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THE DAMSELFLIES (Zygoptera) OF TEXAS

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THE DAMSELFLIES (ZYGOPTERA) OF TEXAS

CLIFFORD JOHNSON

SYNOPSIS: This report presents an identification guide to adult damselflies occurring in Texas. Illustrated characters, a guide to morphological terminology, and short text support the diagnostic keys. The text gives geographical range and habitat preferences for each group. Distribution data appear by county for each species and reveal patterns of convergence between east and west faunas.

TABLE OF CONTENTS

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INTRODUCTION

This study provides a species list for the damselfly fauna of Texas, diagnostic keys for adult identification, and current knowledge of their distribution. The taxonomy of U. S. damselflies is well known, and the latest description of a species occurring in the state appeared in 1924. Table 1 lists 53, possibly 54, species inhabiting Texas with description dates and authorities.

Hagen's (1861) *A Synopsis of North American Neuroptera* was the first major publication to include Texas material. A significant number of Texas records appears in the Odonata section of *Biologia Centrali-Amer-*

TABLE 1. THE DAMSELFLY FAUNA OF TEXAS

LESTIDAE Needham 1903

Archilestes grandis (Rambur) 1842
Lestes alacer Hagen 1861
Lestes disjunctus australis Walker 1952
Lestes forficula Rambur 1842
Lestes inaequalis Walsh 1862
Lestes sigma Calvert 1901
Lestes vigilax Hagen 1862
Lestes simplex Hagen 1861[1]

CALOPTERYGIDAE Selys 1853

Calopteryx dimidiata Burmeister 1839
Calopteryx maculata (Beauvois) 1805
Hetaerina americana (Fabricius) 1798
Hetaerina titia (Drury) 1773

PROTONEURIDAE Tillyard 1926

Neoneura aaroni Calvert 1903
Protoneura cara Calvert 1903

COENAGRIONIDAE Kirby 1890

Anomalagrion hastatum (Say) 1839
Argia apicalis (Say) 1839
Argia barretti Calvert 1902
Argia bipunctulata (Hagen) 1861
Argia fumipennis violacea (Hagen) 1861
Argia hinei Kennedy 1918
Argia immunda (Hagen) 1861
Argia lugens (Hagen) 1861
Argia moesta (Hagen) 1861
Argia munda Calvert 1902
Argia nahuana Calvert 1902
Argia plana Calvert 1902
Argia rhoadsi Calvert 1902
Argia sedula (Hagen) 1861
Argia tibialis (Rambur) 1842
Argia translata Hagen 1865
Enallagma basidens Calvert 1902
Enallagma civile (Hagen) 1861
Enallagma divagans Selys 1876
Enallagma dubium Root 1924
Enallagma durum (Hagen) 1861
Enallagma exsulans (Hagen) 1861
Enallagma geminatum Kellicott 1895
Enallagma novaehispaniae Calvert 1907
Enallagma praevarum (Hagen) 1861
Enallagma signatum (Hagen) 1861
Enallagma traviatum Selys 1876
Enallagma vesperum Calvert 1919
Ischnura barberi Currie 1903
Ischnura demorsa (Hagen) 1861
Ischnura denticollis (Burmeister) 1839
Ischnura kellicotti Williamson 1898
Ischnura posita (Hagen) 1861
Ischnura prognatha (Hagen) 1861
Ischnura ramburii (Selys) 1850
Ischnura verticalis (Say) 1839
Hesperagrion heterodoxum (Selys) 1868
Nehalennia integricollis Calvert 1913
Telebasis salva (Hagen) 1861
Teleallagma daeckii (Calvert) 1903

[1]Questionable status: see text.

icana by Calvert (1901-1908), the *Catalogue of the Odonata of North America* by Muttkowski (1910), and the *Handbook of Dragonflies of North America* by Needham and Heywood (1929). The following regional studies for the state supplement these contributions. Williamson (1914) reported on collections in central and south Texas, while Tucker (1908), Ferguson (1940, 1942), and Harwell (1951) provided distributional notes from north-central and east Texas. Tinkham (1934) and Gloyd (1958) reported on the Texas fauna occurring west of the Pecos River. Gloyd's paper also includes important taxonomic revisions and is essential to any student of the area. Shorter references to Texas species appeared in Calvert (1893), Gloyd (1932), Johnson (1961, 1962, 1963), and Donnelly (1964). Isolated data on Texas material also exist in taxonomic works such as Williamson (1912, 1917). These studies present an incomplete list of the state's fauna and are long out-of-print.

