

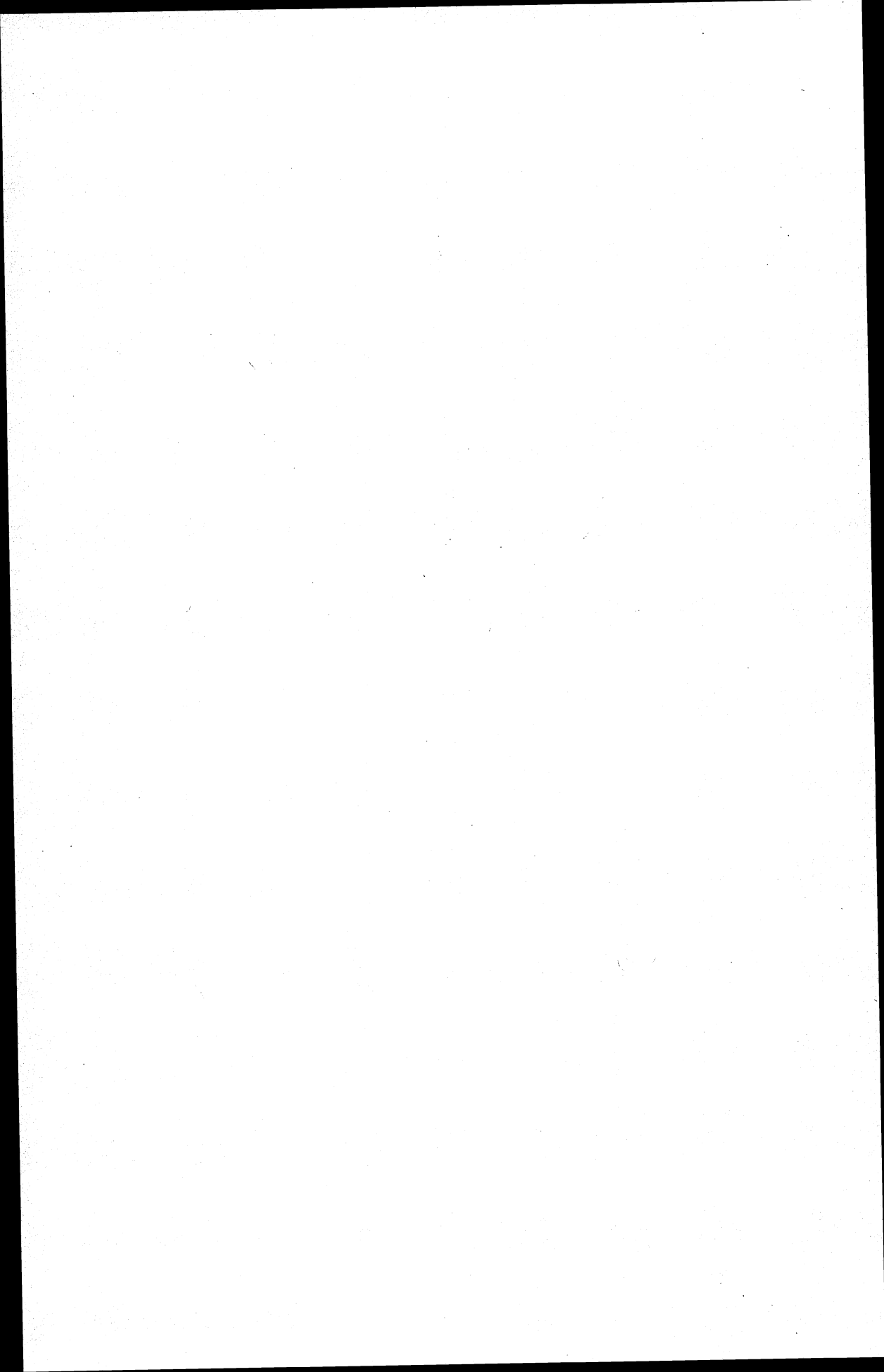
MISCELLANEOUS PUBLICATIONS
MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN, NO. 153

**A Revisionary Study
of the Genus *Acanthagrion*
(Odonata: Zygoptera)**

BY

Justin W. Leonard

Ann Arbor
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CONTENTS

	Page
FOREWORD	vii
INTRODUCTION	1
ACKNOWLEDGEMENTS	2
SOURCES AND DISPOSITION OF MATERIAL STUDIED	3
DISPOSITION OF TYPES	4
CHARACTERIZATION OF THE GENUS <i>ACANTHAGRION</i>	4
DESCRIPTION OF STRUCTURE	5
Coloration	6
Development and Variation of Coloration	7
EVALUATION OF CHARACTERS	9
The Penis	10
The Male Abdominal Appendages	11
The Mesepisternal Fossae	11
Other Structural Characters	11
DISTRIBUTION	12
RECOGNITION AND DISPOSITION OF SPECIES AND INTRAGENERIC GROUPS	14
ABSENCE OF INTERGRADATION	15
SYSTEMATIC SECTION	17
Key to the Species of <i>Acanthagrion</i>	18
Males	18
Females	22
Rubrifrons Group	25
<i>A. rubrifrons</i>	25
<i>A. longispinosum</i>	29
Abunae Group	32
<i>A. jessei</i> n. sp.	32
<i>A. temporale</i> Selys	35
<i>A. abunae</i> n. sp.	37
<i>A. inexpectum</i> n. sp.	41
<i>A. amazonicum</i> Sjöstedt	44
Ablutum Group	47
<i>A. ablutum</i> Calvert	48
<i>A. hermosae</i> n. sp.	51
Apicale Group	52
<i>A. phallicornis</i> n. sp.	53
<i>A. obsoletum</i> (Förster)	56
<i>A. apicale</i> Selys	61
Yungarum Group	66
<i>A. williamsoni</i> n. sp.	66
<i>A. risi</i> n. sp.	69
<i>A. yungarum</i> Ris	73
Ascendens Group	77
<i>A. kennedii</i> Williamson	78
<i>A. quadratum</i> Selys	81
<i>A. trilobatum</i> n. sp.	85
<i>A. ascendens</i> Calvert	90

Viridescens Group	94
<i>A. truncatum</i> Selys	95
<i>A. viridescens</i> n. sp.	98
<i>A. lancea</i> Selys	102
<i>A. gracile</i> (Rambur)	106
<i>A. deceptum</i> n. sp.	110
<i>A. peruvianum</i> n. sp.	114
Adustum Group	119
<i>A. minutum</i> n. sp.	119
<i>A. adustum</i> Williamson	122
<i>A. indefensum</i> Williamson	125
Chararum Group	128
<i>A. latapistylum</i> Calvert	129
<i>A. chararum</i> Calvert	130
<i>A. chacoënsis</i> Calvert	132
GENERAL SUMMARY	133
CONCLUSIONS	136
LIST OF LOCALITIES MENTIONED	139
LITERATURE CITED	145
APPENDIX, by L. K. Gloyd	146
INDEX TO TAXA	153
PLATES I-XIX	155

ILLUSTRATIONS

Plate	Page
I. Penes of <i>Acanthagrion rubrifrons</i> , <i>A. longispinosum</i> , <i>A. jessei</i> , <i>A. temporale</i> , <i>A. abunae</i> and <i>A. inexpectum</i>	155
II. Penes of <i>A. amazonicum</i> , <i>A. ablutum</i> , <i>A. hermosae</i> , <i>A. phallicornis</i> , <i>A. obsoletum</i> and <i>A. apicale</i>	156
III. Penes of <i>A. yungarum</i> , <i>A. risi</i> , <i>A. williamsoni</i> , <i>A. kennedii</i> , <i>A. quadratum</i> and <i>A. trilobatum</i>	157
IV. Penes of <i>A. ascendens</i> , <i>A. truncatum</i> , <i>A. viridescens</i> , <i>A. lancea</i> , <i>A. gracile</i> and <i>A. deceptum</i>	158
V. Penes of <i>A. peruvianum</i> , <i>A. minutum</i> , <i>A. adustum</i> , <i>A. indefensum</i> , <i>Aeolagrion</i> sp. and <i>Cyanallagma interruptum</i>	159
VI. Male appendages of <i>A. rubrifrons</i> , <i>A. longispinosum</i> , <i>A. jessei</i> and <i>A. temporale</i>	160
VII. Male appendages of <i>A. abunae</i> , <i>A. inexpectum</i> , <i>A. amazonicum</i> and <i>A. ablutum</i>	161
VIII. Male appendages of <i>A. hermosae</i> , <i>A. phallicornis</i> , <i>A. obsoletum</i> and <i>A. apicale</i>	162
IX. Male appendages of <i>A. yungarum</i> , <i>A. risi</i> , <i>A. williamsoni</i> and <i>A. kennedii</i>	163
X. Male appendages of <i>A. quadratum</i> , <i>A. trilobatum</i> , <i>A. ascendens</i> and <i>A. truncatum</i>	164
XI. Male appendages of <i>A. viridescens</i> , <i>A. lancea</i> , <i>A. gracile</i> and <i>A. deceptum</i>	165
XII. Male appendages of <i>A. peruvianum</i> , <i>A. minutum</i> , <i>A. adustum</i> and <i>A. indefensum</i>	166
XIII. Mesepisternal fossae of <i>A. rubrifrons</i> , <i>A. longispinosum</i> , <i>A. jessei</i> , <i>A. temporale</i> , <i>A. abunae</i> and <i>A. amazonicum</i>	167
XIV. Mesepisternal fossae of <i>A. phallicornis</i> , <i>A. obsoletum</i> , <i>A. apicale</i> , <i>A. ablutum</i> , <i>A. kennedii</i> and <i>A. quadratum</i>	168
XV. Mesepisternal fossae of <i>A. trilobatum</i> , <i>A. ascendens</i> , <i>A. truncatum</i> , <i>A. viridescens</i> , <i>A. lancea</i> and <i>A. gracile</i>	169
XVI. Mesepisternal fossae of <i>A. peruvianum</i> , <i>A. deceptum</i> , <i>A. yungarum</i> , <i>A. risi</i> and <i>A. adustum</i>	170
XVII. Locality records for the Rubrifrons, Yungarum and Abunae Groups of <i>Acanthagrion</i>	171
XVIII. Locality records for the Apicale, Ascendens and Chararum Groups of <i>Acanthagrion</i>	172
XIX. Locality records for the Viridescens and Ablutum Groups of <i>Acanthagrion</i>	173

FOREWORD

Of unusual occurrence is the publication of a thesis 40 years after its completion and acceptance in partial fulfillment of the requirements for the Doctor of Philosophy degree, and also after the death of the author. Such a thesis is herewith published in the Miscellaneous Publications of the Museum of Zoology, as a memorial number for Dr. Justin W. Leonard.

The greater part of the study reported here was carried on during the period 1931-34 while Dr. Leonard was a graduate student at the University of Michigan. Since that time, the varied demands of his professional duties, and the difficulties in obtaining funds for the printing, resulted in repeated delays of publication. A few years ago, Dr. B. E. Montgomery and Dr. Leonard began to revise the original manuscript and made a few minor changes in the Introduction and preliminary discussion concerning the genus *Acanthagrion*. These have been incorporated in this published version.

The hopeful waiting for the publication of this work has apparently been responsible for the delay in describing new species by other authors. Since the completion of the thesis, only six new species and two new subspecies have been described. These are listed herewith in an Appendix.

Leonora K. Gloyd

INTRODUCTION

The genus *Acanthagrion* was erected for the reception of certain Neotropical coenagrionine Zygoptera by the great Belgian odonatologist, Baron Edmond de Selys-Longchamps, in 1876. Into this genus, at the time of its description, he placed *Agrion gracile*, described "from Brazil" by Rambur (1842) as the first species of "2e groupe: (A. GRACILE)." At the same time, Selys published descriptions of 13 new forms — 8 as species (*apicale*, *cheliferum*, *interruptum*, *laterale*, *nigrinuchale*, *temporale*, *trimaculatum* and *truncatum*), 2 as varieties of *gracile* (*cuneatum* and *quadratum*), and 3 as races of *gracile* (*lancea*, *minarum* and *vidua*). No further additions were made to the genus for 23 years, when Calvert (1899) described *latapistylum*. Ten years later, Calvert (1909) described 9 more forms — 4 as species (*chacoëense*, *chararum*, *chirihuanum* and *cuyabae*) and 5 as subspecies (*ablutum* and *ascendens* as subspecies of *gracile*, *fimense* and *freirensis* as subspecies of *cuyabae*, and *rusticum* as a doubtfully distinct subspecies of *cheliferum*). Ris described 6 forms for the genus — 5 as species (*ambiguum* in 1904, *acutum*, *luna* and *yungarum* in 1916, *lindneri* in 1928) and one, *bonariense*, as a subspecies of *interruptum* in 1913. E. B. Williamson (1916) described 3 species, *adustum*, *indefensum* and *kennedii*. Sjöstedt (1918) described one species, *amazonicum*, and one subspecies, *gracile maculae*.

During all these years, the limits of the genus were becoming increasingly vague, so much so that forms obviously distantly related were being placed side by side. In the light of the new material, the generic characters advanced by Selys had been necessarily modified, but no worker possessed series extensive enough to permit any serious attempt at rectification of the obvious discrepancies. Kennedy (1916) elevated *ablutum* and *ascendens* to the rank of species, and later (1920) removed *acutum*, *cheliferum*, *interruptum* and *laterale* to a new genus, *Cyanallagma*, with *interruptum* as the type species.

At this time, in almost every instance, the species were known from only a few individuals and from a small number of localities, the latter frequently inexact or vague. The true value of the diverse specific characters employed by various authors had never been determined, and a wide range of variation was ascribed to many of the species, especially these of the so-called Gracile Group, as the number of described subspecies attests. Finally, it became almost if not quite impossible to determine material accurately, and the need for a revisional study was quite apparent.

When I entered the University of Michigan as a graduate student in 1931, Mr. E. B. Williamson, then Research Associate in the Museum of Zoology, suggested that a careful investigation of the systematics of this genus should bring about a clarification of the involved status of

many of the species, and that the results of such a study should be of fundamental value in providing a sound systematic basis for any future workers who might have the opportunity of delving into the many interesting biological problems offered by this large and widespread genus of dragonflies. Because an extensive collection of *Acanthagrion* was available, the problem was undertaken. At first, it was hoped that in addition to a clarification of taxonomic matters, conclusions might be reached bearing on possible centers of speciation and dispersal, and that contributions of value might be made toward a knowledge of the zoogeography of the genus. This goal has been only partially attained. While many parts of the Neotropical Region have been sampled for members of this genus and while many species are now represented by large series of specimens, there remain vast gaps throughout the range where no collections have been made. In consequence, the determination of relationships has been postulated, largely on morphological grounds.

It is believed, however, that attempts at the detection and evaluation of specific characters have been, in the main, successful. The effort has been made throughout to derive as much information as possible from such distributional data as are available. But our knowledge of the group is not yet adequate to permit the enunciation of definite conclusions on the distributional and phylogenetic problems of *Acanthagrion*. If, as is hoped, the results of the present investigation may afford a sound foundation for future work in odonate phylogeny, I will consider my time and effort well spent.

ACKNOWLEDGMENTS

During the time covered by the initial study, Frederick M. Gaige, then Director and Curator of Insects, Museum of Zoology, University of Michigan, provided research facilities, constant encouragement and helpful suggestions. It is a particular pleasure to record appreciation of his inspirational guidance.

Edward Bruce Williamson, who collected much of the material on which this revision is based, suggested the study and, until his untimely death, supervised its earlier phases. Clarence Hamilton Kennedy lent several lots of specimens and was generous with advice. John Cowley lent interesting specimens from his private collection. Philip P. Calvert furnished helpful information on types of species described by him. Erich Schmidt lent material and very generously sent some of the sketches he had made of Selysian types in the Brussels Museum. Leonora K. Gloyd supplied valued counsel and notes on type material in various American collections. My wife, Fannie A. Leonard, was of much assistance during preparation of the manuscript.

Editor's note: Grateful appreciation is also expressed to Dennis R. Paulson, who reviewed the manuscript, and to Leonora K. Gloyd, who prepared the Index to Taxa, checked many details of taxonomy, description and locality data, assisted with the rearrangement of, and additions to, the drawings of the Plates, and prepared the Appendix.

SOURCES AND DISPOSITION OF MATERIAL STUDIED

With the exception of the lot of specimens lent by Mr. Cowley, all the material examined is in the collections of the Museum of Zoology, University of Michigan. The sources are as follows: Guatemala, 1905, by E. B. Williamson, C. C. Deam, et al.; Guatemala, 1909, by E. B. Williamson; Trinidad and British Guiana, 1912, by Lent A. Williamson, E. B. Williamson and B. J. Rainey; Colombia and the Canal Zone, 1916-1917, by J. H. Williamson and E. B. Williamson; Venezuela, 1920, by J. H. Williamson, E. B. Williamson and W. H. Ditzler; Peru, 1920, by H. S. Parish; Brazil (Amazon Basin), 1922, by J. H. Williamson and J. W. Strohm; Bolivia, Peru, and Brazil (Rio de Janeiro), 1922, by J. H. Williamson; Honduras, 1923, by T. H. Hubbell; British Honduras and Guatemala, 1931, by Adolph Murie; Peru, 1931, by Paul Nagel; Mexico (Nuevo Leon, Campeche, and Yucatán), 1932, by E. P. Creaser; Mexico (Vera Cruz), 1932, by H. M. Smith; British Honduras, 1933, by J. J. White; Trinidad, 1933, by G. Belmontes; Peru, 1935-37, by Felix Woytkowski; Colombia, specimens with no other data available, by Bouis; and finally, material from the large Förster Collection (now in the Museum of Zoology, the University of Michigan), the work of many commercial collectors, drawn from all parts of South America, notably Paraguay, Bolivia, Peru, Surinam and the Brazilian coast. The lot lent by Dr. Kennedy (also now in the Museum of Zoology, the University of Michigan) comprised specimens collected by William Clarke-Macintyre in the Oriente Ecuador from 1934 to 1937. By far the most important and extensive collections were those made by Messrs. J. H. Williamson and E. B. Williamson. The material taken by Mr. Woytkowski differed greatly from that ordinarily supplied by commercial collectors, in that it was in excellent condition and was accompanied by considerable field data.

The material lent by Mr. Cowley was made up of examples from Peru collected by Dr. P. Martin, and of lots supplied by two commercial collectors, Staudinger and Steinbach, taken in Bolivia, Brazil, Colombia, Surinam, and Peru, the majority without collection dates recorded.

DISPOSITION OF TYPES

The types of species described by Selys were placed in the Selys Collection, in the Musée Royale de Belgique, in Brussels; sketches of male genitalia from this material were prepared and sent to me by Dr. Erich Schmidt in 1937. Types of Sjöstedt's two species are in the Stockholm Museum. The type male and female (all known) of Calvert's *latapistylum* were placed in the National Museum at Buenos Aires. It has been impossible to secure information on specimens in the latter two institutions, and in fact there is no certain assurance that the specimens are still in existence. The original descriptions by Selys are so detailed that in only two cases can reasonable doubt be entertained as to the identity of the species erected by him. The species named by Sjöstedt and by Calvert were well-described and accompanied by figures of sufficient clarity to convince me that I have correctly identified specimens of *amazonicum* Sjöstedt and am justified in recognizing *latapistylum* Calvert as a valid species even though I have never seen specimens of it.

The types of species described by Calvert in 1909 are deposited in the Carnegie Museum, Pittsburgh, Pennsylvania. Notes on these specimens were taken for the writer by Leonora K. Gloyd in 1934. Museum authorities would not permit extrusion of the genitalia of these specimens, but the original descriptions and figures, together with Mrs. Gloyd's supplementary notes, make their identity certain.

With the exception of *luna*, each species described by Ris (1918) was illustrated by a drawing of the penis. A photograph of the type of *luna* was courteously furnished by Dr. Elli Franz, in charge of the Ris Collection in the Senckenberg Museum, Frankfurt a.M.

Types of the three species described by Williamson (1916) are contained in the collections of the University of Michigan Museum of Zoology.

CHARACTERISTICS OF THE GENUS *ACANTHAGRION*

Position.—The genus *Acanthagrion* fits readily into the tribe *Pseudagrionini* of the typical subfamily of the zygopterous family Coenagrionidae. This tribe is world-wide in distribution, although it is represented in the Nearctic and Palearctic Regions by a single genus, *Enallagma*. In the supplementary classification of Zygoptera proposed by Kennedy (1920), *Acanthagrion* becomes one of the members of the *Acanthagrion-Enallagma* Series, distinguished by their possession of short tibial spines, a rounded frons, and, in the females, the presence of an apical spine on the eighth abdominal sternite.

Acanthagrion is readily separated from other neotropical genera of the same tribe. The highly characteristic declivent arrangement of the

male clasping organs is sufficient to distinguish it at a glance from *Telagrion*, *Leptagrion*, *Telebasis*, *Apanisagrion*, *Skiallagma* and *Cyanallagma*. From *Anisagrion* and *Oxyagrion* it may be separated by the presence, in these genera, of an internal penis fold, and by the absence of distinct thoracic color patterns and postocular spots. In at least one known species of *Aeolagrion*, the internal penis fold is wanting, but in this genus, so far as is known, the penis shaft is devoid of lateral setae (Pl. V, Figs. A1-2), structures occurring throughout *Acanthagrion*.

DESCRIPTION OF STRUCTURE

Head.—Labrum strongly arched in dorsal view, bearing a basomesal impression on middorsal line extending from base of sclerite about one-third the distance to apical margin; anteclypeus vertical, slightly rugose; postclypeus planate, anterior margin slightly convex in dorsal view and not definitely overhanging anteclypeus, anterolateral angles rounded, never acute; anterior face of frons sloping slightly caudad; dorsal surface of frons planate except for marked interantennal depression; antennae 7-segmented, the first or basal segment inflated, largely sunk into epicranium near lateral ends of frons, the second segment slightly longer and less robust than the first, the third segment longer than the first, less robust than the second, widest at distal end; remaining four antennal segments setiform, their joints scarcely discernible; vertex slightly convex, bearing three ocelli, two lateral, one median, each of these situated in a low, turret-like elevation from vertex; ocelli small, elliptical; occipital region broadly incised in dorsal view, bordered by a slightly elevated ridge; mandibles robust, heavily sclerotized, dentate; labium and maxillae large, freely movable, lightly sclerotized.

Prothorax.—Small, rounded, its notal region divided into three distinct lobes; anterior lobe broadly rounded cephalad, anterior margin slightly elevated, posterior margin nearly straight, impressed; middle lobe inflated, convex anteriorly and laterally, narrowly impressed along middorsal line; hind lobe small, plate-like, slightly elevated and slanted caudad, narrowly incised middorsally.

Synthorax.—Composed of fused and skewed elements of mesothorax and metathorax; mesostigmal lamina small, narrow, elongate, variously modified in the various species, especially in the female; interlaminal sinus (that restricted portion of the synthorax bounded anteriorly by the mesostigmal laminae and posterolaterally by the anterior bifurcation of the middorsal carina) variably subtriangular, slightly concave; mesepisterna, in the females, bearing a pair of small pits of variable shape, one on either side of middorsal carina (Pls. XIII-XVI), the remainder of synthorax differing little if any from other coenagrionines.

Abdomen.—Elongate, terete, 10-segmented, 17.25 to 30.00 mm in length; segment 10 in the male often subject to considerable modification; sternite 8 in the female bearing a short, sharp spine at the apex, often referred to as the *vulvar spine*; superior abdominal appendages of male basally appressed against posterior end of segment 10, declivent, apices approaching and sometimes touching inferiors; inferior appendages broad basally, acutely-pointed apically, sickle-shaped, the points always curved inward and sometimes upward; tergites 8 and 9, and in some cases 7, bearing a subapical row of minute spines of variable number and position.

Legs.—Typically coenagrionine; tibial spines shorter than spaces separating their bases, except in Rubrifrons Group; inferior tooth of tarsal claw acute but very small, less than one-fourth as long as claw.

Wings.—Membrane hyaline, sometimes slightly infuscated but never maculate; pterostigma oblique lozenge-shaped, height greater than length, subtended by less than one cell; petiolation extensive, reaching to or beyond Ac juncture in most species; number of postnodal crossveins in fore wing from 7 to 14; in hind wing from 6 to 12; arculus arising at or slightly distal to second antenodal crossvein; anterior side of quadrangle in fore wing one-fourth to one-half, in hind wing one-half to two-thirds as long as posterior side.

Coloration.—Although minor differences in color and markings are found to exist between various species of *Acanthagrion*, the fundamental color pattern is remarkably constant and characteristic throughout the genus. The pattern always consists of dark markings laid in strong contrast upon a light background. In fully mature specimens of both sexes the dark markings are black, often giving off metallic greenish reflections when viewed from certain angles. In a majority of the species the light background is light blue, green, or a combination of the two. In several of the intrageneric groups, however, species are found in which the blues and greens have been replaced by yellow, orange, or rich reddish brown. There are some grounds for the belief that blue or green may be the more primitive, ancestral type of coloration, and that the yellow or orange hues are a more recent and specialized development. This question will be more fully discussed under a subsequent heading.

Complete development of the color pattern is seldom encountered except in fully mature individuals. Although the basic plan is usually apparent very soon after emergence, the general difference between newly emerged (or teneral) and mature individuals is so great that on several occasions two or more species have been described from a series of young and old individuals of the same species. *Heterochromatism*, or the occurrence of two color phases among the females of a single species, is known to exist in several coenagrionid genera,

and appears to be quite common in *Ischnura*. No examples of this phenomenon have been encountered in the course of this study.

Development and Variation of Coloration.—In adults of *Acanthagrion* the dorsum of the head, including vertex and dorsal face of frons and the setiform portion of the antennae, is deep black, broken only by the light postocular spots. The only known exceptions to this are *minutum*, in which the postocular spots are narrowly connected across the occipital ridge; *rubrifrons* and *longispinosum*, in which a pair of oblique light bars between antennae and ocelli persist in mature individuals; and *hermosae*, in which the postocular spots are obliterated and the entire head dorsum is black. The postclypeus is black, only the extreme anterior margin and posterolateral angles remaining light. In teneral specimens the head dorsum at first appears mottled light and dark brown which soon changes to dark brown and black, the latter color being most extensive in the depressions. The more elevated regions, especially those immediately surrounding the ocelli and between the antennae, may retain their brownish tone for some time after the remainder of the body colors appear fully developed.

The pronotum is predominantly black. Its anterior lobe is usually light, narrowly bounded in front with dark brown or black. The middle lobe appears to retain its teneral coloration longer than any other sclerite, this consisting of a pair of light dashes on either side of the middorsal line, and a pair of subtriangular light spots on the dorsolateral aspect, which at first are connected laterally with the light color of the anterior lobe. These latter markings, although progressively restricted with age, appear to persist to some degree even in fully adult specimens. The hind lobe is almost always entirely black in the adult, the brownish hue of the teneral remaining longest on its extreme outer tips. The propleurite very soon becomes black along the suture separating it from the notum. The remainder appears to remain light even in the fully mature individuals of most species, although the posterolateral convexity soon acquires an investiture of white or pale bluish pruinescence.

In all but two of the known species, the synthoracic color pattern is very sharply defined, and quite uniform. It consists of a black middorsal stripe embracing the middorsal carina and a portion of the adjoining mesepisterna, and usually covering the antalar ridges, the interlaminal sinus, and the mesal regions of the mesostigmal laminae. The middorsal stripe is adjoined on each side by a pale antehumeral stripe, which lies on the mesepisternum and usually washes the lateral end of the mesostigmal lamina, which in turn is adjoined by the black humeral stripe that covers the humeral suture, part of the mesepimeron and mesinfraepisternum, and in most cases a narrow strip of the mesepisternum. In some species another black stripe occurs along the

second lateral suture, lying almost exclusively upon the metepisternum, and of variable extent, although never reaching beyond the metastigma. In the species where such a stripe is not present there is a suboval black spot near the posterior end of the suture, marking the location of a heavy apodeme of the endoskeleton. Aside from a small amount of black along the lateral alar ridges, the remainder of the synthorax is light in color.

During the teneral period, the dark synthoracic stripes are frequently represented by areas diffusely margined with light brown, often very dilute and frequently with a strong metallic or bronzy sheen. As the insect matures the stripes grow darker, the margins become increasingly sharply defined, and the total width increases. The darkening is usually most pronounced through the caudal half of the stripe, and many individuals are encountered which appear to be fully adult in every way except that the humeral stripe is diluted to light metallic brown over the mesinfraepisternum.

Development of dark leg markings generally parallels that of the thorax. In the fully mature insect the front femora are almost entirely black, lighter colors being limited to the extreme base and the proximal fourth or fifth of the inner face. Femora of the middle and hind legs almost never become wholly black, this color seldom occupying more than the apical half to two-thirds of the outer face of the middle pair and the apical third to half of the hind pair. In recently emerged specimens the femoral black is much less extensive, although usually occurring in the above ratio. Tibiae usually have dark brown to piceous inner faces, the outer faces remaining light brown except for a narrow, interrupted line of brown to piceous. Tarsal segments may become wholly black in very old individuals, but are more often seen to be dark at base and apex, and light brown mesally. Tarsal claws are seldom entirely black, but usually quite dark apically.

Wing membranes may become very slightly infuscated with age, but are commonly hyaline throughout. The color of the pterostigma is pale in very young examples, but apparently reaches its normal adult hue before other parts of the body.

The color pattern of the abdomen is quite uniform throughout the genus. In a few instances differences in the pattern of the second segment have proven of value in specific diagnosis. In general, the dorsum of the abdomen is black, this color extending down the sides of the tergites, very little on the first two or three segments, but increasingly so proceeding posteriorly. The lateral extent of the dorsal black also increases with age. Segments 8 and 9 are always light blue, regardless of the ground color of head and thorax, although the apical spine rows of these segments are usually black. The light color of the sides often becomes rusty brown on segments 4-7.

It has been mentioned above that two species do not possess

clear-cut thoracic patterns even when adult. One of these, *ablutum*, seems to retain throughout life the sort of indistinct pattern just described for teneralis. The other, *hermosae*, is solidly black over the greater portion of the dorsum and sides.

EVALUATION OF CHARACTERS

Owing to the great state of confusion known to exist in the genus *Acanthagrion*, no attempt was made, during the initial stages of this study, to determine unworked material by means of published keys. Instead, all specimens were critically studied with a view to detecting recognizable entities. As the work progressed, forms believed to be conspecific were grouped together and designated by symbols, with little or no reference to literature dealing with the genus. Not until the writer was satisfied that distinctions had been made correctly did he undertake to ascertain which ones of these species had been previously described, and to associate names with them. Working in this fashion, without prejudice and with a much larger amount of material available than any earlier student of the group had possessed, many of the difficulties which had beset them were avoided.

For example, examination of large series demonstrated, very early in the study, that coloration could be of little value in the separation of species. Tabulation of venational characters revealed an astonishing amount of overlapping in species which were obviously distinct. Most perplexing of all were the characters presented by the abdominal appendages and modified tenth abdominal segment of the male. For some time it appeared that these structures were exceedingly plastic, and that there existed a very wide range of variation with numerous examples of every intermediate stage. This condition began to suggest the possibility that the genus might be made up largely of a very few wide-ranging and highly variable species.

At this point in the study, I resorted to the examination of penes. For his paper on the comparative morphology of the second and third abdominal segments of male dragonflies, Schmidt (1915) studied only one species of *Acanthagrion*. Kennedy (1916), who had examined the penes of many species of Zygoptera, published drawings of a number of species of *Acanthagrion*, his paper appearing in conjunction with one by Williamson (1916) in which three new species of this genus were described. Kennedy did not examine the penes of any considerable number of a given species, and was unable to state whether or not intraspecific variation occurred. His observations led him to conclude that while the penis might be of service in the recognition of species, it could not offer clues to the existence of intrageneric groups.

The greatest handicap to the study of penes in dried specimens was

that this structure almost invariably was concealed from view by the so-called "vesicle," a heavily sclerotized linguiform plate covering the caudal end of the genital fossa. To examine the membranous distal portion of the penis, it first is necessary to relax the organ. Application of a small drop of household ammonia to the genital fossa was found to speedily relax the membranes surrounding the vesicle, as well as the hinge at the proximal end of the penis shaft, permitting extrusion of the penis without relaxing the entire insect. A small puncture, made with a fine needle in the side of the second tergite near the base of the penis shaft, so accelerated penetration of the ammonia that the structures could be extruded at a rate of one per minute. This made possible the examination of large series of penes, without risk of damage to the specimens, in a fraction of the time necessary to extract or extrude them for study by the usual method of relaxing the specimens.

Applying this technique, I found that the penis exhibited an exceedingly wide range of modifications throughout the genus and that a given pattern seemed not to vary. Accordingly, the entire collection was blocked out on the basis of penis structure. When the groups thus separated were reviewed, it was discovered that the seemingly variable nature of the male abdominal appendages had almost entirely disappeared and that, while considerable similarity might exist between the form of the structures in several groups of entities, there always existed gaps which were never bridged. The form and position of the mesoepisternal fossae of the females, which hitherto had appeared quite variable, now appeared as rigidly fixed as the structure of the male appendages.

Three characters — the penis, the abdominal appendages of the males, and the mesoepisternal fossae of the females — form the chief basis for the classification here proposed. The form of the appendages has proven to be of considerable taxonomic value, although not as definitive as the shape of the penis.

The Penis.—The zygopterous penis (Pls. I-V) possesses a fundamental design which is encountered throughout the Suborder. It consists of a subcylindrical, sclerotized shaft, hinged basally to the ventral wall of the second segment of the abdomen. This shaft, usually termed *segment 1*, is joined apically by means of a flexible hinge to a broad, slightly convex plate, less heavily sclerotized than the shaft, known as *segment 2*. The apex of segment 2 joins a membranous flap which is bent back over segment 2. Although not separated from segment 2 by any distinctly recognizable joint or suture, the flap is referred to as *segment 3*, or more often as the *distal penis segment*. In a great majority of Zygoptera, segment 2 bears two distinct membranous structures, one a narrow transverse fold across the ventral surface near the apex, the other a dorsal flap near the apex, sometimes free

distally, sometimes closely appressed against the apex of segment 2. Kennedy (1916:327) termed these, respectively, the *internal fold*, and the *terminal fold*.

In *Acanthagrion*, the penis follows the structural pattern just outlined, with the notable exception that the internal fold is absent in all the known species. The terminal fold appears always to be present, although so much reduced and so closely appressed against segment 2 as to be almost undiscernible. Inasmuch as the internal fold is a character of almost uniform occurrence throughout the Coenagrionidae, its absence in *Acanthagrion* might be interpreted as evidence of high specialization, and as placing this genus higher in the Acanthagrion-Enallagma Series than the allied *Enallagma*, in which the internal fold always occurs.

The bizarre penial modifications which have made possible accurate specific diagnoses in *Acanthagrion* are almost always developed from the third or distal penis segment.

The Male Abdominal Appendages.—These structures (Pls. VI-XII), consisting of a pair of superior and a pair of inferior appendages situated at the end of the male abdomen, are employed to clasp the female during mating. In the Zygoptera they are applied to the prothorax of the female, their gripping action being exerted principally upon this and upon the adjoining mesostigmal lamina. In *Acanthagrion* the superiors are broadly appressed against the end of the tenth segment, their dorsal extremities reaching well up toward the dorsal margin of the segment. The tips approach and sometimes touch the inferiors. In all species except the members of the Chararum Group the superiors, therefore, slant strongly downward from base to apex. The dorsal ends of the superiors bear a small, tuberculate projection, directed admesally, and in some cases posteriorly as well. The inferiors are always broad basally, sharp apically, and with the apices hooked inward and sometimes upward.

The Mesepisternal Fossae.—In Odonata, as in many other insect groups, females have presented many difficulties in recognition. In *Acanthagrion*, they possess at least one structural character that of itself is usually adequate to permit ready and certain specific determination. This is a pair of small pits, situated one on either side of the middorsal carina on the mesepisterna, first described by Williamson (1916:314) as *mesepisternal fossae* (Pls. XIII-XVI). Although varying widely in form and position in different species, their function is readily discernible, this being the reception, during mating, of the peculiar tuberculate structures already described as forming the dorsal terminations of the male superior appendages.

Other Structural Characters.—Early in the course of the study it became apparent that venational features, extensively employed in the classification of Odonata, could be of little service. In his comprehen-

sive treatment of venation in Zygoptera, Munz (1919) found it impossible to construct a functional key to the genera of Coenagrionidae employing only venational characters, although he was able to do this satisfactorily for other families. Kennedy (1920:27-28) has stated that "The current confusion in the classification (of Coenagrionidae) is due to . . . the attempt to show phylogeny by venation which is hopeless because of the numerous convergences." In discussing a remarkable new coenagrionid genus from South America, which appeared to be closely related to both the *Argia* and the *Acanthagrion-Enallagma* Series, Williamson and Williamson (1924:5) stated: ". . . this study has greatly disturbed our faith in the value of venational characters for phylogenetic analysis in the Coenagrionidae."

When the writer prepared tables of venational features for the various species of *Acanthagrion*, he found that they presented a jumbled picture from which little if any information could be extracted. In consequence, scant emphasis is placed upon venation in the ensuing pages.

Careful examination of legs has shown that no specific characters are presented by them. Aside from minor differences of size and robustness they vary scarcely at all throughout the genus, the only known exceptions being the two members of the Rubrifrons Group, in which the tooth of the tarsal claw is longer than in other Groups.

The profile of the facial sclerites, while proven to be of value in a few coenagrionine genera, has not been found to be significant specifically in *Acanthagrion*.

As has been previously indicated, coloration has been found to be of little use as a diagnostic character. The color pattern of the head appears to be a good character for separation of the Rubrifrons Group, and the shape of the dorsal spot of abdominal segment 2 has proven to be of specific value in two species of the Viridescens Group. With the exception of these cases, coloration does not appear to be of much importance taxonomically.

Size and degree of robustness may be found to be of significance at some future date. In the present study, a few instances have been encountered in which a figure expressing the ratio obtained by dividing the length of the hind wing by the length of the abdomen has added corroborative evidence to separations based upon other characters. Statistical analyses of such measurements cannot assume significance until material is present in quantity from localities as yet unrepresented in collections.

DISTRIBUTION

(Pls. XVII-XIX)

The known range of the genus *Acanthagrion* extends over the neotropical region from Nuevo Leon in Mexico to Buenos Aires in

Argentina. Species have been taken over most of the intervening region, in habitats ranging from marshes and swamps near sea-level to pools in mountain torrents at an elevation of over 6,000 feet. Although little is known of the ecology of any of the species, such field observations as have been recorded indicate that Acanthagrions prefer areas of sluggish or stagnant water, and thus may be taken around lakes, ponds, sloughs, or slowly moving streams.

In attempting to arrive at explanations for the distributional picture presented by the species of *Acanthagrion* it is necessary, first of all, to recognize the possible sources of error introduced by lack of collections from many parts of the South American continent. Undoubtedly the known range of many species will be extended when collections are made in what are now little known regions of Matto Grosso, and in the inland of Venezuela and the Guianas.

One of the features which may be noted as common in the case of a number of species is the discontinuous nature of their distribution. A striking example is *Acanthagrion apicale*, which is known from the Upper Marañon River in Peru, from both British and Dutch Guiana, and from Pará, and the headwaters of both the Madeira and Paraguay rivers in Brazil (Pl. XVIII). Several species which have been taken near the coast in Venezuela appear again in southeastern Brazil, with no records for any of the vast intervening area. Another general pattern of distribution is displayed by the Ablutum, Yungarum, and Viridescens Groups, which seem to center in the foothills of the Andes and occasionally work down into the adjoining lowlands (Pls. XVII, XIX). The Ascendens Group, except for *ascendens* itself, appears to be the most closely knit in distribution, extending, with few extensive gaps, from northern Mexico through Central America and northern South America to Belém, in the State of Pará (Pl. XVIII). It would appear that there are four rather distinct types of distributional patterns in *Acanthagrion*:

1. The widespread type of local occurrence, exemplified best by *apicale* and *ascendens*.

2. The widespread, highly discontinuous type, well illustrated by *temporale*, *truncatum* and *abunae*.

3. The montane type, represented by such species as make up the Ablutum, Yungarum and Viridescens Groups, which range from the mountainous regions of Colombia through Ecuador, Peru and Bolivia, and continue southeastward across Paraguay into southeastern Brazil.

4. The continuous type, represented by various species of the Rubrifrons and Ascendens Groups, in which each species appears to be of rather common occurrence, but through restricted regions, never widespread (Pls. XVII, XIX).

RECOGNITION AND DISPOSITION OF SPECIES AND INTRAGENERIC GROUPS

Earlier students of *Acanthagrion*, notably Selys and Calvert, being able to confront only a small proportion of the species now known to exist, were able to recognize only two intrageneric groups. In this matter, Calvert (1909) followed quite closely the earlier arrangement proposed by Selys (1876). The latter author separated the genus into two major sections, of which only the first included species now placed in *Acanthagrion*. The species of the second group were removed by Kennedy (1920:87) to other genera. Selys' first section, comprising *Acanthagrion s.s.*, was divided by him into two groups, Apicale and Gracile, separated on the degree of elevation exhibited by abdominal segment 10 in the males.

In the course of the present study, there soon became apparent a strong degree of resemblance in structure of the penis and male appendages of many species. After many specimens of all the known species had been examined, it was seen that these resemblances were based upon diverse modifications of eight fundamental patterns of penial structure (the types of species making up the Chararum Group were not available, and their penial modifications cannot be conjectured). So striking were the degrees of similarity within the range of each of these eight types that they led to the conclusion that, contrary to the statement of Kennedy (1916:329), penial characters could be of utility not only in the separation of species, but in the recognition of intrageneric groups as well.

When other characters believed to be of value were reviewed, such as the male appendages, the mesepisternal fossae of the females, and the stature of the insects, it was observed that in six of the eight groups there appeared a range of modification which paralleled quite closely that seen to exist in the penes. These modifications take the form of a progressive increase in size and in elevation of abdominal segment 10 in the males. The simplest and most generalized form of penis was found to be associated with the smallest insect and the one in which there existed the least disparity between the elevation of the tenth segment and those immediately preceding it.

In the Rubrifrons and Abunae Groups, penial modification was found to be attended by very little difference in the structure of the tenth segment, this being little if at all elevated in any of the species. The differences in penis structure among the species making up each of these groups are not great. The size range is rather narrow. This near approach to uniformity is here considered as indicating a very close degree of mutual interrelationship between the species making up each of these groups.

The morphological similarities upon which these proposed groupings

are based can be shown more readily by figures than by description. The accompanying plates should be consulted whenever there is doubt as to the sort of structure referred to in the text.

On the basis of such data as have been secured, it is quite difficult to determine the natural position of the nine recognized groups within the genus. A given group frequently appears to display rather close relationships with several other groups, and no attempt to arrange a linear succession has proven wholly satisfactory.

ABSENCE OF INTERGRADATION

One of the most surprising features which has been found to run throughout the genus *Acanthagrion* is the complete absence of intergradation between closely related species. In none of the species studied has any approach to a similar but distinct species been noted. The limits of variation possessed by many of the characters are so narrow as to be practically nonexistent. For example, examination of the form of penis and male appendages has been carried through series of several hundred specimens, from widely separated localities, without revealing any detectable variation from the normal pattern which could not be explained by post-mortem deformations, brought about by pinching or twisting of a specimen during the process of drying. In some cases, a slight variation in body measurements may be detected, as evidenced by minor changes in the figure expressing a ratio determined by dividing the length of the hind wing by the length of the abdomen. But in no case is there reason for supposing this to be due to differences in genetic composition, since it always lies well within the limits of individual variation.

Several alternatives may be hypothesized as explanations of this condition. One is the great age of the Odonata. Although the fossil record has yielded dragonflies most sparingly, it is known that the horizon of the Coenagrionidae extends as far back as the Miocene. Scudder (1892) has described a fossil from the Florissant shales under the name of *Trichoonemis aliena* which bears marked resemblances to the modern genus *Argia*, a member of the same family as *Acanthagrion*. Thus it is within the realm of possibility that the genus *Acanthagrion* may have been recognizably differentiated from its ancestral stock as early as the Miocene.

Although knowledge of the geological history of the South American continent is small, there have been, undoubtedly, marked changes of topography and climate since *Acanthagrion* came into existence. In the case of a group of such antiquity, it is not illogical to assume that the species as existing at present have been, in the majority of cases, differentiated so long ago that intermediate forms have dropped out.

Such an hypothesis might account, not only for the absence of intermediates between species, but for the lack of species to link closely the various intrageneric groups.

Considering the fact already stressed, namely, that many portions of the Neotropical Region have never been worked by collectors, it might be thought that this would explain the absence of intergrading forms. However, it has been observed in this study that individuals of widespread species, such as *ascendens*, *apicale*, or *abunae*, appear as closely knit and free from variation as do compact, restricted species such as *quadratum*. Specimens of *ascendens* from southeastern Brazil are indistinguishable from those taken in Venezuela, and individuals of *apicale* from British Guiana seem not to differ from specimens taken in northern Peru.

There exists the possibility that intergrades between closely related species do occur in *Acanthagrion* but that the intergrading characters are of a physiological nature and do not manifest themselves in morphological characters detected during this work.

Little is known of the ecology and physiology of any of the species of *Acanthagrion*. Such field notes as have been seen by me, especially those taken by E. B. and J. H. Williamson on their various expeditions, indicate strongly that this genus tends, in many ways, to replace the holarctic genus *Enallagma* in the neotropical region. Many North American species of *Enallagma* deserve to be called cosmopolitan, and do not appear to be highly specific in their habitat requirements. Many more species, however, do appear to manifest rather narrow preferences, and are quite local in their distribution. It has been observed by many collectors that members of a group of related species inhabiting the same waters, even the same ecological niche, are oftentimes separated by such barriers as different dates of adult emergence, different periods of activity (for example, strictly diurnal or strictly crepuscular), or different manners and levels of flight. It is quite possible that barriers of this nature aid in preserving the sharp identity of the species of *Acanthagrion*.

Information as to what conditions do serve most effectively as barriers to odonate distribution is scant. One of the most interesting instances of wide separation of evidently closely related forms is offered by *Acanthagrion abunae*, known from Paraguay, the Madeira River near the Bolivian frontier, and the Essequibo River in British Guiana. In Panama there occurs a species, *inexpectum*, which resembles *abunae* so closely that for some time they were confused. Surely these two species, at some period of their history, must have been differentiated from a common ancestor. The most obvious means of accounting for their present wide separation, unbridged by intermediate forms, are to suppose either that a once widely ranging and continuous population has been wiped out except at the extremes, or

that an incident of accidental dispersal resulted in the establishment of a small stock in an isolated situation, where contact with the native stock was impossible and subsequent mutational changes could not be absorbed.

The mutually adaptive structural modifications displayed by males and females of *Acanthagrion*, especially the close correspondence in structure of male superior appendages and female mesepisternal fossae, very strongly suggest the existence of a sort of "lock-and-key" relationship between the sexes. It has been seen that the shape and position of the mesepisternal fossae are very closely adjusted to the form and size of the male superior appendages, whose dorsal tubercle is received by the fossae during copulation. Many teneral females have been examined, and in all of these the fossae appear to be as deeply impressed as in fully mature examples. There exists a measure of likelihood that the rigidity of these structures might serve as a means of preserving specific identity through prevention of copulation between males and females of slightly varying structural and genetic composition. The wide range of penial modifications also suggests such a situation, although the genital sinus of the female *Acanthagrion* is largely membranous, and offers little concrete evidence in support of this view.

Whatever the true explanation may be, it appears certain that the genetic composition of each of the known species of *Acanthagrion* is quite stable. The clear-cut characters of the various species, the very narrow range of intraspecific variation, and the apparent absence of intergrading forms point definitely to such a conclusion.

SYSTEMATIC SECTION

As considered in this study, the genus *Acanthagrion* comprises 31 species of which 14 are here described as new. The removal of four species to *Cyanallagma* by Kennedy (1920:87) has already been mentioned.

A number of species described by Selys, Calvert, and Ris do not fit within the limits of *Acanthagrion* as stated herein. While these species must receive careful study before their relationships can be correctly determined, all agree well with the characterization of *Cyanallagma* stated by Kennedy (*ibid.*) as follows: "Characters as in *Acanthagrion*, except the male superior appendages are not decurved from the base and are usually forked." In consequence the following species, not falling within the limits of *Acanthagrion*, are assigned provisionally to *Cyanallagma*: *nigrinuchale* and *trimaculatum* (Selys, 1876); *chirihuanum* (Calvert, 1909); *ambiguum* Ris (1904); and *lindneri* Ris (1928).

Of these species, *ambiguum*, *chirihuanum* and *lindneri* differ from

Acanthagrion in possession of an internal penis fold, in addition to the characters mentioned by Kennedy. The remaining two species, *nigrinuchale* and *trimaculatum*, have not been recorded since their description, and I am unable to confront them in the material at my disposal.

Separate keys have been prepared for the determination of males and females. The key to males has been based chiefly upon the structural characters displayed by the penis and superior appendages, and an attempt has been made to preserve natural order throughout. While this is believed to have been successful, in the main, as regards disposition of species within the various groups, the natural position of the groups themselves cannot be definitely stated. In consequence, the occurrence of a group near the end of the key does not necessarily signify possession, by members of that group, of a higher degree of specialization than that found in groups keying out before it. Adequate appraisal of the phylogenetic position of the various species groups must await the existence of more complete collections and the accumulation of more adequate ecological data.

The key to females has been based, to a very great extent, upon characters displayed by the mesepisternal fossae and mesostigmal lamina. These are the only female structures which have been found to be specific and unvarying throughout the genus. Through dependence on a restricted number of characters, it has not proven practicable to maintain the natural order throughout, and in consequence the key to females must be considered as somewhat artificial. Females are not yet known for several of the species. Their discovery may throw new light upon relationships. In Calvert's description of *latapistylum* (1899: 26-28), he makes no mention of the form of either mesepisternal fossae or mesostigmal lamina. It has, therefore, been impossible to include this species in the key to females.

KEY TO THE SPECIES OF ACANTHAGRION

Males

- | | |
|------|--|
| 1 | Tibial spines equal to or shorter than spaces separating them; distal penis segment usually complex, bearing folds, hooks, or membranous lobes
..... 2 |
| 1' | Tibial spines longer than spaces separating them; distal penis segment simple, flap-like, segment 2 fringed with setae (Figs. 1-4)
..... (Rubrifrons Group) 9 |
| 2(1) | Ental surface of distal penis segment variously modified, but not armed with long, curved, sclerotized hooks; height of abdominal segment 10 variable 3 |
| 2' | Ental surface of distal penis segment bearing a pair of long, curved, sclerotized hooks (Figs. 4-14); abdominal segment 10 little if any higher than 9 in profile (Figs. 59-60, 69-71) (Abunae Group) 10 |

3(2)	Dorsum of abdominal segment 10 variously modified, but not produced to form a pair of posteriorly directed cornuate projections	4
3'	Dorsum of abdominal segment 10 produced to form two posteriorly-directed horns (Figs. 82-84); distal penis segment armed apically with a pair of heavy, short, sclerotized hooks, or, segment 2 armed with setae (Figs. 19-24) (Apicale Group)	14
4(3)	Postocular spots distinct; distal penis segment not strongly convex in profile (e.g. Figs. 26, 38, 42, and 54)	5
4'	Postocular spots obsolescent or entirely wanting; distal penis segment strongly convex, semicircular in profile (Figs. 16 and 17) (Ablutum Group)	16
5(4)	Distal penis segment variously modified, specialized structures developed from mid length to apex	6
5'	Distal penis segment simple, flap-like; specialized structures, when present, located basally, near junction with segment 2 (Figs. 25-30) (Yungarum Group)	17
6(5)	Abdominal segment 10 little if any higher than 9 in profile, or, if higher, inner face of superior appendages differing in color and surface texture from outer face	7
6'	Abdominal segment 10 much higher than 9 in profile; superior appendages uniform in color and surface texture (Figs. 96, 105-107) (Ascendens Group)	19
7(6)	Color and surface texture of superior appendages uniform; modifications of ental surface of distal penis segment not clearly visible in ventral aspect (Figs. 51, 53, and 55)	8
7'	Inner surface of superior appendages lighter in color and duller in surface texture than outer surface, the line of separation marked by a deeply-impressed groove (as in Figs. 116, 122, et. al.); modifications of distal penis segment visible in ventral aspect (Figs. 41, 43, et al.) (Viridescens Group)	22
8(7)	Superior appendages slanting toward inferiors from base to apex (Figs. 130-132); tips rounded or spatulate, never acutely pointed; distal penis segment incised apically (Figs. 51, 53, and 55) . (Adustum Group)	27
8'	Superior abdominal appendages directed posteriorly, not slanting strongly toward inferiors; tips of acutely pointed or bearing a small, angulate, apical tubercle ¹ (Chararum Group)	29
9(1')	Light ground color of body yellow or orange; distal penis segment much expanded through apical half, slightly constricted basally, near junction with segment 2 (Figs. 1-2); posterior margin of superior appendages nearly straight in profile (Fig. 57) <i>rubrifrons</i> n. sp., p. 25	
9'	Light ground color of body blue or green; distal penis segment expanded apically and subbasally, constricted mesally; posterior margin of superior appendages somewhat sinuate in profile (Fig. 58) <i>longispinosum</i> n. sp., p. 29	
10(2')	Penis segment 2 as wide as or wider than greatest length of distal segment; ental hooks of distal segment heavily sclerotized (Figs. 7-14)	11
10'	Distal penis segment considerably longer than greatest width of second segment; ental hooks of distal segment lightly sclerotized; (Figs. 5-6) <i>jessei</i> n. sp., p. 32	

¹ Separation of the Chararum Group and the three species which it comprises is based upon the original descriptions and figures of Calvert (1899, 1909). The form assumed by the penis in these species cannot be conjectured.

- 11(10) Terminal expansion of distal penis segment about one-third width of corresponding sclerotized portion of segment 2; superior appendages widest at apex 12
- 11' Terminal half of distal penis segment expanded sufficiently to cover corresponding portion of segment 2 in ventral aspect (Fig. 7); superior appendages constricted subapically (Fig. 60) *temporale* Selys, p. 35
- 12(11) Sclerotized hooks of ental surface of distal penis segment arising nearer to apex than to base; outline of inflated tip of distal segment triangular or pentagonal in ventral aspect (Figs. 11 and 13); a fenestrate marking on either side of segment 2 near apex 13
- 12' Sclerotized hooks of ental surface of distal penis segment arising nearer to base than to apex (Fig. 10); outline of tip of distal segment smoothly elliptical in ventral aspect (Fig. 9); apex of superior appendages shallowly indented (Fig. 73) *abunae* n. sp., p. 37
- 13(12) Length of distal penis segment approximately equal to greatest width of segment 2 (Fig. 11); dorsal tubercle of superior appendages low, not visible in profile *inexpectum* n. sp., p. 41
- 13' Length of distal penis segment less than greatest width of segment 2 (Fig. 13); dorsal tubercle of superior appendages well developed, plainly visible in profile (Fig. 71) *amazonicum* Sjöstedt, p. 44
- 14(3') Penis segment 2 simple, devoid of setae; a short, heavy, sclerotized hook on either side of distal penis segment near tip (Figs. 22 and 24); dorsal horns of abdominal segment 10 sharply pointed (Figs. 83-84) 15
- 14' Penis segment 2 bearing a dense patch of setae on either side of mid line; no sclerotized hooks near tip of distal penis segment (Figs. 19-20); dorsal horns of abdominal segment 10 rounded, not acute (Figs. 82 and 87) *phallicornis* n. sp., p. 53
- 15(14) Lateral lobes produced from distal penis segment suddenly inflated at apex (Figs. 21-22); superior appendages convex in lateral aspect except at extreme distal end, only their posterior ends approaching inferiors (Fig. 83) *obsoletum* (Förster), p. 56
- 15' Lateral lobes produced from distal penis segment of approximately uniform diameter throughout (Figs. 23-24); superior appendages concave in profile, their apical half appressed against inferiors (Fig. 84) *apicale* Selys, p. 61
- 16(4') Ental surface of distal penis segment unmodified (Figs. 15-16); indications of postocular spots present, although margins often diffuse; light areas of metapleurite blue or green *ablutum* Calvert, p. 48
- 16' Ental surface of distal penis segment bearing a short, transverse, double fold near base (Figs. 17-18); postocular spots entirely absent; light areas of metapleurite cherry red to purple *hermosae* n. sp., p. 51
- 17(5') Dorsal extremities of superior appendages visible in profile (Figs. 93-94); apex of distal penis segment wider than mesal region (Figs. 25 and 27) 18
- 17' Dorsal extremities of superior appendages concealed by apex of abdominal segment 10 in profile (Fig. 95); distal penis segment widest mesally, tip bluntly rounded (Figs. 29-30) *williamsoni* n. sp., p. 66
- 18(17) Basal portions of superior appendages extending dorsad to dorsal margin of abdominal segment 10 (Fig. 74); base of distal penis segment bearing a double transverse fold on ental surface (Fig. 27) *risi* n. sp., p. 69
- 18' Basal portions of superior appendages not extending dorsad to margin of abdominal segment 10 (Fig. 93); ental surface of distal penis segment

- bearing a pair of lightly sclerotized rods, their apices bluntly notched, almost touching segment 2 (Fig. 25) *yungarum* Ris, p. 73
- 19(6') Modifications of distal penis segment, mesal or apical, extending laterad beyond margins of segment 2 in ventral aspect (Figs. 31, 33, 35, et al.) 20
- 19' Distal penis segment narrow basomesally, apically expanded to about twice its mesal width but not extending to margins of segment 2 (Fig. 31) *kennedii* Williamson, p. 78
- 20(19) Prominent lateral lobes produced from distal penis segment between middle and base; dorsum of abdominal segment 10 much elevated and constricted (Figs. 105-107) 21
- 20' Apex of distal penis segment greatly expanded, twice as wide as the portion of segment 2 which it overlies, lateral lobes not attaining margins of segment 2 (Fig. 33); dorsum of abdominal segment 10 moderately elevated, not constricted (Fig. 105) *quadratum* Selys, p. 81
- 21(20) Lateral lobes of distal penis segment gradually expanded from base to apex, curved cephalad, extending to or slightly beyond level of distal segment tip (Fig. 35); superior appendages almost plane in profile (Fig. 106) *trilobatum* n. sp., p. 85
- 21' Lateral lobes of distal penis segment recurved caudad, narrower at apex than at base; segment 2 bearing a pair of subapical and subbasal patches of setae (Figs. 37-38). *ascendens* Calvert, p. 90
- 22(7') Distal penis segment broad, almost uniform in width throughout, but slightly expanded at extreme tip² (Fig. 38); abdominal segment 10 only a trifle higher than 9; superior appendages strongly constricted subbasally and subapically; inferiors sharply recurved at tip 23
- 22' Distal penis segment rather narrow basomesally, slightly expanded at apex, membranous lateral lobes produced from either side of mesal region; abdominal segment 10 definitely higher than 9 in profile; superior appendages either subplanate or concave in profile 25
- 23(22) Terminal expansion of distal penis segment most noticeable in ventral aspect; transverse double fold of ental surface exceeding lateral margins of distal segment, appearing as hollow, rounded lobes visible in ventral aspect (Figs. 41 and 43); superior appendages squarely terminated apically (Figs. 121 and 123) 24
- 23' Terminal expansion of distal penis segment most noticeable in lateral aspect; transverse double fold of ental surface not attaining lateral margins of distal segment (Figs. 39-40); posterior aspect of superior appendages rounded at tip (Fig. 115) *truncatum* Selys, p. 95
- 24(23) Hollow lateral lobes of distal penis segment barely visible from below (Fig. 41); terminal expansion slight, remainder of distal segment uniform in width; tubercle at dorsal end of superior appendages prominent (Fig. 117) *viridescens* n. sp., p. 98
- 24' Hollow lateral lobes of distal penis segment plainly visible from below, overlapping lateral margins of segment 2 (Fig. 43); dorsal tubercle of superiors weakly developed *lancea* Selys, p. 102
- 25(22') Lateral lobes of distal penis segment extending beyond lateral margins of segment 2, directed laterad and cephalad (Figs. 47 and 49) 26
- 25' Lateral lobes of distal penis segment short, simple, directed dorsad rather than to the side (Fig. 46) *gracile* (Rambur), p. 106

² In *truncatum* the terminal expansion is best seen from the side.

