

# NEW DRAGON-FLY NYMPHS IN THE UNITED STATES NATIONAL MUSEUM.

---

By JAMES G. NEEDHAM.

*Of Lake Forest College, Lake Forest, Illinois.*

---

The immature Odonata in the United States National Museum have come together during a long period of years from many diverse and almost accidental sources. Save for a few specimens collected by Dr. Charles V. Riley, and sent to Dr. H. Hagen many years ago, two Columbia River species donated to the Museum by Dr. H. Hagen, and a few Illinois species donated by myself, they have not hitherto been studied. Recently, while examining and naming the nymphs of this collection, it became apparent that some interesting undescribed forms were at hand, and that their careful study would throw light on the interrelationships of the groups to which they belong; and then the preparation of this paper was undertaken.

Concerning the sources of the material from the National Museum hereinafter described, I am indebted to Mr. Rolla P. Currie, of that institution, for the following data:

A number of nymphs were collected in Arizona in the summer of 1901 by Messrs. H. S. Barber and E. A. Schwarz; several bred specimens, and others, are from the collection of Messrs. H. G. Hubbard and E. A. Schwarz, and were taken, principally, in Michigan, Florida, and the West; a large number of nymphs were contained in the collection of insects from Java made in December, 1896, by Mr. D. G. Fairchild, of the United States Department of Agriculture; single species were obtained in the Congo by Mr. J. H. Camp, of Lima, Ohio; in Miyazaki, Japan, by Rev. Cyrus M. Clark; in Nicaragua, by Dr. Charles W. Richmond; in the Galapagos Islands, by Dr. G. Bauer, of Clark University; in the Yellowstone, by Dr. C. Hart Merriam, and in California by Mr. Albert Koebele, of the Department of Agriculture. In addition to these there is quite a collection from various parts of the United States made by the United States Fish Commission, though the majority of the specimens belonged to species the nymphs of which have previously been described.

To the Museum material I have added from my own collection specimens of fifteen additional species representing seven genera in which no immature stages have hitherto been described. These are species that have come from sources outside the geographical or systematic range of my former papers. They have been collected for me by generous correspondents and friends during the past ten years. Some from Mr. Adolph Hempel were collected near Gotha, Florida, and in São Paulo, Brazil. Some from Mr. F. G. Schaupp were collected at Shovel Mount, Texas.; some from Mr. F. C. Willard, at Tombstone, Arizona; some bred specimens from Stanford University collection were sent me by Prof. V. L. Kellogg; and good finds of single species were made by Dr. John M. Stowell, at San Jose, California, Mr. E. B. Williamson, at Fort Wayne, Indiana, Prof. R. C. Osburn and Mr. S. Bethel, at Seattle, Washington.

The following species are described herein:

#### Suborder ANISOPTERA.

Species.	Locality.	Collector.
1. <i>Gomphoides stigmatus</i> .....	Shovel Mount, Texas .....	F. G. Schaupp.
2. <i>Phyllogomphus ethiops?</i> .....	Congo .....	J. H. Camp.
3. <i>Ophiogomphus bison</i> * .....	Lake Tahoe, California .....	Hubbard and Schwarz.
4. <i>Gomphus minutus</i> * .....	Florida .....	Do.
5. <i>Gomphus confraternus?</i> .....	Oregon .....	Samuel Henshaw.
6. <i>Gomphus sobrinus?</i> .....	Seattle, Washington .....	R. C. Osburn.
7. <i>Dromogomphus spoliatus</i> .....	Fort Wayne, Indiana .....	E. B. Williamson.
8. <i>Stenroplebius reticulata</i> .....	Nicaragua .....	Charles W. Richmond.
9. <i>Anax longipes?</i> .....	Jamaica .....	Hubbard and Schwarz.
10. <i>Anax gattatus?</i> .....	Java .....	D. G. Fairchild.
11. <i>Eschma galapagoensis</i> .....	Chatham Island (Galapagos) .....	G. Baur.
12. <i>Cordulegaster dorsalis?</i> .....	Yellowstone .....	C. H. Merriam.
13. <i>Cordulegaster diadema</i> * .....	Arizona .....	F. C. Willard, H. S. Barber.
14. <i>Pallthemis lineatipes</i> .....	California .....	A. Koebele.
15. <i>Dythemis velox?</i> .....	Texas .....	U. S. Fish Commission.
16. <i>Rhythemis phyllis?</i> .....	Java .....	D. G. Fairchild.
17. <i>Crocothemis serritia?</i> .....	do .....	Do.
18. <i>Orthemis ferruginea</i> * .....	Texas .....	F. G. Schaupp.
19. <i>Orthetrum lepturum?</i> .....	Java .....	D. G. Fairchild.
20. <i>Libellulid gen.? sp.?</i> .....	do .....	Do.
21. <i>Libellula saturata</i> * .....	California .....	J. M. Stowell, V. L. Kellogg
22. <i>Libellula forensis</i> * .....	Olympia, Washington .....	S. Bethel.
23. <i>Sympetrum madidum?</i> .....	Twin Lakes, Colorado .....	Chauncey Juday.
24. <i>Trithemis aurea?</i> .....	Java .....	D. G. Fairchild.
25. <i>Diplacodes triradiis</i> .....	do .....	Do.
26. <i>Trithemis minuscula</i> .....	Florida .....	Adolph Hempel.
27. <i>Micrathyria pallida</i> .....	Brazil .....	Do.
28. <i>Tramea caryala?</i> .....	Java .....	D. G. Fairchild.

#### Suborder ZYGOPTERA.

29. <i>Archilestes grandis</i> .....	Arizona .....	F. C. Willard.
30. <i>Argia fumipennis</i> .....	Florida .....	Adolph Hempel.
31. <i>Argia sp.?</i> .....	Rocky Mountains .....	S. A. Forbes, T. D. A. Cocker- ell, and others.
32. <i>Talagrion dackii?</i> .....	Florida .....	Adolph Hempel.
33. <i>Telobasis salva</i> * .....	Texas .....	F. G. Schaupp.
34. <i>Acauthagrion chelificum</i> * .....	Brazil .....	Adolph Hempel.
35. <i>Hesperagrion heterodoxum</i> * .....	Arizona .....	F. C. Willard.
36. <i>Leptobasis sp.?</i> .....	Porto Rico .....	August Busck.

Among these it will be observed are fifteen genera of which no nymphs have been described hitherto. New types of nymphal struc-

ture are represented by Nos. 1, 2, 8, 14, 16, 18, 25, 27, 29, and 32 of the list. In addition to the above there are included in this paper additional descriptive notes or figures, or both, of the following species which have already been noticed elsewhere:

Species.	Locality.	Collector.
37. <i>Epopthalmia elegans</i> .....	Japan .....	Rev. C. M. Clark.
38. <i>Dythemis fugax?</i> .....	New Mexico .....	T. D. A. Cockerell.
39. <i>Pantala flavescens</i> .....	Java .....	D. G. Fairchild.
40. <i>Hyponoura lugens</i> .....	New Mexico .....	T. D. A. Cockerell.

Names followed by ? in the above list are of doubtful specific determination; the species marked with \* were bred by the collector named. That so many not bred are not marked with ? is due to the fact that I have been able to examine satisfactorily the venation in the nymphal wings and to recognize the species thereby. This means of determining miscellaneous nymphs is of remarkable value. It has not been used by other authors, and was not used by myself in the work done for my earlier papers. Its application requires well-preserved specimens old enough to have the adult venation well developed yet not near enough transformation for the wings to be crumpled within their sheaths. If the cleaner, more transparent (more recently moulted) nymphs be selected, and their wings carefully removed by cutting off at the base with a sharp razor, mounted and examined with a microscope, the venation may be studied in them almost as well as in the adult. Save for ultimate fusions (as of the sectors of the areculus) the correspondence is exact.

#### Subfamily GOMPHINÆ.

#### GOMPHOIDES STIGMATUS Say.

Plate XXXVIII, fig. 1.

Nymphs and exuvie and imago, the last in some numbers, from Shovel Mount, Texas, collected by Mr. F. G. Schaupp.

Length 34 mm., abdomen 23 mm., hind femur 5.5 mm.; width of head 6 mm., of abdomen 7 mm.

Body elongate, depressed cylindrical, hairy at the sides. Head thick, pointed and declined in front, with scar-like corrugations behind the eyes, and a conspicuous bare scar on either side of the median line in the rear. Antennæ declined upon the labrum, the two basal segments globular, the second half as large as the first, the third twice as long as both basal together, depressed, clavate, incurved at the apex, and scurfy hairy along its thick margins, the fourth segment a conspicuous upturned conic rudiment about as long as the second segment. Labium (Plate XLIII, fig. 1) of moderate size, the hinge reaching posteriorly as far as the mesothorax, mentum very gradually widened to the bases of

the lateral lobes. Median lobe very strongly convex, nearly semi-circular, with a long fringe of flattened scales along its free border. Lateral lobes rather short, stout. Movable hook long, arcuate, end hook short and strong and moderately incurved. Inner margin with a series of about a dozen minute quadrangular teeth, diminishing in size proximally and extending upon the base of the end hook, where the last two or three are likewise smaller.

Thorax somewhat compressed. Prothoracic disk flattened, continuing the slope of the top of the head, bearing a pair of large bare scars connected by a line across the middle. Legs closely appressed to the body, the fore and middle tibiae very hairy and armed with small recurved burrowing hooks. Middle legs slightly closer together at base than are the fore legs, and about half as far apart as are the hind legs. Wing cases reaching the middle of the fourth abdominal segment.

Abdomen widest before the middle, slowly tapering to the tip and little depressed. Dorsal hooks on segments 2-9 regularly increasing in length and sharpness posteriorly. Lateral spines on segments 7-9 minute, straight, appressed, much smaller than the dorsal hooks on the corresponding segments. Middle abdominal segments of equal length, segment 8 slightly longer, 9 one-fourth longer, and 10 one-half longer than these. Appendages as long as the ninth segment, slender and sharp, the laterals scarcely shorter than the others. The ventral longitudinal grooves of the abdomen end just within the lateral spines of the ninth segment.

But one of the nymphs is in a sufficiently good state of preservation for making out the venation of the wings, but in this one I have been able to compare the venation in close detail with that of the wings of *Gomphoides stigmatus*, and have found entire agreement.

#### PHYLLOGOMPHUS ÆTHIOPUS Selys?

Plate XXXVIII, figs. 2, 3.

“No. 28914, Congo, J. H. Camp.” Length 42 mm., abdomen 30 mm., hind femur 5 mm., width of head 6 mm., of abdomen 9 mm.

Body elongate, widest across the middle of the abdomen, moderately depressed. Head depressed, rather broadly triangular, with obtuse angles. Labrum prominent, with a dense fringe of tawny hair that is continued laterally beneath the eyes, ending there in a long, conspicuous tuft. Ocelli well marked, the lateral ones touching the eyes. Labium (Plate XXXVIII, fig. 3) reaching posteriorly as far as the rear of the prothorax; mentum flat, with parallel side; median lobe angularly concave in front, its border armed with about a dozen spinelike teeth on each side that are longest externally; lateral lobes moderate, with long movable hook; end hook arcuate, slender, with a comb of 12-15 straight spinelike teeth on its inner margin, longest proximally,

where they suddenly end opposite the base of the movable hook. Three scars (areas destitute of the general scurfiness of the skin) upon the rear of the head, with a low transverse ridge on the rear of the head behind them.

Prothorax depressed, with a pair of large dorsal scars. Legs short; burrowing hooks of the fore and middle tibiae well developed; tarsi 2:2:3-jointed; femora and tibiae with lateral bare lines, and lateral-fringes of long hair on their edges. Wing cases reach the middle of the fourth abdominal segment.

Abdomen bare: segments about equal in length as far as the ninth, the tenth triquetral, twice as long as the ninth; appendages almost as long as the ninth segment; equal. Dorsal hooks on segments 2-9, pointed on 2 and 3, obtuse on 4-7, pointed on 8 and 9, and longest on 9. Lateral spines on segments 8 and 9 short, divergent. Prominent lateral scars on segments 3-9.

A single full-grown specimen, taken at the beginning of transformation and pinned. It is a highly interesting form, very distinct from all that have been described hitherto. I have referred it to *Phyllogomphus* because its size and its locality allow this, and especially because I have been able to observe what are practically the adult structures in wings and antennæ, and these correspond very well. Unfortunately I have not seen the adult *Phyllogomphus*, and have been obliged to make my comparisons with the printed statements—not very detailed—of published descriptions. By removing the wings of one side from their loosened sheaths, softening them, and then spreading them out—an exceedingly delicate and tedious operation—I have been able to make out enough of the details of the venation of the adult to admit of settling the question of the correctness of the generic reference, at least, by anyone who has the adult *Phyllogomphus* for comparison.