Acknowledgements

Data in this report represent collective efforts of many students and records from numerous collections. Thomas Donnelly contributed unpublished state records of *Enallagma dubium, Ischnura kellicotti, I. prognatha,* and *Nehalennia integricollis,* in addition to other distribution data. Leonora K. Gloyd provided the unpublished state record for *Argia rhoadsi,* distribution data from the Williamson Collection at the University of Michigan, and several smaller collections. Her invaluable comments on the genus *Argia* deserve special mention. Dennis R. Paulson, George H. Bick, and Claron Bjork contributed distribution data from private collections. Lois O'Brian, Horace C. Burke, Kenneth W. Stewart, and James Sublette supplied collections for study from Texas Technological, Texas A. and M., North Texas State, and Eastern New Mexico Universities respectively. B. Elwood Montgomery assisted with early literature citations and usage of taxonomic categories. Oliver S. Flint, Jr. answered questions on material at the U. S. National Museum, and Minter J. Westfall, Jr. provided data from the Florida State Collection of Arthropods. A state-wide treatment of Texas damselflies would have been impossible without the collective assistance of all the above.

Methods

The paper's principal objective provides an identification guide for Texas damselflies. Text discussions compare species characters with a view to reducing confusion in determinations rather than giving descriptions in formal monograph style. The order of families follows Fraser (1954) where lestids represent a primitive stock and two lines of descent include (1) calopterygids, and (2) protoneurids and coenagrionids.

A statement on geographical range and group characteristics preceeds each genus and species key. The keys require a basic familiarity with numerous structures and veins. Correct orientation of dorsal and lateral views for structural characters is essential, and the required orientation appears throughout

the keys. Structural characters naturally vary somewhat within a species; where such variability affects diagnoses, a species identification occurs at more than one key couplet. Line drawings of structural traits omit hairs and color patterns. An expanded explanation in the preceeding text supplements difficult key characters. Keys are reversible by the number in parenthesis at each couplet.

The Needham system of vein terminology was chosen for use in the keys over the Fraser-Tillyard system simply to conform with the majority of North American Odonata literature. Figure 1 shows body structures with the following usage of symbols: prothorax, T_1; mesothorax, T_2; metathorax, T_3; pterothorax, $T_2 + T_3$; middle and hind prothoracic lobes, MPL and HPL; mesostigmal plates, MP; median carina, MC; humeral suture, H; metapleural suture, LS; abdominal segments 1 and 2, abd. seg. 1 and 2; compound eyes, CE;

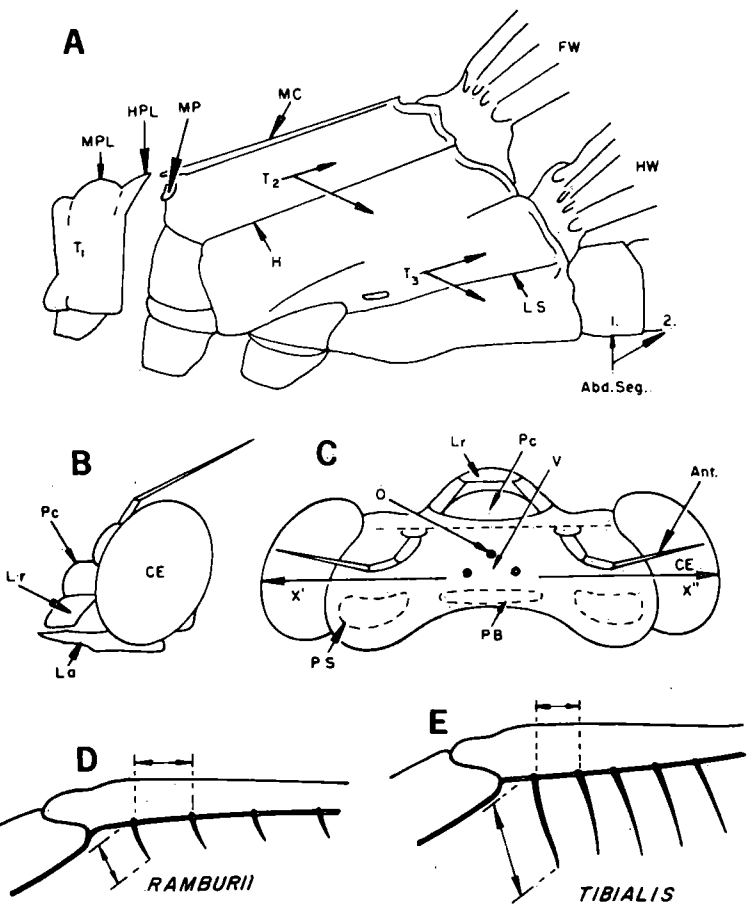

FIGURE 1. — A, thorax in left lateral view (prothorax disarticulated); B, C, head in left lateral and dorsal (anterior end uppermost) views; D, E, tibial spines in selected coenagrionids. Structures identified in text.

