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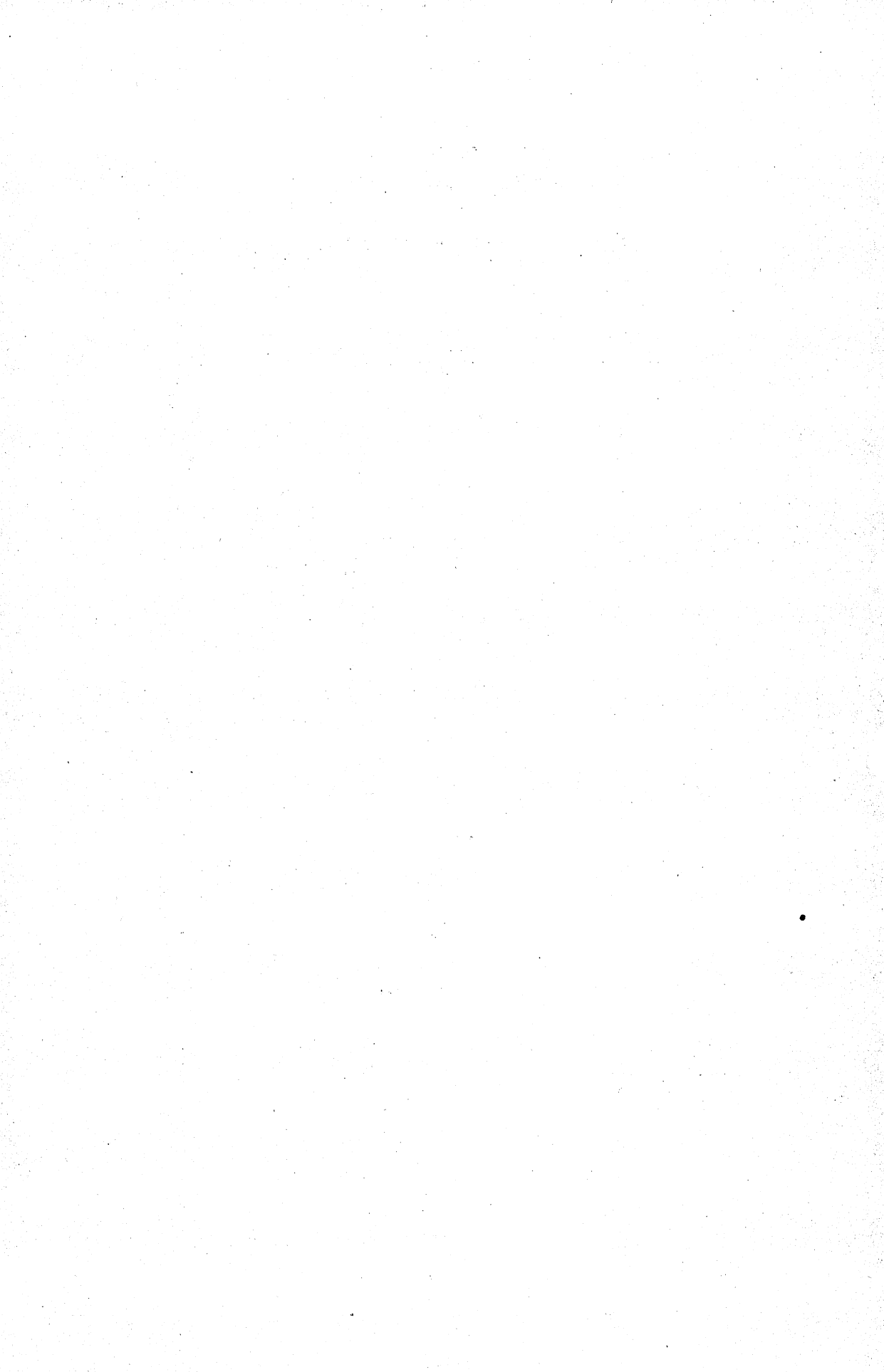
Miscellaneous Publications No. 9

Notes on American Species of
Triacanthagyna and Gynacantha

BY

E. B. WILLIAMSON

ANN ARBOR, MICHIGAN
PUBLISHED BY THE UNIVERSITY
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ALEXANDER G. RUTHVEN,
Director of the Museum of Zoology,
University of Michigan.

NOTES ON AMERICAN SPECIES OF TRIACANTHAGYNA AND
GYNACANTHA (ODONATA)

BY E. B. WILLIAMSON

During the past seventeen years many dragonflies from tropical America have been added to my collection. From time to time, as material in certain groups became of sufficient interest, reports on this material have been published by others as well as myself. In this paper it is proposed to study the specimens of the genera indicated in the title. During our field trips no effort has been spared to make our collections of these striking insects as complete as possible.

These various trips may be briefly summarized as follows. I collected in Guatemala and Honduras in 1905 and 1909. B. J. Rainey, my father, L. A. Williamson and I collected in British and Dutch Guiana and in Trinidad in 1912. In 1916-1917, Jesse H. Williamson and I, as members of the University of Michigan—Williamson Expedition to Colombia, collected in that country. In 1920, H. B. Baker, W. H. Ditzler, Jesse H. Williamson and I were the members of a collecting party for the Museum of Zoology, University of Michigan, in western Venezuela. The last three named devoted most of their time to collecting dragonflies, and Mr. Baker, who was more interested in other groups, brought in some specimens which are properly credited to him in each case. Jesse H. Williamson collected in Peru in 1920, and in Florida in 1921.

For all the assistance I have had, both from the members of the various parties and from the University of Michigan, I wish to express my deepest thanks. Mr. Rainey, Mr. Ditzler and Messrs L. A. and J. H. Williamson not only joined these expeditions at their own expense but gave all their time and strength in the field to collecting dragonflies, and their efforts and cooperation were the largest factor in the success and pleasure of these collecting trips.

The Venezuelan collection especially was so rich in aeshnines of the two genera *Triacanthagyna* and *Gynacantha*, embracing as it did no less than twelve species, that it was felt the material on hand from all the trips could be profitably reported on. This study was begun with the idea of making such a report but early difficulties in the determination of certain specimens compelled me to borrow material from other collections and to study carefully all the species in the New World.

Acknowledgements. Through Dr. Calvert I borrowed valuable material from the Philadelphia Academy of Natural Sciences (abbreviated as A. N. S. in the text), and from him, with the kind consent of Mr. Henshaw, I also obtained material belonging to the Museum of Comparative Zoology (abbreviated as M. C. Z. in the text) which Dr. Calvert had borrowed for study.

Dr. Calvert also turned over to me his notes and keys on American species of these genera, loaned me some otherwise unavailable literature, and has given me valuable advice and criticism. Through Mr. Herbert Campion I have been able to study one of the males in the British Museum, determined by Kirby as *G. subviridis*. Through Miss Bertha P. Currie, I have obtained the material of these two genera in the United States National Museum (abbreviated as U. S. N. M. in the text). Mr. W. T. Davis (abbreviated W. T. D. in the text) has kindly loaned me all his material in these genera. In the same way, Mr. Hugo Kahl of the Carnegie Museum (abbreviated Carn. Mus. in the text) has loaned me all the specimens of these genera in the collections at Pittsburgh. Through Dr. C. H. Kennedy I have obtained material belonging to the Ohio State University (abbreviated O. S. U. in the text). And Professor Needham has loaned me the specimens in the collections at Cornell. To Dr. Ris I am indebted not only for the loan of material without which this paper would be much more incomplete than it is, but he gave me permission to describe one species which he had already detected as new in his collection, and he also kindly loaned me some literature and has furnished me with various notes. Mons. Severin kindly sent me Martin's types of *G. satyrus*, and the specimens labelled *trifida* in de Sely's collection. These specimens are discussed in detail on pages 8-11. A review of the pages which follow will show how incomplete my study would have been without the unselfish cooperation of all these friends. Dr. Kennedy made all the drawings for this paper, and Miss Mina L. Winslow all the photographs of the wings.

THE GENERA TRIACANTHAGYNA AND GYNACANTHA

I have not given the question whether the American species discussed in this paper should be included in one, two, or three genera any particular study and I have no well founded opinion in the matter. My knowledge of related species in other regions than the American is very limited, and, of the American species *oatrix*, for which Förster erected *Selysiophlebia*, I have seen no specimens. However, in the key to species which follows I have indicated at least some characters by which two groups, previously recognized by other authors, may be rather satisfactorily defined, and I am considering these groups as genera. As to the relationships of these two groups with old world groups, as I have stated, I have no opinion. In America I think two genera exist, regardless of their world relationships and the names by which they should be known. And *Selysiophlebia* remains to be studied. A factor that seems to me to have weight in this decision is the fact that in *Triacanthagyna* two groups have developed, somewhat paralleling groups in *Gynacantha*. In *Triacanthagyna* we have the paler *septima* with its unstricted abdomen and the darker brighter *trifida* group with the male abdomens constricted. In *Gynacantha*, somewhat resembling the *septima* group of *Triacanthagyna*, we have several species of the *nervosa* group, while a number of darker and more brilliant species may represent the *trifida* group. At the same time it is not implied that *Triacanthagyna* has the wealth of specific adaptations which we find in *Gynacantha*. The two

genera may be recognized by the following characters: Upper piece of the arculus equal to or larger than the lower piece, Rs forked, separated from Rspl by at least three cells; Sc ending at the nodus; median space free; membranule of hind wings reduced, with only a slight extension on the anal margin; eyes in contact for a greater distance than the antero-posterior dimension of frons and vertex combined; males with the anal triangle and auricles well developed, and no dorsal teeth or well developed carinae on segment 10; females with two or three long inferior spines on 10.

Constricted and unconstricted abdomens.—These terms have been used rather loosely and indefinitely or relatively by authors. The third segment of the abdomen is the region involved. On the second and succeeding segments, except the last two or three, on each side of each tergite two distinct longitudinal carinae can be detected. One of these is the lateral carina and below this, on the margin, is the ventral carina. Both may be armed with small denticles. On the second segment of the male the ventral carina parallels the extreme margin of the genital fossa and often bears denticles of various forms. The lateral carina on the same segment in its anterior part is modified into the auricle. On the third segment the relative position of the lateral and ventral carinae can be accurately described and figured, and serves as a measure for the degree of constriction of the segment. If the carinae are widely separated and approximately parallel the segment is unconstricted. If the carinae fuse at about the level of the transverse carina and, anterior to that point, are joined or are parallel and in close juxtaposition the segment is constricted. If the carinae approach at the level of the transverse carina so they are separated by a distance possibly half the distance of separation near the apex of the segment, the segment may be defined as slightly or somewhat constricted. By defining this character in terms of the position of the carinae it is believed ambiguity or uncertainty in the future can be avoided, and especially in cases where the abdomen is not clearly constricted or not constricted.

The trifida group (Triacanthagyna): This group of four species has given me the most difficulty in this study. All of them had been confused under one name *trifida*, and to add to the confusion *Triacanthagyna needhami* is a synonym of the true *trifida*. The females so far known, strange to say, are more easily recognized than the males. In the latter the appendages are so similar that in three of the species I detect no difference and in the fourth, *caribbea*, differences can be detected, probably, only by direct comparison with other species. Collections south of the equator will probably reveal additional species as practically all of the material seen by me is from more northern localities. Although the species are so similar I am nevertheless convinced, after many hours spent studying them, that the four are distinct.

The nervosa group (Gynacantha): In the same way in Gynacantha, the *nervosa* group offers some serious difficulties. In the *trifida* group no variation within a species in the form of the male abdominal appendages was detected. But among certain species of the *nervosa* group, especially *nervosa*, *bifida*, *croceipennis*, *litoralis* and *interioris*, the superior appendage seems somewhat flexible. Flattened out, there is a distinct angle on the inner

edge where the abrupt widening takes place. But if this angle warps or rolls up, as it seems to do frequently, then the angle is lost, and the passage from the basal stem of the appendage to the expanded apical portion is less abrupt. For example I have specimens of *nervosa*, which so far as I can detect, agree well with both of Ris' figures (35), figure 19 representing *G. bifida* and figure 20, *G. nervosa*. As in the *trifida* group body colors here are practically uniform in the various species, or, if differences exist, these are not well enough known to be of any service at this time. But fortunately in the males of the *nervosa* group, contrary to the condition found in the *trifida* group where all the males have constricted abdomens, constriction of the abdomen of the males has progressed in different degrees. And at the same time some striking wing patterns have been developed or have survived within the group, a thing which does not exist in the *trifida* group. By the use of these two characters, form of abdomen and color of wings, a fairly satisfactory classification of the material before me has been possible, but there are some individual cases which present problems I cannot positively solve at this time. See text under *G. litoralis*.

Eyes and flight: Dr. Calvert (9) has written an interesting account of the relative size of the eyes in various insects, especially in dragonflies, with reference to the varying amount of light in the different environments in which the insects spend their lives, and he points out the great relative advantage of the eyes of *Gynacantha* over some other species. In such predaceous insects as dragonflies keenness of sight and power of flight might be expected to vary directly. In *Gynacantha*, for example, it is probable that the increased size and efficiency of the eyes, make possible the swift and often erratic flight, which would otherwise often terminate fatally. In dark forests many genera of agrionines with eyes relatively very small, compared with *Gynacantha*, live in great numbers, apparently living in such environments more successfully even than *Gynacantha*. Their eyes are amply keen enough to detect food and mates, and to avoid the pitfalls spun by designing spiders. In fact, were they gifted with all of the powers of sight and flight of *Gynacantha*, and at the same time remained as small as they are, it is possible they might not survive in the environment where they now flourish. For *Gynacantha* escapes the ever present danger of spider webs not by keenness of sight but by sheer bulk and momentum. It is unusual to find a fully adult *Gynacantha* with no bits of spider webs attached to wings or body, strands which would have proved the undoing of a *Heteragrion* or a *Palaemnema* with equally unguarded flight. In fact *Gynacanthas* hawking in the evening may often be observed colliding violently with grass or sedge stems and leaves, and once a *nervosa* struck a motionless insect net handle with a resounding whack. Crepuscular flight is probably only an adaptation to the food supply and many aeshnines often practice it, though it seems more confirmed in certain species of *Gynacantha* and *Triacanthagyna* than in other genera such as *Coryphaeschna* and *Aeshna*. In *Aeshna* I have seen certain sun-loving species hawking late in the evening when it was so dark they were visible only against the sky or against the reflection of the sky in the pool over which they were flying. At this time their flight was as

swift and as well controlled, apparently, as is possible for the larger eyed Gynacantha. Generalizations on the habits of flight of aeshnines are dangerous even when a large amount of data is available, but it may be mentioned that the equally large-eyed Neuraeschnas, on the single occasion I observed them, were crepuscular with swift and well controlled flight. I believe such crepuscular flight as is found in Gynacantha and Triacanthagyna and possibly other aeshnine genera is a specialized habit related to the food supply, some approach, under favorable conditions, to which is seen in Coryphaeschna, Aeshna, Boyeria, and probably other aeshnines, Tholymis and Pantala among the libellulines, and Neurocordulia among the cordulines. Certainly it is an adaptation found chiefly among the aeshnines and possibly not present at all in the Zygoptera, though certain species are noticeably most active late in the afternoon.

Ecological notes: That there is some sensitive adjustment to their environment is indicated by the spotted distribution of even the most widely ranging species of Gynacantha. For example, Palma Sola, Venezuela, is in a very level heavily forested region and lies about 35 meters above sea level. By railroad it is about 37 kilometers from Tucacas on the coast. Here in the evenings *nervosa* flew literally by hundreds or thousands. About 30 kilometers farther inland on the railroad lies the plantation Boqueron, at an elevation of about 125 meters. In the vicinity are many beautiful streams of different sizes and character. There are extensive pastures and corn-fields but closely surrounding these are forests as dense and of the same general character as the forests about Palma Sola. The landscape is varied with some low hills and the general result is a region apparently much richer and certainly much more attractive than the region about Palma Sola, but during eight evenings at Boqueron we saw not a single *nervosa* though we looked diligently for them. Cristalina lies far inland in Colombia, near Puerto Berrio, which river port is about 164 leagues above Barranquilla. The elevation of Cristalina is about 320 meters. In general the topography roughly suggests the topography about Boqueron, though there is less flat forest. In fact it differs from Boqueron about as Boqueron differs from Palma Sola. But at Cristalina we found *nervosa* flying in about the same numbers as we found them at Palma Sola. Why were they absent at Boqueron? There is also the factor of seasonal distribution to consider. We may expect this to become more evident as one leaves the equator. It was conspicuously evident at 15-16°N. at sea level at Puerto Barrios, Guatemala, where *T. septima* was abundant in May and June and entirely wanting, that is, there were no great crepuscular flights, in January and February, when none was seen. Generalizations as to where and when these aeshnines may be found are therefore dangerous. They are essentially forest insects, though the forest may be low and chaparral-like; they require moist earth for ovipositing, and rains or overflow must provide water for the larvae; species and individuals seem most numerous at comparatively low elevations above sea level; and they are essentially tropical.

ORGANIZATION OF RESULTS

This paper originated in my efforts to identify properly specimens in my own collection and its purpose is to facilitate identifications by other students. It makes no attempt to summarize completely the extensive literature on these species and it should therefore be regarded as supplemental to the other literature. To make it as useful as possible for the purpose for which it has been prepared different parts of the paper are designed as a check on other parts. For example, in the keys to species the least possible use has been made of venational characters and of male appendages. The tabulation of the venational characters and the figures of appendages therefore will serve as checks on determinations made by the key. In the text under each species are given data on size, form and size of female appendages where known, and in some cases additional data designed to facilitate identification of material, and notes on habits, colors in life, etc. As a check on my own determinations I have listed all the material studied by myself, but I have not summarized all the records gathered by others, since as stated above this paper is merely supplemental to the other literature.

The abbreviations used in designating various collections have been mentioned above in the paragraph under acknowledgments; E. B. W. refers to my own collection. Dr. Walker's use of certain letters in designating abdominal spots, as explained by him (see under his name in the bibliography) has been frequently used in this paper. All measurements are in millimeters, and the length of the abdomen as given is in every case exclusive of the appendages. Notes on colors of living specimens must not necessarily be considered complete. For example, failure in any case to mention pseudopupillae must not be taken as evidence that these are lacking. Field notes are often made under unfavorable circumstances, and I have often found myself regretting the lack of detail or lack of definiteness which the notes sometimes show. In some cases I have slightly re-edited these notes but in no case has anything been added to them.

In the field only a small hand lens was available for examining material. Later studies have been made with a Zeiss binocular, using the number 2 eyepiece and the F 55 and A₂ objectives.

SPECIMENS IN THE DE SELYS COLLECTION, FOLLOWING MARTIN'S REVISION,
UNDER THE LABELS TRIACANTHAGYNA TRIFIDA AND
GYNACANTHA SATYRUS

Several months after this paper had been completed and sent to Dr. Ruthven for publication Mons. Severin kindly sent me for study the thirty-two specimens in de Selys collection under the label *T. trifida* and the six male types (not seven, as stated by Martin) of *G. satyrus*. Six species are included in this lot of thirty-eight specimens. In order to avoid as much as possible the rewriting of several parts of my manuscript, already long since completed, these specimens are considered one by one in this section of my paper, and only the changes rendered imperative in the text are made. These changes have to do with *Triacanthagyna* (*Gynacantha*) *satyrus* Martin.

The study of this material, sent me by Mons. Severin, tends to confirm my opinion expressed under *T. septima* in the text, that *septima* is really a synonym of *obscuripennis*. Incidentally, the matter I could not understand, *i. e.* why de Selys' collection contained only a single male of this widely distributed and common species, is explained; there are seven specimens under the labels *trifida* and *satyrus*.

The study of this material also causes me to think I have included two species under *T. ditzleri*, but at this time adequate characters for separating the two are not discernible. The small specimens from Central America and northern South America will probably be found to be specifically distinct from the similar but larger specimens from southern Brazil. One of these males is referred to in the text under *T. ditzleri*. Other specimens are present in de Selys' collection under the label *trifida*. I have designated as the type of *ditzleri* a male of the smaller northern and better known form. A solution of the problem of the status of the two forms awaits adequate material from southern Brazil.

An examination of the following report on these thirty-eight specimens will impress the student, I think, with at least two things. It shows again, what should now be well known, that differentiation among species in at least certain aeshnine genera has progressed along such lines that specific characters are not conspicuous or obvious to the student, however effective they may be in nature. Following from this, the greatest care and discrimination in the determination of species is necessary. Incidentally it may be remarked, the description of new species in such groups, based on a single female or on any other number of specimens which the particular case renders inadequate, is not science but is an affliction.

*Thirty-two specimens in de Selys' Collection labelled
Triacanthagyna trifida*

Unless otherwise mentioned, in addition to labels indicated, each specimen bears the following label: Collection Selys. *Triacanthagyna trifida* Rb. Revision Martin, 1909. *Triacanthagyna trifida* Rb.

1. male | Honduras | *Gynacantha trifida*? R. male (in de Selys' hand) | C'est espece different Förster (and on the reverse) il n'est pas trifida (all in Förster's (?) hand)|. The specimen is *T. septima*.

2. male.|CI. 2.|7|. The specimen is *T. septima*.

3. female.|Mexique Salle|28|. The specimen is *T. septima*.

4. female.|female 151|Boctes (?)|6|. The specimen is *T. septima*.

5. female.|151 female |14|16|. The specimen is *T. septima*.

6. female.|Para, Schulz (?) (in de Selys hand).|10|. The specimen is *T. septima*.

7. male.|Copa Cabana|113|32|. By its hamules it is *T. ditzleri*. In the anal loop three cells in the anterior row in both hind wings. This is the larger Brazilian form provisionally referred to *ditzleri* in this paper.

8. female.|Botafogo|14|. This is probably the female of the larger Brazilian form referred to *T. ditzleri*. In the anal loop there are two cells in the anterior row in both hind wings.

9. female.|Botafogo|21|. Same remarks as under number 8.

10. male.|Bocas (?) Sta. Cather. (?)|8|. Same remarks as under Number 7, except that the anal loop in one wing has three cells in the anterior row while the other wing has two.

11. male.|Bates|143 A|143 var. A minor|11|. The specimen is typical *T. ditzleri*.