Ante and post nodals are in the fore wing 17 and 13, and in the hind wing 12 and 16, respectively. The triangles and supertriangles are free from cross veins. The triangle of the fore wing is followed by 3:3:2:3:2:3 and then an increasing number of cells; of the hind wing, by 1:2:2:2:2:3:3:3:3 and then an increasing number. The bridge is long and there are in both wings four included cross veins between the subnodus and the oblique vein, and about three others included before the subnodus. The stigma has a brace vein at its inner end, and covers five cross veins besides (shown clearly only in hind wing of this specimen). In the fore wing there are eleven unbisected cells in the fork of veins  $M_1$  and  $M_2$ . There appear to be three medio-cubital cross veins before the triangle in the fore wing, and two in the hind wing, and the cubitus seems to run to the hind angle of the triangle without being angulated in either wing. There is no anal loop, veins  $A_1$  and  $A_2$  being rather wide apart at base with two cells between

them, the number between increasing toward the hind margin. The anal triangle is three-celled. In the relative length of the apical segments of the abdomen the nymph seems to resemble *Phyllogomphus* rather than *Neurogomphus*.

#### OPHIOGOMPHUS BISON Selys.

Plate XXXVIII, figs. 4, 5.

Cast skin of female bred specimen. Collection of Hubbard and Schwarz, Lake Tahoe, California (no date); also, a cast skin of a male imago with fragments of the imago in alcohol; also two nymphs, one of which was very near transformation.

Length, 28; abdomen, 17 mm.; hind femur, 45 mm.; width of head, 5.5 mm.; of abdomen, 8 mm.

Body stout, moderately depressed, skin granulate; face strongly declivous; antenna with third segment strongly flattened, twice as long as the two basal segments together; segment four very rudimentary; a hairy tubercle between the base of the antenna and the eye; labium (Plate XXXVIII, fig. 5), with the mentum a little longer than wide; sides parallel, strongly contracted at basal third; median lobe well rounded with a border of flat brown denticles and a fringe of thin scales; lateral lobe small with a short stout movable hook and no end hook at all, but the end obtusely rounded and the inner edge straight, armed with a series of numerous minute, quadrate denticles. A transverse row of scars across the rear of the head, ending laterally upon the summit of the prominent hind angles. Legs short, thinly fringed with hair on their edges; burrowing hooks of fore and middle tibiae small. The wing cases reach the base of the fifth abdominal segment.

Abdomen stout, chiefly narrowed posteriorly on the eighth and ninth segments; segments of about equal length as far as the ninth; the tenth much shorter, especially on its dorsal side. Appendages longer than the ninth segment, the superior declined at tip, as long as the inferiors, laterals one-fourth shorter. Lateral spines on segments 6-9 well developed, fringed with tawny hairs externally. Dorsal hooks strongly developed on segments 2-9, erect, on the fore, and posteriorly directed on the hinder segments.

#### GOMPHUS MINUTUS Rambur.

Plate XXXVIII, fig. 6.

Male and female specimens bred. Collection of Hubbard and Schwarz, Crescent City, Florida.

Length, 30 mm.; abdomen, 20 mm.; hind femur, 5 mm.; width of head, 5 mm.; of abdomen, 6 mm.

Body slender. Skin scurfy pubescent. Antenna with the slender third segment four times as long as the second, the first twice as long as the second, the fourth segment a very minute rudiment. Labium

(Plate XLIII, fig. 2) moderate, reaching posteriorly between the bases of the fore legs; mentum one-third longer than broad, slightly widest in the middle and tapering both ways to the ends; median lobe narrow, convex, with a dense fringe of long scale-like hairs; lateral lobe short with stout movable hook, arcuate end hook, and about seven quadrangular teeth on the inner margin, largest in the middle, single microscopic setae arising from the notches between the teeth. Rear of head with a transverse line of scars.

Dorsum of prothorax with two confluent scars. Burrowing hooks moderate; legs scantily hairy. Wing cases reach the base of the fourth abdominal segment.

Abdomen lanceolate, slightly depressed, with multiple scars on segments 3-9; lateral spines on segments 7-9, increasing in length posteriorly, those of segment 9 one-third as long as the tenth segment. Dorsal hooks wanting; there is a trace of an impressed median line on segments 4-6, and of a scurfy ridge on segments 7-9. Appendages as long as the tenth segment, and about equal each to each.

#### GOMPHUS CONFRATERNUS Selys?

"Crooked River, Oregon, 21st September, 1878, No. 540b, Henshaw."

Length, 28 mm.; abdomen, 17 mm.; hind femur, 6.5 mm.; width of head, 5.5 mm.; of abdomen, 7.5 mm.

Body lanceolate, depressed, hairy on edge of clypeus, sides of antennae, sides of the head below the eyes, tibiae externally, and lateral margins of the abdomen. Skin scurfy pubescent. Second segment of antennae half as long as the basal segment, the third segment five times as long as both basal together, the fourth segment a minute rudiment. Mentum of labium (Plate XLIII, fig. 3) with parallel sides; median lobe very slightly rounded, densely fringed with hair-like scales; lateral lobes short, arcuate, with long movable hook, and short moderately incurved end hook six to nine quadrate teeth on the inner margin, diminishing in size toward the base.

Burrowing hooks of fore and middle tibiae strong. Wing cases reaching nearly the apex of the fourth abdominal segment.

Abdomen lanceolate, widest across the middle, regularly tapering to the rather acutely pointed apex, with low, flat triangular pointed rudiments of dorsal hooks on segments 4-9, better developed posteriorly. Lateral spines on segments 6-9, increasing in length posteriorly, those on the ninth segment reaching the middle of the tenth segment. Appendages longer than the tenth segment, the laterals slightly shorter than the others.

I think the supposition as to name a very safe one, since the nymph clearly stands in about the same relation to that of *G. graslinellus* as the imago holds toward the imago of that species; this is perhaps the commonest *Gomphus* of the Northwest coast States.

## GOMPHUS SOBRINUS Selys?

Several exuviae were collected by Prof. R. C. Osburn at Seattle, Washington. This species occurs there, and is the only described regional species to which nymphs of this type can be supposed to belong.

Length, 40 mm.; abdomen, 27 mm.; hind femur, 5 mm.; width of head, 6 mm.; of abdomen, 8 mm.

Body elongate, depressed, smooth. Third segment of antenna hairy along its edges, more than four times as long as the two basal, of which the first is twice the second in size; fourth segment a minute rudiment. Labium (Plate XLIII, fig. 4) rather broad, mentum slightly widened anteriorly; median lobe slightly rounded on front margin and densely fringed with hairlike scales; lateral lobe short, stout, abruptly narrowed beyond the movable hook, where it is sharply incurved to form the end hook, before which on the inner margin are 4-5 low, broad teeth, increasing in size proximally. Hind angles of the head prominent, marked with narrow scars; hind margin with three broader scars.

Burrowing hooks small. Wing cases reaching the base of the fourth abdominal segment.

Dorsum of the abdomen with distinct impressed median line on segments 3-6, a pair of transverse small brown spots on either side the line on each of these segments; a flat, triangular rudiment of a dorsal hook on the apex of the ninth segment, perhaps also on the eighth. Prominent lateral spines on segments 6-9, about equal in size, those of segment 9 one-third as long as the tenth segment. Appendages longer than segment 10, and about equal in length each to each.

## DROMOGOMPHUS SPOLIATUS Hagen.

Exuvia, collected at Fort Wayne, Indiana, by Mr. E. B. Williamson, July 16, 1901. Imagoes were observed commonly, flying along the canal at the same place and time.

Length, 34 mm.; abdomen, 21 mm.; hind femur, 6.3 mm.; width of head, 6 mm.; of abdomen, 8 mm.

Body little hairy, strongly depressed, widest across the middle of the lanceolately pointed abdomen. Head depressed, wedge-shaped, pointed anteriorly, the labrum nearly covered by the appressed and flattened antennae. The two basal segments of the antenna are globular, the first a little larger, the third is more than twice as long as both basal ones together, depressed and concave superiorly and incurved at tip, and scurfy hairy on the thick margins, the fourth segment a very minute ovoid rudiment. Labium (Plate XLIII, fig. 5) moderate, hinge reaching posteriorly as far as the meso-thorax, the mentum with parallel sides beyond the narrower basal third, the front

border of the median lobe slightly concave, with minute double tooth in the middle and with the usual fringe of scales, the lateral lobes short and stout with long strong movable hook and without end hook, but with 7-8 backwardly serrate teeth on the inner margin, diminishing in size toward the base.

Legs depressed, hairy on edges, and marked with curved longitudinal bare scars, the fore and middle tibiae armed with strongly developed and conspicuous burrowing hooks. The wing cases reach posteriorly as far as the fourth abdominal segment.

Abdomen strongly depressed, lanceolate, widest across the middle and sharply pointed at the apex. Dorsal hooks rudimentary, represented on segments 6-8 by low apical elevations and on 9 by an even longitudinal middorsal ridge, whose distal end is slightly projecting. Lateral spines on segments 6-9, on 6 very small, on 7 and 8 successively longer and stronger and a little divergent, on 9 almost as long as the tenth segment, sharp-edged and closely appressed. The middle abdominal segments are of about equal length, the eighth is slightly longer, the ninth is a third longer, and the tenth is half as long as the ninth. Appendages as long as the eighth segment, the laterals a fifth shorter than the others.

Subfamily *ÆSCHELININÆ*.

**STAUROPHLEBIA RETICULATA** Burmeister.

Plate XXXIX, figs. 1, 2.

"Nicaragua, Escondido River, 50 miles from Bluefields, September 3, 1892," collected by Dr. Charles W. Richmond. "Found on pile near water."

Length, 51 mm.; abdomen, 35 mm.; hind femur, 9 mm.; antenna, 5; width of head at front across eyes 9, across hind angles 8 mm.; of abdomen, 9 mm.

Body elongate, little depressed, not hairy. Head widest across the very prominent eyes; antennae 7-jointed, pale; ratio of length of segments from base outward 1.5:1:1.5:1: 1.1:1.2:1.1. Labrum prominent, rounder in front, with granulate upper surface. Face with a submedian pair of low obtuse elevations; mandibles with a conspicuous, shelf-like lateral prominence that is armed with numerous short curved spines pointing forward. Vertex with the ocellar tubercle, prominent, deeply bifid, ending above in two erect acute points; sides of head behind the eyes parallel as far as the rounded hind angles, above each of which is a longitudinal row of three or four tubercles; hind margin concave. Labium (Plate XXXIX, fig. 2) very long, the hinge almost reaching the bases of the hind legs; mentum narrow in its basal two-thirds, suddenly widened at distal end, where the margins are upcurved, sharp, and spinulose. Median lobe with a shallow

V-shaped notch separating two low rounded lobes, each of which bears a long, strong, straight, anteriorly directed spine, a short fringe of hairs on the portion of the margin external to the spine. Lateral lobes short, each with a long arcuate movable hook, and a smaller, more slender, more arcuate, sharply pointed end hook, the inner margin very finely denticulate.

Prothorax with the end of its dorsal disk laterally prominent and acute; supracoxal processes obtuse, equal. Minute tubercles covering the sides of the thorax, and rugulations on the bases of the wings. Legs long; femora and tibiae thrice banded with brown; tarsi 3:3:3-jointed. Wing cases reaching the base of the fifth abdominal segment.

Abdomen triquetral, widest on segments 6 and 7, slowly narrowed posteriorly; segments 2-9 of about equal length; segment 10 one-half as long as the others, appendages longer than 9 and 10 together; superior appendages very slightly shorter than inferiors, with a round apical notch and a sharp dorsal carina; laterals one-half as long, straight on the external margin, convex on the internal margin, especially toward the tip, where suddenly contracted to a long point. Dorsal hooks represented by minute triangular rudiments on segments 9 and 10, that of the tenth segment twice the size of that of the ninth. Lateral spines on segments 6-10; on 6 minute; on 7 longer, but hardly reaching the apical suture; on 8 and 9 long, strong, prominent; those of 9 almost reaching the level of the apex of the tenth segment; those of the tenth segment short, triangular. The lateral margins of the eighth, ninth, and tenth segments and of the inferior appendages finely spinulose serrate.

A single female specimen. The venation is well enough indicated on its wing sheaths to allow generic determination, and but one species of *Staurophlebia* is known. The labium is very like that of the nymph of *Gynacantha*, and quite different from that of other known *Æschinae*, but the tuberculate upper surface of the head and the external process of the mandibles mark this as an archaic member of the *Gynacantha* group of genera.

#### Genus ANAX.

Nymphs of this genus are common in every collection of aquatic insects. They are readily recognized by the shape of the head, with the eyes broadly overspreading its sides (see Plate XL, fig. 1), and generally by the possession of lateral spines on abdominal segments 7-9 only. *Anax junius* Drury is probably the commonest species in the whole collection of nymphs of the National Museum, and it is certainly present from a larger number of different localities than any other species. Descriptions and figures of this nymph have been published by both Cabot and myself, the figure by Miss Hart<sup>a</sup> being especially

<sup>a</sup>Bull. Ill. State Lab. Nat. Hist., VI, pl. 1, fig. 5.

good; and other species are so very similar, there is little use in detailed descriptions of all parts. The differences are chiefly in size, form of median and lateral lobes of the labium, and in the relative lengths of the lateral spines and appendages of the abdomen. The descriptions of the two following species will therefore be confined to a statement of those characters in which specific differences have been observed.