- 26(25) Posterior border of superior appendages nearly straight in profile, their basal extremities directed dorsad to level of apex of abdominal segment 10 (Fig. 120); lateral lobes of distal penis segment bearing a pair of short, heavy, sclerotized hooks on caudal border on either side of mid line (Figs. 47-48) *deceptum* n. sp., p. 110
- 26' Posterior border of superior appendages concave in profile, basal extremities not reaching apical margin of abdominal segment 10 (Fig. 129); lateral lobes of distal penis segment long, simple, tapering (Figs. 49-50) *peruvianum* n. sp., p. 114
- 27(8) Ental surface of distal penis segment bearing a membranous, pointed, median lobe about half way from base to apex; superior appendages variously modified but not roundly terminate 28
- 27' Ental surface of distal penis segment bearing a rounded, transverse ridge about one-third distance from base to apex (Figs. 51-52); distal ends of superior appendages rounded in posterior aspect (Fig. 135) *minutum* n. sp., p. 119
- 28(27) Apical end of distal penis segment shallowly indented on median line (Fig. 53); superior appendages apically produced into flattened plates visible in dorsal and end views (Figs. 131 and 137) *adustum* Williamson, p. 122
- 28' Apical end of distal penis segment deeply excavated on median line; terminal expansion of distal segment bifurcate on either side; superior appendages not flattened, tips strongly divaricate (Figs. 132 and 139-140) *indefensum* Williamson, p. 125
- 29(8') Superior appendages much longer than inferiors, directed posteriorly, tips moderately inclined upward 30
- 29' Superior appendages little if any longer than inferiors; apex of superiors terminating in a small, angulate tubercle . . . *latapistylum* Calvert, p. 129
- 30(29) Superior appendages bent upward apically, forming an obtuse angle at mid length, the tips blunt *chararum* Calvert, p. 130
- 30' Superior appendages gradually tapering to an acute point in profile view, tips bent upward very slightly *chacoense* Calvert, p. 132

Females

- 1 Tibial spines shorter than spaces separating them 2
- 1' Tibial spines definitely longer than spaces separating them (Rubrifrons Group) 7
- 2(1) Mesostigmal laminae variously sculptured, but strongly emarginate along entire anterior border (e.g. Figs. 149-150, 154, 156, 161, and 163) . 3
- 2' Mesostigmal laminae diagonally traversed by a strong fold (Figs. 144-146); subtriangular area between this and admesal borders of lamina subplanate (Abunae Group) 8
- 3(2) Portion of middorsal carina separating mesepisternal fossae elevated or not, if elevated always narrow 4
- 3' Portion of middorsal carina separating mesepisternal fossae always much elevated, forming a broad-topped tubercle (e.g. Fig. 149) (Apicale Group) 11
- 4(3) Posterolateral boundaries of interlaminal sinus represented by a narrowly impressed suture (e.g. Figs. 151, 156, 161) 5
- 4' Posterolateral boundaries of interlaminal sinus represented by a sharply

- defined ridge, the dorsal surface plane (Fig. 150)
 (Ablutum Group)³ *ablutum* Calvert, p. 49
- 5(4) Interlaminal sinus concave, V-shaped in cross section; fossae separated from posterior end of sinus by less than their own length or, if by more than this distance, their long axis transverse to middorsal carina (e.g. Figs. 156 and 161) 6
- 5' Interlaminal sinus subplanate, median line a narrowly impressed groove; if distinctly concave, then fossae separated from posterior end of sinus by more than their own length, their long axis parallel to middorsal carina; fossae never confluent (Figs. 151-154) (Ascendens Group) 13
- 6(5) Mesepisternal fossae either confluent or separated by more than their own width (Figs. 161-162) (Yungarum Group) 16
- 6' Mesepisternal fossae immediately adjoining interlaminal sinus or, if separated from it, their long axis transverse to middorsal carina (Figs. 156-160). (Viridescens Group) 17
- 7(1') Outer border of mesepisternal fossae poorly defined; posterolateral boundaries of interlaminal sinus straight; mesostigmal laminae depressed mesally, elevated peripherally; (Fig. 141) *rubrifrons* n. sp., p. 27
- 7' Outer border of mesepisternal fossae distinct; posterolateral boundaries of interlaminal sinus strongly sinuate; mesostigmal laminae subplanate except for admesal ridge along posterior margin; (Fig. 142)
 *longispinosum* n. sp., p. 30
- 8(2') Mesepisternal fossae separated on mid line, elliptical in shape (Figs. 144-146) 9
- 8' Mesepisternal fossae heart-shaped, broadly confluent posteriorly, separated anteriorly by a low, thin septum (Fig. 143) *jessei* n. sp., p. 34
- 9(8) Pointed end of mesepisternal fossae directed mesad, periphery distinctly impressed (Figs. 145-146) 10
- 9' Pointed end of mesepisternal fossae directed laterad, margin at this point indistinct, merging with mesepisternal surface (Fig. 144)
 *temporale* Selys, p. 36
- 10(9) Mesepisternal fossae encroaching on interlaminal sinus; pointed end of fossae directed cephalad (Fig. 145) *abunae* n. sp., p. 39
- 10' Interlaminal sinus entire, fossae adjoining but distinct from its posterior end; pointed end of fossae directed caudad (Fig. 146)
 *amazonicum* Sjöstedt, p. 45
- 11(3') Mesostigmal laminae subplanate except for anteromesal ridge; mesepisternal tubercle inclined cephalad 12
- 11' Mesostigmal laminae impressed mesally, elevated peripherally; mesepisternal tubercle erect (Fig. 147) *phallicornis* n. sp., p. 54
- 12(11) Mesepisternal tubercle separated from anterior border of interlaminal sinus by a distance much less than combined width of sinus and mesostigmal lamina; tubercle glabrous dorsally; posterolateral margins of sinus convex (Fig. 148) *obsoletum* (Förster), p. 58
- 12' Mesepisternal tubercle separated from anterior border of interlaminal sinus by a distance much greater than combined width of sinus and mesostigmal laminae; tubercle deeply impressed along middorsal line; posterolateral margins of sinus concave (Fig. 149)
 *apicale* Selys, p. 63

³ Discovery of the female of *hermosae* may necessitate revision of this rubric.

- 13(5') Mesepisternal fossae separated from posterior end of interlaminal sinus by less than their own length; sinus subplanate (Figs. 151-152) 14
- 13' Mesepisternal fossae separated from posterior end of interlaminal sinus by more than their own length; sinus deeply concave (Figs. 153-154) 15
- 14(13) Posterolateral margins of interlaminal sinus concave; sinus approximately same width as each mesostigmal lamina (Fig. 151)
. *kennedii* Williamson, p. 79
- 14' Posterolateral margins of interlaminal sinus convex; sinus much narrower than each mesostigmal lamina (Fig. 152) *quadratum* Selys, p. 83
- 15(13') Middorsal carina obliterated between mesepisternal fossae and posterior end of interlaminal sinus; fossae separated from sinus by a trifle more than their own length (Fig. 153) *trilobatum* n. sp., p. 87
- 15' Middorsal carina persistent between mesepisternal fossae and posterior end of interlaminal sinus; fossae separated from sinus by more than twice their own length (Fig. 154). *ascendens* Calvert, p. 91
- 16(6) Mesepisternal fossae separated from each other by a distance greater than the width of either fossa; posterolateral boundaries of interlaminal sinus straight (Fig. 162). *risi* n. sp., p. 70
- 16' Mesepisternal fossae partially confluent, separated only by a low thin septum, their long axis parallel to middorsal carina; posterolateral boundaries of interlaminal sinus sinuate (Fig. 161) *yungarum* Ris, p. 75
- 17(6') Mesepisternal fossae rounded or elliptical 18
- 17' Mesepisternal fossae much longer than wide, slightly divaricate cephalad (Fig. 155) *truncatum* Selys, p. 96
- 18(17) Interlaminal sinus entire, posterolateral margins convex or sinuate (Figs. 157-160 and 163) 19
- 18' Mesepisternal fossae encroaching strongly on interlaminal sinus; posterolateral margins of sinus sharply concave (Fig. 156)
. *viridescens* n. sp., p. 100
- 19(18) Mesepisternal fossae separated from anterior margin of interlaminal sinus by over twice the greatest length of one mesostigmal lamina (Figs. 158-160 and 163) 20
- 19' Mesepisternal fossae separated from anterior margin of interlaminal sinus by a distance about equal to the greatest length of one mesostigmal lamina; posterolateral margins of sinus smoothly convex (Fig. 157)
. *lancea* Selys, p. 104
- 20(19) Mesepisternal fossae adjoining or encroaching on posterior end of interlaminal sinus (Figs. 158 and 163) 21
- 20' Mesepisternal fossae separated from posterior end of interlaminal sinus by a distance equal to or greater than their width; fossae either widely separated or confluent (Figs. 159-160) 22
- 21(20) Mesepisternal fossae encroaching on interlaminal sinus; mesostigmal laminae subplanate except for the admesal ridge (Fig. 163)
. *adustum* Williamson⁴, p. 124
- 21' Mesepisternal fossae adjoining but not encroaching on interlaminal sinus; each mesostigmal lamina bordered anteriorly and mesally by an elevated ridge (Fig. 158) *gracile* Rambur, p. 108
- 22(20') Mesepisternal fossae widely separated, their lateral margins indistinct (Fig. 159) *peruvianum* n. sp., p. 116

⁴ In this key, *adustum* runs out in the Viridescens Group. A more natural disposition may be possible when the females of *indefensum* and *minutum* are discovered.

- 22' Mesepisternal fossae subconfluent, separated only by a low, thin, septum; long axis of fossae transverse to middorsal carina; margins distinct throughout (Fig. 160) *deceptum* n. sp., p. 112

RUBRIFRONS GROUP

The two species composing this group are exceedingly close to each other, although separable by the characters mentioned in the key. Their morphological similarity is greater than that encountered in any of the other groups of the genus. Their distribution makes it appear very probable that *rubrifrons* and *longispinosum* have been derived from a common stock at some time occurring widely throughout the Amazon basin, a stock which has since split up, through operation of ecological or physiological barriers.

There are some grounds for believing that the erection of a separate genus for these species would be justifiable. One noteworthy example of an un-*Acanthagrion*-like character is the length of the tibial spines, these structures being considerably longer than the spaces separating their bases, as in the genus *Argia*. The spine occurring on the apex of the eighth abdominal sternite in all other known *Acanthagrion* females is represented in females of the Rubrifrons Group by an almost obsolete tubercle. The odd color pattern of the head in both sexes has not been encountered elsewhere in the genus. The abdominal appendages of the males, however, are of the typical *Acanthagrion* pattern. Well-defined mesepisternal fossae are present in the females. The venational features fit within the limits of the present genus; and it is considered that, on the whole, it would be imprudent to erect a new genus for this group, at least until larger amounts of material are available for study. Let it be sufficient at this time to state that the Rubrifrons Group appears to be the group least typical of the genus *Acanthagrion*.

Acanthagrion rubrifrons, new species

(Pl. I, Figs. 1-2; Pl. VI, Figs. 57, 61-62; Pl. XIII, Fig. 141)

Holotype: Male, Belém, Brazil, Aug. 7, 1922; allotype a female from same locality, Aug. 8, 1922, both by J. H. Williamson and J. W. Strohm.

Holotype Male.—Labrum, exposed portions of mandibles, and lower region of genae orange, labrum with lateral border darker and basomesal impression black; anteclypeus orange, but somewhat duller than labrum; upper parts of genae darker orange, extending to level of base of second antennal segment; postclypeus orange, slightly darker than labrum, a small, rounded black spot on either side of dorsum; anterior

face of frons adjoining clypeofrontal suture marked with black in form of very low triangle, the points directed dorsad; remainder of frons to level of second antennal segment base reddish orange, laterally confluent with orange of genae, covering anterior face of basal antennal segment, and washing anterior face of second; remainder of antennae black; compound eyes, at level of second antennal segment, connected by a black band about as wide as length of second antennal segment, slightly wider between antenna and ocelli but constricted just lateral to median ocellus, then produced to narrowly enclose ocelli; this black band bounded caudad by a reddish orange band of similar width extending from compound eyes to black ocellary border; each lateral ocellus adjoined anteriorly by a small, triangular, reddish orange spot; postocular spots reddish orange, egg-shaped, each slightly smaller than area occupied by ocelli; remainder of head dorsum black; entire rear of head black; labium and exposed portions of maxillae light tan.

Anterior lobe of prothorax yellowish; middle lobe of pronotum black, a large, subtriangular, obscure orange spot on lateral convexity, two dash-like orange marks on either side of mid line, black briefly encroaching on either side of anterior lobe; hind lobe largely obscure orange, black of middle lobe encroaching slightly on mid line; proepisternum and proepimeron black along upper border, remainder obscure greenish tan; prosternum brown, a black spot between fore coxae.

Mesostigmal laminae black mesally, distal third to half of each washed with yellow; middorsal carina black, this color extending narrowly onto mesepisternum, covering about one-sixth width of this sclerite except at posterior end, where it doubles in width; extending directly cephalad from greatest width of this expansion is a dark brown area which would probably be entirely black in an old specimen; antecalar plates orange, keels black; antehumeral stripe orange, through posterior three-fifths occupying about one-third width of mesepisternum, gradually widened anteriorly to join mesinfraepisternal suture; humeral stripe obscure brown, very broadly convex dorsad, at widest point occupying about one-fourth width of mesepisternum; ventral border of humeral stripe diffuse, infuscation embracing almost entire expanse of mesepimeron; brown of humeral stripe intensified over an oval area bridging posterior sixth of suture, and again over anterior convexity of mesepimeron and over mesinfraepisternum, whose dorsal three-fourths it occupies; lateral alar ridge at level of mesepimeron black, this color extended along posterior eighth of first lateral suture as a narrow spur; remainder of lateral alar ridge yellowish green with heavy black anterior border; an infuscated, diffuse-margined band on metepisternum adjoining second lateral suture, darker brown astride posterior sixth of suture, extending from caudal end of suture almost to metastigma; extreme posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light

olive green, bearing irregular diffuse blotches of infuscation, these latter probably due to post-mortem changes; mesosternum, metasternum and intersternum pale yellowish green, practically no pruinescences.

Coxae, trochanters and inner face of femora pale yellowish green, irregularly infuscated; outer face of femora black; front tibiae almost entirely dark piceous to black, middle and hind tibiae predominantly so but lightly mottled and streaked with pale brown; tarsi and tarsal claws piceous to black; inferior tooth of tarsal claw one-half to two-thirds as long as claws; femoral and tibial spines black, longer than spaces separating them.

Dorsum and dorsal half of lateral aspect of abdomen predominantly black, this black giving off metallic green reflections; 1 with narrow apical ring and intersegmental membrane piceous to black, lower two-thirds of side light olive green; lower half of 2 olive green, hamules brown, penis (Figs. 1, 2) shaft and vesicle black, remainder, including intersegmental membrane piceous to black; 3-7 black dorsally and increasingly so laterally, upper half of lateral aspect of 3 black, all but narrow ventral border of 7 black; light portions of sides yellowish blue, infuscated on all but 3, 3-7 with narrow, middorsally interrupted blue ring at base; 7 blue between apical spine row and apex of tergite; 8 and 9 obscure blue with lower fourth of lateral aspect black; 10 black dorsally and laterally except for small blue dorsal spot, venter dark brown; ventral margins of tergites 1-5 yellowish blue, of 6-9 dark brown; sternites dark brown to piceous; superior and inferior appendages (Figs. 57, 61, 62) black.

Wings hyaline, slightly smoky, venation and pterostigma black; petiole extending beyond Ac juncture by about one-half length of Ac; arculus arising barely distal to second antenodal in fore wings, distal by a length equal to second antenodal in hind wings; postnodals $\frac{12}{12} \cdot \frac{10^5}{10}$; M_2 arising just proximal to fifth postnodal in fore wings, at fifth in hind wings; M_{1a} arising $\frac{8}{8} \cdot \frac{8}{8}$; poststigmatal cells $\frac{5}{4} \cdot \frac{5}{5}$.

Abdomen 23 mm; hind wing 14 mm.

Allotype Female.—Color pattern of head similar to that of ♂, but colors themselves different; labrum dark brown, anteclypeus light brown, postclypeus blue with small black spot on either side of mid line; genae yellowish below, light blue near upper end; anterior face of frons and basal antennal segment brownish, gradually merging laterally with blue of genae; remainder of head marked as in ♂, but orange color replaced by light blue; postgenae somewhat pruinose.

Prothorax as in ♂.

⁵ In the venational formulas employed in these descriptions, the first fraction represents the fore wings, the second the hind wings. In each case the numerator represents the right, the denominator the left wing.

Thorax as in ♂, but light colors entirely pale blue instead of orange; dorsal and lateral stripes complete, metallic brown in color; mesepisternal fossae (Fig. 141) small but distinct, located just back of interlaminal sinus.

Abdomen as in ♂ except 8 black, blue between apical spines and apex of tergite; 9 black basally, blue apically; 10 black dorsally, blue to brown laterally and basally; appendages piceous; valves of ovipositor brown; no spine on apex of eighth sternite.

Wings hyaline, venation black, pterostigma light brown; petiole not quite attaining to Ac juncture; postnodals $\frac{12}{12} \cdot \frac{10}{10}$; M_2 arising at fifth postnodal in front wings, between fourth and fifth in hind wings; poststigmatal cells $\frac{5}{4} \cdot \frac{5}{5}$.

Abdomen 22 mm; hind wing 15.5 mm.

Measurements and Venation.—The single paratypic male agrees exactly with the holotype in measurements. The measurements (in mm) of females, including the allotype, are as follows:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Tumatumari	23.0	22.0	21.0	15.5	15.2	14.5	0.69
Belém	23.0	21.6	21.0	16.0	15.3	15.0	0.70
Manáos	21.5	21.0	20.5	15.0	14.5	14.0	0.69

The number of postnodal crossveins in fore and hind wings is: Tumatumari, 13-11 (33 1/3%), 11-10 (33 1/3%), 11-9 (33 1/3%); Belém, 12-10 (91%), 12-11 (9%); Manáos, 12-10 (50%), 11-9 (50%). M_2 originating 5-4 in all specimens; M_{1a} originating 9-8 (93 3/4%), 10-9 (6 1/4%).

Discussion.—*A. rubrifrons* is closely related to *longispinosum*, but is separable at once by the explanate, flap-like distal penis segment, the strongly declivent, roundly terminated superior abdominal appendages of the male, the well-marked mesepisternal fossae and straight posterolateral borders of the interlaminal sinus in the female, and the reddish orange ground color of head and thorax of both sexes. The specific name refers to the reddish color of the frons.

Distribution (Pl. XVII).—*A. rubrifrons* is known from Manáos and Belém along the Amazon in Brazil, and from Tumatumari in British Guiana. It is quite possible that it ranges up some of the northern tributaries of the Amazon and so finds its way across the highlands into the Guianan streams.

Material Examined.—2 ♂, 16 ♀, including holotype and allotype, as follows: BRAZIL: Belém, 1922, August 3, 1 ♂; August 7, 1 ♂ (holotype), 4 ♀; August 8, 4 ♀ (including allotype); August 9, 1 ♀; August 14, 2 ♀; Manáos, 1922, June 16, 1 ♀; June 26, 1 ♀; all by J. H. Williamson and J. W. Strohm. BRITISH GUIANA: Tumatumari, 1912,

Feb. 7, 1 ♀; Feb. 12, 2 ♀; all by L. A. Williamson, E. B. Williamson, and B. J. Rainey.

Acanthagrion longispinosum, new species

(Pl. I, Figs. 3-4; Pl. VI, Figs. 58, 63-64; Pl. XVIII, Fig. 142)

Holotype: Male, Villa Murтинho, Brazil, April 7, 1922, by J. H. Williamson and J. W. Strohm; allotype a female with same data.

Holotype Male.—Labrum, exposed portions of mandibles, genae, ante- and postclypeus light blue, labrum brightest, with narrow lateral edging and basomesal impression dark brown; dorsum of postclypeus with small, impressed, brown spot on either side; light blue of genae extending to level of mid length of basal antennal segment but not touching antennae; anterior face of frons largely black, pale color of genae extended admesally a short distance above clypeofrontal suture but broadly separated by mesal black; a small, elongate-oval, light olive green spot on vertex just behind antennae; postocular spots same color, rounded, about one-third as large as area occupied by ocelli; remainder of dorsum, and rear of head black, labium and exposed portions of maxillae brownish.

Pronotum entirely black except for suboval yellowish blue spot on dorsum of anterior lobe; upper third of proepisternum and proepimeron black, remainder light olive green; prosternum brownish, a black spot, bordered with pruinescence, between fore coxae.

Mesostigmal laminae almost wholly black, extreme outer tips touched with light olive green; dorsum of mesepisternum, and antalar ridge black, this color occupying about one-half width of mesepisternum; antehumeral stripe light olive green, broadest anteriorly where it occupies remaining half of mesepisternum, gradually narrowing caudad to half original width, suddenly expanded ventrad at posterior end; humeral suture black, very broad, occupying part of mesepisternum not included by antehumeral, covering about three-fourths width of mesepimeron, and all but extreme posterolateral angle of mesinfraepisternum; lateral alar ridge dark piceous to black, this color produced along posterior sixth of first lateral suture as a spur whose extreme anterior tip is free, remainder fused with black of humeral stripe; second lateral suture covered by a piceous to black stripe from posterior end to metastigma, upper border broadly convex, at widest part covering about one-half width of metepisternum; lower border approximately parallel to suture, covering about one-fourth to one-fifth width of metepimeron; extreme posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light olive green with irregular blotches of infuscation; mesosternum, metasternum, and intersternum light greenish brown, slightly pruinescent.

Coxae and trochanters olive green, basal two-thirds of inner face of

femora pale olive green, remainder black; tibiae, tarsi, tarsal claws, and leg spines black; leg spines longer than spaces separating them; inferior tooth of tarsal claw two-thirds as long as superior.

Top and sides of abdomen largely black; dorsum and apical ring on 1 black, sides and intersegmental membrane olive green, this color narrowly produced dorsad subapically; dorsum and upper three-fifths of lateral aspect of 2 black, remainder of side olive green but ventrally bordered with piceous; hamules and intersegmental membrane brown to piceous; penis shaft (Figs. 3, 4) and vesicle black; dorsum and most of lateral aspect of 3-6 black, lower part of sides narrowly light olive, this color produced dorsad in narrow basal ring, middorsally interrupted; 7 black dorsally and laterally, but with a blue mark apically, this mark convexly bordered cephalad, occupying apical fourth of dorsum, and extending mid way down lateral aspect; 8 and 9 blue dorsally and laterally, ventral margin of these tergites broadly black; 10 blue dorsally, black laterally, this produced to form narrow apical border; venter of 10 brownish; appendages (Figs. 58, 63, 64) black, base of inferiors brownish basally; ventral margins of tergites 1-6 light brown, 7-10 dark brown to black; sternites piceous to black.

Wings hyaline, venation black, pterostigma black narrowly surrounded by buff on both upper and under surfaces; wings petioled just barely beyond Ac juncture; arculus arising at second antenodal in three wings, barely distal in right hind wing; postnodals $\frac{11}{11} \cdot \frac{10}{10}$; M_2 arising just proximal to fifth postnodal in right fore wing, just distal to fourth in left fore wing, in both hind wings just proximal to fourth; M_{1a} arising $\frac{8}{8} \cdot \frac{8}{8}$; poststigmatal cells $\frac{6}{6} \cdot \frac{7}{6}$.

Abdomen 22 mm; hind wing 16.5 mm.

Allotype Female.—Color pattern of head as in ♂, but labrum, exposed portions of mandibles, and anteclypeus dark brown, postclypeus anteriorly bordered with brown.

Prothorax as in ♂ except lateral angles of hind lobe infuscated.

Thorax as in ♂ except humeral and second lateral stripes and lateral alar ridge dark brown instead of black. Mesepisternal fossae (Fig. 142) small but distinct.

Legs as in ♂, except femora slightly pruinose, and tibiae washed with light brown apically.

Abdominal segments 1-6 similar to ♂, but black covering only about upper half of lateral aspect, somewhat expanded apically, remainder light brown with green tinge on first four segments; all segments with small infuscated area near ventral margin of tergites in intersegmental region; 7 as preceding segments but a small, elongate oval blue spot dorsally between apical ridge and apex of tergite; 8 with blue mark covering apical third of dorsum and upper half of side; ventral margin of eighth tergite brown; 9 black laterally, dorsum and upper half of apico-lateral aspect blue; 10 black, a very narrow apical brown margin,

appendages black; valves of ovipositor brownish; ventral margins of tergites 1-8 brownish; sternites brown to piceous, mid ventral keel black; no apical spine on eighth sternite.

Wings hyaline, venation black, pterostigma light brown; wings petioled to Ac juncture; arculus arising barely distal to second antenodal; postnodals $\frac{12}{12} \cdot \frac{10}{10}$; M_2 arising just proximal to fifth postnodal in fore wing, just proximal to fourth in hind wings; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{8}$, poststigmatal cells $\frac{4}{4} \cdot \frac{5}{5}$.

Abdomen 21 mm; hind wing 16 mm.

Measurements and Venation.—Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Villa Murtinho							
Males	21.5	20.9	20.0	16.0	15.4	14.5	0.74
Females	23.5	21.9	21.0	16.0	15.0	14.5	0.68
Porto Velho							
Females	20.0	19.8	19.5	15.0	14.9	14.5	0.75
Cachuela Esperanza							
Female		22.0			15.5		0.70

Venational features are as follows: Number of Postnodals—Villa Murtinho, males, fore wing, 11-12, ave. 11.5; hind wing, 10-11, ave. 10.2; females, fore wing, 11-12, ave. 11.6; hind wing, 9-11, ave. 10.0. Porto Velho, females, fore wing, 11-12, ave. 11.6; hind wing, 9-11, ave. 10.0. Cachuela Esperanza, female, fore wing, 13; hind wing, 11. Origin of M_2 —Arising at fifth postnodal in fore wings, fourth in hind wings, in all except one Porto Velho female, where it arises at fourth and third, respectively. Origin of M_{1a} —Villa Murtinho, males, fore wing, 8-9, ave. 8.2; hind wing, 7-8, ave. 7.7; females, fore wing, 7-9, ave. 8.3; hind wing, 7-9, ave. 7.8. Porto Velho, females, fore wing, 8-9, ave. 8.4; hind wing, 7-8, ave. 7.7. Cachuela Esperanza, female, fore wing, 9; hind wing, 8.

Discussion.—*A. longispinosum* appears to have only one close relative, namely, *rubrifrons*. It differs from *rubrifrons* in that the distal penis segment, while flap-like, is strongly constricted at mid length; the male superior abdominal appendages are subspatulate and truncate apically; the mesepisternal fossae are shallow and the posterolateral borders of the interlaminal sinus sinuate in the females; and the light ground color of head and thorax is light blue to olive green in both sexes.

Distribution (Pl. XVII).—This species is known from three localities, not far separated, along the upper Madeira River: Cachuela Esperanza in Bolivia, Villa Murtinho and Porto Velho in Brazil.

Material Examined.—10♂, 25♀, including holotype and allotype, as follows: BOLIVIA: Cachuela Esperanza, 1922, April 10, 1 ♀. BRAZIL: Porto Velho, 1922, Feb. 21, 1♀; May 3, 2♀; May 5, 3 ♀; Villa Murtinho, 1922, April 4, 2 ♂, 4 ♀; April 6, 2 ♂, 6 ♀; April 7, 6 ♂, 5 ♀

(including holotype and allotype). All material by J. H. Williamson and J. W. Strohm.

ABUNAE GROUP

The members of this group are bound together by several striking features, one of the most notable of which is the presence, in the males of all five species, of a pair of curved, sclerotized rods projecting from the ental surface of the distal penis segment. This striking modification is least developed in *jessei*, where the rods are rather short, not especially sharp pointed, and lightly sclerotized, and in *temporale*, where they are short and slender, although more heavily sclerotized. This development proceeds through *abunae* and *inexpectum* to find its culmination in *amazonicum*, in which the rods are long, retrorsely curved, heavily sclerotized, and free of sheathing membrane basally. The species are similar also in that abdominal 10 is little if any higher than 9 in the males. Morphologically *inexpectum* and *abunae* are closest together, the males being distinguishable chiefly through minor differences of penis and superior abdominal appendages. *Acanthagrion amazonicum* is very similar to *abunae* in these respects, but may be separated at once by the great breadth of the distal penis segment in the male. The females of *abunae*, *amazonicum* and *temporale* exhibit striking similarities, especially in the form and position of the mesepisternal fossae. The female of *jessei* shows more distant relationship with the other species of the group in the peculiar form of its confluent, heart-shaped fossae. The group seems to be rather generally distributed through South America east of the Andes, although records are scanty. The isolated record of *inexpectum* from Panama, and the scattered records of *temporale* point to an early origin of the group and a once widespread distribution subsequently interrupted by changes obliterating large portions of the population.

Through similarities in size, venation, and male abdominal appendages the Abunae Group appears to manifest slight affinities with the Viridescens Group, especially with *truncatum*, *viridescens* and *lancea*.

Acanthagrion jessei, new species

(Pl. I, Figs. 5-6; Pl. VI, Figs. 59, 65-66; Pl. XIII, Fig. 143)

Holotype: Male, Porto Velho, Brazil, Feb. 25, 1922, by J. H. Williamson and J. W. Strohm; allotype a female with same data.

Holotype Male.—Labrum and exposed portions of mandibles pale green, basal border and basomesal impression of labrum black; anteclypeus slightly darker green; postclypeus black, this color extended slightly to form a low, obtuse-angled mark on anterior face of frons;

genae uniform light olive green; upper face of frons, and vertex, black, this color encroaching on anterior face of frons to form a median declivent point and a slanting lateral border, leaving the light portion of the frons shaped like a wide-angled M; green of genae abruptly terminated at level of antennae, which are entirely black; median ocellus flanked by two subreniform spots of same color as genae, each of these spots slightly larger than the median ocellus; postocular spots light olive green, each about equal in size to the area occupied by the ocelli; occiput and postgenae black, slightly pruinose; exposed portions of labium and maxillae pale yellow to flesh color.

Pronotum entirely black, a small median yellowish green spot on the dorsum of the anterior lobe; posteroventral border of proepimeron and border of proepisternum olive green; coxae pale yellowish to flesh color; prosternum pale, pruinose, a black spot between the fore coxae.

Mesostigmal laminae black, posterolateral keel of each washed with yellowish green as continuation of pale antehumeral stripe; dorsum of mesepisternum, antealar and lateral alar ridges black; yellowish green antehumeral stripe slightly less than half as wide as broad black humeral stripe, slightly dilated at either end; humeral stripe approximately equal in width to mesepimeron, its anterior end covering all but extreme ventral angle of mesinfraepisternum, its posterior end recurved to follow caudal one-fifth of first lateral suture and covering, in all, about one-third of mesepisternum and one-half of mesepimeron; black stripe covering second lateral suture from alar ridge almost to spiracle, about twice as wide as spiracle, tapering anteriorly and posteriorly, all on metepisternum except for a very small encroachment on the metepimeron one-fourth of distance from posterior end; remainder of metapleurite pale bluish green; mesosternum, metasternum, and intersternum pale yellowish green to flesh color.

Coxae and trochanters pale yellowish to flesh color; femora of all legs black externally, gray on inner face; tibiae black basally, fading to light brown apically; tarsi and tarsal claws black basally and apically, light brown between; leg spines black.

Abdominal segments 1-7, and 10, predominantly black dorsally, marked with bluish green as follows; dorsum of 1 entirely black, lateral margins slightly dilated near apex, produced to form a ring along apical ridge; apical four-fifths of dorsum of 2 black, basal margin shaped like a low, broad W, the tips of the arms almost meeting corresponding points developed from a narrow basal black line; 3-7 totally black dorsally save for narrow basal rings of bluish green; 8 and 9 blue, apical spine rows black; 10 black dorsally and laterally, dark brown ventrally; appendages black, bases of inferiors diluted to dark brown.

Wing membrane hyaline, venation and pterostigma black; all wings petioled to Ac juncture; arculus arising at second antenodal; post-

nodals $\frac{10}{10} \cdot \frac{8}{8}$; M_2 arising just proximal to fifth postnodal in fore wings, to fourth in hind wings; M_{1a} arising $\frac{7}{7} \cdot \frac{6}{6}$; poststigmal cells $\frac{4}{4} \cdot \frac{5}{4}$.

Abdomen 21.5 mm; hind wing 14.5 mm.

Allotype Female.—Coloration of head, thorax and legs practically identical with that of ♂; mesepisternal fossae (Fig. 143) well-defined, confluent posteriorly, thus appearing heart-shaped.

Abdomen dorsally black with metallic green reflections, differing from ♂ in that it is continuous on segments 1 and 2, and covers dorsum of 8 except for an incomplete blue apical ring adjoining the intersegmental membrane; 9 blue dorsally and laterally, restricted laterally by a black basal area, the ventral horn of whose sublunate apical border just falls short of the apex of the sclerite; 10 entirely blue, appendages dark brown; sternites of all segments with a dark brown median keel; ventral spine of segment 8 pale yellowish brown, black-tipped; valves of ovipositor pale yellow to flesh color, stylets dark brown.

Wing membrane hyaline, venation piceous to black, pterostigma piceous; all wings petioled to Ac juncture; arculus arising at second antenodal in three wings, barely distal in left hind wing; postnodals $\frac{10}{11} \cdot \frac{8}{9}$; M_2 arising $\frac{5}{5} \cdot \frac{4}{4}$; M_{1a} arising $\frac{8}{7} \cdot \frac{7}{7}$; poststigmal cells $\frac{5}{4} \cdot \frac{5}{5}$.

Abdomen 22.5 mm; hind wing 15 mm.

Measurements and Venation.—Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio
	Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
Males	22.5	21.7	21.0	15.0	14.4	14.0	0.66
Females	23.0	22.1	21.0	15.5	14.9	14.0	0.67

Venational features are as follows: Number of Postnodals—Males, fore wing, 9-11, ave. 9.9; hind wing, 8-9, ave. 8.1. Females, fore wing, 9-11, ave. 10.1; hind wing, 8-9, ave. 8.6. Origin of M_2 —Just distal to fifth postnodal in fore wing, to fourth in hind wing, in the entire series. Origin of M_{1a} —Males, fore wings, 7-8, ave. 7.6; hind wings, 6-7, ave. 6.4. Females, fore wings, 7-9, ave. 7.9; hind wings, 6-7, ave. 6.8.

Discussion.—*Acanthagrion jessei* presents the penial characters of the group in their most simplified form. The ental hooks of the distal penis segment are largely membranous with only a delicate support of sclerotization, and the basomesal portion of this segment is still quite broad, although showing hints of the marked constriction exhibited by the remaining species of the group. It appears to have no close relatives, although affinities with *temporale* are manifested by the presence, at the distal end of the superior appendages in both species, of a small posteroental prominence, and by the broad tip of the distal penis segment in *temporale*.

This species is dedicated to Mr. Jesse H. Williamson, who collected a large part of the material examined during the course of this study.

Distribution (Pl. XVII).—*A. jessei* is known only from Porto Velho, on the upper Rio Madeira, Brazil.

Material Examined.—42 ♂, 8 ♀, including holotype and allotype, as follows: BRAZIL: Porto Velho, 1922, Jan. 26, 4 ♂; Jan 27, 1 ♂; Jan. 28, 1 ♂; Feb. 1, 1 ♂; Feb. 6, 3 ♂; Feb. 9, 1 ♂; Feb. 10, 1 ♂; Feb. 13, 1 ♂; Feb. 18, 5 ♂, 1 ♀; Feb. 20, 2 ♂; Feb. 22, 1 ♀; Feb. 24, 3 ♂, 2 ♀; Feb. 25, 7 ♂, 1 ♀; Feb. 28, 3 ♂; Mar. 3, 1 ♂; Apr. 26, 3 ♂, 1 ♀; Apr. 30, 1 ♀; May 5, 4 ♂, 1 ♀; May 11, 1 ♂. All material by J. H. Williamson and J. W. Strohm.

Acanthagrion temporale, Selys

(Pl. I, Figs. 7-8; Pl. VI, Figs. 60, 67-68; Pl. XIII, Fig. 144)

Acanthagrion temporale Selys, 1876: 312 [reprint p. 68]. ("A pair," Minas Geraes, Brazil)

Male.—Labrum, anteclypeus, and exposed portions of mandibles bluish green, labrum with a black basomesial impression; postclypeus black; genae bluish green, darker above than below; anterior face of frons and of basal antennal segment olive green; dorsum of frons, and vertex, black, sometimes with obscure brownish markings on either side of median ocellus; postocular spots light yellowish green, round anteriorly, posteriorly confluent with buff of postgenae and occipital ridge; labium and exposed portions of maxillae pale buff.

Anterior lobe of prothorax blue, bordered narrowly in front with black; middle and hind lobe of pronotum black, middle lobe with a rounded extension of blue from anterior lobe on its lateral convexity, hind lobe blue on extreme lateral tips; propleurite blue, prosternum dilute blue to buff, a black spot between fore coxae.

Mesostigmal laminae black, each tipped laterally to variable extent with pale greenish blue; dorsum of mesepisternum and antealar ridge black; antehumeral stripe pale greenish blue, slightly dilated at either end; humeral stripe black, constricted to about half its width at posterior end where confluent with black of antealar ridge, gradually expanding mesially, tending anteriorly to follow curve of humeral suture, occupying about one-third width of mesepisternum throughout most of its length but leaving it at level of mesinfraepisternum, whose upper and anterior sides are bordered by it; upper third of width of mesepimeron occupied by humeral stripe, remainder of mesopleurite, metapleurite, and lateral alar ridge blue, except for a short, narrow extension along first lateral suture of black bordering anterior edge of lateral alar ridge; some specimens bear a small suboval black spot near posterior end of second lateral suture; mesosternum, metasternum, and intersternum pale bluish green, pruinose.

Coxae and trochanters pale blue to bluish green; inner face of femora buff to light bluish green, outer face black, this color widest apically, tapering basally, more intense on fore than hind femora; tibiae and tarsi light amber, tibiae slightly darker on outer face; tarsal claws light basally, dark brown to black apically; leg spines black.

Abdominal segments largely blue laterally, dorsally marked with black as follows: a rectangular spot on 1, apically produced at either side to form a black apical ring which is sometimes incomplete; intersegmental membrane blue; 2 bearing a mark shaped like a spear head, the point truncate at base of tergite, apex produced into black ring which does not always encompass entire tergite; hamules buff to dark brown, penis shaft (Figs. 7, 8) and vesicle black; 3-7 with dorsal black stripe, tapered to a point basally, expanded apically to cover half to three-fourths lateral aspect of tergites; 8-10 and appendages (Figs. 60, 67, 68) entirely blue; mid-ventral edges of tergites buffy to dark brown, sternites dark brown to black.

Wings hyaline, venation and pterostigma light brown.

Female.—Head, prothorax and thorax marked almost exactly as in ♂; mesepisternal fossae (Fig. 144) very small, situated at base of very short interlaminal sinus, anterior end of middorsal carina slightly elevated between the fossae.

Abdominal segments 1-7 very similar to those of ♂, except anterior end of dorsal black spot of 2 meeting base of segment broadly instead of with a point; 8 similar to preceding segments; dorsum of 9 black basally, remainder of 9 blue; 10 wholly blue, appendages buffy blue; sternites and ventral margins of tergites yellowish anteriorly, becoming brown posteriorly; midventral keel black; valves of ovipositor blue basally, yellow apically, stylets light brown; apical spine of eighth sternite short, sharp, black.

Wings as in ♂.

Measurements and Venation.—Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Males	21.7	20.6	20.0	14.0	13.6	13.0	0.66
Females	22.5	21.2	20.0	15.7	15.1	14.5	0.71

Venational features are as follows: Number of Postnodals—Males, fore wing, 8 in all except 1 ♂ from Nirgua; hind wing, 6-7, ave. 6.01. Females, fore wing, 8-9, ave. 8.1; hind wing, 6-9, ave. 7.0. Origin of M_2 —Males, fore wing, arising at fourth postnodal 45%, just proximal to fourth 55%; hind wing, just proximal to fourth 20%, at fourth 70%, proximal to third 10%. Females, fore wing, arising at fourth postnodal 80%, just proximal to fourth 20%; hind wing, just proximal to fourth 50%, at third 50%. Origin of M_{1a} —Males, fore wing, arising at seventh postnodal 65%, at sixth 35%; hind wing, arising at seventh 15%, at

sixth 85%. Females, fore wing, arising at seventh postnodal 90%, at sixth 10%; hind wing, arising at seventh 40%, at sixth 60%.

Discussion.—Although without close relatives within the *Abunae* Group, *temporale* possesses several characters which seem to indicate for it a position between *jessei* and *abunae*. The males resemble *jessei* in the wide dilation of the apex of the distal penis segment and in the presence, in both species, of a rudimentary tubercle on the posteroental angle of the superior appendages, as shown in Figs. 65 and 67.

A. temporale can be separated most readily from other members of the group by the characteristic form of the penis.

The material seen by me, all from Venezuela, is in very good agreement with the descriptions of Selys (1876:312) and Calvert (1909:169).

A field note by Mr. E. B. Williamson reads: "This was common species. Sat on rushes like *Enallagma geminatum*."

Distribution (Pl. XVII).—The records of Selys (1876:312 [reprint p.68]) and Calvert (1909:179) were all from Brazil. Selys' material was from the State of Minas Geraes, Calvert's from Cuyabá and the nearby village of Chapada, State of Matto Grosso, from Barreiras, State of Bahia, and from Sete Lagoas, State of Minas Geraes. The occurrence of forms in Venezuela apparently not differing from the Brazilian species indicates a wide, discontinuous range not unlike that shown by *ascendens* (Pl. XVIII).

Material Examined.—286 ♂, 40♀, as follows: VENEZUELA: Bejuma, 1920, Feb. 18, 5♂, 1 ♀; Nirgua, 1920, Feb. 26, 148 ♂, 14 ♀; Feb. 27, 16 ♂, 7 ♀; Feb. 28, 123 ♂, 18 ♀; Feb. 29, 2 ♂. All by J. H. Williamson, E. B. Williamson, and W. H. Ditzler.

References in Literature.—*Acanthagrion temporale* Selys, 1876: Original description as cited above; Calvert, 1899: 28 (compared with *latapistylum*); Calvert, 1909: 162, 169, fig. 92 (recorded from Cuyabá and Chapada, Matto Grosso, Brazil); Williamson, 1916: 324 (compared with *adustum*); Kennedy, 1916: 328, 329, figs. 1, 2 (drawing of penis); Longfield, 1929: 137 (quotes Calvert's 1909 record).

Acanthagrion abunae, new species

(Pl. I, Figs. 9-10; Pl. VII, Figs. 69, 73-74; Pl. XIII, Fig. 145)

Holotype: Male, Abunã, Brazil, March 14, 1922, J. H. Williamson and J. W. Strohm; allotype a female with same data.

Holotype Male.—Labrum, anteclypeus and exposed portions of mandibles light olive green, labrum bearing a black basomesial impression and bordered narrowly with black along its posterolateral margin; anteclypeus slightly darker than labrum, postclypeus black; genae light olive green mesially, growing darker in upper fourth, lighter in lower fourth, fading to a pale yellowish green immediately adjacent to eyes;

anterior face of frons about the same shade as anteclypeus, anterior surface of basal segment of antennae slightly paler; dorsal surface of frons, and vertex, black with the following markings: a green spot about the size of one ocellus just behind and lateral to the antenna-base; an oblong green spot of similar area, its outer end directed slightly caudad, on either side of the median ocellus; green postocular spots slightly larger than the area occupied by the ocelli; a trace of green on the occipital ridge; dorsal surface of basal segment of antennae black, remaining segments dark brown; occipital foramen narrowly surrounded with black, postgenae pale greenish yellow; exposed portions of labium and maxillae pale yellow; entire dorsal surface of head bearing a sparse growth of long, fine, pale hairs.

Anterior lobe of prothorax light blue, surrounded by a narrow black margin; middle lobe of pronotum black, bearing two small, closely adjoined blue spots, one on either side of the mid-line; proepimeron and proepisternum blue; hind lobe of prothorax black, its extreme outer ends sometimes tipped with blue; prosternum pale, pruinose, a black spot between the coxae.

Mesostigmal laminae black, posterolateral keel of each washed apically with blue; dorsum of thorax black, lateral margin of this black practically straight, covering about one-half of mesepisternum; humeral stripe black, constricted posteriorly where confluent with black of antealar sinus, almost immediately expanded anteriorly to a width approximately equal to that of mesepimeron, and inclined downward slightly, embracing upper two-thirds of mesinfraepisternum save for an incision of blue from the ventral third which runs up through the middle of this sclerite; on mesinfraepisternum the ventral border of the humeral stripe is diluted to dark brown; lower half of mesepimeron blue; metepisternum blue, a short, narrow black point along the mesepimeral suture produced from the black of the alar sinus; metepimeron and metinfraepisternum blue; mesosternum pruinose white; metasternum and intersternum pale yellow to flesh color, washed laterally with light green.

Coxae and trochanters blue; femora black externally, pale yellowish green on inner face, the black narrowing basally; tibiae, tarsi, and tarsal claws pale except for slight basal infuscation; leg spines black.

Abdominal segments 1-7 black dorsally, with metallic green reflections; 8 and 9 blue; 10 black; black on segment 1 extending from anterior end to blue intersegmental membrane, extending laterally to embrace three-fourths of dorsum, slightly narrowing anteriorly, a small point on each side extending laterally about two-thirds distance from apex; posterior end of black narrowly produced laterally and downward, almost encircling tergite; black on 2 extending over dorsal two-thirds of tergite from front to back, margins straight except for slight swelling just before caudal end; penis shaft (Figs. 9, 10) and

vesicle black; black on 3-7 covering dorsum of segments except for narrow basal blue rings, which are sometimes interrupted by a very narrow connection of black on the middorsal line; appendages (Figs. 61, 62, 69) black, inferiors sometimes diluted to brown basally; abdominal sternites pale greenish-yellow, with slight progressive infuscation on segments 6-10; vesicle on third sternite dark brown.

Wings hyaline, venation and pterostigma black; petiolation extending beyond Ac juncture by a distance equal to about one-half length of Ac; arculus arising at second antenodal; postnodals $\frac{10}{10} \cdot \frac{8}{8}$; M_2 arising just proximal to fifth postnodal in fore wings, just proximal to fourth in hind wings; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{3}{3} \cdot \frac{4}{4}$.

Abdomen 24.5 mm; hind wing 15.0 mm.

Allotype Female.—Colors and markings similar to those of male, with these exceptions: labrum brown with faint greenish tinge; exposed portions of mandibles light yellowish green, anteclypeus colored like labrum; postclypeus dark olive; three small black spots along anterior margin, posterior margin entirely black, this color encroaching on lower part of frons in form of very broad, flat triangle; interantennal depression black; remainder of frons, and vertex to level of median ocellus, dark olive green; a small subreniform spot of this color just behind and to side of each antenna; a narrow slanting mark of same color between lateral ocelli and antennae; basal antennal segment and anterior face of second light olive; postocular spots light blue, suboval, each about same size as area occupied by ocelli; remainder of head as in male.

Prothorax as in male.

Synthorax differing from that of male in that mesepimeral portions of humeral stripe fade to light metallic brown through caudal two-thirds; mesepisternal fossae (Fig. 145) small but well defined, mid-dorsal carina flattened just behind fossae, mesepisternum slightly inflated at this level.

Legs as in male except that only apical third of outer face of femora is black.

Abdominal segments 1-7 as in male; 8 similar to 7; 9 with triangular black spot extending half way from base to apex on either side of mid line, remainder blue; appendages black; venter of abdomen as in male; valves of ovipositor light blue edged with yellow, stylets dark brown; apical spine of eighth sternite long, sharp, black tipped.

Wings hyaline, venation yellowish to light brown, pterostigma yellowish brown; petiolation extending beyond Ac juncture by a distance equal to length of Ac; arculus arising at second antenodal; postnodals $\frac{10}{10} \cdot \frac{8}{8}$; M_2 arising proximal to fifth postnodal in right fore wing, at fourth in left; in hind wings arising proximal to fourth; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{3}{4} \cdot \frac{4}{3}$.

Abdomen 25.0 mm; hind wing 15.5 mm.

Measurements and Venation.—Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio
	Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
Abunã							
Males	25.5	24.1	23.0	15.7	15.3	14.0	0.64
Females	26.0	24.6	23.0	16.0	15.7	14.0	0.64
Georgetown							
Males		25.0			16.0		0.64
Females		25.0			16.0		0.64
Ububevo and Villarica							
Males	25.0	24.6	23.5	16.0	15.5	15.0	0.63

The data for venation are based on a series of 100♂ and 25 ♀ for Abunã and on all specimens available for other localities. Venational features are: Number of Postnodals—Abunã, males, fore wing, 9-11, ave. 9.1; hind wing, 8-9, ave. 8.2. Females, fore wing, 9-11, ave. 9.4; hind wing, 8-10, ave. 8.5. Georgetown, males, fore wing, 10; hind wing, 8. Female, fore wing, 9, hind wing, 8. Paraguay, males, fore wing, 9-11, ave. 9.3; hind wing, 8-9, ave. 8.1. Origin of M_2 —Abunã, males, fore wing, arising just proximal to fifth postnodal 80%, just distal to fourth 20%; hind wing, just proximal to fourth in all examples. Females, fore wing, arising at fifth postnodal 10%, just proximal to fifth, 90%; hind wing, arising just proximal to fourth 98%; at third 2%. Georgetown, males, fore wing, arising at fifth postnodal, both specimens; hind wing, arising at fourth in both specimens. Female, fore wing, arising at fifth postnodal, hind wing, at fourth. Paraguay, males, fore wing, arising just proximal to fifth postnodal 100%; hind wing, arising at fourth 100%.

Discussion.—*Acanthagrion abunae* appears to be most closely related to *inexpectum* and *amazonicum*. It differs from both in that in *abunae* the rear of the head is pale except immediately adjoining the occipital foramen, whereas in *amazonicum* and *inexpectum* there is little if any light color on the rear of the head. Further, the sclerotization of penis segment 2 in *abunae* is not thinned to produce a pair of apical, fenestrate markings, as in the other two species. The male superior appendages of *abunae* do not extend as far dorsad basally as do those of *amazonicum*, nor do they possess such strongly developed dorsal tubercles as are encountered in the latter species. They are more squarely truncate apically than in *amazonicum*, less deeply indented apically than in *inexpectum*. As would be expected, the mesepisternal fossae are shallower and nearer the border of the mesostigmal lamina than in *amazonicum*.

Nothing is known concerning the habits of *abunae*. The envelope containing a male and female taken at Abunã March 26, 1922, bears the note: "In cop. in r.r. ditch." This doubtless was a sluggish pond along the Madeira-Mamoré railroad.

Distribution (Pl. XVII).—At present, *abunae* is known from three

isolated regions: Paraguay, the upper Madeira River near the Bolivian border, and the Essequibo River in British Guiana. This would appear to be a striking instance of discontinuous distribution. However, although a very limited amount of material is available from Paraguay and British Guiana, these examples seem not to differ from those taken along the Madeira. Should this species be found to occur up the Guaporé or Beni rivers into the Bolivian Andes, and up the Rio Branco toward the Guianan highlands, it would not be illogical to conclude that the relatively short gaps separating these streams from the Paraguay and Essequibo systems, respectively, had been bridged by this species.

Material Examined.—119 ♂, 32 ♀, including holotype and allotype, as follows: BRAZIL: Abunã, 1922, March 8, 1 ♂; March 9, 1 ♂, 1 ♀; March 10, 1 ♀; March 11, 5 ♂, 1 ♀; March 14, 49 ♂, 7 ♀; March 15, 13 ♂, 3 ♀; March 17, 1 ♂, 1 ♀; March 19, 2 ♂; March 21, 1 ♂; March 23, 10 ♂; March 24, 20 ♂, 11 ♀; March 25, 3 ♂, 1 ♀; March 26, 5 ♂, 3 ♀; Villa Murinho, 1922, April 3, 1 ♀. All by J. H. Williamson and J. W. Strohm. BRITISH GUIANA: Georgetown, 1912, Jan. 26, 1 ♂, 1 ♀; Feb. 18, 1 ♂. L. A. Williamson, E. B. Williamson, and B. J. Rainey. PARAGUAY: Ubuvevo, 1911, April 9, 4 ♂; May 21, 1 ♂; Villarica, 1911, March 24, 1 ♂. From Förster Collection.

Acanthagrion inexpectum, new species
(Pl. I, Figs. 11-12; Pl. VII, Figs. 70, 75-76)

Holotype: Male, Rio Mazamba, Panama Canal Zone, Dec. 6, 1916, J. H. Williamson and E. B. Williamson.

Holotype.—Labrum bright green, lateral margin and basomesal impression black; exposed portions of mandibles green, faintly tinged with brown; anteclypeus dull olive green; genae light greenish blue, extending to level of second antennal segment base; postclypeus black, its posterolateral angles green; anterior face of frons olive green, covering basal antennal segment, slightly restricted ventrad by a very low, obtuse-angled triangle along clypeofrontal suture; a reniform, bluish green spot about size of median ocellus located just behind and to the side of each antenna base; postocular spots greenish blue, subtriangular, each about one-third larger than area occupied by ocelli; remainder of head dorsum and antennae black; rear of head largely black, postgenae adjoining compound eyes narrowly blue-buff, about as wide as labium base at dorsal end, tapering rapidly to a point ventrally; a small amount of bluish pruinescence on postgenal region; labium and exposed portions of maxillae pale brown.

Anterior lobe of prothorax bearing suboval blue spot dorsally, remainder piceous to black; middle lobe of pronotum black, a small, subreniform, greenish blue spot on either side of lateral convexity and

a small yellowish green dash on either side of middorsal line; hind lobe black, outer ends piceous; proepisternum black, ventral border blue; posterolateral convexity of proepimeron light blue, remainder black; prosternum light brown, slightly pruinose, a black spot between fore coxae.

Mesostigmal laminae black, lateral fourth of each light blue, antalar ridge black; dorsum of mesepisternum black, this color widest about one-fifth distance from anterior end, somewhat constricted anteriorly, tapering very slightly posteriorly; antehumeral stripe light blue; narrowest through mesal half where it occupies about one-third width of mesepisternum, gradually expanded by about one-third at anterior end, where it touches front half of dorsal mesinfraepisternal suture, and by about one-fourth at posterior end; humeral stripe black, somewhat constricted at posterior and where confluent with black of alar ridges, immediately expanded cephalad; upper margin broadly convex, widest near mid length where it occupies about one-third width of mesepisternum; lower border approximately parallel to humeral suture, occupying about three-fifths width of mesepimeron, stripe following anterior curvature of humeral suture and extending across all but extreme posteroventral angle of mesinfraepisternum, diluted to dark metallic brown over latter sclerite and anterior end of mesepimeron; lateral alar ridge at level of mesepimeron black, this color produced along posterior eighth of first lateral suture as a narrow spur; remainder of lateral alar ridge yellowish blue edged with black; posterior end of second lateral suture bearing suboval black mark at level corresponding to first lateral spur, this mark lying about equally on metepisternum and metepimeron; remainder of meso- and metapleurites light blue, washed with yellow near leg bases; mesosternum, metasternum and intersternum yellowish blue, pruinose.

Coxae and trochanters pale pruinose blue, each coxa with an irregular, basal, brown blotch; inner face of femora light blue washed with yellowish, outer face black; inner face of tibiae light brown to piceous, outer face light brown mottled with dark; tarsi light brown, piceous apically; tarsal claws brown, black tipped; leg spines black.