12. female.|Bates|38|12|*Gynacantha praedatrix* Bates. Amazonas (in de Selys' hand). The specimen is typical *T. ditzleri*.

13. male.|Panama (in de Selys' hand)|9|. The specimen is typical *T. ditzleri*.

14. female.|Coary. Amaz. Sup. (in de Selys' hand)|17|. The specimen is typical *T. ditzleri*.

15. male.|Bates|51|30|. The specimen is typical *T. ditzleri*. There are three cells in the anterior row of cells in the anal loop in the right hind wing.

16. female.|Dusem (?) 15/2 (in de Selys' hand)|24|. The specimen most closely resembles *T. ditzleri*, but has the anal loops unusually large with three cells in the anterior row of cells. I believe it is *ditzleri* but identification is not positive. Venation shows it is certainly not *trifida*. In size and degree of constriction of the abdomen it is *ditzleri*.

17. male.|Small rectangle of silver paper|Sta. Cruz, Bolivia|3|. Hamules concealed by glue or shellac; eyes are gone and the specimen is badly faded, but the legs and appendages are those of *T. caribbea*, to which species, in the absence of more and better material, this single specimen is referred.

18. male.|25 (?)|Para St.|4|. Head and superior appendages gone, but the legs and hamules clearly show it to be *T. caribbea*.

19. male.|Para. Schulz|23|*trifida*, petite sous race (Förster's (?) hand)|. This is a specimen of *T. satyrus* and doubtless belonged to the same lot of specimens as that from which three of the types of *Gynacantha satyrus* were selected.

20. male.|Ci.|13|. This specimen, which lacks the last seven abdominal segments, is *Gynacantha adela*.

21. female.|Bocas (?) Sta. Cath.|a small rectangle of orange colored paper|14|. The specimen lacks all its legs but one and the apices of the appendages are gone. I think it is certainly *Gynacantha adela*, certainly it is not a *Triacanthagyna*.

22. male.|male.|a small rectangle of gilt paper|Cuba|5|*trifida* Ramb.|A. *trifida*|Type *Gynacantha trifida* Rb.| Stock label, described in introductory sentence, with the additional word *type*. The eyes are gone, the abdomen is slightly damaged, and the left superior appendage is gone. This is one of Rambur's types of *trifida*.

23. female. Similar to Number 22, and also labelled *type*. The eyes are gone and all of the abdomen but a few fragments of two or three basal segments.

24. male. Similar to Number 22, also labelled *type*, and carrying in addition the following label in de Selys' hand; *Triacanthagyna trifida* R. Type de Rambur, Coll. Serville, male, Cuba. The eyes are gone and only the two basal abdominal segments, themselves damaged, remain.

25. male.|Cuba|22|. The specimen is *T. trifida*.

26. male.|Cuba|25|*Triacanthagyna trifida*. Rb. Collection Selys|. Lacks the stock label described in the introductory sentence. The specimen is *T. trifida*.

27. male.|Cuba|20|————(?) *trifida* (and on the reverse) Förster dixit|. The specimen is *T. trifida*.

28. male.|Cuba|18|. The specimen is *T. trifida*.

29. male.|S. Domingo|29|*Triacanthagyna trifida* Rb. Collection Selys|. Lacks the stock label described in the introductory sentence. The specimen is *T. trifida*. This and numbers 30 and 31 doubtless belonged to the same lot as one of the specimens selected as one of the types of *Gynacantha satyrus*.

30. male.|Santa Domingo|26|113|*Triacanthagyna trifida* R. St. Dominique male (in de Selys' hand)|. The specimen is *T. trifida*.

31. male. | S. Domingo | 31 | Triacanthagyna trifida collection Selys | Triacanthagyna trifida Rb. |. The specimen is *T. trifida*.

32. female. | Jamaïque Deby | 15 | Triacanthagyna trifida R. female Jamaïque (in de Selys' hand) |. The last seven abdominal segments are gone. In size, venation, and constriction of abdomen, the specimen is *T. trifida*.

The six (not seven as stated by Martin) types of Gynacantha satyrus in de Selys' Collection

These all belong to the genus Triacanthagyna. Each specimen bears the two following labels in addition to labels indicated in each case: Collection Selys Type. Gynacantha satyrus M. Révision Martin 1909. Gynacantha satyrus Mart.; and a red bordered label on which is printed TYPE, and on which is written Gynacantha satyrus Mart.

1. male. | Pilanqui (?) Ecuador (?) | 2 |. The specimen is *T. septima*.
2. male. | S. Domingo | 6 |. The specimen is *T. trifida* and is probably one of the same lot as number 29, 30 and 31 above, properly labelled *T. trifida*.
3. male. | Yurimaguas, Perou | 56 | 1 |. The specimen is *T. satyrus*.
4. male. | Para. Schulz | 3 |. The specimen is *T. satyrus*. Numbers 4, 5, and 6 of this lot and number 19 above doubtless belonged to the same lot of specimens.
5. male. | Para. Schulz | 4 | Boite 46 |. The specimen is *T. satyrus*.
6. male. | Para Schulz | 5 |. The specimen is *T. satyrus* and I have designated it as the type of the species.

ALPHABETIC LIST OF NAMES PROPOSED IN THE TWO GENERA

- Triacanthagyna caribbea*, new species.
Triacanthagyna ditzleri, new species.
Triacanthagyna needhami Martin. See text under *T. trifida*.
Triacanthagyna obscuripennis Blanch. See text under *T. septima*; not in the key to species.
Triacanthagyna (Gynacantha) satyrus Martin.
Triacanthagyna septima Selys.
Triacanthagyna trifida Rambur.
Gynacantha adela Martin.
Gynacantha (Selysiophlebia) aratrix Förster. See text under *G. chelifera*; not in the key to species.
Gynacantha auricularis Martin.
Gynacantha bifida Rambur.
Gynacantha caudata Karsch.
Gynacantha chelifera McLachlan. Not in the key to species.
Gynacantha convergens Förster.
Gynacantha croceipennis Martin.
Gynacantha ereagris Gundlach.
Gynacantha gracilis Burmeister.
Gynacantha interioris, new species.
Gynacantha jessei, new species.
Gynacantha jubilaris Navas. See text under *G. membranalis*.
Gynacantha klagesi, new species.
Gynacantha laticeps, new species.
Gynacantha limai Navas. See text under *G. convergens*.
Gynacantha litoralis, new species.
Gynacantha martini Navas. See text under *G. adela*.

Gynacantha membranalis Karsch.

Gynacantha mexicana Selys.

Gynacantha nervosa Rambur.

Gynacantha robusta Kolbe. See text under *G. bifida*.

Gynacantha (Aeshna) subviridis Selys. See text under *G. auricularis*.

Gynacantha tenuis Martin.

Gynacantha tibiata Karsch.

Species are arranged in the text in the same order as in the tabulation of venational characters as follows: *T. septima*, *ditzleri*, *caribbea*, *trifida*, *satyrus*, *G. laticeps*, *chelifera* (and *aratrix*), *adela*, *convergens*, *tenuis*, *caudata*, *tibiata*, *jessei*, *auricularis*, *klagesi*, *eragris*, *mexicana*, *nervosa*, *bifida*, *croceipennis*, *litoralis*, *interioris*, *gracilis*, and *membranalis*.

Key to American Species of *Triacanthagyna* and *Gynacantha*

1. Two rows of cells between M1 and M2 beginning under the stigma; fork of Rs near the proximal end of the stigma in the front wing (except in *trifida*) and more basal in the hind wing than in the front wing. Third joint of penis in ventral view elliptical, without membranous margins, from slightly shorter than to less than half as long as the second joint, and only slightly wider; ligula relatively long and narrow, in ventral view subequal in width; superior appendage with a short narrowed base, apically blade-like, with parallel or subparallel margins to near the minutely toothed apex, the blade without carinae or processes; posterior part of hamular process relatively low and therefore appearing more nearly horizontal, with no deep sulcus entirely across the process dividing it from the anterior part, which is relatively narrow. Ventral process on abdominal segment 10 of female three-pronged. So far as observed crepuscular, flying in the evening and rarely in the morning; flight very erratic. *Triacanthagyna*. 2.
- 1'. Two rows of cells between M1 and M2 beginning at or proximal to the stigma in the hind wing and usually in the front wing; fork of Rs distinctly basal to the stigma in the front wing and more basal in the hind wing (except in *aratrix*). Third joint of penis in ventral view roughly triangular with a large expanded membranous basal margin on each side, equal to or slightly exceeding the second joint in length, and nearly or quite twice as wide; ligula relatively shorter, wider caudad, not subequal in width in ventral view; appendages variously shaped; posterior part of hamular process high and vertical or subvertical, sharply divided by a deep sulcus, which extends across the process, from the anterior part which is broad and thin. Ventral process on abdominal segment 10 of female two-pronged. Habits varied, when crepuscular, flight less erratic and often in regular beats at a uniform height. *Gynacantha*. 6.
- 2 (1). Legs entirely pale; thorax without definite dark markings; abdomen pale; anterior edge of frons seen from above convex. Male with abdomen not constricted at segment 3; the opposing hairs on the blades of the superior appendages reduced in length from the base to the middle of the blade, the apical half with only ordinary short hairs..... *septima*.
- 2'. Legs more or less dark, in teneral the legs are pale but the apices of the femora and bases of the tarsi dark to black; thorax with definite dark markings; abdomen dark; anterior edge of frons seen from above more or less angled. Male with abdomen constricted at segment 3; the opposing hairs on the blades of the superior appendages about equally long and numerous the entire length of the blade..... *trifida* group. 3.
- 3 (2'). Anterior row of cells in anal loop usually consisting of two cells; second and third femora similar in color. Hamular process relatively small and short, less than .4 in length, equal to much less than one-third the distance from its

- posterior edge to the anterior end of the median sulcus of the anterior lamina; superior appendage with the sides of the blade beyond the narrowed base parallel. Female with abdomen very slightly constricted, the space between the lateral and ventral carinae distinctly narrowed at the level of the transverse carina; appendages about as long as the last three segments. *ditzleri*.
- 3' Anterior row of cells in anal loop usually consisting of three cells. Hamular process larger, more than .4 in length, equal to more than one-third the distance from its posterior edge to the anterior end of the median sulcus of the anterior lamina. 4.
- 4 (3'). Second and third femora dissimilar in color. Hamular processes with the mesal edges diverging posteriorly, less than .6 long; superior appendages with the sides of the blade beyond the base slightly converging posteriorly as seen in supero-internal view. Female with abdomen not constricted, and the appendages slightly shorter than the last three segments. *caribbea*.
- 4' Second and third femora similar in color. Hamular processes with the mesal edges subparallel; superior appendages with the sides of the blade beyond the base parallel. Female of the single species known with the abdomen constricted at segment 3 and the appendages as long as the last three and one-half segments. 5.
- 5 (4'). Hamular process less than .6 long; margins of genital fossa without spines. Female as described in paragraph 4' *trifida*.
- 5'. Hamular process about .7 long; posterior border of genital fossa with a large patch of black spines or teeth. Female not known. *satyrus*.
- 6 (1'). No antenodal crossveins of the first or second series, basal to the first thickened antenodal, present (rarely a single crossvein may be seen in one wing). 7.
- 6'. One or more antenodal crossveins of the second series, and rarely of the first series, basal to the first thickened antenodal, present in front wings or hind wings or both; venation complex, two rows of cells between M_3 and M_4 immediately following the loop in M_4 ; size large, abdomen 55 or more, hind wing 55 or more, and stigma front wing 5 or longer; colors bright and contrasting; wings with a colored basal area extending to nearly the first antenodal at least; femora light, clear reddish brown to almost black with the apices dark to black, tibiae darker, the dorsal surface sometimes more or less light yellowish brown; abdomen greatly enlarged at base, constricted at 3. In the male the ventral carina on abdominal segment 2, posterior to the point of convergence, concave, meeting the lateral carina at an acute angle; spines of anterior lamina directed caudo-ventrad. Apparently on the wing throughout the day. *gracilis* group. 27.
- 7 (6). Small to medium insects (abdomen 32-54, hind wing 32-54); dull to brilliant coloration, legs variously colored; stigma rarely 4.5 long, in which case the auricles of the male are greatly enlarged or there is a median apical tubercle on the sternum of abdominal segment 1 in both sexes; venation simple to complex; wings hyaline to tinged yellowish brown, rarely with very restricted brown at base. In the male the abdomen is constricted at segment 3 (except in *laticeps*) and the ventral carina on 2, posterior to the point of convergence, is concave, meeting the lateral carina at an acute angle; spines of anterior lamina varicously directed. Habits various. Several groups. 8.
- 7'. Medium to large (abdomen 43-62, hind wing 42-57, stigma front wing 4 long or longer), dull colored, brownish insects, with green if present dull or pale; sides of thorax brown with at least four usually distinctly defined brown to black spots or areas as follows: one surrounding the metastigma, a spot above

- the metastigma, a spot at the upper end of the second lateral suture, and a spot or stripe posteriorly on the latero-ventral carina; legs pale colored; venation complex, two rows of cells between M_3 and M_4 immediately following the loop in M_4 ; wings hyaline to tinged yellowish brown or with a brown or brownish longitudinal stripe near the costal margin; sternum of abdominal segment 1 without a median apical tubercle. Auricles of male not greatly enlarged; the ventral carina on abdominal segment 2, posterior to the point of convergence, straight or convex, never concave, meeting the lateral carina in a more or less rounded angle; spines of anterior lamina directed caudad and slightly ventrad. So far as observed, flying for a short time in the evening just before dark or rarely in dark woods during the day. *neriosa* group. 16.
- 8 (7). Legs pale colored, yellowish or reddish.....9.
- 8'. Legs black or black and yellow, bases of femora more or less pale.....
..... *tibiata* group. 15.
- 9 (8). No distinct brown stripe on the first lateral suture; anal loop normally separated by two or three rows of cells from the posterior wing margin. 10.
- 9'. A distinct brown stripe on the first lateral suture; anal loop separated by a single row of cells from the posterior wing margin. *caudata* group. 14.
- 10 (9). Smaller species, hind wing less than 45 in length. Auricles of male in lateral view not extending caudad to the level of the transverse carina at mid-height. In the female the lateral and ventral carinae on abdominal segment 2 subparallel. 11.
- 10'. Larger species, hind wing 45 or more in length. Auricles of the male very large, expanded, in lateral view extending caudad far beyond the level of the transverse carina at mid-height; spines of anterior lamina not directed more ventrad than caudad. In the female the lateral and ventral carina on abdominal segment 2 diverging anteriorly, and the abdominal appendages shorter than the last two segments. *auricularis* group. 13.
- 11 (10). Spines of anterior lamina of male directed more ventrad than caudad. Female not as in 11'. 12.
- 11'. Wings not brown spotted at base. Male with spines of the anterior lamina directed more caudad than ventrad, and two cells between anal loop and anal triangle in first row posterior to A. Female with wing bases hyaline and four cells posterior to A and proximal to the anal loop. *adela*.
- 12 (11). Base of wings hyaline. Abdomen of male not constricted at 3 and in the female the distance between the lateral and ventral carina on the same segment less narrowed than in *convergens*. In the male one cell between the anal loop and the anal triangle in the first row posterior to A, and in the female three cells in the first row posterior to A and proximal to the anal loop; the smallest species. *laticeps*.
- 12'. Base of wings tinged brown nearly to or slightly beyond the first antenodal. Abdomen of male constricted at 3, and in the female the distance between the lateral and ventral carinae on the same segment narrowed at the level of the transverse carina to about one-half the width posterior to this point. In the male two cells between the anal loop and the anal triangle in the first row posterior to A, and in the female four cells in the first row posterior to A and proximal to anal loop. *convergens*.
- 13 (10'). Auricles of male large, not brilliantly colored ventrally, the black edge not produced anteriorly on the ventrum to the level of the hamular process; no teeth on the ventral carina of segment 2. Female with abdomen not constricted at 3; lateral carina on 2 uniformly low throughout its length. *auricularis*.

- 13'. Auricles of male larger, brilliantly colored ventrally, the black edge produced anteriorly on the ventrum to the level of the hamular process; ventral carina on 2 with a row of scale-like teeth anterior to the point of convergence. Female with abdomen constricted at 3; lateral carina on 2 elevated at the point corresponding to the auricle in the male. *klagesi*.
- 14 (9'). Male usually with a row of small scale-like teeth on the ventral carina of the second segment anterior to the point of convergence; the lateral carina on the same segment, posterior to the level of the apex of the auricle, black or dark brown. Female with the lateral and ventral carinae on abdominal segment 3 only very slightly converging just anterior to the level of the transverse carina. *tenuis*.
- 14'. Male without teeth on the ventral carina of abdominal segment 2; lateral carina on the same segment, posterior to the level of the apex of the auricle, pale colored. Female not known. *caudata*.
- 15 (8'). Tarsi of four posterior legs striped yellow dorsally; sternum of abdominal segment 1 with a low median posterior tubercle; abdominal appendages yellow. Apical abdominal segments of male yellow or yellowish. *tibiata*.
- 15'. Tarsi of all the legs black or with the merest trace of yellow; no tubercle on sternum of abdominal segment 1. Apical abdominal segments and appendages of male black; female not known *jessei*.
- 16 (7'). A wide black stripe covering the posterior third or more of the metepimeron; wings hyaline or with the merest trace of color near the costal margin. Male with the abdomen greatly constricted at segment 3. Female with the lateral carina on segment 2 distinctly black *mexicana*.
- 16'. No distinct wide black stripe on the metepimeron. Lateral carina on segment 2 on the female not distinctly black. Males, paragraph 17; females, paragraph 22.
- 17 (16'). Abdominal segment 3 greatly constricted as seen in dorsal view, the lateral and ventral carinae fused or in juxtaposition at the level of the transverse carina and for a short distance anterior to that point. 18.
- 17'. Abdominal segment 3 slightly or not constricted as seen in dorsal view, the lateral and ventral carinae separated throughout their length 20.
- 18 (17). Wings with a longitudinal stripe of color near the costal margin from base to apex, darker basally, shading out apically *interioris*.
- 18'. Wings without a costal colored stripe 19.
- 19 (18'). Smaller, hind wing 42-43, venation less complex, two rows of cells between the anal loop and the hind margin of the wing. Cuba and the Bahamas. *ereagris*.
- 19'. Larger, hind wing 48-50, venation very complex, three rows of cells between the anal loop and the hind margin of the wing. South American. *litoralis*.
- 20 (17'). Wings hyaline or uniformly brownish tinged; lateral and ventral carinae on abdominal segment 3 approaching at the level of the transverse carina, but distinctly separate and diverging anteriorly from this point. *nervosa*.
- 20'. Wings with a distinct stripe of color near the costal margin; lateral and ventral carinae on abdominal segment 3 widely separated throughout their length and only slightly approaching anterior to the level of the transverse carina 21.
- 21 (20'). Color on wings confined to near the costal margin. *bifida*.

- 21'. Wings with the entire membrane suffused with yellowish.....*croceipennis*.
- 22 (16'). Abdomen slightly constricted at segment 3, the space between the lateral and ventral carinae narrowed at the level of the transverse carina to about one-half or less the maximum width between them posterior to this point....23.
- 22'. Abdomen not constricted at segment 3, the space between the lateral and ventral carinae slightly or not narrowed at the level of the transverse carina.....24.
- 23 (22). Smaller, hind wing 43-46, venation less complex, two rows of cells between the anal loop and the hind margin of the wing. Cuba and the Bahamas...*ercagris*.
- 23'. Larger, hind wing 55, venation more complex, three rows of cells between the anal loop and the hind margin of the wing. South America.*litoralis*.
- 24 (22'). Wings hyaline or uniformly tinged.....*neriosa*.
- 24'. Wings with a distinct dark stripe near the costal border.....25.
- 25 (24'). Wing membrane suffused with yellowish or brownish, the costal stripe bounded posteriorly by R.....*croceipennis*.
- 25'. Wings hyaline except the costal stripe.....26.
- 26 (25'). Costal color yellowish, darker to brownish at base, bounded posteriorly by R *bifida*.
- 26'. Costal color darker, browner and wider, bounded posteriorly by M... *interioris*.
- 27 (6'). Colored basal wing area reduced, occupying less than half the median space and bounded posteriorly by A; T-spot on frons well marked. Male with the ventral carina on segment 2 with few to no teeth anterior to the point of convergence and a few posterior to the same point and with seven or eight denticles on the auricle.....*gracilis*.
- 27'. Colored basal wing area extensive, occupying all or nearly all the median space and extending posteriorly beyond A, especially in the hind wing; frons above black or obscure, no evident T-spot. Male with the ventral carina on segment 2 with a row of ten or more teeth anterior to the point of convergence and none posterior to this point, and with only three or four denticles on the auricle *membranalis*.

DISCUSSION OF SPECIES¹*Triacanthagyna septima* Selys

6, 7, 10 (female is *ditzleri*), 11, 12, 23, 25, 26, 36, 40.

Abdomen male 38-45, female 42-48; hind wing male 34-41, female 37-43; superior appendage male 4.2-5, female 5-5.2; stigma front wing 3-3.5.

Dr. Calvert has called attention to the variation in the number of cells in the anal triangle in this species. And equally surprising is the variation in both sexes in the number of rows of cells between M_4 and $Mspl$ in the hind wing and the number of cells in the anterior row of cells in the anal loop. Of fourteen males from Puerto Barrios, six have four rows between M_4 and $Mspl$, seven have three, and one has four on one side, three on the other; of twelve females from the same locality nine have four rows and three have three rows. Moreover the four-rowed condition is not confined to specimens

¹ Numbers following each species refer to the citations in the bibliography.

from Guatemala, specimens from as widely separated localities as Mexico and Ecuador showing the same character. The larger number of specimens have three cells in the most anterior row of cells of the anal loop, but specimens with two cells are numerous, and asymmetrical specimens are not rare. With few exceptions there is a single row of cells throughout between M_2 and Rs but in a few cases there is a single double cell. In the males there are usually two cells just posterior to A between the anal loop and the anal triangle, rarely one; and in the female there are four cells between the anal loop and the wing base. In the male the sternum of abdominal segment 1 may be smooth or may have as many as twelve small black spines and the spines on the ventral posterior margins of 2 vary from a single row of six or seven spines on each side to a small patch of as many as sixteen spines. In contrast with these variable characters, there are three denticles on each auricle, one of these concealed on the inside of the auricle and anterior to the other two.