**ANAX LONGIPES** Hagen?

A single huge cast skin from Jamaica, collected by Hubbard and Schwarz, is here referred by supposition to this species. There is in this case, however, no satisfactory assurance that the reference is correct.

Length, 55 mm.; abdomen, 39 mm.; hind femur, 11 mm.; width of head, 10 mm.; of abdomen, 10.5 mm. The color pattern is well shown, even in this cast skin (Plate XL, fig. 1). The labium is as in *Anax junius*, with rather prominent median lobe, divided to the base by an almost completely closed median cleft. The superior margin of the superior abdominal appendage is distinctly more convex than in *A. junius*, and the lateral appendages are a little longer, being half as long as the superior—a little less than half as long in *A. junius*.

**ANAX GUTTATUS** Burmeister?

Plate XL, fig. 2.

A number of nymphs from Buitenzorg, Java, collected by D. G. Fairchild, between April and December, 1896, all pinned, and some in bad condition.

The largest, apparently not fully grown, measures in total length 42 mm., abdomen 27 mm., hind femur 9 mm.; width of head 9 mm., of abdomen 10 mm. There is less development of color pattern in this species. The labium is similar as to its median lobe, but the end of the lateral lobe is less truncated, more rounded externally, and the rather stouter end hook, instead of being pointed directly backward, is inclined toward the opposite side of the body. The upper line of the superior appendage is very slightly convex, and the appendages are all rather shorter and stouter than in the preceding species.

The reason for referring the nymphs to this species is that this appears to be the common species of the East Indies, and the only one known from this locality. I am unacquainted with the adult.

**ÆSCHNA GALAPAGOENSIS** Currie.

Plate XL, fig. 3.

There are a few interesting little nymphs of this species, the largest of them hardly more than half grown, from Chatham Island (Galapagos), collected in 1891 by Dr. G. Baur and bearing the U. S. National

Museum Accession No. 26662. These are quite the most distinctly marked species of the genus that I have seen.

The largest measures in total length 32 mm., abdomen 21 mm., hind femur 6 mm.; width of head 7 mm., of abdomen 7.5 mm. The hinge of the labium (Plate XLIII, fig. 6) reaches backward barely as far as the metathorax. The median lobe is very short, and its middle cleft is tightly closed all its length. The end of the lateral lobe is squarely truncate, and not narrowed to the tip, and lacks end hook. The upper line of the superior appendage of the abdomen is straight—not convex in the least—and the laterals are three-fourths to four-fifths as long as the superior.

Lateral spines are obsolete on the sixth abdominal segment, and small on the seventh, but well developed upon the eighth and ninth, thus exhibiting a development that has hitherto been considered as distinctively characteristic of *Anax*. Mr. Currie pointed out in the original description of this species<sup>a</sup> that it is closely allied to *A. californica*, and in my description of the nymph of that species<sup>b</sup> I have mentioned the squarely truncated lateral labial lobes, correlated with less development of the lateral spines of the abdominal segments than is shown by nymphs of the more typical species of *Aeschna*.

Subfamily CORDULEGASTERINÆ.

CORDULEGASTER DORSALIS Selys?

Plate XXXIX, fig. 3.

“Upper Firehole Basin, Yellowstone Park, 1872, C. H. Merriam.”

Length, 35 mm.; abdomen, 23 mm.; hind femur, 7.5 mm.; width of head, 8.5 mm.; of abdomen, 8.5 mm.

Blackish, clothed with tawny hair only on sides of thorax, legs, and apical carinae of abdominal segments. Head narrowed behind the eyes, hardly concave posteriorly. Labium broad; median lobe with the usual bifid middle tooth (fig. 1*b*), the divisions of which are truncate on the end, with a very shallow indentation on the side, followed by a straight row of five or six excessively minute denticles and the usual fringe of hairs. Lateral setæ, 6-7; mental setæ, 8-9 each side, the outer five in a separate, stronger series and closer together; teeth as usual.

Wing cases reaching to the middle of the fifth abdominal segment.

Abdomen regularly tapering to a sharp point; no dorsal hooks; no lateral spines; appendages decurved at apex, as long as the ninth and tenth segments together; lateral appendages one-fourth as long as the others.

<sup>a</sup>Proc. Washington Acad. Sci., III, 1901, p. 385.

<sup>b</sup>Bull. Ill. State Lab. Nat. Hist., VI, p. 45.

Doctor Hagen mentioned under this specific name three nymphs from California,<sup>a</sup> which agree with this one in the only diagnostic character stated—the absence of lateral spines from abdominal segments. Doctor Hagen did not describe the form of the median lobe of the labium carefully or mention the raptorial setae at all.

CORDULEGASTER DIADEMA Selys?

“Bright Angel, Ariz., July 12. H. S. Barber, collector.”

Male. Length, 35 mm.; abdomen, 23 mm.; hind femur, 7 mm.; width of head, 8 mm.; of abdomen, 8 mm.

Body rough, hairy all over; head with prominent eyes anteriorly; sides behind them at first parallel, then abruptly narrowed to the straight hind margin, before which is a pair of large scars. Frons with a shelf-like prominence fringed with stiff yellow hairs. Antennae short, third segment as long as the first and second together, fourth half as long, and the remaining segments successively shorter. Labium ample; median lobe with the usual bifid tubercle (fig. 1*a*) at its apex, each half of which is again bifid (as in *C. diastatops*), the lower tooth hardly rising above the level of the fringe of hairs at the sides. Lateral setae 5; mental setae 8-9 each side, the four outermost constituting a separate and stronger series.



FIG. 1.—DIVIDED MEDIAN TOOTH OF MIDDLE LOBE OF NYMPHAL LABIUM. *a*, IN *CORDULEGASTER DIADEMA*; *b*, IN *C. DORSALIS*.

Abdomen regularly tapering, without dorsal hooks or lateral spines, with the usual apical fringes of incurved hairs on segments 2-9; appendages longer than segments 9 and 10 together, the laterals one-fifth to one-fourth as long as the others.

After the above description was written Mr. Currie sent me from the National Museum another specimen—a cast skin left by a nymph at transformation.<sup>b</sup> This, he suggested, should belong to *C. diadema*, since the imago of that species was collected in the same locality. It agrees closely with the younger nymph above described, except for larger size. Length, 47 mm.; abdomen, 34 mm.; hind femur, 8 mm.; width of head 9 mm.; of abdomen, 9 mm.

The wing cases reach only the fourth abdominal segment, and there are shaggy locks of hair on the sides of the body below them. The ninth segment is shorter on the ventral side, and the tenth segment is shorter on the dorsal side than preceding segments. The end of the abdomen is nearly destitute of stiff hairs, which abundantly fringe the high apical carinae of the middle and basal segments.

Mr. F. C. Willard sent me a cast nymphal skin of this species from Tombstone, Arizona, in 1897.

<sup>a</sup>Trans. Amer. Entom. Soc., XI, 1885, p. 289.

<sup>b</sup>This is the one mentioned by him in Proc. Ent. Soc., Washington, V, 1903, p. 303.

Subfamily MACROMIINAE.<sup>a</sup>

## EPOPTHALMIA ELEGANS Brauer.

There is in the National Museum a single alcoholic specimen of nymph of this magnificent species, received through Oberlin College from Rev. Cyrus M. Clark, Miyazaki, Japan. It agrees entirely with the description given by Cabot of one in the Museum of Comparative Zoology, from Canton, China,<sup>b</sup> but is a larger specimen: Length, 40 mm.; abdomen, 25 mm.; hind femur, 14 mm.; width of head, 8 mm.; of abdomen, 14 mm. There are in the Cornell University collection a number of imagos received from the same source. I have compared the venation in the wings of nymph and imagos, and have fully satisfied myself that the nymph belongs to this species. The nymphal wings are distinctly spotted with blackish brown, as described in Cabot's paper, but it does not follow therefrom, as supposed in that paper, that the wings of the imago would be likewise spotted. In *Pantala flavescens* there are conspicuous spots of brown upon the nodus of the nymphal wings, which, as everybody knows, are wanting in the wings of the imago. I believe that these markings are ontogenetic and that the developmental tendency is generally toward hyalinity of wing membrane, and not toward infuscation.

This species differs from the more typical species of *Epoptthalmia* by characters which I believe will be regarded as justifying its generic separation. Aside from its huge stature, its singular color pattern, its unusual proportions in length of male abdominal appendages, and its smaller number of cubito-anal cross veins, it has three other characters in contradistinction to the more typical species of *Epoptthalmia* that I regard of generic importance: (1) Its cubital vein where it borders the subtriangle is straight and strong; in the others it is weak and angulate. (2) Its radial sector is gently and regularly curved; in the others it is broken and distinctly ajog opposite the distal end of the radial supplement. (3) Its ninth abdominal segment in the male bears above a truncated cone; in the others it bears two basal denticles.

Since this is the largest and one of the most peculiar members of the fauna of the Land of the Dragonfly, I would suggest as an appropriate name for a new genus to contain it the classical Japanese name Azuma.<sup>c</sup>

<sup>a</sup> The use of the name *Synthemine* for this subfamily in Bull. Ill. State Lab. of Nat. Hist., VI, p. 5, was due to enforced haste in printing, whereby proof corrections made by me were not received by the printer in time for incorporation into the text.

<sup>b</sup> Immature State of the Odonata, Pt. 3, 1890, pp. 9-11, pl. 1, fig. 1-1d.

<sup>c</sup> My friend and pupil, Mr. S. Asada, of Tokio, informs me that the children with whom he played as boy would sometimes capture a female of this species, tether her with a thread, and use her as a decoy to lure the males within their reach.

## Subfamily LIBELLULINÆ.

## PALTOTHEMIS LINEATIPES Karsch.

Plate XXXIX, fig. 4.

San Bernardino County, California, May. "A. Koebeler, collector."

Length, 23 mm.; abdomen, 14 mm.; hind femur, 6 mm.; width of head, 6.5 mm.; of abdomen, 9 mm.

A smooth blackish species, paler ventrally, with yellowish, basal rings on femora and tibiae. Head wider than long, with eyes not very prominent, well rounded; a very obtuse frontal ridge across the face, before which the face is vertical, behind which, sloping. The curve of the very obtuse and scurfy pubescent hind angles of the head, beginning at the eye and ending upon the straight hind margin. Labium broad, the hinge reaching posteriorly between the bases of the middle legs, median lobe prominent, spinulose on margin; lateral lobes ample, each with 7-8 large obtuse teeth on opposed lateral margins, the uppermost double, the others separated by deep notches, each armed with about four graduated spinules at tip internally; movable hook stouter, but hardly longer than setæ; lateral setæ 9; mental setæ 14-15 each side in a regular series, longest in the middle.

Legs short smooth; wing cases reaching the base of abdominal segment 7.

Abdomen broad, depressed, most narrowed posteriorly on the ninth segment, tenth segment short, half as long as the ninth, but not included in the ninth. Dorsal hooks on segments 2-6 erect diminishing in size from the front, on 6 very rudimentary, a trace on 7, wanting on 8-10; all hidden between the wing cases. Lateral spines on segments 8 and 9 short, sharp, straight, those of the ninth segment not reaching the level of the apex of the tenth segment on the ventral side. Appendages short stout, as long as the ninth segment on its ventral side; superiors and inferiors equal; laterals one-third shorter; the inferiors spinose on lateral margins; the superior thick at base with a strongly arcuate, median longitudinal, carina.

This singular nymph, so suggestive of the Cordulinae in the form of its body and in the large teeth, higher than wide, on the opposed edges of the lateral labial lobes, was so puzzling to me I could not resist the temptation to remove the wings of one side from the solitary specimen. A moment's examination of the venation shown was enough to settle its identity.

## DYTHEMIS VELOX Hagen ?

Plate XLII, fig. 2.

There is a single nymph in the National Museum that I take to belong to this species. It is from Sand River, San Marcos, Texas, and was collected March 24, 1899. It is apparently not quite grown.

Length, 17 mm.; abdomen, 8 mm.; hind femur, 5 mm.; width of head, 5 mm.; of abdomen, 6.5 mm.

Body smooth, depressed, greenish, varied with brown above. Head depressed, sloping forward to the base of the antennæ, strongly narrowed behind the eyes to the nearly straight hind margin. Labium large, its hinge reaching posteriorly as far as the middle of the mesothorax; median lobe of the mentum prominent, with a fringe of slender scattered spines; mental setæ 9-10, the 5-6 outermost longer than the others. Lateral setæ 10. Hook slender, setiform; teeth almost obsolete, with the usual spinules.