Abdomen predominantly black dorsally, blue to brownish laterally; 1 blue with rectangular spot on basal two-thirds of dorsum, and narrow black apical ring, the two black areas not connected; 2 with mesal two-thirds of dorsum occupied by black bell-shaped spot, the mouth directed caudad, both ends of spot continued to either end of tergite by narrow black middorsal hair line; 2 with black apical ring, piceous intersegmental membrane, and small black spot on anteroventral corner of tergite, remainder blue; hamules light brown, penis shaft (Figs. 11, 12) and vesicle black; 3 with dorsum black, gradually tapered to a point basally, expanded apically over most of lateral aspect; remainder blue; 4-6 similar to 3 but black more extensive,

bluntly rounded anteriorly, and light areas of sides changing from blue to brownish; apical half of 7 blue, remainder black; 8 and 9 blue, apical spine rows black; 10 yellowish brown ventrally, remainder black, ventral margins of tergites 1, 2, 8 and 9 blue, of 3-6 yellow, of 7 piceous, 8-10 light brown; superior appendages black, inferiors yellowish brown basally, black apically (Figs. 70, 75, 76).

Wings hyaline, venation piceous, pterostigma dark brown; wings petioled to Ac juncture in three wings, barely proximal to this point in left hind wing; arculus arises at or barely distal to second antenodal; postnodals $\frac{11}{11} \cdot \frac{9}{9}$; M_2 arises $\frac{5}{5} \cdot \frac{4}{4}$; M_{1a} arises $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{5}{5} \cdot \frac{5}{6}$.

Female.—Unknown.

Measurements and Venation.—Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
26.75	26.0	25.0	17.0	16.75	16.25	0.65

Venational features are as follows: Number of Postnodals—Fore wing, 10-12, ave. 11.1; hind wing, 9-10, ave. 9.3. Origin of M_2 —Fore wing, arising at fourth postnodal in four specimens, just proximal in remaining three; hind wing, arising just proximal to fourth in all specimens. Origin of M_{1a} —Fore wing, arising at eighth postnodal in five specimens, at ninth in remaining two; hind wing, arising at seventh in four specimens, at eighth in three.

Discussion.—So close is the resemblance between *inexpectum* and *abunae* that they were at first confused. The structure of the male superior appendages is very similar in the two species, although *inexpectum* possesses a deeper apical indentation than *abunae*. The rear of the head is largely black, thus differing from *abunae* and approaching the condition encountered in *amazonicum*. The penial modifications of *inexpectum* resemble those of both *abunae* and *amazonicum*, the apical restriction of the distal segment being very similar to that of *abunae*, while the occurrence of fenestrate markings near the apex of penis segment 2 has been noted as present also in *amazonicum*. The peculiar, campanuliform black spot upon the dorsum of abdominal segment 2 in *inexpectum* is constant in shape throughout the seven available specimens. No approach to this has been found in either *abunae* or *amazonicum*. Examples of *inexpectum* average slightly larger in size than either *abunae* or *amazonicum*. So marked are its similarities to both of these that it is difficult to state which is its closest relative.

Distribution (Pl. XVII).—Since *inexpectum* is known from only two adjoining localities, two small streams in the Canal Zone, the conclusions already expressed as to its probable relationships can receive little distributional support. So strong are its morphological similarities to

the two Amazonian species, *abunae* and *amazonicum*, that a very close degree of relationship is indicated. The wide but discontinuous distribution displayed by *temporale* has, as stated previously, suggested the hypothesis of a once widespread ancestral stock for members of the Abunae Group.

Material Examined.—7 ♂, holotype and paratypes, as follows: PANAMA: Canal Zone, Rio Mazamba, 1916, Dec. 6, 6 ♂ (including holotype); Rio Sardanilla, 1916, Dec. 5, 1 ♂. All by J. H. Williamson and E. B. Williamson.

Acanthagrion amazonicum, Sjöstedt

(Pl. II, Figs. 13-14; Pl. VII, Figs. 71, 77-78; Pl. XIII, Fig. 146)

Acanthagrion amazonicum Sjöstedt, 1918: 16-19, Pl. 1, fig. 6, pl. 2, figs. 9-10. (2 ♂, Manáos)

Male.—Labrum bluish green, mandibles same color but lighter; genae and anteclypeus slightly darker than mandibles, anteclypeus duller; dorsum of postclypeus entirely black, this color encroaching on anterior face of frons in form of low, obtuse-angled triangle whose base lies along clypeofrontal suture, its apex connected with black of head dorsum; on either side of mid line, about half way up frons, is a dark greenish olive oblique bar, confluent laterally with pale color of genae, which color extends dorsad to level of second antennal segment base, washing anterior face of first; a small, oval, greenish spot about size of median ocellus posterolateral to each antennal base (sometimes a small green fleck on either side of median ocellus); postocular spots light bluish green, egg-shaped, each about as large as area occupied by ocelli; remainder of head dorsum and antennae black; entire rear of head black except for narrow pale brownish yellow stripe on lower half of postgenae adjoining eyes, rear of head totally black in old specimens; labium and exposed portions of maxillae yellowish white.

Anterior lobe of prothorax black with small oval blue spot dorsally; middle and hind lobes of pronotum wholly black except for a small rounded blue spot on each side of middle lobe, and faint blue washing on lateral tips of hind lobe, even these black in old specimens; proepisternum and proepimeron black over anterodorsal half, remainder light blue; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae black, lateral fourth of each blue; dorsum of mesepisternum black, this color widest about one-fifth distance from anterior end where it occupies about one-third width of sclerite, slightly narrowing anteriorly and posteriorly; antelar plates light blue, changing to dark brown or blackish in old specimens, keels black; antehumeral stripe light blue, through mesal half of its length occupying about one-fourth width of mesepisternum, slightly widened be-

fore and behind; humeral stripe black, slightly constricted at posterior end, upper border slightly convex, meeting anterior third of mesinfraepisternal suture; lower border almost parallel to humeral suture, stripe covering upper and anterior two-thirds of mesinfraepisternum, lower angle of this sclerite blue, incising humeral stripe; mesepimeral region of lateral alar ridge black, produced along posterior eighth of first lateral suture as a narrow spur; remainder of lateral alar ridge blue, black bordered; marking of second lateral suture varying from a suboval posterior black spot to a definite stripe extending almost to metastigma, lying chiefly on metepisternum; periphery of metinfraepisternum often marked with piceous to black; extreme posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light blue; mesosternum, metasternum and intersternum blue to brownish, intersternum sometimes quite dark.

Coxae and trochanters blue, often infuscated basally; inner face of femora yellowish blue, outer face black, black often almost interrupted near proximal end; inner face of tibiae dark brown to black, outer face light brown, mottled with dark; tarsi brown, piceous apically; tarsal claws brown, black tipped; leg spines black.

Abdominal segment 1 black dorsally, lateral margins concave caudad and produced to form narrow apical ring; remainder of 1 and intersegmental membrane blue; dorsum of 2 bearing a black apical spot shaped roughly like an arrowhead whose point is directed cephalad, spot occupying apical third to half of dorsum, point of spot connected with very narrow basal black ring by a thin middorsal black line; intersegmental membrane dark brown, ventral margin of tergite often infuscated; hamules chiefly dark brown, penis shaft (Figs. 13, 14) and vesicle black; 3-7 increasingly black dorsally, blue laterally, this latter color often giving way to brown caudad, dorsal black tapering cephalad; 8 and 9 blue, apical spine rows black; 10 black, rusty brown ventrally; both superior and inferior appendages (Figs. 71, 77, 78) black; extreme ventral margins of anterior abdominal tergites bluish, changing to brown posteriorly; sternites piceous to black.

Wings hyaline, venation piceous to black, pterostigma light to moderate brown.

Allotype Females.—Very similar to ♂, minor differences noted as follows:

Labrum dark brown, mandible bases and anteclypeus light brown with greenish tinge; anterior face of frons and a spot on either side of median ocellus dark olive green; rear of head with narrow postgenal light stripe.

Prothorax and thorax as in ♂, but humeral stripe diluted to dark brown on mesinfraepisternum and anterior convexity of mesepimeron; thorax slightly pruinose ventrally and near coxae; mesepisternal fossae (Fig. 146) very deeply impressed.

Legs similar to ♂, pale colors slightly lighter.

Abdominal markings as in ♂, with following exceptions: 2 with dorsal black stripe of almost uniform width, slightly expanded in rounded outline over posterior fourth; 3-7 with black extending further cephalad without restriction, expanded apically; 8 with apicolateral intrusion, and apex between spine row and end of tergite, blue, remainder black; 9 blue except for angular black protrusion on either side of mid line basally; 10 blue with small dorsal spot and appendages black; ventral margins of tergites brownish; sternites dark brown, mid ventral keel piceous to black; valves of ovipositor brownish; apical spine on eighth sternite well developed, sharp, piceous to black.

Wings hyaline, venation piceous, pterostigma dark brown; petiolation extending to Ac juncture; arculus arising slightly distal to second antenodal; postnodals $\frac{10}{10} \cdot \frac{9}{9}$; M_2 arising $\frac{5}{5} \cdot \frac{4}{4}$; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{4}{3} \cdot \frac{5}{5}$.

Abdomen 22 mm; hind wing 15 mm.

Measurements and Venation.—Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Porto Velho							
Males	22.5	21.5	20.5	14.0	13.6	13.2	0.63
Manáos							
Males	22.5	21.7	20.0	15.0	14.1	13.2	0.65
Females	22.5	22.1	21.5	15.5	14.6	13.5	0.66

Venational features are as follows: Number of Postnodals—Porto Velho, males, fore wing, 10; hind wing, 8, in both specimens. Manáos, males, fore wing, 9-11, ave. 9.5; hind wing, 7-9, ave. 8.0. Females, fore wing, 9-11, ave. 9.8; hind wing, 7-10, ave. 8.3. Origin of M_2 —Porto Velho, males, fore wing, arising just proximal to fifth postnodal; hind wing, just proximal to fourth. Manáos, males, fore wings, arising just proximal to fifth postnodal in all except the right fore wing of one specimen, where it arises at the fourth; hind wings, arising just proximal to fourth in all except two specimens, where it arises at the fifth. Females, fore wings, arising at fifth postnodal in three specimens, just proximal to fifth in remaining two; hind wings, arising at fourth postnodal in two specimens, just proximal to fourth in remaining three. Origin of M_{1a} —Arising at eighth postnodal in fore wings, at seventh in hind wings, throughout the entire series.

Discussion.—Recognition of this species has been made possible by the detailed description and figures published by Sjöstedt (1918) as cited above. The female, which was unknown to Sjöstedt, is here described for the first time. In ambisexual characters it is almost identical with the male.

The probable relations of *amazonicum* to other members of the

Abunae Group, especially to *abunae* and *inexpectum*, have been discussed under the headings of those species. It is obviously very close to these two, less so to *temporale* and *jessei*. *Acanthagrion amazonicum* may be distinguished readily from all other known species of the group by the great width and heavy sclerotization of the second penis segment, by fact that the dorsal end of the male superior appendages reaches almost to the dorsum of abdominal segment 10, and by the smoothly convex posterolateral borders of the interlaminal sinus in the female. It appears to represent the culmination of penial specialization in the Abunae Group.

Distribution (Pl. XVII).—At present, *amazonicum* is known from two localities, Manáos and Porto Velho, Brazil. It may be of local occurrence, since it was not taken by Williamson and Strohm at any other of the many stops made by them along the Amazon, Madeira, or Negro rivers.

Material Examined.—14 ♂, 5 ♀, as follows: BRAZIL: Manáos, 1922, June 8, 4 ♂, 2 ♀; June 16, 1 ♂; June 20, 7 ♂, 3 ♀; Porto Velho, 1922, May 5, 2 ♂. All by J. H. Williamson and J. W. Strohm.

References in Literature.—*Acanthagrion amazonicum* Sjöstedt, 1918: Original description, as cited above.

ABLUTUM GROUP

Two closely related species, *ablutum* and *hermosae*, compose this group. Features possessed in common include the very similar form of male appendages and penes, the tendency toward obliteration of postocular spots, and the large number of postnodal crossveins.

The peculiar type of coloration displayed by the two species comprising this group, especially the loss of distinctness or even complete disappearance of postocular spots, has not been encountered elsewhere in *Acanthagrion*, and closely approaches the condition found in *Cyanallagma chirihuanum*, and in an as yet undescribed species of *Aeolagrion*. This apparent resemblance may be due to convergence, since both *ablutum* and *hermosae* possess characters of penis and male appendages in perfect accord with the definitions of *Acanthagrion*.

The group appears to be without close relatives, although the simplified structure of the distal penis segments hints at distant alliance with members of the Yungarum Group.

The group is distributed along the eastern slopes of the Andes. *Acanthagrion hermosae* is known from a single locality, on a small tributary of the upper Amazon in northeastern Peru, where it was taken at an altitude of over 6,000 feet. Specimens of *ablutum* have been taken along the Rio Beni in the Bolivian foothills, as well as in the uplands of northern Argentina.

Acanthagrion ablutum, Calvert

(Pl. II, Figs. 15-16; Pl. VII, Figs. 72, 79-80; Pl. XIV, Fig. 150)

Acanthagrion gracile ablutum Calvert, 1909: 161, 162, 164, fig. 80 (5 ♂, Coroico, Bolivia; 2 ♀, Chulumani, Bolivia).

Male.—Labrum and exposed portions of mandibles light greenish blue; anteclypeus slate gray, almost black in fully mature individuals; genae light blue below, darkening slightly dorsad, this color extending to level of second antennal segment base; postclypeus black, its posterolateral angles greenish blue; pale color of genae produced admesally across lower part of anterior frons face, interrupted on mid line by black; remainder of frons black, sometimes entirely so in very old examples; postocular spots bluish, each about twice as large as area occupied by ocelli, but margins diffuse and spots sometimes almost entirely obscured by black, whether due to age or postmortem changes it is impossible to state certainly; rear of head mixed yellowish blue and brown, somewhat infuscated about occipital foramen; labium and exposed portions of maxillae light brown.

Anterior lobe of prothorax largely black, a small oval blue spot usually present on dorsum; middle lobe of pronotum black, a blue spot of varying dimensions present on either side of lateral convexity, and an olive dash on either side of middorsal line; hind lobe black; propleurite black above, lower half light blue; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae, interlaminal depression, and antealar ridge black; dorsum of mesepisternum black, this color occupying about one-half width of sclerite; humeral stripe almost entirely obsolescent, represented by a small suboval black spot near caudal end of humeral suture, and by light brownish infuscation over upper third to half of mesinfraepisternum and anterior end of mesepimeron; lateral alar ridge piceous to light olive, bordered with black; first lateral suture unmarked; a black spot near posterior end of second lateral practically identical in size, shape, and position with that on humeral suture; posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light blue, occasionally streaked irregularly with darker blue, tinged with yellowish near leg bases; mesosternum, metasternum and intersternum light yellowish blue, intersternum sometimes slightly infuscated, slightly pruinose.

Coxae and trochanters yellowish blue, irregularly infuscated basally; inner face of femora yellowish blue to light brown, outer face black; fore and middle tibiae brown to piceous, hind tibiae lighter brown on outer face; tarsi and tarsal claws piceous, black apically; leg spines black.

Abdomen largely black dorsally and over upper third to half of lateral aspect, remainder blue to brown; 1 with rectangular spot occu-

pying basal two-thirds of dorsum, its caudal margin slightly convex; narrow apical ring black, remainder of 1 light blue; black of 2 occupying dorsum and upper half of sides, enclosing a small subapical blue spot whose ends are sometimes confluent with blue of remainder of sides; intersegmental membrane piceous; hamules light brown edged with piceous; penis shaft (Figs. 15, 16) and vesicle black; 3-7 black dorsally and progressively increasingly so laterally, remainder of sides blue to brownish, this color produced as a narrow, middorsally-interrupted basal ring; 8 and 9 blue, apical spine rows and lower fourth of lateral aspect black; 10 brown ventrally, remainder black; sternites, and ventral margins of tergites, brownish, intensity varying with age of specimen, mid ventral keel usually same color as sternite; superior appendages (Figs. 72, 79, 80) black, posterior face obscure brownish; inferiors brown basally, black apically.

Wings hyaline, sometimes slightly smoky; venation black; pterostigma piceous to black.

Female.—Similar to ♂, differing as follows:

Head dorsum brown to piceous rather than black, postocular spots thinly stippled with cinnamon brown.

Prothorax with light markings more extensive than black; most of lateral convexity of middle lobe light blue, confluent anterolaterally with blue of anterior lobe; hind lobe almost entirely pale; propleurite pale olive to blue, orange along upper border.

Thorax as in ♂, but interlaminal depression pale brown, middorsal carina adjoined on either side throughout its length by a pale stripe occupying about one-fifth width of mesepisternum; this in turn flanked by a brown stripe with diffuse borders and stippled with darker brown, occupying about one-third width of mesepisternum; mesepisternal fossae (Fig. 150) shallow, located near anterior bifurcation of middorsal carina, which is slightly elevated between them.

Legs as in ♂.

Abdomen similar to ♂, but black not including as much of lateral aspect in ♂; on 2 about same width as on 1 through basal two-thirds, then suddenly widened to form a lobular lateral prolongation on either side, suddenly constricted to a narrow middorsal line joining it with apex; apical ring and intersegmental membrane of 2 piceous to black; 3-6 black dorsally, almost interrupted by blue band basally, expanded apically; 7 like preceding segments; 8 and 9 black, blue between apical spine rows and apex of tergite; 10 blue, narrowly black basally; appendages piceous; sternites and ventral margins of tergites brownish, mid ventral keel piceous to black; valves of ovipositor brown, stylets piceous; apical spine of eighth sternite well developed, broad at base, acutely pointed, tip black.

Wings hyaline, venation black, pterostigma medium brown; petiolation extending slightly distal to Ac juncture; arculus originating distal

to second antenodal; postnodals $\frac{12}{12} \cdot \frac{11}{11}$; M_2 arising $\frac{-6}{-6} \cdot \frac{-5}{-5}$; M_{1a} arising $\frac{9}{9} \cdot \frac{8}{9}$; poststigmal cells $\frac{6}{5} \cdot \frac{7}{6}$.

Measurements and Venation.—Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio
	Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
Bolivia							
Males	27.5	26.9	26.0	18.8	18.4	18.0	0.68
Female		27.3			19.8		0.72
Paraguay							
Male		27.0			18.5		0.68

Venational features are as follows: Number of Postnodals—Bolivia, males, fore wing, 12-14, ave. 12.8; hind wing, 10-13, ave. 12.5. Female, fore wing, 12; hind wing, 11. Paraguay, male, fore wing, 13; hind wing, 12. Origin of M_2 —Bolivia, males, fore wing, arising at sixth postnodal in five specimens, at fifth in one; hind wing, arising slightly distal to fifth in five specimens, just proximal to fifth in one. Female, fore wing, arising proximal to sixth postnodal; hind wing, arising proximal to fifth. Paraguay, male, fore wing, arising at sixth postnodal; hind wing, arising at fifth. Origin of M_{1a} —Bolivia, males, fore wing arising at tenth postnodal in five specimens, at ninth in one; hind wing, arising at ninth in five specimens, at eighth in one. Female, fore wing, arising at ninth postnodal; hind wing, arising at ninth also. Paraguay, male, fore wing, arising at tenth postnodal; hind wing, arising at ninth.

Discussion.—*Acanthagrion ablutum*, while apparently very closely related to *hermosae*, is separable at a glance by its lighter coloration, its possession of postocular spots, and the greater simplicity of the ental surface of the distal penis segment. In the limited number of specimens at hand, the superior appendages extend slightly beyond the inferiors.

Distribution (Pl. XIX).—Like *hermosae*, *ablutum* appears to occur at rather high elevations in the Andes. The Paraguay record probably indicates a tendency of the species to spread into lowlands closely adjoining mountainous regions.

Material Examined.—7 ♂, 1 ♀, as follows: BOLIVIA: Coroico, 1912-1913, 1♂ (1800 M.), Förster Collection; Mapiri, no date, 1 ♂; Sorata, no date, 3 ♂; Mapiri and Sorata specimens by Staudinger, in Cowley Collection; Songo, April 9, 1♂, 1♀, Förster Collection. PARAGUAY: Villarica, 1911, May 1, 1 ♂, Förster Collection.

Records in Literature.—*Acanthagrion gracile ablutum* Calvert 1909: Original description cited above; Ris, 1913:66 (recorded from Argentine near Paraguay River); Ris, 1916:123, 124 (Coroico and Rio Songo, Bolivia). *Acanthagrion ablutum*, Kennedy, 1916:327, 328, Figs. 10, 11 (penis drawn).

Acanthagrion hermosae, new species
(Pl. II, Figs. 17-18; Pl. VIII, Figs. 81, 85-86)

Holotype: Male, vicinity of Pampa Hermosa, Peru, 1600 meters, May 1-15, 1935, by F. Woytkowski.

Holotype Male.—Labrum and exposed portions of mandibles dark green, lateral and basal margins and basomesal impression of labium black; anteclypeus dark slate gray, almost black; remainder of head entirely black except for postgenae, which are tinged obscurely with bluish, and labium and maxillae, which are brown.

Pronotum and propleurite entirely black; prosternum dark brown, a black spot between fore coxae.

Synthorax uniform deep black except as follows: that portion of metepisternum which lies immediately adjacent to anterodorsal boundary of metinfraepisternum, and the last-named sclerite, greenish brown; metepimeron deep cherry red mesally, extreme anterior end yellowish brown, posterolateral angle black; mesosternum, metasternum, and intersternum brownish, somewhat pruinose.

Coxae piceous, irregularly mottled with lighter brown; hind tibiae dark piceous externally; remainder of legs deep black.

Abdomen predominantly black throughout; 1 black except for small, round spot of deep cherry red on either side near bottom of lateral aspect; 2 black, grading to dark piceous along ventral margin, hamules dark piceous, penis shaft (Figs. 17, 18) and vesicle black; 3-7 black dorsally and laterally, extreme ventral margins narrowly edged with greenish yellow, which is separated from black by a narrow stripe of deep cherry red; 7 with blue between apical spine row and apex of tergite dorsally; 8 and 9 blue, lower third of lateral aspect black, this color produced dorsad to mid-height between apical spine rows and apices of tergites; 10 brown ventrally, remainder black; sternites reddish brown to piceous, darkest posteriorly; superior appendages (Figs. 81, 85, 86) black; inferiors black except for narrow brownish region basally.

Wings hyaline, slightly smoky; venation black, pterostigma deep maroon; petiolation extending barely beyond Ac juncture; arculus arising slightly distal to second antenodal; Postnodals $\frac{13}{13} \cdot \frac{11}{11}$; M_2 arising midway between sixth and seventh postnodals in fore wings, at fifth in hind wings; M_{1a} arising $\frac{11}{10} \cdot \frac{10}{9}$; poststigmatal cells $\frac{6}{7} \cdot \frac{6}{6}$.

Measurements and Venation.—Measurements (in mm), which include the type, are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
27.0	25.2	25	19.0	18.1	17.5	0.71

Venation features are as follows: Number of Postnodals—Fore wing,

12-13, ave. 12.5; hind wing, 11-12, ave. 11.4. Origin of M_2 —Fore wing, arising distal to sixth postnodal in one specimen, at sixth in two specimens, just proximal to sixth in remaining two; hind wing, arising at fifth postnodal in four specimens, distal to fifth in remaining one. Origin of M_{1a} —Fore wing, arising at tenth postnodal in three specimens, at ninth in one, at tenth and eleventh of left and right wings, respectively of one (the type); hind wing, arising at ninth postnodal in four specimens, at ninth and tenth in left and right wings, respectively, of one (the type).

Discussion.—This strikingly handsome insect is obviously close to *ablutum*, as shown in the discussion of that species. It is distinguishable from that and all other known species of the genus by the uniform black coloration of the head dorsum and mesothoracic elements of the synthorax, and by the appearance, on the thorax and abdomen, of small but vivid areas of brilliant cerise, a color not encountered elsewhere in *Acanthagrion*.

Aside from *ablutum*, *hermosae* appears to have no near relatives, although discovery of the female may reveal affinities with other forms.

Distribution (Pl. XIX).—*A. hermosae* is known only from the type locality, near Pampa Hermosa, where it was taken at an altitude of 1600 meters in the Peruvian Andes. This is the loftiest elevation known to be attained by any member of the genus except *ablutum*, which has been taken at an altitude of 1800 meters.

Material Examined.—5 ♂, (holotype and paratypes), as follows: PERU: Vicinity of Pampa Hermosa, 1600 M., 1935, May 1-15, 5 ♂, by F. Woytkowski.

APICALE GROUP

This group is composed of three closely linked species, *phallicornis*, *obsoletum*, and *apicale*. Noteworthy characteristics possessed in common are: the prolongation, in the males, of the apex of abdominal segment 10 to form two posteriorly-directed horns; the presence, in the females, of a tubercle pinched up from the thoracic middorsal carina, on either side of which the mesepisternal fossae are impressed; and the presence, in mature specimens of both sexes, of orange and black coloration. *Acanthagrion apicale* and *obsoletum* are most intimately related, this being demonstrated by the existence, in the males of both, of a pair of short, stout, heavily sclerotized hooks, one on either side of the tip of the distal penis segment. *A. obsoletum* and *phallicornis* are apparently restricted to streams of the upper Amazon system, while *apicale* occurs throughout the drainage from the Andes to Belém, and has in addition spread to the Essequibo and Paraná systems.

On the basis of male penis and appendages, this group appears to have relationships with the Ascendens Group, especially *ascendens*, where the orange color phase occurs and where the penis possesses setiferous areas similar to those of *phallicornis*.

Acanthagrion phallicornis, new species

(Pl. II, Figs. 19-20; Pl. VIII, Figs. 82, 87-88; Pl. XIV, Fig. 147)

Holotype: Male, Porto Velho, Brazil, Feb. 20, 1922, by J. H. Williamson and J. W. Strohm; allotype a female, Feb. 21, same data.

Holotype Male.—Labrum and exposed portions of mandibles bluish green, labrum narrowly edged laterally with black, and bearing a black basomesal impression; anteclypeus somewhat darker than labrum; dorsum of postclypeus margined with bluish green, remainder chiefly black, a small oval yellowish green spot on either side of mid line; genae bluish green, a little lighter than labrum; lower half of anterior face of frons about same color as anteclypeus, the light color divided mesally by a black line connecting black of upper frons surface with that of postclypeus; remainder of frons dark, the lighter color merging laterally with that of genae and covering most of anterior face of basal antennal segment terminating obliquely at about level of base of second antennal segment; remainder of frons and antennae, and vertex and occiput black except for dark buff, subtriangular postocular spots; rear of head to level of lower side of occipital foramen black, remainder pale bluish white; labium and exposed portions of maxillae white to pale cream color.

Anterior lobe of prothorax pale orange bordered with black; middle and hind lobe of pronotum black save for a small triangular pale orange spot on either side of middle lobe; proepisternum and proepimeron chiefly black, yellowish green below and on posterolateral convexity; prosternum flesh color, slightly tinged with green, a black spot between fore coxae.

Mesostigmal laminae black, distal third of each pale buff, narrowly bordered with black; dorsum of mesepisternum and antelar ridge black; antehumeral stripe pale tan, throughout middle three-fourths of its length occupying about one-third width of mesepisternum, dilated at either end, more so anteriorly where its ventral border touches dorsal suture of mesinfraepisternum; humeral stripe black, occupying approximately one-fourth width of mesinfraepisternum and two-thirds width of mesepimeron, covering all but posteroventral angle of mesinfraepisternum, constricted to about half its width near posterior and just before joining black of antelar and lateral alar ridges, produced as a short narrow spur along posterior sixth of first lateral suture; black stripe on metepisternum following second lateral suture from black anterior border of pale lateral alar

ridge almost to metastigma, slightly expanded at mid length, tapering to each end, at widest point about one-half as wide as metepimeron; posteroventral triangular area of metepimeron tipped with a small black spot; remainder of pleural area pale tan with occasional irregularly defined patches of light bluish gray (probably due to post-mortem color changes); mesosternum, metasternum and intersternum same color as lighter portions of metapleurite, somewhat pruinose.

Coxae and trochanters pale blue; femora rather more robust than in other members of Apicale Group, black on external face, very dilute bluish green on inner face; tibiae pale amber, external faces dark brown, interrupted and beaded on middle and hind tibiae; tarsi, tarsal claws, and leg spines piceous to black.

Abdomen predominantly black dorsally, lateral and ventral half of tergites pale greenish blue with occasional patches of dark tan (probably also due to post-mortem changes); 1 with lateral pale color extended to form subapical encircling ring, intersegmental membrane and narrow apical border of 1 black; black on dorsum of 2 in form of spear-head, point truncated against basal border, extreme apex of tergite and intersegmental membrane, black; penis shaft (Figs. 19, 20) and vesicle black; 3-7 with only a narrow, basal ring encroaching on dorsal black, which is continuous on mid line; 8 and 9 dark blue dorsally, apical spine rows and lower third of tergites black; 10 and appendages (Figs. 82, 87, 88) black, slight infuscation on venter of 10 and inferior appendages; dorsum of 10 produced into two posteriorly-directed horns, closely resembling those found in *apicale* and *obsoletum*, but somewhat shorter and more bluntly tipped.

Wings hyaline, venation piceous, pterostigma dark maroon; petiolation extending beyond Ac juncture by about one-half length of Ac; arculus arising at second antenodal in three wings, slightly distal in left hind wing; postnodals $\frac{10}{10} \cdot \frac{8}{8}$; M_2 arising at fourth postnodal in fore wings, between third and fourth in hind wings; M_{1a} arising $\frac{7}{7} \cdot \frac{7}{7}$; poststigmatal cells $\frac{4}{3} \cdot \frac{5}{5}$.

Abdomen 24.5 mm; hind wing 16 mm.

J. H. Williamson gives the following description of colors just after death:

“Eyes: Black on top, green below and running up anterior sides. Postocular spots golden yellow. Black between eyes. Face green with black bar, upper lip black, lower a yellowish white.

Thorax: Yellow with black dorsal and other black stripes.

Legs: Femora dark brown, tibiae light brown.

Abdomen: 1, 2, and part of 3 yellowish on sides, 1-6 black on top, 7 black except posterior end blue on top, 8 and 9 blue on top and sides, 10 black.”

Allotype Female.—Markings and colors almost identical with those of ♂, with following differences; labrum piceous instead of bluish green,

exposed portions of mandibles olive green; pale spots on postclypeus confluent across mid line; black of upper surface or frons not joined with that of postclypeus; remainder of head as in ♂.

Prothorax identical with that of ♂.

Synthorax marked and colored as in ♂; mesepisternal fossae (Fig. 147) impressed in either side of a small tubercle produced from middorsal carina at caudal end of interlaminal sinus, about one-third distance from anterior end of synthorax; dorsum of tubercle smooth, polished.

Legs as in ♂, but black of middle and hind femora not quite so extensive, and tarsal segments light brown, black tipped.

Abdominal segments 1-7 as in ♂, but dorsal rectangular black spot of 1 narrowly joined with black apical ring; 8 similar to preceding segments; 9 with apical tridentate blue mark, the middorsal lobe extending almost to the segment base, the two lateral lobes extending midway from apex to base; remainder of 9 black; 10 blue, appendages black; sternites and ventral margins of tergites light brown; mid ventral keel black; valves of ovipositor light brown, stylets a trifle darker; apical spine of eighth sternite short, sharp, black tipped.

Wings hyaline, venation brownish gray, pterostigma light olive; petiolation extending barely beyond Ac juncture; arculus arising barely distal to second antenodal; postnodals $\frac{10}{10} \cdot \frac{9}{9}$; M_2 arising slightly proximal to fifth postnodal in front wings, to fourth in hind wings; M_{1a} arising $\frac{8}{8} \cdot \frac{8}{8}$; poststigmatal cells $\frac{5}{5} \cdot \frac{5}{4}$.

Abdomen 24.5 mm; hind wing 17 mm.

Measurements and Venation.—Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Males	26.0	25.1	24.5	17.0	16.2	16.0	0.65
Females	26.2	25.2	24.0	18.5	17.7	17.0	0.70

Venational features are as follows: Number of Postnodals—Males, fore wing, 9-11, ave. 10.2; hind wing, 7-9, ave. 8.4. Females, fore wing, 10-12, ave. 11.0; hind wing, 9-11, ave. 9.4. Origin of M_2 —Males, fore wing, arising just proximal to fifth postnodal in eight specimens, at fourth in one (the holotype); hind wing, arising between third and fourth in all specimens. Females, fore wing, arising slightly proximal to fifth postnodal in one specimen, at fifth in remainder; hind wing, arising at fourth in all specimens. Origin of M_{1a} —Males, fore wing, arising at eighth postnodal in eight specimens, at seventh in one; hind wing, arising at seventh in eight specimens at eighth in one. Females, fore wing, arising at eighth postnodal in all save one specimen, in that arising at ninth; hind wing, arising at eighth in three specimens, at seventh in three.

Discussion.—In regard to development of abdominal segment 10 in the

male, *phallicornis* appears to be the least specialized member of the group. Its dorsal horns (Figs. 82, 87, 88) are rather short and blunt, in contrast to the progressive increase in length and sharpness characterizing other members of the group.

It appears almost certain that *phallicornis* is very closely related to *obsoletum* and *apicale*, although the existence of setiferous areas on penis segment 2 suggests affinities with *ascendens*.

From the other members of the group, *phallicornis* differs by the characters of penis, appendages, and mesepisternal fossae mentioned in the key, and also by its smaller size.

Distribution (Pl. XVIII).—At present *phallicornis* is known only from the type locality, Porto Velho, Amazonas, Brazil. As nearly as can be discovered from a perusal of Mr. J. H. Williamson's field notes, this species was taken in a clearing along a small sluggish creek near Porto Velho.

Material Examined.—9 ♂, 6 ♀, including holotype and allotype, as follows: BRAZIL: Porto Velho, 1922, Jan. 29, 1 ♂; Feb. 6, 1 ♂; Feb. 9, 1 ♂, 2 ♀; Feb. 13, 1 ♂, 1 ♀; Feb. 20, 1 ♂; Feb. 21, 1 ♂, 2 ♀; Feb. 22, 1 ♂; March 2, 2 ♂; May 14, 1 ♀. All by J. H. Williamson and J. W. Strohm.

Acanthagrion obsoletum (Förster)⁶

(Pl. II, Figs. 21, 22; Pl. VIII, Figs. 83, 89-90; Pl. XIV, Fig. 148)

Myagrion obsoletum Förster, 1914:68-70 (1 ♂, Madre de Dios, Peru, 500 meters, Förster Collection), type species of *Myagrion* (new synonym) and holotype of *obsoletum* by monotypy. Allotype, here described: ♀, Mera, Oriente Ecuador, Nov. 15, 1936, W. Clarke-Macintyre, in Kennedy Collection.

New synonym: *Acanthagrion luna* Ris (1918:122-123, Fig. 64).

Holotype Male.—Labrum and exposed portions of mandibles light green, labrum with lateral margins and basomesal impression black; anteclypeus dull grayish green; genae light olive, darker above than below, olive color extending to level of second antennal segment base; postclypeus black, its posterolateral angles green; lower part of anterior frons face bearing a broad, low, black triangle whose apex is narrowly joined to black of frons dorsum; upper half of anterior frons face black, remainder obscure olive green; postocular spots light reddish brown, rounded, each a trifle larger than area occupied by ocelli, remainder of head dorsum and antennae black; rear of head black to level of upper edge of occipital foramen, black then restricted to surround foramen with a band about three times as wide as foramen; postgenae buff to yellowish brown, lower portions streaked with light

⁶ See Appendix under *A. leonora* Gloger.

blue; labium pale bluish white, exposed portions of maxillae light brown.

Anterior lobe of prothorax light orange, narrowly edged in front with light brown; middle lobe of pronotum black, lateral convexity bearing a subtriangular orange spot on either side, this spot confluent anterolaterally with lateral ends of orange of anterior lobe; hind lobe black mesially, outer third orange; upper fourth of propleurite black, remainder olive green lightly washed with orange; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae and interlaminal sinus black, outer half of each lamina orange; antealar ridge black, reddish brown mesally; dorsum of mesepisternum black, this color widest about one-fourth distance from anterior end, tapering very slightly cephalad and caudad, in all occupying about one-third width of sclerite; antehumeral stripe orange, widest anteriorly where it touches dorsal mesinfraepisternal suture, gradually restricted caudad to about half this width, expanded slightly at extreme posterior end; humeral stripe black, widest at mid length where it occupies about one-fifth width of mesepisternum and one-third that of metepimeron, suddenly constricted to one-third this width at posterior end where confluent with black of alar ridges; lower border approximately parallel to humeral suture; stripe diluted to metallic brown over mesinfraepisternum, whose upper two-thirds it covers; lateral alar ridge, at level of mesepimeron, black, this color produced along posterior eighth of first lateral suture in form of very narrow, sharply-pointed triangle; remainder of lateral alar ridge light yellowish green, bordered with black; second lateral suture bordered by an infuscated area which occupies about one-third width of metepisternum and extends from posterior end to metastigma, quite vague and diffuse throughout; extreme posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites chiefly light green suffused with yellowish, especially near leg bases; mesosternum, metasternum and intersternum light yellowish green, very slightly pruinose.

Coxae and trochanters olive green, somewhat infuscated basally; inner face of femora greenish buff, outer face black, latter color entirely surrounding femur at apex; inner face of tibiae piceous, outer face light brown mottled with dark brown; tarsi and tarsal claws piceous, black apically; leg spines black.

Abdomen predominantly black dorsally; dorsal black of 1 expanded to form narrow apical ring, constricted by about one-third anteapically, remainder, including intersegmental membranes, yellowish green; 2 black dorsally and over upper third of lateral aspect, produced into an angular lateral expansion one-fourth distance from apex, then constricted to less than its original width, then produced as narrow apical band; intersegmental membrane piceous, hamules brownish,

penis shaft (Figs. 21, 22) and vesicle black, remainder of 2 yellowish green; 3-7 black dorsally and over most of sides, remainder of lateral aspect light green on 3, gradually darkening to brown on 6 and 7; light color produced to form narrow, middorsally-interrupted basal ring on 3 to 5; 7 blue dorsally between apical spine row and end of tergite; 8 and 9 blue, apical spine rows black, piceous to black washings along lower fourth of sides, 10 brown ventrally, remainder black; ventral margins of tergites same color as light portions of sides, but irregularly tinged with yellowish; sternites dark brown, midventral keel piceous, genital valvules blue; superior appendages (Figs. 83, 89, 90) black, posteroental face dark brown; inferiors narrowly brown basally remainder black.

Wings hyaline, venation black, pterostigma piceous; petiolation extending beyond Ac juncture by one-half length of Ac; arculus arising barely distal to second antenodal; postnodals $\frac{12}{12} \cdot \frac{10}{10}$; M_2 arising $\frac{-6}{-6} \cdot \frac{-5}{-5}$; M_{1a} arising $\frac{8}{8} \cdot \frac{8}{8}$; poststigmatal cells $\frac{6}{5} \cdot \frac{6}{6}$.

Abdomen 27 mm; hind wing 19 mm.

Allotype Female.—Labrum dark brown, lateral margins and basomesal impression black; exposed portions of mandibles brown, somewhat lighter than labrum and faintly tinged with green; anteclypeus dull slate color; genae light tan below, gradually suffused with pale green above, finally changing to light olive near upper extremity, which terminates about level of mid height of second antennal segment; postclypeus black, posterolateral angles and a small triangular spot on either side of mid line olive green; anterior face of frons bearing a very low, broad, black triangle based on clypeofrontal suture; frons then light blue, giving way to light reddish brown above, interantennal depression black with an anterior prolongation on mid line which is joined with apex of ventral triangle by a very narrow black line; reddish brown of frons washing anterior faces of first and second antennal segments; a small subreniform spot of reddish brown just behind antennae near margin of compound eyes; a narrow, irregular line of similar color between antennae, briefly interrupted by black just anterior to median ocellus; a very small, oval, reddish spot on either side of lateral ocelli, and a fleck of this color in front of each lateral ocellus; postocular spots reddish brown, suboval, each about one-fourth larger than area occupied by ocelli; occipital ridge dark reddish brown, not connected with postocular spots; remainder of head dorsum and antennae black; black barely extending over occiput to rear of head, at once restricted to surround occipital foramen by a band about three times as wide as foramen; remainder of rear of head pale brownish green, slightly pruinose; labium white, faintly edged with light brown; exposed portions of maxillae brown.

Anterior lobe of prothorax pale orange, its anterior margin light brown; middle lobe of pronotum black, a narrow dash of greenish

yellow on either side of mid line, and a large reddish brown spot on either side of lateral convexity, narrowly confluent anterolaterally with orange of front lobe; hind lobe reddish brown throughout; propleurite narrowly black along upper border, remainder light greenish yellow; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae black mesally, each with outer half light greenish yellow; anterolaminal depression and antelar ridge black, the latter ringed with brown laterally; mesepisternum black dorsally, this color occupying about one-third width of sclerite, slightly constricted at anterior end; mesepisternal fossae (Fig. 148) impressed on either side of a tubercle elevated from middorsal carina one-fourth distance from anterior end; antehumeral stripe light orange, at anterior end extending to dorsal mesinfraepisternal suture, only slightly restricted caudad by black of humeral stripe, thus covering almost all of mesepisternum not occupied by middorsal black; humeral stripe black to piceous posteriorly, constricted to a point where confluent with black of alar ridges, expanded immediately to occupy about one-third width of mesepimeron and a very small portion of mesepisternum, upper border leaving latter sclerite entirely at about mid length and following humeral suture cephalad; stripe diluted to light metallic brown over anterior end of mesepimeron, and over mesinfraepisternum, whose upper two-thirds it occupies; lateral alar ridge at level of mesepimeron black, this color produced as a narrow spur along posterior eighth of first lateral suture; remainder of lateral alar ridge light olive, anteriorly bordered with black at level of metepisternum and interrupted by black at level of second lateral suture; second lateral suture bearing an oval, piceous mark astride its posterior eighth, this color diluted to obscure brown and produced cephalad to metastigma, lying wholly on metepisternum and occupying about one-third its width; posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light yellowish green, increasingly yellow near leg bases; mesosternum, metasternum and intersternum yellowish green, pruinose.

Coxae and trochanters yellowish green, slightly infuscated, pruinose; hind legs absent from specimen; remaining femora light greenish yellow, apical half to two-thirds of outer face piceous to black; inner face of tibiae dark brown to piceous, outer faces brown mottled with piceous; tarsi and tarsal claws brown, black tipped; leg spines black.

Abdomen black dorsally, light bluish green to greenish brown laterally; dorsum of 1 black, narrowly constricted to half its width antepically, then expanded to form narrow apical ring; sides and intersegmental membrane light bluish green; dorsum of 2 black, approximately same width as that of 1 through basal two-thirds, then widened and constricted to form rounded lateral expansion subapically, again produced to form narrow apical ring; remainder of lateral aspect of 2 light bluish green; 3-8 black dorsally and over one-fourth to one-half

lateral aspect, black increasingly extensive caudad, remainder of sides greenish brown to brown, light color produced dorsad to form narrow, middorsally interrupted basal rings; 7 and 8 blue dorsally between apical spine rows and apex of segments; 9 similar to 8, but apical third blue; 10 entirely blue, appendages piceous; sternites and ventral margins of tergites light brown, sternites of first three segments darker brown; midventral keel piceous, light brown at posterior end; valves of ovipositor light brown, stylets black; apical spine of eighth sternite well developed, brown with black tip.

Wings hyaline, venation black, pterostigma light olive; petiole extending beyond Ac juncture by a distance almost equal to length of Ac; arculus arising distal to second antenodal; postnodals $\frac{12}{12} \cdot \frac{10}{10}$; M_2 arising slightly distal to fifth postnodal in fore wings, just proximal to fifth in hind wings; M_{1a} arising $\frac{8}{8} \cdot \frac{8}{8}$; poststigmatal cells $\frac{6}{6} \cdot \frac{5}{5}$.

♀ abdomen 27.5 mm; hind wing 19 mm.

Measurements and Venation.—Measurements (in mm), based on a series of 30♂ from Colombia and Ecuador, are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
29.0	27.4	26.5	19.0	18.6	18.0	0.68

Venational features are: Number of Postnodals—Fore wing, 11-13, ave. 12.1; hind wing, 9-12, ave. 10.0. Origin of M_2 —Fore wing, arising at sixth postnodal 66 2/3%, between fifth and sixth 33 1/3%; hind wing, arising at fifth postnodal 16%, between fourth and fifth 84%. Origin of M_{1a} —Fore wing, arising at ninth postnodal 66 2/3%, mid way between eighth and ninth 16 2/3%, at eighth 16 2/3%; hind wing, arising at eighth postnodal 84%, slightly proximal to eighth 16%.

No geographical trends have been observed in measurements or in venation from the various localities.

Discussion.—When Förster described this species, he erected a new genus to contain it (1914:68-70). He noted the elongated body and abdomen and the two pronged dorsal extension (horns) of abdominal segment 10 as features remindful of *Heteragrion* and *Anisagrion*, respectively. It is surprising that he did not even mention *Acanthagrion*, because *obsoletum* shows striking similarities to *Acanthagrion apicale*. This may be partially explained in that no specimens of true *apicale* have been found in the Förster Collection, he having incorrectly applied this name to specimens of *ascendens*. Examination of Förster's type, a unique male, shows that it is indeed an *Acanthagrion*, close to both *apicale* and *phallicornis*. Accordingly, *Myagrion* becomes a new synonym of *Acanthagrion*.

Photographs of the type of *Acanthagrion luna* Ris (1918:122, 123, fig. 64), kindly supplied by Dr. Elli Franz, of the Senckenberg

Museum, prove that this name must fall as a new synonym of *obsoletum*. Ris compared the species to *Acanthagrion gracile* and to *Oxyagrion basale* Selys.

On the basis of morphological similarities, *obsoletum* is closely related to both *apicale* and *phallicornis*. The male abdominal appendages and tenth abdominal segment are very similar to those of *obsoletum*, while the penis is almost indistinguishable from that of *apicale*. The mesepisternal fossae are impressed on either side of a tubercle produced from the middorsal carina, as in the other species of the group, but differ in that the tubercle is situated much nearer to the interlaminal sinus in *obsoletum*. Aside from members of its group, *obsoletum* appears to have no close relatives.

Distribution (Pl. XVIII).—Known from mountainous regions of Colombia, Ecuador, and Peru, *obsoletum* is apparently adapted to conditions of high altitude, like other members of the group, and is probably of rather general occurrence throughout the Andes.

Material Examined.—38 ♂, 2 ♀, including holotype and allotype, as follows: COLOMBIA—Umbria, 1930, Oct. 29-Nov. 23, 8 ♂, 1 ♀, Staudinger, in Cowley Collection. ECUADOR—Napo, 1934, April 20, 2 ♂; Rio Anzu, 1934, Aug. 6-25, 6 ♂; Rio Pupuyacu, 1934, Nov. 19, 2 ♂; Rio Jatun Yacu, 1935, January, 4 ♂; Mera, Rio Pastaza Watershed, 1936, Nov. 15-20, 14 ♂, 1 ♀ (allotype). All by W. Clarke-Macintyre, in Kennedy Collection. PERU—Madre de Dios, 1 ♂ (holotype), 500 meters, no date, in Förster Collection; Rio Seco, 1934, October, 1 ♂, by G. G. Klug, in Cowley Collection.

Records in Literature.—*Myagrion obsoletum* Förster, 1914 (Original description as cited above). *Acanthagrion luna* Ris, 1918:122-123, fig. 64 (1 ♂, Villavicencio, Colombia).

Acanthagrion apicale Selys⁷

(Pl. II, Figs. 23-24; Pl. VIII, Figs. 84, 91-92; Pl. XIV, Fig. 149)

Acanthagrion apicale Selys, 1876: 306 (males only, from Pará, and from "Pebe, haut Amazone"); allotype a female, here described, Pará (Belém), Brazil, Aug. 5, 1922, by J. H. Williamson and J. W. Strohm.

Male.—Labrum and exposed portions of mandibles brilliant orange, labrum with lateral border and basomesal impression black; anteclypeus rusty red; genae light orange below, gradually changing to reddish orange at upper end, which reaches level of second antennal segment base, and covers anterior face of basal segment; postclypeus reddish orange, irregularly bordered with black, and with black band on mid line; reddish orange of genae connected across anterior face of frons, which bears a very low, obtuse-angled triangle of black based on

⁷ See Appendix under Types.

frontoclypeal suture; postocular spots orange to reddish brown, sub-triangular, each about one-fourth larger than area occupied by ocelli; in some examples a minute orange spot on either side of median ocellus; remainder of head dorsum and antennae black; this black extending over rear of head to level of occipital foramen, then restricted to surround foramen with black band equal in width to pale yellow to golden postgenae; labium and exposed portions of maxillae cream color to light brown.

Anterior lobe of prothorax orange, anteriorly edged with black, and with two short lateral encroachments of black from middle lobe; middle and hind lobes of pronotum black, lateral fifth of hind lobe washed with orange; upper third of proepisternum and proepimeron black, remainder orange; prosternum buff to light brown, a black spot between fore coxae.

Mesostigmal laminae black, outer fourth to fifth of each orange; mesepisternum with black dorsal band occupying about one-third width of sclerite, tapering somewhat anteriorly; antealar ridges orange with black keels; antehumeral stripe reddish orange, narrowest two-sevenths distance from posterior end where it occupies about one-fourth width of sclerite, expanding gradually cephalad to double this width where it touches dorsal suture of mesinfraepisternum, expanded by about one-third at posterior end; humeral stripe black, upper border broadly convex, lower border approximately paralleling upper, widest about one-fourth distance from posterior end where it occupies about one-fourth width of mesepisternum and one-half width of mesepimeron; constricted to about two-thirds this width where confluent with black of alar ridges, tapering very slightly anteriorly, in mature specimens covering all but extreme posteroventral angle of mesinfraepisternum; lateral alar ridge black at level of mesepimeron, this color produced along posterior seventh of first lateral suture to form narrow spur, widest at base, acutely pointed apically; remainder of lateral alar ridge orange, margined with black; second lateral suture bearing a black stripe extending from alar ridge to metastigma, all save a small posterior encroachment lying on metepisternum, occupying half to two-thirds width of that sclerite; posterolateral angle of metepimeron edged with black; remainder of mesepimeron and metepisternum orange, metepimeron and metinfraepisternum light olive, slightly infuscated irregularly; mesosternum, metasternum and intersternum buff to light olive, somewhat pruinose.

Coxae and trochanters olive green, sometimes infuscated; outer face of femora black, inner face light greenish yellow to obscure olive green; inner face of tibiae black to brownish, outer face light brown mottled and streaked with dark brown to piceous; tarsi piceous to black, darkest apically; tarsal claws brownish, black tipped; leg spines black.

Abdomen largely black dorsally and laterally; dorsal black of 1 produced to form narrow apical ring; intersegmental membrane brown to black, sides olive green, sometimes suffused with orange; black of 2 about same width as that of 1, but expanded and contracted to form lateral angular extension on posterior third; intersegmental membrane piceous to black; lower half of lateral aspect similar to 1, but often narrowly infuscated adjoining hamules; hamules brownish, edged with piceous, penis shaft (Figs. 23, 24) and vesicle black; 3-7 black dorsally and over half to two-thirds lateral aspect; remainder of sides greenish brown to brown, produced dorsad on 3-5 as a narrow, middorsally interrupted basal ring; lower half lateral aspect of 8 and 9, and apical spine rows, black, remainder blue; 10 black dorsally and laterally, venter mostly brown; superior appendages (Figs. 84, 91, 92) black, inferiors black washed with brown basally, especially below; sternites and extreme ventral margins of tergites brown, yellowish brown on first three of four segments, progressively darkened to rusty brown posteriorly, mid ventral keel piceous to black.

Wings hyaline, often somewhat smoky; venation black, pterostigma reddish brown. The following is a field color description taken by J. H. Williamson, at Porto Velho, Brazil, on January 25, 1922:

"Eyes — brown on top, greenish yellow below; postocular spots orange

Face — greenish, with orange cross bar.

Thorax — middorsal stripe, black, then orange stripe, then black, then yellow, black, and finally a short yellow one.

Abd. 1-7 and 10 black with 8 and 9 light blue on top."

Allotype Female.—Color pattern almost exactly as in ♂, but orange and reddish colors replaced by light bluish green, light olive, or greenish brown.

Head as in ♂, but labrum dark brown with faint greenish tinge, genae, anteclypeus and exposed portions of mandibles light olive green; light regions of postclypeus and of anterior frons face dark olive green, dull in tone; postocular spots light bluish green.

Prothorax and thorax almost exactly as in ♂, but antehumeral stripe olive green, light portions of mesepimeron, mesinfraepisternum, and metapleurite light bluish green, with some pruinescence along metinfraepisternal and second lateral sutures, and over postero-lateral angle of metepimeron; mesepisternal fossae (Fig. 149) round, impressed on either side of a small tubercle elevated from middorsal carina at about mid length.

Legs as in ♂, but with considerable pruinescence on coxae, trochanters, and basal portions of femora.

Abdominal segments 1-7 as in ♂, 7 blue dorsally between apical spine row and apex of tergite; 8 similar to 7; 9 blue over apical third of dorsum, produced over upper half of sides, extending cephalad to base of segment on middorsal line; 10 blue, sometimes narrowly edged

with black basally and apically, appendages piceous to black; sternites and ventral margins of tergites as in ♂, but not so dark posteriorly; valves of ovipositor brownish; apical spine on eighth sternite small, sometimes almost obsolescent, but sharply pointed, black.

Wings hyaline, sometimes slightly smoky; venation piceous to black; pterostigma light brown; petiolation extending beyond Ac juncture by a distance equal to length of Ac; arculus arising slightly distal to second antenodal; postnodals $\frac{12}{12} \cdot \frac{10}{10}$; M_2 arising $\frac{5}{5} \cdot \frac{4}{4}$; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{6}{6} \cdot \frac{7}{6}$.

Abdomen 25 mm; hind wing 18 mm.

Measurements and Venation.—Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Porto Velho							
Males	27.0	26.1	24.5	19.0	18.3	17.5	0.70
Peru							
Males	29.5	27.8	26.2	20.2	19.5	18.7	0.71
Belém							
Males	28.0	26.7	25.2	19.5	18.4	18.0	0.68
Tumatumari							
Males	29.0	28.1	27.5	20.0	19.2	18.5	0.68

Venational features are as follows: Number of Postnodals—Males, all localities, fore wing range, 11-14; hind wing range, 9-12. Porto Velho average, fore wing, 11.8; hind wing, 10.1. Peru average, fore wing, 12.0; hind wing, 10.5. Belém average, fore wing, 11.8; hind wing, 10.3. Tumatumari average, fore wing, 12.1; hind wing, 11.0. Origin of M_2 —Porto Velho males, fore wing, arising at fifth postnodal 80%, just proximal to fifth, 20%; hind wing, arising at fourth postnodal 85%, just proximal 15%. Peru, males, fore wing, arising at fifth postnodal 70%, slightly distal to fifth 10%, slightly proximal 20%; hind wing, arising at fourth 90%, slightly proximal 10%. Belém, males, fore wing, arising at fifth postnodal 100%; hind wing, arising at fourth 100%. Tumatumari, males, fore wing, arising at fifth postnodal 80%, slightly distal to fifth 20%; hind wing, arising at fourth postnodal 100%. Origin of M_{1a} —Porto Velho, males, fore wing, arising at eighth postnodal; hind wing, arising at seventh postnodal, in all specimens. Peru, males, fore wing, arising at eighth postnodal 80%, slightly distal to eighth 20%; hind wing, arising at seventh postnodal 90%, at sixth 10%. Belém, males, fore wing, arising at eighth postnodal; hind wing, arising at seventh postnodal, in all specimens. Tumatumari, males, fore wing, arising at eighth postnodal 60%, slightly distal 20%, slightly proximal 20%; hind wing, arising at seventh postnodal in all specimens.

Discussion.—*Acanthagrion apicale* appears to represent the highest point in the course of specialization found throughout species of the Apicale Group. The tenth abdominal segment of the male is much

more elevated than in *phallicornis* or *obsoletum*. The dorsal horns of abdominal segment 10 are longer and more acutely pointed, and the appendages much longer, than in either of the two species mentioned. As would be expected from the great height of abdominal segment 10 in the male, the mesepisternal fossae of the female are situated much farther from the mesostigmal laminae than in *phallicornis* or *obsoletum*.

The slight differences in size and venation noted between specimens from different localities is probably without significance, since the series from Belém, Peru, and Tumatumari are so small. It is of interest, however, to note that the largest specimens were taken in mountainous regions.

In *apicale*, there has been observed a tendency to depart from the light blue or green ground colors common in the genus. Teneral specimens are of the usual type, but as maturity is attained the blues give way to yellow and orange. In this respect *apicale* differs from *obsoletum* and *phallicornis*, whose colors appear to be fixed from the time of emergence.

Distribution (Pl. XVIII).—See p. 172.

Material Examined.—116 ♂, 9 ♀, including allotype*, as follows: BOLIVIA—Buena Vista, 1933, February to April, 8 ♂, by Staudinger, in Cowley Collection; Cachuela Esperanza, 1922, April 12, 6 ♂, by J. H. Williamson and J. W. Strohm. BRAZIL—Abunã, 1922, March 10, 2 ♂; March 18, 1 ♂; March 21, 2 ♀; Belém, 1922, Aug. 5, 5 ♂, 2 ♀*; Aug. 7, 1 ♀; Aug. 9, 2 ♂, 1 ♀; Aug. 14, 1 ♂; Porto Velho, 1922, Jan. 25, 6 ♂; Feb. 1, 5 ♂, 1 ♀; Feb. 3, 4 ♂; Feb. 13, 8 ♂; Feb. 17, 5 ♂; Feb. 21, 4 ♂; Feb. 22, 4 ♂; Feb. 25, 2 ♂; Feb. 27, 3 ♂; Feb. 28, 2 ♂; March 2, 1 ♂; April 24, 3 ♂; April 25, 1 ♂; April 26, 2 ♂; April 27, 1 ♂; April 30, 2 ♂; May 3, 2 ♂; May 4, 2 ♂; May 5, 2 ♂; May 7, 1 ♂; May 18, 2 ♂; May 19, 2 ♂; May 24, 1 ♂. All by J. H. Williamson and J. W. Strohm. BRITISH GUIANA—Tumatumari, 1912, Feb. 6, 1 ♂; Feb. 7, 2 ♂; Feb. 12, 2 ♂. L. A. Williamson, E. B. Williamson, and B. J. Rainey. PERU—Iquitos, 1931, July 13, 2 ♂, 1 ♀; July 15, 1 ♂; July 16, 1 ♀; all by Paul Nagel; April 12, 1920, 1 ♂, H. S. Parish; Mishyacu, 1931, July 1, 1 ♂, Paul Nagel; Rio Seco, 1934, November, 2 ♂, G. G. Klug, in Cowley Collection; Moyobamba, no date, 1 ♂, Staudinger in Cowley Collection; Yurimaguas, 1920, April 12, 1 ♂, H. S. Parish.