The wide variation in many characters, the great variation in size, and the wide distribution of the material before me, led me to expect to find two or more confused species, but I have been unable to recognize more than one species. At the same time I have been unable to identify the species *obscuripennis*. It is rather remarkable that *septima* is represented in the large de Selys collection by a single male. As recorded by Martin *obscuripennis* is represented in the same collection by two males and two females. The appendages of *obscuripennis* as figured by Martin seem relatively shorter and heavier than those of *septima*, but characters for separating the two species are not very definite. Much of the material before me has been studied by Dr. Calvert and I follow him in referring it all to *septima* but it seems to me not improbable that that name is really a synonym of *obscuripennis*. The abdominal appendages of the female of *septima* are elliptical with a low median longitudinal dorsal carina and the extreme apex acute.

My notes contain the following references to living colors: Males, Bolivar, Colombia: Eyes dark greenish brown above, gray beneath; thorax largely bright light green with few light brown markings, dorsum with a semicircular area covering the lower part; abdomen light brown, markings green and black. Female, Santa Marta, Colombia: Thorax above rich light brown, with a wide curved stripe on the mesepisternum green, wider and yellowish below, sides largely green; abdomen clove brown, markings obscure yellowish and black. Several well preserved males are colored as follows: On dorsum of thorax a lower central triangular or semicircular area, and an antehumeral stripe, which tends to fade out in the surrounding green, pale brown; sides of thorax and abdominal segments 1 and 2 and base of 3 to or beyond the transverse carina, largely green. Dorsum and sides of abdomen brown, green as follows: 1, D spot; 2, AD narrow, MD large, joined with AML, PDs separated in the midline above, and on side PD and PL not joined; 3, AL, ML, MD, PD and PL present, the two latter not joined; on 4 and progressively posteriorly the spots are smaller and more obscure, MD, the best marked, disappearing after 8; extreme base of 2-8 dark ringed.

At Puerto Barrios the large palm swamp adjoining the town had been cut off prior to 1909 for some distance back from the coast, and over this area in May and June, as darkness came on in the evenings and as darkness gave way to light in the mornings, *septima* came from the nearby forest to dart back and forth, high in the air, or near the ground, in countless thousands. But because of their erratic flight the collector found himself netting only an occasional specimen where dozens were apparently awaiting the sweep of the net. At Bolivar the following note: "This species the most erratic flier I have ever seen, and possibly the most difficult to catch. Along road after sunset. Few flying where there were many last evening. Began flying at 5:45 p. m." At Puerto Berrio, "Flying along the railroad track below the hotel about 6:10 p. m.,—almost dark." At Cienega, "A male flew into a lighted car at railroad station at 7:15 p. m.—dark outside." At Palma Sola, "Flies along railroad track and in clearings in the woods just after sundown; very erratic especially in clearings; in town along railroad tracks associated with *Gynacantha nervosa*." At Tachira, "Flying along railroad after sundown."

Their erratic flight is due to sudden darts after their prey which they detect at some distance. In clearings and along roads or trails the sky above them is a clear bright field and I have often seen *septima* rise several feet to seize its prey. In fact, so far as I can recall, they always strike from below. I have never found them flying in the mornings except at Puerto Barrios. It seems improbable that early evening and early morning flying occur generally, for the usual great differences in day and night temperatures might be expected to prevent this.

In my field notes the reference to *septima* as the most erratic flier I have ever known should doubtless be modified. Other species of *Triacanthagyna* are probably as swift and erratic, and, after repeated observations one afternoon, I give the palm for abrupt and erratic and perfectly controlled flight, among all the dragonflies I know, to *Tholymis citrina*.

Material examined: *Mexico* (A. N. S. 1 male, 1 female; U. S. N. M. 1 female); *Guatemala* (Van. Patten, 1 female M. C. Z.), Puerto Barrios (May 25, 26, 28, and 30, and June 23, 1909, 16 males, 12 females E. B. W.), Santa Tomas (May 29, 1909, 1 male, E. B. W.), San Felipe (Hay and Maxon, February 22, 23, 1905, 1 male, 1 female, U. S. N. M.); *Costa Rica*, Guapiles (P. P. C., July 13, 1915, 1 female, A. N. S.); *Colombia*, Santa Marta (December 16, 1916, 2 females, E. B. W.), Bonda, Dept. Magdalena, 250 feet (H. H. Smith, July and August, 2 males, 1 female, Carn. Mus.), Bolivar, near Santa Marta (December 21, 24, 25 and 26, 5 males, 3 females, E. B. W.), Cienega, Dept. Magdalena (February 26, 1917, 1 male, E. B. W.), Rio Frio, Dept. Magdalena (January 7, 1917, 1 male, E. B. W.), Rio Neuvo, Dept. Bolivar, on Magdalena River, between Magangué and El Banco (January 22, 1917, 1 female, E. B. W.), Puerto Berrio, Dept. Antioquia (January 31 and February 21, 1917, 2 females, E. B. W.); *Ecuador*, (F. Campos R., 1 female, Cornell), Guayaquil (F. Campos R., 4 males, 2 females, A. N. S., 1 female, Ris), El Salado (F. Campos R., 1 male, 1 female, A. N. S.), S. Rafael (F. Campos R., 1 female, A. N. S.), Babahayo (F. Campos R.,

1 female, A. N. S.); *Bolivia*, Province del Sara, Dept. Sta. Cruz, 350 m (José Steinbach, February, 1913, 1 female, Acc. 5076, Carn. Mus.); *Venezuela* (Appun, 1 male, M. C. Z.), Puerto Cabello (1 female, M. C. Z.), Palma Sola, Dept. Falcon (March 4-10, 1920, 10 males, 5 females, E. B. W.), Tachira, Dept. Falcon, about 364 m (April 11, 1920, 1 male, E. B. W.); *Dutch Guiana* (1 female, O. S. U.; 1 male, U. S. N. M.; 1 female, M. C. Z.; 1 male, 1 female, Ris), Paramaraibo (K. Mayo, 1 female, A. N. S.); *French Guiana*, Cayenne (S. M. Klages, February, 1917, 3 males, 1 female, Acc. 5873, Carn. Mus.); *Brazil*, Para (February 6, 1901, 1 female, Ris; C. F. Baker, 1 female, E. B. W.), Santarem (A. H. Fassel, July, 1920, 1 female, Ris), Manaus (Miss H. B. Merrill, 2 males, 2 females, U. S. N. M.), Bom Jesus de Itabapoana, Rio Janiero (Zikan, March 26, 1906, 1 female, Ris); *Trinidad*, San Juan (March 2, 1912, 1 female, E. B. W.); *Cuba* (Poey, 1 male, 1 female, M. C. Z.). See also discussion above of specimens in the de Selys Collection.

Triacanthagyna ditzleri, new species

6 (Chapada male as *trifida*), 10 (April female and August male as *trifida*, September female as *septima*).

Abdomen male 36-40, female 41-43; hind wing male 33-36, female 37-42; superior appendage male 4.8, female 6-6.9; stigma front wing 3.4-3.6.

Male.—Living colors, from notes on the Palma Sola male, March 6, 1920. (Descriptive notes in parentheses made from preserved specimens.) Eyes above dark green, in front on either side an oblique line of bright blue, narrowly bordered on its upper edge with black especially at the superior end of the line; lower half of eyes pale green with a slight brownish cast and one conspicuous black and five or six smaller brown pseudo-pupillae. (Face green, paler and duller below, darker to black above, anteclypeus brown; frons above in front black, stem of T-spot obscure or wanting; frontal vesicle black; occiput small, green.) Rear of head greenish yellow, a broad black band from foramen to occiput.

Prothorax brown, anterior lobe blue, elevation of posterior lobe dark brown, the free edge narrowly greenish blue.

Thorax brilliant grass green, marked with rich dark brown, almost black on the dorsum; dark mid-dorsal area nipple-shaped, narrower above, the edge on either side at midheight concave then widening out and convex below. Antehumeral stripe wide, almost as dark as the dorsal area, shading out above, especially anteriorly, and very narrowly joined above with the middorsal area; two lateral narrow brown stripes, the first the wider and forked above; interalar spots green.

Abdomen above rich reddish brown, almost black, apex of 7 and 8 and 9 paler. In a male from La Fria the thorax above and the abdomen above were entirely black, not brown and not paler apically. Abdominal markings bright green as follows: 1 with D interrupted, L present; 2 with AD tapering from base to apex, AML large, MD narrow and triangular, PD narrowly divided in the mid line, PL and PD not joined, PL about the same size as PD on either side, both small; (two or three denticles on each auricle;

margins of genital fossa without spines or teeth, a small patch of short bristles on the marginal prominence opposite the posterior end of the ligula); on 3 AL triangular, reaching about half the distance to the transverse carina; 3-7 each with MD small, triangular, narrowly separated, and PD small and elliptical, both MD and PD progressively smaller posteriorly, almost gone on 7, on 8 MD represented by mere dots; ML and PL apparently wanting or very faint on 3 and posterior to that segment; AL on 4 and posteriorly inconspicuous or wanting.

(Wings hyaline, costa dark reddish brown to black, stigma dark brown, ventral surface paler and yellowish; venation black or nearly so.)

(First femora black, green behind the full length except the extreme apex, first tibiae and tarsi dark brown; middle and hind legs similar in color, femora and tibiae light to dark reddish brown, each femur paler toward the base and black at apex, each tibia dark to black at base and apex, tarsi black or nearly so.)

Female.—Based entirely on preserved material. Face yellowish brown, yellower below, darker and obscurer above with only faint tinges of green. Head above similar to the male.

Thorax similar to the male, the middorsal dark area more nearly triangular in shape, the dark colors reddish brown, paler, and the green less vivid.

Abdomen, like the thorax, paler than in the male, only the apical three or four segments apparently black or much darker than the paler basal segments. D and L present on 1, the latter large; 2 with AML, MD and PL joined into a long wide longitudinal bar just above the lateral carina; on 3 AL and ML joined, and the other spots, MD, PD and PL, present; 4 with the five spots, AL, ML, MD, PD and PL all present, though small; these spots can all be detected on 5 and 6, and in life doubtless some of them are continued farther posteriorly. Appendages regularly elliptical, widest about the middle, maximum width .9-1.0, a low median longitudinal dorsal carina, apex regularly rounded, extreme apex acute.

Wings and legs as in the male.

Of fourteen wings of males, twelve had two cells in the most anterior row in the anal loop, and two wings had three cells; of fourteen wings of females nine had two cells and five had three cells. In the males there were invariably two cells just posterior to A between the anal loop and the anal triangle; and in the females there were in every case four cells posterior to A from wing base to anal loop. Of both sexes twenty-three front wings had a single row of cells throughout between M_2 and Rs, three wings had a single double cell, and two wings had two-three double cells; in the twenty-eight hind wings all had a single row of cells between M_2 and Rs.

Ditzleri is the smallest and possibly the handsomest of the *trifida* group, and the smallest specimens are smaller than the smallest *septima* I have seen. However, the male from Blumenau, referred to this species, is larger than the measurements given above, the abdomen being 42.5 and the hind wing 40. The wings are slightly tinged brownish; there are two cells in the anterior

row in the anal loop. The second and third legs are darker than usual, the reddish brown of the femora being darker with the apical black more extensive. But I believe the species is certainly *ditzleri*.

Several evenings at Palma Sola, returning home about sunset, walking on the railroad track through the practically continuous forest which surrounds the village, suddenly before us, near at hand and as far as we could see down the track, would appear the widely darting forms of Triacanthagynas. Even when seen in numbers each individual's flight was too erratic and independent to permit calling the assemblage a flock. One evening they were especially numerous. We tried striking at individuals, and we ran down the track beating back and forth with the net, but two of us doing our best failed to catch a single one. Returning later one evening I ran along the track striking right and left as rapidly as possible and thus by sheer good fortune netted two individuals, a male each of *ditzleri* and of *caribbea*. The single specimen taken at Puerto Barrios was associated with *T. septima*. I had been catching specimens of *septima* since about sundown and when *ditzleri* was captured it had grown so dark I could see individuals only when they came between me and the clear sky. I think all the other specimens of *ditzleri* we captured were taken in the forest where, when flushed, they usually flew a short distance and alighted on some twig or stem, or even tree trunk, in characteristic aeshnine position with down-hanging abdomen.

Material examined: *Guatemala*, Cayuga (Schaus and Barnes, April, 1 female, August 27, 1 male, September 16, 1 female, A. N. S.; first two recorded, Calvert 10, as *T. trifida*, the female of September 16 as *septima*), Puerto Barrios (June 23, 1909, 1 male, E. B. W.); *Colombia*, Puerto Berrio, Dept. Antioquia (January 31 and February 8 and 21, 1917, 3 males, 3 females, E. B. W.); *Venezuela*, Palma Sola, Dept. Falcon, (March 6, 1920, 1 male, E. B. W.), El Guayabo, Dept. Falcon (April 22, 1920, 1 male, E. B. W.), La Fria Dept., Falcon (April 12, 13, 16 and 17, 1920, 4 males, 2 females, E. B. W.); *British Guiana*, Bartica (H. S. Parish, May 28 and June 1, 1901, 2 males, O. S. U.); *Dutch Guiana* (1 male, 1 female, O. S. U.; 1 male, det. by R. Martin as *trifida*, Ris; 1 male, E. B. W.), Paramaraibo (Miss K. Mayo, 1 female, A. N. S.); *Brazil*, Para (C. F. Baker, 1 female, E. B. W.), Tapajos, Amazon, Monte Christo (A. H. Fassel, May, 1920, 1 female, Ris), Porto Alegre, Rio Grande de Sul (J. D. Haseman, January 21, 1909, 1 male, Acc. 3768, Carn. Mus.), Blumenau, Santa Catharina, (1 male, E. B. W.), Chapada (1 male M. C. Z., recorded, Calvert 6, as *trifida*). See also discussion above of specimens in the de Selys' Collection. Type male and allotype female, La Fria, Venezuela, April 17, 1920, E. B. W. Named for William Howard Ditzler, who, as a member of the University of Michigan Venezuelan Expedition collected, among many other dragonflies, the type of this handsome species.

Needham's Figure 3, Plate XXXIX. A Genealogic Study of Dragonfly Venation, is probably of the wings of this species.

Triacanthagyna caribbea, new species

6, 10, 11, all in part. See text.

Abdomen male 41-45, female 44-47; hind wing male 39-45, female 42-46; superior appendage male 5.4-5.7, female 6.9; stigma front wing 3.5-4.2.

Male.—Living colors, from notes on the Palma Sola male, March 6, 1920. (Descriptive notes in parentheses made from preserved specimens.) Very much like *T. ditzleri*; head above darker green, the black line, bordering the blue bar across the eyes, is itself narrowly bordered above with light green, and the blue bar itself below passes through darker blue to black; rear of head with very nearly white replacing the greenish yellow.

Prothorax almost white, posterior lobe darker.

Thorax less brilliant green but still very bright; dark markings reddish brown, less contrasted with the green as compared with *T. ditzleri*, but still very distinct, the dorsal dark area more widely connected with ante-humeral stripe, thus more isolating the dorsal green.

Abdomen brown, much paler than in *T. ditzleri*; on 2 PL is large, quadrangular, twice as wide as PD above it, and joined with the auricle, not so joined in *T. ditzleri*; (three denticles or three and the vestige of a fourth on each auricle; one to nine, usually four to six, small teeth of varying sizes on the margin of the genital fossa on the prominence opposite the posterior end of the ligula); on 3 AL larger, reaching the transverse carina; 3-8 with ML present as small pale yellowish brown spots; MD and PD still conspicuous on 7; on 8 as conspicuous as on 7 in *T. ditzleri*; PD represented on 9 by small spots.

(Wings hyaline to brownish tinged, costa dark reddish brown to almost black at apex, stigma reddish brown, beneath lighter yellowish brown, venation black or nearly so.)

(First and second femora black or nearly so, paler at base and green behind, the two similar in color, thus different from *ditzleri* where the second and third legs are similarly colored; third femora black, or nearly so, thus distinctly darker than in *T. ditzleri*; tibiae black beneath, reddish brown above; tarsi black.)

A teneral male, Santa Marta, December 14, 1916, in life was colored as follows: Eyes above dark brown. Dorsum of thorax bright brown, stripes bright green and distinct; sides green with brown markings in definite pattern. Abdomen brown, markings black (at the extreme apex of each segment from 3 posteriorly to about 7), and (spotted) obscure yellow. (In this specimen the third femora are dark brown and the contrast between the second and third femora is as well marked as in adults.)

The following notes on living colors were made on an apparently adult male, Bolivar, Colombia, December 21, 1916: Colors of thorax bright green and rich brown in distinct and sharp pattern. Abdomen brown with green and black markings.

Female.—Based on preserved material. Face light yellowish brown, darker above, with only faint traces of green; frons above dark dull green shading into black anteriorly, with the stem of the T-spot obscure or wanting, as in the male.

Thorax and abdomen as in the male, to judge from preserved material, the colors possibly slightly paler, especially those of the abdomen. Appendages similar to *ditzleri* in shape, basal narrowing slightly longer.

Wings and legs as in the male.

Of fourteen wings of males twelve had three cells in the most anterior row in the anal loop, and two wings had two cells; of fourteen wings of females all had three cells. In thirteen wings of males there were two cells just posterior to A between the anal loop and the anal triangle, and in one wing there were three cells; in the fourteen wings of females there were in every case four cells posterior to A from wing base to anal loop. Twenty-two of the twenty-eight front wings had one row of cells throughout between M_2 and Rs, four wings of females had a single double cell, and one wing of each sex had two double cells; in all twenty-eight hind wings there were invariably a single row of cells.

In a dry brush-choked gully near Santa Marta we found slightly teneral specimens of this species in December. Crawling about through the almost impenetrable spiny vegetation the collector flushed occasional individuals, a few of which it was possible to capture in his fingers. Other specimens were taken soon after sunset flying along the road at Bolivar and other specimens from various localities were flushed in forests.

Caribbea, in the form of the superior appendages of the male, differs from the other three species of the *trifida* group, but this difference is slight and will be detected probably only by those having specimens of the several species for comparison. The green color of the posterior surface of the second femora, which thus resemble the first femora and differ markedly from the third femora, is obvious in well colored specimens of both sexes. In teneral individuals this green is replaced by gray and the color is less conspicuous as the entire femur is paler in such specimens. But in these cases the third femora are darker than the second, so the dissimilarity between the second and third femora still holds. In *trifida* Rs forks more basally than in other species of the group and this can be more readily detected in the front wing (because of the greater proximity of the fork to the stigma) than in the hind wing. In figure 146, Martin 25, *trifida*, Rs in the front wing forks basal to the level of the last postnodal crossvein, and in the hind wing basal to the level of the stigma a distance equal to or greater than the length of the stigma. A comparison of Martin's figure 146 with figure 3 of *caribbea* in this paper will show this difference, which however, like the differences in appendages, is difficult of precise definition. See last paragraph under *T. ditzleri*.

Material examined: *Mexico* (1 male, 1 female, U. S. N. M.); *Guatemala*, Cayuga (Schaus and Barnes, forest, August 23, 1 female, A. N. S.); *Colombia*, (Turbo, Mack, 1 male, M. C. Z.), Santa Marta, Dept. Magdalena (December 13, 14 and 16, 1916, 9 males, 9 females, E. B. W.), Bolivar, near Santa Marta (December 21, 23, 26, 1916, 2 males, 1 female, E. B. W.); Puerto Berrio, Dept. Antioquia (February 8, 1917, 1 female, E. B. W.); *Venezuela*, Caracas (Rolle, 1910, 1 female, Ris), San Esteban, Dept. Carabobo (February 8, 1920, 1 female, E. B. W.), Palma Sola, Dept. Falcon

(March 4, 6 and 9, 1920, 1 male, 3 females, 1 female shot by H. B. Baker in forest, E. B. W.); Boqueron, Dept. Yaracuy (March 16, 1920, 1 male, E. B. W.), Aroa, Dept. Yaracuy (March 14, 1920, 1 female shot by H. B. Baker in forest, E. B. W.); *Dutch Guiana* (Thorey, 1 male, M. C. Z.); *Brazil*, (Heyer, 1 male, labelled "*Gynacantha elata* Hagen", and 1 male labelled "*Aeschna augusta* Hagen," M. C. Z.), Bom Jesus de Itabapoana, Rio Janeiro (Zikan, July 27, 1905, 1 female, Ris). The single specimen from Guatemala is recorded as *trifida* in Calvert 10; and the five males and one female from Mexico, Colombia (Turbo), Dutch Guiana, and Brazil (Heyer, M. C. Z.) are recorded as the same species in Calvert 6 and 11. See also discussion above of specimens in the de Selys Collection. Type male and allotype female, Palma Sola, Venezuela, March 6, 1920, E. B. W.

It should be noted that some of the above material is teneral and otherwise in a bad state of preservation, making determinations difficult, and the female of *T. satyrus* is not known and may be confused as a female of this or other species. For these reasons the records for Mexico, Guatemala, and Rio Janeiro, Brazil, are open to question.

Triacanthagyna trifida Rambur

1, 2, 5, 6 (Chapada male is *ditzleri*; Mexico, Colombia, Dutch Guiana and Brazil [Heyer] specimens are *caribbea*), 8 (is *satyrus*), 9 (is *satyrus*), 10 (male and April female are *ditzleri*; August female is *caribbea*), 11 (see 6 above), 12, 13, 16, 20, 23, 25, 26, 34, 35, 36, 39; all references in the literature to specimens outside the range of *T. trifida*, as indicated in the material studied in this paper, are probably to some other species than *trifida*.

Abdomen male 42-45, female 47-50; hind wing male 41-43, female 44-47; superior appendage male 6-6.3, female 9-10.6; stigma front wing 3.3-4.2.

I have seen only preserved material. The coloration is essentially the same as in *T. ditzleri*, but the dark dorsal thoracic area, in those specimens where the pattern is discernible, is triangular, with the lateral edges nearly or quite straight, not nipple-shaped as in *T. ditzleri*.