Legs long and thin. Wings reaching backward as far as the middle of the seventh abdominal segment.

Abdomen broad, depressed, with thin lateral margins. Dorsal hooks on segments 3-9 in a regular and even series, thin, flat, sharp-pointed, that of the ninth segment bent downward at tip. Lateral spines on segments 8 and 9, thin, flat, sharp, strongly convergent on 9, and with spinulose-serrate external margins. Ninth segment strongly concave on dorsal apical margin; tenth annular included. Appendages slightly longer than segment 9 is on the dorsal side, short-triangular, sharp-pointed, hairy on margins, the laterals a little more than half the length of the others.

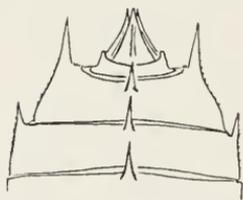


FIG. 2.—END OF ABDOMEN OF NYMPH OF DYTHEMIS FUGAX? FROM ABOVE.

#### DYTHEMIS FUGAX Hagen?

I have described "a nymph from Roswell, New Mexico, which I have supposed belongs to this species. It is very like the nymph described above, and referred to *D. velox*, except in the form of the lateral spines on the eighth and ninth abdominal segments. Fig. 2 is a drawing of the end of the abdomen of this species. A comparison of this figure with the photograph reproduced in Plate XLII, fig. 2, will serve to show the differences. I have deposited a specimen of this species in the United States National Museum.

#### RHYOTHEMIS PHYLLIS Sulzer?

Plate XLI, figs. 1, 2.

Three nymphs apparently well grown.

Length, 19 mm.; of abdomen, 12.5 mm.; hind femur, 6 mm.; width of head, 5 mm.; of abdomen, 7 mm.

A short and very smooth species, with broad depressed abdomen. Head pentagonal, with straight or slightly concave hind margin, obtuse hind angles, small eyes covering the lateral angles of the head at midway its length, and with obtusely prominent labrum. Antennæ pale, 7-jointed, joints nearly equal in length excepting the third, which

is one-third longer than the others. Labium short, the hinge scarcely reaching the mesothorax; median lobe not very prominent, its sides straight and spinulose and a pair of spinules on the obtuse median angle, and an elongate-oval, chitinous thickening on the middle of the floor of the mentum; mental setae 10 each side, fifth, counting from the side longest; lateral setae 5, longer than the slender, tapering, nearly straight movable hook; teeth on opposed edges low, serrate, incurved, each armed with 3-4 graduated spinules.

Legs long, thin, nearly bare, and longitudinally grooved. Wings reaching the middle of the seventh abdominal segment.

Abdomen triquetral, with sharp lateral edges, and flat sides sloping like a low roof, oval in outline, the long appendages furnishing an attenuate apical point. Lateral spines on segments 8 and 9, stout, short, triangular, those of the ninth segment as long as the tenth segment. Segments slightly increasing in length from the second to the ninth, the tenth one-third as long as the ninth on the dorsal side. Inferior appendages as long as segments 9 and 10 together, superiors scarcely shorter, laterals one-third as long. Dorsal hooks on segments 3-10, on 3 and 4 slender erect on 5 and 6 broader, declined, on 7-9 still broader, covering basally their respective segments, their thin superior margins produced posteriorly in a sharp point; the hook on segment 10 similar, much smaller, its point obtuse.

Buitenzorg, Java. D. G. Fairchild.<sup>a</sup>

<sup>a</sup> While reading the proof of this article there have come to hand a number of nymphs from Batangas, Philippine Islands, sent by my former pupil, Mr. C. F. Carstens, now of the provincial high school of that place. These nymphs are slightly larger, being fully grown (length, 22 mm.), the number of raptorial setae upon the mentum of the labium is but 8 each side, and the third of these, counting from the side, is longest. Aside from these trivial differences, they are apparently quite identical with the ones described above.

I am able to make out in these some further venational characters that should assist in identifying the species: The ante and post cubitals are in the fore wing 12 and 8-9, respectively, and in the hind wing 8 and 10, respectively. Vein *Cu* is strongly angulate at base of triangle in the fore wing, the apex of the triangle appearing sharply retracted. There is one cross vein in the triangle, there are but three cells in the subtriangle, and the space between the latter and the hind margin is very narrow. There are three rows of cells beyond the triangle for a distance, and there is a weakly developed median supplement subtending one row of oblique cells.

In the hind wing there is a single cubito-anal cross vein before the triangle; the latter is open, and the broad anal loop consists of two rows of large cells, the distal row divided and double from "heel" to "toe;" from the proximal marginal vein of the loop about five accessory sectors are decurrent to the hind margin.

The venation is not very different from that of such species of *Neurothemis* as *N. equestris*; but the sectors of the areculus are apparently separate at base in the fore wing, as they should not be in *Neurothemis*. Specimens of the Batangas nymphs are deposited in the National Museum.

## CROCOTHEMIS SERVILIA Drury?

Plate XLI, fig. 3.

Two nymphs somewhat similar to the preceding, apparently grown, smaller.

Length, 13.5 mm.; abdomen, 8.5 mm.; hind femur, 4 mm.; width of head, 4 mm.; of abdomen, 6 mm.

Head pentagonal, straight behind, sides sloping from the laterally prominent eyes, front somewhat depressed; all smooth except the hind angles inferiorly. Labium short; median lobe with front margin produced into a median obtuse middle angle, and with spinose margins. Mental setæ 11-12 each side, the seventh (counting from the side) longest; lateral setæ 6 with an additional basal axial spinule; movable hook longer and stronger than the setæ, attenuate to the slightly incurved apex; teeth on opposed edges of lateral lobes small, serrate spinulose—each with three to four graduated spinules.

Legs long, thin, nearly bare, longitudinally grooved. Wing cases reaching the middle of the seventh abdominal segment.

Abdomen sharply triquetral, widest in the middle, oval in outline. Lateral spines on segments 8 and 9, stout, those on the ninth segment about attaining the level of the apex of the tenth segment. Dorsal hooks on segments 3-9, erect and narrower in front, becoming declined and broader at base posteriorly; all sharp, longest on segment 6. Appendages longer than the last two segments on their dorsal side, sharp-edged, the superior slightly declined at tip, laterals paler, one-third as long.

The reference of these nymphs to this species is made with misgivings. It can only be said, therefore, that imagos of this species were sent by D. G. Fairehild from the same locality, Buitenzorg, Java, and that in the venation rather scantily evidenced by markings on the wing sheaths there appear to be no serious disagreements. The nymphs seem, however, rather too small. The reference is very doubtful.

## ORTHEMIS FERRUGINEA Fabricius.

This species, which is common through most parts of tropical America, was bred for me by Mr. F. G. Schaupp, at Shovel Mount, Texas, in August and September, 1897, and bred specimens are in the National Museum and in my own collection. Its nymph is very similar to the nymphs of *Plathemis* and *Ladona*, and agrees with them in having the front border of the median lobe of the labium erenulate; but it differs from both in lacking dorsal hooks, and its abdominal appendages are much longer than in *Plathemis*.

Length, 22 mm.; abdomen, 13 mm.; hind femur, 5.5 mm.; width of head, 5.5 mm.; of abdomen, 7 mm.

Body lanceolate-cylindric, little depressed. Head somewhat cubical,

with small eyes capping the antero-lateral angles, scarcely narrowed on the sides before the obtuse hind angles; hind margin a little concave; frons very hairy. Labium (fig. 3) short, hinge reaching between the bases of the fore legs. Median lobe of the mentum moderately prominent, with a strongly crenulate front border, the crenulations increasing in size on either side up to the base of the prominent median tooth. Mental setae about 10 each side, the innermost indistinct, the fourth (counting from the side) longest, the fifth and succeeding ones suddenly shorter. Lateral lobes moderate, lateral setae 8, hook moderate, teeth serrate, each armed with three or four graduated spinules.

Prothorax with high and well-exposed spiracles. Legs rather short and very hairy; held close to the body in locomotion. Wing cases reaching posteriorly as far as the sixth abdominal segment.

Abdomen somewhat triquetral, widest in the middle and tapering gradually to the apex, without dorsal hooks but with dorsal tufts of long hair replacing hooks on segments 4-7. Lateral spines on segments 8 and 9, of nearly equal size and in length equaling about one fourth the length of their respective segments. Segments 8 and 9 concave on their dorsal apical margins and 10 annular. Appendages as long as segments 8-10 on the dorsal side (about as long as 9 and 10 on the ventral side), spinous margined, slender and sharp, the laterals less than half as long as the others.

There are traces of single black bands on the sides of the thorax and near the apex of the abdomen, ending upon the base of the lateral appendages. Base of the superior appendage black.

#### ORTHETRUM LEPTURUM Burmeister?

Plate XLI, figs. 4, 5.

Twenty-nine specimens, some in very bad condition. Buitenzorg, Java, D. G. Fairchild; also a number of imagoes from the same locality.

Nymph (apparently nearly grown). Length, 17 mm.; width of head, 4 mm.; of abdomen, 5.5 mm.

Body slender, not depressed, with sides nearly parallel, and sharply pointed abdomen. Head cubical, concave in front between the high, prominent eyes. Face and hind angles hairy; eyes situated before the middle of the length of the head, the sides behind them nearly straight and parallel as far as the rounded hind angles, hind margin scarcely concave. Labium moderate, hinge reaching posteriorly to the mesothorax, median lobe prominent, with a brownish middle tooth, and

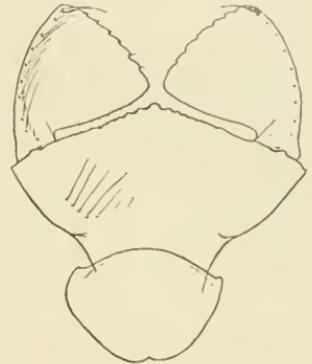


FIG. 3.—LABIUM OF NYMPH OF ORTHEMIS FERRUGINEA, FROM WITHIN.

the margin on either side of the tooth distinctly serrulate, with spinules arising singly between the serrulations. Mental setæ 3 each side, with an irregular transverse band of smaller ones across the middle. Lateral setæ 8. Hook rather short, stout at base, rapidly tapering to a slender incurved point. Teeth on opposed margins of lateral lobes small, becoming obsolete at the inner angle, slightly hooked, each armed with one or two short spinules.

Thorax slightly compressed, high. Legs slender, hairy. Wing cases reaching the base of the seventh abdominal segment.

Abdomen triquetral, the sides nearly appparallel as far as the eighth segment. Lateral spines on segments 8 and 9, straight, sharp, spinose on external margin. Dorsal hooks on segments 4-7, long, straight, sharp, slightly declined at apex, decreasing in size anteriorly where hidden between the wings, with spinose superior margins. Appendages very long and slender, as long as the last three segments of the abdomen together; laterals two-fifths as long as the others, all thinly fringed with tawny hairs. Segment 10 exerted, more than twice as long on the ventral side as on the dorsal.

LIBELLULID gen.? sp.?

Plate XLI, figs. 11, 12.

Two small nymphs, apparently half grown. Length, 11 mm.

Stocky, rather smooth of body, with short legs.

Head of the type of *Libellula*, concave in front between the high, narrow, very prominent eyes, which are directed forward and are situated before the middle of the head. Sides of the head scarcely narrowed before the broadly rounded hind angles. Rear marked with longitudinal scars. Antennæ pale with basal segments blackish. Labium ample, median lobe prominent, with a wide obtuse middle tooth, on either side of which the edge is strongly serrulate; stout spinules arise singly between the serrulations; eleven mental setæ each side, the seven outermost in a stronger series; nine lateral setæ; movable hook long, slender, straight to the incurved apex; teeth on opposed margins about ten, strongly serrate, each armed with about three or four graduated spinules.

Legs pale, scantily hairy; femora with two dark bands.

Abdomen blackish with paler margins, smooth, depressed, possessing the merest rudiments of dorsal hooks on segments 4 and 5, where hidden between the wings. There are very short bare lateral spines on segments 8 and 9, one-fifth the length of their respective segments. Segment 9 very strongly concave on its apical dorsal margin, less than half as long on middorsal as on midventral line. Tenth segment annular, included in the apex of the ninth. Appendages short, hardly longer than the ninth segment on its ventral side, triangular, yellowish, with black bases; laterals one-third as long as the others. Seg-

ment 10 one-half as wide as 9, which, with the abbreviated appendages, gives the abdomen a truncate appearance.

I am wholly unable to locate these nymphs generically. There is no venation to guide, and they are immature. They will be found to belong, however, to some genus allied to *Orthetrum*, with which they agree in all points except the structures of the apical abdominal segments, the brevity of the abdominal appendages, etc.

LIBELLULA SATURATA Uhler.

Plate XLII, fig. 1.

Prof. V. L. Kellogg has kindly sent me a bred specimen of this species from Stanford University collection (lot 143, sub. 20), and I have a number of nymphs kindly collected for me by Dr. John M. Stowell at San Jose, California, in February. These latter, dated April, 1897, are "from water cress in running water."