References in Literature.—*Acanthagrion apicale* Selys, 1876: Original description as cited above; Calvert, 1899: 28 (compared with *latapistylum*); Calvert, 1909: 161, 166 (1 ♂, Iquitos, Peru); Williamson, 1916: 349-350 (description of males from Tumatumari, British Guiana); Kennedy, 1916: 328, 329, figs. 3, 4 (penis figured); Williamson, 1930: 15 (reference to occurrence in British Guiana).

YUNGARUM GROUP

This group is made up of three species: *yungarum*, *risi* and *williamsoni*. The features possessed in common which permit recognition of the group are: the simplified distal penis segment, with only slight specializations which are restricted to the base; the elevated 10th abdominal segment of the males; the close agreement in size, degree of robustness, and coloration; and venational features, especially the lengthy wing petiolation and large number of postnodal crossveins. Aside from its probable affinity with the Ablutum Group already mentioned, the Yungarum Group appears to be without close relatives. It is distributed through the northwestern part of South America from Peru to Colombia.

Acanthagrion williamsoni, new species

(Pl. III, Figs. 29-30; Pl. IX, Figs. 95, 101-102)

Holotype: Male, Mariquita, Colombia, Feb. 4, 1917, J. H. Williamson and E. B. Williamson.

Holotype Male.—Labrum and exposed portions of mandibles blue with light greenish tinge; labrum with narrow lateral margin and basomesal impression black; anteclypeus slightly darker and duller than labrum; genae pale yellowish green at level of mandibles, gradually changing to pale blue dorsad, extending to level of second antennal segment base, but not touching antennae, produced across lower part of anterior face of frons in form of oblique olive green bar, narrowly interrupted with black on mid line; postclypeus black dorsally, posterolateral angles light blue; a minute, obscure brownish spot behind each antenna; postocular spots light blue, subtriangular, each about one-half larger than area occupied by ocelli; remainder of head dorsum, and antennae, black; occipital foramen bordered laterally and dorsally by dark brown, about as wide as foramen; remainder of rear of head light yellowish brown, gradually merging with yellowish green of genae ventrally, postgenae slightly pruinulent; labium and exposed portions of maxillae whitish to pale buff.

Anterior lobe of prothorax light blue, bordered anteriorly with light metallic bronze; middle lobe of pronotum black, a light blue spot on either side of lateral convexity, black slightly encroaching on anterior lobe on either side of mid line; hind lobe black, its extreme lateral tips blue; proepisternum and proepimeron black along dorsal suture, remainder light olive green; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae black, lateral fifth of each pale blue; dorsum of mesepisternum, and antealar ridge, black; mesepisternal black widest about one-fourth distance from anterior end, narrowed cephalad and very slightly so caudad, occupying approximately one-half width of

sclerite; antehumeral stripe light blue, through middle two-thirds of extent occupying about one-third width of mesepisternum, somewhat dilated anteriorly, very slightly so posteriorly; humeral stripe chiefly black, widest at mid length where it occupies about one-fourth width of mesepisternum and two-fifths of mesepimeron, dorsal border slightly tapering posteriorly, and anteriorly where it coincides with anterior half of dorsal mesinfraepisternal suture; lower border constricted at posterior end, remainder paralleling humeral suture, diluted to metallic brown on mesinfraepisternum whose upper two-thirds it covers; lateral alar ridge at level of mesepimeron black, this color produced along posterior fifth of first lateral suture as a narrow spur; remainder of lateral alar ridge blue, its anterior margin narrowly edged with black at level of metepisternum; second lateral suture bearing an obscure sub-oval brown mark on its caudal end, this mark lying more on metepisternum than metepimeron, lower part of metepisternum slightly infuscated between this mark and metastigma; extreme posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light blue, slightly tinged with yellowish, and with pruinose near coxae; mesosternum, metasternum and intersternum pale yellowish or bluish, pruinose.

Coxae and trochanters same color as thoracic sternites, pruinose; femora same color as coxae on inner face, outer face piceous to black, dark colors most extensive on front femora; tibiae light brown, outer faces mottled with darker brown; tarsi yellowish brown, piceous apically; tarsal claws light brown tipped with black; leg spines black.

Abdomen chiefly black dorsally; dorsal black of 1 produced to form narrow apical ring, and enclosing a suboval middorsal blue spot one-third distance from apex; sides blue; black of 2 about same width as that of 1, but with lateral rounded expansion about two-thirds distance from base, apex and intersegmental membrane piceous to black; lateral aspect of 2 light blue, hamules light to dark brown, penis shaft (Figs. 29, 30) and vesicle black; dorsum and most of lateral aspect of 3-6 black, remainder of lateral aspect blue to brownish, produced to form narrow, dorsally interrupted basal ring on each segment; 7 and 8 blue, apical spines black, a small black spot on either side between spine rows and apex; 10 black dorsally, and laterally to level of inferior appendages, remainder brown; superior appendages (Figs. 95, 101, 102) black, inferiors brown, extreme tips black; abdominal sternites and ventral margins of tergites brownish, midventral keel dark brown.

Wings hyaline, venation and pterostigma piceous to black; all wings petioled beyond Ac juncture by a distance almost equal to length of Ac; arculus arising at second antenodal in all wings; post-nodals $\frac{12}{11} \cdot \frac{9}{9}$; M_2 arising proximal to fifth antenodal in fore wings,

just proximal to fourth in hind wings; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{5}{5} \cdot \frac{5}{5}$.

Abdomen 25.5 mm; hind wing 16.5mm.

Female.—Unknown.

This species is dedicated to the memory of Edward Bruce Williamson, with deepest respect and admiration.

Measurements and Venation.—Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
28.0	26.0	24.5	17.5	16.8	16.0	0.65

Venational features are as follows: Number of Postnodals—Fore wing, 9-12, ave. 11.2; hind wing, 7-10, ave. 9.0. Origin of M_2 —Fore wing, arising at fifth postnodal 85%, slightly distal to fifth 5%, slightly proximal 10%; hind wing, arising at fourth postnodal 60%, slightly proximal 40%. Origin of M_{1a} —Fore wings, arising at eighth postnodal 70%, at ninth 20%, at seventh 10%; hind wings, arising at seventh postnodal 80%, at eighth 20%.

Discussion.—According to E. B. Williamson's field notes, *williamsoni* was "Collected along a small tributary of the Poquera which crosses the railroad track about 3 kilometers S. of Town (Mariquita). This small stream has almost ceased to flow, has deep, clear pools, is largely rocky, and is shaded. Width 2-6 feet. Near its mouth is a small swampy swale 4-6 feet wide and 10-20 feet long." The notes do not indicate whether the specimens of *williamsoni* were taken from the pools or from the swale.

The reasons for grouping *williamsoni* with *risi* and *yungarum* have already been mentioned. From these two species, *williamsoni* may be distinguished by the characteristic form of penis and appendages. In the material at hand, the postocular spots are very large. It is probable, however, that none of these specimens are fully mature, and that the dark colors would be found to be more extensive in old examples.

Upon the basis of morphological resemblances, it is believed that *williamsoni* is more closely related to *risi* than to *yungarum*. The most simplified form of penis and appendages in the Yungarum Group is displayed by *williamsoni*.

Distribution (Pl. XVII).—The exact locality for the specimens collected by Bouis is not known. It is probable that the single word "Cauca" refers to some collecting station along the Rio Cauca. The town of Mariquita is at an elevation of about 1500 meters, according to Williamson's notes. This may indicate that *williamsoni* shares with *yungarum* a preference for higher altitudes.

Material Examined.—20 ♂, including holotype, as follows: COLOMBIA—Cauca, 12 ♂, Bouis, no date; Mariquita, 1917, Feb. 4, 8 ♂, including holotype, J. H. Williamson and E. B. Williamson.

Acanthagrion risi, new species⁸

(Pl. III, Figs. 27-28; Pl. IX, Figs. 94, 99-100; XVI, Fig. 162)

Holotype: Male, Tachira, Venezuela, April 8, 1920, J. H. Williamson, E. B. Williamson, and W. H. Ditzler; allotype a female with same data.

New synonym: *Acanthagrion yungarum* form b Ris, 1918:125, figs. 67, 68 (7 ♂, Villavicencio, Colombia).

Holotype Male.—Labrum, exposed portions of mandibles, and genae light bluish green; anteclypeus, postclypeus, frons, antennae, vertex and occiput black, except for postocular spots which are of same color as labrum, subtriangular, about twice as large as area occupied by ocelli; postgenae pale flesh color, occipital foramen surrounded by black; exposed portions of labium and maxillae pale yellowish white.

Anterior lobe of prothorax blue mesally, dark brown to black laterally; middle and hind lobe of pronotum entirely black save for a minute light mark on extreme lateral tips of hind lobe; proepisternum and proepimeron pruinose blue on lower half, remainder black; prosternum flesh color, a black spot between fore coxae.

Mesostigmal laminae black, distal third of each light bluish green; dorsum of mesepisternum and antealar ridge black; antehumeral stripe light bluish green, slightly dilated at either end; humeral stripe black, about equal to mesepimeron in width, occupying about one-third width of mesepisternum but declined anteriorly to join upper border of mesinfraepisternum, whose upper two-thirds it covers; humeral stripe occupying slightly less than one-half width of mesepimeron; remainder of mesepimeron light bluish green except for a narrow black spur produced from black of lateral alar ridge along posterior fifth of first lateral suture; metapleurite light bluish green save for a dark brown stripe on metepisternum bordering second lateral suture, extending as far forward as metastigma, barely encroaching on metepimeron at a point about one-fifth distance from posterior end of suture; lateral alar ridge black through level of mesepimeron, light bluish green at level of metapleurite, narrowly bordered with black; mesosternum, metasternum, intersternum and coxae pale yellowish to flesh color, pruinose.

Coxae and trochanters pale yellowish to yellowish brown; femora buff to tan on inner face, black on outer face, almost enclosing apex, gradually tapering to a point near trochanter; tibiae light brown, mottled with darker brown along outer face; tarsi light brown, darker at joints; tarsal claws buff to light brown, teeth black; leg spines black.

Abdomen predominantly black dorsally, first three segments largely blue laterally; 1 bearing a rectangular dorsal black spot, separated from apical black ring and black intersegmental membrane by a suboval blue

⁸ See Appendix under *A. vidua* Selys.

spot; 2 black dorsally, the black produced to a subtriangular point on either side one-fifth distance from apex, which is encircled by black hamules light to dark brown, penis shaft (Figs. 27, 28) a vesicle black; 3-6 black dorsally, a blue basal ring on each segment narrowly interrupted on middorsal line and gradually expanding laterally and ventrally; 7 almost entirely black dorsally, bearing an arcuately bordered dorsal blue mark at apex; 8-9 blue; 10 black dorsally, light brown ventrally; superior appendages (Figs. 94, 99, 100) black, inferiors brown basally, black apically; ventral portions of abdominal tergites light brown, sternites brown, mid-ventral keel darker, increasingly so posteriorly.

Wings hyaline, venation and pterostigma black; arculus arises barely distal to second antenodal in all four wings; all wings petioled beyond Ac juncture; postnodals $\frac{12}{12} \cdot \frac{10}{10}$; poststigmatal cells $\frac{4}{4} \cdot \frac{4}{5}$; M_2 arises before sixth postnodal in fore wing, between fourth and fifth in hind wing; M_{1a} at ninth postnodal in right fore wing, at eighth in remaining three wings.

Abdomen 24.5 mm; hind wing 16 mm.

Allotype Female.—Labrum very dark olive green, slightly infuscated along anterior margin, narrow lateral margin and basomesal impression black; exposed portions of mandibles, and anteclypeus, light buff slightly tinged with green; genae yellowish buff, changing to pale green at upper end which attains to level of second antennal segment base; posterolateral angles of postclypeus light green, its anterior and posterior margins broadly black, joined by a black mesial line, remainder olive green; frons and top of head to level of median ocellus dark brown except for black interantennal depression which is connected with postclypeal black by a narrow mesal line, and for all save basal segments of antennae, which are black; postocular spots light blue, subtriangular, each about one-fifth larger than area occupied by ocelli; remainder of head dorsum black; occipital foramen bordered above and laterally with piceous band about three times as wide as foramen; remainder of rear and venter of head light yellowish buff; labium white to light brown, exposed portions of maxillae cream to amber.

Anterior lobe of prothorax light blue, narrowly edged in front with light brown; middle lobe of pronotum black, a subtriangular brownish spot on either side of lateral convexity confluent anterolaterally with blue of front lobe; black of middle lobe narrowly encroaching blue of front lobe on either side of mid line; hind lobe black, dorsal margin brown, lateral tips light blue; hind lobe depressed caudad on mid line; dorsal border of propleurite black, remainder olive, slightly pruinose; prosternum buff, a black spot between fore coxae.

Mesostigmatal laminae black admesially, each with outer two-thirds light blue; interlaminal sinus black, much longer than in other *Acanthagrion*, carinal bifurcation beginning at level of mesepisternal fossae,

these latter structures well marked but rather widely separated (Fig. 162); antalar ridge black; dorsum of mesepisternum black, this color occupying about one-third width of sclerite; antehumeral stripe light blue, through mesial third occupying about one-third of sclerite, expanded anteriorly to adjoin dorsal mesinfraepisternal suture, and posteriorly to about twice its mesal width; humeral stripe light metallic bronze, a small, suboval dark brown spot on humeral suture near posterior end; humeral stripe narrowly constricted at posterior end, widest one-fourth distance from posterior end where it occupies about one-third width of mesepisternum and a like amount of mesepimeron; upper border of stripe gradually declivent cephalad, coinciding with dorsal mesinfraepisternal suture; lower part of stripe paralleling humeral suture, stripe covering upper two-thirds of mesinfraepisternum; lateral alar ridge piceous to light green, the piceous produced to form a narrow spur along posterior eighth of first lateral suture; a light reddish brown stripe with metallic reflections lying on metepisternum adjoining second lateral suture, extending from posterior end to metastigma; extreme posterolateral angle of metepimeron bordered with black; remainder of meso- and metapleurites light greenish blue, washed with yellow near leg bases; mesosternum, metasternum and intersternum light greenish yellow, slightly pruinulent.

Coxae, trochanters, inner face and all of base of femora, and tibiae, light buffy yellow, all save tibiae slightly pruinulent, apical half of outer face of femora black, outer face of tibiae lightly mottled with dark brown; tarsi and tarsal claws yellowish brown, black apically, leg spines black.

Abdominal segments 1-7 as in ♂, but black not extending quite so far down on sides; 8 and 9 similar to preceding segments, blue between apical spine rows and apex; dorsum and upper half of sides of 10 black, remainder obscure olive; appendages black; sternites and ventral margins of tergites 1-7 yellowish buff, of 8-10 dark brown; midventral keel piceous; valves of ovipositor yellowish brown, stylets black; apical spine of eighth sternite small, sharp, pale yellow.

Wings hyaline, venation black, pterostigma light olive, petiolation extending barely beyond Ac juncture; arculus arising slightly distal to second antenodal; postnodals $\frac{10}{10} \cdot \frac{9}{8}$; M_2 arising just proximal to fifth postnodal in fore wings, just proximal to fourth in hind wings; M_{1a} arising $\frac{7}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{4}{5} \cdot \frac{4}{4}$.

Abdomen 23.5 mm; hind wing 16 mm.

This species is named in honor of the late Dr. F. Ris, of Rheinau, Switzerland.

Measurements and Venation.—Measurements and tabulation of venational features are based on a series of 200 ♂ and 20 ♀ from Venezuela and Trinidad. Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio
	Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
Males	28.5	25.6	23.5	18.0	16.7	16.0	0.65
Females	26.5	24.4	24.0	18.0	17.5	16.8	0.71

Venational features are as follows: Number of Postnodals—Males, fore wing, 10-12, ave. 10.8; hind wing, 8-10, ave. 9.0. Females, fore wing, 10-12, ave. 10.9; hind wing, 8-10, ave. 9.1. Origin of M_2 —Males, fore wing, just proximal to fifth postnodal 80%, at fifth 20%; hind wing, at fourth postnodal 35%, slightly proximal 35%, slightly distal 30%. Females, fore wing, arising at fifth postnodal 50%, slightly proximal to fifth 40%, at fourth 10%; hind wing, arising at fourth postnodal 50%, slightly proximal to fourth 45%, at third 5%. Origin of M_{1a} —Males, fore wing, arising at eighth postnodal 65%, at seventh 20%, at ninth 15%; hind wing, arising at seventh postnodal 45%, at eighth 45%, at sixth 5%, at ninth 5%. Females, fore wing, arising at eighth postnodal 60%, at ninth 30%, at seventh 5%, at tenth 5%; hind wing, arising at eighth 80%, at seventh 15%, at ninth 5%.

Discussion.—*Acanthagrion risi* was first recognized by Dr. Ris, who published (1918:125, figs. 67, 68) a brief description of it, and figured the male appendages and penis. He stated at that time that inasmuch as the significance of the penis as a specific character had not yet been evaluated, he would not assign a name, but record it instead as "Form b" of *yungarum* Ris.

The range of intraspecific variation in size is rather large in *risi*. As tabulated above, the length of the abdomen fluctuates over a range of 4.5 millimeters. Genitalic characters, however, are constant, and no geographic trends have been discerned in the size variations. Examples from Trinidad are in perfect agreement with those from Venezuela. There appears to be a constant disparity between the ratio of hind wing divided by abdomen of males and females, although the figure for females is based upon a much smaller series of specimens than that for males.

The male superior appendages are most distinctive, especially because of their strong development basally, their dorsal extremities extending as far dorsad as the apical margin of segment 10, and never sheathed by it. This character, as well as the highly characteristic penis form and widely separated mesepisternal fossae, make it difficult to confuse either sex of *risi* with other species.

Although Williamson's field notes contain no definite reference to this species, they indicate that *risi*, like most of its congeners, occurs around ponds and sluggish streams.

Distribution (Pl. XVII).—It is possible that mountains act as a barrier to the spreading of *risi*. Although apparently quite abundant in Trinidad and through the seaward regions of Venezuela, it was not encoun-

tered by the Williamsons on their expedition up the Magdalena River in Colombia. The specimens examined by Ris came from Villavicencio in Colombia. It is quite possible that *risi* has reached eastern Colombia by spreading through the Orinoco drainage.

Material Examined.—279 ♂, 33 ♀, including holotype and allotype, as follows: TRINIDAD—Brasso, 1932, March 2, 1 ♂, 1 ♀; March 7, 2 ♂, 2 ♀; Grand Couva, 1932, March 5, 3 ♂, 1 ♀; "Todd's Road," 1932, March 1, 2 ♂, 2 ♀; March 3, 2 ♂; all by G. Belmontes. VENEZUELA—Aroa, 1920, March 12, 1 ♂; March 13, 5 ♂; March 14, 11 ♂, 2 ♀; Bejuma, 1920, Feb. 13, 8 ♂; Feb. 14, 20 ♂; Feb. 15, 27 ♂, 3 ♀; Feb. 16, 15 ♂, 2 ♀; Feb. 17, 2 ♂, 2 ♀; Feb. 18, 5 ♂, 1 ♀; Feb. 23, 4 ♂, 3 ♀; Feb. 24, 2 ♂; Caserio Silva, 1920, Feb. 20, 4 ♂; Feb. 21, 16 ♂, 2 ♀; Feb. 22, 36 ♂, 3 ♀; "La Mona to Bejuma," 1920, Feb. 22, 2 ♂; Nirgua, 1920, Feb. 25, 5 ♂; Feb. 26, 1 ♀; Feb. 27, 7 ♂, 3 ♀; Feb. 28, 4 ♂; Feb. 29, 10 ♂, 2 ♀; Salom, 1920, Feb. 25, 18 ♂; Tachira, 1920, April 4, 23 ♂, 1 ♀; April 6, 1 ♂; April 7, 2 ♂; April 8, 3 ♂, 1 ♀ including holotype and allotype; April 9, 3 ♂; April 10, 3 ♂, 1 ♀; April 11, 1 ♂; "Valencia to Bejuma," 1920, Feb. 12, 4 ♂; all by J. H. Williamson, E. B. Williamson, and W. H. Ditzler.

References in Literature.—*Acanthagrion yungarum* form b. Ris 1918 (original reference as cited above).

Acanthagrion yungarum Ris

(Pl. III, Figs. 25-26; Pl. IX, Figs. 93, 97-98; Pl. XVI, Fig. 161)

Acanthagrion yungarum Form a. Ris, 1918:124-125, 127, figs. 65-66 (2 ♂, Pozuzo, Peru; allotype ♀, here described, vicinity of Guayabamba, Peru, Aug. 14, 1936, F. Woytkowski.)

Male.—Labrum and exposed portions of mandibles green, labrum with a narrow lateral border and basomesal impression black; anteclypeus dark grayish green; postclypeus black in fully mature specimens, extreme posterolateral corners tipped with light bluish green, extending up to level of base of second antennal segment, and connected across frons by a narrow line adjoining postclypeal suture; postocular spots same color as genae, suboval, each about one-third larger than area occupied by ocelli; remainder of antennae and dorsum of head black, except sometimes a faint washing of obscure blue on anterior face of first antennal segment; black continued over rear of head to level of occipital foramen, then restricted and encircling foramen with a band equal in width to light postgenae, which are pale buff to yellowish green, pruinose, and merge gradually with bluish green of genae at level of labium base; labium and exposed portions of maxillae buff to light amber.

Anterior lobe of prothorax pale greenish brown, front margin black, middle lobe of pronotum black in fully mature individuals, in younger

ones marked laterally with bluish green of varying extent and often with a small dash of this color on either side of mid line; hind lobe of pronotum black, sometimes tipped with buff to bluish green; propisternum and proepimeron black above, pale buff to yellowish green below and on posterolateral convexity; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae black, their lateral tips washed with pale blue; mesepisternum and antealar ridges black dorsally; antehumeral stripe light blue, through the middle half of its length occupying about one-fourth width of mesepisternum, expanded anteriorly to occupy about two-thirds, posteriorly three-fifths; humeral stripe black, at its widest point (about mid length) covering one-fourth width of mesepisternum, its dorsal border broadly convex, ventral border nearly straight and parallel to carina throughout greater portion of its extent, thus occupying about one-third width of mesepimeron, constricted at posterior end where confluent with black of lateral alar ridge, expanded and somewhat diffuse anteriorly, covering anterior convexity of mesepimeron and all but extreme posteroventral angle of mesinfraepisternum; lateral alar ridge at level of mesepimeron black, this color extending along posterior eighth of first lateral suture as narrow spur; remainder of meso- and metapleurites pale blue with diffuse yellowish infuscations, except for a roughly heart-shaped black spot at posterior end of second lateral suture, and a small black mark on extreme posterolateral angle of metepimeron; remainder of lateral alar ridge pale blue, bordered anteriorly with black; mesosternum, metasternum and intersternum pale buff, pruinose.

Abdomen chiefly black dorsally, blue laterally; 1 blue, basal two-thirds of dorsum occupied by rectangular black spot whose posterolateral angles are sometimes narrowly produced; apex of 1 ringed with black, intersegmental membrane dark brown; 2 with dorsal black stripe which is about same width as black on 1 basally, about one-third distance from apex with rounded expansion, narrow apical ring and intersegmental membrane black; lowest part of lateral aspect of 2 usually bordered with dark brown or black; hamules brownish, penis shaft (Figs. 25, 26) and vesicle black; 3-7 black dorsally, black occupying about half of lateral aspect, abruptly narrowed basally, slightly expanded apically, remainder of sides blue to buff; 8 and 9 blue except for a narrow black band embracing apical spine rows, often somewhat expanded between spine rows and apex near lower edge of lateral aspect; 10 black dorsally and laterally, brown ventrally, superior appendages (Figs. 93, 97, 98) black, inferiors dark brown, black tipped; abdominal sternites, where visible, light to dark brown.

Coxae and trochanters light brown, pruinose; femora black on outer face, greenish buff on inner face; tarsi and tarsal claws dark brown, darker apically, leg spines black.

Wings hyaline, sometimes somewhat smoky in old individuals; venation and pterostigma black.

Allotype Female.—Labrum dark brown basally, gradually diluted apically, extreme anterior margin yellow; exposed portions of mandibles dark slate blue; anteclypeus light olive; genae light olive green below, extending up almost to level of median ocellus, overlaid with reddish brown near upper end; postclypeus largely black, its posterolateral angles and a small oval spot on either side of mid line reddish brown; anterior face of frons with low, black triangle based on clypeofrontal suture; anterantennal depression black, a pointed projection on mid line approaching, but not meeting, apex of triangle just mentioned; remainder of frons, vertex to level of median ocellus, and basal antennal segment reddish brown; a small oval spot of dark olive between median ocellus and each lateral ocellus; postocular spots light green, oval, each about one-third larger than area occupied by ocelli; occipital ridge same color but not confluent with spots; remainder of head dorsum black, this color narrowly produced anteriorly to cover second antennal segment and all those following it; occipital foramen surrounded by a piceous splotch about twice as wide as foramen; remainder of rear of head light yellowish brown; labium white, exposed portions of maxillae light brown.

Anterior lobe of prothorax light olive, anterior margin brown; middle lobe of pronotum largely black, a narrow dash of light tan on either side of lateral convexity, their anterior angles confluent laterally with pale color of front lobe; hind lobe light yellowish brown; propleurite dark along its upper border, remainder light olive; prosternum buff, a black spot between fore coxae.

Mesostigmal laminae light olive green except for extreme admesal ends, which are black, interlaminal sinus and dorsum of mesepisternum black, this color occupying about one-third width of latter sclerite; mesepisternal fossae (Fig. 161) situated half way between anterior border of mesostigmal laminae and antealar ridge, the pits oval and rather shallow, the carina depressed between them; antehumeral stripe pale olive green, occupying nearly all remaining surface of mesepisternum; humeral stripe black through posterior three-fifths of its length, roundly terminated just before reaching alar ridges, diluted to light metallic brown over anterior convexity of mesepimeron and over mesinfraepisternum, of which it covers all but extreme posteroventral tip; humeral stripe not quite as wide as in male, merely encroaching on mesepisternum and occupying about one-third width of mesepimeron; antealar ridge reddish brown; lateral alar ridge black at level of mesepimeron, this color produced along posterior ninth of first lateral suture as a narrow spur; remainder of lateral alar ridge pale olive green, anteriorly edged with black at level of metepisternum; second lateral suture bridged by a small piceous spot near posterior end; a very faint

region of pale brown lying on metepisternum adjoining second lateral suture, extending from posterior end to metastigma; posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light bluish green, tinged with yellow near leg bases, metinfraepisternum pruinose; mesosternum, metasternum and intersternum light greenish yellow, pruinose.

Coxae and trochanters yellowish brown, pruinose; femora similarly colored, apical half of outer face black; inner face of tibiae light brown, outer face yellowish brown mottled with piceous; tarsi and tarsal claws dark brown, black apically; leg spines black.

Abdominal segments 1-7 marked as in male; 8 largely black, a semicircular blue mark on apex of dorsum; basal half of sides of 9 black, remainder blue; 10 blue except for narrow black basal line; appendages brown; sternites and extreme ventral margins of tergites brown, midventral keel black; valves of ovipositor yellowish blue, stylets dark brown; apical spine of eighth sternite short, sharp, black tipped.

Wings hyaline, venation brown to piceous, pterostigma light olive; petiolation extending beyond Ac juncture by about one-half length of Ac; arculus arising barely distal to second antenodal; postnodals $\frac{12}{12} \cdot \frac{10}{11}$; M_2 arising between fifth and sixth postnodals in front wings, just proximal to fifth in hind wings; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{5}{6} \cdot \frac{5}{6}$.

Measurements and Venation.—Measurements (in mm), based on a series of 80 ♂ and 6 ♀, are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Males	28.0	27.6	26.0	19.0	18.5	17.3	0.67
Females	27.5	25.8	24.0	19.5	17.5	17.0	0.68

Venational features are as follows: Number of Postnodals—Males, fore wing, 11-13, ave. 12.2; hind wing, 10-12, ave. 10.5. Females, fore wing, 11-12, ave. 11.6; hind wing, 10-12, ave. 10.4. Origin of M_2 —Males, fore wing, arising just proximal to sixth postnodal, 70%, at sixth 20%, slightly distal to sixth 10%; hind wing, arising just proximal to fifth postnodal 65%, at fifth 35%. Females, fore wing, arising between fifth and sixth postnodals, hind wing just proximal to fifth, in all specimens. Origin of M_{1a} —Males, fore wing, arising at eighth postnodal 55%, at ninth 45%; hind wing, arising at eighth postnodal 90%, at seventh 5%, at ninth 5%. Females, fore wing, arising at eighth postnodal, hind wing at seventh, in all specimens.

Discussion.—The identification of *yungarum* has been made certain by the excellent figures which accompanied the original description (Ris, 1918:124-125, Figs. 65-66).

A. yungarum may be distinguished from *risi* and *williamsoni* by the greatly elevated male tenth abdominal segment and by the presence of a pair of straight, subterete, sclerotized rods on the ental surface of the otherwise simple distal penis segment. The mesepisternal fossae resemble those of *deceptum*, but females may be separated readily by the characters employed in the key.

Aside from the other members of its group, *yungarum* appears to have no close relatives.

A field note by Woytkowski, accompanying one of the Guayabamba males, reads: "Upon open, marshy meadows along boggy brooks. The most abundant species here. Sits upon leaves, sticks, and even upon the ground. Many were mating on this date (Aug. 17)."

Distribution (Pl. XVII).—*A. yungarum* appears to range rather generally through the Peruvian Andes. Since it seems to be of common occurrence wherever found, it is quite likely that it will be discovered in mountainous sections of Bolivia, northern Chile, and Ecuador.

Material Examined⁹.—88 ♂, 6 ♀, including allotype, as follows: PERU: Campamiento, 1920, June 5, 5 ♂; June 7, 14 ♂; June 8, 6 ♂; June 9, 10 ♂; June 12, 1 ♂; June 15, 1 ♂; June 17, 8 ♂; June 18, 4 ♂; June 19, 7 ♂; June 24, 1 ♂; June 25, 1 ♂; all by J. H. Williamson; Madre de Dios, 500 meters, no date, 2 ♂, Förster Collection; San Ramón, 1920, July 13, 3 ♂; July 14, 2 ♂; July 15, 4 ♂; all by J. H. Williamson; vicinity of Guayabamba, Andes, 1300 meters, 1936, Aug. 14, 12 ♂, 4 ♀ (Including allotype and four mating pairs); Aug. 15, 1 ♂, 2 ♀; Aug. 17, 1 ♂; Aug. 18, 5 ♂; all by F. Woytkowski.

References in Literature.—*Acanthagrion yungarum* Form a. Ris, 1918 (original description as cited above).

ASCENDENS GROUP

Included here are *kennedii*, *quadratum*, *trilobatum* and *ascendens*. Some of the more important features shared by these species are the elevated 10th segment of the males, and the fundamental similarity in the form of the distal penis segment and the male superior abdominal appendages. The modifications of these structures proceed from *kennedii*, where they are most simplified for the group, through *quadratum* and *trilobatum* to *ascendens*, where they are most complicated. Closest relationships appear to exist between *ascendens* and *trilobatum*, and between *quadratum* and *kennedii*.

Indications of relation of the Ascendens Group to the Apicale Group have already been mentioned under the latter heading. Aside

⁹ A series of *yungarum* from the Rio Pastaza watershed, Oriente Ecuador, collected by W. Clarke-MacIntyre for Dr. Kennedy, was received too late for inclusion.

from this there appear to be no close relatives, although there are some resemblances between members of the Ascendens Group and *gracile*, *peruvianum* and *deceptum*, of the Viridescens Group, as regards male abdominal appendages and female mesepisternal fossae.

Members of the Ascendens Group are distributed over the northern part of South America from Belém to Pará to Vera Cruz in Mexico. Most remarkable is the isolated type locality of *ascendens*, Cachoeira in southern Brazil. Specimens from a nearby locality in Paraguay are indistinguishable from Venezuelan material.

Acanthagrion kennedii Williamson

(Pl. III, Figs. 31-32; Pl. IX, Figs. 96, 103-104; Pl. XIV, Fig. 151)

Acanthagrion kennedii Williamson, 1916:314-317, figs. 5, 6, 8, 11. (♂ and ♀, Cumuto, Trinidad, March 10, 1912).

Male.—Labrum and exposed portions of mandibles green, labrum with lateral border and basomesal impression black; anteclypeus green, slightly darker than labrum; postclypeus black dorsally in mature specimens, posterolateral angles usually tipped with green; genae pale bluish green, this color extending to level of base of second antennal segment, connected across lower portion of frons just above postclypeal suture, sometimes narrowly interrupted with black at midline, and occasionally washing anterior face of basal antennal segment; postocular spots almost circular, each usually covering an area almost twice as large as that occupied by ocelli; remainder of frons, antennae, vertex and occiput black, this color extended over rear of head to level of upper boundary of occipital foramen, then restricted and encircling foramen with a band about equal in width to postgenae; postgenae pale buff color, slightly infuscated ventrally, often pruinose; labium and exposed portions of maxillae pale buff to flesh color.

Anterior lobe of prothorax greenish yellow, edged anteriorly with black; middle and hind lobes of pronotum black, sometimes a small rounded spot of greenish yellow on lateral convexity of middle lobe, and extreme lateral tips of hind lobe usually lightly washed with same color; proepisternum and proepimeron black above, greenish yellow below and on posterolateral convexity; prosternum pale, a black spot between fore coxae.

Mesostigmal laminae black, outer third of each pale olive green; mesepisternum black dorsally, the black occupying a trifle less than half the width of sclerite, slightly constricted just before the mesostigmal laminae, and expanding posteriorly to cover antelar ridge; antehumeral stripe olive green, throughout the middle three-fourths of its extent occupying about one-fourth width of mesepisternum, expanded at anterior end to border mesinfraepisternum, and at posterior end to barely touch humeral suture; humeral stripe black, covering

about one-fourth width of mesepisternum posteriorly, tapering forward to dorsal boundary of mesinfraepisternum, ventrally occupying about three-fourths of posterior end of mesepimeron, slightly restricted anteriorly, paralleling curves of humeral suture and flowing over mesinfraepisternum leaving the posterolateral third olive green; in younger individuals the humeral stripe is constricted to about half its greatest width posteriorly, joins black of lateral alar ridge at this level, which is then produced along posterior eighth of first lateral suture as a narrow black spur; in old examples the area between the humeral stripe and spur on first lateral is filled in with black, leaving free only a short acute angle of the spur; remainder of lateral alar ridge olive green, anteriorly bordered with black; second lateral suture with a black stripe extending from posterior end almost of metastigma, lying on metepisternum save for one narrow encroachment on metepimeron near posterior end, in width equal to about one-third width of metepisternum; a small black spot on extreme posterolateral angle of metepimeron; remainder of meso- and metapleurites olive green; mesosternum, metasternum and intersternum pale greenish buff, pruinose.

Abdominal segments 1-7 black dorsally, blue laterally; black on 1 rectangular on outline, confluent with narrow black apical ring, occasionally a small narrow point produced from either side about one-third distance from apex; black on 2 widening gradually from base to apex, where it is expanded in rounded outline, again restricted before merging with black apical ring; lowest part of lateral aspect of second tergite often infuscated, sometimes black; hamules dark brown, penis shaft (Figs. 31, 32) and vesicle black; black on 3 contracted to midline basally, rapidly expanding to cover all but ventral half of tergite, further expanded at apex to form an almost complete ring; 4-7 similar, black becoming gradually more extensive on each one; 7-8 largely blue, apical spine rows black, this color often expanded in older specimens and directed cephalad along lower margin of lateral aspect of tergites; 10 black except for buff to brown washing on venter; superior appendages (Figs. 96, 103, 104) black, inferiors buff to brown basally, black apically; extreme ventral margins of tergites yellowish buff to brown, sternite brown to black.

Coxae and trochanters bluish to bluish green, pruinose; outer face of femora black, inner face buff to bluish; tibiae mottled brown externally, heaviest basally; tarsi brown, joints black, claws brown, black tipped; leg spines black.

Wings hyaline, sometimes slightly smoky, venation and pterostigma black.

Female.—Head colors as in ♂, except black on frons diluted to dark brown on anterior face.

Prothorax as in ♂, but light area on middle lobe of pronotum and on proepimeron slightly more extensive.

Thoracic color pattern similar to ♂, but olive green on outer tips of mesostigmal laminae more extensive, humeral stripe not adjoined to entire length of first lateral spur, and diluted to dark brown over anterior convexity of mesepisternum, and mesinfraepisternum. Mesepisternal fossae (Fig. 151) well marked, the carina between them elevated into a well-marked tubercle.

Abdominal segments 1-7 as in ♂, but light lateral areas infuscated on 3-7; 8 blue, top and sides largely occupied by a black marking whose apical border is even, paralleling apical end of segment, but whose basal margin is broadly tridentate, one point produced along the midline, and on either side about half way between midline and ventral margin of tergite; sides of 9 partially black basally, remainder blue, arranged like a three-lobed clover leaf basally, but apically continuous with color of 10 which is entirely blue; appendages black; valves of ovipositor brown; vulvar spine sharp, well-defined.

Coxae and trochanters pale buff to flesh color; femora and tibiae much lighter than in ♂, dark brown to black over apical half on fore femora, over apical fourth in hind femora, remainder same color as coxae, occasional narrow lateral prolongation of brown along outer face; tibiae almost wholly buff to light amber, outer surfaces faintly mottled with brown; tarsi same color as tibiae, joints dark brown, claws dark brown tipped with black; leg spines black.

Wings hyaline, venation and pterostigma black.

Measurements and Venation.—Measurements and venational features are based on a series of 25 ♂ and 5 ♀ from Trinidad and a like number from Belém, Brazil. Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Males	26.0	24.6	23.0	16.5	15.8	14.8	0.64
Females	27.0	24.7	23.5	17.5	16.6	15.0	0.67

Venational features are as follows: Number of Postnodals—Males, fore wing, 10-13, ave. 11.0; hind wing, 8-10, ave. 9.0. Females, fore wing, 10-12, ave. 11.0; hind wing, 9-10, ave. 9.3. Origin of M_2 —Males, fore wing, arising just proximal to fifth postnodal 60%, at fifth 40%; hind wing, arising at fourth postnodal 55%, just proximal to fourth, 45%. Females, fore wing, arising at fifth postnodal 80%, just proximal to fifth 20%; hind wing, arising at fourth postnodal 70%, just proximal to fourth 20%, slightly distal 10%. Origin of M_{1a} —Males, fore wing, arising at eighth postnodal 60%, at ninth 30%, at seventh 10%; hind wing, arising at eighth postnodal 50%, at seventh 50%. Females, fore wing, arising at eighth postnodal 70%, at ninth 30%; hind wing, arising at seventh postnodal 40%, at eighth 50%, at ninth 10%.

Discussion.—*Acanthagrion kennedii* appears to be very closely related to *quadratum*, less so to *trilobatum* and *ascendens*. In *kennedii* the tip

of the distal penis segment is less dilated, and the male superior appendages less robust, than in *quadratum*; the inferior appendages are slightly shorter in relation to the superiors, and the mesepisternal fossae are further separated from the interlaminal sinus. *A. kennedii* possesses a distinct black stripe along the second lateral thoracic suture, a marking reduced to a small spot in *quadratum*.

The two Panama specimens here assigned to *kennedii* differ from Trinidad and Belém material in having the tip of the distal penis segment slightly narrower and the dorsal tubercle of the superior appendages apparently less strongly developed. In other characters they do not appear to differ from typical *kennedii* and are therefore placed here.

Williamson (1916:318) wrote of *kennedii*: "Much of this material was collected at the small swamp near Cumuto (Trinidad) where we took three species of *Metaleptobasis*, a new *Telagrion*, and many other things." J. H. Williamson's field notes indicate that most of the Belém specimens were collected around the city water supply reservoirs.

Distribution (Pl. XVIII).—It is rather surprising to note the wide gaps which separate the three localities from which *kennedii* is known. Acquisition of more material from Panama may reveal differences sufficient to justify erection of a new species for such examples; but it is rather strange that no Guianan records have ever been obtained.

Material Examined.—64 ♂, 10 ♀, including holotype, allotype, and paratypes, as follows: BRAZIL—Belém, 1922, Aug. 1, 2 ♂; Aug. 2, 6 ♂; Aug. 3, 6 ♂, 1 ♀; Aug. 5, 8 ♂, 2 ♀; Aug. 7, 1 ♂; Aug. 8, 1 ♂; Aug. 9, 4 ♂, 2 ♀; Aug. 14, 1 ♂; all by J. H. Williamson. PANAMA—Guabito, Bocas del Toro, 1917, March 6, 2 ♂; J. H. Williamson and E. B. Williamson. TRINIDAD—Arima, 1912, March 4, 6 ♂, 1 ♀; Cunapo River, 1912, Feb. 27, 5 ♂, 1 ♀; Cumuto, 1912, March 6, 3 ♂, 1 ♀; March 8, 10 ♂, 1 ♀; March 10, 9 ♂, 1 ♀ (including holotype and allotype); all by L. A. Williamson, E. B. Williamson, and B. J. Rainey.

References in Literature.—*Acanthagrion kennedii* Williamson, 1916 (original description as cited above); Kennedy, 1916:327, 329, figs. 14, 15 (penis figured); Ris, 1916:127 (compared with specimens from Bahia); Williamson and Williamson, 1924:7 (compared with *Acanthallagma luteum* Williamson); Geijskes, 1932:127, 254, 255 (recorded from swamps and small rivers of Trinidad).

Acanthagrion quadratum Selys

(Pl. III, Figs. 33-34; Pl. X, Figs. 105, 109-110; Pl. XIV, Fig. 152)

Acanthagrion gracile var. *quadratum* Selys, 1876:309 [reprint p. 65] (3 ♂, Mexico).

Synonym: *Acanthagrion gracile*, Calvert, 1902; 1907; Kennedy, 1916; Williamson and Williamson, 1924.

Male.—Labrum, exposed portions of mandibles, anteclypeus and genae light blue, labrum with lateral border and basomesal impression black, anteclypeus slightly duller than other blue regions; postclypeus with anterior margin, posterolateral angles, and spot either side of mid line light blue, remainder black; anterior face of frons with greenish brown tendencies ventrad, anterior face of basal antennal segment sometimes blue; postocular spots light blue, subtriangular, each about size of area occupied by ocelli; remainder of top of head and antennae black; rear of head golden brown to buff streaked with blue, a piceous to black patch encircling occipital foramen; labium and exposed portions of maxillae yellowish brown.

Anterior lobe of prothorax chiefly blue, its anterior margin black, and on either side of rear face a short encroachment of black from middle lobe; middle lobe of pronotum black, lateral convexity bearing a small rounded blue spot on either side; hind lobe black, sometimes mixed with blue laterally; anterodorsal half of propleurite black, remainder light blue; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae and antealar ridge black, each lamina blue over lateral fourth to sixth; mesepisternum black admesally, this color occupying about one-half width of sclerite except through anterior sixth, where it is slightly constricted; antehumeral stripe light blue, gradually expanded caudad through posterior sixth of its length to occupy approximately one-third width of mesepisternum; proceeding anteriorly, the next one-third is narrowed to occupy about one-fifth width of mesepisternum; through remaining half stripe is expanded gradually, touching anterior two-thirds of dorsal mesinfraepisternal suture; humeral stripe black, occupying remainder of mesepisternum and about half width of mesepimeron, its lower boundary very nearly parallel to humeral suture except for constriction at posterior end, stripe directed cephalad to cover upper half of mesinfraepisternum but on this sclerite diluted to piceous; lateral alar ridge at level of mesepimeron black, this color produced along posterior eighth of first lateral suture as a narrow spur; remainder of lateral alar ridge light blue, anteriorly edged with black; a black suboval spot on posterior end of second lateral suture, corresponding in position and extent to first lateral spur; extreme posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light blue, portions adjoining coxae often lightly suffused with pale yellow; mesosternum, metasternum and intersternum pale yellowish blue, somewhat pruinulent.

Coxae and trochanters pale blue, sometimes with irregular blotches of infuscation; inner face of femora colored similarly, outer face black, this color sometimes nearly interrupted subbasally; internal face of tibiae brown to piceous, outer face light brown, mottled with dark

brown, tarsi similar color, piceous apically; tarsal claws brownish, black tipped; leg spines black.

Abdomen largely black dorsally; dorsum of 1 with subrectangular black spot over basal two-thirds, apex ringed with black, dorsal spot often confluent with this apical ring; remainder of 1 light blue; dorsum of 2 entirely black, about same width as black of 1, but widened and contracted to form lateral angular expansion near apex; intersegmental membrane piceous, ventral margin of tergite often infuscated; hamules light brown edged with piceous, penis shaft (Figs. 33, 34) and vesicle black, remainder of 2 light blue; 3-6 black dorsally and over increasing amount of sides; basal, middorsally interrupted blue ring merging with blue of remainder of lateral aspect, this latter changing to brown caudad; 7 often similar to 6, but with dorsum and sides blue, extent of blue quite variable, sometimes limited to region between black apical spine row and apex of tergite, sometimes embracing half to two-thirds apex of 7; 8 and 9 blue, apical spine rows black; 10 black dorsally, and laterally to level of inferior appendages, remainder brownish; sternites and ventral margins of tergites light to dark brown, lighter anteriorly than posteriorly, mid ventral keel brown to piceous; superior appendages (Figs. 105, 109, 110) black, inferiors brown basally, black apically.

Wings hyaline, slightly smoky in old individuals; venation and pterostigma piceous to black.

Female.—Head, prothorax, and thorax very similar to ♂, except light colors often fainter and black less extensive; middorsal carina often rusty brown before and behind mesepisternal fossae (Fig. 152), these structures deep, rounded, the carina slightly elevated just caudad.

Abdominal segments 1-7 similar to ♂, but light blue to brownish color of lateral aspect usually more extensive; black of 7 variable as in ♂; 8 and 9 variable, usually blue apically, black basally; 10 blue, appendages brown to black; venter of abdomen brown as in ♂, often somewhat lighter in tone; valves of ovipositor brownish; apex of eighth sternite with well-developed, sharp spine, brown, black tipped.

Wings hyaline, venation brown to piceous, pterostigma light brown.

Measurements and Venation.—Measurements and tabulation of venation are based on a series of 45 ♂ and 9 ♀. The small number of males studied in this fashion is accounted for by the fragmentary condition of many specimens. Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Males	27.5	25.4	24.0	17.0	16.2	15.2	0.64
Females	27.0	25.4	24.0	17.0	16.0	15.0	0.63

Venational features are as follows: Number of Postnodals—Males, fore wing, 10-11, ave. 10.1; hind wing, 8-9, ave. 8.2. Females, fore wing,

10-12, ave. 10.3; hind wing, 8-9, ave. 8.5. Origin of M_2 —Males, fore wing, arising just proximal to fifth postnodal 55%, at fifth 30%, slightly distal to fifth, 15%; hind wing, arising just proximal to fourth postnodal 55%, at fifth 40%, slightly distal to fifth 5%. Females, fore wing, arising just proximal to fifth postnodal, hind wing, just proximal to fourth postnodal, in all specimens. Origin of M_{1a} —Males, fore wing, arising at eighth postnodal 66 2/3%, at ninth 33 1/3%; hind wing, arising at or very near seventh postnodal 100%. Females, fore wing, arising at eighth postnodal, in hind wing at seventh postnodal, in all specimens.

Discussion.—So far as is known at present, *quadratum* is the only *Acanthagrion* to occur north of Panama. It is almost certainly the species Selys had before him when he described it as a variety of *gracile* although the color character on which he based its separation from *gracile* (an isolated square black spot on abdominal segment 1) is variable.

This is the species which Calvert recorded as *gracile* in the *Biologia Centrali-Americana*, and which Williamson and Kennedy referred to as "*gracile*." As has been stated above, *quadratum* appears to be closely related to *kennedii*, although separable at once by the greatly inflated tip of the distal penis segment. From *trilobatum* and *ascendens* it differs in the absence of long lobes or setae from the penis, and in the less elevated tenth abdominal segment of the male, as well as in minor differences of size and venation.

In writing concerning Guatemala material Williamson (1916:356) termed *quadratum*: "A common, widely distributed species, in life suggesting *Enallagma exsulans*."

Distribution (Pl. XVIII).—It is possible that the highlands of Panama serve as a barrier to the southern distribution of *quadratum*. From Honduras northward through Mexico it appears to occur commonly. The record from near Linares, in Nuevo Leon, suggests that *quadratum* may occur within the United States along the southwestern border of Texas.

Material Examined.—73 ♂, 9 ♀, as follows: BRITISH HONDURAS—Cayo, 1931, March 22, 6 ♂, A. Murie; pine ridge south of Cayo, March 7, 1 ♂, A. Murie; Punta Gorda, 1933, June, 8 ♂, 2 ♀, J. J. White; Rio Temash, 1934, June, 2 ♂, J. J. White. GUATEMALA—Agua Caliente, 1909, June 2, 2 ♂, 2 ♀; Gualán, 1905, Jan. 11, 3 ♂, 1 ♀; Jan. 12, 3 ♂; Jan. 13, 1 ♂, 1 ♀; Jan. 14, 4 ♂; Jan. 23, 1 ♂; 1909, June 12, 1 ♂, 1 ♀; June 13, 2 ♂; June 16, 1 ♂; June 18, 1 ♂, 1 ♀; "along railroad near Guatemala City," 1905, Jan. 30, 4 ♂; Livingston, 1905, Feb. 18, 1 ♂; Los Amates, 1905, Jan. 18, 4 ♂; 1909, June 21, 3 ♂, June 22, 1 ♂; Morales, 1909, May 27, 2 ♂; Puerto Barrios, 1905, Feb. 24, 1 ♂; Feb. 25, 1 ♂; Feb. 26, 2 ♂; 1909, May 28, 1 ♂; Uaxactún, 1931, May 13, 1 ♂. Uaxactún ♂ by A. Murie, all other specimens by E. B. Williamson.

HONDURAS—Tela, 1923, March 15, 1 ♂, T. H. Hubbell; San Pedro, 1905, Feb. 22, 1 ♀; Feb. 24, 1 ♂, San Pedro material by E. B. Williamson. MEXICO—NUEVO LEON, "Nine miles north of Linares," 1930, April 23, 1 ♂, E. P. Creaser. VERA CRUZ, Tierra Colorado, near Vera Cruz, 1932, July 17, 1 ♂, H. M. Smith. YUCATÁN, Chichén Itzá, Xanaba Cenote, 1932, June 27, 4 ♂; Xtoloc Cenote, 1932, June 8, 4 ♂; June 28, 3 ♂; Mérida, Xlaka Cenote, 1932, July 22, 1 ♂, E. P. Creaser.

References in Literature.—*Acanthagrion gracile* var. *quadratum* Selys, 1876 (original description as cited above). *Acanthagrion gracile*, Calvert, 1902:115; 1907:383, pl. 5, fig. 20 (recorded from Guatemala; female described). Williamson, 1936:139 (recorded from Yucatan). *Acanthagrion* "gracile," Williamson, 1916:355, 356 (description of Guatemala specimens); Kennedy, 1916:328, 329, figs. 8, 9 (penis drawn); Williamson and Williamson, 1924: 6 (compared with *Acanthalgma*).

Acanthagrion trilobatum, new species

(Pl. III, Figs. 35-36; Pl. X, Figs. 106, 111-112; Pl. XV, Fig. 153)

Holotype: Male, Río Frio, Colombia, January 4, 1917, J. H. Williamson and E. B. Williamson; allotype a female with same data.

Acanthagrion ascendens Form b. Ris, 1918:126, figs. 69, 70.

Holotype Male.—Labrum blue, with slight greenish tinge, lateral borders and basomesal impression black; exposed portions of mandibles, anteclypeus, and genae similar but slightly lighter and without greenish admixture; blue of genae extending to level of base of second antennal segment, but not actually covering any of antennal segments, which are wholly black; blue of genae extending across either side of anterior face of frons in form of narrow, slightly oblique bars, these narrowly separated on mid line by black of frons, which is confluent with that of postclypeus; dorsum of postclypeus entirely black save for extreme posterolateral angles which are same color as genae; postocular spots blue, slightly darker than genae, subtriangular, each enclosing an area about one-third greater than that occupied by ocelli; remainder of head dorsum black; outer half of postgenae pale buff dorsally, gradually merging with blue of genae ventrally, extending dorsally to level of upper edge of occipital foramen; remainder of rear of head black; labium and exposed portions of maxillae buff to light tan.

Anterior lobe of prothorax black on anterior margin and lateral third, dorsal third light blue, slightly constricted by lateral black at middle of its extent; middle lobe of pronotum largely black, blue of anterior lobe encroaching slightly mesially, a very minute blue spot on lateral convexity; hind lobe entirely black; proepisternum and propimeron black above, lower margin blue tinged with olive green; prosternum buff to tan, a black spot between fore coxae.

Mesostigmal laminae black, their outer third blue narrowly surrounded by black; dorsum of mesepisternum, and antealar ridge, black, this color covering approximately one-half width of sclerite, widest about one-fifth distance from anterior end, somewhat constricted at anterior end, tapering very slightly to posterior end; antehumeral stripe light blue, very slightly sinuate, increasing in width by about one-third anteriorly, by about one-fourth posteriorly; humeral stripe black, confluent posteriorly with black of antealar and lateral alar ridges, the former black throughout, the latter black through and slightly beyond level of mesepimeron; humeral stripe widest about one-fourth distance from posterior end, constricted to about three-fifths this width just before merging with black of alar ridges; at widest point occupying about one-third width of mesepisternum, upper margin gradually declined anteriorly to follow curvature of humeral suture, coinciding finally with anterior two-thirds of dorsal mesinfraepisternal suture; lower border of stripe, except for posterior constriction mentioned above, closely paralleling humeral suture, and occupying about one-half width of mesepimeron, bent down almost at right angles to parallel anterior curve of humeral suture, then directed cephalad again in such a way as to leave uncovered only posterolateral angle of mesinfraepisternum; black of lateral alar ridge produced as a narrow spur along posterior sixth of first lateral suture; lateral alar ridge through level of metapleurite blue-buff anteriorly bordered with black, which is extended cephalad along second lateral suture, all save slight angular extension near caudal end lying on metepisternum, extending almost to metastigma but gradually diluted to brown anteriorly, widest at mid length where it occupies one-half width of metepisternum, tapering anteriorly and posteriorly; extreme posterolateral angle of metepimeron tipped with black; remainder of meso- and metapleurites light blue; mesosternum, metasternum, and intersternum buff to light blue, slightly pruinose.

Coxae and trochanters pale blue, with occasional irregular blotches of infuscation which may be due to post-mortem color changes; front femora largely black, their inner faces washed with light brown along basal two-thirds; middle and hind femora similar, light color somewhat more extensive; all tibiae dark brown to black on inner faces, mottled dark and light on outer; tarsi piceous to black, darker apically than basally; claws dark brown, black tipped; leg spines black.

Abdomen predominantly black; 1 with black rectangular spot covering basal two-thirds of dorsum, its two apical corners produced as short, narrow spurs; apical ring and intersegmental membrane black, remainder of tergite light blue; dorsum of 2 with complete black stripe about equal in width to that of 1 except for a rounded expansion about one-fourth distance from apex; base, apex, and lower margin of lateral aspect black merging with dorsal stripe at either end; hamules

dark amber to brown; penis shaft (Figs. 35, 36) and vesicle black; 3-7 almost entirely black dorsally and laterally, 3 with a narrow, dorsally interrupted blue ring which is slightly expanded caudad on sides; 7 and 8 slate blue, ventral margins of lateral surface black, this color following up lower extensions of apical spine rows; 10 entirely black except for limited dark brown area on venter; superior appendages (Figs. 106, 111, 112) black, inferiors brown basally, black apically; sternites and ventral margins of tergites brown to piceous, mid-ventral keel dark brown to black.

Wings hyaline, venation piceous to black, pterostigma black; wings petioled beyond Ac juncture by a distance equal to length of Ac; arculus arises just distal to second antenodal in all four wings; postnodals $\frac{11}{11} \cdot \frac{8}{9}$; M_2 arises just proximal to fifth postnodal in fore wings, at fourth in hind wings; M_{1a} arises at eighth postnodal in both fore wings and left hind wing, at seventh in right hind wing; poststigmatal cells $\frac{5}{5} \cdot \frac{6}{6}$.

Abdomen 25.2 mm; hind wing 17 mm.

Allotype Female.—Labrum dark slate blue, narrowly bordered anteriorly with yellowish brown, posterior portion and lateral borders piceous to black, basomesal impression black; exposed portions of mandibles pale bluish green, tinged with yellow near labrum and genae; genae yellowish buff below, changing to light green above, this color extending to level of second antennal segment base; anteclypeus obscure bluish green, tinged with yellow near labrum and genae; genae yellowish buff below, changing to light green above, this color extending to level of second antennal segment base; anteclypeus obscure bluish green; postclypeus black above, its anterior margin and posterolateral angles colored; like anteclypeus; a small suboval dark green spot on either side of mid line; anterior face of frons bearing a low, broad triangle based on clypeo-frontal suture, its apex narrowly connected with black of head dorsum; remainder of anterior frons face dark olive green, confluent laterally with paler color of genae and covering anterior face of basal antennal segment; postocular spots light bluish green, round, each about one-third larger than area occupied by ocelli; median ocellus adjoined on either side by a very minute lunate spot of dark olive green; remainder of antennae and head dorsum black; black continued over rear of head to level of upper border of occipital foramen, then restricted to surround foramen with a band about three times as wide as foramen; remainder of rear of head yellowish buff; labium and exposed portions of maxillae cream color to buff.

Prothorax almost exactly as in ♂, except for a large subtriangular pale blue spot on either side of lateral convexity.

Synthorax with colors and markings as in ♂, except for the following differences: humeral stripe slightly indented on mesinfraepisternum so as to cover only upper two-thirds of this sclerite; stripe

along second lateral suture piceous, rather than black as in ♂; portions of meso- and metapleurites adjoining leg bases lightly tinged with yellow. Mesepisternal fossae (Fig. 153) well defined, carina slightly elevated between them.