The wings are hyaline to yellowish brownish tinged. Twelve wings of males and twelve wings of females each had three cells in the most anterior row of the anal loop. In the males there were invariably two cells just posterior to A between the anal loop and the anal triangle, and in the female there were four cells posterior to A between the wing base and the anal loop. In three front wings of males one front wing of a female and two hind wings of males there was in each case a single double cell between M_2 and Rs; in all the other wings there was a single row of cells throughout. For a note on the basal forking of Rs see text under *T. caribbea*. See also last paragraph of text under *T. ditzleri*.

In the specimens examined there were no spines or teeth on the ventral margins of abdominal segment 2 in the male, and the auricles were armed each with three denticles or with three and the vestige of a fourth. Appendages of female elliptical, a low median longitudinal carina, of nearly uniform width throughout after the gradually tapering basal third; apex rather abruptly rounded, extreme apex acute, maximum width 1.3.

Material examined: *California* (1 male, 1 female, A. N. S.); *Georgia*, Billy's Island, Okefenokee Swamp (June, 1912, 1 male, Cornell); St. Simons Isl. (Sept., Oct., 1910, 1 female, Cornell); *Florida*, Lakeland (W. T. Davis, November 8 and 10, 1911, 2 females, W. T. Davis), Hastings (1 female, Cornell), St. Augustine (C. W. Johnson, 1 male, A. N. S.), Miami (1 female, Cornell); *Cuba*, (Poey, 1858, 1 male, 1 female, M. C. Z.), Havana (C. F. Baker, 1 male A. N. S.), Guanajay (Palmer and Riley, May 6, 1 male, 1 female, U. S. N. M.), Baraca (Aug. Busck, September, 1901, 1 male, U. S. N. M.); *Haiti* (Dr. Abbott, 1 male, A. N. S.), Samana (Frazar, 2 males, 1 female, M. C. Z.), Tortuga, N. W. Haiti (W. L. Abbott, July, 1917, 1 female, A. N. S.); *Jamaica*, Bath (Mrs. Swainson, 1 male, 1 female, A. N. S.). See also discussion above of specimens in the de Selys Collection.

Triacanthagyna needhami Martin is a synonym of *T. trifida* unless another species, which I have not seen, inhabits Florida.

Triacanthagyna satyrus Martin

8, 9, under both titles as *trifida*, 25, 26.

Abdomen male 42-43,? female 43; hind wing male 39-42,? female 41; superior appendage male 6-6.3,? female 7.8; stigma front wing 3.6-4.

Male.—Colored like *T. ditzleri* except that on abdominal segment 3 ML and PL are evident in the preserved material, and these spots may have been present on segments posterior to 3 during life. Like *T. ditzleri* it is darker than *T. caribbea*, and the following note was made of the La Fria male at time of capture. Thorax and abdomen above black, not brown, and not paler apically in the case of the abdomen. The frons above is dark to entirely black.

Dr. Calvert has kindly given me the following notes on the living colors of the Costa Rican male taken by him. Eyes brilliant green, darker above. Frons dark brown with an ill-defined superior black spot. Clypeus and labrum pale green, the latter more yellowish; labium pale brown but with some pale green on the middle of the lobes. Thoracic dorsum dark brown with a cuneiform, sharply marked, green antehumeral stripe, diverging from above from its fellow of the opposite side. Sides of thorax bright green, a narrow brown stripe on the first and second lateral sutures. Abdomen black, the following green; on 1 a transverse posterior dorsal, and on each side a transverse posterior lateral stripe, the three not confluent; on 2 each side a transverse anterior stripe, a narrow median transverse line, three posterior spots arranged in a transverse line, a mid-dorsal line and the auricles; on 3 a basal spot each side; on 3-7 each with a pair of transverse triangular spots just posterior to the transverse carina; on 3-5 a pair of transverse posterior spots. Pectus and under side of abdomen pale flesh color.

A teneral female from Rio Janeiro, Collection Ris, may belong to this species, and the above measurements of the female are based on this specimen. Although pale and faded it has plainly the leg colors of the *trifida* group and the third abdominal segment is constricted as in *T. trifida*. The

slightly shorter appendages alone distinguish it from the geographically widely separated *T. trifida*.

In the three males available and in the single female provisionally referred to this species there are invariably three cells in the anterior row of cells in the anal loop; in the male there are two cells posterior to A between the anal loop and the anal triangle, and in the female there are four cells posterior to A between the wing base and the anal loop; in the front wings of males, one wing has a single double cell between M_2 and Rs. two wings have three double cells, and one wing has four double cells; in all the other wings of both sexes there is a single row of cells throughout between M_2 and Rs.

The auricles of the second segment of the male are each armed with three denticles or with three and the vestige of a fourth.

Material examined: *Costa Rica*, Banana River (P. P. C., forest, upper reservoir, November 9, 1909, one male, A. N. S.); *Venezuela*, La Fria, Dept. Tachira (in forest, April 17, 1920, 1 male, E. B. W.); *British Guiana*, Bartica (H. S. Parish, May 27, 1901, 1 male, O. S. U.). See also discussion above of specimens in the de Selys Collection, where Martin's six types of *satyrus* are considered in detail. As explained there, these types were received for study long after this paper was completed. During the preparation of this paper Mons. Severin kindly sent me one of the types of *satyrus*, but this one happened to be the Santo Domingo specimen. On the basis of this examination *satyrus* was reduced to a synonym of *trifida* in my paper, and I described my material as a new species. With the examination of all six of Martin's types it is now possible to save his species and I have designated one of these specimens as the type of *satyrus*.

Gynacantha laticeps, new species

Abdomen male 33-33.5, female 35-38; hind wing male 32, female 34-37; superior appendage male 4.5; stigma front wing 2.25-3.

Male and female.—Labium and face dull pale yellow, slightly darker above, and occupying most of the frons above, which has a darker greenish shade, so the brown T-spot is reduced and inconspicuous; frontal vesicle dark brown; occiput greenish yellow; rear of head dull pale yellow, black margining the eyes above, and this joined with a broad black bar to the foramen.

Prothorax pale brown or greenish brown, the posterior edge yellowish green.

Thorax green; if any markings are present in life they have not survived post-mortem changes.

Abdomen not constricted, brown or yellowish brown, marked with pale (green or yellow or both) and black; 1 and sides of 2 apparently largely green, 1 darker above apically; 2 with AD very narrow and extending from the base to and across the subapical transverse carina, but ending before the extreme margin of the segment and interrupted at the median transverse carina; a basal trace of AD on 3; MD present as a triangular spot on either side on 2-7; sides of 2-7 slightly if any paler than the dorsa, no definite

pattern of dark and pale in the dried material; median transverse carina, subapical transverse carina, and extreme apex of 2-7, and to a lesser extent of 8 distinctly black ringed; 8-10 and appendages brown, slightly darker than the segments basal to them. Margins of genital fossa of 2 without teeth or spines; auricles small, armed with five to seven denticles.

Wings hyaline; costa, venation and stigma brown or yellowish brown to nearly black; the stigma in the females is lighter yellowish, due probably to immaturity, and the posterior vein, especially, is conspicuously black. In the two males and two females, of all the wings, there is, in each wing, a single row of cells throughout between M_2 and R_s ; in all the wings the loop in M_4 is greatly reduced and in the wings of the two males and one of the females there is, in each wing, a single row of cells throughout between M_3 and M_4 ; in the other female in each front wing there is one double cell and in each hind wing there are three to five double cells.

Legs pale dull yellow, unmarked, the first femora slightly darker above.

The two females show a marked difference in size of all parts but I cannot separate them on any other character.

Material examined: *Brazil*, Minas Geraes (I. Rolle, 1914, 2 males, 2 females, R_s), type male and allotype female of this material. I am able to describe this species through the kindness of Dr. Ris who loaned me the four specimens I have seen, and who expressed the opinion, when the specimens were sent to me, that they represented an undescribed species.

Gynacantha chelifera McLachlan

25, 26, 27.

Gynacantha (Selysiophlebia) aratrix Förster

14, 25, 26.

Unfortunately I have not seen specimens of these species. They are about of the same size (abdomen 40-43, hind wing 35-37, Martin, 25), and the descriptions and figures of appendages indicate very closely related if not identical, species. In fact, with this evidence alone before me, I regard *aratrix* as a synonym of *chelifera*.

Gynacantha adela Martin

25, 26, 35.

Abdomen male 44-45, female 44; hind wing male 42-43, female 43; superior appendage male 5.1; stigma front wing 2.7-3.

The margins of the genital fossa of the second abdominal segment of the male are armed on either side, just anterior to the point of convergence, with three to six small scale-like teeth in a single row; the auricles are each armed with six or seven denticles. In one of the males from Bolivia in the left front and hind wing M_3 , distal to the loop in M_4 , is switched anteriorly one row of cells, resulting in three rows of cells between M_3 and M_4 . This

is the only case I have seen in all the wings studied in which a main sector is so switched. The appendages of the single female are broken.

Material examined: *Peru*, Campamiento, Colonia del Perene (W. T. M. Forbes, June 12, 1920, 1 female, Cornell); *Bolivia*, near Coroico, Yungas (W. J. Gerhard, May 2, 4, and 12, 1899, 3 males, A. N. S.); *Brazil*, Minas Geraes (Rolle, 1914, 1 male, Ris). See also discussion above of specimens in the de Selys Collection.

Navas (29) describes a male from Sao Paulo as a new species, *G. martini*. His figures of appendages indicate that the inferior is relatively slightly longer than in specimens of *adela* seen by me, but definite characters for separating the two species are not evident and it is probable *martini* is a synonym of *adela*.

Gynacantha convergens Förster

15, 17, 26, 35.

Abdomen male 42, female 44-45; hind wing male 38, female 41-41.5; superior appendage male 4.8; stigma front wing 3.3.

I follow Dr. Ris's determination of this species. The margins of the genital fossa of the second abdominal segment of the male are without teeth or denticles. The auricles are each armed with five to seven denticles, of which the two or three most anterior ones are very small. Between M_2 and Rs in the front wing there is one double cell in two male wings and one female wing, two-three double cells in one female wing, three double cells in one female wing, and four double cells in one female wing; in the hind wing there are no double cells in two male wings, one double cell in two female wings, one-two double cells in one female wing, and two-three double cells in one female wing. Appendages of both females broken.

Material examined: *Bolivia*, Province del Sara, Dept. Santa Cruz, 450 m (José Steinbach, 1918, 1 female, Acc. 6443, Carn. Mus.); *Argentina*, Yuto, Jujuy 450 m (P. Joergensen, April, 1911, 1 male, 1 female, Ris).

Navas (32) describes a single female from Italiba, Brazil, as *Gynacantha limai*. From the very nature of the case positive identification is impossible, but I believe *limai* will prove to be a synonym of *convergens*.

Gynacantha tenuis Martin

25, 26.

Abdomen male 38.5-44, female 41-47; hind wing male 39-41.5, female 38-46; superior appendage male 4.2-4.4, female 3.2-3.6; stigma front wing 3.2-3.4.

Specimens in the M. C. Z. labelled *tenuis* by Hagen make the determination of this species certain. In Martin's description (25) his figure 178 is certainly *tenuis*. In the last paragraph of his text he says "L'aile de l'individu figuré porte exceptionnellement deux rangs de cellules sous la boucle anale." Presumably this remark applies to the specimen of which the appendages are figured, figure 179. It is doubtful if figure 179 is really *tenuis* as it does not agree well and really much more resembles *auricularis*.

Moreover Martin's description of the female appendages as "extrêmement longs" is hardly applicable, and there is the absence, in the description of the male, of the broad mid-lateral brown thoracic stripe, so I am inclined to believe more than one species is included under *tenuis* in the de Selys Collection.

The wings are hyaline to lightly brown tinged. In the male the margins of the genital fossa on abdominal segment 2, anterior to the point of convergence, have on either side from none to thirteen small scale-like teeth. When these teeth are present in numbers they are in a single irregular row. Posterior to the point of convergence there are none to two similar teeth. The auricles on the same segment are each armed with five to nine denticles. The abdominal appendage of the female is linear widening very slightly from the base to about five-sixth the length from which point it tapers symmetrically to the acute apex; maximum width .36-.4.

The following color notes were made from the freshly killed Tachira male. Eyes above dark green, shading below into paler green and grayish with black pseudopupillae. Prothorax pale flesh brown, hind lobe brown. Mesepisternum with inner half green, outer half brown, a rich brown mesothoracic collar, continuous with narrow middorsal brown, this collar narrowly bordered in front with green; mesepimeron, metepisternum and metepimeron green; a dark brown, almost black stripe between the mesepimeron and metepisternum, and a brown stripe between the metepisternum and metepimeron. Three anterior interalar sclerites on each side and those between these, green or greenish; the others blue. Abdominal segment 1 brown, pale basally, darker apically; 2 brown above, a longitudinal middorsal green stripe wider basally and at midlength, and passing apically into a wide transverse trilobed blue band, on either side a basal spot and a median triangular spot, green; 3 and 4 with MD present, small and green; 3 with PD present and blue; 3-8 with ML present, greenish or yellowish; AL present on 3, blue, reaching the transverse carina; 8-9 with a dorsal median yellowish spot on either side.

The following notes were made on the living colors of the female taken at Cristalina. Eyes dark green, almost brown above, paler to greenish gray beneath. Dorsum of thorax green, divided in the middorsal line and bordered below with brown; the dorsal green fades out behind into a wide brown antehumeral stripe; behind this, on the mesepimeron, is a pale greenish stripe three-fourths as wide as the antehumeral brown stripe; behind the green stripe is a very distinct dark brown stripe one-third as wide as the pale stripe anterior to it. Abdomen brown, green and black markings small, not evident on 7-10.

As we observed *tenuis* at La Fria it was on the wing through the day. It frequented dense forests and was usually found hunting about, with apparently relatively weak flight and much poising, in knee-high vegetation, usually of rather thick growth. In such locations it frequently alighted on vertical stems within a few inches of the ground. In the same forest we found *Triacanthagyna ditzleri* and *Gynacantha tibiata*, *gracilis* and *membranalis*. Thinking there might be some twilight fliers, we waited one

evening, near some favorable looking openings in the forest, till it was quite dark without seeing a dragonfly. In this forest palms were dominant, with some exogens, many of large size and a few giant ceibas, and more rarely a small wild cacao, and many vines and scattered areas of heliconias of varying extent.

Material examined: *Colombia*, Cristalina, Dept. Antioquia (February 16, 1917, 1 female, E. B. W.); *Peru*, Iquitos (H. S. Parish, May 11, 1920, 1 male, E. B. W.), El Encanto, Rio Caraparana, Putumayo Dist. (W. T. M. Forbes, August 25, 1920, 1 male, Cornell); *Venezuela*, Tachira, Dept. Tachira (April 6 and 8, 1920, 2 males, 1 female, E. B. W.), La Fria, Dept. Tachira (April 12-18, 1920, 19 males, 4 females, E. B. W.); *French Guiana*, Tamanoir, Mana River (S. M. Klages, May and June, 1917, 2 males, 3 females, Acc. 6008, Carn. Mus.); in the M. C. Z. are 3 males and 3 females; one female bears the label "Essequibo (British Guiana), Schneider"; two females each bear the label "Chapada (Brazil)"; two males bear the label "America," one an additional label "Charp"; a large blue label, "tenuis, n. sp. Hagen," and a label "Gynacantha Rambur"; the remaining male has a single label "176."

Gynacantha caudata Karsch

22.

Abdomen male 40-41; hind wing male 40-41; superior appendage male 4.2-4.3; stigma front wing 3.

As compared with Karsch's description of a single male the following may be noted. Face is greenish above. Thorax very similar to that of *tenuis*, the brown outer part of the mesepisternum wider than the green inner part, and also the dark stripe between the mesepimeron and metepisternum wider than in *tenuis*. Abdomen apparently brown, extreme apex of 1-7 and 10 black; 1 with L well developed and D probably present; 2 with AD, MD, PD, AML, and PL present, AML developed basally well onto the dorsum, PD and PL narrowly separated; margins of genital fossa without spines or teeth, auricles with seven to nine denticles, the anterior ones very small, increasing in size posteriorly; 3 with AL, MD, and ML clearly present, all reduced, MD and ML joined, both narrow, probably apical spots are present in life on this and succeeding segments, but these cannot be detected on any of these segments in the single preserved specimen before me; 4-6 with AL, MD, and ML present, MD and ML separated or very narrowly joined, AL small and narrow, not produced posteriorly in its lower part; AL the only spots to be detected on 7.

Material examined: *Ecuador*, San Rafael (F. Campos R., 1 male, A. N. S.).

Gynacantha tibiata Karsch

6, 9, 10, 22, 25, 26, 27, 36.

Abdomen male 41-50, female 51-53.5; hind wing male 41-50, female 50-53; superior appendage male 5-5.4, female 7-7.5; stigma front wing 3-4.5.

This is the most brilliantly colored of the American Gynacanthas. In keeping with this it is an especially alert and wary species apparently not at all crepuscular in its habits. Dr. Calvert's male (9) was taken during the day (before 4 p. m.), and at La Fria it was observed from about 9 a. m. to 4 p. m. Several were seen but in spite of our best efforts we succeeded in taking only a single male, though two days, after the capture of this single male, were practically given to search for this species. At La Fria the heavy tropical forest north of town covered the nearly level surface in a great unbroken stretch of dense verdure. Through this forest, at the season we collected there, odonate life was widely distributed with no concentrating at suitable spots such as streams or permanent pools. When odonate life is so scattered in the temperate regions, even where agriculture or natural conditions permit easy access to all parts of the dragonfly domain, it is a matter of common knowledge that the capture of specimens is difficult or well nigh impossible. To appreciate some of our difficulties in the search for *tibiata*, instead of the varied landscape of an agricultural region with its regular fields and wood lots and its section-line roads, where the collector searches possibly in vain for *Ophiogomphus*, imagine the unbroken and unknown expanse of an almost impenetrable forest with its somber twilight and brooding silence. In such a forest we found *tibiata*. One would suddenly appear alighting on a bush twig twenty feet away. A movement would be made towards it and it disappeared as quickly as it had come. The collector resumes his aimless wandering, an hour passes before another one is seen and the experience repeated, or night may come without another one having put in an appearance. The four of us in several days saw less than a dozen specimens. At another season conditions might well be very different. When the rains have started little streams through the forest, and when some of the muddy depressions have become ponds, the capture of *tibiata* may be a less difficult matter. When we saw them they ranged freely through the forest, flying at varying heights and resting on twigs from four or five feet to ten or twelve feet high without any of the effort at concealment which Gynacantha so often shows and which Dr. Calvert has well described (9, p. 315). Sometimes at rest the abdomen was more nearly horizontal than vertical, and at such times the yellow tipped abdomen and the position strongly suggested a gomphine rather than an aeshnine.

Dr. Calvert has described the living male from Peralta, March 23, 1910, as follows: Eyes bright green above, yellowish green below, posteriorly narrowly edged with blue; three horizontal rows of pseudopupillae visible in profile view. Frons above blue on each side of the T-spot, green anteriorly, as also are clypeus, lips, basis of mandibles, thorax, abdominal segment 1, basal half of 2 and much of 3-5. Blue as follows: rear of head inferiorly, interalar region of hind wings, auricles, posterior half of 2, and each side of the base of 3, which latter merges gradually into the green. Dark brown or black as follows: rear of head superiorly, a transverse stripe just behind the auricles, and another apical one on 2, a mid-dorsal line, an apical transverse stripe, and a transverse stripe at the median carina on 3-7, and a transverse stripe at five-sixths the length on

3-6; 8 and 9 pale reddish brown with a pair of transverse green streaks near the base of each; 10 and appendages yellow; 6 and 7 are greenish anteriorly merging into brown posteriorly. Legs black, first and second femora inferiorly, and second and third tibiae superiorly, pale green. When this insect was flying the chief color effects were the green of the head and thorax, and orange at the end of the abdomen due to a blending of the red of 8 and 9 and the yellow of 10 and the appendages. It would poise in the same spot in the air for a minute or so at a time and at five to ten inches above the ground which was a somewhat muddy piece of grassy road. Twice I struck at it and came very near it, but it flew swiftly away only to a short distance, soon returning to a spot near where I had struck at it. (Many male Anisoptera, following copulation, will return to the spot where they captured their ovipositing mate, certainly associating the place with the capture, and again seeking the female there.—E. B. W.)

The following notes on living colors were made on the male captured April 13 at La Fria: Eyes bright dark green above, paler in front, bluish posteriorly (not rear of head), and gray beneath with one black and several brown pseudopupillae. Labrum almost white, face pale bluish, darkening above; frons above blue, T-spot black; rear of head above narrowly shining black, a broad black band to the foramen, remainder very light blue, darker above, white below.

Front lobe of prothorax almost white, middle and hind lobes brown, the latter narrowly green edged behind. Thorax bright green, a small brown area below on the mes- and metepimeron; middorsal carina narrowly dark reddish brown; interalar sclerites green, except the two posterior median ones and the one on either side between these two on the wing base, which four are bright blue.

Abdominal segment 1 green, light brown above on the apical half; 2 green below and beneath the auricles, above green at base, a longitudinal median bar, green in front and shading into blue behind where it passes into a broad transverse bar of blue which is bordered posteriorly with black; auricles bright blue above; above each auricle is a broad brown area not quite divided by a transverse green bar which is slightly wider above; anteriorly this brown area shades out into the basal green; (none to four small denticles in a scattering row on the converging margins of the genital fossa; auricles with five to six denticles); abdomen passing progressively posteriorly from a rich brown and bright green coloration to a dull orange color on 8 and 9, and light yellow on 10 and appendages; 3-7 with a very narrow longitudinal middorsal brown stripe which disappears progressively posteriorly; 3-10 beneath yellow; 3 on either side at base blue, remainder above green, shaded posterior to the transverse carina with light reddish brown, on either side a small triangular median and a larger rounded subapical bright green spot; 4 similar, but lacking the basal blue and the posterior brown shading more extensive; 5-7 similar to 4, the area posterior to the transverse carina brown, and therefore progressively posteriorly occupying more of each segment, all with four green spots as described for 3, except the apical spots which have disappeared on 7; 8 light

reddish brown or dull orange with only a trace of the median green spots and the apical spots wanting; sides of 3-8 light golden brown, shaded with darker and with green; base of 3 blue; a distinct green spot below, posterior to the transverse carina on 3-9, faintest on 9.