This species is distinguished among its congeners by its hairiness, its lack of dorsal hooks, and especially by the unusual brevity of the lateral spines of the ninth abdominal segment.

Length, 26 mm.; abdomen, 16 mm.; hind femur, 6.5 mm.; width of head, 6.5 mm.; of abdomen, 8 mm.

Body stout, depressed cylindrical, with squarish head and tapering abdomen. Head of the usual form, very hairy on the hind angles. Antennae with basal segments very hairy, the ratio of length of segments from the base outward being as 1:1.1:2:1.2:1.6:2:2. There is a transverse blackish band between the eyes, inclosing a paler spot on the frontal tubercle. The labium is large, with its hinge reaching posteriorly as far as the metathorax. The median lobe of the mentum is rather less prominent than usual, with smooth border and no middle tooth bearing regularly placed spinules. Lateral setae 11-12, the six outermost in a longer series. Lateral lobes broad, concave, each with 9-10 lateral setae and about ten low, crenate teeth with eroded summits on the opposed borders, each armed with 3-4 graduated spinules.

Thorax blackish on the dorsum, darker around the spiracles, and before the bases of the wings. Legs yellowish, hairy. Wings reaching the seventh abdominal segment.

Abdomen with a single middorsal and a pair of obscure lateral longitudinal lines; the dorsum of the tenth segment and the sides of the appendages blackish. Dorsal hooks wanting. Lateral spines on segments 8 and 9 about one-eighth as long as their respective segments, that of 9 a very little shorter than that of 8. Segment 9 concave on its dorsal apical margin; 10 annular, and almost included in the apex of 9. Appendages as long as segments 9 and 10 together, the superiors and inferiors equal, spinous margined; the laterals about half as long.

A later sending of a few alcoholic nymphs, received by the National Museum from the United States Fish Commission, includes several

specimens of this species from White's Warm Springs, Saw Tooth, Idaho. There are in the collection of the Illinois State Laboratory of Natural History a number of specimens collected by Prof. S. A. Forbes in the Yellowstone National Park, labeled "Firehole, Jul. 19th, 1890." There is in the collection of Dr. O. S. Westcott, of Chicago, Illinois, a single imago collected by him in the Yellowstone Park. It will be observed that these specimens, representing the northermost limit of the known range of the species, come from warm water. Possibly this species, which appears to be common in ordinary waters far to the southward, is able to extend its range through the agency of these warm streams, which furnish the proper temperature conditions for the development of its nymph. Possibly this is equally the case with *Mesothemis collocata*, and with other species also.

#### LIBELLULA FORENSIS Hagen.

I have of this species a single female specimen that was bred by Mr. S. Bethel, at Olympia, Washington, on May 2, 1898, and a number of younger nymphs taken earlier in the season by the same collector. The imago was placed in alcohol before transformation was complete, and is in a very bad condition, and hardly determinable. It appears to be the species named above, and the structural characters of the nymph point to the same species.

Length, 24 mm.; abdomen, 15 mm.; hind femur, 6.5 mm.; width of head, 6.5 mm.; of abdomen, 7 mm.

Body lanceolate, very hairy. Head compact, half as long as wide, with small eyes capping the high anterolateral angles, little contracted behind the eyes, where sides are nearly parallel to the broadly rounded and scurfy pubescent hind angles. Antennæ about as long as the head, the relative length of segments from base outward: 1:1:1.8:1:1.2:2:1.5. Hinge of labium reaching backward as far as the mesothorax. Median lobe of mentum moderate, a toothlike prolongation in the middle of its front border, which is bordered with spinules rather regularly placed, but not crenate. Mental setæ about 8 each side in a short and sharp curve, all weak and fragile. Lateral setæ 6. Teeth about 10, low, subtruncate, subserrate, each armed with three or four graduated spinules.

Legs slender, very hairy. Wing cases reaching backward as far as the base of the sixth abdominal segment.

Abdomen lanceolate, widest on segment 6, and gradually tapering thereafter to a long point. Dorsal hooks on segments 3-7, poorly developed, except on middle segments, and hidden under thick tufts of coarse hairs. Lateral spines on segments 8 and 9, short, sharp, straight, about a fifth as long as their respective segments. Appendages longer than the long ninth and tenth segments together, slender, sharp, fringed with tawny hairs; laterals less than half as long as the others.

Since the above was written I have seen another specimen in the Museum of Comparative Zoology, from Cache Valley, Utah (No. 659), collected by C. Thomas.

SYMPETRUM MADIDUM Hagen?

A single fully grown specimen was collected for the United States Fish Commission by Mr. Chauncey Juday in Lake Creek at Twin Lakes, Colorado, on August 12, 1902. It is more strongly chitinized than usual for nymphs of the genus, and differs from all others known to me in the extreme reduction of the dorsal hook on the eighth abdominal segment and in the relatively greater length of the lateral abdominal appendages. Its reference to *madidum* is more or less doubtful. *S. decisum* and *S. atripes* both belong to the Colorado fauna.

Length (fully grown), 14.5 mm.; abdomen, 9 mm.; hind femur, 4.5 mm.; width of head, 4.5 mm.; of abdomen, 5 mm.

Body short and rather stout, smooth. Head widest across the anterior portion, where the eyes are rather prominent and are set well forward. The top of the head is smooth and the obtuse hind angles are strongly hairy, while the hind margin is nearly straight—perhaps slightly concave. Antennæ slender and hardly longer than the head, the length of the segments from the head outward being in the following ratio: 1:2:3:2:2.5:3:2.5. Labium of the proportions usual for the genus, with about 12 mental setæ each side, the fifth or sixth (counting from the side) longest. Lateral setæ 12, diminishing in size toward the base, the hook setiform, about as long as the seta behind it. Teeth subobsolete, with the usual groups of spinules.

Legs slender, smooth. Wing cases reach the middle of the sixth abdominal segment. Abdomen moderately depressed, and with rather sharp lateral margins. Lateral spines on segments 8 and 9, straight, on 9 about as long as the segment and twice as long as on 8. Dorsal hooks represented on segments 5-8, well developed on 6 and 7, smaller and erect on 5, and on 8 rudimentary and very inconspicuous. Segment 8 of abdomen slightly and segment 9 strongly concave on hind dorsal margin; 10, annular, included in the apex of 9. Appendages very unequal, the superior about three-fourths as long as the inferiors, its tip attaining the level of the tips of the lateral spines of the ninth segment. Laterals three-fourths as long as the superior. Superior and inferiors with spinous margins, stout triangular pyramidal bases and acuminate points set at an angle with the bases and directed posteriorly, while the bases are directed upward. Laterals pale yellowish.

## TRITHEMIS AURORA Burmeister?

Plate XLI, figs. 6, 7.

More than eighty specimens, some in very bad condition; many apparently well grown: Buitenzorg, Java, D. G. Fairchild.

Length, 16 mm.; abdomen, 10 mm.; hind femur, 4.5 mm.; width of head, 5.5 mm.; of abdomen, 6 mm.

A short, stocky nymph, with flat head and abruptly pointed abdomen. Head strongly flattened anteriorly and strongly sloping to the front, with hind margin nearly straight, sides sloping outward to the eyes, which are rather large and directed antero-laterally. Antennæ seven-jointed pale beyond the second segment. Labium broad, its hinge reaching the middle of the mesothorax; median lobe prominent, obtuse at apex, its sides straight, thinly spinulose; mental setæ about 14, weak, in an indistinct series, the fifth to seventh each side longest; lateral setæ 10, in length equaling the very slender hook; teeth on opposed edges obsolete of lateral lobes, but single spinules remain to mark their position.

Legs rather short, hind tibiæ showing a series of fine spinules. Wing cases reaching the middle of the seventh abdominal segment.

Abdomen stout, little depressed, rounded dorsally, without dorsal hooks. Lateral spines on segments 8 and 9, short, stout, one-third as long as their respective segments, spinulose on their external margins. Tenth segment less than half as long on the middorsal as on the mid-ventral line, more or less included in the apex of the ninth segment. Appendages as long as the ninth segment on its ventral side; laterals one-half as long as the others, divaricately curved at tips. Some nymphs show paler markings on ocellar tubercle, and on apical and lateral margins of abdominal segments. Legs pale, with indistinct darker bands on femora.

This is certainly a *Trithemis*, and one of the more typical group of species; if not the one named above, then, at least, some closely allied species.

## DIPLACODES TRIVIALIS Rambur.

Plate XLI, figs. 8, 9.

More than a hundred specimens, many in bad condition, and some possibly not the same species, but not sufficiently distinct in their present state for separation. Some apparently grown. Also a number of imagos, collected at the same time and place: Buitenzorg, Java, D. G. Fairchild.

Length, 11.5 mm.; abdomen, 6 mm.; hind femur, 3.5 mm.; width of head, 4 mm.; of abdomen, 4.5 mm.

Similar to the preceding species, but much smaller, with head less flattened in front and eyes more prominent laterally. Median lobe

with very short spinules at regular intervals along its straight sides. Mental setæ 13, the second to sixth longest. Lateral setæ 10-11, teeth on opposed margins of lateral lobes serrate, small, uni-spinulose.

Abdomen similar to that of *T. aurora*, without dorsal hooks, with minute lateral spines on segments 8 and 9, sometimes apparently wanting on 8, on 9 perhaps one-fifth as long as that segment; segment 10 annular, included in the apex of the ninth; appendages as long as 9 on the ventral side, superiors a little shorter than inferiors, suddenly contracted to a slightly declined tip, laterals a little shorter, three-fourths as long as inferiors.

On Plate XLI, figs. 6-10, I bring together figures of the nymphs of the typical *Trithemis aurora* and of two aberrant species that are sometimes referred to the same genus, *T. trivialis* and *T. minuscula*, and on Plate XLIV I bring together the wings of the same species. To *Diplacodes* belongs, I think, *trivialis*, for reasons well indicated by Doctor Krüger.<sup>a</sup> The single crossvein under the stigma with a long vacant space before it, combined with the cubital branches of the hind wing separated at their departure from the triangle are very characteristic.

As to *T. minuscula*, with its more elongate nymph, its reduced venation, short anal loop and single row of cells between the radial sector and its supplement, I agree with Doctor Ris.<sup>b</sup> that it, together with its nearest tropical American allies, will eventually have to be separated from *Trithemis* as a new genus.

#### TRITHEMIS MINUSCULA Rambur.

Plate XLI, fig. 10.

Full-grown nymphs collected at Gotha, Orange County, Florida, in January, 1897. While the species was not bred, its identification is positive, because the venation of the imago is fully indicated in the wings of the well-preserved nymphs, and is unmistakable among the species that belong to Florida. Imagos were sent from the same locality a little later in the season.

The nymph measures in total length 12 mm., abdomen 7 mm., hind femur 3.5 mm.; width of head 3.5 mm., of abdomen 4 mm.

Body stout, nearly smooth. Head somewhat depressed, especially across the front, which is flush with the very prominent and large eyes, narrowed behind the eyes to the nearly straight hind margin. Antennæ slender, shorter than the head; ratio of length of segments from the base outward: 1 : 1.2 : 2.2 : 1.2 : 1.2 : 2 : 2. Labium with hinge reaching backward to the mesothorax; median lobe very prominent, its front border not crenulate, but with a row of rather regularly arranged spinules along the margin on either side and a pair close together at the tip of the median tooth-like prolongation.

<sup>a</sup> Stett. Ent. Zeit., 1902, p. 127.

<sup>b</sup> Ent. News, XIV, p. 219.

Mental setæ about 12 each side, the fifth (counting from the side) longest. Lateral lobes large, broadly concave. Lateral setæ 8; hook slender, setiform; teeth minute, almost obsolete, unispinulose.

Legs rather thinly clad with hairs. The basal segment of the tarsus is longer than half the length of the second or third segments. The wing cases reach posteriorly as far as the apex of the sixth abdominal segment.

Abdomen triquetral, sharp edged; in outline, oval. Dorsal hooks wanting. Lateral spines on segments 8 and 9, terminating very strongly spinulose; lateral margins on these segments about a fourth as long as the segments that bear them, straight and sharp. Segment 9 slightly concave above on the apical margin; 10 one-half shorter dorsally, one-third shorter ventrally, than 9. Appendages as long as the last two segments are on the dorsal side; superior and inferiors stout, with thin, divaricate tips and spinous margins; laterals one-fourth shorter than the others.

Color greenish, suffused with brownish dorsally, the brown divided on thorax and abdomen by a narrow middorsal pale line that is most sharply marked behind. There is a row of dots either side of the dorsum of the abdomen extending from the hind wing to the base of the lateral appendage, a pair of dots to each segment. There is a divided brownish spot on the dorsum of the prothorax and another on the mesothorax, and there are the usual bare scars on the rear of the head.