ocelli, O; vertex, V; postclypeus, PC; labrum, Lr; labium, La; and antennae, Ant. Body length refers to the total length from anterior tip of the head to the apex of abdominal segment 10. Abdominal and body length exclude appendages. Greatest width across the compound eyes refers to a line drawn over the width of the head connecting points x' and x" shown in Figure 1.

The following characters identify males of all species. The genital fossa accommodating the penis lies conspicuously in the sternum of abdominal segment 2 and the anterior part of segment 3. The abdominal appendages consist of a superior and inferior pair just posterior to segment 10. *Argia*-type appendages shown in Figure 2 A and B exemplify these structures. Additional structures (tori, torifer, and torealea) occur on the 10th abdominal segment in

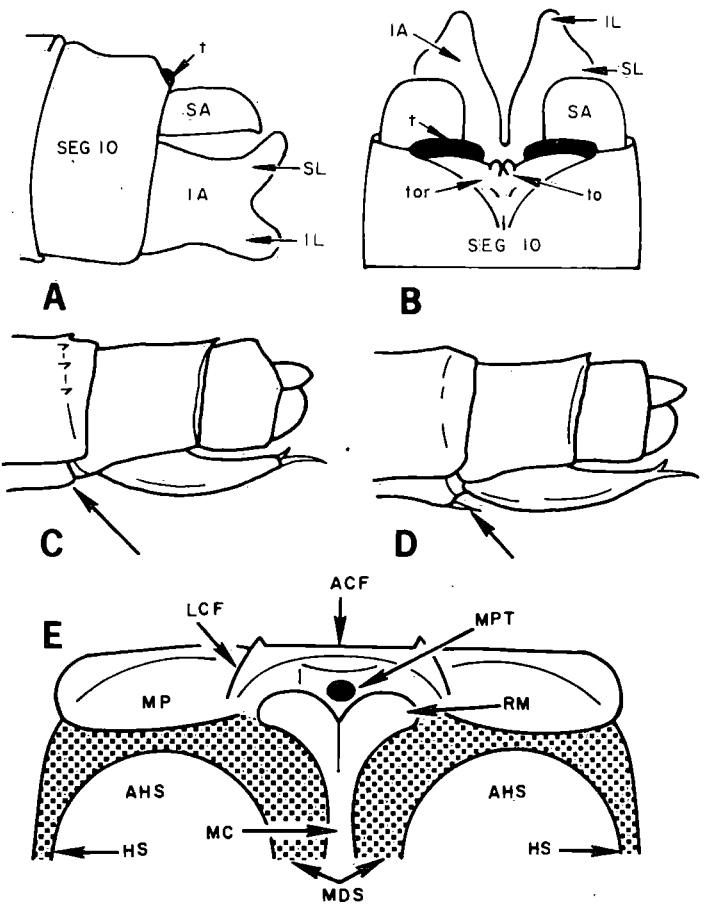

FIGURE 2. — Generalized *Argia*-type, male abdominal appendages, tori shown in black; A, left lateral and, B, dorsal (anterior end lowermost) views; C, D, left lateral views of terminal abdominal structures in female coenagrionids; E, dorsal (anterior end uppermost) view of mesostigmal plates and associated structures in a typical coenagrionid female. Structures identified in text.

Argia males, and an explanation of their structure appears under that genus. Abdominal male appendages occasionally dry or become accidentally displaced to an atypical position. Usually such conditions are obvious, but may lead to error in determinations if not recognized. Females lack a genital fossa and possess an ovipositor at the terminal end of the abdomen (Fig. 2 C, D). Determinations of females frequently use the mesostigmal plates or laminae, MP, (Fig. 1 A; Fig. 2 E). The text for the Coenagrionidae contains a description of these structures.

Figures 3 and 4 show wing venation with the following usage of symbols.