Coxae, trochanters, and femora largely light yellow, outer face of femora mottled with black, this color heaviest apically; tibiae olive, their inner face dark brown, outer face mottled with light brown; tarsi and tarsal claws yellowish brown, piceous apically.

Abdominal segments 1-7 as in ♂, except black not extending quite so far down on sides of 3-7; basal half of 8 black, remainder blue; 9, 10, and appendages blue; sternites and ventral margins of tergites yellowish brown, midventral keel black; valves of ovipositor blue, stylets brown; apical spine of eighth sternite long, sharp, black tipped.

Wings hyaline, venation dark brown to piceous, pterostigma light olive; petiolation extending beyond Ac juncture by a distance equal to length of Ac; arculus arising at second antenodal; postnodals $\frac{12}{10} \cdot \frac{9}{9}$; M_2 arising $\frac{5}{5} \cdot \frac{4}{4}$; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{8}$; poststigma $\frac{4}{4} \cdot \frac{5}{5}$.

The specific name alludes to the trilobate structure of the distal penis segment.

Measurements and Venation.—Figures are based on a series of 300 ♂ and 25 ♀. No indications of constant geographic variation have been detected among specimens from the different localities. Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Males	30.0	26.9	24.3	18.0	17.0	15.9	0.63
Females	31.2	27.5	25.4	19.5	18.6	16.2	0.68

Venational features are as follows: Number of Postnodals—Males, fore wing, 10-12, ave. 11.2; hind wing, 8-10, ave. 9.2. Females, fore wing, 10-12, ave. 11.6; hind wing, 8-10, ave. 9.3. Origin of M_2 —Males, fore wing, arising just proximal to fifth postnodal 40%, at fifth 40%, slightly distal to fifth 15%, at sixth 5%; hind wing, arising just proximal to fourth postnodal 40%, at fourth 40% slightly distal to fourth 20%. Females, fore wing, arising at fifth postnodal 80%, just proximal to fifth 20%; hind wing, arising at fourth postnodal 76%, just proximal to fourth 24%. Origin of M_{1a} —Males, fore wing, arising at eighth postnodal 75%, at seventh 12.5%, at ninth 12.5%; hind wing, arising at eighth postnodal 40%, at seventh 50%, at ninth 10%. Females, fore wing, arising at eighth postnodal 80%, at seventh 20%; hind wing, arising at seventh postnodal 92%, at eighth 8%.

Discussion.—So marked is the similarity of *trilobatum* to *ascendens* that Ris, who possessed two specimens of the former, declined to describe it as a distinct species, contenting himself with pointing out a few instances of dissimilarity, and designating the specimens as "Form b." of *ascendens*.

The study of an ample series has enabled me to indicate, with considerable confidence, the specific distinctness of *trilobatum*. Figures 35 and 36 show how the small, pointed lateral lobes of the distal penis segment in *kennedii* and *quadratum* become long and flaring in *trilobatum*. In *ascendens* (Figs. 37 and 38) these lateral lobes are curved caudad instead of cephalad, are of almost uniform diameter, and bear a membranous hook at about mid length. Further, *trilobatum* lacks the setae encountered on penis segment 2 in *ascendens*. The dorsal production of male abdominal segment 10 is less elevated and constricted, and the male superior appendages less lengthy and robust, in *trilobatum* than in *ascendens*. Although females of the two species are more difficult to separate, it has been found that the mesepisternal fossae, in dorsal view, are always much broader cephalad than caudad, whereas in *ascendens* these structures are definitely reniform in outline, the two ends similar. Characters of size, color, and venation are of little value in separating the two species. *A. trilobatum* is less robust throughout than *ascendens*, but no means of resolving this into a usable character has been discovered.

Acanthagrion trilobatum appears to display a stage of specialization intermediate between that of *quadratum* and that of *ascendens*, although characters of size and venation indicate that it is most closely related to *ascendens*.

E. B. Williamson's field notes indicate that *trilobatum* was found to be abundant in both Colombia and Venezuela, frequenting irrigation ditches, sluggish streams, and marshes.

Distribution (Pl. XVIII).—*Acanthagrion trilobatum* appears to be generally distributed through the Caribbean drainages of Venezuela and Colombia. No records have yet been obtained from the Orinoco or Amazon drainages, nor from Central America north of the Canal Zone. It is possible that spreading beyond these points is restricted by high altitudes.

Material Examined.—324 ♂, 33 ♀, including holotype, allotype, and paratypes. COLOMBIA—Aracataca, Dec. 15, 1916, 3 ♂; Jan. 9, 1917, 5 ♂; Arroyo Grande, Porto Colombia, Dec. 10, 1916, 16 ♂, 2 ♀; Bolívar, 1916, Dec. 23, 1 ♂; Dec. 26, 1 ♂; Cristalina, 1917, Feb. 12, 5 ♂; Feb. 13, 5 ♂; Feb. 14, 3 ♂, 1 ♀; Feb. 15, 1 ♂; Feb. 18, 1 ♂; Feb. 19, 1 ♂; El Banco, 1917, Jan. 23, 1 ♂; Jan. 24, 10 ♂; Jan. 25, 1 ♀; Fundación, 1917, Jan. 10, 4 ♂, 1 ♀; Jan. 11, 17 ♂, 1 ♀; Jan. 12, 1 ♂; Jan. 13, 2 ♂; Gamarra, 1917, Jan. 27, 2 ♂; Porto Berrio, 1917, Jan. 31, 9 ♂, 3 ♀; Feb. 8, 2 ♂, 2 ♀; Porto Colombia ("small creek"), 1916, Dec. 11, 2 ♂, 1 ♀; Río Frio, 1917, Jan. 4, 14 ♂, 5 ♀ (including holotype and allotype); Jan. 5, 7 ♂, 2 ♀; Jan. 6, 1 ♂; Jan. 7, 29 ♂, 4 ♀; Jan. 8, 4 ♂, 2 ♀; Rio Nuevo, 1917, Jan. 22, 1 ♂; Santa Marta, 1916, Dec. 16, 6 ♂, 1 ♀; Dec. 18, 1 ♂, 1 ♀; 1917, Jan. 3, 2 ♂; Santata, 1918, Jan. 25, 1 ♂, M. A. Carriker; Sevilla, 1916, Dec. 15, 9 ♂, 2 ♀; Sogamosa, 1917, Jan.

24, 1 ♂. All specimens collected by J. H. and E. B. Williamson except the Santata ♂ noted above. PANAMA, Canal Zone—Alhajuela, 1933, July 15, 1 ♂, Arthur Greenhall; Rio Mazamba, 1916, Dec. 6, 5 ♂; Rio Sardanilla, 1916, Dec. 5, 23 ♂, 4 ♀. All but Alhajuela material taken by J. H. and E. B. Williamson. VENEZUELA—Aroa, March 14, 2 ♂; Bejuma, Feb. 13, 11 ♂, 1 ♀; Feb. 17, 6 ♂, 2 ♀; Boquerón, March 17, 4 ♂; Caserio Silva, Feb. 20, 2 ♂; El Guayabo, April 20, 21 ♂; April 21, 5 ♂; April 22, 1 ♀; Encontrados, April 6, 2 ♂; April 22, 1 ♂; April 25, 44 ♂, 9 ♀; “Gran Ferrocarrillo de Tachira, Km. 108,” April 3, 1 ♂; La Fria, April 12, 5 ♂; April 14, 13 ♂; April 15, 1 ♂; April 16, 2 ♂; Nirgua, Feb. 25, 1 ♂; Feb. 27, 7 ♂, 1 ♀; Feb. 28, 4 ♂; Palma Sola, March 4, 17 ♂; March 6, 12 ♂, 3 ♀; March 8, 9 ♂; March 9, 24 ♂, 1 ♀; March 10, 4 ♂; San Felipe, March 2, 1 ♂, 1 ♀; Tachira, April 4, 7 ♂; April 5, 3 ♂; April 6, 12 ♂, 1 ♀; April 9, 5 ♂; April 10, 2 ♂; April 11, 2 ♂; April 12, 2 ♂; Tucacas, March 24, 15 ♂, 1 ♀; March 25, 2 ♂; “Valencia to Bejuma,” Feb. 12, 2 ♂, 1 ♀. All specimens collected in 1920 by J. H. and E. B. Williamson and W. H. Ditzler.

Acanthagrion ascendens Calvert¹⁰

(Pl. IV, Figs. 37-38; Pl. X, Figs. 107, 113-114; Pl. XV, Fig. 154)

Acanthagrion gracile ascendens Calvert, 1909:161, 165, 166, pl. 5, figs. 81, 81a. (1 ♂, Cachoeira, Brazil)

Male.—Labrum bright grass green, narrowly edged with black laterally and with a black basomesal impression; exposed portions of mandibles, and genae, light bluish green; anteclypeus dark olive green; postclypeus black; anterior face of frons and basal antennal segments slate gray; dorsum of frons, and antennae, vertex, and occiput black; postocular spots light olivaceous; postgenae buffy, slightly darkened ventrally, occipital foramen surrounded by black; labium and exposed portions of maxillae buff.

Anterior lobe of prothorax light olive green, front margin brown; middle and hind lobes of pronotum black, a small, round, olive green spot on either side of middle lobe; proepisternum and proepimeron black, with pruinose blue over ventral and posterior half; prosternum and fore coxae buff to amber, a black spot between fore coxae.

Mesostigmal laminae black mesally, the outer half of each light olive; dorsum of mesepisternum, and antealar ridge, black; antehumeral stripe light olive, through the middle third of its length occupying about one-fourth of width of mesepisternum, expanded gradually through anterior third until it occupies over half of width of this sclerite, its posterior third only slightly expanded, but curved downward almost to humeral suture; humeral stripe black, slightly con-

¹⁰ See Appendix under *A. luteum* Racenis.

stricted near posterior end, expanding anteriorly to occupy, through middle four-fifths of its course, about one-fourth width of mesepisternum and one-half width of mesepimeron, covering upper half of mesinfraepisternum; lateral alar ridge, at level of mesepimeron, black, confluent with that of antalar ridge and humeral suture, produced along posterior one-sixth of first lateral suture as a narrow line; remainder of mesepimeron light bluish green; metepisternum and lateral alar ridge at this level same color as mesepimeron, save for an obscurely bordered black stripe along second lateral suture occupying lower level of metastigma; remainder of metapleurite light bluish green, with yellowish reflections near ventral margin; mesosternum, metasternum, intersternum, and coxae pale buff, pruinose.

Trochanters buff to amber; femora black on outer faces, buff to light brown on inner faces; tibiae and tarsi light brown, outer faces of tibiae mottled with brown; joints of tarsi and distal half of claws dark brown, remainder light brown, leg spines black.

Abdominal segment 1 with rectangular dorsal black spot confluent with narrow apical black ring, laterally light bluish green; 2 with dorsal spear-head black mark, truncated basally, expanded apically to form a terminal ring; hamules brown, penis shaft (Figs. 37, 38) and vesicle black; 3-7 predominantly black, bluish green appearing laterally at apex; 8 and 9 blue, with black rings at level of apical spine rows; 10 black dorsally and laterally, blue to brown ventrally; superior appendages (Figs. 107, 113, 114) black, inferiors black, brown basally; ventral margins of tergites tan, sternites black.

Wings hyaline, venation and pterostigma black.

Female.—Color pattern similar to ♂, but dark colors not quite so extensive in any of the specimens at hand.

In most specimens the labral green is considerably tinged with brown, while the olive anteclypeus is quite distinctly brown; the postclypeus is brown with a faint greenish tinge, and with a broken black border; remainder of head as described for ♂.

Prothorax and thorax as in ♂, but light spots on lateral convexity of middle lobe of pronotum larger, confluent anterolaterally with light color of front lobe, and thoracic humeral stripe piceous instead of black, diluted to metallic brown over mesinfraepisternum; mesepisternal fossae (Fig. 154) shallowly impressed on either side of a small, low tubercle produced from middorsal carina at mid length, carina often reddish brown, but black at level of fossae.

Coxae and trochanters pale yellow; femora buff to golden brown, black of outer faces reduced to small amounts apically; tibiae light yellow throughout, mottled with brown on outer faces; tarsi and tarsal claws yellowish basally, black apically; leg spines black.

Abdominal segments 1-7 as in ♂ but bluish green color replaced by yellowish brown; 8 similar to preceding segments; 9 black over basal

half of lateral aspect, remainder blue; 10 entirely blue, appendages piceous, sternites, and ventral margins of tergites, yellowish brown, ventral keel black; apical spine of eighth sternite well developed, sharp, brown with black tip; valves of ovipositor obscure brown, stylets piceous.

Wings hyaline; venation brownish proximally, black distally; pterostigma light olive.

Measurements and Venation.—Figures are based on a series of 50 ♂ and 8 ♀ from Venezuela. Series from other localities fall within the limits of variation shown here and do not appear to show any constant geographic variation. Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Males	30.0	28.2	26.0	19.0	17.7	16.2	0.62
Females	28.8	26.5	25.5	19.2	17.9	17.2	0.68

Venational features are as follows: Number of Postnodals—Males, fore wing, 9-12, ave. 10.9; hind wing, 8-12, ave. 9.0. Females, fore wing, 10-12, ave. 11.0; hind wing, 9-10, ave. 9.4. Origin of M_2 —Males, fore wing, arising just proximal to fifth postnodal 66%, at fifth 30%, slightly distal to fifth 4%; hind wing, arising just proximal to fourth postnodal 66%, at fourth 30%, at fifth 4%. Females, fore wing, arising at fifth postnodal, hind wing arising at fourth postnodal, in all specimens. Origin of M_{1a} —Males, fore wing, arising at eighth postnodal 90%, at ninth 5%, at seventh 5%; hind wing, arising at seventh postnodal 55%, at seventh 45%. Females, fore wing, arising at eighth postnodal 62.5%, at ninth 37.5%; hind wing, arising at eighth postnodal in seven specimens, at seventh in remaining one.

Discussion.—In his original description of this species Calvert (1909: 166) states: "The colors of *gracile ascendens* are as in *gracile* type . . ." This would indicate a ground color of light blue with black markings. As has been noted for *apicale (antea)* it appears that certain species of *Acanthagrion* take on yellowish or orange colors when fully adult, although presenting the usual blue or green while immature. In the series of *ascendens* here recorded, all examples from Bejuma, Salom, and Nirgua, Venezuela, display rich brown to black markings on an orange ground. All remaining material shows the usual *Acanthagrion* coloration of black on light blue. In this case, there are grounds for doubt that the blue color is always changed to orange with maturity. Examples from Tucacas, Palma Sola, and Boquerón, Venezuela, from Abunã, Brazil, and from Georgetown, British Guiana, retain the blue coloration while appearing to be fully mature. Throughout the entire series the structural characters, especially the penis and male appendages, appear to show no detectable variation. Although only the Venezuelan series is large enough to admit of statistical

analysis, measurements of specimens from all localities reveal no tendency toward constant differences.

It is possible that a color mutation has arisen to produce the orange Venezuelan specimens, so recently that it has not yet begun to spread throughout the wide range occupied by this species.

As has been stated during the discussion of *trilobatum*, that species appears to be the closest relative of *ascendens*. *Acanthagrion ascendens* may be distinguished from all other known species of *Acanthagrion* by the greatly elevated and constricted dorsum of male abdominal segment 10. The presence of setae on penis segment 2 in both *ascendens* and *phallicornis* may indicate relationship. These two species may represent two lines of divergence from a common ancestor, specialization in one line taking the form of the elevated and constricted tenth abdominal segment encountered in males of the Ascendens Group, in the other line progressing through the development of paired dorsal cornua on this segment in males of the Apicale Group.

Acanthagrion ascendens appears to be the most specialized member of its group. The existence of what are apparently two color phases indicates a degree of genetic plasticity not encountered in other species of the genus.

Distribution (Pl. XVIII).—*Acanthagrion ascendens* is of wide but local occurrence over a large part of the South American continent. It is highly desirable that additional collections be made, to discover certainly whether or not geographical variation occurs. Williamson has stated (1916:355): "The species is a pond or sluggish stream inhabitant." High altitudes may serve as a barrier to its distribution, since it has never been found among the rather extensive collections at hand from Peru and Ecuador.

Material Examined.—220 ♂, 18 ♀, including allotype ♀, as follows: BRAZIL—Abunã, 1922, March 6, 4 ♂; March 7, 1 ♂; March 8, 1 ♂; March 9, 2 ♂; March 11, 2 ♂; March 14, 7 ♂, 2 ♀; March 17, 1 ♂; March 18, 3 ♂; March 19, 1 ♂; March 23, 2 ♂, 1 ♀; March 24, 1 ♂; March 25, 4♂, 2 ♀; March 26, 2 ♂; all by J. H. Williamson and J. W. Strohm; Nova Teutonia, 1936, Dec. 29, 1 ♂, 1 ♀; 1937, Jan. 8, 1 ♂, 1 ♀; Fritz Plaumann, in Kennedy Collection; Villa Murtinho, 1922, April 1, 1 ♂, J. H. Williamson and J. W. Strohm. BRITISH GUIANA—Georgetown, 1912, Jan. 25, 2 ♂; Jan. 26, 2 ♂; L. A. Williamson, E. B. Williamson, and B. J. Rainey. COLOMBIA—Boca Murindo, 1918, Feb. 9, 1 ♂; Feb. 10, 1 ♂, 1 ♀; M. A. Carriker. DUTCH GUIANA—Paramaribo, 1912, Feb. 23, 1 ♂; L. A. Williamson, E. B. Williamson, and B. J. Rainey; 3 ♂, no data, from Förster Collection. PARAGUAY—Ubuvevo, 1911, April 9, 2 ♂; May 21, 1 ♂; Villarica, 1911, March 4, 1 ♂; March 5, 1 ♂; March 26, 1 ♂; April 7, 3 ♂; May 4, 1 ♂; May 14, 2 ♂, all in Förster Collection. TRINIDAD—Arima, 1912, Jan. 28, 1 ♀ (allotype); March 4, 2 ♂; Baracon Chaguanas, March 7, 1 ♂; Cumuto,

March 6, 1 ♂; Cunapo River, Feb. 27, 5 ♂; Maracas River, March 5, 2 ♂; St. Ann River, March 1, 1 ♂; St. Joseph River, March 11, 1 ♂; all by L. A. Williamson, E. B. Williamson, and B. J. Rainey; Grand Couva near Brasso, 1932, May 3, 2 ♂, 2 ♀; "Todd's Road," 1932, May 3, 2 ♂; G. Belmontes. VENEZUELA—Bejuma, 1920, Feb. 13, 4 ♂; Feb. 14, 1 ♂; Feb. 15, 2 ♂; Feb. 16, 2 ♂; Feb. 17, 7 ♂, 1 ♀; Feb. 18, 115 ♂, 6 ♀; Feb. 24, 1 ♂; Boquerón, 1920, March 16, 1 ♂; Nirgua, 1920, Feb. 25, 1 ♂; Palma Sola, 1920, March 4, 1 ♂; March 8, 2 ♂; Salom, 1920, Feb. 25, 6 ♂; Tucacas, 1920, March 24, 1 ♂; March 25, 3 ♂, 1 ♀; all by J. H. Williamson, E. B. Williamson, and W. H. Ditzler.

References in Literature.—*Acanthagrion gracile ascendens* Calvert 1909 (original description as cited above). *Acanthagrion ascendens*, Williamson, 1916:314, 318, 320, 351, 353-355, fig. 13 (recorded from British Guiana, Dutch Guiana, and Trinidad; female described); Kennedy, 1916:327, 329, figs. 12, 13 (penis drawn); Ris, 1918:124, 125, 127, 185, 190 (distinguished from *A. ascendens* Form b., here described as *trilobatum* n. sp.); Campos, 1922: 6, pl. 1, fig. 6 (recorded from Ecuador; almost certainly not *ascendens*, probably *yungarum* or *peruvianum*); Longfield, 1929:136 (quotes Calvert's original record); Geijskes, 1932:255, 256, 257 (recorded from southern part of Trinidad; additional color notes on ♀).

VIRIDESCENS GROUP

This, the largest group recognized in the genus, is made up of *truncatum*, *viridescens*, *lancea*, *gracile*, *peruvianum*, and *deceptum*. These species possess numerous evidences of common ancestry, notably the peculiar double transverse fold on the ental surface of the distal penis segment, which persists throughout the group; the subbasal and subapical constrictions, and dorsal tubercles, of the male superior appendages; and the absence, in both sexes, of a dark stripe along the second lateral thoracic suture.

Acquisition and study of additional examples of *gracile*, *deceptum*, and *peruvianum* may point to the recognition of two groups, one comprising these three species, the other including *truncatum*, *viridescens* and *lancea*. At present these are divisible only on a basis of size and robustness, all six species being bound together by a fundamental similarity of important morphological characters.

Members of the Viridescens Group present a distributional picture frequently encountered in the South American fauna, ranging from Oriente Ecuador southeastward along the eastern slope of the Andes and continuing across Paraguay to southeastern Brazil. The occurrence of *truncatum* near the seacoast of Venezuela is difficult to explain, although its known distribution is closely paralleled by that of *tem-*

porale, of the Abunae Group. Here again we may hypothesize a former widespread dispersal since broken up by oblitative changes of environment.

Acanthagrion truncatum Selys

(Pl. IV, Figs. 39-40, 108; Pl. X, Figs. 115-116; Pl. XV, Fig. 155)

Acanthagrion truncatum Selys, 1876:311 [reprint p. 67-68] (both sexes, from San João del Rey, province of Minas, Brazil).

Male.—Labrum and exposed portions of mandibles light greenish blue, basomesal impression of labrum brown; anteclypeus blue, slightly darker than labrum; genae light yellowish green at level of mandibles, pale greenish blue above, extending up to level of anterior edge of median ocellus; postclypeus largely black, posterolateral angles tipped with blue; light color of genae covering anterior face of basal antennal segment, almost meeting across lower third of anterior face of frons, barely interrupted by black on mid line; postocular spots blue, subtriangular, each about equal in size to area occupied by ocelli; occipital ridge blue; remainder of head dorsum black, antennae piceous to black; entire rear of head pale yellow tinged with blue except for black ring enclosing occipital foramen; labium and exposed parts of maxillae pale yellow.

Anterior lobe of prothorax light blue, narrowly margined anteriorly with black, posterior face marked on either side by a short, narrow extension of black from middle lobe; middle lobe of pronotum black, its lateral convexity bearing on either side a large, rounded blue spot which is confluent laterally with blue of anterior lobe; anterior face of middle lobe bearing a small light brown dash on either side of mid line; hind lobe of pronotum black, narrowly edged with light blue; propleuron almost entirely light blue, black along propleural suture, slightly pruinose; prosternum pale yellow, a black spot between fore coxae.

Mesostigmal laminae black, their outer ends tipped with yellowish blue; dorsum of mesepisternum black, covering about half mesial width of this sclerite; antelar ridge black, keels lightly washed with tan; antehumeral stripe blue, occupying about one-fourth width of mesepisternum throughout posterior three-fourths of its length, anterior fourth expanded to about twice previous width, touching dorsal suture of mesinfraepisternum; humeral stripe black, constricted at posterior end where confluent with extension of dorsal black along antelar ridge, then expanded to occupy about one-fourth width of mesepisternum, gradually declivent cephalad to coincide with humeral suture at anterior curvature, on mesepimeron occupying about one-half width of sclerite, lower border nearly parallel to humeral suture, proceeding across mesinfraepisternum in such a manner as to follow outline of

upper two-thirds of this sclerite, thus leaving stripe with a sharp, ventrally directed point near its anterior end; lateral alar ridge black at level of mesepimeron, this color produced along posterior sixth of first lateral suture as a narrow spur; lateral alar ridge at level of metepisternum blue, anteriorly bordered with black, remainder blue; second lateral suture bearing a suboval black mark at level corresponding to that of first lateral spur; extreme posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites light blue, slightly pruinose near ventral margins; mesosternum, metasternum, and intersternum pale bluish yellow, pruinose.

Coxae and trochanters blue tinged with yellow, duller than thorax; femora pale yellowish blue on internal face, outer face predominantly black, this color not quite attaining proximal end; tibiae almost entirely light brown, slightly mottled with darker brown on outer face; tarsi yellowish brown, claws same color, black tipped; leg spines black.

Abdomen largely black dorsally, blue laterally; dorsal black of 1 produced to form a narrow apical ring, intersegmental membrane and sides blue; black on 2 same width as that of 1 through basal three-fourths, slightly expanded and contracted again to original width to form rounded inflation over apical fourth, intersegmental membrane dark brown, hamules yellowish, penis shaft (Figs. 39, 40) black, vesicle black and brown; remainder of 2 blue; dorsal black of 3-7 restricted to a thin middorsal line at base, somewhat expanded apically; 7 blue between apical spine row and apical end; 8 and 9 blue, apical spine rows black; 10 black dorsally and laterally, brownish ventrally; ventral margins of tergites blue to yellowish blue, sternites light brown anteriorly, grading to darker brown posteriorly, mid ventral keels piceous to black; superior appendages (Figs. 108, 115, 116) black, inferiors brown basally, black tipped.

Wings hyaline, venation brown to black, pterostigma black.

Female.—Similar to ♂ in basic color pattern, venation, and body proportions, but color pattern not so well developed, and light color often yellowish or reddish brown instead of blue.

Labrum, exposed portions of mandibles, anteclypeus, and lower half of genae light brown to pale yellowish brown; postclypeus dark brown, three dark spots along anterior margin; frons and basal antennal segment dark olive green except for black spot on interantennal depression; anterior face of second antennal segment brown, remainder black; pale color of genae extending to level of median ocellus, upper third light blue; lateral ocelli immediately surrounded by blue, median ocellus set in midst of narrow black band which then encroaches on lateral ocelli and fuses posterolaterally with black of vertex; postocular spots and occipital ridge blue, confluent, spots slightly smaller than in ♂; entire rear of head, and labium and maxillae, pale yellowish white except for small, isolated spots of light brown near occipital foramen.

Pale areas of prothorax somewhat more extensive than in ♂, and yellowish brown rather than blue.

Thoracic color pattern fundamentally like that of ♂, but dark stripes not quite so extensive, and in case of humeral stripe represented by light metallic brown instead of black, with a dark condensation near posterior end of humeral suture; antealar ridge dark brown, keels light blue; remainder of meso- and metapleurites as in ♂, substituting brown for black and yellowish blue for pale blue; thoracic sternites as in ♂; mesepisternal fossae (Fig. 155) elongate, adjoining interlaminal sinus.

Coxae and trochanters light yellowish brown, pruinose; front femora the same, a narrow black stripe on basal two-thirds of anterior face; middle and hind femora light yellowish brown, outer face slightly infuscated basally; tibiae, tarsi, tarsal claws and leg spines as in ♂.

Abdominal tergites 1-7 similar to those of ♂, but lateral blue tinged ventrally with yellowish brown; 8 and 9 black dorsally, brownish laterally; 10 entirely brownish blue, appendages brown; ventral margins of tergites, and sternites and valves of ovipositor yellowish brown to brown, mid ventral keels dark brown to piceous.

Wings hyaline, venation light brown, pterostigma light yellowish brown; all wings petioled just to Ac juncture; arculus arising barely distal to second antenodal; postnodals $\frac{9}{9} \cdot \frac{8}{8}$; M_2 arising just proximal to fourth postnodal in all wings, M_{1a} arising $\frac{6}{6} \cdot \frac{6}{6}$; poststigmatal cells $\frac{3}{3} \cdot \frac{3}{3}$.

Measurements and Venation.—Figures are based on a series of 20 ♂ and 1 ♀. Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio
	Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
Males	21.5	20.7	19.5	13.5	12.9	12.0	0.62
Females		21.0			13.5		0.64

Venational features are as follows: Number of Postnodals—Males, fore wing, 8-9, ave. 8.4; hind wing, 7-8, ave. 7.2. Female, fore wing, 9; hind wing, 8. Origin of M_2 —Males, fore wing, arising just proximal to fourth postnodal 60%, at fourth 40%; hind wing, arising just proximal to fourth postnodal 95%, at third 5%. Female, arising just proximal to fourth postnodal in all four wings. Origin of M_{1a} —Males, fore wing, arising at sixth postnodal 55%, at seventh 45%; hind wing, arising at sixth postnodal 85%, at seventh 15%. Female, arising at sixth postnodal in all four wings.

Discussion.—On the basis of male superior appendages, *truncatum* appears to be quite closely related to *viridescens* and *lancea*. Superficially, the penis form is not in good agreement with that found throughout the remaining species of the group. The ental surface of the distal segment, however, follows the group pattern, although reduced in most details, and lacking the strong lateral lobular prolunga-

tions which extend from the double transverse fold in other members of the group.

The mesepisternal fossae take on a peculiar, elongate form in *truncatum*. It is possible that these pits are occupied by a portion of the apical margin of male abdominal segment 10, as well as by the dorsal tubercles of the male superior appendages, during mating. Whatever their function, they serve to set females of *truncatum* apart from all known members of the genus.

It is interesting to note that in *truncatum* M_2 and M_{1a} arise at very nearly the same point in both fore and hind wings. That this is not merely a corollary to small size and reduced venation is indicated by the occurrence of a normal venational pattern in *minutum*, which is even smaller than *truncatum*.

Distribution (Pl. XIX).—The distribution of *truncatum* is closely paralleled by that of *temporale*. The possibility that these two species have been incorrectly determined does exist, although in each case the specimens at hand fit the original descriptions perfectly. Kennedy (1916: figs. 24, 25) published drawings of the penis of a specimen from Chapada, in southern Brazil, which was determined as *truncatum* by Calvert. These drawings check very closely with those accompanying this text, which were made from Venezuelan specimens.

Acanthagrion truncatum appears to be a rather rare species, judged by the small series obtained by the Williamsons. Rarity, coupled with small size, may have resulted in its being overlooked by commercial collectors. Its actual occurrence may be much more general through the continent than authentic records indicate.

Although Williamson's field notes do not contain definite references to *truncatum*, it was apparently found about sluggish streams and marshes in Venezuela.

Material Examined.—24 ♂, 1 ♀, as follows: VENEZUELA—Bejuma, 1920, Feb. 13, 1 ♂; Feb. 15, 2 ♂; Feb. 16, 1 ♂; Feb. 17, 1 ♂; Feb. 23, 1 ♂; Feb. 24, 14 ♂, 1 ♀; Caserio Silva, 1920, Feb. 21, 1 ♂; "La Mona to Bejuma," 1920, Feb. 22, 1 ♂; Nirgua, 1920, Feb. 27, 2 ♂. All by J. H. Williamson, E. B. Williamson, and W. H. Ditzler.

References in Literature.—*Acanthagrion truncatum* Selys, 1876 (original references as cited above); Calvert, 1899:28 (compared with *lata-pistylum*); Calvert, 1909:162, 169, 209, pl. 5, fig. 87 (recorded from Chapada, Sete Lagoas, and São Paulo, Brazil; male appendages figured); Williamson, 1916:324 (compared with *kennedii*); Kennedy, 1916:328, 329, figs. 24, 25 (penis figured); Longfield, 1929:136 (quotes Calvert's 1909 records).

Acanthagrion viridescens, new species

(Pl. IV, Figs. 41-42; Pl. XI, Figs. 117, 121-122; Pl. XV, Fig. 156)

Holotype: Male, Porto Velho, Brazil, Feb. 24, 1922, by J. H. Williamson and J. W. Strohm; allotype a female with same data.

Holotype Male.—Labrum and exposed portions of mandibles light bluish green, labrum with lateral borders and basomesal impression black; anteclypeus and genae bluish green, slightly paler than labrum; postclypeus light green with brownish tinge basally, bearing two black lines, one following anterior margin, the other following posterior margin, connected by short black stripe on mid line; anterior face of frons light green with slight olive tinge, this color extending to base of second antennal segment and covering anterior face of first, restricted slightly by narrow black line along clypeofrontal suture; a small oval light green spot about size of median ocellus lying between antenna and compound eye; postocular spots yellowish green, suboval, each about one-third larger than area occupied by ocelli; remainder of top of head and antennae black, this color extending over rear of head to level of occipital foramen, then restricted to surround foramen with band equal in width to light color of postgenae; postgenae yellowish green, darkening to bluish green ventrally; labium and exposed portions of maxillae yellowish white.

Pronotum predominantly black, a suboval blue spot on anterior lobe, a yellowish green rounded spot on either side of middle lobe, and extreme lateral tips of hind lobe washed with olive; proepisternum and proepimeron black above, lower two-thirds pale green, slightly infuscated; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae black, lateral fourth of each light olive; dorsum of mesepisternum, and antelar ridge, black, this color occupying a trifle less than one-half width of sclerite, constricted by about one-third anteriorly, slightly tapered posteriorly; antehumeral stripe light olive, narrowest one-fourth distance from posterior end where it occupies about one-fourth width of mesepisternum widest through anterior sixth where it adjoins dorsal line of mesinfraepisternum; humeral stripe black, upper border almost parallel to humeral suture and following its anterior convexity over front end of mesepimeron; anterodorsal two-thirds of mesinfraepisternum covered by humeral stripe, posterolateral angle light olive, this color produced dorsad to form distinct incision in lower border of humeral suture; lateral alar ridge at level of mesepimeron black, this color produced along posterior seventh of first lateral suture in form of very narrow spur; remainder of lateral alar ridge light olive green, anteriorly edged with black; second lateral suture bearing a suboval piceous spot at posterior end, this spot about equal in length to first lateral spur, lying more on metepisternum than on metepimeron; posterolateral angle of metepimeron black-bordered; remainder of meso- and metapleurites light bluish to olive green; mesosternum, metasternum and intersternum light olive to bluish green, pruinose.

Coxae, trochanters, and inner face of femora light olive to yellowish green, outer face of femora black; inner face of tibiae piceous to

black, outer face light brown mottled with dark brown; tarsi light brown, apices black; tarsal claws yellowish brown, black tipped; leg spines black.

Abdominal segments 1-3 largely black above, light green laterally; dorsum of 1 bearing a black spot on basal two-thirds, its apical margin slightly convex; remainder, except for narrow black apical ring, light green, intersegmental membrane light blue; 2 largely light green, a black spot in form of truncated triangle whose base is directed caudad, occupying dorsum from mid-length to about one-sixth distance from apex of tergite; apex of 2 bearing a small dorsal black triangle whose apex is connected with larger basal spot by a thin mid dorsal line; ventral border of second tergite black, hamules brownish, penis shaft (Figs. 41, 42) and vesicle black, remainder of 2 light green; apical seven-eighths of 3 with dorsal black stripe, tapered to a point cephalad and connected with base of tergite by thin black line, expanding apically to almost encircle tergite; remainder of 3 light green; 4-6 similar to 3 but black increasingly extensive and green tending to be replaced with brown; 7 similar to segments 4-6, but dorsal black interrupted about one-fourth distance from apex by encircling extension of blue from lateral aspect; 8-9 blue, apical spine rows black; 10 black dorsally and laterally, venter brown; appendages (Figs. 117, 121, 122) black, inner face of superiors gray, inferiors brown basally; ventral margins of tergites 1-3 light green, of 4-7 green to brown, 8 and 9 blue; sternites dark brown to piceous, mid-ventral keel black.

Wings hyaline, venation and pterostigma black; all wings petioled slightly beyond Ac juncture; arculus arising at second antenodal in all wings; postnodals $\frac{8}{8} \cdot \frac{7}{7}$; M_2 arising about midway between fourth and fifth postnodals in fore wing, in right hind wing just proximal to fourth, in left just distal to third; M_{1a} arising $\frac{7}{7} \cdot \frac{7}{6}$.

Allotype Female.—Head similar to ♂, differing as follows: labrum darker green, black of postclypeus largely absent from anterior margin, dorsum of frons mottled with dark brown, a yellow spot before each lateral ocellus.

Prothorax as in ♂ but pale spots on each side of middle lobe almost entirely light olive green; mesepisternal fossae (Fig. 156) deep, rounded; middorsal carina smoothed over for some distance behind fossae; dorsum of antealar plates reddish brown, keels black; humeral stripe dilated to metallic brown over mesinfraepisternum and anterior convexity of mesepimeron; thorax otherwise as in ♂.

Abdominal segment 1 as in ♂; 2 as in ♂, but truncated tip of triangular black mark produced to base of tergite; 3-7 as in ♂ but black somewhat more extensive, sides olive green rather than brown; 7 blue dorsally between apical spine rows and apex; 8 blue with obscure brownish spots on lateral aspect near ventral margin of tergite and subapical black ring; 9 blue dorsally, extending over sides of apical

half, extreme apex black; 10 black dorsally, brown laterally and ventrally, appendages black; ventral margins of tergites brownish; sternites yellowish brown, midventral keel piceous to black; apical spine of eighth sternite small, sharp, black.

Wings hyaline, venation piceous, pterostigma light brown; all wings petioled beyond Ac juncture by one-fourth to one-half length of Ac; arculus arising just distal to second antenodal; postnodals $\frac{8}{8} \cdot \frac{7}{7}$; M_2 arising at fourth postnodal in fore wings, between third and fourth in hind wings; M_{1a} arising $\frac{7}{7} \cdot \frac{6}{6}$; poststigmatal cells $\frac{4}{4} \cdot \frac{4}{4}$.

The following color notes were taken by J. H. Williamson on two males taken at Porto Velho, Brazil, Jan. 24, 1922:

"Eyes black; postocular spots green; face green, lower lip light gray.

Thorax—green with black stripes.

Legs—Black, greenish cast on inner surface.

Abdomen—1, 2, 3 green on sides; 2 has black spot at posterior and on top; 3, 4, 5, and 6 black on top; 7 black on top with narrow blue band near posterior end; 8 and 9 blue top and sides; 4 shades out on side from light green to yellowish green on posterior end; 5 the same; 6 shades back to green on side anterior and then to blue posterior; 10 black."

The specific name alludes to the green ground color of the insect.

Measurements and Venation.—Figures are based on a series of 50 ♂ and 25 ♀ from Porto Velho. Measurements (in mm) are:

	Abdomen			Hind Wing			Ratio Hind Wing/Abdomen
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Males	24.5	23.2	21.8	16.0	15.2	14.5	0.65
Females	24.0	22.5	20.0	16.5	15.5	14.0	0.69

Venational features are as follows: Number of Postnodals—Males, fore wing, 8-10, ave. 9.8; hind wing, 6-8, ave. 7.4. Females, fore wing, 8-11, ave. 9.9; hind wing, 7-9, ave. 8.0. Origin of M_2 —Males, fore wing, arising just proximal to fifth postnodal 80%, at fifth 20%; hind wing, arising just proximal to fourth postnodal 80%, at fourth 20%. Females, fore wing, arising at fourth postnodal 48%, slightly distal to fourth 22%, at fifth 30%; hind wing, arising just proximal to fourth postnodal 68%, at fourth 32%. Origin of M_{1a} —Males, fore wing, arising at seventh postnodal 52%, at eighth 48%; hind wing, arising at sixth postnodal 50%, at seventh 50%. Females, fore wing, arising at seventh postnodal 80%, at eighth 20%; hind wing, arising at sixth postnodal 68%, at seventh 32%.

Discussion.—Within its group, *viridescens* appears to be most closely related to *lancea*, less so to *truncatum*. On the basis of penial characters it is almost as close to *gracile* as to *lancea*, but the larger size and subplanate superior appendages of *gracile* distinguish it at a glance. From *lancea*, *viridescens* may be separated most readily by its longer,

less strongly hooked male inferior appendages, the less extensive lateral development of the membranous penial lobes, and by the consistently smaller size. The mesepisternal fossae of *viridescens* encroach upon the interlaminal sinus, whereas those of *lancea* adjoin but do not invade this region. The dorsal tubercle of the male superior appendages is more strongly produced dorsad than in any other member of the group except *deceptum* and *peruvianum*, whose other differences are so great as to obviate any possibility of confusion.

The light portions of the head, thorax, and most of the abdomen are vivid green in *viridescens*, even in preserved material. In other members of the group the light colors are predominantly blue.

Distribution (Pl. XIX).—At present, *viridescens* is known from only three localities, not far separated, along the upper Madeira River near the Bolivian border. J. H. Williamson's field notes indicate that much of the material was collected near stagnant water in ditches along the Madeira-Mamore railroad.

Material Examined.—71 ♂, 25 ♀, including holotype*, allotype** and paratypes, as follows: BOLIVIA—Cahcueta Esperanza, 1922, April 10, 2 ♂. BRAZIL—Abunã, 1922, March 14, 1 ♂; Porto Velho, 1922, Jan. 24, 3 ♂, 1 ♀; Jan. 27, 13 ♂, 3 ♀; Jan. 30, 1 ♂, 1 ♀; Feb. 6, 15 ♂, 7 ♀; Feb. 9, 3 ♂, 1 ♀; Feb. 10, 2 ♀; Feb. 11, 4 ♂; Feb. 18, 5 ♂; Feb. 20, 8 ♂, 4 ♀; Feb. 21, 1 ♂; Feb. 24, 6* ♂, 3** ♀; Feb. 27, 1 ♂; April 26, 4 ♂, 2 ♀; April 27, 4 ♂, 1 ♀. All material taken by J. H. Williamson and J. W. Strohm.

Acanthagrion lancea Selys

(Pl. IV, Figs. 43-44; Pl. XI, Figs. 118, 123-124; Pl. XV, Fig. 157)

Acanthagrion gracile Race ? *lancea* Selys, 1876:310 [reprint p. 66] (6 ♂, Buenos Aires, 1 ♂, Entrerios, 1 ♂, Santa Cruz; ♀ described Ris, 1904:11-12, Bahia).

New synonyms: *Acanthagrion cuyabae* Calvert, 1909:166, 167, pl. 5, figs. 85, 86; *Acanthagrion cuyabae fimense* Calvert, 1909:168, pl. 5, fig. 84; *Acanthagrion cuyabae freirensis* Calvert, 1909:168, pl. 5, fig. 83.

Male.—Labrum and exposed portions of mandibles greenish blue, sometimes infuscated, labrum with lateral margin and basomesal impression black; anteclypeus colored like labrum, but duller in tone; genae yellowish green below, changing to bluish green above; postclypeus black in mature individuals, its posterolateral angles green; anterior face of frons with low black triangle based on clypeofrontal suture, its apex narrowly conjoined with black of frons dorsum; remainder of anterior face of frons olive green, washing greater part of basal antennal segment; postocular spots greenish blue, subtriangular, each about one-fourth larger than area occupied by ocelli; remainder of head dorsum and antennae black; rear of head light buff, slightly mixed with pale blue, occipital foramen surrounded by black band about

twice width of foramen; labium and exposed portions of maxillae light brown.

Anterior lobe of prothorax chiefly blue, anterior margin black, posterior face bearing on either side a blunt, rounded encroachment of black from middle lobe; middle lobe of pronotum black with a small, dash-like olive green spot on either side of middorsal line, and on either side of lateral convexity a posteriorly-rounded bluish green spot which is produced anteriorly and fused with lateral ends of blue of anterior lobe; hind lobe black, infuscated laterally; proepisternum black, ventral border blue; proepimeron black, posterolateral convexity blue; prosternum brown, a black spot between fore coxae.

Mesostigmal laminae black, outer fourth of each light blue; antalar ridge piceous to black; dorsum of mesepisternum black, widest about one-seventh distance from anterior end, constricted by about one-fourth cephalad, and very gradually tapering caudad, occupying one-half to one-third width of sclerite; antehumeral stripe light greenish blue, through middle three-fourths occupying about one-third width of mesepisternum, expanded to touch dorsal mesinfraepisternal suture anteriorly, very slightly expanded posteriorly; humeral stripe predominantly black, somewhat constricted where confluent with black of alar ridges, widened anteriorly to occupy about one-fourth width of mesepisternum, depressed to coincide with upper edge of mesinfraepisternum; lower border almost parallel to humeral suture, occupying two-fifths to one-third width of mesepimeron; stripe usually diluted to dark metallic brown over anterior end of mesepimeron and so continued across mesinfraepisternum where its lower border is diffuse, but usually leaving only posteroventral angle uncovered; lateral alar ridge at level of mesepimeron black, this color produced along posterior seventh of first lateral suture as a narrow spur; remainder of lateral alar ridge brownish blue, anteriorly edged with black at level of metepisternum and crossed by black at level of second lateral suture; second lateral suture with a suboval piceous to black mark near posterior end, corresponding in position to first lateral spur; extreme posterolateral angle of metepimeron black edged; remainder of meso- and metapleurites light blue, lightly washed with yellow near leg bases; mesosternum, metasternum and intersternum mixed light yellow and blue, to brown, somewhat pruinose.

Coxae and trochanters yellowish blue, sometimes irregularly infuscated; inner face of femora light greenish yellow to brown, outer face piceous to black; inner face of tibiae brown to piceous, outer face light brown, streaked and mottled with dark brown; tarsi brown, piceous apically; tarsal claws brown, black tipped; leg spines black.

Abdomen largely black dorsally, blue to brownish laterally; dorsal black of 1 produced to form narrow apical ring, and with a short, angular subapical protrusion on either side; 2 bearing a black arrow-

head marking, its point directed cephalad, spot occupying apical two-thirds of dorsum, point connected with base of segment by narrow middorsal black line; sides of 1 and 2 blue, intersegmental membrane of 1 blue, of 2 piceous; hamules yellowish brown, penis shaft (Figs. 43, 44) and vesicle black; black of 3 gradually brought to a point basally, expanded over sides apically, remainder of sides blue to brownish; 4-7 similar to 3, but black more extensive apically and laterally, and more bluntly rounded apically, light portions of sides brownish; 7 blue between apical spine row and end of tergite, 8 and 9 blue, apical spine rows black; venter of 10 light brown, remainder black; ventral margins of tergites, and sternites, yellowish brown to brown, depending somewhat on age of specimen, usually lighted anteriorly and becoming progressively darker posteriorly; mid ventral keel piceous to black; superior appendages (Figs. 118, 123, 124) black, inner faces brown; inferiors brown, black tipped.

Wings hyaline, venation and pterostigma piceous to black.

Female.—Appearance very similar to ♂, with following exceptions:

Postclypeus with a dark olive green triangular spot occupying about half of dorsum, one on either side of mid line; light color of frons extending a little higher, and washing anterior face of both first and second antennal segments; head dorsum as in ♂, but with several irregular obscure brownish markings between antennae and ocelli, and mesial portion of occipital ridge light brownish green.

Prothorax and thorax almost exactly as in ♂, but middorsal carina and antelar ridge brown, and humeral stripe much diluted over mesinfraepisternum; mesepisternal fossae (Fig. 157) well developed, situated far anterior, adjoining posterior margin of interlaminal sinus.

Legs as in ♂ but paler throughout, and black of femora diluted to dark brown over proximal half of extent.

Abdominal segments 1-7 very similar to ♂ but black on dorsum of 2 not sharply pointed but meeting basal margin broadly; segment 8 similar to preceding segments; 9 with bilobate black basal spot on either side, the lower lobe reaching two-thirds distance to apex of tergite; remainder of 9 blue; 10 entirely blue, appendages dark brown; sternites and ventral margins of tergites 1-5 light brown, remainder dark brown; mid ventral keel piceous; valves of ovipositor medium brown, stylets black; apical spine of eighth sternite almost obsolete.

Wings hyaline, venation dark brown, pterostigma light brown; wings petioled slightly beyond Ac; postnodals $\frac{11}{11} \cdot \frac{9}{9}$; M_2 arising $\frac{5}{5} \cdot \frac{4}{4}$; M_1 arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{4}{4} \cdot \frac{5}{5}$.

Abdomen 25.0 mm; hind wing 17.0 mm.

Measurements and Venation.—Figures are based on a series of 10 ♂. Both females agree with the text description. Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
26.0	25.1	23.0	18.0	16.7	15.0	0.66

Venational features are as follows: Number of Postnodals—Fore wing, 9-11, ave. 10.2; hind wing, 7-10, ave. 8.8. Origin of M_2 —Fore wing, arising at fifth postnodal 80%, just proximal to fifth 20%; hind wing, arising at fourth postnodal 80%, just proximal to fourth 20%. Origin of M_{1a} —Fore wing, arising at eighth postnodal 90%, at seventh 10%; hind wing, arising at seventh postnodal 50%, at eighth 40%, at sixth 10%.

Discussion.—As stated in the discussion of *viridescens*, that species is very similar in appearance to *lancea*, and the two are probably more closely related to each other than to any other members of the Viridescens Group. The male appendages and penial modifications show striking resemblances between the two species, *lancea* being distinguishable by its slightly larger size, its shorter, more sharply-curved inferior appendages and the somewhat stronger development of the lateral lobes of the distal penis segment.

Calvert's species *cuyabae*, together with its two subspecies *fimense* and *freirensis*, appears to be merely a color variation of *lancea* in which the lance-head-shaped black spot on the dorsum of abdominal segment 2 is truncated, thus losing its resemblance to the lance-head. The minor differences displayed in Calvert's drawings of the male appendages of *cuyabae*, *c. fimense* and *c. freirensis* (1909, pl. 5, figs. 83, 84, 85, 86) appear to me to be due to slightly differing degrees of orientation. Kennedy's drawings (1916: figs. 16, 17) of the penis of a specimen of *cuyabae* determined by Calvert bear close resemblance to the penis drawings shown here (Figs. 43, 44) for *lancea*, which were made from a specimen satisfying Selys' original description in every way. Notes taken on Calvert's type series of *cuyabae* by L. K. Gloyd lend added support to the conclusion that *cuyabae* and its two subspecies must fall as synonyms of *lancea* Selys.

The series examined by me, although quite small, displays a considerable degree of variation in extent of dorsal black on abdominal segment 2. While most of the males have the lance-head spot noted by Selys, three males and both females possess markings whose pointed, or cephalad end is broadly truncate against the basal margin of abdominal segment 2.

This constitutes an additional example of the danger incident to the placing of phylogenetic weight upon minor characters of coloration, especially when a small series is all that is available.

Distribution (Pl. XIX).—Coastal area of southeastern Brazil and in Paraguay.

Material Examined.—13 ♂, 2 ♀, as follows: BRAZIL—Santa Leopoldina,

no date, 9 ♂, 2 ♀; Santa Catharina, no date, 1 ♂; Porto Catharina de Santa Leopoldina, no date, 1 ♂. PARAGUAY—Villarica, 1911, May 14, 2 ♂. All specimens from Förster Collection.

References in Literature.—*Acanthagrion gracile* Race ? *lancea* Selys, 1876 (original description as cited above); *Acanthagrion gracile lancea* Calvert, 1899:28 (compared with *latapistylum*); Ris, 1904:11, 12 (♀ described as cited above); Calvert, 1909:161, 168 (separated in key; compared to *A. cuyabae freirensis* Calv.); Ris, 1913:65, 66 (recorded from Tucumán, Argentina); Sjöstedt, 1918:17 (compared with *amazonicum*); *Acanthagrion lancea*, Ris, 1918:127 (compared with *quadratum*, there referred to as *gracile*); Ris, 1930:45.

Acanthagrion gracile (Rambur)^{1 1}

(Pl. IV, Figs. 45-46; Pl. XI, Figs. 110, 125-126; Pl. XV, Fig. 158)

Aggrion gracile Rambur, 1842:260 (♂, "From Brazil").

Acanthagrion gracile (Rambur), Selys, 1876:308.

Synonyms: *Acanthagrion gracile* var. *cuneatum* Selys, 1876:309 [reprint p. 65];

Acanthagrion gracile race ? *minarum* Selys, 1876:309 [reprint p. 65].

Male.—Labrum and exposed portions of mandibles light bluish green, labrum with lateral border and basomesal impression black; genae light greenish blue; anteclypeus colored similar to labrum, but darker and duller in tone; postclypeus dark green with brownish tinge, bearing a middorsal black band linking anterior and posterior black submarginal stripes, extreme anterior and lateral margin and posterolateral angles brownish green; light color of genae extending to level of mid length of second antennal segment, anterior face of basal segment washed with light blue; pale color of genae darkened to olive green and directed toward midline in form of narrow, slightly oblique bars, bounded below and separated mesally by a low, obtuse-angled triangle of black whose base joins clypeofrontal suture and whose apex, narrowly produced dorsad, meets black of frons dorsum; postocular spots light blue, subtriangular, each about one-fourth larger than area occupied by ocelli; occipital ridge slightly infuscated admesally; remainder of head dorsum and antennae black; entire rear of head light buff except for piceous to black patch encircling occipital foramen, its total diameter about equal to width of labium; buff postgenae gradually merging with blue of genae ventrally; labium and exposed portions of maxillae cream color to light tan.

Anterior lobe of prothorax blue, slightly obscured by faint brown, edged anteriorly with dark brown; middle lobe of pronotum largely

^{1 1} See Appendix; type species of *Acanthagrion*.

black, a rounded olive spot on each side of lateral convexity confluent with blue of anterior lobe antero-laterally; a small dash-like mark on either side of middorsal line; black encroaching slightly on anterior lobe on either side of midline; hind lobe of pronotum black mesially, lateral fourth brownish; propleurite black along upper border, remainder olive, slightly infuscated and pruinose; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae black, the lateral fourth of each light blue; antelar ridge black; dorsum of mesepisternum black, this color occupying about one-half width of sclerite, widest about one-fourth distance from anterior end, slightly constricted anteriorly, and very slightly so posteriorly; antehumeral stripe light blue, widest through anterior eighth where its lower border touches dorsal suture of mesinfraepisternum, gradually constricted to half this width through mesial three-eighths, slightly expanded at posterior end; antehumeral stripe piceous, greatly constricted at posterior end where confluent with black of alar ridges, immediately expanded cephalad to occupy about one-third width of mesepisternum and three-fifths that of mesepimeron, becoming diffuse metallic brown over anterior convexity of mesepimeron, and continued in this tone across mesinfraepisternum, leaving only posteroventral angle of this sclerite untouched; lateral alar ridge at level of mesepimeron black, this color produced along posterior ninth of first lateral suture as a narrow spur; lateral alar ridge at level of metepisternum yellowish blue, edged in front with black; remainder blue, marked with black at level of second lateral suture; on posterior end of second lateral suture; corresponding in position to first lateral spur, is a small oval black spot, all but a small part of it lying on metepisternum; remainder of meso- and metapleurites light blue, washed with pale yellow near leg bases; mesosternum, metasternum and intersternum buff, pruinose.

Coxae and trochanters yellowish blue; inner face of femora similarly colored, outer face black; inner face of tibiae brown to piceous, outer face yellowish brown mottled with piceous, apices black; tarsi light brown basally, black apically; tarsal claws yellowish brown, black tipped; leg spines black.

Abdominal segments 1-3 black dorsally, blue laterally; dorsal black of 1 expanded to form narrow apical ring, intersegmental membrane blue; black of 2 about same width as on 1 through basal three-fifths, then expanded angularly and contracted to original width at apex; apex narrowly ringed with piceous; hamules brownish, penis shaft (Figs. 45, 46) and vesicle black; black of three bluntly rounded at base, almost interrupted by production of lateral blue, slightly expanded at apex, lower half of lateral aspect blue; 4-6 similar to 3, but extent of black gradually increasing and blue turning to obscure brown; 7 similar to preceding segments, but apical fifth entirely blue except for small

black spot low down on either side; 8 and 9 blue, with apical spines and small spot on either side between spine rows and apex black; 10 brown ventrally, remainder black; ventral margins of tergites blue anteriorly, becoming brown on posterior segments; sternites and ventral keels light brown from 1-6, remainder dark brown, keel piceous; superior appendages (Figs. 119, 125, 126) black basally, brownish apically, inner surfaces light greenish brown; inferiors brown, black tipped.

Wings hyaline, venation black, pterostigma piceous.

Female.—Labrum and exposed portions of mandibles dark brown; anteclypeus dark brownish green; genae yellow to level of clypeolabral suture, then changing to dark blue; postclypeus similar to ♂, but darker; anterior face of frons and of basal antennal segment dark brown with faint greenish tinge; postocular spots as in ♂; remainder of head dorsum and antennae black, somewhat mottled obscurely with brown in ocellary region; rear of head, labium and maxillae as in ♂.

Prothorax and thorax almost exactly as in ♂; mesepisternal fossae (Fig. 158) well-defined, about one-fourth distance from anterior end; middorsal carina broadly rounded and somewhat elevated posterior to fossae; humeral stripe as in ♂, but black instead of brown except on mesinfraepisternum; remainder of thorax as in ♂.

Coxae and trochanters yellowish, slightly pruinose; femora yellow to buff, outer aspect piceous to black over apical two-thirds to one-half, most extensive on fore femora and progressively decreasing on middle and hind pairs; tibiae light yellowish brown, inner face slightly infuscated, outer face with line of brown dashes; tibiae light brown, piceous apically; tarsal claws yellowish brown, black tipped; leg spines black.

Abdominal tergites 1-6 as in ♂, 7 and 8 like preceding segment, blue between apical spine rows and apex; apex of 9 with blue spot on top and sides, this color extending to base of tergite middorsally, half way to base on sides; lower third of lateral aspect also blue; 10 entirely blue, appendages dark brown; ventral aspect of abdomen as in ♂ but mid ventral keel piceous to black throughout; valves of ovipositor brown; apical spine of eighth sternite well-developed, sharp, dark brown with black tip.

Wings hyaline, venation dark brown to black, pterostigma light brown; petiolation extending just beyond Ac juncture; arculus arising barely distal to second antenodal; postnodals $\frac{10}{10} \cdot \frac{8}{8}$; M_2 arising just proximal to fifth postnodal in fore wings, just proximal to fourth in hind wings; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{4}{4} \cdot \frac{5}{4}$.

Measurements and Venation.—Figures are based on a series of 20 ♂. Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
26.0	25.1	23.0	17.0	15.6	15.0	0.62

Venational features are as follows: Number of Postnodals—Fore wing, 9-12, ave. 10.1; hind wing, 8-10, ave. 8.6. Origin of M_2 —Fore wing, arising at fifth postnodal 50%, slightly proximal to fifth 45%, slightly distal to fifth 5%; hind wing, arising at fourth postnodal 60%, just proximal to fourth 30%, slightly distal to fourth 10%. Origin of M_{1a} —Fore wing, arising at eighth postnodal 50%, at seventh 40%, at ninth 10%; hind wing, arising at seventh postnodal 75%, at eighth 20%, at sixth 5%.