Material examined: *Mexico*, Colima (Rolle, 1913, 1 male, Ris), Cordoba (F. Knab, December 24, 1907, 1 female, U. S. N. M.); *Costa Rica*, Cimarones (C. H. Lankester, April 8, 1 male, A. N. S.), Ontario Farm (C. H. Lankester, September 16 and 17, 2 males, A. N. S.); *Venezuela*, La Fria, Dept. Tachira (April 13, 1920, 1 male, E. B. W.).

Gynacantha jessei, new species

Abdomen male 47; hind wing male 43; superior appendage male 5.4; stigma front wing male 3.6.

Male.—The following description is based on the single known specimen. Notes on living colors were made at the time of capture and these notes form the basis of the description, other notes based on the well preserved specimen being included in parentheses. Eyes above very dark blue, shading into paler dull blue at midheight, the lower third gray. Frons above light yellowish brown, T-spot large, face light greenish brown, labrum blue (labium dingy greenish yellow; labrum dingy blue at base shading out to dingy orange at the margins; anteclypeus dingy greenish yellow; face green in front, bluish on either side next the eyes; frons above and frontal vesicle black, the frons on either side with a narrow transverse blue bar, which is a dorsal continuation of the lateral blue of the face, thus forming a T-spot, with the cross-bar in the midline almost as wide as long, and a stem as wide as long; occiput small, greenish, darker in front, paler and clearer behind; rear of head pale yellowish, narrowly shining black above, and a broad band from this to the foramen).

(Front lobe of prothorax pale, middle lobe brownish, hind lobe brownish, pale margined behind.)

Thorax bright green with the following narrowly lined brown: middorsal carina, humeral and first and second lateral sutures; the lower end of the middorsal brown stripe has two cross bars of the same color, the inferior one of these is the longer and has the ends turned upward; metepimeron with the upper third blue, shading below into green; interalar spots between the front wings green, between the hind wings blue; (in the dried specimen the green and blue are fairly well preserved but the brown sutural stripes are no longer evident).

Abdominal segment 1 rich brown, apex black, on either side a subapical transverse broad green bar which ends dorsally at the point which marks the inferior termination of the posterior carina; below, the bar curves forward along the ventral margin of the segment and almost reaches the base of the segment; 2 black marked with bright blue as follows: a transverse basal ring, narrow in the middorsal line but widening rapidly on the sides and continuing with the blue on the auricles which are broadly edged with black, a median longitudinal bar, arising in the basal ring and ending posteriorly at the level of the posterior carina, a triangular spot on each

side just anterior to the median carina, and a subapical transverse band on either side (the above description of 1 and 2 applies equally well to the preserved specimen; 2 beneath, anterior to the lateral carina and the auricles largely green, auricles beneath largely black with a broad bar of blue, a dark spot on the margin of the genital fossa opposite and adjacent to the spine of the anterior lamina, margin of the genital fossa, anterior to the point of convergence, very narrowly brown and armed with a single row of seven to nine low scale-like teeth; auricles with eight denticles, the anterior ones very small, increasing in size posteriorly); 3-10 above very dark brown to black; 3 has AL blue, large and shading out above, and MD, PD, ML, and PL green and small; 4 and 5 have AL reduced and the four green spots reduced; 6-8 have AL greatly reduced to a narrow transverse basal line and PL wanting; PD is almost gone on 6 and does not appear on 7 and 8, and on these two segments MD and ML are greatly reduced; on the posterior segments spots MD, PD, and PL are green or bluish green but ML is duller being greenish or bluish yellow; 8-10 and appendages black (all the above markings are more or less discernible in the preserved specimen; beneath the abdomen is brown or yellowish brown).

(Wings hyaline, costa dark, stigma reddish brown, venation black or nearly so; anal loop short and rounded, separated from the anal triangle by two cells; one row of cells throughout between M_2 and Rs in all the wings.)

(Legs entirely black except as follows: first femora broadly green or blue behind for the entire length, and the merest streak of yellow above at the base of the middle tibiae.)

Material examined: a single male, the type, taken near Puerto Berrio, Dept. Antioquia, Colombia, January 31, 1917, by Jesse H. Williamson, for whom this beautiful species is named; specimen in coll. E. B. W. In the account of our collecting trip to Colombia (Univ. of Mich., Mus. of Zool., Misc. Publ. No. 3) on the bottom of page 13 and top of page 14, I have described the forest where this specimen was taken. J. H. W. found it hanging on a vine in the shade in this deep forest. *Jessei* is a close but very distinct relative of *tibiata*. Whether it will be found to have the wide distribution of the latter species remains to be seen. *Tibiata* has not been taken in Colombia but it has been taken in Venezuela in the nearby Catatumbo River basin and there is no reason why these two handsome species may not at some future date be found in the same forest.

Gynacantha auricularis Martin

23 (as *subviridis*), 25, 26.

Abdomen male 50-52, female 51-55; hind wing male 49-51, female 51-54; superior appendage male 5.4, female 4.2-4.8; stigma front wing 4.2-4.8.

The following notes are based on the living colors of the male taken at Palma Sola. Eyes above green, lighter than in *T. ditzleri* and *T. caribbea*, shading out into lighter brighter green in front and below into light greenish yellow with three or four large brown pseudopupillae. Rear of head

pale flesh, narrowly black above, with an irregular black bar to the foramen. Prothorax flesh or very light brown, hind lobe darker. Thorax above green, a narrow interrupted half collar of light yellowish green, bordered above with a brown transverse stripe three or four times as wide which is narrowly continued up the middorsal carina to spots below the antearlar sinus; on either side a broad indefinite brown antehumeral stripe which fades out above in the green, and is darker below; mesepimeron light greenish brown, greener above, shading out to brown below; metepisternum and metepimeron pinkish flesh brown, traces of green about the stigma; beneath the same pinkish flesh; sclerites between front wings bright grass green, between hind wings brilliant evanescent blue. Abdominal segment 1 flesh, apical third or half brown above; 2 brown above, a narrow longitudinal median green line which passes posteriorly into a broad blue subapical ring, the extreme apex black; basally a narrow transverse green line on either side, widely separated from the median green line; posterior to mid-length on either side a narrow transverse green stripe or line, narrowly bordered black, and less widely separated than the basal lines from the median line; auricles bright blue above, edged with black (margins of genital fossa without denticles or spines; auricles with seven to nine denticles, with several long black hairs on the dorsal surface near or between the basal teeth); 3 with a large lateral basal blue spot on either side, and traces of pale light brown spots at the transverse carina, base and apex shaded into darker brown; 4 brown, shading into darker at base and apex, a minute green spot on either side at the transverse carina; 5-7 brown, shading into darker apically and a darker line at the transverse carina; 8 and 9 slightly darker brown; 10 slightly paler than 8 and 9 except at apex; at the transverse carina, on either side of 8 trace of a pale spot.

Female abdominal appendages narrow, of nearly uniform width throughout, about .5 wide, narrowed on the inner margin in the basal seventh, the apical seventh tapering to the acute apex, the tapering mostly on the inner edge, the outer edge being relatively straight throughout the length of the appendage.

Aeschna viridis Rambur was described from a single male with the last seven abdominal segments gone, and "sans indications de patrie." De Selys (Rev. des Od.) stated that it is an exotic species very different from *A. viridis* Eversmann, but there is nothing to indicate that de Selys regarded it as a *Gynacantha*. The next mention of the species is by Kirby (23) who records specimens from Para and Tapajos, referring them to *Gynacantha*. At my request these specimens were studied by Mr. Champion who kindly sent me one for study. He reports that there is no reason to think any of these specimens were ever seen by de Selys. The male loaned me by Mr. Champion is *G. auricularis* Martin. If it should be shown that these specimens in the British Museum, or any of them, had been compared with Rambur's type, now lost (Martin, 25), and determined by de Selys as *subviridis*, then *auricularis* would become a synonym. However the description of *subviridis* (*viridis*) seems to exclude this identification and we have in addition Mr. Champion's opinion that de Selys never saw the Para and

Tapajos specimens in the British Museum. The last opinion, that of Ris (36), that *subviridis* is a synonym of *Coryphaeschna luteipennis* is as plausible as any. With the loss of the imperfect type, which lacked a locality label, further discussion of the application of the name is futile.

The only *auricularis* we saw alive came flying down a little creek near Palma Sola at the noon hour, circled once or twice the little pool at the edge of which we were seated eating our lunch, and then alighted on some small tree rootlets on the underside of an overhanging washed out creek bank. Here it was impossible to use a net and the dragonfly was carefully stalked and caught in the fingers.

Material examined: *Costa Rica*, probably Ontario Farm (C. H. Lankester, September 18, 1919, 1 female, A. N. S.); *Venezuela*, Palma Sola, Dept. Falcon (March 6, 1920, 1 male, E. B. W.); *British Guiana*, Bartica (H. S. Parish, May 21, 1901, 1 male, O. S. U.); *French Guiana*, Pied Saut, Oyapok River (S. M. Klages, Nov., 1917, 1 male, Acc. 6111, Carn. Mus.); *Brazil*, Para (C. F. Baker, 1 male, 1 female, U. S. N. M., 1 female, E. B. W.), Val del Can, Para (Hagmann, May 19, 1901, 1 female, Ris), Chapada (Gyn. "t," number 195, 1 male, M. C. Z.), Tapajos (1 male, British Museum, determined by Kirby as *subviridis*).

Gynacantha klagesi, new species

Abdomen male 47-49, female 50; hind wing male 47-48, female 50; superior appendage male 6, female 5.4; stigma front wing 3.6-3.9.

Male.—Labium yellow, greenish at the side; face green, yellowish below and against the eyes, darker above; frons above brown in front for more than half its length with a brown bar to the black frontal vesicle, the pale area on either side of the bar light greenish gray; occiput green or yellowish; rear of head yellowish, narrowly shining black above, with a broad bar of brown or black down to the foramen.

Prothorax light brown, posterior border green.

Thorax bright green above, middorsal carina and margins of the antealar sinus black or brown, the carina narrowly bordered on either side with brown; a short, broad antehumeral stripe or area occupying the outer half and lower two thirds of the mesepisternum, darkest along the anterior edge parallel to the carina, and shading out on all the other edges; sides of thorax bright green, a pale brown line on the humeral suture, a short brown line above on the first lateral and a darker brown line on the second lateral suture. Interalar wing spots green anteriorly and blue posteriorly; spots beneath the front wings green, beneath the hind wings blue and yellowish. Beneath pale flesh.

Abdomen brown to black, the apical segments darkest; 1 brown, L large, yellow, shading into blue above, D apparently not present, extreme apex dark to black; 2 with AML yellow below and blue above, auricles below bright yellow with greenish shadings, above blue, broadly surrounded with dark brown or black, the blue not continuous with AML; AD and MD narrow, green in color, the latter apparently continuous into PD which is joined with PL to form a broad blue transverse bar; transverse carina and

extreme apex black; nine to twelve scale-like teeth in a single row on the posterior half of the converging margins of the genital fossa; eleven to fourteen denticles on the auricles, the most anterior ones the smallest, increasing in size posteriorly, the posterior five or six about equal in size; 3 with AL blue, MD and PD small, apparently green in life, no other spots evident in the preserved specimen; AL and MD small but present on 4-8, ML not quite so plain but fairly distinct traces of it in all of the same segments; 9-10 and appendages dark to black; 3-7 light brown beneath, each segment darker at apex; 8 pale beneath, apparently light green in life.

Wings hyaline, costa dark brown, stigma brown surrounded with darker veins, venation black or nearly so; one row of cells throughout between M_2 and Rs; in the four front wings examined the loop in M_4 is single rowed between M_3 and M_4 in two wings and with a single double cell in the other two wings; in the four hind wings likewise the loop is single rowed in two wings and with a single double cell in the other two wings.

Legs light reddish brown; first femora darker, especially at apex, and with a broad green or gray stripe behind; second and third tibiae yellow dorsally.

Female.—The single specimen is not fully matured and the color is not well preserved. The head is similar to the male. The prothorax and thorax are faded to a uniform unmarked light reddish brown. Abdominal segment 1 brown, darker above posteriorly, apically ringed with black; 2 with only MD, PD and PL evident, the first apparently green, the last two clearly blue, but the abdomen is too faded to determine the color pattern certainly; it probably does not differ materially from the male. However AL can be discerned on 3-8, and MD and ML on 3-7; as in the male PD, if present in life, has disappeared due to postmortem changes. The lateral carina on 2 is black and at the level of the transverse carina is elevated in the nearest approach to an auricle attained by the female of any American Gynacantha. The ventral carina on the same segment is also characteristically curved at its posterior end in a manner suggesting the form in the male. At the anterior end of the ventral carina and just above it is a brown spot.

The abdominal appendages are linear to about five-ninths the length, where they widen slightly in a symmetrical expansion which tapers symmetrically to a rather abruptly acute apex; the expanded portion with a maximum width of about .5 and with a low median dorsal longitudinal keel.

Wings similar to the male, stigma paler, due doubtless to less mature condition; one row of cells throughout between M_2 and Rs; in both front wings and one hind wing the loop in M_4 is single rowed between M_3 and M_4 , and in the other hind wing there is one double cell and one forked cell. Legs as in the male.

Material examined, *French Guiana*, Tamanoir, Mana River (S. M. Klages, May and June, 1917, 2 males, 1 female, Acc. 6008, Carn. Mus., type male, June and allotype female, May). This fine species is named for S. M. Klages, whose collections have added much to our knowledge of neotropical insects.

Gynacantha ercagris Gundlach

II.

Abdomen male 43-44.5, female 45-46; hind wing male 42-43, female 43-46; superior appendage male 6; stigma front wing 3.5-4.

The above data is from Calvert. I have seen no additional specimens and have nothing to add to his discussion of this species. It has been taken only in Cuba and the Bahamas.

Gynacantha mexicana Selys

6, 10, 25, 26.

Abdomen male 49-52, female 49-51; hind wing male 46-48, female 47-50; superior appendage male 6-6.6, female 7.5-9; stigma front wing 4.6-5.1.

Wings hyaline to brown tinged, slightly to distinctly brown at base between C and R+M, darker between Sc and R+M, as far as or slightly beyond the first antenodal; more or less distinctly yellowish between Sc and R+M to the nodus, and between C and R beyond the nodus; this longitudinal stripe usually most evident in wings otherwise hyaline, but even in some hyaline wings no trace of it exists.

In the male there are nine to fifteen scale-like teeth in a row on the ventral carina of segment 2 anterior to the convergence of the margins of the fossa, and teeth are absent or there may be as many as five on the prominence, near the apex of the segment, where the lateral and ventral carinae meet. There are four or five denticles on each auricle. The abdominal appendages of the female have the outer edge relatively straightened and the inner curved, the widest point slightly distal to the middle, so the basal half of the appendage is more tapering than the apical half; a very faint longitudinal median dorsal carina; maximum width 1.5; extreme apex acute. The appendage is thus distinctly different from such other species as *nervosa* and *interioris*.

The following notes on living colors were made from specimens collected at Bejuma and Palma Sola. Male.—Eyes above dark brown (or dark green), almost black, with a small (or large) green reflecting area in front on either side, which green area may be wanting in the female; below light brown (with a slight yellowish cast), with one large black and about five dark brown pseudopupillae; rear of head pale dull yellow, narrowly black above, with a broad band of black to the foramen.

Prothorax light flesh brown, middle lobe with a bluish cast. Thorax above bright (or dull) olive green, clouded with brown; a narrow rich brown mesothoracic half collar which is bordered below by a slightly narrower, narrowly interrupted, bright yellowish green half collar; above the brown half collar the thoracic green is brightest and clearest, and on its outer edges are traces, more or less, of a dorsal brown stripe which is definite only opposite and immediately adjacent to the green; mesepimeron above green, below brown; metepisternum brown, restricted green above; metepimeron

brown, a trace of yellow at the extreme upper edge; four spots on the side and a latero-ventral stripe black; sclerites between wings bright blue (or those between front wings green).

Abdomen reddish brown, 1 paler with an apical narrow transverse blue bar, bordered very narrowly behind with black; 2 with a similar wider blue bar (PD) and narrow green MDs, black bordered behind, reaching or not to the auricles which are brown, edged with black; 3 with AL small, blue; 3-8 with MD and PD present and small, green in color, smaller and paler progressively posteriorly, PD on 7 and MD and PD on 8 yellowish, 9 with PD only; 3-8 and 10 each with extreme apex black ringed; 3-7 each narrowly black edged on the lower lateral margin, PL more or less distinctly present.

Female similar, only slightly duller, thorax above lighter, and AL, MD and PD on 3-7 light dull yellow (probably green in some cases).

In flight and environment this species so far as I have observed resembles *G. nervosa* though it is possibly more wary and slightly more erratic. A Georgetown I took a single female flying alone at twilight in the Botanical Gardens. At Bolivar it was flying at twilight with other species. At Palma Sola it flew along the railroad tracks in the evening with *G. nervosa*. Between the northeastern part of the town of Bejuma and the river, so called, lying to the north are a number of artificial depressions, some with shallow pools of water, formed by excavations for clay. There is no adjacent native forest, but there are scattered low bushes, and, at short distances, some trees along the river and in nearby coffee plantings. The mud about the pools is irregularly roughened by the sharp hoofs of visiting burros, and in their deep tracks we found the females of *mexicana* ovipositing. Yellow breasted flycatchers, resembling kiskeedees, at dusk from nearby bushes watched the pools for the dragonflies. No attempts were made by the birds to capture the swift flying males but when a female alighted and descended into one of the burro tracks there was usually an observant bird ready to take advantage of her helpless position. Alighting over the depression the bird seized the dragonfly at her work several inches below the surface. No other species of *Gynacantha* was found at these clay diggings. Along the grade for the railroad Y at Fundacion are a number of shallow, muddy pools formed by excavations for the railroad grade. Here we found *mexicana* flying at dusk, coming from over the adjacent pastures to patrol the pools, returning again to the wider range of pastures.

Material examined: *Colombia*, Bolivar, near Santa Marta (December 21 and 24, 1916, 3 females, E. B. W.), Fundacion, Dept. Magdalena (January 9 and 10, 1917, 2 males, 1 female, E. B. W.), *Ecuador*, San Rafael (F. Campos R., 1 male, 1 female, A. N. S.), Babahoyo (F. Campos R., 1 male, A. N. S.); *Venezuela*, Palma Sola, Dept. Falcon (March 7-10, 1920, 5 males, 3 females, E. B. W.), Bejuma, Dept. Carabobo (February 12-23, 1920, 7 males, 5 females, E. B. W.), El Guayabo, Dept. Zulia (April 20, 1920, 1 female, E. B. W.); *British Guiana*, Georgetown (February 18, 1912, 1 female, E. B. W.); *Brazil*, Para (C. F. Baker, 1 male, E. B. W.).

Gynacantha nervosa Rambur

6, 7, 11, 12, 19, 20, 23, 25, 26, 31, 35, 36.

Abdomen male 50-54, female 52.5-57; hind wing male 47-54, female 52.5-56; superior appendage male 6.5-7.5, female 5.4-6.3; stigma front wing 4.5-5.7.

Wings hyaline to brown tinged; in some cases, and this seems especially true of tenerals or younger individuals, irrespective of locality, there is a faint yellowish longitudinal stripe, which suggests the wing coloration of *bifida*, but in such specimens of *nervosa* the yellow line is not darkened and more conspicuous basally as it is in *bifida*.

The margins of the genital fossa of segment 2 in the male are armed on each side, anterior to the point of convergence, with eleven to nineteen scale-like denticles, mostly in a single row, about twelve being the most usual number; and the auricles are armed with five to eight denticles, five or six being the usual number. The female abdominal appendages are linear at the base, the apical third or more slightly widened, suggesting in a way a modified male appendage of this group; the expanded portion with a dorsal median longitudinal carina or low keel; maximum width .6; extreme apex acute.

Dr. Calvert has kindly furnished me with notes on living colors of two Costa Rican males. Where these descriptions are not in accord the differences shown are indicated in parentheses. Eyes olive green above, very pale brown below (dark brown above, bordered anteriorly with a line of pale green, below which the eye is pale brown) with distinct black pseudopupillae; face and lips very pale brown; frons superiorly pale green with a black T-spot; vertex black with a pair of very small greenish spots; occiput pale bright green; rear of head very pale green, eye margins black. Dorsum of thorax pale green, sides with some green but mostly (also pectus and legs) pale brown (most of sides of thorax and pectus very pale lilaceous). Dorsum of abdomen dark brown with small (pale) green dorsal spots (or transverse lines) as follows: a dorsal apical transverse green stripe on 1; a middorsal longitudinal green line on 2; three transverse stripes, all interrupted middorsally, at anterior end, middle, and posterior end of 2; 3-8 similar to 2, lacking the longitudinal green stripe, but the transverse stripes mere lines, the middle stripe at the transverse suture (the apical spots or interrupted stripes absent or almost so on 7 and 8); 9 with (without) apical spots; 9 and 10 with (without) traces of the anterior spots; ventral surface of abdomen pale lilaceous (probably usually brown, E. B. W.); a pale brown longitudinal stripe on ventral part of each tergite of 2-8.