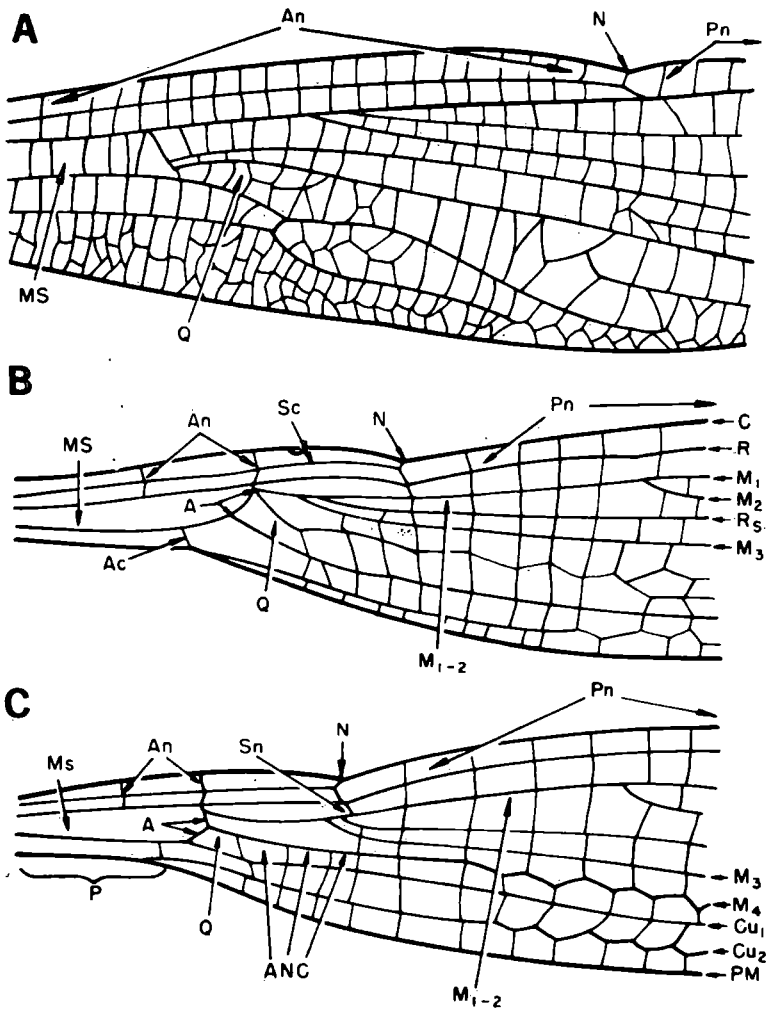

FIGURE 3. — Basal half of fore wings in: A, Calopterygidae, *Hetaerina americana*; B. Lestidae, *Lestes vigilax;* C, Coenagrionidae, *Argia tibialis*. Venation identified in text.

Longitudinal veins are costal, C; cubital veins 1 and 2, Cu_1 and Cu_2; combined 1st and 2nd branches of the median vein, M_{1-2}; four medial branches, M_1 to M_4; radial vein, R; the radial sector, Rs; and the subcostal, Sc. Specialized cross veins are the arculus, A; nodus, N; and subnodus, Sn. The anal crossing, Ac, appears also as a cross vein. Other identified cross veins are the ante- and postnodal cross veins, An and Pn. Postnodal cross veins consist of the first cross vein distal to the nodus, N. and all cross veins in the series outward to and including the cross vein just proximal to the brace vein, b,