**MICRATHYRIA PALLIDA**, new species.

Length, male, 29 mm., abdomen 20 mm., hind wing 22 mm.; female, length 25 mm., abdomen 17 mm., hind wing 21 mm.

Color pale, fulvous; face greenish yellow. top of frons and vertical tuberele washed with chalybeous. Thorax nearly uniform fulvous, without stripes, with black dots sprinkled over the dorsum and narrow black lines on some of the corinæ about the wing roots. Legs yellowish fulvous, apical part of femora externally and all of tibiæ internally, and the tarsi blackish. Wings hyaline, slightly flavescent at extreme base; veins fuscous; stigma pale, fulvous. Abdomen brownish fulvous, darker toward apex by reason of confluence of fuscous tracts along the dorsal and lateral carinæ. Appendages yellow. Sides of abdomen little narrower beyond basal segments, regularly approximating posteriorly. Appendages as shown in figs. 5 and 6.

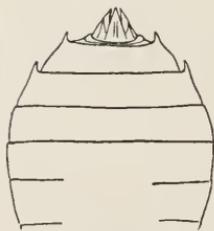


FIG. 4.—END OF ABDOMEN OF NYMPH OF MICRATHYRIA PALLIDA FROM ABOVE.

Venation of wings very similar in the two sexes. Ante- and postnodals in fore wing 11 and 7 respectively, in hind wing 8 and 8 respectively. There are 2 crossveins behind the stigma. There are 3 cells in the subtriangle of the fore wing; there is one crossvein

traversing the triangle, and there are 2 or 3 cells immediately thereafter with 2 rows following for a considerable space, increasing to 3 and to 4 at wing margin. In the hind wing the triangle is open, there is but a single cubito-anal crossvein before it, vein  $Cu_1$  arises from its outer side, distinctly apart from  $Cu_2$ , the anal loop is rather short, with a single row of cells along either side its bisecting vein except at the "heel" where there is a single additional cell interpolated.

The hind lobe of the prothorax is produced in a moderate quadrangular undivided posterior lobe fringed with tawny hairs.

The vulvar lamina of the female is elongate triangular, rounded on the tip, which nearly attains the level of the apex of the slightly produced sternum of the ninth segment.

This species was bred at São Paulo, Brazil, by Mr. Adolph Hempel, on October 8, 1897, and a number of adult specimens were captured at large at the same time and place.

*Nymph*: Length 12 mm., abdomen 7 mm. hind femur 3.5 mm.; width of head 3.5 mm., of abdomen 4.5 mm.

Body thick set; head highest in the rear, sloping forward, the large, bulging eyes capping the antero-lateral angles, broadly rounded behind the eyes to the nearly straight hind margin. Labium moderate, the hinge reaching posteriorly beyond the bases of the fore legs. Mentum wide, median lobe very prominent, its border not crenate, but armed with spinules rather regularly placed and with a pair of spinules close together at the tip, which is not produced forward to form a distinct tooth; mental setæ 9 each side, the fifth (counting from the side) longest. Lateral setæ 6. Teeth minute, serrate, unispinulose.



FIG. 6.—GENITAL HAMULE AND LOBE OF MALE OF MICRATHYRIA PALLIDA.

Thorax somewhat compressed, high; spiracles very prominent, highest at their projecting inner angle. Legs thin, sparsely spinulose externally. Wing cases reaching posteriorly as far as the middle of the sixth abdominal segment. Tarsal claws increasing markedly in length posteriorly, those of the hind tarsi being twice as long as those of the fore tarsi.

Abdomen (fig. 4) triquetral, ovate, widest on segment 6, tapering gradually to the ninth, which is suddenly narrower. Tenth segment short, annular, almost included in the apex of the ninth. Dorsal hooks wanting. Lateral spines on segments 8 and 9 about a third as long as the segments. Appendages as long as segments 9 and 10 together, superior and inferiors of equal length, laterals a little more than half as long.

This species clearly belongs to *Micrathyria*, but I am not sure it may not have been described already under some of the older names.



FIG. 5.—TERMINAL ABDOMINAL APPENDAGES OF THE MALE OF MICRATHYRIA PALLIDA.

some of which, relating to the South American fauna, I have no knowledge of. I therefore present herewith a figure of the abdominal appendages (fig. 5) and of the accessory genitalia of the second abdominal segment (fig. 6) of the male, and trust that these will render certain the identity of this species later when Brazilian *Micrathyrius* shall come to be studied.

TRAMEA EURYALE Selys ?

Plate XL, fig. 4.

In the Fairchild collection from Java are a number of nymphs belonging to a species of *Tramea*, here doubtfully referred to *euryale*; two other species of *Tramea*, *T. burmeisteri* and *T. chinensis*, are known from the East Indies.

The apparently full grown nymph measures in total length 22 mm., abdomen 15 mm., hind femur 7 mm., width of head 7 mm., of abdomen 8.5 mm.

Body and head of the usual form (Plate XL, fig. 4). Antenna longer than the head; the relative length of the segments from the base outward in the ratio: 1 : 1.1 : 2.5 : 2 : 2.3 : 2.4 : 2.6. Labium ample, with about eleven mental setæ each side, the seven outermost in a close set series of which the fourth or fifth is longest; lateral setæ 10, the basal one smaller than the others. Teeth about 11 in number, low, serrate, each armed with four or five spinules at tip.

Lateral spines on abdominal segments 8 and 9 incurvate, exteriorly spinulose, slightly longer on 9, almost reaching the level of the tips of the inferior appendages. Superior appendage three-fourths as long as the inferiors, and slightly longer than the laterals. The inferiors strongly spinous on their margins.

PANTALA FLAVESCENS Fabricius.

Plate XL, fig. 5.

Side by side with the nymph of *Tramea* just described I place the nymph of the cosmopolitan *Pantala flavescens*, for the sake of showing clearly the differences between the two genera they represent. In *Pantala* the teeth on the opposed edges of the lateral lobes of the labium are separated by much deeper incisions of the margin and the mid-dorsal terminal appendage is much longer than in *Tramea*.

Subfamily LESTINÆ.

ARCHILESTES GRANDIS Rambur.

Plate XLII, fig. 3.

Folsom, California, July, 1885, and Hot Springs, Arizona, June 26, 1901; also Bright Angel, Arizona, July 12, Colorado Canyon, 3,500 feet. Nymphs apparently grown.

Length 40, including gills 12 mm., abdomen 20 mm., hind femur 7 mm., antennæ 9 mm.; width of head 5 mm., of abdomen 4 mm.

Body elongate, cylindric. Head scarcely wider than the thorax, with large, well-rounded, laterally prominent eyes, low obtuse hind angles, and a wide notch between the latter on the hind margin. Antennæ long and very slender beyond the two basal segments. Ratio of length of segments in order from the base 1: 1.5: 3: 2.5: 2: 1.5: 1. Labium very long and slender; hinge reaching posteriorly beyond the bases of hind legs; mentum narrow, with sides parallel, suddenly widened in its distal fourth; median lobe produced, rounded—almost truncate—in front, with a shallow, hardly closed median cleft; mental setæ 7 each side, decreasing in length internally; lateral setæ 3-4, of which but one is on the body of the median lobe, the others being upon the long, strong arcuate movable hook; lateral lobe (Plate XLIII, fig. 7) trifid at its distal end, the divisions each forming simple arcuate hooks, of which the innermost—the end hook—is longest and strongest.

Thorax stout, short. Legs long, slender, smooth. Wing cases almost reaching the apex of the fourth abdominal segment.

Abdomen cylindric, very slightly tapering on the last two segments, with stout lateral spines on segments 5-9, lesser ones on segments 3 and 4, and with serrulate lateral margins for the entire length. Segment 10 somewhat compressed, with a sharply compressed dorsal ridge, which ends in a high triangular fold whose posterior margins are strongly spinose. Gills broad, oblong, with parallel sides, obtuse apices, and distinctly segmented axes; color brown, with transverse median and basal (this one interrupted on the axis) pale bands. The better preserved specimens show the color to have been pale yellowish or greenish brown, with a transverse row of arcuate marks on the rear of the head, indistinct vertical bands on the sides of the thorax, narrow longitudinal lines on the femora, a double row of brownish clouds each side of the abdomen, and two little transverse marks on the dorsum of 3-7.

This species was bred for me by my friend and former pupil, Mr. Frank C. Willard, in the Huachuca Mountains, near Tombstone, Arizona, in July, 1897. It was found at an altitude of from 5,500 to 7,500 feet. The following interesting observations as to its haunts and habits are quoted from one of Mr. Willard's letters:

The water was a swift little mountain stream that kept appearing and disappearing as it flowed down; also a deep reservoir, formed by damming a similar stream in another canyon. The water was very cold. The nymphs [of *Archilestes*] were very numerous. They were observed transforming about 10 o'clock in the morning, ascending the stems of cat-tails and horsetails about a foot above the surface of the water. The imagos were very pale and flabby for some time after emergence, and even when fully developed they are very sluggish, staying among the thick grass and keeping their wings horizontal, instead of holding them up, as other damsel flies do.

## Subfamily AGRIONINÆ.

## ARGIA FUMIPENNIS (Burmeister).

Several young specimens, collected at Gotha, Florida, on January 1, 1897, by Mr. Adolph Hempel. Numerous imagos of this species were collected at the same place and time, and no other species of *Argia*. These circumstances, as well as the structural characters of the nymphs themselves, render the supposition very probable.

Length (very immature) 10 mm., gills 4 mm. additional, abdomen 6.5 mm.

Body thickset and rather short. Head depressed, with moderate eyes, behind which the large hind angles are rather squarely truncated behind and rounded and scurfy hairy at the sides. The antennæ are slightly longer than the head. The labium (Plate XLIII, fig. 9) is moderate, with the hinge extending posteriorly as far as the mesothorax. Mental setæ wanting as in other members of the genus. Lateral setæ 2 and a rudimentary third. Lateral lobe (Plate XLIII, fig. 10) lacking the usual notch that separates the inner margin from the end hook.

Legs short. Wings reaching only the base of the second abdominal segment.

Abdomen rather short, cylindric, with the segments decreasing slightly in length apically as far as the ninth, the tenth being slightly longer than the ninth. Gills oboval, dark colored, the laterals, carinate for a distance from the base, the carinæ being low and spinulose and extending outward three-fourths of their length. Color dark, with a transverse blackish band near the apex.

## ARGIA sp.?

Plate XLII, fig. 4.

This species differs from other known species of the genus in the possession of strongly triquetral gills, the lateral lamellæ possessing a high, sinuate lateral carina extending to the apex. The species appears to belong to tepid or mineralized waters in the Rocky Mountains. Full-grown specimens are from Bright Angel, Arizona, collected by Messrs. Barber and Schwarz on July 13, and from White Sulphur Springs, shore of Great Salt Lake, Utah, collected by Messrs. Hubbard and Schwarz. There are younger specimens in the Illinois State Laboratory collection, obtained by Professor Forbes in the Yellowstone Park, and Professor Cockerell has taken immature specimens of it in the tepid brooklets that flow outward from the Las Vegas Hot Springs in New Mexico.<sup>a</sup>

Length, 12 mm.; gills, 4 mm. additional; abdomen, 7 mm.; width of head, 4 mm.; of abdomen, 2.5 mm.

<sup>a</sup>These are the nymphs referred to in Psyche, X, p. 136.

Body short and stout, frequently incrustated and showing little color pattern, little hairy. Head depressed, subquadrangular, with well-rounded eyes capping the antero lateral angles, and with the hind angles rather prominent and very obtuse, and hairy externally, a deep notch in the hind margin between the hind angles. Antenna about as long as the head, the relative length of the segments for the base outward being as follows: 1: 1.2: 2.5: 2: 1.2: 1: 1. Labium moderate, the hinge reaching posteriorly as far as the mesothorax. Median lobe prominent, its border finely spinulose. Lateral setæ 3, preceded by one or more small spinules. Hook stout, arcuate. I have already published a figure of the labium of this species.<sup>a</sup>

Thorax stout, not at all depressed. Legs short. Wings reaching posteriorly well over the fifth abdominal segment.

Abdomen short, slightly tapering, the segments beyond the second decreasing successively a little in both length and diameter as far as the ninth; the tenth distinctly longer than the ninth, and emarginate on its apical margin on the dorsal side. Gills oblong, their margins parallel almost to the tip, there tapering suddenly; laterals triquetral and concave internally, with a high sinuate external carina extending to the apex; dorsal gill with two less developed carinæ on its sides; all blackish mottled, with a more or less distinct subapical transverse paler band, and white tips.

#### HYPONEURA LUGENS Hagen.

Plate XLII, fig. 5.

I have already described this species,<sup>b</sup> but without figures. I give some figures herewith to aid in comparing with the foregoing nearly allied species of *Argia*. In Plate XLII, fig. 5, is shown the nymph and also a lateral view of a detached gill lamella. In Plate XLIII, fig. 8, is shown the labium as viewed from within. This form is one of the most generalized of the *Agrioninae* (*s. str.*).