The following notes were made on living colors of specimens taken at Palma Sola. Male.—Eyes above dark green, a blue transverse line in front on either side, shading below into pale yellowish brown with six to eight or more brown pseudopupillae; rear of head narrowly black above, remainder light dull yellow. Prothorax flesh colored, middle lobe brown. Thorax above with a very narrow light yellow mesothoracic collar, this collar bordered above and below with light reddish brown, dorsum green, rather dull, indefinite antehumeral brown areas fading out above; mesepimeron and

metepisternum brown, greenish above, metepimeron paler; sides of thorax with small distinct brown or black spots; beneath light flesh brown, whitish; interalar spots green. Abdomen brown; 1 pale at base with a brown basal spot above on either side and a narrow subapical bluish green transverse band, the extreme apex black; 2 with a widely interrupted narrow transverse basal green band, a less interrupted oblique green band at the transverse carina, which carina is black, a wider uninterrupted but narrowed, subapical blue band, the extreme apex black, and a narrow longitudinal median green stripe which posteriorly passes into the apical blue; (J. H. Williamson noted on a Palmdale, Florida, male: spots between wings and on basal abdominal segments, green); auricles above bluish gray, edged black; 3-8 each with a very small basal spot on either side, minute on 7 and 8; 3-9 each with a small triangular spot on each side at the transverse carina, these spots basal on 9; 3-8 and 10 narrowly black at apex, 10 with a small basal median spot; lower lateral margins of 3-9 pale, this pale area interrupted on each segment at the transverse carina and by a downward projection of the dorsal brown between the transverse carina and the apex, thus dividing the pale lateral area of each segment into three areas or spots, the posterior one of these areas becomes progressively smaller posteriorly and wanting on 6 and posterior to that segment. Female.—Similar to male but duller; lower lateral edge of abdomen paler, the posterior one of the three pale areas on each segment present on 3-7, and the sides below of 8-10 largely pale.

The following less detailed notes were made from slightly teneral males taken at Santa Marta: eyes above and thorax above greenish brown; narrow obscure short brown thoracic stripes on mid-mesepisternum; thorax below and behind brown; wing bases and markings on 1 and 2 blue. Abdomen clove brown, markings black and light dull yellow. And of an adult male taken at Bolivar I have the following note: thoracic dorsum greenish brown, sides light brown; abdomen darker brown; 1 and 2 marked blue, other segments marked black and yellowish.

G. nervosa seems essentially crepuscular in its flight. Where the species occurs abundantly the numbers on the wing and in sight at once, the mobile active flight, and the rapidly coming darkness of the tropical night combine to form a scene to fire the imagination. The collector has spent the day in the forest closely surrounding the little village of thatched huts which he knows as "home," and among the hundreds of dragonflies flying about woodland pools and streams no *nervosa* have been seen. At sundown, muddy, wet and tired he returns home. Suddenly a large brown dragonfly goes with undulating flight down the village path before him. In a bit of near-by garden another with lower more direct flight appears. Then three or four are seen circling about a thatched hut and at once the garden and path are alive with interweaving forms and the flight is on. They come from everywhere, the air is filled with them, some fly erratically, others patrol regular beats, apparent spots of greater density lure the collector from one point to another. As suddenly as they appeared, only a few are seen, and then they are gone, and the disappointed collector with possibly only two or three specimens in his bottle, realizes that the twenty to thirty

minute flight is at its end, and that he will not see *nervosa* again for twenty-four hours.

That the flight is not always confined to the evening however is shown by a note by Klages at Cayenne, French Guiana: "Flies at dusk and at dawn only; captured in mangrove swamp." Neither is the flight confined to villages, but so far as I have observed numbers are found only about clearings or extensive open places, and it is probable that in such places, in proximity to houses, cattle, grasses and freshly hewed timbers, *nervosa* finds its most abundant food supply. Abundance of food supply may be a factor in determining the number of flights in each twenty-four hour period or the amount of activity during the day. The number of specimens recorded below from Cayenne, where two flights a day were observed, and from Palma Sola, where there was a single flight, may possibly indicate a difference in abundance of *nervosa* on the wing and a difference in the abundance of the food supply. In dark places in the forest with presumably different insect prey one might expect to find *nervosa* on the wing throughout the day and our observations seem to bear this out. In the forests about Palma Sola, where most wonderful evening flights occurred, the four of us, ranging the forest every day, never saw a *nervosa* till the evening flight began. At Puerto Berrio, where we did not see *nervosa* about the town, we took a single male at 9 A. M. one day flying in brush in dark forest about five kilometers from town. J. H. W. noted at Palmdale, Florida: *nervosa* found in darkest part of cypress grove in creek bottom, flying about bases of trees, or hanging up from three to five feet above the ground. As might be expected from its habits at certain times and places of flying closely about buildings, *nervosa* occasionally and apparently accidentally, enters such buildings and is rarely entrapped and captured there.

At Cristalina, Colombia, about noon one day I saw a *Gynacantha* fly out from some brush far ahead of me along the creek. It fluttered along in a helpless manner and in attempting to return to the brush, fell into the water from which I picked it. It was a male of *G. nervosa* and on the dorsum of abdominal segments 2 and 3 were six small white eggs. This specimen was sent to Miss Currie at Washington, and the eggs were identified as those of some diptera, apparently a tachinid. There is no previous record of tachinids being parasitic on dragonflies. The same day another *nervosa*, apparently ill also, was seen fluttering through the brush with hanging abdomen, but I lost sight of it and did not capture it. A male, also taken at Cristalina, had in its mouth an insect identified by Mr. McAtee as a cicadellid.

I have observed *nervosa* ovipositing on two occasions. At Maraquita, Colombia, at the edge of town there was a much used water tap, the overflow water being drained in an artificial ditch with steep dirt sides. About 6 P. M. several females were observed ovipositing in the soil on the banks of this ditch. In Trinidad a female was taken about noon ovipositing in the damp but hard earth of a wet-weather stream bed in low forest. *Staurophlebia* in larger numbers were ovipositing at the same place.

Material examined: *California* (1 female, A. N. S.); *Florida* (W. H. Finn, Coll. C. V. Riley, 1 male, U. S. N. M.), (1 female, A. N. S.), Paradise Key, Everglades of Dade Co. (C. A. Mosier, November, 1917, 1

male, U. S. N. M.; shot in dense hammock 18 miles S. W. of Paradise Key, H. S. Barber, March 11, 1917, 1 female, U. S. N. M.), South Jacksonville (W. T. Davis, November 3, 1911, 2 females, W. T. D.), Lakeland (W. T. Davis, November 8, 1911, 2 females, W. T. D.), Punta Gorda (W. T. Davis, November 15, 1911, 1 female, W. T. D.), Gulfport (G. A. Reynolds, June, 1914, 1 male, Ris), Palmdale (J. H. Williamson, April 5, 1921, 3 males, 1 female, E. B. W.), St. Petersburg (Mrs. Chas. C. Deam, October 6, 1907, 1 male, E. B. W.), Miami (S. N. and M. C. Rhoads, January 16-24, 1899, 3 males, 2 females, E. B. W.); *Guatemala*, Santa Lucia (February 1, 1905, 1 male, 1 female, E. B. W.); *Costa Rica*, Liberia (J. F. Tristan, room in schoolhouse, January 12, 1910, 1 male, A. N. S.), Caché (C. H. Lankaster, caught in office, March 19, 1910, 1 female, A. N. S.); *Canal Zone*, camp at Empire (Lieut. G. C. Dunham, 1917, 1 female, U. S. N. M.); *Colombia*, Puerto Colombia, Dept. Bolivar (December 11, 1916, 1 male, E. B. W.), Santa Marta, Dept. Magdalena (December 13-16, 1916, 4 males, E. B. W.), Bolivar, near Santa Marta, (December 21-26, 1916, 2 males, 4 females, E. B. W.), Don Diego, 100 ft., and Bonda, 250 feet, Dept. Magdalena (H. H. Smith, 1 male, 2 females, Carn. Mus.), Rio Frio, Dept. Magdalena (January 7, 1917, 1 female, E. B. W.), Fundacion, Dept. Magdalena (Jan. 9 and 13, 1917, 1 male, 1 female, E. B. W.), Puerto Berrio, Dept. Antioquia (February 21, 1917, 1 male, E. B. W.), Cristalina, Dept. Antioquia (February 11-20, 1917, 20 males, 9 females, E. B. W.), Maraquita, Dept. Tolima (February 4 and 5, 1917, 2 females, E. B. W.); *Ecuador*, Babahoyo (F. Campos R., 1 male, 3 females, A. N. S.), Guayaquil (F. Campos R., 4 males, 2 females, A. N. S., 2 males, 1 female, Ris); *Bolivia*, Province del Sara, Dept. Santa Cruz, 350-450 meters (José Steinbach, 1 male, 3 females, Accs. 5076, 5574 and 6443, Carn. Mus.); Puerto Suarez (José Steinbach, November, 1908-January, 1909, 1 female, Acc. 3842, Carn. Mus.); *Venezuela* (Appun, 1 male, M. C. Z.), Palma Sola, Dept. Falcon (March 4-10, 1920, 4 males, 13 females, E. B. W.), La Fria, Dept. Tachira (April 12-16, 1920, 7 males, 4 females, E. B. W.), Tachira, Dept. Tachira (April 10, 1920, 1 female, E. B. W.); *British Guiana*, Rockstone (February 1, 1912, 1 female, E. B. W.); *Dutch Guiana*, Paramaraibo (K. Mayo, 1 male, A. N. S.); *French Guiana*, Cayenne (S. M. Klages, March, 1917, 3 males, Acc. 5897, Carn. Mus.), Tamanoir, Mana River (S. M. Klages, May, 1917, 2 males, Acc. 6008, Carn. Mus.); *Brazil*, (1 female labelled "Mus. Berol," and "robusta," M. C. Z.), Chapada (1 male, M. C. Z.), Cachoeira (1 female, M. C. Z.); *Trinidad*, Baracon, Chaquanas (March 7, 1912, 1 female, E. B. W.); *Cuba* (Poey, 1 female, M. C. Z.), S. Diego d. l. Banos (Palmer and Riley, April, 1 male, U. S. N. M.); *Haiti*, Samana (Frazar, 1 male, M. C. Z.); *Jamaica* (C. W. Johnson, 1 female, A. N. S.).

Gynacantha bifida Rambur

5, 6, 25, 26, 31, 33, 35, 36, 39.

Abdomen male 51-52, female 53-54; hind wing male 51-52, female 54-55; superior appendages male 7.2, female 6; stigma front wing 5.1-5.7.

In the male there are eleven to thirteen scale-like teeth in a single row on each side of the converging margins of the genital fossa of the second

abdominal segment. The auricles are armed with five to seven denticles. The female abdominal appendages are narrow, slightly widening on the inner edge from the base to about two-thirds the length where the maximum width is about .6; the median keel on the apical third low and inconspicuous; apical third tapering symmetrically to the apex, with the extreme apex acute.

Dr. Ris (35) has studied this species carefully and places *G. robusta* Kolbe as a synonym.

Material examined: *Brazil* (through Scheider, Berlin, 1 female, Ris), Minas Geraes (Rolle, 1914, 1 female, Ris), Bom Jesus de Itabapoana, Rio Janeiro (Zikàn, January 21, 1905, 1 female, Ris), Salto Grande, Rio Paranópanéma, Sao Paulo (J. D. Haseman, October 21, 1908, 1 male, Acc. 3202, Carn. Mus.), Porto Catherina de Santa Leopoldina (2 males, E. B. W.); *Argentina*, Yuto, Jujuy, 450 meters (Joergensen, April, 1911, 1 male, Ris).

Gynacantha croceipennis Martin

5, 24, 25, 26, 36.

Abdomen male 55, female 60; hind wing male 54, female 57; superior appendage male 7; stigma front wing 6.

I have seen only the material from Peru and Bolivia in Dr. Ris' collection, carefully studied by him (36). The young female from Pozuzo is the only Peruvian specimen; it is smaller than the others, abdomen 55 and hind wing 55 (not 52, as stated). Teneral specimens of *bifida* sometimes show some yellowing of the wings and it is not impossible that large series of *bifida* would show that species to be as variable as *nervosa* is known to be in this character. The same thing may be true of all the *nervosa* group, including *interioris* to which species I am inclined to refer this Pozuzo female, though I have seen no other specimens referred to that species as darkly tinged as the Pozuzo female. The specific distinctness of *croceipennis* is open to serious question. In the males, wing color, a dubious character in this connection, alone separates it from *bifida*; and in the females the same unreliable character alone separates it from *bifida* and *interioris*. At the same time but little material is known and better characters may be discovered later. Because of its geographical range and the greater elevation at which it occurs as compared with *bifida*, the name should stand for the present, though it is not improbable that a condition analogous to that found in certain species of Hetaerina is duplicated here, for we know some Hetaerinas of wide range, which, in the mountains, attain a size and a depth and extent of wing coloration unrivalled by the same species in lower situations.

Gynacantha litoralis, new species

Abdomen male 50; hind wing male 48; superior appendage male 6.6; stigma front wing male 4.8.

Male.—Labium and face pale yellowish brown; frons and frontal vesicle black, a pale brown median transverse bar on either side of the frons, wider than in *interioris*, and with its fellow of the opposite side defining a con-

spicuous T-spot; occiput yellow or greenish yellow; rear of head as in *interioris*.

Prothorax and thorax as in *interioris*.

Abdomen faded, apparently similar to that of *interioris* but darker, so the lateral carinae on 4-7 are not conspicuously darker than surrounding areas; the four lateral brown spots on 2, described in *interioris*, not as distinct as in that species; auricles each with six denticles; about ten scale-like teeth in a single row on each side of the genital fossa anterior to the point of convergence; PL apparently wanting on 5-7 and other lateral spots apparently reduced on these segments, but these details cannot be certainly determined from the dried specimen. Appendages brown.

Wings slightly clouded at the extreme base, costa and stigma light yellowish brown, the end and posterior veins of the latter darker; venation generally a light reddish brown, giving the wing a ruddy appearance at certain angles.

Legs similar to those of *interioris*, the tarsi less darkened apically.

The following notes were made on the recently captured male: Eyes above dark green, blue across the middle at the level of the frons, below drab. Dorsum of thorax pale green over a limited area, shading out above and laterally, sides dark flesh or light brown with shadings of green beneath the wings; spots between front wings green, between hind wings blue. Abdomen dark brown, nearly black, 1 and 2 paler, (sub) apical blue rings on 1 and 2 and an interrupted basal blue ring on 3; dull drab lateral spots on 3-9; beneath pale brown, darkest on 4-6. Flying at twilight along a dry ditch near the botanical gardens.

Dr. Calvert has seen the single male and in his opinion it represents an undescribed species. He compared it with *ereagris* which has simpler venation and superior appendages less widened apically.

Material examined: *Dutch Guiana*, Paramaribo (February 22, 1912, a single male, the type, E. B. W.).

With some question I have referred also to this species two males and two females from Manaos, Brazil, collected by Miss H. B. Merrill, and in the U. S. N. Mus. One of these specimens bears the following note: Lake near Manaos, Santa Maria, February 22, 1908; first three segments of abdomen with spots of sky blue; eyes blue; sides of thorax green and brown; abdomen brown.

In general appearance these four specimens are strikingly different from the type from Paramaribo, but I have found it impossible, with the limited material, to satisfactorily separate them. The Brazilian specimens are larger; abdomen male 53, female 56; hind wing male 52, female 55; superior appendages male 6.7; stigma front wing 5.4-5.6; and the wing venation is much more complex. For example, in addition to characters indicated in the tabulation of venational characters, in the Brazilian specimens there are two rows of cells between M_2 and Rs adjacent to the forking of Rs; in the type there is one row of cells throughout between M_2 and Rs. In the Brazilian specimens, moreover, the wings of all are uniformly brown-tinged throughout and the veins are dark colored. To this character and to the larger size are due the striking dissimilarity in general appearance of the

specimens from the two localities. At the same time the differences in complexity of venation, the coloring of the wings and the size offer no specific characters and I have been unable to detect others.

Gynacantha interioris, new species

Abdomen male 54-56, female 54-57; hind wing male 51-52, female 54-56; superior appendage male 7.2-8.1, female 7.5; stigma front wing 5.4-6.3.

Male and female.—Labium and face pale yellowish brown; more or less darker above; frons above and frontal vesicle black, a pale brown median transverse bar on either side of the frons which thus, with its fellow of the opposite side, defines a large conspicuous T-spot; occiput greenish yellow; rear of head light brown or yellowish brown, above narrowly shining black adjacent to the eyes with a brown or black bar to the foramen.

Prothorax light brown, the middle and hind lobes indefinitely shaded with brown, the front lobe almost white.

Thorax brown, darker to almost black with or without greenish reflections on the middorsum; metastigma surrounded with black, a small brown spot above it, another brown spot on the mesepimeron at the upper end of the second lateral suture, and a more or less distinct spot posteriorly on the latero-ventral carina.

Abdomen brown; 1 with a subapical dorsal transverse blue bar, bordered behind and below with black; 2 with AD the length of the segment, and MD and PD present, apparently all blue in life, sides obscure brown, bright colors not evident in dried material, in the male a brown spot just above the auricle near its middle, a round spot posterior to this a distance slightly more than the diameter of the anterior spot, a brown area below this posterior spot in the angle of the auricle, and a brown spot near the ventro-anterior margin of the segment; auricle blue above, black edged, armed with five to eight denticles; the ventral margin of the genital fossa, anterior to the point of convergence, armed with a single row of eleven to thirteen scale-like teeth; 1-8 narrowly black ringed at apex; 3-8 with MD and probably ML present on all, and 3-7 apparently with AL, ML and PL present on each, ML especially large and distinct; in life these spots are probably greenish yellow or, in the case of the lateral spots, yellowish; lateral carina black on 4-7; appendages brown or black. Appendages of female, narrow at base, slightly more than the apical half expanded, suggesting a modified male appendage of this group, expanded portion with a dorsal median longitudinal carina or low keel; maximum width .8-.9; apex tapering, acute.

Wings hyaline to brownish tinged, with a longitudinal dark stripe, especially conspicuous in the hyaline wings. Costa light yellowish brown; the stigma the same color, darker above, the enclosing end and posterior veins black; venation black or nearly so.

First femur dark brown, shading to black at apex, a broad pale stripe behind; second and third femora pale reddish yellow; tibiae and tarsi pale yellow, paler than the second and third femora, the tarsi dark to black at the apex adjacent to the dark reddish brown tarsal claws.

J. H. W. noted of the male taken by himself on June 6 at Campamiento, Colonia del Perené, elevation 680 meters: Twilight flier at the crossing of the trail and Quebrada Repressa, 5:50 P. M., rare and difficult to catch. The female we took at Tachira, elevation 364 meters, was flying erratically along the railroad track when it was nearly dark.

Material examined: *Venezuela*, Tachira, Dept. Tachira (April 10, 1920, 1 female, E. B. W.); *Peru*, Campamiento, Colonia del Perené (J. H. Williamson, June 4-6, 1920, 3 males, 1 female, E. B. W.), San Ramon (J. C. Bradley, June 16, 1920, 1 female, Cornell), Yurimaguas (H. S. Parish, April 3, 1920, 1 female, E. B. W.); *Brazil*, Santarem (S. M. Klages, May, 1919, 1 female, Acc. 6324, Carn. Mus.). Type male and allotype female, Campamiento, Peru, June 5 and June 4, 1920, respectively, E. B. W. For a possible additional record see text under *croceipennis*.

Gynacantha gracilis Burmeister

3, 6, 8, 9, 10, 11, 20, 25, 26, 38.

Abdomen male 60-62, female 58-62; hind wing male 57-62, female 57-63; superior appendage male 6.4-8.2, female 8.2-9.4; stigma front wing 5-6.2.

Female appendages with the outer edge relatively straight, inner edge widening from the slender base to about two-thirds the length of the appendage where the maximum width is about 1 or 1.1, from which it tapers gradually to the acute apex; a low median dorsal longitudinal carina is more or less evident.

The following notes on living colors were kindly given me by Dr. Calvert: Male, forest near highest reservoir, upper Banana River, Costa Rica, November 9. Eyes ranging from blue above through green adjoining the genae, yellow to reddish brown along the postero-inferior margin. Frons brown with a superior black spot; nasus olive; labrum and external surface of mandibles yellowish; labium pale brownish green. Thorax chiefly grass green with an ill-defined brown antehumeral stripe, a narrow brown stripe on the second lateral suture, and a superior brown stripe on the metepisternum; pectus pale brown. Abdominal segment 1 luteous with a posterior dorsal blackish spot; 2 dark reddish brown, a middorsal line, a transverse median line and a posterior transverse stripe blue, and all interrupted; auricles blue above, black margined; 3-10 dark brown, almost black; 3 flesh colored laterally on the basal two-thirds, with a basal blue spot on each side; a fainter blue spot just posterior to the median transverse carina on each side of 3-8, becoming fainter on each successive segment; ventral surfaces of 3-10 pale reddish brown with a trace of blue near the middle of each. Legs dark red, knees and tarsi black.

Material examined: No locality (Mus. Berol., 1 female, M. C. Z.); *Costa Rica*, probably Ontario Farm (C. H. Lankester, September 15 and 18, 1919, 1 male, 1 female, A. N. S.); *Ecuador*, Quevedo (F. Campos R., 1 female, A. N. S.); *Bolivia*, Rio Yapani, 650 m., Dept. Santa Cruz (José Steinbach, 1914-1915, 1 female, Acc. 5574, Carn. Mus.); *Venezuela*, La Fria, Dept. Tachira (H. B. Baker, April 12, 1920, 1 male, E. B. W.); *British Guiana*, Kartabo, Bartica Dist. (W. T. M. Forbes, October, 1920,

2 males, one "in shady path," Cornell); *Dutch Guiana* (Mus. Berol., 1 male, M. C. Z.); *Brasil*, Tapajos, Mte. Christo and Barreiras (A. H. Fassl, May, 1920, 3 males, Ris), Rio Janiero, Bom Jesus de Itabapoana (Zikàn, November 23, 1904, 1 female, Ris).

Gynacantha membranalis Karsch

6, 9, 20, 21, 25, 26, 27, 30 (as *jubilaris*), 36, 37.

Abdomen male 55-63, female 61.5-65; hind wing male 55-60, female 59-64; superior appendage male 6-6.5, female 6.9-7.2; stigma front wing 5.5-6.6.

The auricle in the male has only three, more rarely four, denticles, and between the two posterior (basal) teeth and on the dorsal surface of the auricle are a number of long black hairs. Superior appendage of female narrow, the outer edge nearly straight, widening very gradually on the inner edge from the base to beyond the middle where the maximum width is about .9; from this point tapering gradually in the apical third to the acute apex; a low dorsal median longitudinal keel usually about half as long as the appendage itself and with its extremities about equally distant from the base and the apex of the appendages or more extended on the apex.