Discussion.—Almost ever since the time of its description, *gracile* has proven to be the most difficult of recognition of any species of *Acanthagrion*. Rambur's original description (1842:260) is so generalized as to apply to almost any blue-and-black member of the genus, and the type locality, "From Brazil" is of little help. Selys (1876: 307-309; reprint p. 63-65) redescribed the species, with much more attention to detail, basing his remarks largely upon Rambur's type male, which was then in the Selys Collection. On the basis of this description, the species here treated as *gracile* is the only Brazilian form which meets Selys' definition. The forms described as "Race ? *minarum*" and as "Variété *cuneatum*" (Selys, 1876:309; reprint p. 65) are almost certainly conspecific with *gracile*, being separated from it by Selys on the basis of extent of abdominal black coloration and wing petiolation, characters since proven too variable to be utilized diagnostically.

Because I was unable to visit the Brussels Museum to check specimens of *Acanthagrion* in the Selys Collection, and no one there could check specimens sent for comparison, the certain identity of *gracile* must continue to remain doubtful.¹² This state of affairs is more unfortunate in the case of *gracile* than in any other species of the genus. Almost all species recognized by Selys can be determined with certainty from his descriptions. Because that of *gracile* is less exact, this name has long been applied by many workers to almost any blue-and-black *Acanthagrion*. In consequence, a number of the published records of this species cannot be accepted. Under the heading "References in Literature" *postea*, I have included such published records as can be definitely assigned to some species. Under the heading "Doubtful References" are included references to species whose identity I have been unable to determine.

In penial characters, *gracile* differs from *viridescens* and *lancea* in possessing a narrower distal segment. The male abdominal appendages appear to represent a stage of development intermediate between that of *lancea* and that of *deceptum*.

Although differences of male appendages are considerable throughout the Viridescens Group, slight changes in orientation of specimens being studied may alter the appearance of these structures. Only after

¹² See Appendix: Type species.

the penis of a specimen has been examined can a name be applied to it with safety.

Distribution (Pl. XIX).—Owing to the confusion existing in *gracile*, no locality records have been plotted for this species except those substantiated by specimens examined by me. Since the region embracing most of Paraguay and southeastern Brazil has received surprisingly little attention from collectors, it is quite probable that *gracile* will be found to occur much more widely through this region than the accompanying map indicates.

On the envelope containing the single pair taken by J. H. Williamson near Rio de Janeiro appears this note in his hand: "Taken in tandem on grassy vegetation at edge of pool in creek."

Material Examined.—21 ♂, 2 ♀, as follows: BOLIVIA—Coroico, 1800 meters, (no date) 1 ♂, Förster Collection. BRAZIL—Rio de Janeiro, 1922, Aug. 31, 1 ♂, 1 ♀ (pair), J. H. Williamson. PARAGUAY—Villarica, 1911, March 4, 1 ♂; March 11, 1 ♂; March 14, 1 ♂; March 26, 1 ♂; April 4, 1 ♀; April 5, 1 ♂; April 7, 1 ♂; April 14, 1 ♂; April 20, 1 ♂; May 1, 2 ♂; May 2, 3 ♂; May 5, 1 ♂; May 7, 2 ♂; May 9, 2 ♂; May 14, 1 ♂.

References in Literature.—*Agrion gracile* Rambur, 1842 (original reference as cited above). *Acanthagrion gracile* Selys, 1876 (transferred to *Acanthagrion* as cited above); Calvert, 1899:28 (compared with *latapistylum*); Calvert, 1901:115, pl. 5, fig. 20 (*quadratum* recorded from Guatemala as *gracile*); Ris, 1904:11, figs. 5, 6; Calvert, 1907:382 (*quadratum* recorded as *gracile*); Calvert, 1909:160-167 (recorded from Bahia and Rio de Janeiro, Brazil; from Chapada, Brazil, as *A. g. minarum*); Ris, 1916:120, 122, 126, 127 (records Guatemala specimens of *quadratum* as *gracile*); Sjöstedt, 1918:2 (compared with *amazonicum*); Calvert, 1919:164 (Guatemala specimens of *quadratum* recorded as *gracile*). *Acanthagrion "gracile"* (actually *quadratum*), Williamson, 1916:313-320, 323, 324, 350, 353-355, figs. 9, 12 (Guatemala records); Kennedy, 1916:327-329, figs. 8, 9 (penis of Guatemala specimen drawn); Calvert, 1919:164 (additional Guatemala records); Williamson and Williamson, 1924:6 (compared with *Acanthallagma*).

Doubtful References.—*Acanthagrion gracile*, Martin, 1896:2; Martin, 1896:3; Needham and Anthony, 1903:123; Schmidt, 1915:6; Navas 1916:5; Navas, 1924:331; Longfield, 1929:136.

Acanthagrion deceptum, new species¹³

(Pl. IV, Figs. 47-48; Pl. XI, Figs. 120, 127-128; Pl. XVI, Fig. 160)

Holotype: Male, Campamiento, Colonia del Perené, Peru, June 7, 1920, J. H. Williamson; allotype a female with same data.

Holotype Male.—Labrum, exposed portions of mandibles, and ante-

¹³ See Appendix under *A. peruanum* Schmidt.

clypeus light blue with faint greenish tinge, anteclypeus a trifle duller than labrum, which has a black lateral border and basomesal impression; labrum somewhat more bluntly rounded than in other species examined; genae pale greenish blue at level of mandibles, slightly darker above, extending to level of base of second antennal segment and washing anterior face of basal segment; postclypeus black, posterolateral angles and narrow anterior border same color as anteclypeus; anterior face of frons adjoining clypeofrontal suture bearing black marking in form of very low, obtuse-angled triangle whose apex is connected with black of frons dorsum by a narrow mesal line, this interrupting obscure olive green extension from genae across anterior face of frons; a small, obscure greenish spot just behind apex of second antennal segment; postocular spots yellowish green, suboval, each about twice as large as area occupied by ocelli; occipital ridge same color as postocular spots, but not confluent with them; remainder of head dorsum and antennae black; dorsal black extended over rear of head to level of top of occipital foramen, then restricted and surrounding top and sides of foramen by a black band equal in width to pale tan postgenae; postgenae somewhat pruinulent, the tan gradually changing to blue ventrally; labium and exposed portions of maxillae buff to light tan.

Anterior lobe of prothorax light blue, anterior border brown to piceous; middle lobe of pronotum black, a rounded, obscure blue spot on either side of lateral convexity, a small reddish brown dash dorsally on either side of mid line, black narrowly encroaching on either side of anterior lobe; hind lobe of pronotum black, extreme lateral tips blue; proepisternum and proepimeron piceous to black along notal border, remainder light blue; prosternum buff, a black spot between fore coxae.

Mesostigmal laminae black, their lateral tips light blue; dorsum of mesepisternum and keels of antealar ridge black, occupying about one-third width of sclerite; dorsum of antealar ridge dark metallic green; antehumeral stripe light blue, large, occupying about one-half width of mesepisternum; humeral stripe chiefly black, rather narrow, upper border slightly convex, lower border approximately parallel to humeral suture; stripe at widest point, near mid length, occupying about one-fourth width of mesepisternum and one-third that of mesepimeron; humeral stripe covering all but extreme posteroventral angle of mesinfraepisternum, but on this sclerite diluted to metallic bronze; lateral alar ridge at level of mesepimeron black, this color produced along posterior ninth of first lateral suture as narrow black spur; at corresponding level on second lateral suture is a small, suboval, brown spot, lying almost entirely on metepisternum; lateral alar ridge at this level blue bordered with black; remainder blue; extreme posterolateral angle of metepimeron edged with black; remainder of meso- and meta-

pleurites light blue, stippled with minute brownish dots, slightly infuscated near coxae; mesosternum, metasternum, and intersternum light brown, pruinose.

Coxae and trochanters light brown, pruinose, trochanters with faint bluish tinge; outer face of femora black, inner face pale bluish yellow; inner face of tibiae piceous to black, outer face of front tibiae similarly colored, outer face of middle and hind tibiae light brown, faintly mottled with darker brown; tarsi yellowish brown, apices piceous; tarsal claws light brown, black tipped; leg spines black.

Abdominal segments 1-3 largely blue; 1 blue with apically rounded black spot on basal half of dorsum, apical ring and intersegmental membrane black to piceous; dorsum of 2 bearing a small black spot similar in shape to a "spade" playing-card pip, this spot lying on apical third of dorsum with apex directed cephalad and narrow basal portion expanded to form narrow apical ring; intersegmental membrane piceous, hamules light brown, penis shaft (Figs. 47, 48) and vesicle black, remainder of 2 blue; dorsum of 3 with rather narrow, anteriorly-tapering black stripe on posterior three-fourths, this stripe expanded to cover most of lateral aspect at apex, remainder of 3 blue; 4-7 similar to 3 but black becoming progressively more extensive; 7 blue between apical spine row and apex of tergite; 8 and 9 blue, apical spines black, a small black spot between apical spines on apex and on each side; 10 black dorsally, and laterally to level of inferior appendages; remainder blue, giving way to buff ventrally; superior appendages (Figs. 120, 127, 128) black, inferiors light yellowish brown, black tipped; sternites yellowish brown, mid ventral keel piceous to black.

Wings hyaline, venation and pterostigma piceous to black; wings petioled beyond Ac juncture by a distance equal to half length of Ac, except left hind wing, which is petioled just to Ac juncture; arculus arising at second antenodal in all four wings; postnodals $\frac{11}{11} \cdot \frac{10}{9}$; M_2 arising $\frac{6}{6} \cdot \frac{5}{5}$; M_{1a} arising $\frac{9}{9} \cdot \frac{8}{8}$; poststigmatal cells $\frac{6}{6} \cdot \frac{7}{6}$.

Abdomen 24.3 mm; hind wing 16.8 mm.

Allotype Female.—Head similar to that of ♂, but black not quite so extensive; labrum, exposed portions of mandibles, and anteclypeus same color as in ♂, but less vivid; genae as in ♂; postclypeus with dorsal black represented by isolated irregular black spots on brown field; anterior face of frons obscure brown where ♂ is olive green; second antennal segment as well as basal one washed anteriorly with light green to greenish brown, remainder of antennae piceous; post-ocular spots and occipital ridge as in ♂; region between ocelli and antennae mottled with obscure brownish and black; rear of head as in ♂.

Prothorax similar to ♂ but blue on lateral convexity more extensive, and hind lobe almost entirely greenish brown.

Thorax differs from that of ♂ essentially only in humeral stripe,

which, except for a black spot on suture posteriorly, is metallic bronze instead of black, and a trifle wider; pleurites slightly infuscated, this probably due to post-mortem changes; thoracic sternites heavily pruinose, this encroaching on lateroventral regions of pleurites; mesepisternal fossae (Fig. 160) growing shallow laterad to merge insensibly with dorsum of mesepisternum.

Legs as in ♂, but black a trifle less extensive throughout.

Abdomen as in ♂, with following exceptions: black spot on 2 more pointed cephalad, and a minute black middorsal spot at base of tergite; 7 and 8 black dorsally, brownish blue laterally, blue between apical spine rows and apex of tergite; 9 black dorsally, encroached by blue throughout apical half; 10 blue, appendages brown; ventral margin of tergites, and sternites, buff to light brown, mid ventral keel dark brown; apical spine on eighth sternite well-defined, light brown, extreme tip black; valves of ovipositor same color as venter of abdomen.

Wings hyaline, venation brown, pterostigma light brown; petiolation extending just beyond Ac juncture in all four wings; arculus arising a trifle distal to second antenodal in all wings; postnodals $\frac{12}{12} \cdot \frac{10}{10}$; M_2 arising just proximal to seventh postnodal in right fore wing, just proximal to sixth in left; in both hind wings arising just proximal to fifth postnodal; M_{1a} arising $\frac{9}{8} \cdot \frac{8}{8}$; poststigmatal cells $\frac{5}{5} \cdot \frac{6}{6}$.

Abdomen 25.0 mm; hind wing 14.0 mm.

The specific name assigned is suggested by the close resemblance of this species to *peruvianum*.

Measurements and Venation.—Figures are based on a series of 9 ♀. The two paratypic males agree with the type male as described in the text. Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
25.0	24.8	24.0	18.3	16.0	14.0	0.64

Venational features are as follows: Number of Postnodals—Fore wing, 11-12, ave. 11.2; hind wing, 9-10, ave. 9.9. Origin of M_2 —Fore wing, arising at sixth postnodal 55.6%, at fifth 22.2%, just proximal to sixth 11.1%, just proximal to fifth 11.1%; hind wing, arising at fifth postnodal 55.6%, at fourth 22.2%, just proximal to fifth 11.1%, just proximal to fourth 11.1%. Origin of M_{1a} —Fore wing, arising at eighth postnodal 77.8%, at ninth 11.1%, at seventh 11.1%; hind wing, arising at eighth postnodal 44.5%, at seventh 55.5%.

Discussion.—Males of *deceptum* may be separated from other members of the group at a glance, due to the presence of a blunt, sclerotized hook on the membranous lateral lobes of the distal penis segment, as shown in Figs. 47 and 48. The dorsal tubercle of the male superior appendages, while rather strongly produced posteriorly, is very thin, almost plate-like in lateral view (Fig. 120). The mesepisternal fossae

are deeply impressed, confluent admesally, where they are only partially separated by a low, thin septum. This characteristic structure serves to distinguish females of *deceptum* from all other females of the Viridescens Group. The fossae in *deceptum* resemble those of *yungarum*, but may be separated by the fact that in *deceptum* their long axis lies transverse to the middorsal carina, whereas in *yungarum* it is parallel to the carina.

The numerous examples of morphological similarity existing between *deceptum* and *peruvianum* suggest that they have been derived from a common ancestral stock. There is little if any evidence at hand for considering the one more specialized than the other, although the modifications of both appear to be more complicated than any of the four remaining members of the Viridescens Group.

Distribution (Pl. XIX).—*A. deceptum* is known from a single locality, Campamiento, in the Colonia del Perené, Peru. J. H. Williamson's field notes contain no references to its habitat.

Material Examined.—3 ♂, 9 ♀, holotype, allotype, and paratypes, as follows: PERU—Campamiento, Colonia del Perené, 1920, June 7, 2 ♂, 5 ♀, including holotype and allotype; June 18, 1 ♂, 2 ♀; June 19, 2 ♀. All by J. H. Williamson.

Acanthagrion peruvianum, new species¹⁴

(Pl. V, Figs. 49-50; Pl. XII, Figs. 129, 133-134; Pl. XVI, Fig. 159)

Holotype: Male, Campamiento, Colonia del Perené, Peru, June 10, 1920, J. H. Williamson; allotype female, June 7, 1920, same locality and collector.

Holotype Male.—Labrum, exposed portions of mandibles, and anteclypeus light greenish blue, labrum with posterolateral borders and basomesal impression black; genae light blue, extending up to level of second antennal segment base, washing anterior face of basal segment, and continuing across anterior face of frons, narrowly interrupted at mid line by black line produced from black postclypeus to join black of remainder of frons; posterolateral angles of postclypeus green, these and light color of frons slightly darker and duller in tone than labrum and genae; postocular spots pale blue, suboval, each covering an area about one-third larger than that occupied by ocelli; remainder of top of head and antennae black; postgenae pale buff above, slightly pruinose lower, gradually merging with blue of genae ventrally; black of head dorsum flows over rear of head mesally to enclose occipital foramen with a black band equal in width to pale colors of postgenae; labium and exposed portions of maxillae cream color, slightly darkened with brownish.

Anterior lobe of prothorax light blue, with anterior border and

¹⁴ See Appendix under *A. gracile floridense* Fraser.

short lateral mark on either side of rear aspect black, these latter marks confluent with black of middle lobe; middle and hind lobes of pronotum entirely black except for a narrow dash-like mark on either side of lateral convexity of middle lobe, just above propleural suture; proepisternum and proepimeron black above, blue over lower two-thirds, slightly pruinose; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae black, lateral fifth of each light blue; dorsum of mesepisternum and antealar ridge black, covering approximately one-half width of mesepisternum, slightly widening near anterior end but constricted to original length before joining black of mesostigmal laminae; antehumeral stripe light blue, occupying about one-third width of sclerite except through anterior fifth, where it is slightly expanded; humeral stripe black, constricted posteriorly where confluent with black of alar ridges, then expanding cephalad; dorsal border of stripe broadly convex, at widest point occupying about one-fourth width of mesepisternum, gradually declining to meet dorsal suture of mesinfraepisternum; lower border, after posterior constriction, closely paralleling humeral suture, covering upper third of mesepimeron and anterodorsal two-thirds of mesinfraepisternum; lateral alar ridge black at level of mesepimeron, this color produced as a narrow spur along posterior seventh of first lateral suture; remainder of lateral alar ridge buff to blue, narrowly edged with black anteriorly; a minute suboval black spot on metepisternum adjoining second lateral suture near posterior end; border of posterolateral angle of metepimeron black, remainder of meso- and metapleurites light blue; mesosternum, metasternum and intersternum buff to flesh color, pruinose.

Coxae and trochanters light blue, occasionally tinged with yellow (possibly due to post-mortem changes), pruinose; outer face of femora black, inner face buff to light blue, tibiae light brown, outer faces mottled with dark brown which is most extensive on front legs; tarsi same color as tibiae, but apex of each segment banded with piceous to black; tarsal claws light brown tipped with black; leg spines black.

Abdomen chiefly black dorsally, blue laterally; dorsum of 1, and narrow apical ring, black, intersegmental membrane and sides light blue; black on dorsum of 2 approximately same width as that of 1 through basal two-thirds, then produced and contracted to form lateral angular expansion; intersegmental membrane dark brown; hamules brown, penis shaft (Figs. 49, 50) and vesicle black; 3-7 black dorsally, blue laterally, the blue extending basally to almost ring tergites, but narrowly interrupted with black on mid line, black laterally expanded at apex; dorsal black gradually increasing in basal and lateral extent proceeding caudad from 3; black of 7 forming an almost complete apical ring, but not quite attaining ventral margin of tergite, and interrupted by a blue, hour-glass-shaped spot on caudal fifth of mid-

dorsal line; 8 and 9 blue, apical spines and apical spot half way down sides black; 10 black dorsally and laterally, brown ventrally; superior appendages (Figs. 129, 133, 134) black, inferiors light brown basally, black apically; sternites and ventral margins of abdominal tergites brownish, mid ventral keel brownish cephalad, becoming progressively darker until black on eighth sternite.

Wings hyaline, venation black, pterostigma dark brown; wings petioled beyond Ac juncture by distance almost equal to length of Ac; origin of arculus slightly distal to second antenodal; postnodals $\frac{12}{12} \cdot \frac{10}{10}$; M_2 arising at fifth postnodal in fore wing, just proximal to fifth in right hind wing, slightly distal to fourth in left hind wing; M_{1a} arising $\frac{9}{9} \cdot \frac{8}{8}$; poststigmatal cells $\frac{6}{7} \cdot \frac{6}{6}$.

Allotype Female.—Labrum dark brown, grading into piceous basally; exposed portions of mandibles tan to light brown; anteclypeus light olive green; genae pale greenish yellow at level of mandible bases, becoming pale green dorsally, extending to level of median ocellus, at this end tinged with tan; postclypeus bordered with black anteriorly and posteriorly, same color as anteclypeus mesally, posterior black encroaching on lower third of anterior face of frons in form of low, obtuse-angled triangle whose apex is directed dorsad on mid line; interantennal depression just anterior to median ocellus black, a slender black extension on mid line produced toward apex of basofrontal triangle; basal antennal segment, anterior face of second antennal segment, and remainder of frons light brown; postocular spots light blue, subtriangular, each enclosing an area about one-third greater than that occupied by ocelli; occipital ridge light brown; median and lateral ocelli surrounded by black, but separated from each other by a narrow M-shaped mark of light brown; remainder of top of head and antennae black; postgenae, labium, and exposed portions of maxillae pale cream color; black of head dorsum extended to encircle occipital foramen by a black band equal in width to light color of postgenae.

Prothorax similar to that of ♂, but light color pale brown rather than blue, light spot on anterolateral convexity of middle lobe three times larger, rounded, and two additional small dash-shaped marks adjacent to mid line on anterior face of middle lobe; hind lobe entirely light; light portions of propleurite a trifle more extensive than in ♂; prosternum light brown, a black spot between fore coxae.

Mesostigmatal laminae dull yellow, extreme admesal edges dark brown, mesal area of each light brown to dull orange, mid line narrowly black; mesepisternal fossae (Fig. 159) black, well defined, separated by thin septum, located one-fourth distance from anterior to posterior end of middorsal carina; this carina same color as mesostigmatal plate, smoothed off and slightly convex for some distance behind fossae; antealar ridge obscure brown dorsally; dorsum of mesepisternum black, this color occupying about one-third width of scler-

ite adjacent to pale carina, slightly expanded posteriorly and following anterior edge of antealar ridge to humeral suture, a trifle constricted at anterior end; antehumeral stripe pale yellowish green, widest at anterior end where its outer margin touches dorsal suture of mesinfraepisternum; humeral stripe light metallic brown, occupying about same area as that of ♂; near its posterior end lies a small black spot, a bit more on mesepisternum than mesepimeron; lateral alar ridge at level of mesepimeron light brown edged with black anteriorly, then changing to pale blue through remainder of course; a short, obscure brown spur produced along posterior eighth of first lateral suture; a small, sub-reniform, dark brown spot on metepimeron adjacent to posterior seventh of second lateral suture; posterolateral angle of metepimeron edged with black; remainder of meso- and metapleurites pale blue, slightly infuscated anteriorly; mesosternum, metasternum and intersternum pale greenish yellow, pruinose.

Coxae and trochanters light yellow; femora predominantly pale yellow to buff, occasionally lightly washed with light green, outer faces black over distal two-thirds; tibiae light brown, outer face with mottled brownish stripe; tarsi same color as tibiae, with piceous apical ring; tarsal claws light yellowish brown, black tipped; leg spines black.

Abdominal tergites 1-6 very similar to those in ♂; 7 similar to that of ♂, but only intersegmental membrane pale; 8 black, pale from apical spine row to apex; 9 black basolaterally, apically blue, the blue encroaching basally on mid line; 10 entirely blue, appendages black; extreme ventral margins of tergites, and sternites, light yellowish brown, mid ventral keel piceous to black; valves of ovipositor same color as sternites; apical spine of eighth sternite well developed, sharp, same color as sternites but with black tip.

Wings hyaline, venation dark brown to black, pterostigma light brown; petiolation as in ♂; origin of arcus just distal to second antenodal in all but left front wing, where it arises at second antenodal; postnodals $\frac{11}{11} \cdot \frac{9}{9}$; M_2 arising $\frac{5}{5} \cdot \frac{4}{4}$; M_{1a} arising $\frac{9}{9} \cdot \frac{8}{9}$; post-stigmal cells $\frac{6}{6} \cdot \frac{6}{8}$, the excessive number in left hind wing being due to interpolation of veins.

The specific name was suggested by the wide occurrence of this species in Peru, whose *Acanthagrion* fauna is apparently quite scanty. **Measurements and Venation.**—Figures are based on a series of 20 ♂ from Campamiento, Peru. Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
26.0	25.1	24.0	17.0	16.1	16.0	0.64

Venational features are as follows: Number of Postnodals—Fore wing, 11-13, ave. 11.5; hind wing, 9-11, ave. 9.6. Origin of M_2 —Fore wing, arising at fifth postnodal 85%, just proximal to fifth 10%, slightly distal

to fifth 5%; hind wing, arising at fourth postnodal 95%, just proximal to fourth 5%. Origin of M_{1a} —Fore wing, arising at eighth postnodal 65%, at ninth 25%, at seventh 10%; hind wing, arising at seventh postnodal 65%, at eighth 35%.

Discussion.—The characters most useful in separating *peruvianum* from its relatives, especially *deceptum*, are the penis and the mesepisternal fossae. Although differences in male appendages exist, as has been pointed out during the discussion of *deceptum*, they are easily overlooked. In stature, degree of robustness, venational detail, and coloration the two species are so similar as to make examination of penes and fossae necessary for certain determination. The striking shape of the dorsal black spot on abdominal segment 2 in both sexes of *deceptum* is constant through all specimens at hand, and may serve as an additional means of diagnosis. The danger of depending upon such a character has been noted at various times, especially under the Viridescens Group. The value of the markings of abdominal segment 2 cannot be stated until larger series of *deceptum* are at hand.

Next to *deceptum*, *peruvianum* appears to be most closely related to *gracile*, one notable difference being that the lateral penis lobes are much more highly developed in *peruvianum*.

The widely separated mesepisternal fossae of *deceptum* females permit them to be readily distinguished from all other species. Only in *rishi* are the fossae so far separated, and from this species the smaller size of *deceptum* easily distinguishes it.

Distribution (Pl. XIX).—Consignments of specimens recently received from Dr. Kennedy indicate that *peruvianum* is of rather frequent occurrence throughout the mountainous sections of Peru and Ecuador. It has been taken at altitudes ranging from 500 to 1000 meters. One of the Campamiento specimens is accompanied by a field note reading "At small swamp one-half mile from hacienda."

Material Examined.—210 ♂, 30 ♀, holotype, allotype, and paratypes as follows: ECUADOR—Cotos, 1934, June 3, 1 ♀; June 5, 3 ♂; Puyo, 1000 meters, 1936, Nov. 18-20, 6 ♂, 1 ♀; Napo, 1934, April 20, 3 ♂; April 21, 4 ♂, 1 ♀; Rio Anzu, 1934, July 17, 2 ♂; July 18, 5 ♂, 1 ♀; July 19, 7 ♂, 1 ♀; July 21, 5 ♂; July 27, 1 ♂; Aug. 5, 20 ♂, 3 ♀; Aug. 6, 30 ♂, 5 ♀; Aug. 7, 4 ♂, 4 ♀; Aug. 22, 1 ♂; Aug. 25, 19 ♂, 1 ♀; Aug. 27, 7 ♂, 1 ♀; Sept. 7, 1 ♂; Sept. 25, 1 ♂; Nov. 10, 2 ♂; Nov. 11, 1 ♂; Nov. 15, 3 ♂; Nov. 16, 1 ♂; Nov. 19, 1 ♂; Rio Ila, 1934, November, 38 ♂, 9 ♀; Rio Jatun Yacu, 1935, January, 2 ♂. All by Wm. Clarke-Macintyre, in Kennedy Collection. PERU—Campamiento (Colonia del Perené), 1920, June 6, 2 ♂, 1 ♀; June 7, 10 ♂, 1 ♀ (allotype); June 8, 1 ♂; June 9, 2 ♂; June 10, 2 ♂ (including holotype); June 12, 3 ♂; June 17, 2 ♂; June 18, 3 ♂; June 19, 1 ♂. All by J. H. Williamson. Chuchuras, no date, 4 ♂, Dr. P. Martin, Cowley Collection; Moyobamba, no date, 1 ♂, by Staudinger, Cowley Collection; Rioja, no date,

3 ♂, by Dr. P. Martin, Cowley Collection; Rio Pachitea, no date, 1 ♂, 1 ♀, by Staudinger, Cowley Collection; Rio Seco, 1934, November, 2 ♂, by G. G. Klug, Cowley Collection; Tarapoto, no date, 2 ♂, Dr. P. Martin, Cowley Collection; Madre de Dios, 500 meters, no date, 4 ♂, from Förster Collection.

ADUSTUM GROUP

The species composing this group, *minutum*, *adustum*, and *indefensum*, appear to be less closely interrelated than those of any of the other groups. None of the species are represented by adequate series, and the females of *minutum* and *indefensum* are unknown. More extensive collections in the now little-known regions between the Amazon and the Orinoco may reveal more natural placements for these species. In spite of certain divergences, however, there are several characters which are shared by all three species, and on these the identity of the group is based. The distal penis segment shows considerable similarity, especially in modifications of the ental surface and in the terminal indentation or bifurcation of its free end. The species are all quite small, and agree well in venational features. The range of the group extends from Nirgua, Venezuela, to Dutch Guiana. Paucity of material makes it difficult to determine relationship with other groups.

Acanthagrion minutum, new species
(Pl. V, Figs. 51-52; Pl. XII, Figs. 130, 135-136)

Holotype: Male, Nirgua, Venezuela, Feb. 27, 1920, by J. H. Williamson, E. B. Williamson, and W. H. Ditzler.

Holotype Male.—Exposed portions of mandibles dull bluish green; labrum brighter bluish green, its base and basomesal impression black; genae bluish green, lighter than labrum, extending to mid length of second antennal segment; frons dark olive green, black of postclypeus slightly encroaching at middle of clypeofrontal suture, posterior border of green of frons almost straight, extending up as far as apex of basal antennal segment whose anterior aspect it covers, indented by a short angle of black just mesal to antennal bases; a subreniform spot of bluish green about size of median ocellus just behind and slightly lateral to second antennal segment; a very minute fleck of same color along anterior margin of median ocellus, which is flanked by two tiny reddish brown dots; postocular spots greenish blue, their lateral margins rounded, mesally produced and tapering to join across occipital ridge; remainder of top of head and antennae black, black extended to encircle occipital foramen with a band about as wide as bluish gray postgenae; labium and exposed portions of maxillae light cream color.

Anterior lobe of prothorax light blue; middle lobe of pronotum black, a blue spot on either side of lateral convexity, mesial border rounded, outer border concave; hind lobe light blue except for narrow black middorsal interruption; proepisternum and proepimeron black along upper border, remainder pale blue; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae black mesally, outer half of each light blue; dorsum of mesepisternum and of lateral alar ridge black, occupying a trifle less than half width of mesepisternum; lateral border of mesepisternal black nearly straight, almost exactly parallel to middorsal carina; antehumeral stripe light greenish blue, widest at anterior end where its outer border touches dorsal edge of mesinfraepisternum, gradually narrowing posteriorly to its narrowest point where it occupies about one-third width of mesepisternum about one-fourth distance from posterior end, at which it is slightly dilated; humeral stripe black, constricted at posterior end where confluent with black of antearlar ridge, rapidly expanded to twice this width, dorsal margin gradually declining to follow dorsal suture on mesinfraepisternum, ventral margin paralleling humeral suture, occupying about three-fifths width of mesepimeron, covering anterodorsal two-thirds of mesinfraepisternum; remainder of mesepimeron light blue; lateral alar ridge at level of mesepimeron washed with blue at juncture with antearlar ridge, remainder black, this color produced as a narrow spur along posterior fifth of first lateral suture; lateral alar ridge at level of metepisternum blue, anteriorly bordered with black which is produced along second lateral suture as an elongate suboval mark equal in length and corresponding in position to first lateral spur; posterolateral angle of metepimeron black bordered; remainder of metapleurite light blue; mesosternum, metasternum, and intersternum heavily pruinose, a black line on mid line of metasternum, produced posteriorly as a narrow line which bifurcates and terminates in two small, brown, oval spots, free from pruinoscence, on intersternum.

Coxae and trochanters light blue, somewhat pruinose; outer face of femora black, inner face mixed light blue and buff; tibiae pale tan, anterolateral keels piceous; tarsi dark brown, claws light brown basally, black apically; leg spines black.

Abdomen largely black dorsally, light blue laterally; 1 black dorsally, sides and intersegmental membrane blue, a small black spot half way down on either side at apex; 2 black dorsally, basal three-fifths about same width as that of 1, then with rounded expansion; intersegmental membrane dark brown, hamules dark brown to piceous, penis shaft (Figs. 51, 52) and vesicle black, remainder of 2 blue; 3-7 black dorsally, progressively increasingly so laterally, lateral blue encircling bases except for narrow mid dorsal interruption, black expanded apically to about double its mesal width; intersegmental mem-

branes dark brown to black; lateral blue of 3-7 progressively darkened and obscured caudad, lateral portions of 7 appearing dull slate color; 7 blue between apical spine row and apex of tergite; 8 and 9 blue, 8 with low triangular dorsal black spot at base, apex of triangle directed caudad along mid line; 10 black dorsally and laterally at base and apex, brown ventrally, remainder blue; superior appendages (Figs. 130, 135, 136) black, inferiors brown basally, black apically; ventral aspect of tergites 1-4 blue, 5-9 brownish; sternites, where visible, piceous to black.

Wings hyaline, venation light brown, pterostigma light reddish brown; petiolation fails to attain Ac juncture by slightly less than length of Ac in three wings, in one (left fore wing) petioled just to Ac juncture; arculus arising barely distal to second antenodal in all four wings; postnodals $\frac{7}{7} \cdot \frac{6}{6}$; M_2 arising just proximal to fourth antenodal in all four wings; M_{1a} arising $\frac{6}{7} \cdot \frac{6}{6}$; poststigmatal cells three in all four wings.

Abdomen 19.0 mm; hind wing 14.3 mm.

Female.—Unknown.

The specific name selected alludes to the diminutive size of this, the smallest known species of *Acanthagrion*.

Measurements and Venation.—Figures are based on 5 paratyptic ♂. Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
20.0	18.7	17.3	14.2	13.4	13.0	0.71

Venational features are as follows: Number of Postnodals—Fore wing, 7-8, ave. 7.8; hind wing, 6-7, ave. 6.4. Origin of M_2 —Arising just proximal to fourth postnodal in both fore and hind wings of all specimens. Origin of M_{1a} —Fore wing, arising at seventh postnodal 60%, at sixth 20%, at eighth 20%; hind wing, arising at sixth postnodal 100%.

Discussion.—The confluent postocular spots displayed by *minutum* distinguish it at a glance from all other known species of *Acanthagrion*. Although the species is known from only six specimens, the arrangement of this character makes it appear certain that the spots are always connected by a broad band across the occipital ridge, regardless of age. The minute size and reduced venation are distinctive; and the penis and abdominal appendages assume a form not readily confused with that of any other known species.

As has been indicated earlier, members of the Adustum Group do not appear to be closely related to each other, although bound together by a few combinations of characters. The abdominal appendages of *minutum* bear some resemblance to those of *temporale*, similarities being especially pronounced in terminal view (compare Figs. 67 and

135). The penes of the two species, however, possess few features in common.

That *minutum* is a species of rare occurrence must be obvious, as the three enthusiastic collectors, two of them possessed of extraordinary skill, were able to take only six specimens.

These examples were taken at a laguna one-half mile N.E. of Nirgua, Venezuela. Concerning this locality E. B. Williamson wrote in his journal, "Laguna is formed by damming across a low, swampy valley between low hills and has an area now (low water stage) of possibly 5 acres. A few patches of rushes (low) and a small waterlily with mottled leaves and a small white flower (about 1 inch in diameter or less) with petals cut feathery. Small blue *Acanthagrion [temporale]* was by thousands and dragonflies generally were numerous."

Distribution (Pl. XIX).—*A. minutum* is known only from the type locality, the laguna near Nirgua, Venezuela, mentioned in the discussion. [In a pencilled addition, Leonard recorded the receipt of males and females from E. Schmidt, collected in Bolivia by Steinbach.]

Material Examined.—6 ♂, including type, as follows: VENEZUELA—Nirgua, 1920, Feb. 27, 2 ♂ (including type); Feb. 28, 4 ♂. All taken by J. H. Williamson, E. B. Williamson, and W. H. Ditzler.

Acanthagrion adustum Williamson

(Pl. V, Figs. 53-54; Pl. XII, Figs. 131, 137-138; Pl. XVI, Fig. 163)

Acanthagrion adustum Williamson, 1916:320-324, figs. 1, 2, 10 (♂ and ♀, Wismar, British Guiana, Feb. 15, 1912, by L. A. Williamson, E. B. Williamson, and W. H. Ditzler).

Male.—Labrum orange, faintly tinged with brown, its lateral and basal margins and basomesal impression black; exposed portions of mandibles, and anteclypeus, brown; lower portions of genae light yellowish tan becoming infuscated dorsad, this color extending to level of mid length of second antennal segment, then almost interrupted by a finger-like production of black from vertex toward compound eye, then widened to original width and terminating in a light lobe approximately equal in size and shape to black lobe just mentioned; frons, except for black interantennal depression and very narrow, low, black triangle along clypeofrontal suture, brownish orange, this color washing basal antennal segment and anterior face of second; area between antennae and ocelli colored similar to frons, ocelli surrounded by black, this color narrowly produced toward antennal bases on either side; postocular spots dull orange, subtriangular, each slightly smaller than area occupied by ocelli; occipital ridge same color as postocular spots; remainder of head dorsum black, antennae dark piceous to black; rear of head largely black, a narrow greenish yellow stripe produced from genae lying along margin of eye, curved admesally at

level of occipital foramen; traces of pruinescence on postgenae; labium yellowish white, exposed portions of maxillae light brown.

Anterior lobe of prothorax pale greenish yellow, lateral ends of anterior margin brownish; middle lobe of pronotum chiefly black, a pale greenish yellow narrow stripe on either side adjoining black middorsal line, and a small brownish subtriangular spot on either side of lateral convexity; hind lobe black near juncture with middle lobe, remainder light greenish yellow; upper third of propleurite black, remainder tan with slight greenish tinge; prosternum light brown, a black spot between fore coxae.

Mesostigmal laminae light greenish yellow, admesal fourth of each black; anterior portion of interlaminal sinus obscure orange with black mid line; middorsal carina and antealar ridge reddish brown; a parallel-sided straight black stripe adjoining light carina, occupying about one-third width of mesepisternum; remainder of mesepisternum occupied by reddish brown antehumeral stripe except for narrow encroachment of black humeral stripe along posterior fourth; humeral stripe black, upper border following humeral and dorsal mesinfraepisternal sutures except as noted above; stripe occupying about one-half width of mesepimeron and upper half of mesinfraepisternum; lateral alar ridge light brownish to brownish green bordered with black, this color produced along posterior eighth of first lateral suture as a narrow, sharply-pointed triangle whose upper side is fused with humeral stripe through its basal third; second lateral suture bearing a black stripe extending from posterior end almost to metastigma, lying chiefly on metepisternum except for small metepimeral encroachment near posterior end, this stripe widest at mid length where it occupies two-thirds width of metepisternum, tapering anteriorly and posteriorly; upper margin of metinfraepisternum dark brown, remainder light olive; balance of meso- and metapleurites light yellowish green, lightest near leg bases; mesosternum, metasternum, and intersternum slightly infuscated, yellowish green, moderately pruinose.

Coxae and trochanters yellowish green, coxae brown basally; inner face of femora similar to coxae, infuscated apically, outer face piceous to black; tibiae light brown, inner face somewhat darker than outer; tarsi piceous, black apically, tarsal claws brown, black tipped; leg spines black.

Abdomen predominantly black dorsally and over upper half of lateral aspect, remainder of sides yellowish to brownish green, progressively darkening posteriorly; dorsal black of 1 expanded to form narrow apical ring; sides of 1 yellowish green, intersegmental membrane bluish green; 2 black dorsally and over upper third of sides, remainder yellowish green, slightly infuscated along ventral margin, apical ring and intersegmental membrane piceous; hamules light greenish brown, penis shaft (Figs. 53, 54) and vesicle black; 3-7 black

dorsally and over half to two-thirds of lateral aspect, the lateral increase being progressive caudad; light lateral color produced to form narrow basal ring interrupted by black middorsally; dorsum and upper half of lateral aspect of 8 black over basal two-thirds, remainder light blue except for black apical spine row; 9 entirely blue, apical spines black; dorsum and upper third of side of 10 black, this color narrowly produced ventrad basally, brown ventrally, remainder blue, posterior face of dorsal extension blue; sternites and ventral margins of tergites 1 and 3-7 light brown, midventral keel black; superior appendages (Figs. 131, 137, 138) black, posterior face brown; inferiors brown basally, apices black.

Wings hyaline, venation piceous, pterostigma reddish brown.

Female.—Very similar to ♂, with differences as follows:

Labrum reddish brown, genae light yellow except at upper end where infused with yellowish brown; postocular spots slightly smaller than in ♂, produced to a sharp point admesally; pale postgenal stripe about twice as wide as in ♂.

Prothorax and thorax as in ♂ but humeral stripe diluted to light brown, nearly obsolete through mesial three-fifths of its length; mesepisternal fossae (Fig. 163) shallow, slightly elongate, situated at base of anterior bifurcation of middorsal carina, the carina slightly elevated between them and black at this level.

Legs as in ♂ but outer face of hind femora light brown with two longitudinal stripes of dark brown.

Abdominal segments 1-7 as in ♂, 8 and 9 like preceding segments except for blue between apical spine rows and apices of tergites; 10 with narrow black basal ring, remainder blue; appendages piceous; sternites and ventral margins of tergites light brown, midventral keel piceous; valves of ovipositor light brown, stylets dark brown; apical spine of eighth sternite long, sharp, black at tip.

Wings hyaline, venation piceous, pterostigma light yellowish brown; petiolation extending beyond Ac juncture by half to two-thirds length of Ac; arculus arising at second antenodal in right fore and hind wings, barely distal to that point in left; postnodals $\frac{10}{9} \cdot \frac{8}{8}$; M_2 arising at fifth postnodal in fore wings, at fourth in left hind wing, midway between fourth and fifth in right hind wing; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; post-stigmal cells $\frac{3}{3} \cdot \frac{5}{4}$.

Measurements and Venation.—Figures are based on a series of 20 ♂ from Brazil and British Guiana. Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
23.0	21.3	20.0	15.0	14.6	13.5	0.68

Venational features are as follows: Number of Postnodals—Fore wing, 8-9, ave. 8.7; hind wing, 7-8, ave. 8.1. Origin of M_2 —Fore wing, arising

at fifth postnodal 50%, just proximal to fifth 45%, at fourth 5%; hind wing, arising at fourth postnodal 50%, just proximal to fourth 45%, at third 5%. Origin of M_{1a} —Fore wing, arising at eighth postnodal 85%, at seventh 15%; hind wing, arising at seventh postnodal 90%, at sixth 10%.

Discussion.—Males of *adustum* may be easily recognized by the peculiar flattening of the ental surfaces of the superior abdominal appendages, best shown in Fig. 137. The ental surface of the distal penis segment bears a membranous median lobe similar to that encountered in *indefensum*. The penis of *adustum* differs, however in the greater simplicity of the tip of the distal segment. Females are easily separated from other members of the genus by the form of the mesepisternal fossae, and by the combination of small size with yellowish or reddish ground colors. Both sexes possess a heavy black stripe along the second lateral thoracic suture, this stripe frequently interrupted at the level of the metastigma.

The striking form of the male superior appendages somewhat resembles that found in two species of *Anisagrion*, *truncatipenne* Calvert and *kennedii* Leonard. This similarity is probably due to convergence, since the two genera are quite distinct when judged by other characters.

Distribution (Pl. XIX).—*Acanthagrion adustum* appears to be a member of the Amazonian fauna, being known from the upper Madeira, the Negro near Santa Isabel and at Manáos. The type locality is near Wismar in British Guiana. Concerning it Williamson (1916:324) wrote: "This species flew with *Enallagma* - or *Ischnura*-like flight in the vegetation bordering the canal along its left bank just above the sawmill at Christianburg, a mile below Wismar."

Material Examined.—36 ♂, 8 ♀, including holotype, allotype, and 5 paratypes, as follows: BRAZIL—Belém, 1922, Aug. 5, 1 ♂; Aug. 7, 1 ♂; Manáos, 1922, June 7, 2 ♂; June 8, 2 ♂; June 15, 2 ♂; June 26, 3 ♂; Porto Velho, 1922, Feb. 9, 2 ♂, 2 ♀; Feb. 18, 1 ♂, 3 ♀; Feb. 24, 2 ♂; Rio Negro "at Miguel Pecil's Ranch," 1922, July 8, 1 ♂, 1 ♀; Santa Isabel, 1922, July 7, 8 ♂, 1 ♀. All by J. H. Williamson and J. W. Strohm. BRITISH GUIANA—Wismar, 1912, Jan. 31, 1 ♂ (paratype); Feb. 15, 1 ♂, 1 ♀ (holotype and allotype); Feb. 16, 4 ♂ (paratypes). All by L. A. Williamson, E. B. Williamson, and B. J. Rainey. DUTCH GUIANA—5 ♂, Förster Collection, no data.

References in Literature.—*Acanthagrion adustum* Williamson, 1916 (original description as cited above); Kennedy, 1916:328, 329, figs. 20, 21 (penis figured); Williamson and Williamson, 1924:7 (compared with *Acanthallagma*).

Acanthagrion indefensum Williamson
(Pl. V, Figs. 55-56; Pl. XII, Figs. 132, 139-140)

Acanthagrion indefensum Williamson, 1916:319-320, figs. 3, 4, 7. (♂, Wismar, British Guiana, Feb. 16, 1912, L. A. Williamson, and B. J. Rainey).

Holotype Male.—Labrum and exposed portions of mandibles green, faintly tinged with brown, lateral and basal borders and basomesal impression of labrum and portions of mandibles adjoining labrum, black; anteclypeus dull greenish blue; genae light green, lightest below, gradually darkening dorsad, green color extending to level of second antennal segment base but not touching antennae, which are black throughout; postclypeus black save for very small amount of green on posterolateral angles; lower part of frons bearing a low, obtuse, black triangle based on clypeofrontal suture, its apex narrowly connected with black which occupies dorsum and upper half of anterior face of frons; remaining space on frons occupied by olive green extensions from green of genae, in form of an oblique bar directed admesally from either side; postocular spots light greenish blue, subtriangular, their margins slightly crenulate, each about same size as area occupied by ocelli; remainder of head dorsum black except for pale markings on postgenal area as follows: near level of occipital foramen a rounded yellowish mark about size of postocular spot, its lower part produced along margin of eye as a very narrow line whose color changes from yellow to light green and merges ventrally with similar color of genae; labium cream color, exposed portions of maxillae light brown.

Anterior lobe of prothorax black, bearing a suboval blue mark dorsally; middle and hind lobes of pronotum black; proepisternum black with blue ventral margin; proepimeron piceous to black, its ventral margin and a small oval spot on posterolateral convexity blue; prosternum brownish, a black spot between fore coxae.

Mesostigmal laminae, interlaminal sinus, and antealar ridge black; dorsum of mesepisternum black, occupying approximately one-half width of sclerite but a trifle wider one-fourth distance from anterior end; antehumeral stripe light blue, widest at anterior end where it touches dorsal mesinfraepisternal suture, gradually tapering caudad to about one-half its original width; humeral stripe black, heavy, slightly constricted through posterior sixth to its fusion with black of alar ridges; through remainder of its extent practically uniform in width, occupying about three-fifths width of mesepimeron and one-third that of mesepisternum, but declined to follow anterior half of dorsal mesinfraepisternal suture; humeral stripe covering all but posteroventral angle of mesinfraepisternum, which is brownish, grading to blue at extreme tip; lateral alar ridge black at level of mesepimeron, this color produced as a spur along posterior seventh of first lateral suture, black filled in between humeral stripe and posterior half of this spur; lateral alar ridge at level of metepisternum light blue, heavily bordered with black; remainder blue except for black interruption at level of second lateral suture; second lateral suture bearing a black stripe extending from posterior end to metastigma, lying almost entirely on metepisternum, widest at mid length where it occupies about one-third

width of this sclerite, slightly tapering anteriorly and posteriorly; extreme posterolateral tip of metepimeron edged with black; periphery of metinfraepisternum brownish, center portion yellowish brown; remainder of meso- and metapleurites light blue; mesosternum, metasternum and intersternum light brown, slightly pruinose.

Coxae and trochanters light green, washed irregularly with light brown; both middle legs and right hind leg wanting; fore femora entirely black except for faint, dark brown ring near base; fore tibiae, tarsi, and tarsal claws black or very dark piceous; inner face of hind femur yellowish green, outer face black; tibia and tarsus piceous to black; leg spines black.

Abdomen almost entirely black dorsally and laterally; 1 black dorsally, produced into narrow apical ring, and again subapically to form a small, acute, lateral prolongation on either side; remainder of sides, and intersegmental membrane, blue; 2 black dorsally and over upper half of lateral aspect, widest on basal fourth; remainder of sides blue, intersegmental membrane piceous; hamules dark brown, penis shaft (Figs. 55, 56) and vesicle black; 3-7 black dorsally and progressively increasingly so laterally, remainder of sides blue on 3, light brown on remainder; lateral blue of 3 produced dorsad basally; 7 blue between black apical spine row and apex of tergite; 8 and 9 blue, apical spine rows black; 10 brown ventrally, remainder black; sternites and ventral margins of tergites 1-7 light brown, midventral keel piceous; ventral margins of tergites 8 and 9 blue, sternites dark brown, keel piceous; superior appendages (Figs. 132, 139, 140) black, mesal portion of inner face dark brown; inferiors brown basally, black tipped.

Wings hyaline; venation black, pterostigma piceous; petiolation extending just to Ac juncture; arculus arising barely distal to second antenodal; postnodals $\frac{11}{11} \cdot \frac{9}{9}$; M_2 arising $\frac{5}{5} \cdot \frac{4}{4}$; M_{1a} arising $\frac{8}{8} \cdot \frac{7}{7}$; poststigmatal cells $\frac{4}{4} \cdot \frac{5}{5}$.

Abdomen 23.0 mm; hind wing 15.5 mm.

Measurements and Venation.—Figures are based on a series of 10 ♂. Measurements (in mm) are:

Abdomen			Hind Wing			Ratio
Max.	Ave.	Min.	Max.	Ave.	Min.	Hind Wing/Abdomen
23.5	22.9	22.5	16.0	15.4	14.0	0.67

Venational features are as follows: Number of Postnodals—Fore wing, 10-11, ave. 10.5; hind wing, 8-10, ave. 9.0. Origin of M_2 —Fore wing, arising slightly proximal to fifth postnodal 90%, at fifth 10%; hind wing, arising slightly proximal to fourth postnodal 80%, at fourth 20%. Origin of M_{1a} —Fore wing, arising at eighth postnodal 100%; hind wing, arising at seventh postnodal 90%, at eighth 10%.

Discussion.—Males of *indefensum* are readily distinguished from other species of *Acanthagrion* by their widely divaricate superior abdominal

appendages and by the extensively modified tip of the distal penis segment. Inasmuch as this latter structure appears to present the strongest modifications encountered in the Adustum Group, *indefensum* is here considered as the group's most specialized member. Its relationships can be better determined when the female is discovered. **Distribution (Pl. XIX).**—*Acanthagrion indefensum* is known only from the type locality near Wismar, British Guiana, and from an indefinite locality in Dutch Guiana. Williamson (1916:320) wrote: "On February 16, my father and I collected near the canal and government sawmill at Christianburg about a mile below Wismar. A short distance above the sawmill a dressing room for bathers is located. We collected in brush on the right bank of the canal below this dressing room, and along a small stream on the left side of the canal, parallel to and only a short distance from it, in the brush. My notes fail to show just where the specimens of *indefensum* were collected."

Material Examined.—15 ♂, including holotype and 7 paratypes, as follows: BRITISH GUIANA—Wismar, 1912, Jan. 30, 1 ♂ (paratype); Jan. 31, 2 ♂; Feb. 15, 5 ♂ (paratypes); Feb. 16, 2 ♂ (holotype and paratype). Collected by L. A. Williamson, E. B. Williamson, and B. J. Rainey. DUTCH GUIANA (SURINAM)—5 ♂, Förster Collection, no data.

References in Literature.—*Acanthagrion indefensum* Williamson, 1916 (original reference as cited above); Kennedy, 1916:329, figs. 22, 23 (penis figured); Williamson and Williamson, 1924:6 (compared with *Acanthallagma*).

CHARARUM GROUP

The species placed in this group, *chararum*, *chacoënsis* and *latapistylum*, are so located on the basis of the original descriptions alone. Apparently none have been taken since the types, and since these have not been available for careful study their present disposition must be grounded on the original descriptions and figures. The most striking feature thus represented to be possessed in common is the position and great length of the male superior abdominal appendages. These are considerably longer than the inferiors, and directed posteriorly rather than tending to meet inferiors apically, as in the other groups. *A. latapistylum*, in particular, may possess affinities with members of the Viridescens Group. It is, however, unsafe to generalize without having examined specimens and studied the penes.

The descriptions of the three following species are quoted literally from their sources of original appearance. That of *latapistylum* is taken from Calvert (1899:25, 26-28, Figs. 1-3), and (1909:161, 162 in key); those of *chacoënsis* and *chararum* from Calvert (1909:162, 170-173).

The distribution for each of these three species is shown on the maps of Plate XVIII.

Acanthagrion latapistylum Calvert

Male.—Labrum (except a median, basal, black point), rhinarium, anterior part of frons, rear of head and labium pale green or yellow. Nasus and vertex black, a pair of small pale dots on the nasus, some small pale brown spots in front of the median ocellus and near the bases of the antennae; the postocular spots green, elongate.

Dorsum of prothorax black, sides yellow, a pair of exceedingly small middorsal pale spots; hind margin rounded with a very slight median notch.

Dorsum of thorax with a median and a humeral stripe (each side) black; the pale antehumeral stripe between them is half as wide as the middorsal, the humeral is three-fourths as wide as the middorsal. Sides of the thorax colorless except for a very small black line under each wing.

Dorsum of abdominal segments 1-7 and 10 dark metallic green, almost black, which extends uninterruptedly from base to apex on 1 and 2, but is interrupted by a narrow, transverse, basal, yellow ring on 3-7; 8 and 9 blue but each with a very narrow, transverse, apical black line. Lower surfaces of all the segments yellow.

Legs yellowish, femora superiorly and apices of the tarsal joints blackish.

Apical margin of tenth abdominal segment with a middorsal, semi-circular excision one-third as deep as the length of the segment.

Superior appendages slightly shorter than 10, black, pale on their inner apical surfaces; viewed from above, divergent, enclosing a semi-circular interval, apices rounded and obtuse; viewed from the side, each appendage is gradually widened from base to apex which is truncated almost at right angles to the upper and lower margins of the appendage; the upper margin is convex, the lower concave; on the inner surface of the appendage is an anteapical groove running obliquely upward and backward.

Inferior appendages as long as the lower margin of the superiors, yellow at base whence they taper to the slender black apex which is curved upward toward the superior.

Female.—Similar, pale colors duller. Dorsum of abdominal segment 8 metallic green, of 9 pale with a metallic green spot each side of base half as long as the segment, of 10 pale. The black on the femora replaced by dusky blotches. Ventral apical spine of 8 well developed. Abdominal appendages one-third as long as 10, obscure, dusky.

Measurements and Venation.—Inferior sector of the triangle separating from the hind margin of the wing a short distance *beyond* the submedian crossvein on *all four* wings. Front wings with the upper side of the quadrilateral one half (δ) or one-third (♀) as long as the lower side, three antenodal cells, 10-11 postnodal crossveins, nodal sector arising near (in

front of or beyond) the fifth. Hind wings with the upper side of the quadrilateral two-thirds (♂), or half (♀), as long as the lower side, three antenodal cells, 8 (♂) or 9 (♀) postnodal crossveins, nodal sector arising at the fourth. Pterostigma rhomboidal, costal side slightly the longest, outer side slightly convex, surmounting a little less than one cell, similar on-front and hind wings, dark brown (♂) or luteous (♀), with a pale line just within the enclosing veins.

Total length ♂ 30 mm, ♀ 31 mm. Abdomen ♂ 24.5, ♀ 25.5. Hind wing ♂ 15.5, ♀ 17.

Discussion.—From the previously described species of *Acanthagrion*, *latapistylum* differs as follows: The separation of the inferior sector of the triangle from the wing-margin on all the wings being beyond the submedian crossvein, distinguishes it from the species of de Selys' second section *interruptum*, *nigrinuchale*, *laterale* and *cheliferum*; the coloration of thorax and of abdomen is likewise different.

From *apicale*, *latapistylum* differs by the coloration of the side of the thorax, by the shape of 10 and of the appendages.

From *gracile* and its races (?) *minarum*, *lancea* and *vidua* the male differs by the shape of the appendages, and, in addition, from *lancea* by the color of the abdomen, and from *vidua* by the color of the thorax. *Gracile* is the nearest ally of *latapistylum* and the females do not appear to differ.

From *truncatum*, *latapistylum* differs by the shape of the pterostigma, the larger postocular spots, the shape of the male appendages, the color of the abdomen of the female.

From *temporale*, by larger size and coloration of the abdomen.

From *trimaculatum*, by the coloration of the sides of the thorax and of abdominal segments 8-10, and the relative length and shape of the inferior appendages of the male.

Material Examined.—1 ♂, 1 ♀, as follows: PARAGUAY—San Pedro, Rio Aguaray-Guazu, by Calvert (Calvert, 1899:25).

Acanthagrion chararum, Calvert

Male.—Vertex dark blackish-brown, this color reaching down between the antennae to the nasus, which may be of the same color narrowly bordered with blue on its free margin, or blue with a dark streak on each side. Blue postocular spots very large, separated only incompletely from the pale (cream?) color of the rear of the head by a narrow brownish stripe. Rhinarium, labrum, genae, and external surfaces of mandibles pale blue; a black mid-basal labral point; labium pale (blue or cream-color?).

Prothorax blackish brown, front lobe, a lateral spot and a pair of median lines on the middle lobe, middle of the hind lobe and the sides inferiorly blue; hind margin of hind lobe convex, low.

Dorsum of meso-metathorax dark reddish brown; a blue ante-humeral stripe widening somewhat inferiorly, at mid-height one-fourth to three-fifths as wide as the dark middorsal, and one-half, or more, as wide as the dark humeral stripe; the dark middorsal stripe is much contracted at its extreme anterior (lower) end; the dark humeral stripe is contracted both at the upper and near the lower end of the humeral suture and at the latter its outer edge bends outward (laterad) and backward (caudad) almost at right angles, then again downward (ventrad) and forward (cephalad) on the lower part of the mesepimeron, continuing downward over the mesinfraepisternum. These dark stripes (humeral and middorsal) show a tendency to become black along the middle line of each stripe leaving the edges and extremities brown, and eventually probably become black throughout. Sides of the thorax blue; a short very fine brown or black line on the upper end of the obsolete first lateral suture, a longer thicker black line on the upper end of the second suture, in some continued downward by a very fine line; pectus blue.