#### TELAGRION DÆCKII Calvert?

A single full-grown female nymph, collected at Gotha, Florida, on January 1, 1897, by Mr. Adolph Hempel. Its slight form, long abdomen, and moderately long and slender legs seem to foreshadow the proportions these parts have in the adult of the species to which they are here referred, and there is hardly any other species inhabiting Florida to which they could be supposed to belong. The wings are unfortunately crumpled within their sheaths, and do not admit of an examination of the venation.

Length, 18 mm.; gills, 5.5 mm. additional; abdomen, 13 mm.; width of head, 3 mm.; of abdomen, 1.5 mm.

<sup>a</sup> Bull. 68, N. Y. State Museum, pl. xiv, figs. *i* and *j*.

<sup>b</sup> Psyche, X, pp. 135, 136.

Body very slender, with long cylindric abdomen. Head depressed, with eyes very large and laterally very prominent, the sides of the head sloping behind the eyes to the obtuse and scurfy pubescent hind angles between which is a deep notch on the hind margin. The three basal segments of the antenna (which only are preserved) are in relative length from the base outward as 1:1.5:3. The labium (Plate XLIII, fig. 13) is long and slender, with the hinge reaching posteriorly as far as the mesothorax. The median lobe is rather obtusely prominent; there are three mental setae each

side, decreasing in length toward the median line. There are six strong lateral setae, and the end hook is rather short and stout. The inner margin of the lateral lobe is rather strongly convex and terminates in a stout and arcuate end hook, above which on the end is a row of four teeth in a straight row, diminishing in size externally, the outer angle being nearly a right angle.



FIG. 7.—CAUDAL GILL LAMELLE OF NYMPH OF *TELAGRION DECKII*, FROM THE SIDE.

The legs are slender and not very long; each femur shows a faint subapical brown ring. Wings reaching the base of the fourth abdominal segment. Thorax rather small.

Abdomen long, slender, cylindric; segments 2-8 of equal length, the ninth a little shorter, and the tenth half as long as the eighth. Gills (fig. 7) almost half as long as the abdomen, narrowly oblong, widest just beyond the middle and abruptly narrowed to submucronate tips, the basal half of both margins of each gill thickened and spinous, but not jointed where the thinner margin begins.

#### TELEBASIS SALVA Hagen.

Bred specimens from Mr. F. G. Schaupp collected at Shovel Mount, Texas.

Length, 14 mm., including gills, 3.3 mm.; abdomen, 6 mm.; width of head, 3.5 mm.

Head depressed, much wider than succeeding parts of the body, with large laterally prominent eyes, low hind angles, a sharp notch between them on the hind margin. Antennae much shorter than the head is wide. Labium short, hinge hardly reaching the mesothorax.

Legs moderate, scantily spinulose. Wing cases reaching the middle of the fourth abdominal segment. Abdominal segments of about equal length, cylindric; the tenth a little shorter than the others, especially on the dorsal side. Gills (fig. 8) oblanceolate, widest at three-fourths their length, and suddenly narrowed to an obtusely rounded apex, their margins smooth, marked with a few distant faint brown spots, and tracheae more or less pigmented.



FIG. 8.—MIDDLE GILL LAMELLA OF NYMPH OF *TELEBASIS SALVA*.

## ACANTHAGRION CHELIFERUM Selys.

This species was reared at São Paulo, Brazil, September 20, 1897, by Mr. Adolph Hempel. The following description is drawn from a single cast skin, lacking gills and otherwise somewhat mutilated; the skin was accompanied by the teneral male imago that had emerged from it, and in the same sending were other maturer specimens of the same species, serving to render certain the identification of it by direct comparison. No nymphs of the genus being known, it is thought worth while to describe those characters that are shown by the present specimens, more especially because the most important of these are in the labium, which is well preserved.

The nymph measures in total length of body (gills wanting) about 13 mm.; abdomen, 7.5 mm.; hind femur, 3 mm.

Body and head of the same form and proportions as in *Eudlagma* and *Ischnura*. Antennæ longer than the head, the ratio of length of segments from the base outward being: 1:1.5:2.2:2.2:2:1.7:1. Labium (Plate XLIII, fig. 11) moderate, mentum regularly widened to the base of the lateral lobes, just before each of which is a row oblique of minute spinules near the lateral margin; one mental seta each side. Lateral setæ 7, strong; movable and end hooks both well developed, the end of the lateral lobe (Plate XLIII, fig. 12) between these hooks, thin and rather evenly denticulæ on its revolute margin, the outer angle well rounded.

Legs slender, scantily armed with minute spinules. Wing cases reaching posteriorly as far as the apex of the third abdominal segment.

## HESPERAGRION HETERODOXUM Selys.

This exquisite damselfly was bred for me by Mr. Frank C. Willard in the Huachuca Mountains near Tombstone, Arizona, in the latter part of July, 1897. The altitude was near 7,500 feet. The situation was a deep reservoir of cold water, formed by damming a stream that flowed through a narrow canyon. The imagos of the species "spent most of their time among the joint-grass that grew in the edge of the water."

The nymph measures 15 mm.; gills, 4.5 mm. additional; hind femur, 2.5 mm.; width of head, 2.5 mm.; of abdomen, 2 mm.

Body elongate, slender, gradually tapering posteriorly. Head wide, with eyes laterally very prominent, and the sides broadly rounded behind the eyes to the



FIG. 9.—LABIUM OF NYMPH OF HESPERAGRION HETERODOXUM, THE LATERAL LOBE OF THE SAME, MORE ENLARGED.

excavate hind margin. Antennæ longer than the head, six, possibly seven, jointed, the last suture being indistinct, the ratio of the segments from the base outward being as 1:1.4:1.8:1.3:1.1:1:3? The labium (fig. 9) is of moderate size. The mentum is regularly widened to the base of the lateral lobes. The median lobe is moderately prominent, smooth on the edge and with straight sides. Mental setæ four (in one case on one side three) each side. Lateral lobe with six setæ, a stout movable hook, three distinct teeth on the end above the end hook, and the outer angle angulate with unusual sharpness, its margins scarcely edentulate.



FIG. 10.—MIDDLE GILL LAMELLA OF NYMPH OF *HESPERAGRION HETERO-DOXUM*.

The legs are rather short. The wing cases reach posteriorly as far as the middle of the fourth abdominal segment.

The abdomen is cylindric, with segments of nearly equal length, slightly diminishing in diameter toward the end, the tenth segment somewhat emarginate on its superior apical margin. Gills (fig. 10) oblong-oval, widest just beyond the middle, broadly rounded at the ends, and with somewhat darker pigmentation along the axis.

#### LEPTOBASIS sp.?

Four nymphs, not fully grown, collected by Mr. August Busch at Cataña, Porto Rico, in January, 1899.

Length, 13 mm.; gills, 4 mm. additional; width of head, 3 mm.; of abdomen, 2 mm.

Slender, pale, short-legged nymphs, with broad, depressed head, large, laterally prominent eyes, behind which the sides slope abruptly to the obtusely prominent hind angles, between which on the rear of the head is a deep and well-rounded excavation. Antennæ longer than the head; ratio of segments 1:1.2:1.5:1.4:.6:.4. Labium moderate, its hinge reaching backward as far as the mesothorax, its median lobe very prominent, with serrulate margins, the serrulations directed laterally, and, therefore, in opposite directions on the two concave sides. One mental seta only each side. Lateral setæ, 3. End of the lateral lobe above the end hook with a series of 4-5 minute recurved denticles, diminishing in size to the outer angle.



FIG. 11.—MIDDLE GILL LAMELLA OF NYMPH OF *LEPTOBASIS* SP.? FROM PORTO RICO.

Legs short and rather slender. Wings reaching as far back as the apex of the fourth abdominal segment.

Abdomen cylindric, the segments of about equal length, or the two hindmost slightly shorter than the others and narrower. Gills (fig. 11) oblong, obtuse at apex, with a broad longitudinal diffuse pigmented axial tract, and pale margins. Each gill is divided transversely across

the middle by a suture into two parts, of which the basal is thicker and more strongly chitinized and has spinulose edges. On the dorsal side the brown of the skin is divided by a pale, narrow, longitudinal line, close beside which is a pair of blackish dots upon the apex of each segment.

## EXPLANATIONS OF PLATES.

## PLATE XXXVIII.

- Fig. 1. Nymph of *Gomphoides stigmatus* from Texas.  
 2. Nymph of *Phyllogomphus athiops?* from the Congo.  
 3. Labium of the same.  
 4. Nymph of *Ophiogomphus bison* from Lake Tahoe.  
 5. Part of labium of same. -  
 6. Cast skin of nymph of *Gomphus minutus* from Florida.

## PLATE XXXIX.

- Fig. 1. Nymph of *Staurophlebia reticulata* from Nicaragua.  
 2. Labium of same.  
 3. Nymph of *Cordulegaster dorsalis?*, with labium partly opened.  
 4. Nymph of *Pallothemis lineatipes* from California.

## PLATE XL.

- Fig. 1. Cast skin of nymph of *Anax longipes?* from Jamaica.  
 2. Nymph of *Anax guttatus?* from Java.  
 3. Nymph of *Eschna galapagoensis* from Chatham Island.  
 4. Nymph of *Tramea euryle?* from Java.  
 5. Nymph of *Pantala flavescens* from Java.

## PLATE XLI.

- Fig. 1. Nymph of *Rhyothemis phyllis?* from Java.  
 2. Lateral view of the same.  
 3. Nymph of *Crocothemis scriveria?* from Java.  
 4. Nymph of *Orthetrum lepturum?* from Java.  
 5. Lateral view of the same.  
 6. Nymph of *Trithemis aurora?* from Java.  
 7. Lateral view of the same.  
 8. Nymph of *Diplacodes trivialis* from Java.  
 9. Lateral view of the same.  
 10. Nymph of *Trithemis minuscula* from Florida.  
 11. Lateral view of unidentified *Libellulid* nymph from Java.  
 12. Dorsal view of head of same.

## PLATE XLII.

- Fig. 1. Nymph of *Libellula saturata* from California.  
 2. Nymph of *Dythemis relox?* from Texas.  
 3. Nymph of *Archilestes grandis* from Arizona.  
 4. Nymph of *Argia sp.?* from Rocky Mountains (hot springs).  
 5. Nymph of *Hyponeura lugeus* from New Mexico (gill detached).

## PLATE XLIII.

- Fig. 1. Labium of nymph of *Gomphoides stigmatus*.  
2. Labium of nymph of *Gomphus minutus*.  
3. Labium of nymph of *Gomphus confraternus?*  
4. Labium of nymph of *Gomphus sobrinus?*  
5. Labium of nymph of *Drogomphus spoliatus*.  
6. Labium of nymph of *Eschna galapagoensis*.  
7. Lateral lobe of labium of nymph of *Archilestes grandis*.  
8. Labium of nymph of *Hypponeura lugens*.  
9. Labium of nymph of *Argia fumipennis*.  
10. Inner view of lateral lobe of the same.  
11. Labium of nymph of *Acanthagrion chelififerum*.  
12. Inner view of lateral lobe of the same.  
13. Labium of *Tetragrion dæckii?*

## PLATE XLIV.

- Fig. 1. The wings of *Trithemis aurore?*.  
2. The wings of *Trithemis minuscula*.  
3. The wings of *Diplacodes trivialis*.



2



1



3



4



6



5

DRAGON-FLY NYMPHS.

FOR EXPLANATION OF PLATE SEE PAGE 719.