Among the females, and especially among the more recently emerged of these, are individuals with the costal area of the wing colored dark brown, the color continuous basally with the usual basal colored area; this brown longitudinal stripe is bounded posteriorly before the nodus by R and after the nodus by M_1 . Between females with this region darkly marked and females with the same area hyaline, all degrees of coloring exist.

Of the Guacimo, Costa Rica, male, Dr. Calvert noted: "Eyes in life brilliant metallic green." The single male from Rockstone, British Guiana, may owe its dark color to its recently emerged condition, though the blue color on segment 2 was bright and clear. My brief notes made on this specimen are: Eyes and thorax above black, sides of thorax black and light brown; abdomen above black; sides of 3-6, below the transverse carina, pale; 2 with the auricles and spot above bright clear blue. The thorax of this specimen showed no trace of green which was the dominant color in the Venezuelan specimens described below, and the dorsum especially was a deep velvety black. The specimen is fresh, but apparently mature; equally recently emerged specimens from Venezuela are green, and I believe the difference is racial rather than individual. The following notes were made from a San Esteban male: Eyes dark green, almost black above, gray below. Prothorax brown with a short transverse green bar near the posterior border. Mesepisternum brilliant green with a black bar, giving the effect of two dorsal green stripes on either side of the dorsum; black bar darkest below, shading out above; mesepimeron slightly but very little duller than the mesepisternum; a black bar on the second lateral suture, shading out over the metepimeron to brown, with the upper and posterior edges of the sclerite green. Segment 1 largely green, dorsum apically brown; 2 black, auricles above, a narrow transverse basal line on either side, a narrow longitudinal middorsal line, and a large transverse subapical spot

on either side, bright blue; sides of 3 below from base to slightly posterior to the transverse carina duller blue; 3-5 each with a small triangular blue or green dorsal spot on either side at the transverse carina, the two spots on each segment very narrowly separated; otherwise the abdomen above and on the sides is dark brown or black. Femora rich reddish brown, black at apices.

The following notes were made from a San Esteban female: Eyes very dark brown above, gray beneath. Mesothorax and metepisternum green, the last gray behind along the suture; dorsum of thorax darker green with a black bar on each side and black on the middorsal carina and bordering the antealar sinus in front; metepimeron black, gray behind and below; black between the front wings, posteriorly blue spotted between the wings. Segment 1 light brown, dark above apically; 2 largely black above with a blue subapical spot on either side and traces of a longitudinal middorsal stripe; 3-6 with a small spot on either side at the transverse carina, these spots progressively smaller posteriorly, and the spots on each segment very narrowly separated.

Membranalís is a wide ranging and adaptable species. In Venezuela, after collecting it on the high rocky quebradas back of San Esteban, associated with such things as Hetaerina, Cora, and Heteragrion, we were surprised to find it equally at home about the small scattered muddy spots in the heavy low-lying forests about La Fria, where its dragonfly associates were such things as Lestes, Metaleptobasis, and Orthemis. The San Esteban specimens were all freshly emerged, and their recent advent into aerial life may account for the frequently observed high soaring, back and forth over some quebrada, which opened a path through the forest for their flight.

On February 5 at 4 P.M. several were seen soaring high above the reach of an insect net and an effort was made to bring them down with our revolvers loaded with dust shot. We crippled two, but they darted downward into the forest and we could not find them. The next day J. H. W. at the same place, flushed a specimen, which he easily caught, and which proved, by the shot marks, to have been one of our targets of the day before. On February 9, we observed that *membranalís* was on the wing at all times from about 9 A. M., when we reached the quebrada above Las Quiggas where we spent the day, till 4 P. M. when we left. About 3:30 P. M. possibly eight or ten were patrolling a stretch of quebrada about two hundred feet long where an extensive land slide had opened the stream to the sun. Five of these were captured, one male and four females, and all were recently emerged. On several occasions we observed males, apparently in search of females, flying about rocky pools of crystal water high up the quebradas back of San Esteban. And at La Fria a male taken near a pool of the consistency of batter or gravy, lying in a great expanse of level forest, had parts of the abdomen and wings coated with a wash of light reddish earth, probably due to an attack on an ovipositing female. The male taken at Rockstone, British Guiana, was captured just after sundown patrolling a stagnant pool in a mud-bottomed creek in which the water

had ceased to flow. At this stream and nowhere else have we found *membranalis* and *Staurophlebia* associated.

As Ris (36) points out, *G. jubilaris* Navas is a synonym of *membranalis*.

Material examined: *Costa Rica*, Guacimo (in forest, P. P. Calvert, June 6, 1909, 1 male, A. N. S.), Alajuela (D. E. Harrower, August 2, 1915, 1 male, A. N. S.); *Panama* (Hassler, 1 male, M. C. Z.); *Colombia* (Appun, 1 female, M. C. Z.), Sta. Fe de Bogota (Lindig, 1 male, M. C. Z.), Rio Negro, East Colombia (A. H. Fassel, 1911, 1 male, 800 m., 1 female, 500 m., Ris); *Bolivia*, Prov. del Sara, 450 m. (J. Steinbach, 1 female, Acc. 4547, Carn. Mus.); *Peru*, Iquitos (1 female, M. C. Z.; W. T. M. Forbes, August 4, 1920, 1 male, Cornell); *Venezuela* (Appun, 1 male, M. C. Z.), San Esteban, Dept. Carabobo (February 1, 6, 8 and 9, 1920, 3 males, 9 females, E. B. W.), La Fria, Dept. Tachira, 140 m. (April 12, 13, 15, 18 and 21, 1920, 3 males, 1 female, and 1 male and 3 females by H. B. Baker, E. B. W.); *British Guiana* (1 male, Cornell), Bartica (H. S. Parish, May 15, 1901, 1 male, O. S. U.), Rockstone, (February 2, 1912, 1 male, E. B. W.); *French Guiana*, Tamanoir, Mana River (S. M. Klages, May, 1917, 2 males, 1 female, Acc. 6008, Carn. Mus.); *Brazil* Benevides, Para (S. M. Klages, October, 1918, 1 male, 1 female, Acc. 6174, Carn. Mus.).

NOTE

In the U. S. N. M. is a male *Gynacantha* labelled Crowley, Louisiana, July 17, 1911, E. S. Tucker, collector. This is very close, if not identical to the widely distributed oriental *G. hyalina*. Miss Currie feels certain the locality label is correct. Mr. Tucker has no recollection of the specimen. If it was really taken in Louisiana it is probable it was brought to this country as an egg or larva and it is improbable that an undescribed *Gynacantha* inhabits Louisiana.

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TABULATION OF VENATIONAL CHARACTERS

The tabulation of venational characters based on the following males: *Triacanthagyna septima*, 5; Puerto Barrios, Guatemala, 1; Rio Frio and Bolivar, Colombia, 2; Palma Sola and Tachira, Venezuela, 2: *ditzleri*, 5; Puerto Barrios, Guatemala, 1; Puerto Berrio, Colombia, 1; Palma Sola, El Guayabo and La Fria, Venezuela, 3: *caribbea*, 5; Santa Marta and Bolivar Colombia, 3; Palma Sola and Boqueron, Venezuela, 2: *trifida*, 5; California, 1; Georgia, 1; Guanajay, Cuba, 1; Hayti, 1; Bath, Jamaica, 1: *satyrus*, 3; Banana River, Costa Rica, 1; La Fria, Venezuela, 1; Bartica, British Guiana, 1: *Gynacantha laticeps*, 2; Minas Geraes, Brazil: *aratrix*, Martin 25, figure 182: *adela*, 3, Yungas, Bolivia: *convergens*, 1, Jujuy, Argentina: *tenuis*, 5; La Fria, Venezuela, 3; Iquitos, Peru, 1; Tamanoir, French Guiana, 1: *caudata*, 1, San Rafael, Ecuador: *tibiata*, 5; Colima, Mexico, 1; Ontario Farm and Cimarones, Costa Rica, 3; La Fria, Venezuela, 1; *jessci*, 1, Puerto Berrio, Colombia: *auricularis*, 3; Palma Sola, Venezuela, 1; Bartica, British Guiana, 1; Oyapok River, French Guiana, 1: *klagesi*, 2, Tamanoir, French Guiana: *ereagris*, 2, Havana, Cuba: *mexicana*, 5; Fundacion, Colombia, 1; Palma Sola and Bejuma, Venezuela, 3; Para, Brazil, 1: *nervosa*, 5; Bolivar and Cristalina, Colombia, 2; Palma Sola and La Fria, Venezuela, 2; Rockstone, British Guiana, 1: *biifida*, 3; Porto Catherina de Santa Leopoldina, Brazil, 2; Jujuy, Argentina, 1: *croceipennis*, 2, Rio Songo, Bolivia: *litoralis*, 3; Paramaribo, Dutch Guiana, 1; Manaus, Brazil, 2: *interioris*, 4; Peru, 3; Santarem, Brazil, 1: *gracilis*, 2; Ontario Farm, Costa Rica, 1; Kartabo, British Guiana, 1: *membranalis*, 5; Rio Negro, Colombia, 1; San Esteban and La Fria, Venezuela, 2; Rockstone, British Guiana, 1; Tamanoir, French Guiana, 1.

In the tabulation each number is the per cent of the total number of wings examined. Some numbers are followed by letters, which are explained on page 55.

Explanation of Letters in Venational Tabulation

- a. One present in one left front wing.
- b. In one wing a minute fourth cell formed by a forking, near its distal end, of the crossvein.
- c. Two wings each with one crossvein forked, and three wings each with a single double cell.
- d. Two for one cell's length in two wings and two for two cell's length in one wing.
- e. One wing with two rows only one cell's length, and one wing with double and single cells interspersed.
- f. One front wing with an antenodal of the first series basal to the first thickened antenodal.
- g. Obviously an abnormal condition.
- h. This is the Paramaribo specimen,—the type.
- i. One present in one right hind wing.
- j. Abnormal.
- k. Left front wing with added basal crossvein in both series; absent in right front wing and left hind wing; right hind wing with an added crossvein in the second series.
- l. In both cases anal loop apparently malformed.
- m. In two wings there are some single cells between the anal loop and the hind wing margin.
- n. In the left front wing and left hind wing of one specimen M_3 , beyond the loop of M_4 , is diverted or switched anteriorly one row of cells, resulting in three rows of cells between M_3 and M_4 . This is the only case observed in all the wings examined in this study in which a main sector is so diverted.
- o. One row of two cells.
- p. Two for one-two cell's length.
- q. Abnormal.
- r. Abnormal.
- s. In each case the fourth cell is small, interpolated.
- t. In one wing the cubital space is two cells wide for a distance of three cells.
- u. In one wing a few rows of three cells.

VENATIONAL TABULATION

		Number of cells in anal triangle	Subtriangle hind wing	Subtriangle front wing	Number cubito-anal crossveins basal to subtriangle in hind wing
TRIACANTHAGYNA	<i>septima</i>	30	10	10	70
	<i>ditzleri</i>	70	100	90	80
	<i>caribbea</i>	100b	100	90	20
	<i>trihda</i>	100	10	100	40
	<i>satyrus</i>	100	100	100	17
	<i>laticeps</i>	100	100	50	50
	<i>aratrix</i>	100	100	100	50
	<i>adela</i>	100	100	100	50
	<i>convergens</i>	100	100	100	60
	<i>tenuis</i>	70	100	100	40
	<i>caudata</i>	100	100	100	60
	<i>hibiata</i>	100	100	100	50
	<i>jesset</i>	100	100	100	33
	<i>annularis</i>	100	100	100	50
	GYNACANTHA	<i>klagesi</i>	100	100	100	50
<i>evagris</i>		100	100	100	50
<i>mexicana</i>		10	100	100	40
<i>nervosa</i>		100	100	100	60
<i>bifida</i>		100	100	100	17
<i>croceipennis</i>		100	100	100	50
<i>litorea</i>		100	100	100	75
<i>interiors</i>		100	100	100	25
<i>gracilis</i>		50s	100	100	40
<i>membranalis</i>		100	100	100	60
oper.		10	10	10	10
once crossed		100	90	100	90
open		10	10	10	10
once crossed		90	100	100	100
twice crossed		100	100	100	100
3	70	80	60	17	
4	30	20	40	67	
5	100	100	100	17	
6	100	100	100	100	
7	100	100	100	100	

VENATIONAL TABULATION

	Maximum number of rows of cells between Rs and Rspl in hind wing	Maximum number of rows of cells between Rs and Rspl in front wing	Number of rows of cells in fork of R ₅ posterior to stigma in hind wing	
TRIACANTHAGYNA	<i>sephima</i>	...	20	
	<i>dizleri</i>	...	...
	<i>caribbea</i>	...	...
	<i>trihda</i>	...	...
	<i>satyrus</i>	...	...
	GYNACANTHA	<i>laticeps</i>	...	...
		<i>aratrix</i>	...	...
		<i>adela</i>	...	...
		<i>convergens</i>	...	...
		<i>tenuis</i>	...	...
		<i>caudata</i>	...	...
		<i>tibiala</i>	...	...
		<i>jesseri</i>	...	...
		<i>articulatrix</i>	...	...
		<i>klagesi</i>	...	...
		<i>cragvis</i>	...	...
		<i>mexicana</i>	...	...
<i>nervosa</i>		...	...
<i>bifida</i>		...	...
<i>croceipennis</i>		...	...
<i>litoralis</i>		...	...
<i>interris</i>		...	...
<i>gracilis</i>	...	...
<i>membranalis</i>	...	...

VENATIONAL TABULATION

	Number of cells in the anterior row of cells in the anal loop	Number of rows of cells between Cu ₁ and Cu ₂ posterior to the triangle in the hind wing	Number of rows of cells between M ₃ and M ₄ following the loop in M ₄ in hind wing
GYNACANTHA	<i>membranalis</i>	... 50 70 30	... 10 90
	<i>gracilis</i>	... 50 70	... 100 100
	<i>interioris</i>	... 100 100	... 100 100 100e
	<i>litoralis</i>	... 83 17	... 100 100 100e
	<i>crucifera</i>	... 100 100	... 50 50 100 100e
	<i>bifida</i>	... 100 100	... 17 83
	<i>nervosa</i>	... 100 100	... 20 80
	<i>mexicana</i>	... 100 100	... 100d 20
	<i>cragris</i>	... 50 25q 75	... 100
	<i>klagesi</i>	... 50 83 17	... 100 100
	<i>auricularis</i>	... 50j 50	... 100 100 100
	<i>jesset</i>	... 100 100	... 100 100 100
	<i>tibiala</i>	... 100 100	... 100 100 100
	<i>caudata</i>	... 100 100	... 100 100 100
	<i>tenuis</i>	... 100 100	... 40 100 100 100
	<i>convergens</i>	... 100 100	... 50 60 50
	<i>adela</i>	... 100 100	... 50n 50
<i>aratrix</i>	... 100 100	... 100 100 50	
<i>laticeps</i>	... 25r 75	... 100 100 100	
TRICANTHACYNNA	<i>satyrus</i>	... 100 100	... 100 100 100
	<i>trifida</i>	... 100 100	... 100 100 100
	<i>caribbea</i>	... 10 90	... 100 100 100
	<i>ditzleri</i>	... 100 100	... 100 100 100
	<i>septima</i>	... 40 60	... 100 100 100

PLATE I

Wing photographs by Miss Mina L. Winslow.

Figure 1, *Triacanthagyna septima*, male, Palma Sola, Venezuela, March 5, 1920; Figure 2, *T. ditzleri*, male, Puerto Berrio, Colombia, January 31, 1917; Figure 3, *T. caribbea*, male, Santa Marta, Colombia, December 14, 1916; Figure 4, *Gynacantha laticeps*, male, Minas Geraes, Brazil.

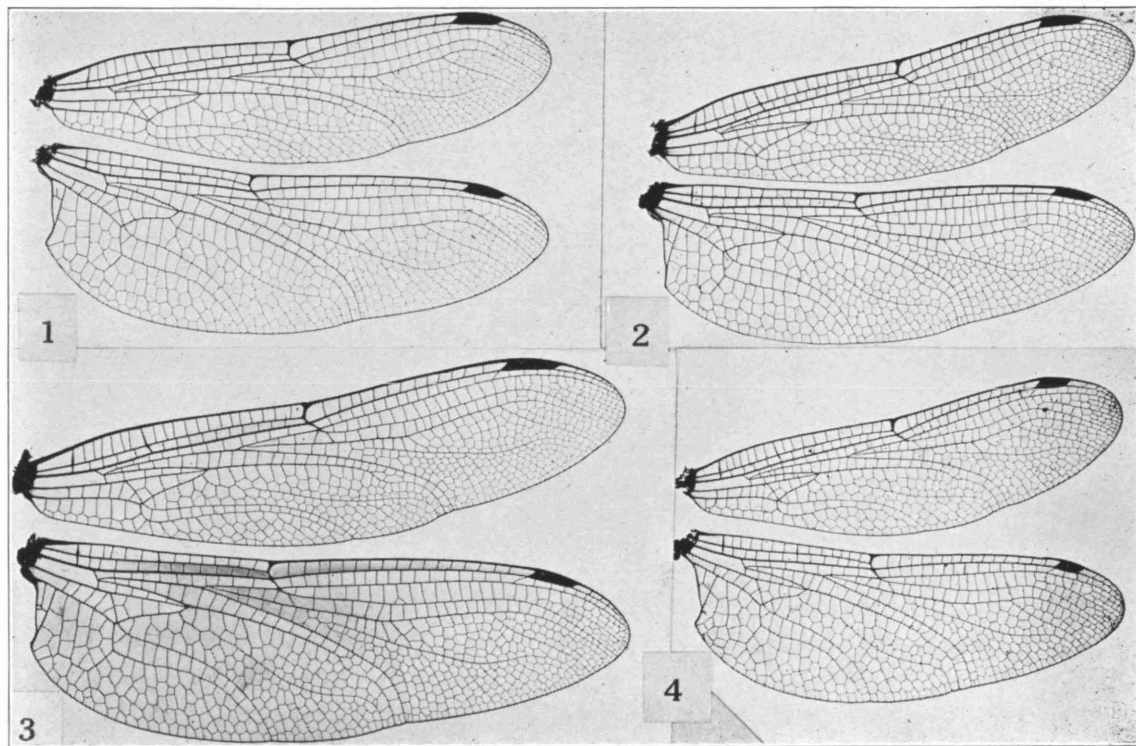


PLATE II

Wing photographs by Miss Mina L. Winslow.

Figure 5, *Gynacantha tenuis*, male, La Fria, Venezuela, April 12, 1920; Figure 6, *G. mexicana*, male, Bejuma, Venezuela, February 17, 1920; Figure 7, *G. nervosa*, male, Palma Sola, Venezuela, March 6, 1920.

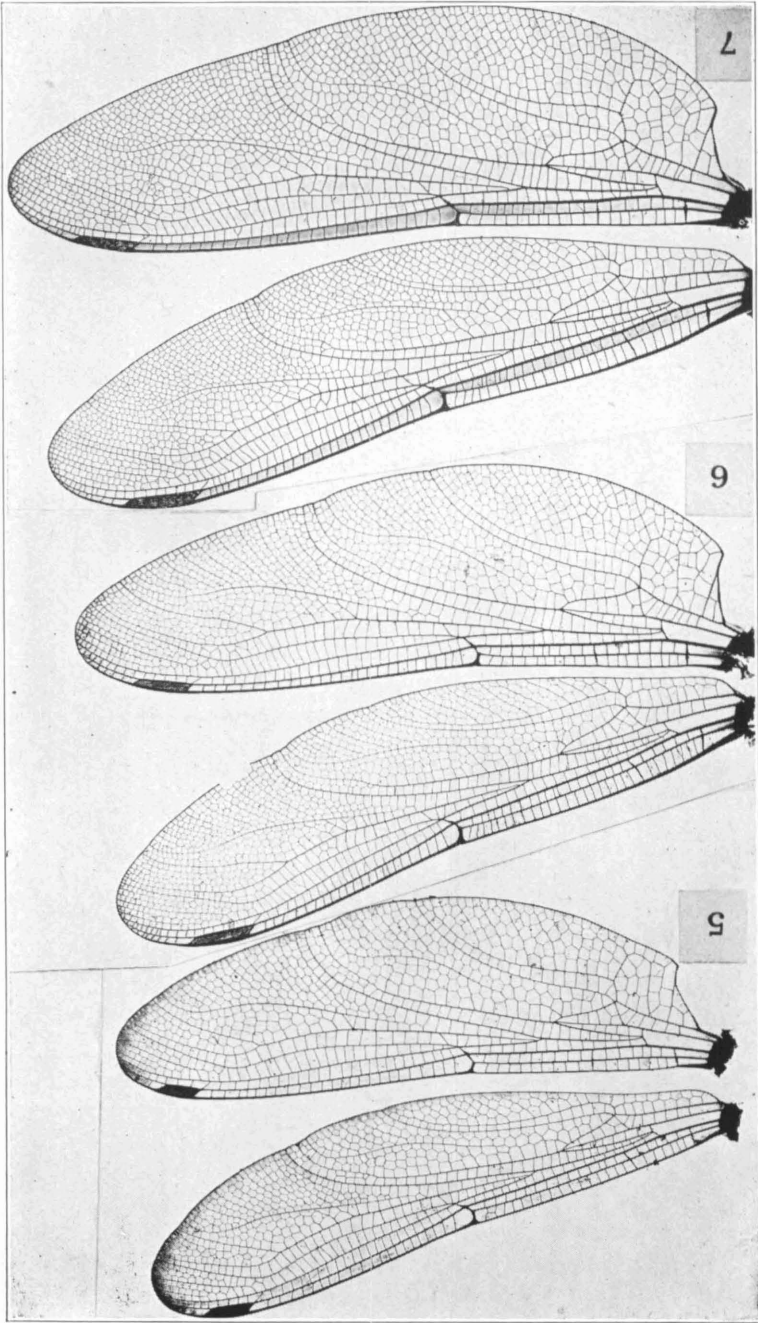




PLATE III

Wing photographs by Miss Mina L. Winslow.

