strongly recommended in the Studies Series: "(Jones, 1910:122)" or "...Jones (1910:122)." If bibliographic footnotes are

required, use the short form (author, brief title, page) with the full citation in the bibliography.

Footnotes, when few in number, whether annotative or bibliographic, should be typed on separate sheets and inserted immediately after the text pages on which the references occur. Extensive notes must be gathered together and placed at the end of the text in a notes section.

Bibliography, depending upon use, is termed "Literature Cited," "References," or "Bibliography." Spell out titles of books, articles, journals, and monographic series. For book and article titles use sentence-style capitalization according to the rules of the language employed (exception: capitalize all major words in English). For journal and series titles, capitalize the initial word and all subsequent words except articles, conjunctions, and prepositions. Transliterate languages that use a non-Roman alphabet according to the Library of Congress system. Underline (for italics) titles of journals and series and titles of books that are not part of a series. Use the parentheses/colon system for volume (number):pagination: "10(2):5-9." For alignment and arrangement of elements, follow the format of recent publications in the series for which the manuscript is intended. Guidelines for preparing bibliography may be secured from Series Section, SI Press.

Legends for illustrations must be submitted at the end of the manuscript, with as many legends typed, double-spaced, to a page as convenient.

Illustrations must be submitted as original art (not copies) accompanying, but separate from, the manuscript. Guidelines for preparing art may be secured from the Series Section, SI Press. All types of illustrations (photographs, line drawings, maps, etc.) may be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively as they will appear in the monograph. If several illustrations are treated as components of a single composite figure, they should be designated by lowercase italic letters on the illustration; also, in the legend and in text references the italic letters (underlined in copy) should be used: "Figure 9b." Illustrations that are intended to follow the printed text may be termed **Plates**, and any components should be similarly lettered and referenced: "Plate 9b." Keys to any symbols within an illustration should appear on the art rather than in the legend.

Some points of style: Do not use periods after such abbreviations as "mm, ft, USNM, NNE." Spell out numbers "one" through "nine" in expository text, but use digits in all other cases if possible. Use of the metric system of measurement is preferable; where use of the English system is unavoidable, supply metric equivalents in parentheses. Use the decimal system for precise measurements and relationships, common fractions for approximations. Use day/month/year sequence for dates: "9 April 1976." For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc. Omit space between initials of a personal name: "J.B. Jones."

Arrange and paginate sequentially every sheet of manuscript in the following order: (1) title page, (2) abstract, (3) contents, (4) foreword and/or preface, (5) text, (6) appendices, (7) notes section, (8) glossary, (9) bibliography, (10) legends, (11) tables. Index copy may be submitted at page proof stage, but plans for an index should be indicated when the manuscript is submitted.