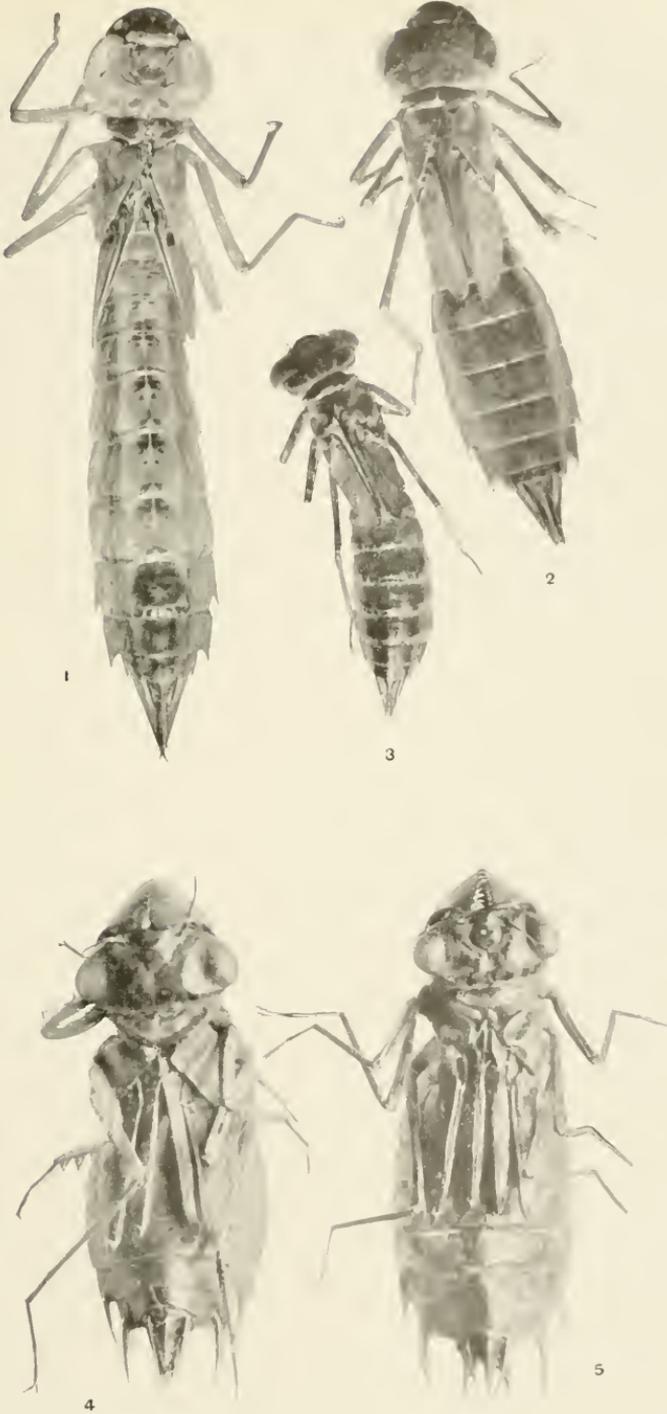




DRAGON-FLY NYMPHS.

FOR EXPLANATION OF PLATE SEE PAGE 719.

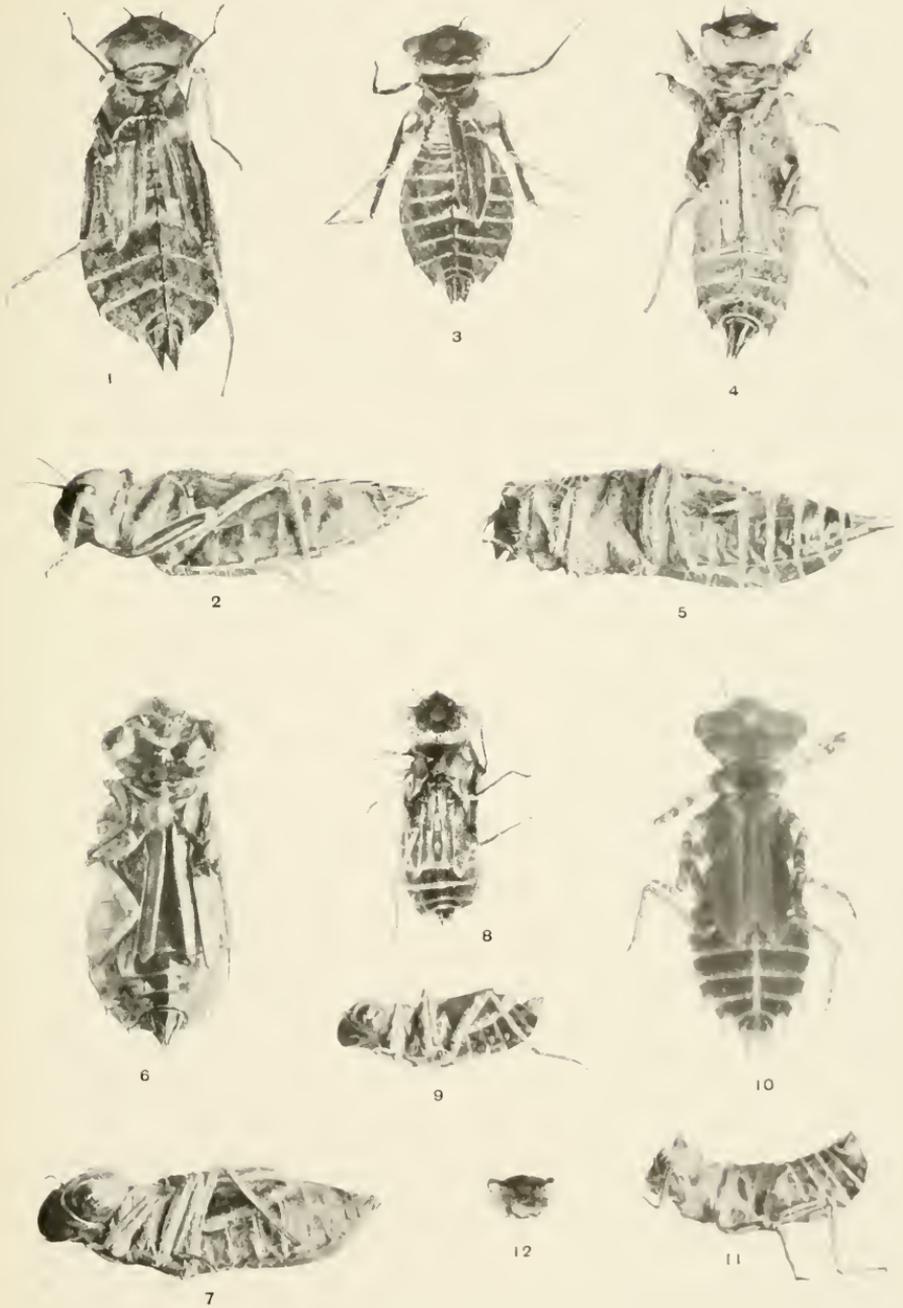




DRAGON-FLY NYMPHS.

FOR EXPLANATION OF PLATE SEE PAGE 719.





DRAGON-FLY NYMPHS.

FOR EXPLANATION OF PLATE SEE PAGE 719.

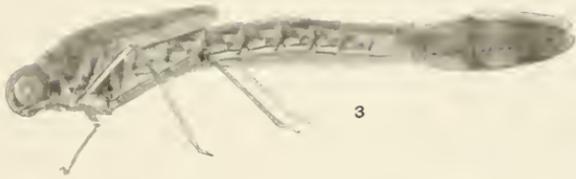




1



2



3



4

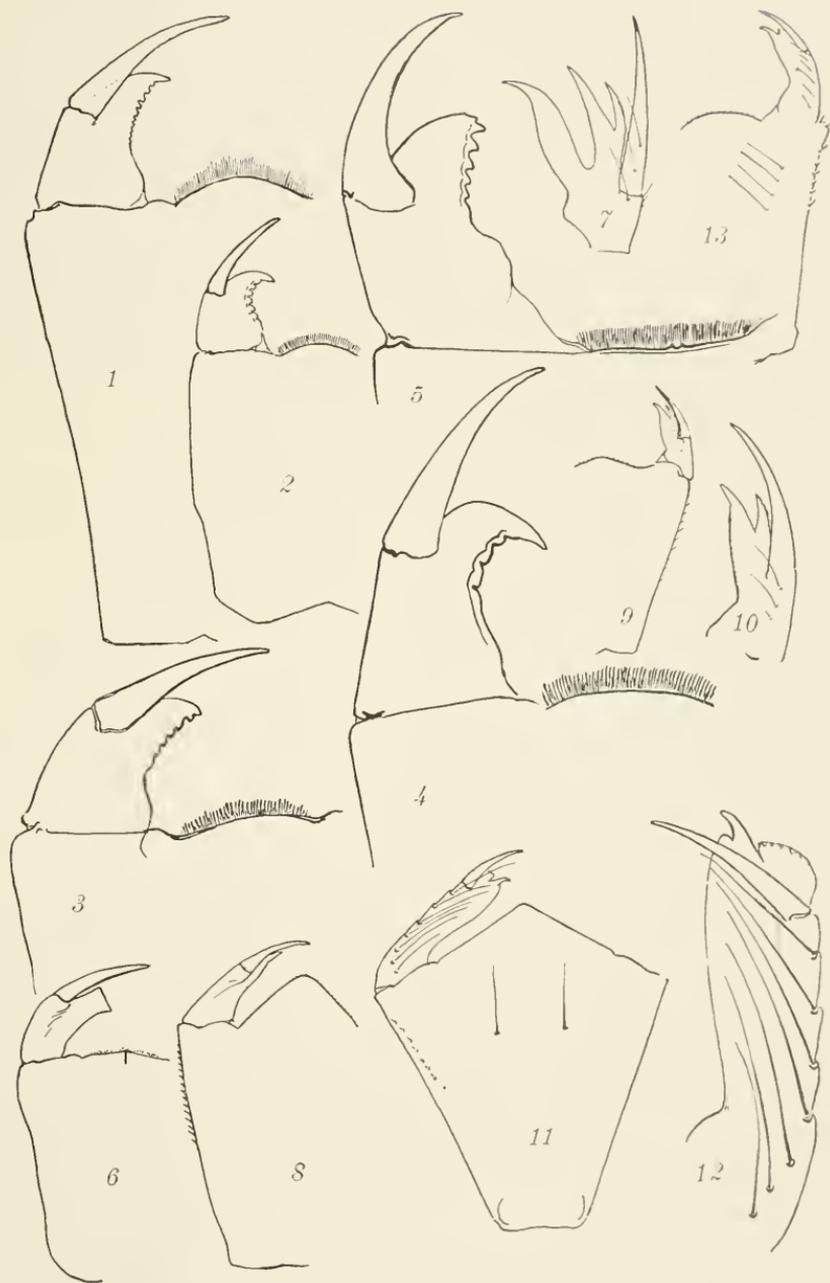


5

DRAGON-FLY NYMPHS.

FOR EXPLANATION OF PLATE SEE PAGE 719.

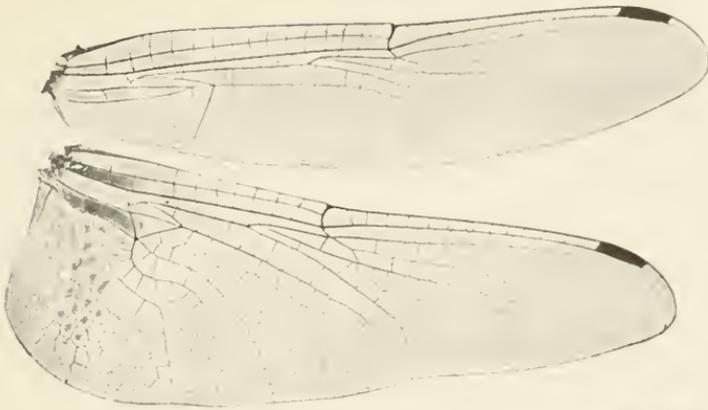




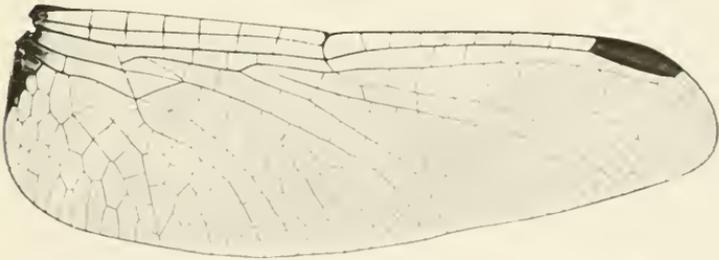
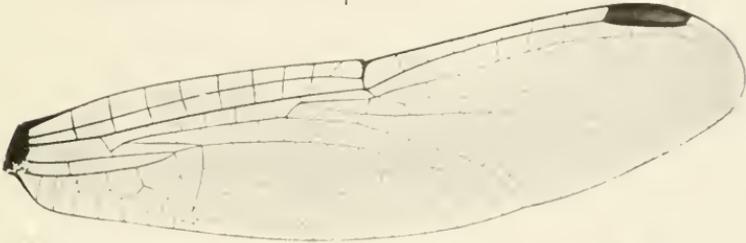
LABIAL CHARACTERS OF DRAGON-FLY NYMPHS.

FOR EXPLANATION OF PLATE SEE PAGE 720.

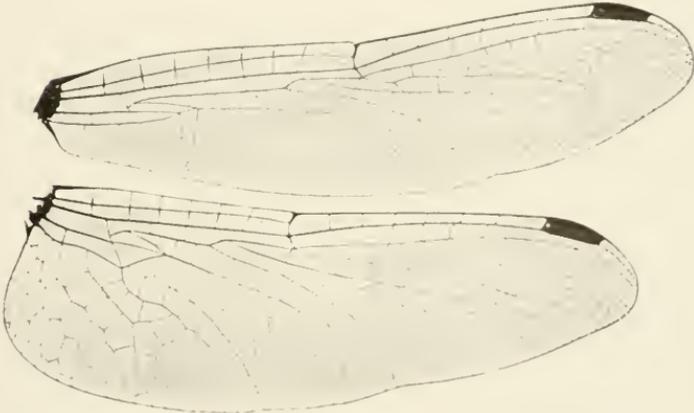




1



2



3

DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 720.