Figure 8, *Gynacantha interioris*, male, Colonia del Perené, Peru; Figure 9, *G. membranalis*, male, La Fria, Venezuela, April 21, 1920; Figure 10, *G. gracilis*, La Fria, Venezuela, April 12, 1920.

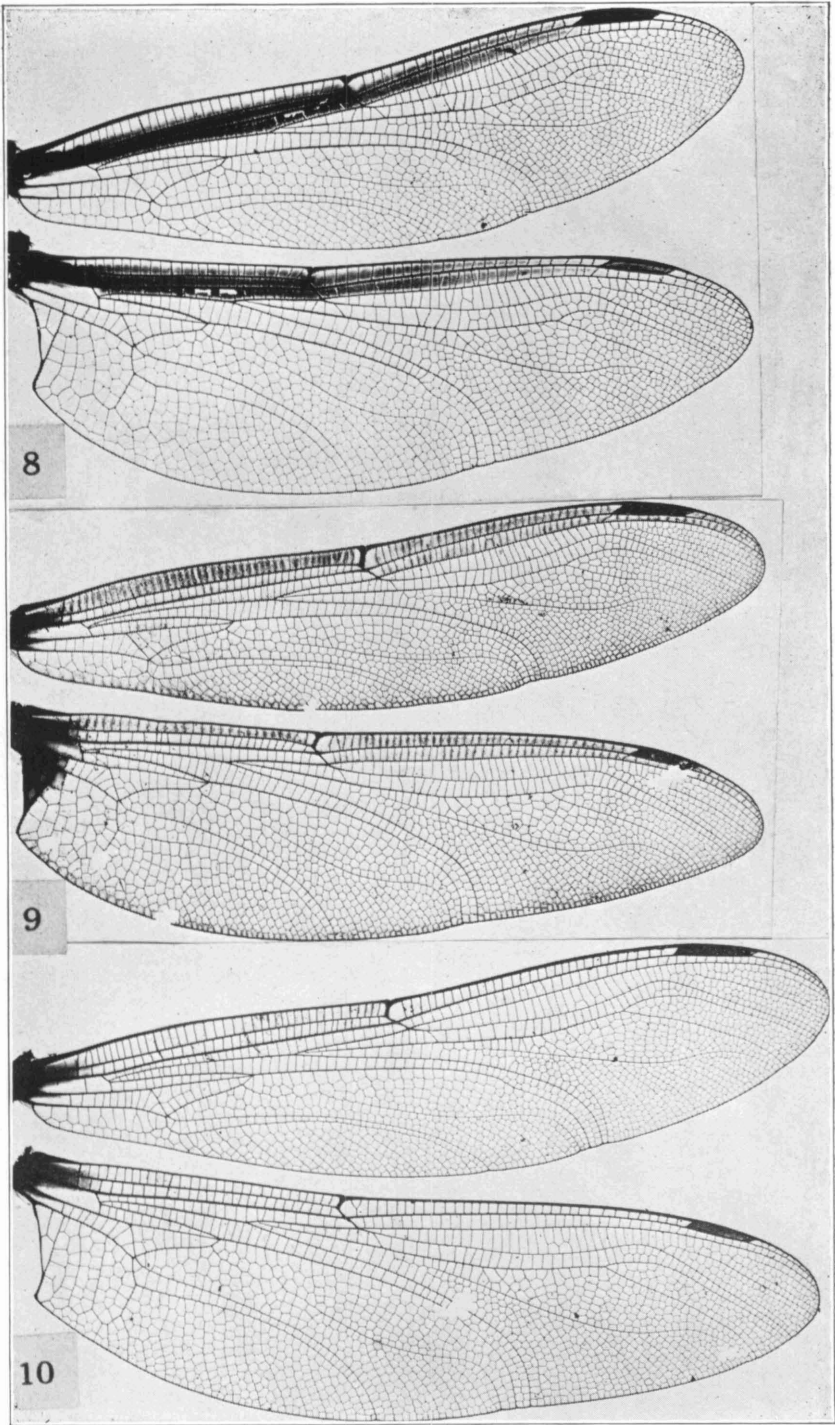
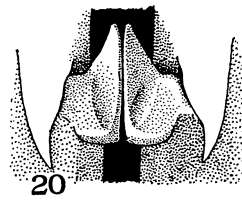
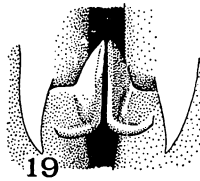
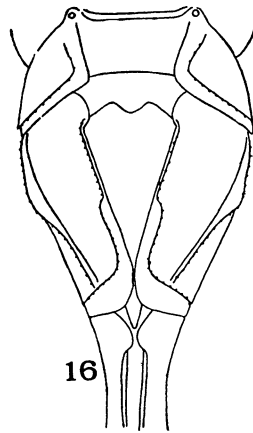
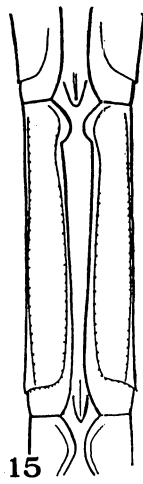
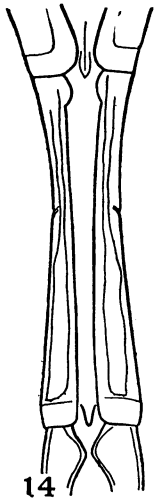
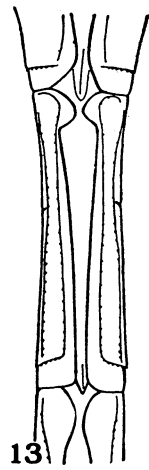
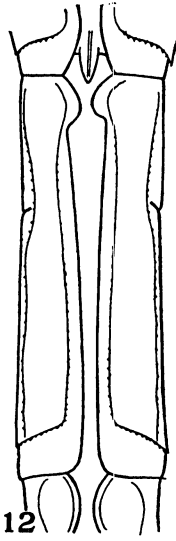
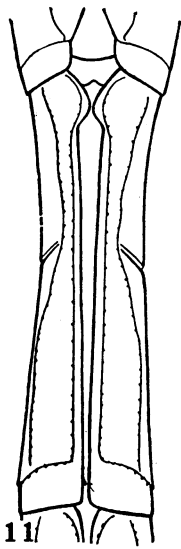




PLATE IV

Figures 11-15, ventral views of third abdominal segments; Figure 16, ventral view of second abdominal segment; Figures 17-20, hamular processes. All drawings by Dr. C. H. Kennedy.

Figure 11, *Gynacantha nervosa*, male, Palma Sola, Venezuela, March 6, 1920; Figure 12, *G. nervosa*, female, Palma Sola, Venezuela, March 4, 1920; Figure 13, *Triacanthagyna ditzleri*, allotype female; Figure 14, *T. trifida*, female, Samana, Hayti, M. C. Z.; Figure 15, *T. caribbea*, allotype female; Figure 16, *Gynacantha klagesi*, allotype female, to show elevated lateral carinæ; Figure 17, *T. ditzleri*, type male; Figure 18, *T. caribbea*, type male; Figure 19, *T. trifida*, male, Samana, Hayti, M. C. Z.; Figure 20, *T. satyrus*, male. La Fria, Venezuela.



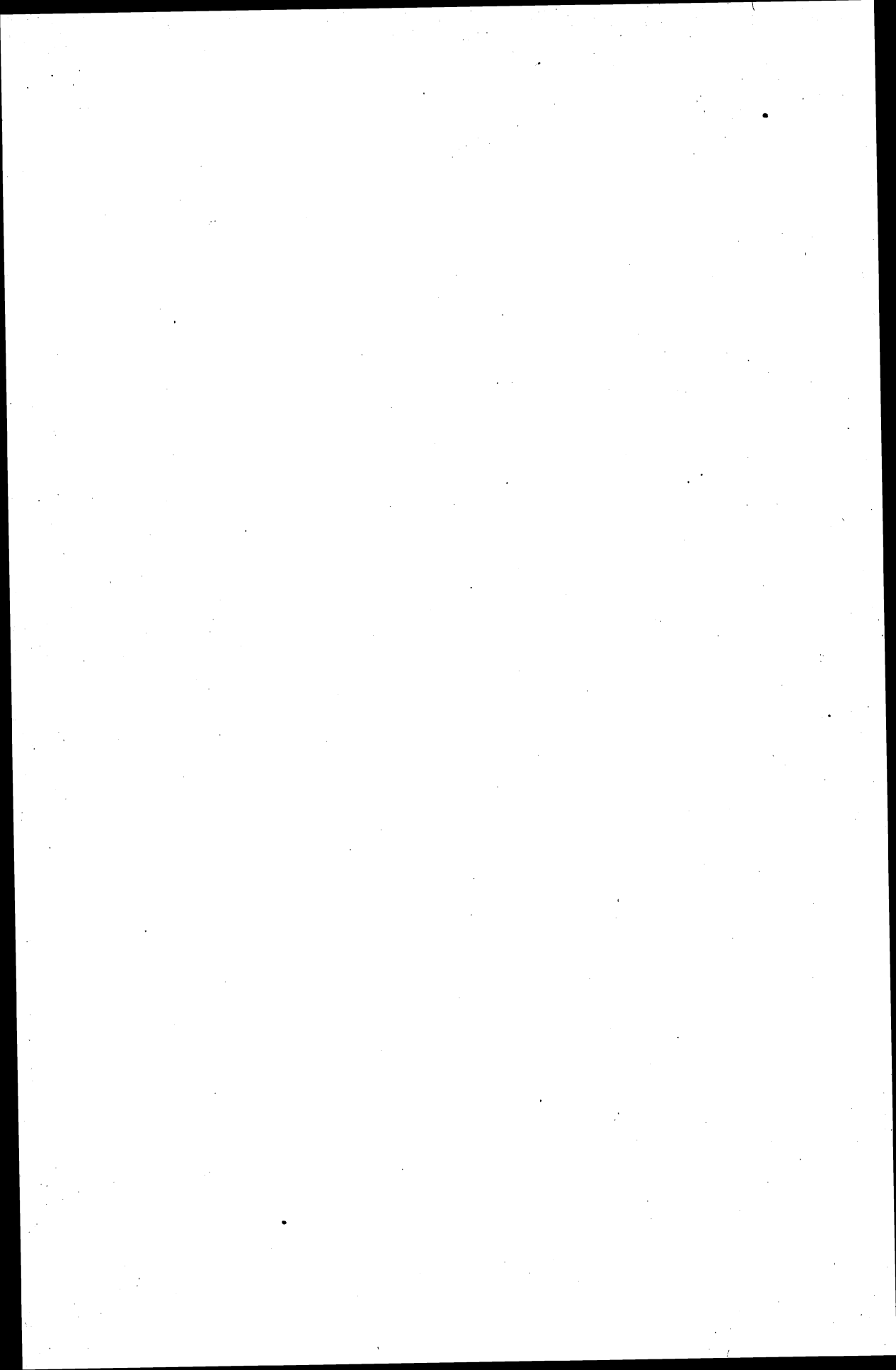


PLATE V

Figures 21-29, male abdominal appendages in dorsal and lateral views. All drawings by Dr. C. H. Kennedy.

Figure 21, *Triacanthagyna septima*, Rio Frio, Colombia, January 7, 1917; Figure 22, *T. ditzleri*, type; Fig. 23, *T. caribbea* type, figure at left, appendages in supero-internal view; Figure 24, *T. trifida* Samana, Hayti, M. C. Z.; Figure 25, *T. satyrus*, La Fria, Venezuela; Figure 26, *Gynacantha laticeps*, type; Figure 27, *G. chelifera*, after Figure 174, Martin 25; Figure 28, *G. aratrix*, after Figure 183, Martin 25; Figure 29, *G. convergens*, Yuto, Jujuy, Argentina, April, 1911.

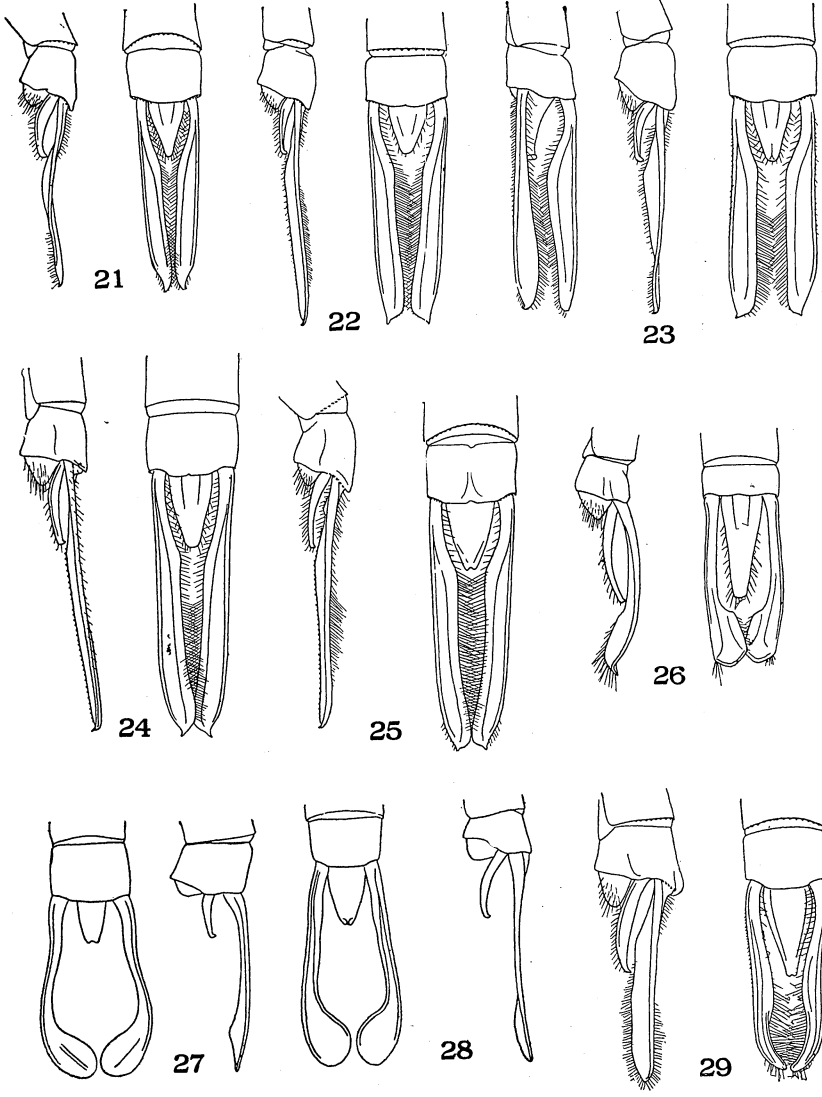


PLATE VI

Figures 30-38, Male abdominal appendages in dorsal and lateral views. All drawings by Dr. C. H. Kennedy.

Figure 30, *Gynacantha adela*, near Coroico, Yungas, Bolivia, May 4, 1899; Figure 31, *G. tenuis*, La Fria, Venezuela, April 16, 1920; Figure 32, *G. caudata*, San Rafael, Ecuador; Figure 33, *G. tibiata*, La Fria, Venezuela, April 13, 1920; Figure 34, *G. jessei*, type; Figure 35, *G. auricularis*, Palma Sola, Venezuela, March 6, 1920; Figure 36, *G. klagesi* type; Figure 37, *G. gracilis*, Mte. Christo, Tapajos, Brazil, May, 1920; Figure 38, *G. membranalis*, San Esteban, Venezuela, Feb. 9, 1920.

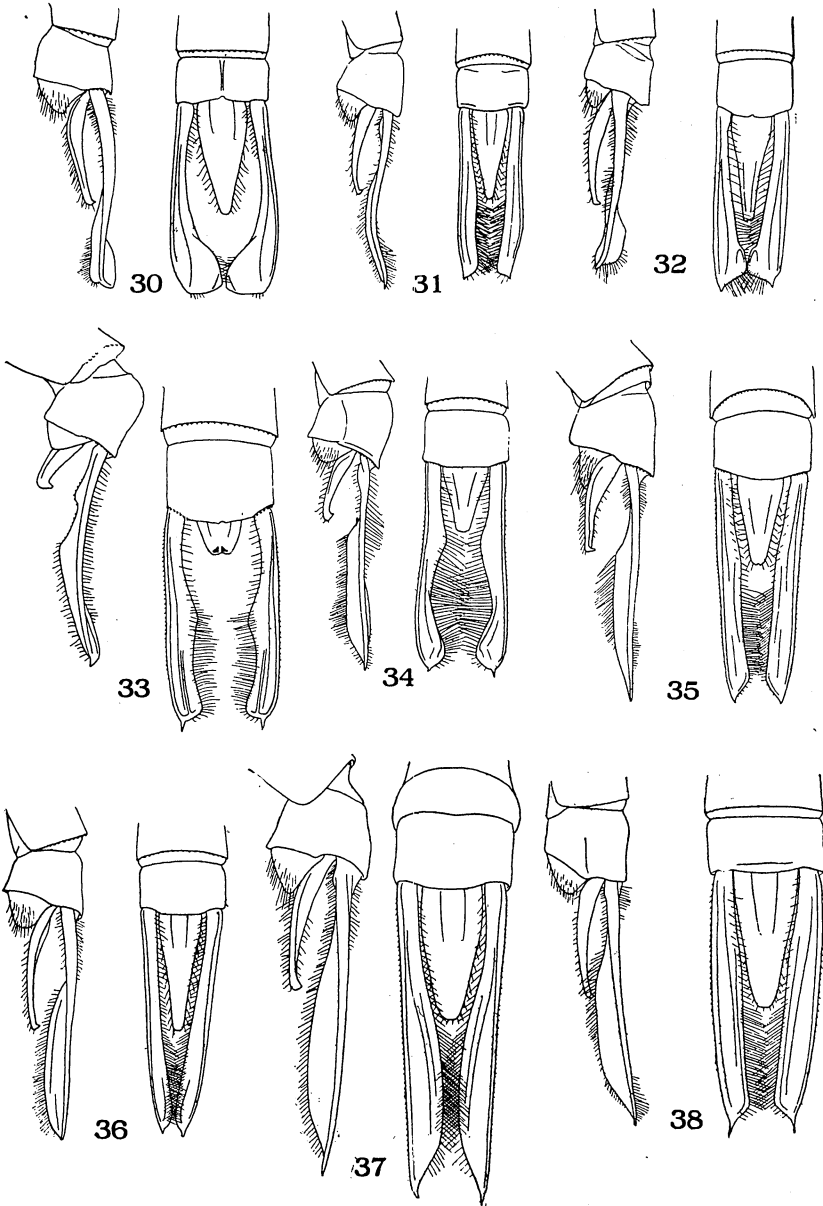
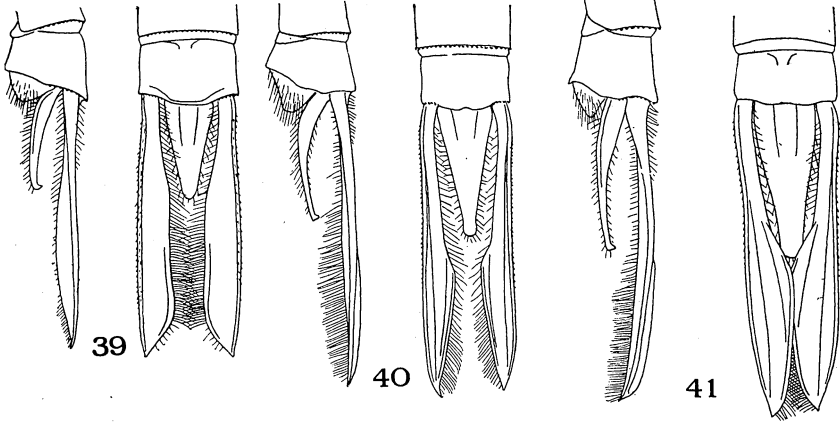


PLATE VII

Figures 39-45, male abdominal appendages in dorsal and lateral views. All drawings by Dr. C. H. Kennedy.

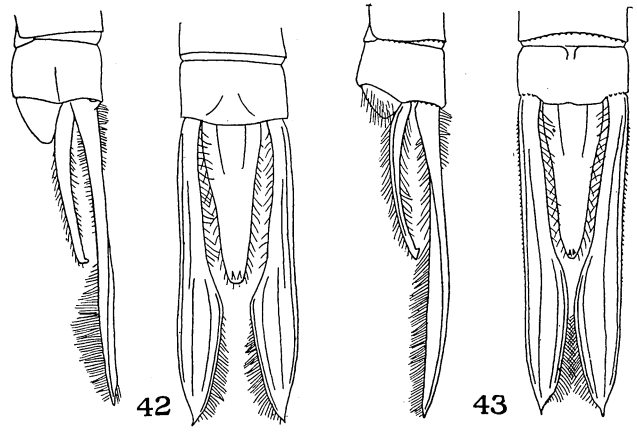
Figure 39, *Gynacantha mexicana*, Fundacion, Colombia, January 9, 1917; Figure 40, *G. creagris*, Havana, Cuba, Baker; Figure 41, *G. nervosa*, Palma Sola, Venezuela, March 6, 1920; Figure 42, *G. bifida*, Porto Catherina de Santa Leopoldina, Brazil; Figure 43, *G. croceipennis*, Rio Songo, Bolivia, Fassl; Figure 44, *G. litoralis*, type; Figure 45, *G. interioris*, type.



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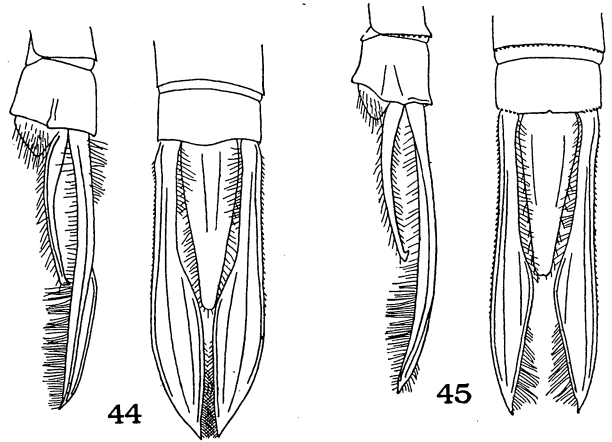
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