Abdominal segments 1 and 2 blue; the intersegmental articulations of 1 and 2 and of 2 and 3, a square dorsal basal spot on 1, and an isolated triangular dorsal spot with its anterior angle more or less truncated on the middle of 2, black. Dorsum of 3-7 black, having a lanceolate form on 3 and 4, narrower and more acutely pointed anteriorly on 3, and markedly contracted at three-fourths or four-fifths of the length of the segment, again widening to the hind end; sides and a transverse basal ring on 3-7 blue, blue decreasing in extent on each successive segment. Segments 8-10 blue, hind margin of 10 very slightly excised and elevated into a low process, the tip of which in rear view is rather rounded than truncated.

Superior appendages a little longer than 10, in dorsal view nearly straight, somewhat divergent, each one rather narrow, its inner edge straight, outer edge slightly convex, apex tapering, subacute; the inner basal process of each appendage corresponding to that of *Acanthagrion gracile* is present, but concealed under the hind margin of 10; in profile view each appendage rapidly decreased in thickness in its basal half, its upper edge slanting caudad and ventrad, its lower edge nearly horizontal, distal half slenderer, of subuniform thickness, directed slightly upward, apex subacute. Inferior appendages about two-fifths as long as the superiors, appearing merely as small tubercles applied against the lower surfaces of the superiors. Legs blue; a superior band on the femora, much of the tarsi, and, in some at least, the tibiae blackish inferiorly.

Wings clear, stigma rhomboidal, blackish, its costal edge more often longer than the proximal or distal edges, but not infrequently equal in length. Front wings with 10-11 postnodals, 11 more frequent; hind

wings with 8-10 postnodals, 9 most frequent, M_2 arising nearest the fourth.

Female.—Unknown.

Measurements and Venation.—Abdomen 26-28.5; hind wing 18-19.5; width of head 3.4; width of one postocular spot .72; maximum height of segment 10 .96; height of segment 9 at base .84; width of tip of dorsal process of 10 about .16; maximum width of 10 .8 mm. The last six dimensions taken from one specimen only.

Material Examined.—BRAZIL, Cuyabá, 7 ♂ and parts of 1 other; Cachoeira, parts of 2? ♂ numbered 26 by the collector; all by H. H. Smith. Carnegie Museum, Pittsburgh.

The specific name is suggested by that of the nearby Charaes, Xaraes, or Jaraes marshes, taken in turn from that of a former Indian tribe.

Acanthagrion chacoense Calvert

Male.—Vertex black, this color reaching down on the frons between the antennae almost to the nasus, which is also black narrowly bordered with blue along its free margin, black of frons and of nasus connected by a vertical black line; the following blue: postocular spots, a dot on each side of the median ocellus, a larger spot behind each antenna-base, a short line between the median ocellus and each antenna, genae, external surface of mandibles, labrum (except a mid-basal black point) and the labium, or the last possibly cream-color in life. Rear of the head partly pruinose, but apparently largely blue.

Prothorax black; sides inferiorly, a dorsal spot on the front lobe, a pair of short median lines on the middle lobe, a middorsal trace on the hind lobe, blue; hind margin of hind lobe low, convex, slightly truncated, and with a minute notch medially.

Dorsum of meso-metathorax black; a blue antehumeral stripe, which is narrowest at two-thirds' height, and at mid-height is one-third as wide as the black middorsal and one-half as wide as the black humeral; black middorsal much contracted at its anterior (lower) end; black humeral stripe uniting at its upper end with a short black line on the upper end of the obsolete first lateral suture, at its lower end its outer edge bends twice similarly to the condition described for *Acanthagrion chararum*. Sides blue, a black stripe on the second lateral suture from the upper end to more than half-way to the level of the metastigma below, which latter is a blackish spot. Pectus pale blue, a blackish area, covered with pruinose, at the hind end.

Dorsum of abdominal segment 1 black, (in the Corumba ♂ a narrow transverse apical blue ring), sides blue; dorsum of 2 black, sides, a narrow transverse basal ring (middorsally interrupted by a fine black line) and a very fine transverse apical ring, blue; dorsum of 3-7 black,

this color narrowed at four-fifths of each segment's length and widened greatly in the hindmost fifth; sides and a transverse basal ring on these segments blue; 8 and 9 blue; 10 black, except ventrally, otherwise as in *Acanthagrion chararum*.

Superior appendages very similar to those of *Acanthagrion chararum*, but in profile view a little thicker at the base, decreasing in thickness more rapidly in the proximal half. Inferiors as in *A. chararum*.

Legs pale blue; femora with a superior stripe, tibiae with an anterior line, black.

Wings uncolored, stigma rhomboidal, blackish, its costal edge equal to, or slightly longer, or slightly shorter, than the proximal or distal edges. Front wings with 10-12 postnodals, hind wings with 8-9; M_2 on the latter arising nearest the fourth postnodal, or between the fourth and fifth.

Female.—Unknown.

Measurements and Venation.—Abdomen 25-26; hind wing 17; width of head 3.32; width of one postocular spot 0.52; maximum height of segment 10 0.92; height of segment 9 at base 0.76; width of tip of process of 10, end view, about 0.16; maximum width of 10 0.84 mm.

Material Examined.—2 ♂, as follows: BOLIVIA, Piedra Blanca, April, 1 ♂. BRAZIL, Corumbá, May, part of 1♂. Both specimens by H. H. Smith, Carnegie Museum, Pittsburgh.

GENERAL SUMMARY

In the absence of adequate fossil records, conclusions as to the probable course of evolution within a group of animals must be based largely on data of morphology and distribution. Through the foregoing pages the attempt has been made to recognize and evaluate the evidence offered by all available material pertaining to the genus *Acanthagrion*. Now a brief assessment of the factors determining the arrangement of species and of species groups is in order.

The question of what constitutes a primitive, what a modern character, is not certainly answered for the Odonata as a whole. It has been pointed out by Kennedy (1920) that in many zygopterous genera which appear to occupy an intermediate or connective position with regard to other genera, sparse venation is the rule. Long study of the Zygoptera has led him to the belief that, in general, those species presenting the most reduced venation are more ancient than those with rich venation, and that augmented venation is a specialization brought about by the necessity for greater wing area to support a larger body. This is in agreement with the conclusion of Tillyard (1929) who, in a brief but brilliant discussion, reviews the known fossil record, and,

after indicating the Megasecoptera as the ancestral Order for both Protodonata and Odonata, concludes that the culmination of modern zygopterous evolution lies in the brilliantly colored and richly veined Calopterygidae.

It is significant to note that in the species groups here recognized, simplicity of penis structure almost invariably accompanies sparse venation, small size and a little modified male tenth abdominal segment, and that, with the exception of *adustum*, reddish coloration replaces the ancestral blue or green in those species possessing the highest degree of structural complexity.

Added support for the conclusion that the small, simplified forms are more primitive than the more complex forms is supplied by the fact that in all save the Ascendens Group the species believed to be most generalized appear to be less closely related to the other members of their respective groups than do the remaining species. In the Abunae Group, *jessei*, placed at the bottom of the series, is quite widely separated morphologically from its relatives, while the remaining four species manifest very close similarities. In the Viridescens Group, *truncatum* differs widely from the next species, *viridescens*, whereas *viridescens*, *lancea* and *gracile*, and *peruvianum* and *deceptum*, bear resemblances so strong as to make their separation possible only through careful examination of structural characters. The setiferous penis of *phallicornis* sets it apart from *obsoletum* and *apicale*, which are scarcely distinguishable on penis characters alone. There are numerous points of difference between *williamsoni*, placed at the beginning of the Yungarum Group, and the two remaining species, *yungarum* and *risi*, which are so closely related that Ris did not believe them to be specifically distinct. The two species making up the Rubrifrons Group are apparently very intimately related. A similar condition is found in the Ablutum Group. In each case, the known species have probably been derived from their ancestral stocks so recently that differentiation has not gone as far as in other groups. Although the species of the Chararum Group are known from description only, it is evident that *latapistylum* is more simplified in structure than either *chararum* or *chacoëense*, in which the male superior appendages greatly exceed the inferiors, and in which size and venation are both considerably increased.

It might be argued that, if the above idea of structure be acknowledged, it would be more natural to associate simplified forms in one series, and complicated ones in another. The progressive modifications of homologous structures, particularly of penis and male appendages as shown in the accompanying plates, seem to allow no arrangement other than the present one, if comparative morphology is to be considered of value in determining relationships. The present arrangement is supported by the evidence of combinations of characters,

including venation, size and coloration, in addition to the genitalic characters mentioned.

Apparent relationships existing between some of the groups have been indicated in the text. However, no attempt at arranging the groups in a completely natural order has proven successful. It is believed that in *Acanthagrion* evolution has been radiate rather than linear; and with such a small amount of distributional evidence at hand it is unwise to attempt to draw a family tree.

The long tibial spines, shallow mesepisternal fossae and relatively simple penis structure found in *rubrifrons* and *longispinosum*, all considered as primitive characters, indicate for the Rubrifrons Group a position near the bottom of the genus. It is possible that the ancestor of these two species was differentiated from protacanthagrion stock so long ago that intermediates have dropped out and that it has retained these evidences of early origin after their loss by the main stem of *Acanthagrion*.

The Ablutum and Yungarum Groups retain comparative simplicity in penis characters, but indicate a higher degree of specialization in their possession of more richly veined wings. Speciation within these two groups may have been aided by their oreophilous habits. *Acanthagrion hermosae* appears to represent the culmination of this line of development, as evidenced by the absence of postocular spots and the presence of greater penial modification than is found elsewhere in the two groups.

Members of the Abunae Group, while obviously closely interrelated, appear to have few characters in common with other groups. Their widespread, discontinuous distribution offers no clues as to possible connections with other species. Certain similarities of male appendages and stature exist between species of the Abunae Group and *truncatum*, *viridescens* and *lancea*, of the Viridescens Group.

Acanthagrion minutum, placed in the Adustum Group largely on the basis of its penial modifications, bears some slight resemblance to *temporale*, of the Abunae Group, in the peculiar incurved design of the male superior appendages. In other characters its affinities appear to lie more strongly with *adustum* and *indefensum*, hence its placement. Aside from this possible distant linkage with the Abunae Group, the Adustum Group appears to be without close relatives.

Probable relationships of the Chararum Group cannot be conjectured until adequate collections of its three species are at hand.

In the Apicale and Ascendens Groups, the course of specialization noted through the majority of the other groups appears to reach its maximum development. The occurrence, in both groups, of species with setiferous penes, the strong modifications of the male tenth abdominal segment, the rich venation and large, robust bodies, as well as the occurrence in species of both groups of orange coloration,

combine to indicate derivation from a common ancestral stock. In both groups, existing locality records indicate a much more continuous distribution than is displayed by any other group of comparable size, which may be construed as indicative of comparatively recent differentiation.

CONCLUSIONS

1. All known species of the genus *Acanthagrion* may be separated from their allies by the highly specific form of the distal penis segment of the male and mesepisternal fossae of the female.
2. The abdominal appendages or clasping organs of the males, while affording characters of specific value, must receive careful study, giving attention to proper orientation. Separations based on a study of male appendages should be verified by examination of penes whenever possible.
3. Characters of size, venation and coloration, while of some value in indicating the probable course of specialization within intrageneric groups, are of little use in separating species; and, if used in this way, may lead to frequent misidentifications.
4. Various morphological characters, especially those displayed by the male penis and appendages and the female mesepisternal fossae, occur in such combinations as to make possible the recognition of eight intrageneric species groups within *Acanthagrion*. A ninth group is recognized tentatively on the basis of characters of male appendages, venation, size, and distribution.
5. Within each of the species groups there appears a progressive course of modification leading from a species with relatively generalized structure, as evidenced by simplified penial structure, non-elevated male tenth abdominal segment, small, slender stature, sparse venation and light blue or green ground colors, to a species with complex penial modifications, elevated and specialized male tenth abdominal segment, large size, rich venation, and, in some cases, orange and black coloration.
6. Although the members of the various species groups show progressive modifications, no instances of intergradation have been encountered. Alternative explanations suggested for this condition are: (a) operation of physiographic, ecological or physiological barriers, or a combination of the three, in such manner as to preserve genetic stability; (b) absence of collections from many portions of the known range of the genus which might supply intermediate forms; (c) morphological isolation resulting from the reflection of mutational changes in strong structural differentiation, obviating likelihood of cross-breeding between forms of slightly different genetic composition; and

(d) the existence of physiological intergradation unaccompanied by detectable morphological change.

7. Distributional data are insufficient, in most instances, to permit recognition of centers of origin or dispersal. The known distribution of the Ablutum, Apicale and Yungarum Groups suggests an Andean origin, that of the Rubrifrons Group an origin in the Amazon valley.

8. Although immature stages are not known for any of the species, and detailed ecological data are wanting, collectors' observations indicate that the various species of *Acanthagrion* occur about quiet or sluggish water, whether in ponds, marshes, swamps or sluggish streams, and avoid rapid currents. [See Appendix]

9. The marked degree of intrageneric resemblance manifested by all the known species indicates a recent origin of the genus *Acanthagrion* in relation to allied genera, placing *Acanthagrion* near the top of the Acanthagrion-Enallagma Series.

LIST OF LOCALITIES MENTIONED

Information as to location of the various collecting stations has been obtained from a number of sources. Much has been derived from such standard reference works as the *Century Atlas*, *Stiegler's Hand-Atlas*, and the *Rand McNally World Atlas, Premier Edition*. Felix Woytkowski has supplied sketch maps of territory worked by him in Peru. I am deeply indebted to John Cowley for considerable data on localities in Bolivia, Ecuador, Honduras and Peru. Finally, much of the information as to localities in Bolivia, Brazil, British and Dutch Guiana, Colombia, Guatemala, Panama, Peru, Trinidad and Venezuela, has been derived from the copious field notes of E. B. Williamson and J. H. Williamson, taken during their extensive tropical explorations.

The exact locality of some stations remains in doubt.¹⁵

ARGENTINA

Buenos Aires - The capital city of Argentina, recorded by Selys as the source of some of his material.

Tucumán - Dept. of Tucumán, at approximately 27° S, 65° W. [26°49' S, 65°13' W]

BOLIVIA

Buena Vista - Dept. of Santa Cruz, 17°22' S, 63°06' W; alt. 450 m. [Ischila Prov., 40 mi. NW of Santa Cruz.]

Cachuela Esperanza - Prov. of Vaca Díez, near first falls of Rio Beni, about 15 miles south of the junction of the Beni and Guaporé rivers. [Dept. of Beni.]

Chulumani - Not located. [Dept. of La Paz, Sud Yungas Prov., SE of Coroico and 40 mi. ENE of La Paz, ca 16°24' S, 67°31' W; alt. 6,250 ft.]

Coroico - Dept. of La Paz, in the Andes about 50 miles [35 miles] NE of the city of La Paz. [16°6' S, 67°15' W; alt. 5,659 ft.]

Mapiri - [Dept. of La Paz.] 15°23' S, 68°05' W.

[Piedra Blanca - Calvert 1909:77. A small trading station and custom house, 4 mi. W of Corumba, Brazil, just within the boundary of Bolivia.]

Songo - [Dept. of La Paz] About 20 mi. W of Coroico, q.v.

Sorata - [Dept. of La Paz] 15°45' S, 68°36' W.

BRAZIL

Abunã - State of Matto Grosso, on the Madeira-Mamoré railroad near junction of Abunã and Madeira rivers. [Now in State of Guaporé. 9°42' S, 65°23' W]

Bahia (= São Salvador) - State of Bahia. Exact source of collections labelled "Bahia" unknown.

[Barreiras - State of Bahia. 430 mi. W Salvador, near Goiás border; 12°16' S, 45°1' W.]

Belém (= Pará) - Largest city in the State of Para. Most material collected near municipal water supply reservoirs.

Blumenau - State of Santa Catharina [Catarina], near coast.

[Bom Fim - State of Bahia. Bom Fim = Senhor do Bonfim; 200 mi. NNW of Salvador. Until 1944, called Bonfim, sometimes spelled Bomfim.]

[Cachoeira - State of Mato Grosso, a stream. Collections were made about 15 mi. NE of Chapada. (Calvert 1909:76)]

¹⁵Data in brackets have been added by L. K. Gloyd. Supplemental information is from references as cited and from the following: U.S. Board of Geographical Names, *Lippincott Gazetteer of the World*, indices and maps of the *National Geographic Society*; and for Ecuador, papers by F. M. Brown (1941, *Ann. Entomol. Soc. Am.*, 34(4)), and by C. H. Kennedy (1936-42, 1946, *Ann. Entomol. Soc. Am.*).

- Chapada - According to Calvert (1909) a small village about 25 mi. ENE of Cuyabá, on the plateau. [And "The real name of this village is Santa Anna La Chapada, and in some maps appears as Santa Anna, . . ."]
 [Corumbá - State of Mato Grosso. "A town on the River Paraguay, near the junction of the Taguary, the port of entry for Matto Grosso. Calvert (1909:76).]
- Cuyabá - Capital city of the State of Matto Grosso, on a tributary of the Paraguay River. [Name now spelled Cuiabá. $15^{\circ}35' S, 56^{\circ}7' W$]
- Entrerios [or Entre Ríos] - Locality unknown. The source of some Selysian material, [Judged by the dates and localities that Walthère de Selys collected in the vicinity of Rio de Janeiro, Entre Ríos would be in the State of Rio de Janeiro. Since 1943, the name of the city is Três Rios.]
- Manáos - State of Amazonas at junction of Negro and Solimoes rivers. [Name now spelled Manaus.]
- Nova Teutonia - State of Santa Catharina [now Santa Catarina]. $26^{\circ}-27^{\circ} S, 52^{\circ}-53^{\circ} W$.
 [Porto Catharina de Santa Leopoldina - Not located.]
- Porto Velho - State of Amazonas, on [Upper] Madeira River at northern terminal of Madeira-Mamoré railroad, alt. 60 m. [Until the formation of Guaporé territory (1943) city was part of Amazonas. $8^{\circ}42' S, 63^{\circ}54' W$]
- Rio de Janeiro - State of Rio de Janeiro; capital city of Brazil. J. H. Williamson collected along small creeks NW of the city limits.
- San João del Rey - State of Minas Gerais, about 150 mi. NW of Rio de Janeiro.
- Santa Catharina - Material in Förster Collection so labelled is probably from the vicinity of Blumenau, q.v.
- Santa Cruz - Locality uncertain; probably the town of Santa Cruz near Porto Alegre in the State of Rio Grande do Sul. [In October, Walthère de Selys collected in the vicinity of Rio de Janeiro at Santa Cruz and Teresópolis, both in the State of Rio de Janeiro. Santa Cruz is W of Rio de Janeiro near the coast and Teresópolis NE of it (also NE of Petrópolis).]
- Santa Isabel - State of Amazonas on the Rio Negro about 450 mi. above Manáos. [= Tapuruquá or Tapuruquará until 1944, Santa Isabel.]
- Santa Leopoldina - Probably the same as Leopoldina, State of Minas Gerais, about 100 mi. NE of Rio de Janeiro. [Not the same. A town about 40 km. WNW of Vitória, State of Espírito Santo.]
- São Paulo - Capital of the State of São Paulo.
 [Sete Lagoas - State of Minas Gerais. 35 mi. NW of Belo Horizonte, ca $19^{\circ}30' S, 44^{\circ} W$.]
- [Uacaryzal - State of Mato Grosso. Calvert (1909:77), "a plantation in Matto Grosso either near the Rio Paraguay or near Cuyabá."]
- [Villa Murinho - State of Guaporé; a short distance (half a day's trip) from the junction of the Beni and Mamoré rivers to form the Madeira.
- BRITISH GUIANA [Now GUIANA]**
- Georgetown - the capital of British Guiana. Collecting done within the city limits. [Gemerara Co.: $6^{\circ}49' N, 58^{\circ}10' W$.]
- Tumatumari - on the Potaro River, a tributary of the Upper Essequibo. [9 mi. W of mouth of Potaro River.]
- [Wismar - Demerara Co.; 55 mi. SSW of Georgetown, on left bank of Demerara River.]
- BRITISH HONDURAS**
- [Cayo (or El Cayo) - Cayo Dist.; central British Honduras, on Belize River; 60 mi. SW of Belize.]
- Punta Gorda - $16^{\circ}06' N, 88^{\circ}48' W$, elev. about 10 ft.
- Rio Grande - $16^{\circ}14' N, 89^{\circ}01' W$, elev. about 500 ft.
- Rio Temash (or Temax) - $15^{\circ}58' N, 89^{\circ}07' W$, elev. about 200 ft.

COLOMBIA

- Aracataca - About 50 mi. S of Santa Marta, Dept. of Magdalena. [80 mi. S of Santa Marta, according to notation by E. B. Williamson on cover of map of Colombia and Venezuela used on the trip. This would seem to be distance by river. According to the Columbia Lippincott Gazetteer, it is 32 mi. S of Ciénaga. $10^{\circ}36' N$, $74^{\circ}12' W$]
- Buca Murindo - Exact locality unknown, but probably in Dept. of Magdalena. [Specimens collected by M. A. Carriker about the same time as those he collected in Sevilla, which is in the Department of Valle del Cauca.]
- Bolívar - About 5 mi. out of Santa Marta, Dept. of Magdalena.
- Cauca - Locality unknown. May refer to some station along the Cauca River, or to the Dept. of Cauca, probably the former. [On the Cauca River N of Palmira and Cali, Dept. of Valle del Cauca. $4^{\circ}43' N$, $76^{\circ}01' W$]
- Cristalina - Along the Magdalena River about 60 mi. S of Puerto Berrío, q.v.
- El Banco - Along the Magdalena River, Dept. of Magdalena, "86 leagues up the river from Barranguilla," (Williamson, 1918:11).
- Fundación - At end of railroad a few miles S of Aracataca, q.v. [Magdalena Dept.; 50 mi. S of Santa Marta.]
- Gamarra - Exact locality not known, but along the Magdalena River between 100 and 200 mi. [by river] above [i.e. S of] El Banco, q.v. [Dept. Magdalena. 50 mi. SSE of El Banco, ca $8^{\circ}20' N$, $73^{\circ}45' W$.]
- Mariquita - On the Magdalena River just within the northern boundary of the Dept. of Tolima. [$5^{\circ}12' N$, $74^{\circ}54' W$]
- Puerto Berrío - On the Magdalena River, Dept. of Antioquia, according to Williamson (1918:13), "163 $\frac{3}{4}$ leagues above Barranguilla." [And the elevation "about 130 meters." $6^{\circ}29' N$, $74^{\circ}24' W$]
- Porto Colombia (= Puerto Colombia) - On the coast about 10 mi. W of Barranguilla. [According to E. B. Williamson's notes this place is also known as "Sabanvilla" (= Savanilla). In Dept. of Magdalena.]
- Rio Frio - Exact locality not known, but close to Aracataca and Fundación, q.v. [United Fruit Company Headquarters on the Rio Frio, 30 mi. S of Santa Marta, Dept. of Magdalena.]
- Rio Nuevo - Tributary stream joining the Magdalena River near Puerto Berrío. Santa Marta - On the coast, Prov. of Magdalena.
- Santata - Not located. [? = Sautatá, Dept. of Choco. $7^{\circ}50' N$, $77^{\circ}4' W$. Probably a misinterpretation of handwriting.]
- Sogamosa (= Sogamoso) - not referred to in Mr. Williamson's notes. Probably refers to specimens collected near confluence of Rio Sogamosa with Magdalena, Prov. of Santander. [According to National Geographic Society Index and Lippincott Gazetteer, the town of Sogamoso is in Dept. Boyacá; $5^{\circ}43' N$, $72^{\circ}56' W$; alt. 8,432 ft.]
- Umbria - Near Guineo, on Río Putumayo, $0^{\circ}51' N$, $76^{\circ}11' W$.
- Villavicencio - Just within western boundary of Dept. of Meta, about 50 mi. SE of Bogota.

DUTCH GUIANA = SURINAM

- [Paramaribo - On left bank of Surinam River 15 mi. upstream from its mouth on the Atlantic; $5^{\circ}50' N$, $55^{\circ}13' W$.]

ECUADOR

- Cotos - Locality uncertain. [Plantation on Rio Napo below town of Napo, elev. 400 m., Oriente Prov. (now Napo-Pastaza).]
- Mera - Prov. of Tungurahua on Rio Pastaza. [Mera is now in Prov. of Napo-Pastaza, on high terraces north of the Rio Pastaza, ca $1^{\circ}28' S$, $78^{\circ}6' W$, elev. 1100 m.]
- Napo - Exact locality unknown. In upper Rio Napo drainage in territory disputed with Peru. [Prov. Napo-Pastaza. Near junction of Jatun Jacu and Rio Anzu, ca $1^{\circ}2' S$, $77^{\circ}47' W$.]

[Puyo - Napo-Pastaza Prov; ca $1^{\circ}30'$ S, $78^{\circ}0'$ W; elev. 981 m. "A rather recent jungle town on the west bank of the stream of the same name, a tributary of the Rio Pastaza." Brown, 1941:842.]

Rio Anzu } Tributaries of Upper Rio Napo. Exact localities of collec-
Rio Pupuyacu } tions not known. [Probably not far from the town of Napo,
Rio Jatun Yacu } q.v.]

[Rio Ila - Napo-Pastaza. A tributary of the Rio Anzu S of Napo, el. ca 700 m.]

Tena - near Napo, q.v. [Napo-Pastaza Prov. Brown (1941:948, "A town not far from Archidona in the humid tropical jungle of the upper Amazon." $0^{\circ}59'$ S, $77^{\circ}48'$ W, elev. 512 m.)]

GUATEMALA

Agua Caliente - Dept. of Santa Rosa.

Gualán - Dept. of Zacapa. [On Motagua River, 15 mi. NE of Zacapa; ca $15^{\circ}10'$ N, $89^{\circ}16'$ W.]

[Guatemala City - Guatemala Dept.; 150 mi. SW of Puerto Barrios; $14^{\circ}45'$ N, $90^{\circ}32'$ W; alt. 4,872 ft.]

Livingston - Dept. of Izabal, on the Gulf of Amatique. [At mouth of Rio Dulce, 11 mi. WNW of Puerto Barrios; $15^{\circ}49'$ N, $88^{\circ}55'$ W.]

Los Amates - Not definitely located. [Dept. of Izabal, on Motagua R., 45 mi. SW of Morales; ca $15^{\circ}16'$ N, $89^{\circ}06'$ W.]

Morales - Not definitely located. [On Motagua R., 22 mi. SW of Puerto Barrios; ca $15^{\circ}29'$ N, $88^{\circ}49'$ W.]

Puerto Barrios - Dept. of Izabal, on Gulf of Amatique. [$15^{\circ}44'$ N, $88^{\circ}36'$ W.]

Uaxactún - Near northern boundary of Dept. of Petén. [37 mi. NNE of Flores; ruins ca $17^{\circ}22'$ N, $89^{\circ}40'$ W.]

HONDURAS

San Pedro - Dept. of Yoro, about 50 mi. ESE of Puerto Barrios, Guatemala.

Tela - A banana plantation of uncertain locality, but not far from San Pedro. [Atlántida Dept. Coast town, ca $15^{\circ}45'$ N, $87^{\circ}10'$ W.]

MEXICO

Chichén Itzá - State of Yucatán, about 80 mi. SE of Merida. [$20^{\circ}40'$ N, $88^{\circ}34'$ W.]

Linares - State of Nuevo Leon, on the Mexico National railroad near the Tamaulipas boundary. [At foot of Sierra Madre Oriental, on Inter-American Highway, 75 mi. SE of Monterrey.]

Merida - State of Yucatán, about 20 mi. S of Progreso. [$20^{\circ}58'$ N, $89^{\circ}37'$ W.]

Tierra Colorado - State of Veracruz, near city of Veracruz.

PANAMA

Alhajuela - In Canal Zone. [= Alajuela = Madden Dam (town formerly called Alajuela); Balboa District; 19 mi. NNW of Panama City.]

Guabito - In Bocas del Toro. [Ca $9^{\circ}30'$ N, $82^{\circ}37'$ W.]

Rio Mazamba } Two small streams, exact locality unknown, lying near each
Rio Sardinilla } other in the Canal Zone.

PARAGUAY

[Rio Aguaray-Guazú - $24^{\circ}47'$ S, $57^{\circ}19'$ W. Probably not far from San Pedro.]

[San Pedro - San Pedro Dept.; near Jejui-Guazú and Paraguay rivers; 90 mi. NNE of Asunción; $24^{\circ}07'$ S, $56^{\circ}59'$ W.]

Ububevo - Locality not certainly known, believed to be on a tributary of the Paraguay River some distance north of Villarrica.

Villarrica (= Villarrica) - At approximately 26° S, 56° W. [Dept. Guaira, 85 mi. ESE of Asunción; $25^{\circ}44'$ S, $56^{\circ}27'$ W.]

PERU

Campamiento - In the Colonia del Perené, Prov. of Tarma, Dept. of Junin; alt. about 680 m.

- [Chuchuras (= Chuchurras) Same as Puerto Chuchurras ? ; Dept. Junín; ca 10°8' S, 75°10' W.]
- Guayabama - Not located. [Dept. of Amazonas, Andes Mts., 70 km. SE of Chachapoyas (F. Woytkowski, *in litt.* Aug. 1936); alt. 1300 m.]
- Iquitos - Prov. of Bajo Amazonas [called Maynos after 1943], Dept. of Loreto; 3°44' S, 73°12' W, alt. ca 106 m. [900 mi. W of Manáos, Brazil; 640 mi. NNE of Lima.]
- Madre de Dios - Collections made along Rio Madre de Dios, Prov. of Manu and Tambopata, Dept. of Madre de Dios.
- Mishyacu - 15 kilometers from Iquitos, q.v.
- Moyobamba - Dept. San Martín, Prov. of Moyobamba, 6°03' S, 76°58' W, alt. ca 866 m.
- Pampa Hermosa - Dept. of Junín near northern boundary of Dept. of Huanca-velica.
- ["Peba, haut Amazone" - ? = Pebas, Dept. Loreto ? [Landing on left bank of the upper Amazon, and 115 mi. ENE of Iquitos; 3°17' S, 71°49' W.]
- Pozuzo - Dept. and Prov. of Huanuco, 9°58' S, 75°18' W, alt. ca. 803 m. [Rioja - Dept. San Martín, Rioja Prov.; 11 mi. WSW of Moyobamba, on road from Cajamarca.]
- [Rio Marañon - Dept. of Loreto.
- [Rio Pachitea - On label of specimen in Cowley Collection as Puerto Inca, Rio Pachitea. Puerto Inca-Village, Huánuco Dept., landing on Pachitea River, 100 mi. NE of Huánuco.]
- Rio Seco - Prov. of Huallaga, Dept. of San Martín, alt. ca. 300 m.
- San Ramón - Prov. of Tarma, Dept. of Junín, 11°07' S, 75°25' W, alt. ca. 850 m.
- [Tarapoto - Dept. San Martín, el. 830 m.; 55 mi. SE of Moyobamba; 6°31' S, 76°19' W.]
- [Yurimaguas - Alto Amazonas Prov., Loreto Dept.; on the Huallaga River, 60 mi. E of Moyobamba; 5°54' S, 76°5' W.]
- TRINIDAD Although it has not proven feasible to locate the collecting stations in Trinidad, it is known that the collections made by the Williamsons were in the northern part of the island in the vicinity of Port of Spain.
- VENEZUELA
- Aroa - State of Yaracuy; near San Felipe, on Aroa River.
- Bejuma - State of Carabobo, near Lake Valencia. [18 mi. NW of Valencia.]
- Boquerón - State of Yaracuy.
- Caserio Silva - State of Carabobo.
- El Guayabo (= Guayabo) - State of Zulia, SW of Lake Maracaibo, between Encontrados and La Fria.
- Encontrados - On the Catatumbo River, W. of the lower end of Lake Maracaibo. [State of Zulia]
- La Fria - State of Tachira, southern terminal of "Grand Ferrocarril de Tachira."
- Mérida - State of Merida; 8°36' N, 71°9' W; alt 5,384 ft.]
- Nirgua - State of Yaracuy. [39 mi. W of Valencia.]
- Palma Sola - State of Falcón near border of Yaracuy. [On Aroa River, 22 mi. NE of San Felipe, and 39 mi. WNW of Puerto Cabello.]
- Salom - State of Yaracuy. [In coastal range, 33 mi. W of Valencia.]
- San Felipe - Principal city of State of Yaracuy, near border of State of Carabobo. [50 mi. NNW of Valencia; 10°20' N, 68°44' W.]
- Tachira - near La Fria (q.v.), State of Tachira.
- Tucacas - State of Falcón, on coast near Yaracuy border. [Caribbean port on Triste Gulf, 27 mi. NW of Puerto Cabello.]
- Valencia - Principal city of State of Carabobo, about 25 mi. from the coast. [10°11' N, 68° W; alt. 1,568 ft.]

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APPENDIX

by Leonora K. Gloyd

DESIGNATION OF TYPES

The type Species of *Acanthagrion*.—In Appendix II of "A Synonymic Catalogue of Neuroptera Odonata," Kirby (1890:187) designated *Agrion gracile* Rambur as the type species of the genus *Acanthagrion*. It would seem that *apicale*, the only species of Selys' group one, should have been selected instead of a species in group two. Apparently the selection was made on the basis of the oldest described species included in the new genus.

The holotype specimen, or one that is supposedly Rambur's type ♂ in the Selys Collection in Brussels, was studied by Dr. B. E. Montgomery on June 23, 1964. According

to Montgomery's notes, "Of the additional names on the label—*cyanurum*, *fastans* (?), and *tenellum*—none can be found in my master list of species names of the Odonata. They were probably manuscript names—or rather label names—in collections in museums. . . ." Below the drawings he made in 1964 is a note to me under the date of August 16, 1976, "I believe these are all drawings I made of the Rambur type in Brussels; I can explain nothing more than can be seen from them. Leonard & I examined them & decided, in spite of my poor drawing, this is the same species he considered *gracile*."

Type Specimens of *apicale* Selys.—Of the three males of the original description, Kimmins (1970:182) designated the one from Pará, Brazil, a Bates specimen in the Selys Collection, as the lectotype and the two from Peba of the McLachlan Collection in the British Museum of Natural History as paralectotypes. The allotype ♀ described *antea* by Leonard is in the Williamson Collection, University of Michigan.

DESCRIPTIONS OF NYMPHS

At the time Leonard completed his thesis there was no description of the nymph for any species retained in the genus *Acanthagrion*. Needham (1904:717, pl. 43, figs. 11-12) described the nymph of *cheliferum* (reared by Adolph Hempel), a species later placed in *Cyanallagma*. Cowley (1939:144-147, figs. 13-18) described a nymph as *Acanthagrion* sp. by supposition which appears to be generically correct but as yet not associated with a particular species. Of the species now included in *Acanthagrion*, Geijskes (1941 and 1943) was the first to describe nymphs definitely associated with adults, viz. *ascendens* (not of Calvert, but of Williamson and of Kennedy = *luteum* Racenis), *adustum* Williamson and *indefensum* Williamson.

THE IDENTITY OF *ACANTHAGRION VIDUA* SELYS

In a letter (March 19, 1963) to Dr. Montgomery, Leonard wrote, "I ignored that one in the thesis out of sheer desperation, but no notes made at the time indicate that I had some suspicion that the species described by Ris as *yungarum* form b, and which I gave the ms. name *risi* in his honor, might turn out to be the Selysian *vidua*." Racenis (1958:183-184, fig. 2 of type ♂ by Erich Schmidt) bears this out, and *risi* Leonard must be considered a synonym of *vidua* Selys (1876), originally described as a race of *gracile*. However, neither Ris nor Racenis described the female and thus the allotype of *risi* described by Leonard is to be regarded as the allotype ♀ of *vidua*.

NEW SPECIES DESCRIBED SINCE 1937

It is remarkable that so few new species of *Acanthagrion* have been described in the last forty years. To associate or compare some of the new species with those described by Leonard is somewhat difficult because so much depends upon the characters of the penes, and none of the figures accompanying the descriptions show the details visible at a higher magnification of a fully relaxed organ as those of Leonard do. Accordingly, my evaluation of the following species and subspecies may need to be reconsidered.

Acanthagrion apicale descendens Fraser (1946:37, fig. 9a; 39-40, fig. 10:4).—This subspecies, according to figures and description, is very similar and probably the same as the *apicale* (Selys) of Leonard.

A. eglei Santos (1961:2-5, figs. 1-7).—This species is not obviously the same as any species treated by Leonard. The red coloration of abdominal segments 8-10 set it apart from other species in the genus.

A. gracile floridense Fraser (1946:36, fig. 8a; 37-39, fig. 10:2-3).—The figure of the penis is very similar to that of *peruviana* n.sp. of Leonard. A careful study of the two is necessary to determine their status.

A. hildegarda Gloger (1967:54-55; 56, figs. 1-3).—I have been unable to associate it with any species included in the genus by Leonard. The figures of the penis and abdominal appendages suggest *Oxyagrion*, but not the description of the coloration.

A. leonora Gloger (1967:52-53; 56, fig. 6).—According to fig. 6, the description, and type locality, this species appears to be the same as *obsoletum* (Förster, 1914) and, therefore, is here considered a new synonym of Förster's species.

A. luteum Racenis (1958:184-190, fig. 3b, c, e).—Although Calvert verified the determination of specimens from northern South America recorded in the literature by Williamson and by Kennedy (1916) as *ascendens* Calvert, by a critical study Racenis shows that they are not the same as the typical specimens from southern Brazil. He described specimens from Venezuela and Surinam as *luteum* n.sp. All specimens studied and listed by Leonard under *ascendens* are thus to be assigned to *luteum* Racenis.

A. peruanum Schmidt (1942:236-237, figs. 5-6; republished in 1952:218-219).—Although Schmidt's figures of the penis and abdominal appendages are not as detailed as those of Leonard for *deceptum*, they are very similar and the descriptions of color patterns are alike. There is little or no doubt that *deceptum* Leonard is a synonym of *peruanum* Schmidt (1942) and should be so considered until proven otherwise. Schmidt did not describe the female. The allotype ♀ of *deceptum* Leonard thus becomes the allotype of *peruanum*.

A. taxaensis Santos (1965:60-63).—In some respects this species does not seem to belong in *Acanthagrion*. In a letter of January 7, 1977, Dr. Santos agreed with me that a re-examination would be necessary to determine to what genus it belongs.

RELATED GENERA

Concerning the placement and biology of species once included in *Acanthagrion*, papers by the following authors should be consulted: Böttger and Jurzitza (1967); Bulla (1973); Donnelly and Alayo D. (1966); Fraser (1948); Gloger (1967); Racenis (1958); and Santos (1965).

NORTH TO SOUTH DISTRIBUTION OF *ACANTHAGRION* BY COUNTRY¹⁶

MEXICO	trilobatum
quadratum	truncatum
GUATEMALA	vidua
quadratum	GUIANA
BRITISH HONDURAS	abunae
quadratum	adustum
PANAMA	apicale
inexpectum	ascendens (not Calvert, = <i>luteum</i>)
kennedii	indefensum
trilobatum	rubrifrons
COLOMBIA	SURINAM
ascendens (not Calvert, = <i>luteum</i>)	adustum
gracile <i>floridense</i>	ascendens (not Calvert, = <i>luteum</i>)
luna (= obsoletum)	indefensum
<i>luteum</i>	ECUADOR
obsoletum	gracile (Campos 1927)
risi (= vidua)	<i>leonora</i> (= obsoletum)
trilobatum	luna (= obsoletum)
williamsoni	obsoletum
TRINIDAD	peruvianum (? = <i>g. floridense</i> ?)
ascendens (not Calvert, = <i>luteum</i>)	PERU
kennedii	apicale
<i>luteum</i>	deceptum (= <i>peruanum</i>)
risi (= vidua)	hermosae
VENEZUELA	obsoletum
ascendens (not Calvert, = <i>luteum</i>)	<i>peruanum</i>
<i>luteum</i>	peruvianum (? = <i>g. floridense</i> ?)
minutum	yungarum
risi (= vidua)	apicale <i>descendens</i>
temporale	

¹⁶ Species in italics indicate those described since 1937.

BRAZIL	viridescens
abunae	BOLIVIA
adustum	ablutum
amazonicum	apicale
apicale	chacoense
ascendens Calvert	gracile
ascendens (not Calvert, = <i>luteum</i>)	longispinosum
chacoense	minutum
chararum	viridescens
<i>egleri</i>	PARAGUAY
gracile	ablutum
jessei	abunae
kennedii	ascendens (not Calvert, = <i>luteum</i>)
lancea	gracile
longispinosus	lancea
<i>luteum</i>	latapistylum
phallicornis	ARGENTINA
rubrifrons	ablutum
<i>taxaensis</i>	<i>hildegarda</i>
temporale	lancea
truncatum	

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(Does not include all references for species assigned to other genera nor perhaps a few other papers mentioning species of *Acanthagrion*.)

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INDEX TO TAXA

Genera are listed in capital letters; new synonyms and relevant page numbers in italics; new species and page numbers for principal treatment of genera and species in bold face.

- Ablutum Group, 13, 19, 23, 47-52, 66, 134, 135, 137
- Abunae Group, 14, 18, 22, 32-47, 95, 134, 135
- ACANTHAGRION, 1, 2, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 17, 18-25 (key), 47, 52, 60, 61, 70, 84, 92, 93, 109, 117, 121, 130, 133, 135, 136, 137
- ablutum Calvert, 1, 9, 20, 23, 47, 48-50, 52
- abunae n. sp., 13, 16, 20, 23, 32, 37-41, 43, 44, 47
- acutum (Ris), See under CYANALLAGMA
- adustum Williamson, 1, 22, 24, 37, 119, 122-125, 134, 135
- amazonicum Sjöstedt, 1, 4, 20, 23, 32, 40, 43, 44-47, 106, 110
- ambiguum (Ris), See under CYANALLAGMA
- apicale Selys, 1, 13, 16, 20, 23, 52, 54, 56, 60, 61-65, 92, 130, 134
- ascendens Calvert, 1, 13, 16, 21, 24, 37, 53, 56, 60, 77, 78, 80, 94, 88, 89, 90-94
- ascendens form b Ris, 85, 94
- bonariense Ris (ssp. of interruptum Selys), 1
- chacoënsis Calvert, 1, 22, 128, 132-133, 134
- chararum Calvert, 1, 22, 128, 130-132, 133, 134
- cheliferum (Selys), See under CYANALLAGMA
- chirihuanum Calvert, 1, 17 (to CYANALLAGMA, n. comb.)
- cuneatum Selys (var. of gracile), 1, 106, 109 n. syn.
- cuyabae Calvert, 1, 102 & 105 n. syn.
- deceptum n. sp., 22, 25, 77, 78, 94, 102, 109, 110-114, 118, 134
- fimense Calvert (ssp. of cuyabae Calvert), 1, 102 & 105 n. syn.
- freirensis Calvert (ssp. of cuyabae Calvert), 1, 102 & 105 n. syn., 106
- gracile (Rambur), 1, 21, 24, 61, 78, 81, 84, 85, 92, 94, 97, 106-110, 118, 130, 131, 134
- hermosae n. sp., 7, 9, 20, 23, 47, 50, 51-52, 135
- indefensum Williamson, 1, 22, 24, 119, 125-128, 135
- inexpectum n. sp., 16, 20, 32, 40, 41-44, 47
- interruptum (Selys), See under CYANALLAGMA
- jessii n. sp., 19, 23, 32-35, 37, 47, 134
- kennedii Williamson, 1, 21, 24, 77, 78-81, 84, 89, 98
- lancea Selys, 1, 21, 24, 32, 94, 97, 101, 102-106, 109, 130, 134, 135
- latapistylum Calvert, 1, 4, 18, 22, 37, 65, 98, 106, 110, 128, 129-130, 134
- laterale (Selys), See under CYANALLAGMA
- lindneri Ris, 1, 17 (to CYANALLAGMA, n. comb.)
- longispinosum n. sp., 7, 19, 23, 25, 28, 29-32, 135
- luna Ris, 1, 4, 56 n. syn. of obsoletum (Förster), 60, 61
- maculae Sjöstedt (ssp. of gracile), 1
- minarum Selys (race? of gracile), 1, 106 & 109 n. syn., 110, 130
- minutum n. sp., 7, 22, 24, 98, 119-122, 135
- nigrinuchale Selys, 1, 17 (to CYNALLAGMA, n. comb.)
- obsoletum (Förster), 20, 23, 52, 54, 56-61 n. comb., 65, 134
- peruvianum n. sp., 22, 24, 78, 94, 102, 113, 114-119, 134
- phallicornis n. sp., 20, 23, 52, 53-56, 60, 61, 65, 93, 134
- quadratum Selys, 1, 16, 21, 24, 77, 80, 81-85, 89, 106, 110
- risi n. sp., 20, 24, 66, 68, 69-73, 77, 118, 134 [See Appendix]
- rubifrons n. sp., 7, 19, 23, 25-29, 31, 135
- rusticum Calvert (ssp. of cheliferum), 1
- temporale Selys, 1, 13, 20, 23, 32, 34, 35-37, 44, 47, 94, 98, 121, 122, 130, 135
- trilobatum n. sp., 21, 24, 77, 80, 84, 85-90, 93, 94
- trimaculatum Selys, 1, 17 (to CYNALLAGMA, n. comb.)
- truncatum Selys, 1, 13, 21, 24, 32, 94, 95-98, 101, 130, 134, 135
- vidua Selys (race of gracile), 1, 130
- viridescens n. sp., 21, 24, 32, 94, 97, 98-102, 105, 109, 134, 135
- williamsoni n. sp., 20, 66-68, 77, 134
- yungarum Ris, 1, 21, 24, 66, 68, 73-78, 94, 114, 134
- yungarum form a Ris, 73, 77

- yungarum form b Ris, 69, 72, 73 (=risi n. sp.) [See Appendix]
 Acanthagrion-Enallagma series, 11, 137
ACANTHALLAGMA, 85, 110, 125, 128
 luteum Williamson, 81
 Adustum Group, 19, 119-128, 135
AEOLAGRION, 5, 47
ANISAGRION, 5, 60
 kennedyi Leonard, 125
 truncatipenne Calvert, 125
APANISAGRION, 5
 Apicale Group, 19, 22, 52-65, 77, 135, 137
 Apicale Group (Selys), 14
ARGIA, 12, 15, 25
 Ascendens Group, 13, 19, 23, 53, 77-94, 134, 135
 Chararum Group, 11, 14, 19, 128-133, 134, 135
CYANALLAGMA, 1, 5, 17
 acutum (Ris), 1
 ambiguum (Ris), 1, 17 (n. comb.)
 cheliferum (Selys), 1, 130
 chirihuanum (Calvert), 1, 17 (n. comb.), 47
 interruptum (Selys), 1, 130
 laterale (Selys), 1, 130
 lindneri (Ris), 1, 17 (n. comb.)
 nigrinuchale (Selys), 1, 17 (n. comb.), 18, 130
 trimaculatum (Selys), 1, 17 (n. comb.), 18, 130
ENALLAGMA, 4, 11, 12, 16, 125, 137
 exsulans, 84
 geminatum, 37
 Gracile Group (Selys), 14
HETERAGRION, 60
ISCHNURA, 7, 125
LEPTAGRION, 5
METALEPTOBASIS, 81
MYAGRION, 56, 60 (n. syn.)
 obsoletum, 56, 61
OXYAGRION, 5
 basale Selys, 61
 Rubifrons Group, 6, 12, 13, 14, 18, 22, 25-32, 134, 135, 137
SKIALLAGMA, 5
TELAGRION, 5, 81
TELEBASIS, 5
TRICHOENEMIS aliena Scudder, 15
 Viridescens Group, 12, 13, 19, 23, 24, 32, 78, 94-119, 128, 134, 135
 Yungarum Group, 13, 19, 23, 66-77, 134, 135, 137

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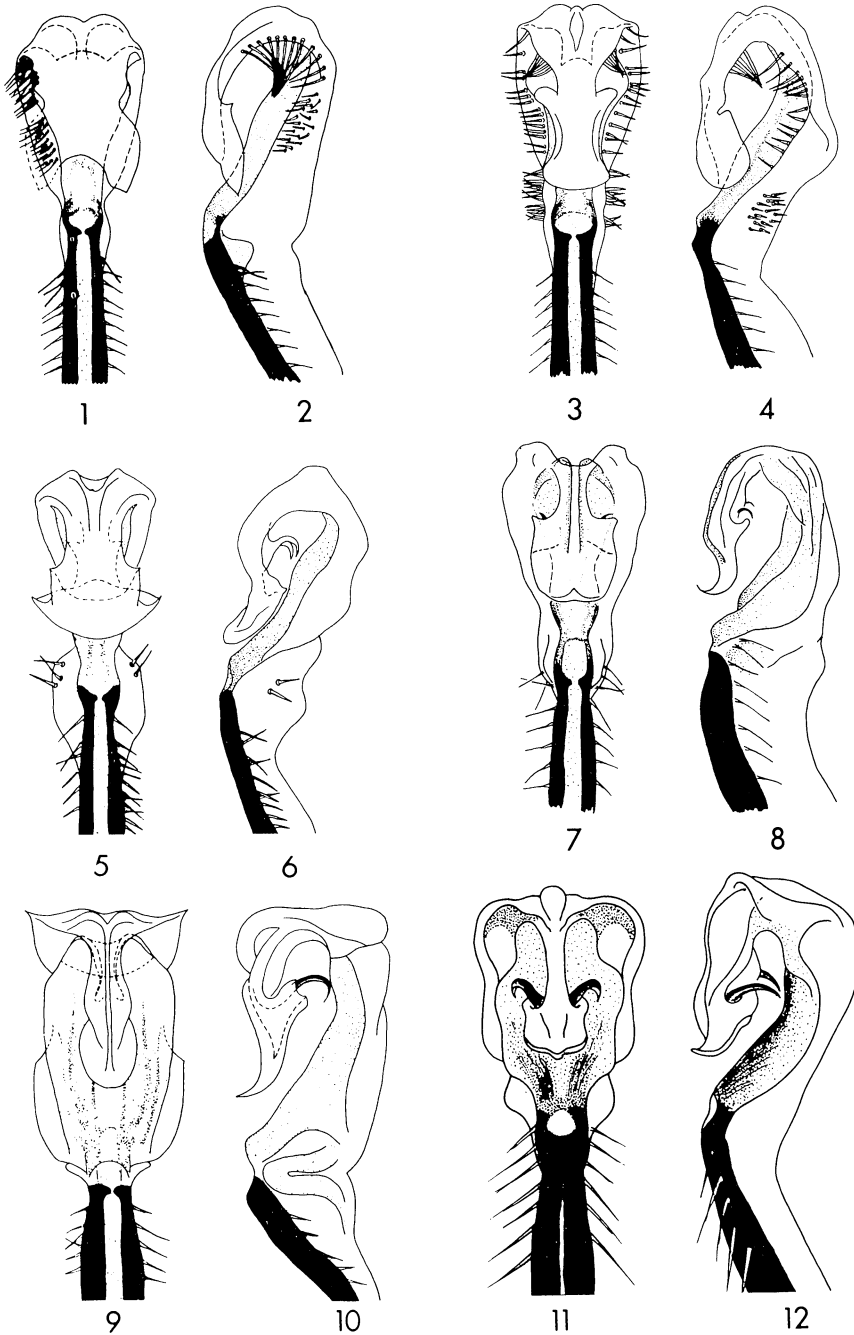


PLATE I. Penes of *Acanthagrion*, ventral and lateral views. Figs. 1, 2. *A. rubrifrons* n. sp., paratype, Belém, Brazil; Figs. 3, 4. *A. longispinosum* n. sp., paratype, Villa Murinho, Brazil; Figs. 5, 6. *A. jessei* n. sp., paratype, Porto Velho, Brazil; Figs. 7, 8. *A. temporale* Selys, Nirgua, Venezuela; Figs. 9, 10. *A. abunae* n. sp., Abuná, Brazil; Figs. 11, 12. *A. inexpectum* n. sp., paratype, Rio Mazamba, Panama Canal Zone.

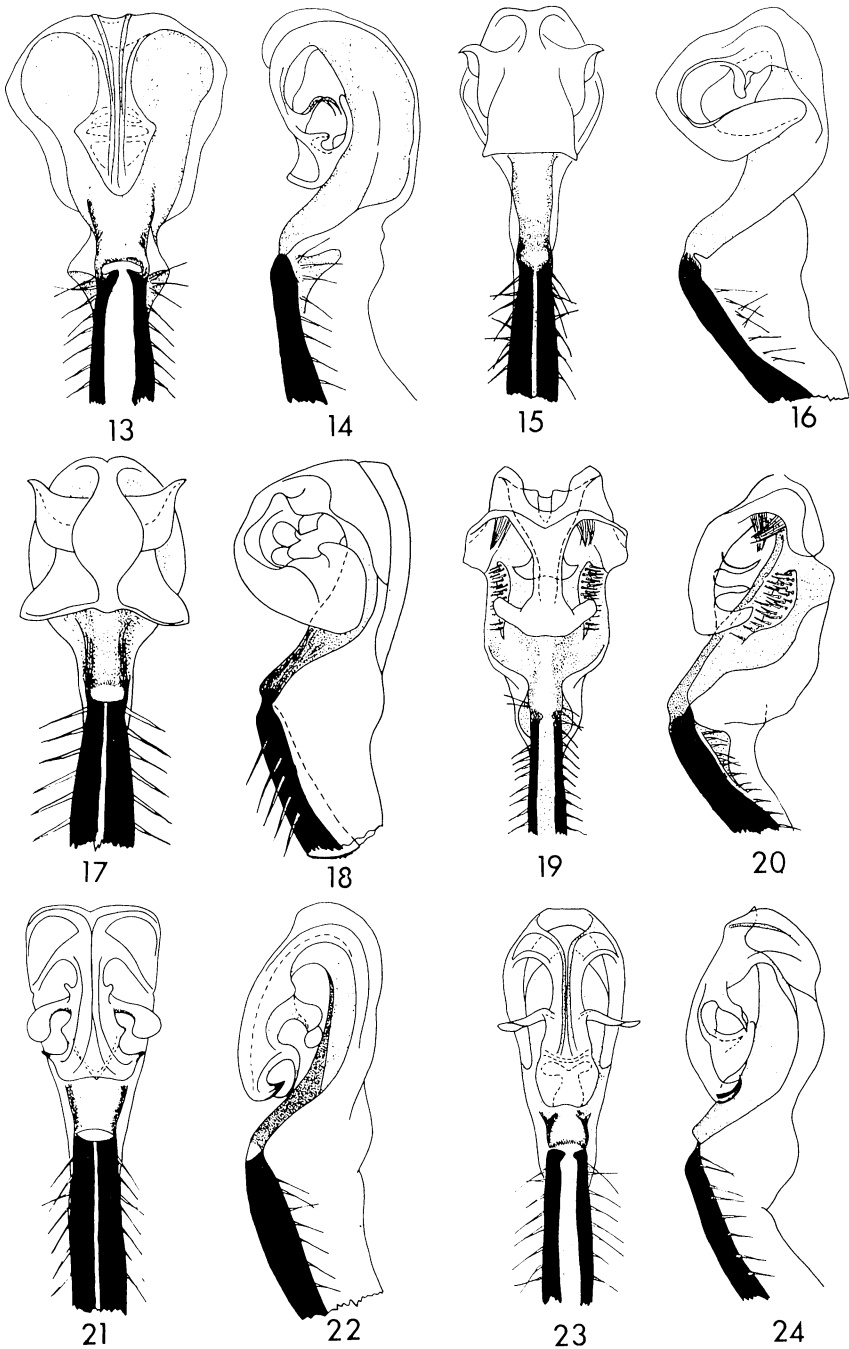


PLATE II. Penes of *Acanthagrion*, ventral and lateral views. Figs. 13, 14. *A. amazonicum* Sjöstedt, Manáos, Brazil; Figs. 15, 16. *A. ablutum* Calvert, Coroico, Bolivia; Figs. 17, 18. *A. hermosae* n. sp., paratype, Pampa Hermosa, Peru; Figs. 19, 20. *A. phallicornis* n. sp., paratype, Porto Velho, Brazil; Figs. 21, 22. *A. obsoletum* (Förster), Umbria, Colombia; Figs. 23, 24. *A. apicale* Selys, Rio Seco, Peru.

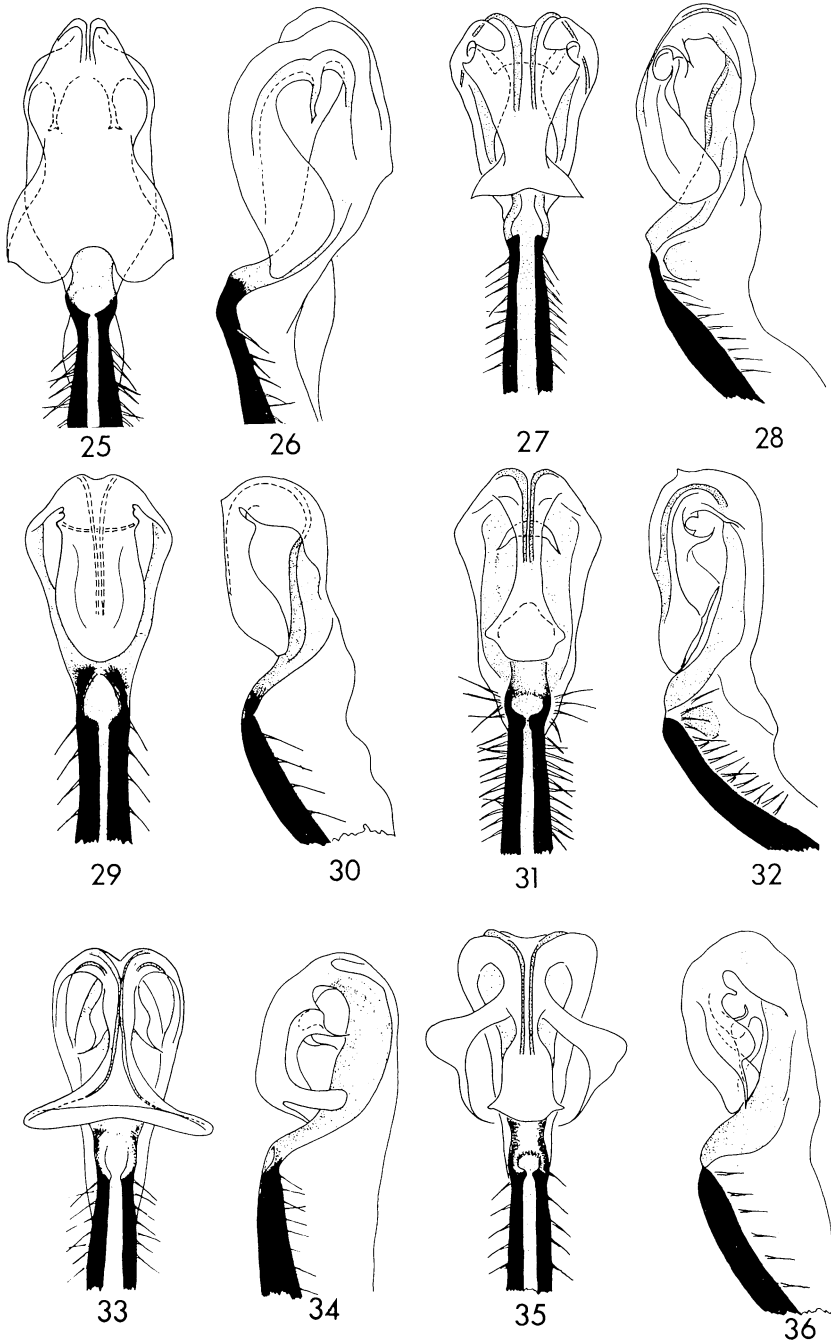


PLATE III. Penes of *Acanthagrion*, ventral and lateral views. Figs. 25, 36. *A. yungarum* Ris, Campamiento, Peru; Figs. 27, 28. *A. risi* n. sp., paratype, Bejuma, Venezuela; Figs. 29, 30. *A. williamsoni* n. sp., paratype, Miriquita, Colombia; Figs. 31, 32. *A. kennedii* Williamson, paratype, Cumuto, Trinidad; Figs. 33, 34. *A. quadratum* Selys, Gualan, Guatemala; Figs. 35, 36. *A. trilobatum* n. sp., paratype, Tachira, Venezuela.

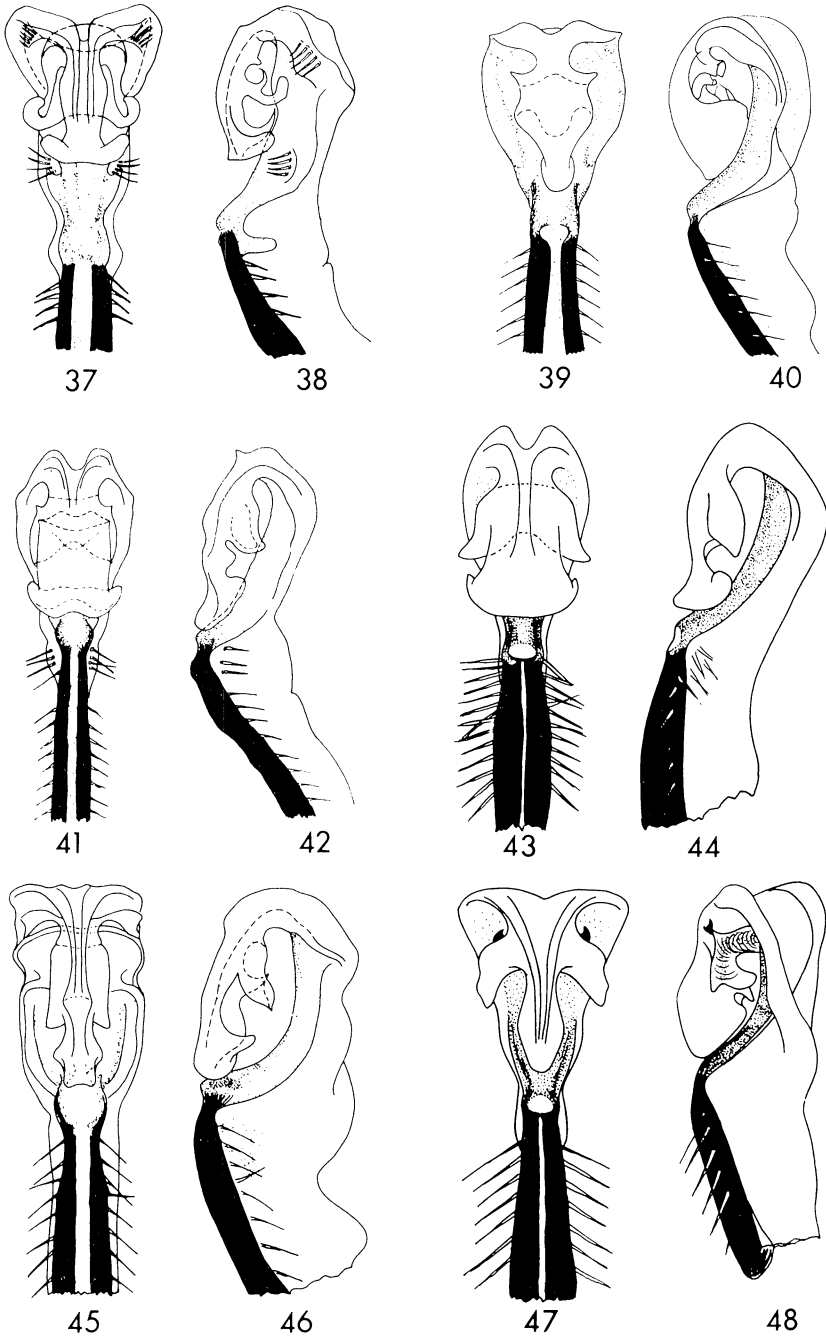


PLATE IV. Penes of *Acanthagrion*, ventral and lateral views. Figs. 37, 38. *A. ascendens* Calvert, Bejuma, Venezuela; Figs. 39, 40. *A. truncatum* Selys, Behuma, Venezuela; Figs. 41, 42. *A. viridescens* n. sp., paratype, Porto Velho, Brazil; Figs. 43, 44. *A. lancea* Selys, Rio de Janeiro, Brazil; Figs. 45, 46. *A. gracile* (Rambur), Rio de Janeiro, Brazil; Figs. 47, 48. *A. deceptum* n. sp., paratype, Campamiento, Peru.

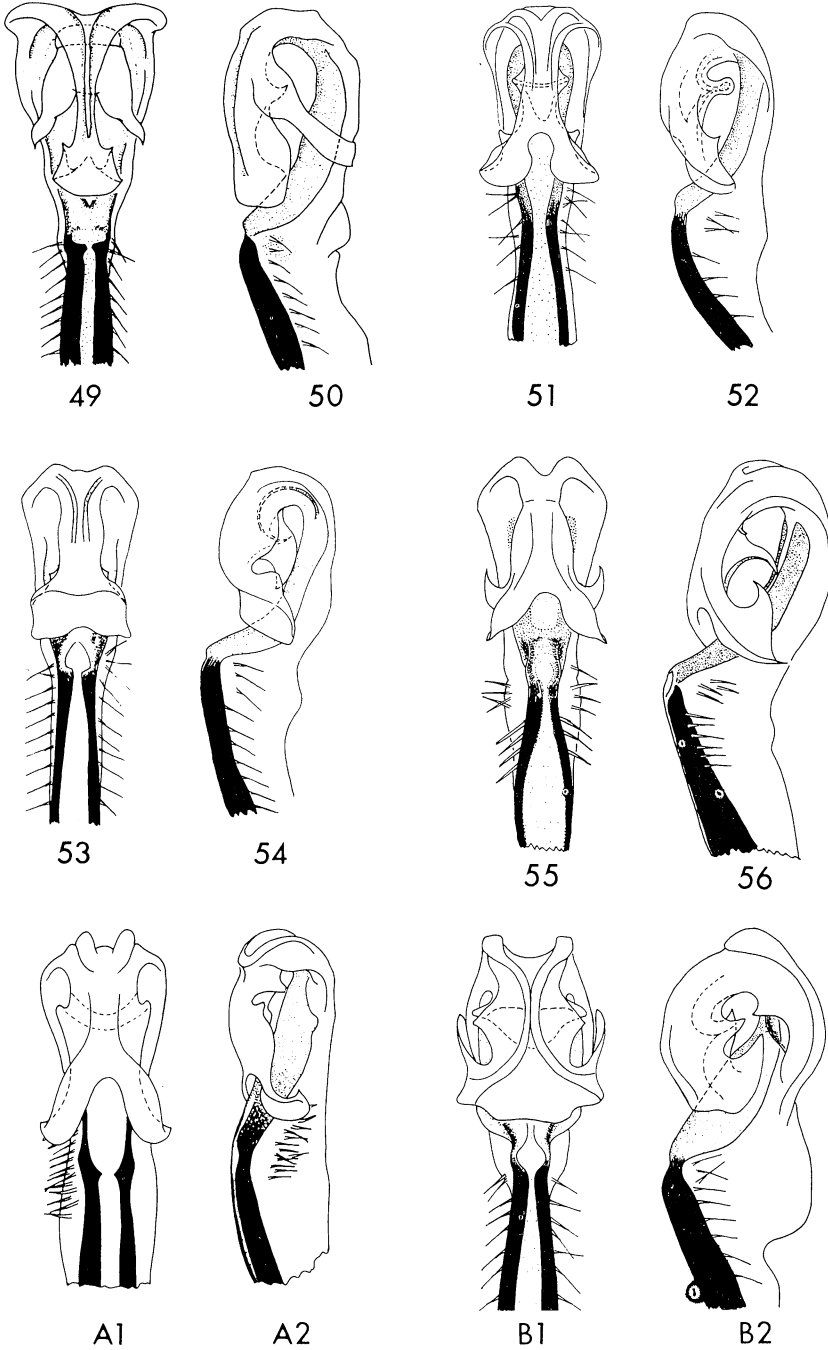
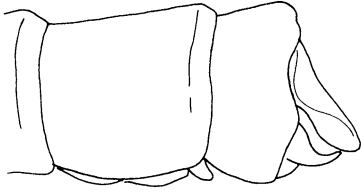
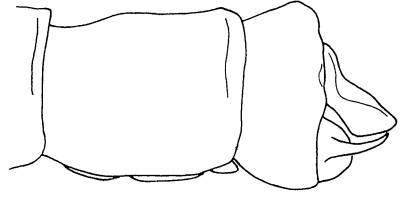


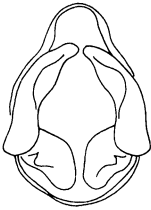
PLATE V. Penes of *Acanthagrion*, ventral and lateral views. Figs. 49, 50. *A. peruvianum* n. sp., paratype, Campamiento, Peru; Figs. 51, 52. *A. minutum* n. sp., paratype, Nirgua, Venezuela; Figs. 53, 54. *A. adustum* Williamson, paratype, Wismar, British Guiana; Figs. 55, 56. *A. indefensum* Williamson, paratype, Wismar, British Guiana; Figs. A1, A2. *Aeolagrion* sp., Aracatica, Colombia; Figs. B1, B2. *Cyanallagma interruptum* (Selys).



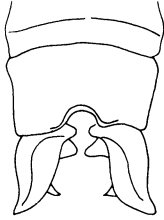
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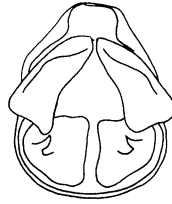
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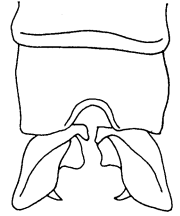
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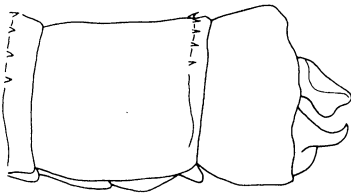
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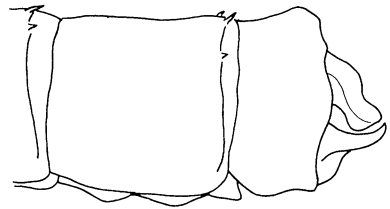
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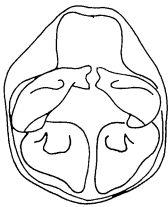
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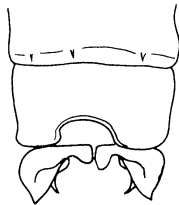
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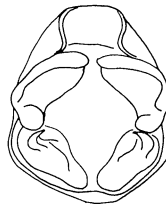
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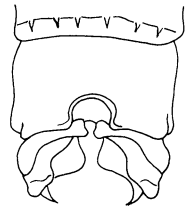
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68

PLATE VI. Male Abdominal Appendages of *Acanthagrion*, lateral, terminal and dorsal views. Figs. 57, 61, 62. *A. rubrifrons* n. sp., holotype, Belém, Brazil; Figs. 58, 63, 64. *A. longispinosum* n. sp., holotype, Villa Murтинho, Brazil; Figs. 59, 65, 66. *A. jessei* n. sp., holotype, Porto Velho, Brazil; Figs. 60, 67, 68. *A. temporale* Selys, Nirgua, Venezuela.

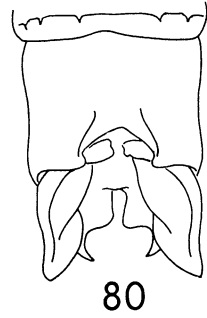
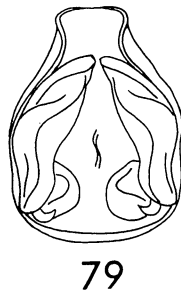
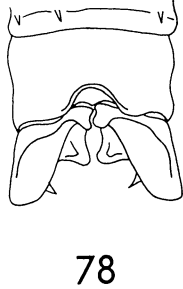
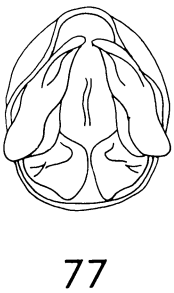
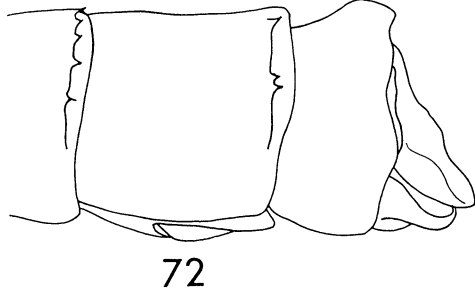
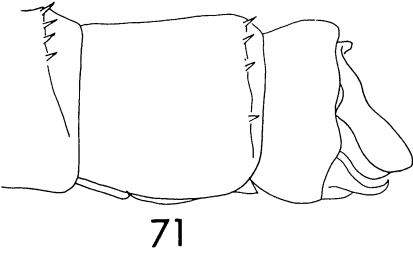
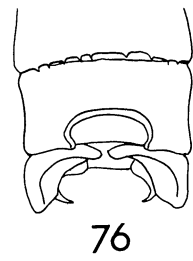
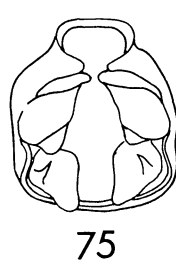
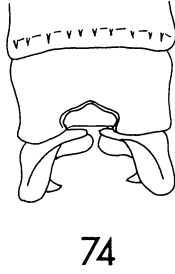
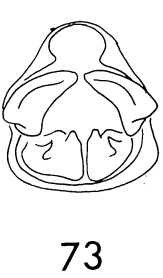
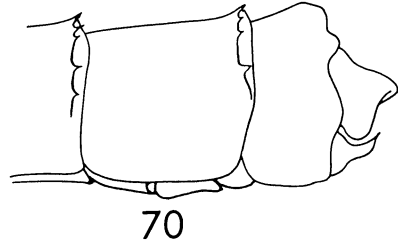
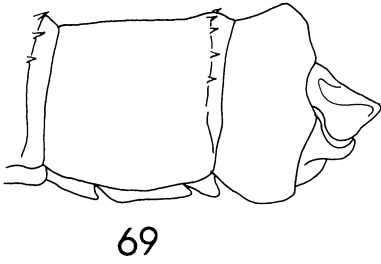
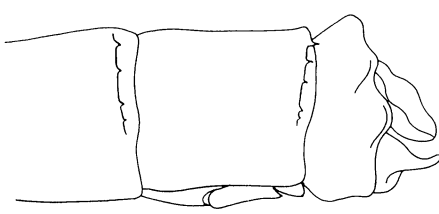
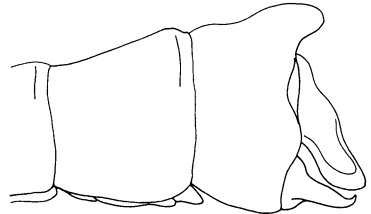


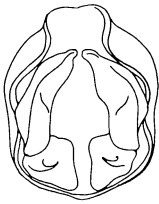
PLATE VII. Male Abdominal Appendages of *Acanthagrion*, lateral, terminal and dorsal views. Figs. 69, 73, 74. *A. abunae* n. sp., holotype, Abuná, Brazil; Figs. 70, 75, 76. *A. inexpectum* n. sp., holotype, Rio Mazamba, Panama Canal Zone; Figs. 71, 77, 78. *A. amazonicum* Sjöstedt, Manaós, Brazil; Figs. 72, 79, 80. *A. ablutum* Calvert, Coroico, Bolivia.



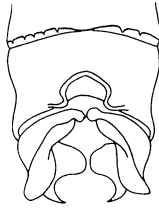
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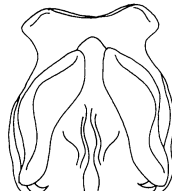
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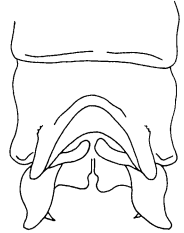
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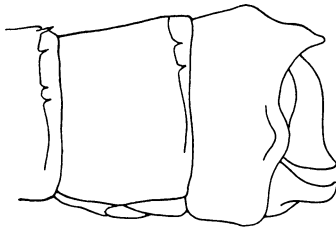
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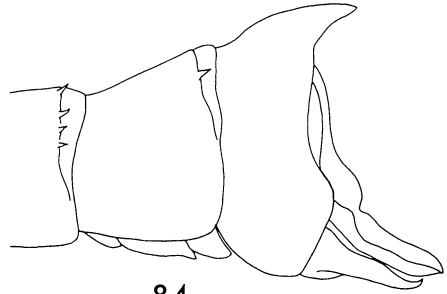
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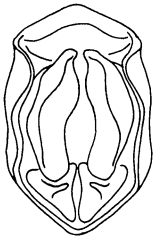
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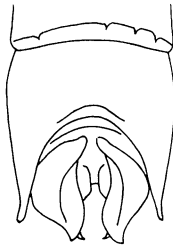
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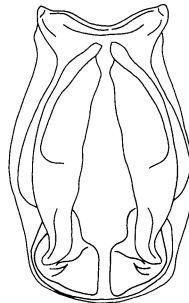
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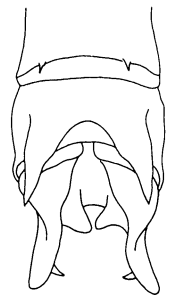
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90



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92

PLATE VIII. Male Abdominal Appendages of *Acanthagrion*, lateral, terminal and dorsal views. Figs. 81, 85, 86. *A. hermosae* n. sp., holotype, Pampa Hermosa, Peru; Figs. 82, 87, 88. *A. phallicornis* n. sp., holotype, Porto Velho, Brazil; Figs. 83, 89, 90. *A. obsoletum* (Förster), holotype, Madre de Dios, Peru; Figs. 84, 91, 92. *A. apicale* Selys, Rio Seco, Peru.

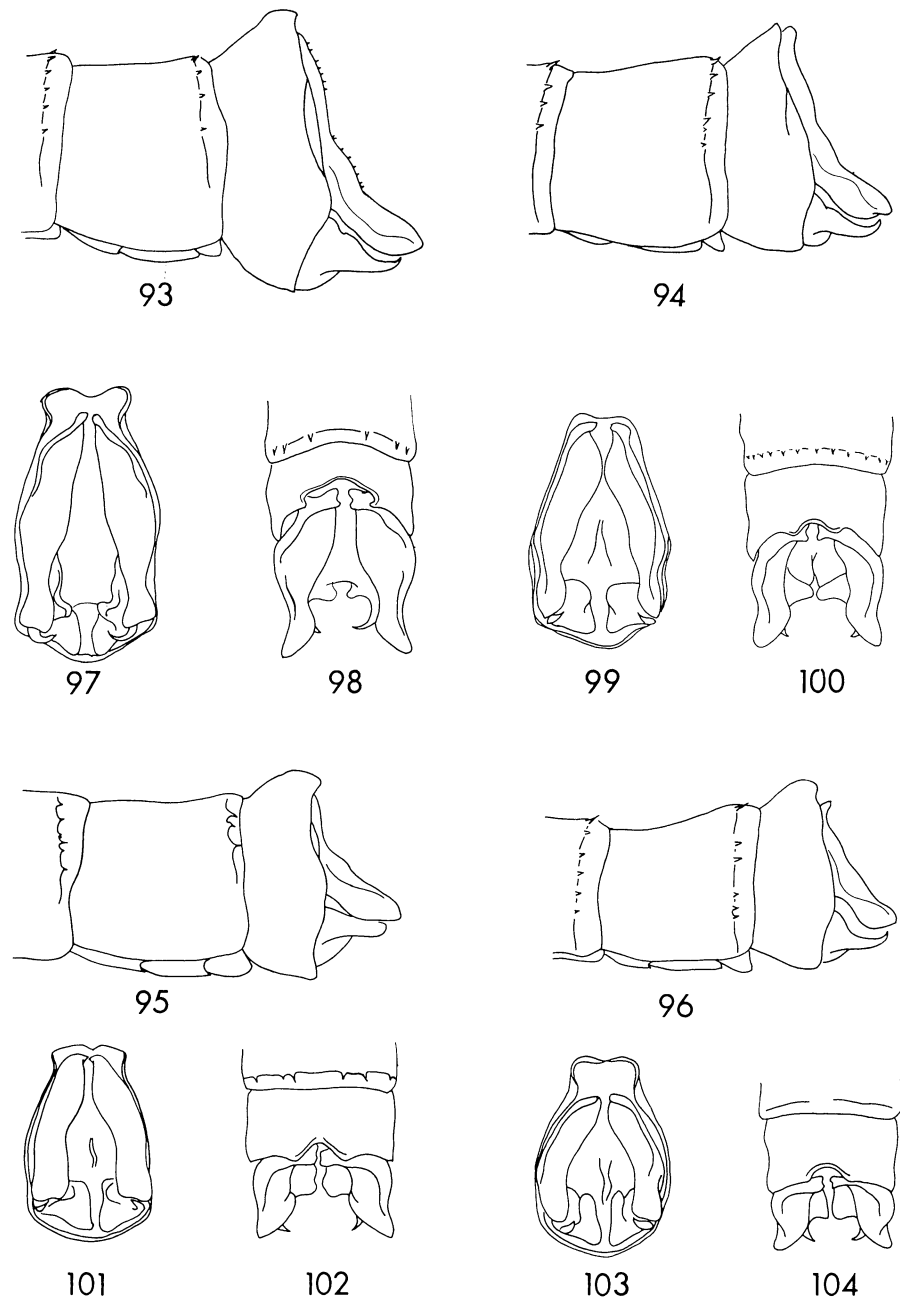
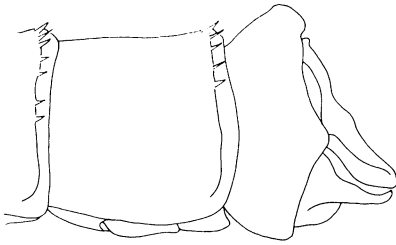
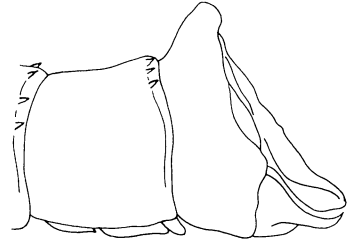


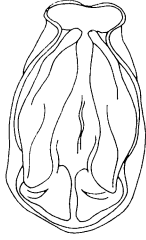
PLATE IX. Male Abdominal Appendages of *Acanthagrion*, lateral, terminal and dorsal views. Figs. 93, 97, 98. *A. yungarum* Ris, Campamiento, Peru; Figs. 94, 99, 100. *A. risi* n. sp., holotype, Tachira, Venezuela; Figs. 95, 101, 102. *A. williamsoni* n. sp., holotype, Mariquita, Colombia; Figs. 96, 103, 104. *A. kennedii* Williamson, holotype, Cumuto, Trinidad.



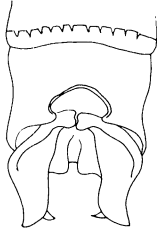
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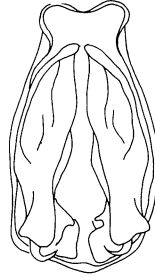
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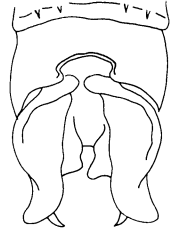
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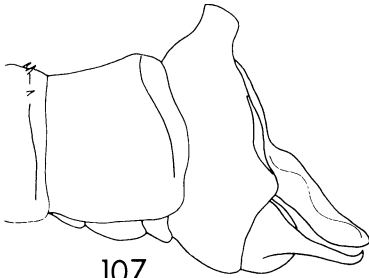
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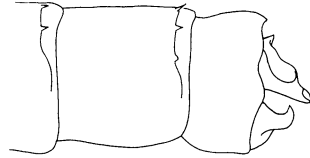
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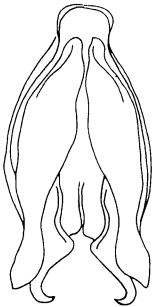
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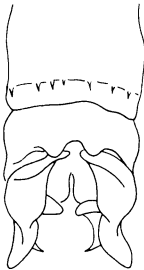
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108



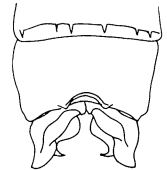
113



114



115



116

PLATE X. Male Abdominal Appendages of *Acanthagyron*, lateral, terminal and dorsal views. Figs. 105, 109, 110. *A. quadratum* Selys, Gualan, Guatemala; Figs. 106, 111, 112. *A. trilobatum* n. sp., holotype, Rio Frio, Colombia; Figs. 107, 113, 114. *A. ascendens* Calvert, Bejuma, Venezuela; Figs. 108, 115, 116. *A. truncatum* Selys, Bejuma, Venezuela.

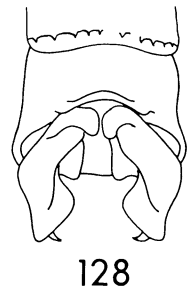
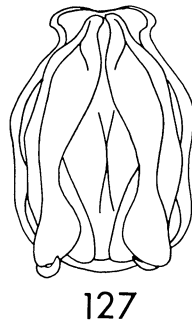
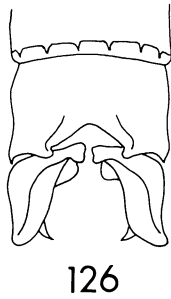
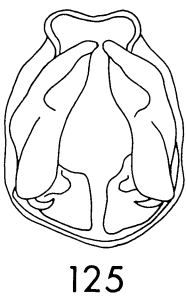
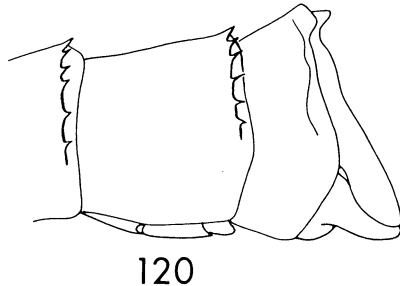
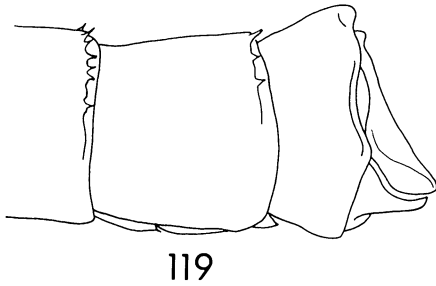
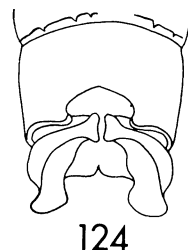
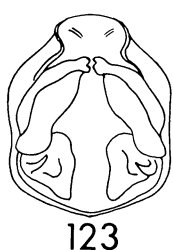
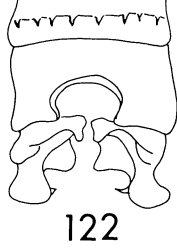
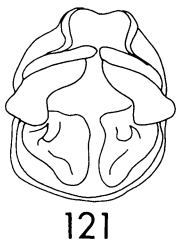
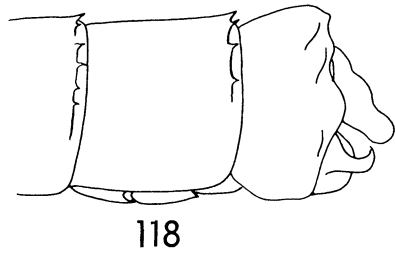
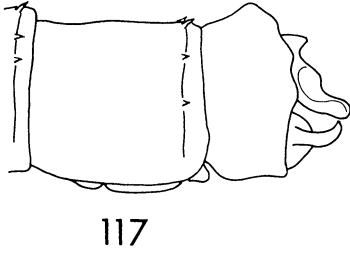
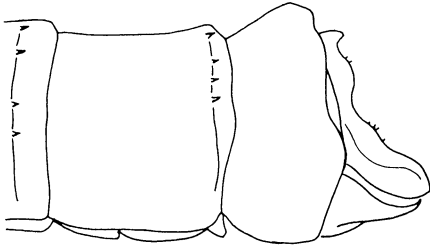
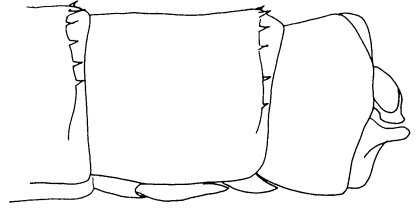


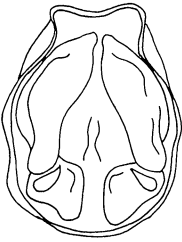
PLATE XI. Male Abdominal Appendages of *Acanthagrion*, lateral, terminal and dorsal views. Figs. 117, 121, 122. *A. viridescens* n. sp., holotype, Porto Velho, Brazil; Figs. 118, 123, 124. *A. lancea* Selys, Rio de Janeiro, Brazil; Figs. 119, 125, 126. *A. gracile* (Rambur), Rio de Janeiro, Brazil; Figs. 120, 127, 128. *A. deceptum* n. sp., holotype, Campamiento, Peru.



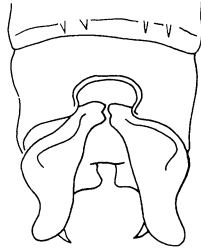
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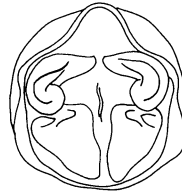
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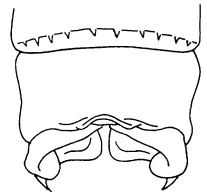
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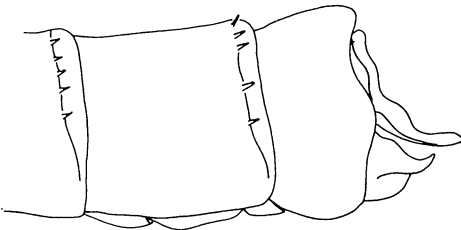
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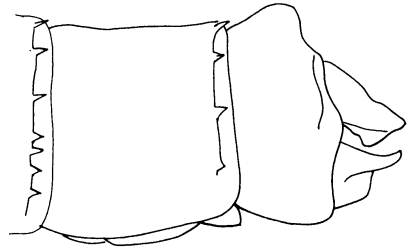
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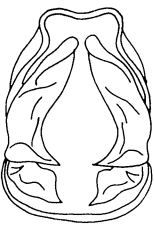
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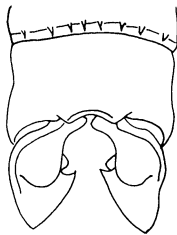
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132



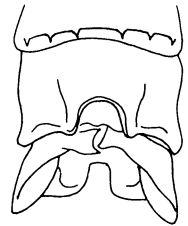
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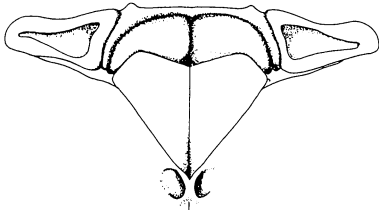


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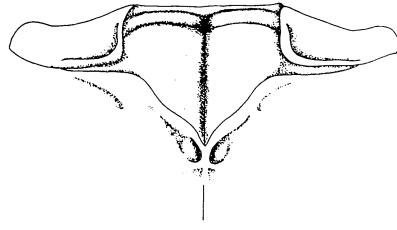


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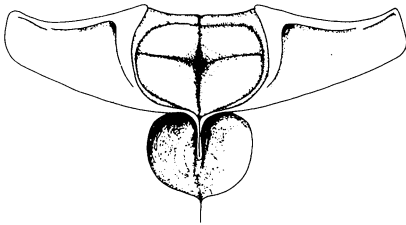
PLATE XII. Male Abdominal Appendages of *Acanthagrion*, lateral, terminal and dorsal views. Figs. 129, 133, 134. *A. peruvianum* n. sp., holotype, Campamiento, Peru; Figs. 130, 135, 136. *A. minutum* n. sp., holotype, Nirgua, Venezuela; Figs. 131, 137, 138. *A. adustum* Williamson, holotype, Wismar, British Guiana; Figs. 132, 139, 140. *A. indefensum* Williamson, holotype, Wismar, British Guiana.



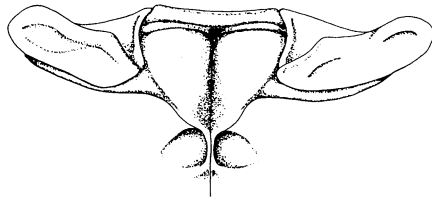
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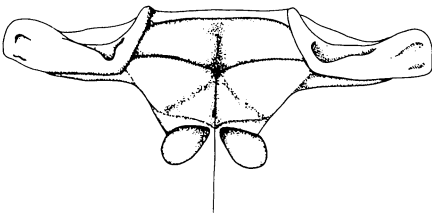
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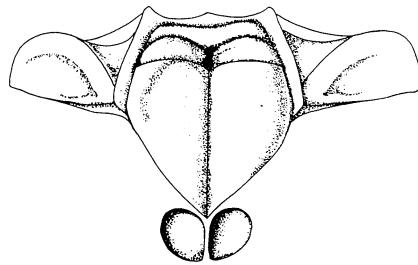
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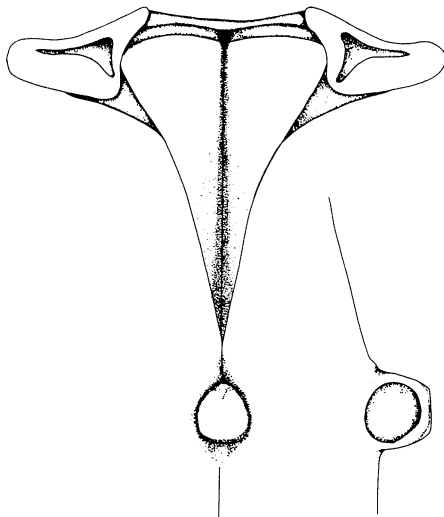


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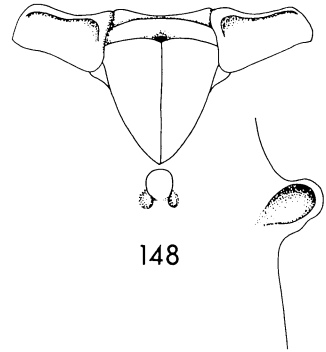


146

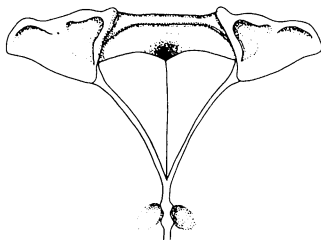
PLATE XIII. Mesepisternal Fossae of *Acanthagrion*. Fig. 141. *A. rubrifrons* n. sp., allotype, Belém, Brazil; Fig. 142. *A. longispinosum* n. sp., allotype, Villa Murquinho, Brazil; Fig. 143. *A. jessei* n. sp., allotype, Porto Velho, Brazil; Fig. 144. *A. temporale* Selys, Bejuma, Venezuela; Fig. 145. *A. abunae* n. sp., allotype, Abuná, Brazil; Fig. 146. *A. amazonicum* Sjöstedt, Manáos, Brazil.



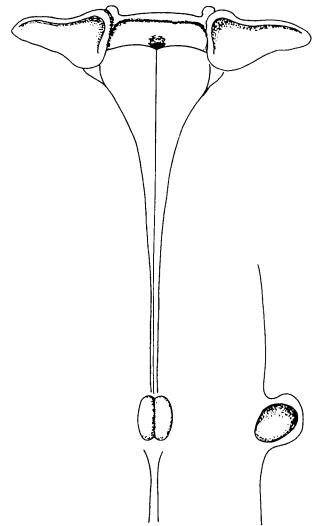
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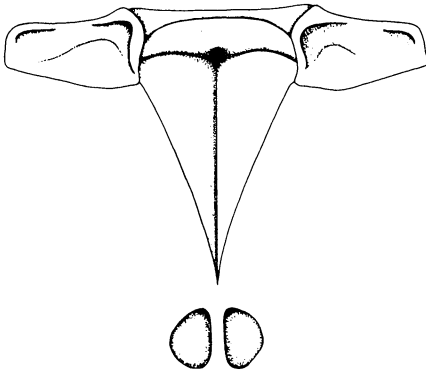
148



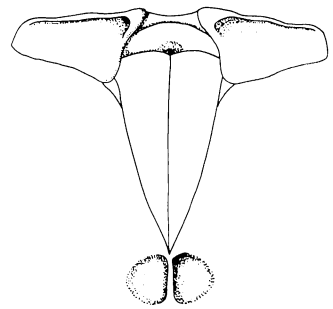
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151



152

PLATE XIV. Mesepisternal Fossae of *Acanthagrion*. Fig. 147. *A. phallicornis* n. sp., allotype, Porto Velho, Brazil; Fig. 148. *A. obsoletum* (Förster), allotype, Mera, Ecuador; Fig. 149. *A. apicale* Selys, allotype, Belém, Brazil; Fig. 150. *A. ablutum* Calvert, Coroico, Bolivia; Fig. 151. *A. kennedii* Williamson, paratype, Cumuto, Trinidad; Fig. 152. *A. quadratum* Selys, Gualan, Guatemala.

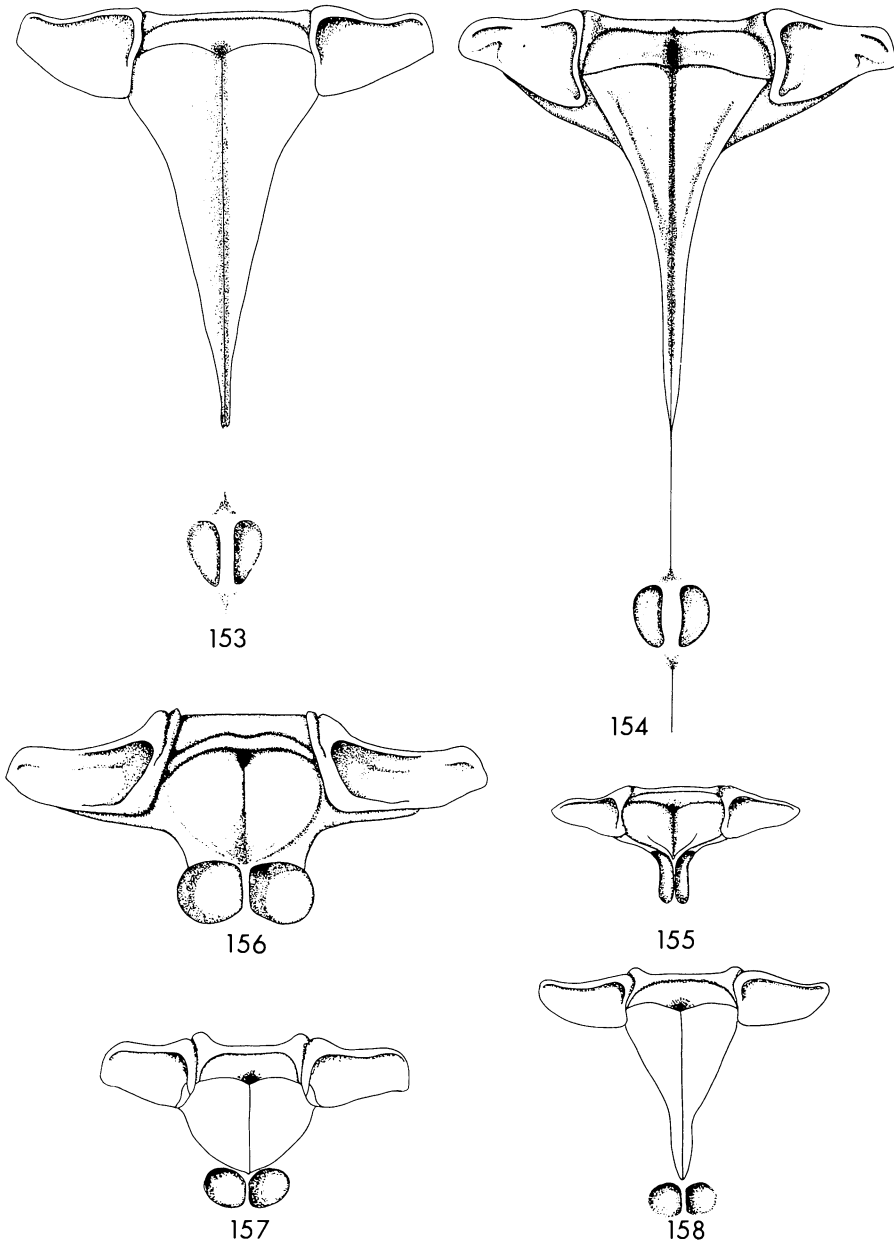


PLATE XV. Mesepisternal Fossae of *Acanthagrion*. Fig. 153. *A. trilobatum* n. sp., allotype, Rio Frio, Colombia; Fig. 154. *A. ascendens* Calvert, Bejuma, Venezuela; Fig. 155. *A. truncatum* Selys, Nirgua, Venezuela; Fig. 156. *A. viridescens* n. sp., allotype, Porto Velho, Brazil; Fig. 157. *A. lancea* Selys, Rio de Janeiro, Brazil; Fig. 158. *A. gracile* (Rambur), Rio de Janeiro, Brazil.

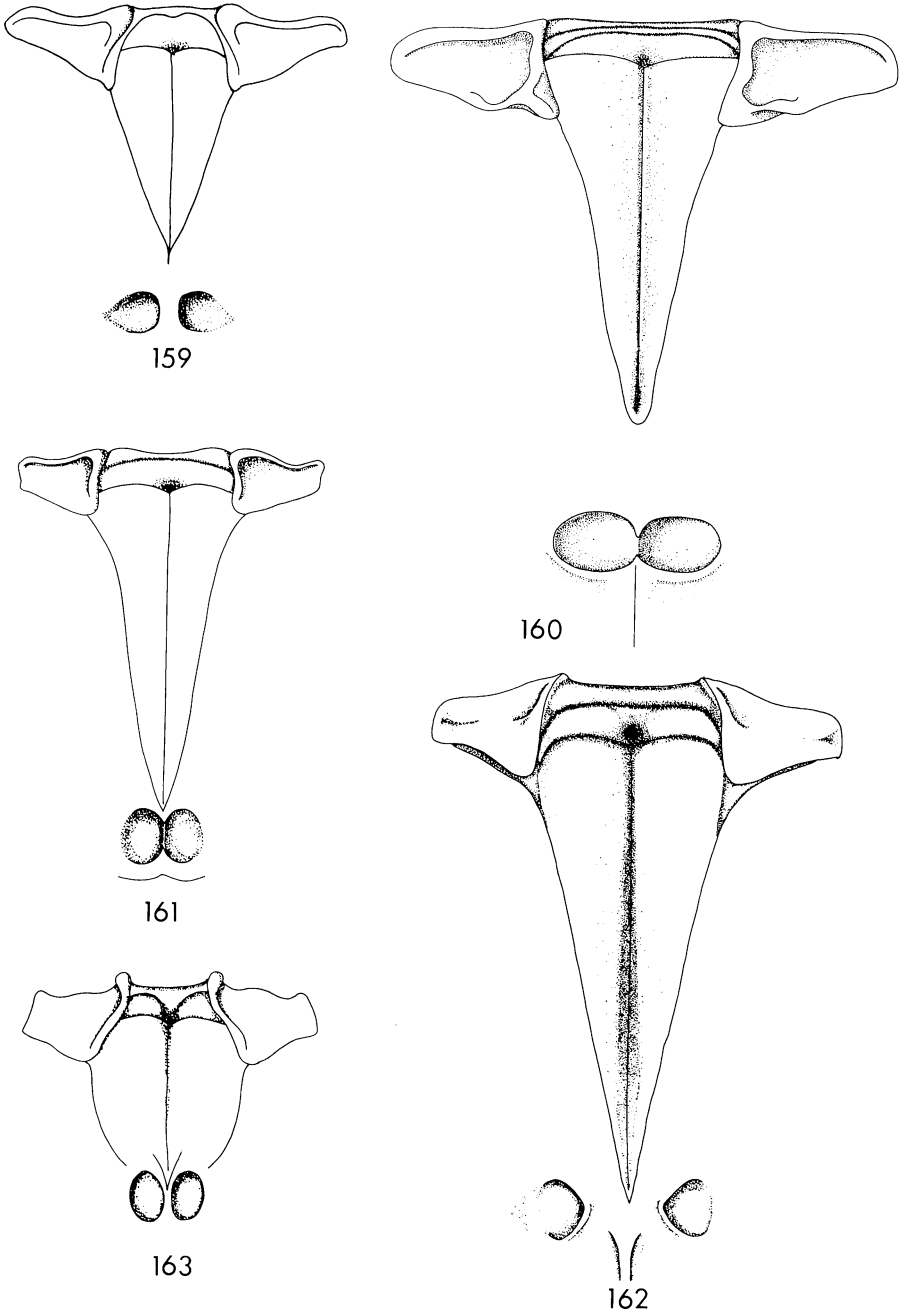


PLATE XVI. Mesepisternal Fossae of *Acanthagrion*. Fig. 159. *A. peruvianum* n. sp., allotype, Campamiento, Peru; Fig. 160. *A. deceptum* n. sp., allotype, Campamiento, Peru; Fig. 161. *A. yungarum* Ris, allotype, Guayabamba, Peru; Fig. 162. *A. risi* n. sp., allotype, Tachira, Venezuela; Fig. 163. *A. adustum* Williamson, allotype, Wismar, British Guiana.

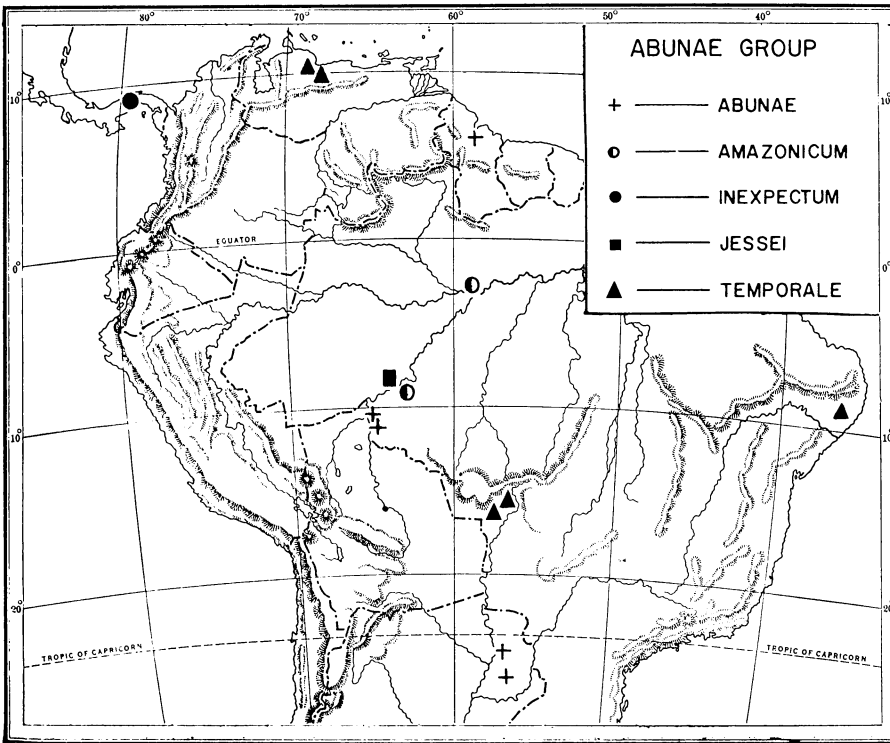
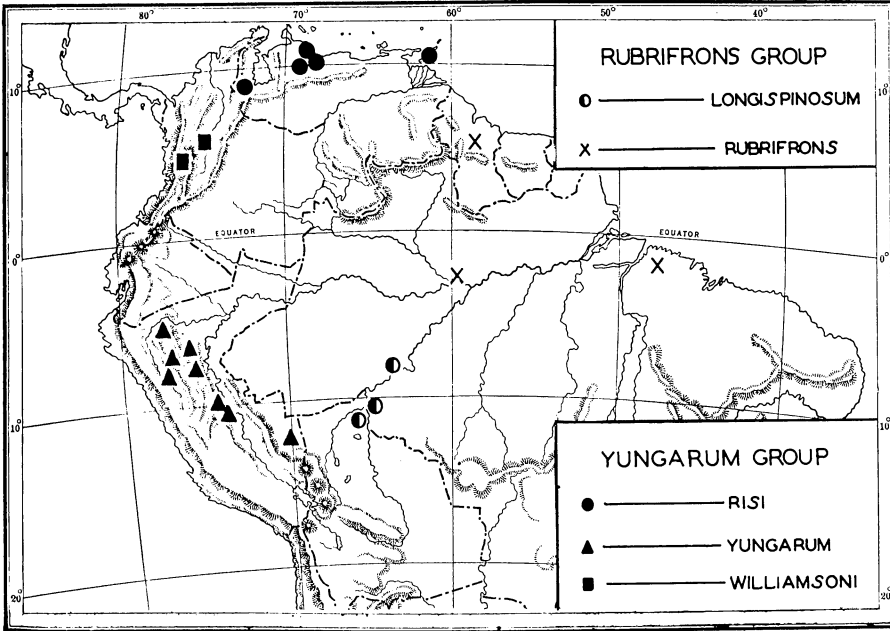


PLATE XVII. Locality Records for the Rubrifrons, Yungarum and Abunae groups of *Acanthagrion*.

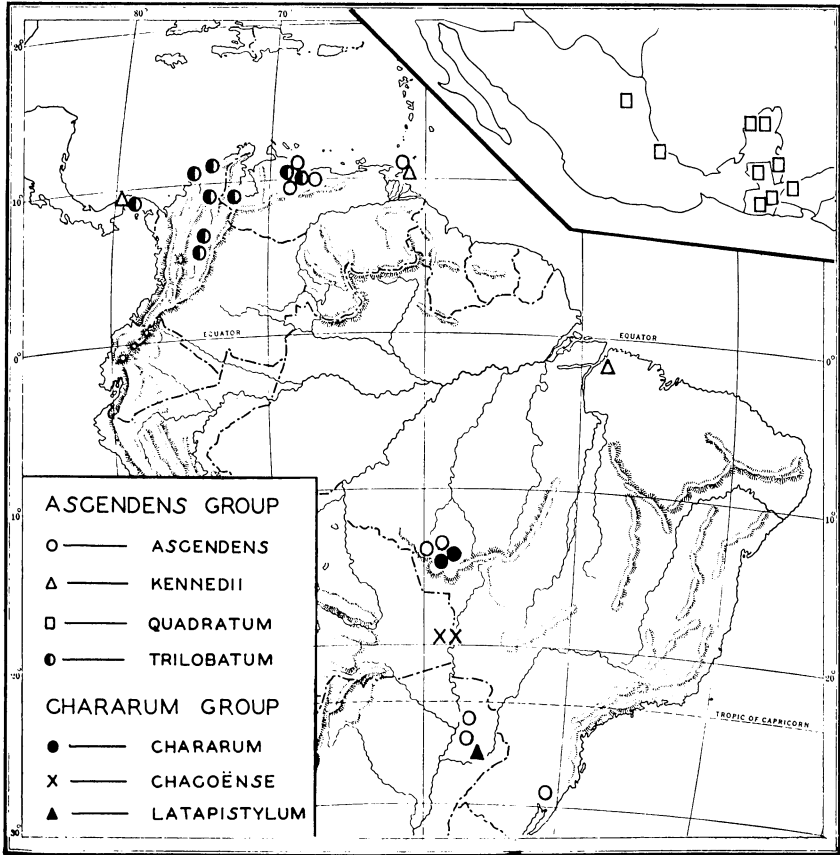
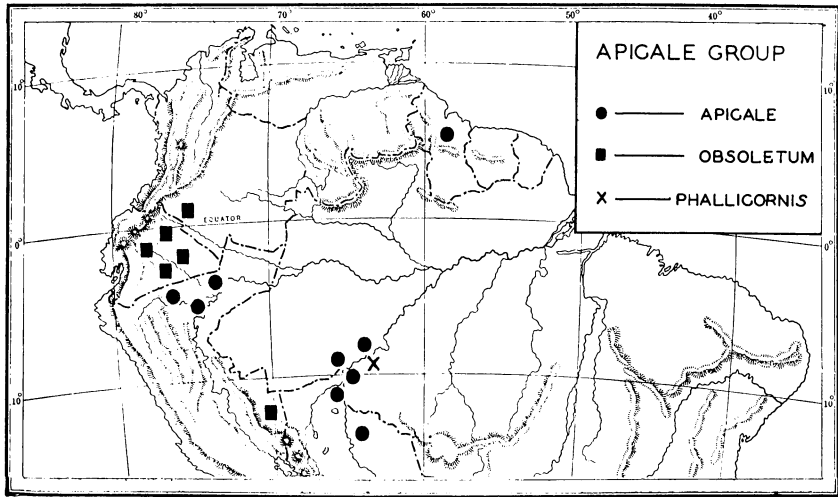


PLATE XVIII. Locality Records for the Apicale, Ascendens and Chararum groups of *Acanthagrion*.

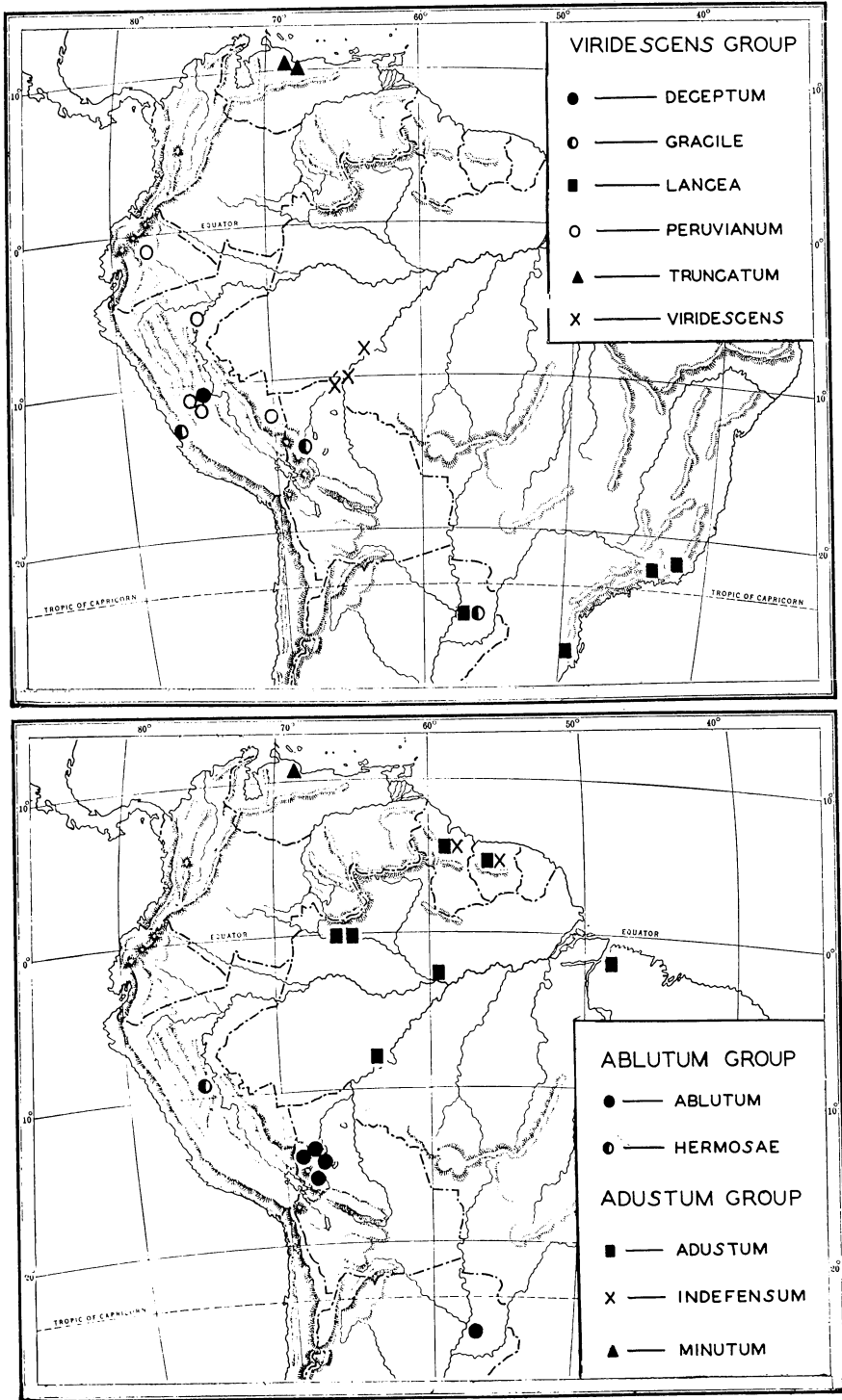


PLATE XIX. Locality Records for the Viridescens, Ablutum and Adustum groups of *Acanthagrion*.