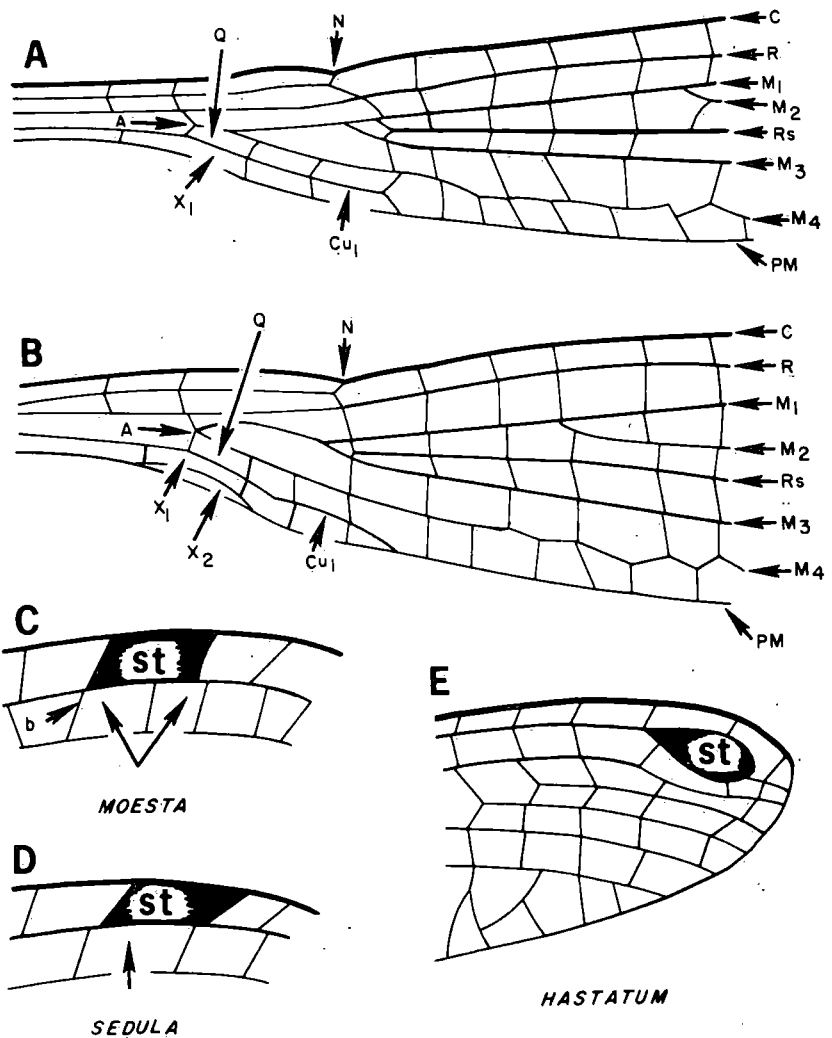

FIGURE 4. — Basal half of fore wings in protoneurids: A, *Protoneura cara;* B, *Neoneura aaroni;* C, D, and E, stigma variations in selected coenagrionids, venation as in Fig. 3.

under the stigma, st. Specific cells are the discoidal cell or quadrangle, Q; antenodal postquadrangular cells, ANC; and median space. MS. Subquadrangle cells, X_1 and X_2, just posterior to the quadrangle, Q, form their longitudinal margins by veins Cu_1, Cu_2, and the wing's posterior margin, PM. Where Cu_2 is absent in some protoneurids, X_2 is also absent. The contour of the wing base is narrow in all Texas damselflies other than calopterygids, and the slender stalk is the petiole, P. The following reference points identify the above veins. The arculus, A, forming the distal margin of the medial space, MS, and the notch-like nodus, N, on the anterior wing margin are distinct structures. Counting four longitudinal veins (including C) from the anterior wing margin rearward at a level just distal to A identifies M_{1-3} in all Texas Zygoptera with petiolate wings. M_3 is the first branch of the medial vein separating from the M_{1-3} stem distal to the arculus. The quadrangle, Q, has as its basal (nearest the body) side the posterior portion of A, and M_4 is, completely or in part, the forward margin.

Color patterns of the pterothorax and abdomen are alternating dark and pale stripes or bands. Pale areas occur in a wide range of colors; the dark stripes, rings, or bands are usually brown, black or metallic bronze. Pale areas are largely absent in some species, and the dark pattern then consists of metallic greens, blues or bronze. A pale antehumeral stripe borders the middorsal thoracic stripe on each side. A dark humeral stripe borders each antehumeral stripe laterally. The basic pattern in dorsal view appears in Figure 2 E. An additional dark stripe often occurs on each metapleural suture. The middle abdominal segments are predominantly pale or dark, with narrow dark apical or pale basal transverse rings or bands on each segment. Pale segments may possess only a dark stripe on each dorsolateral side. These stripes may be constricted about midsegment and, if the constriction is complete, two elongate spots result; the postbasal and apical spots. The terminal abdominal segments of many males are distinct with extensive, pale dorsolateral surfaces. The head pattern typically consists of a pair of pale postocular spots, PS, often a pale postoccipital bar, PB, and a variable facial pattern (Fig. 1 C). Much variation exists on these basic patterns, and texts for specific keys give, where needed, additional explanation. Color characters require recognition of teneral and mature specimens. A recently emerged, winged adult is a teneral specimen, and its exocuticle is still soft and the wings are fragile. Sexual maturity develops after a variable period depending on the species, and frequently involves a change in color. See Walker (1953) for an introduction to odonate morphology.

Distributional data represent collective contributions of all sources listed in the Acknowledgements, acceptable published records, and material collected by the author. Each record of doubtful validity was omitted. Specimens available for confirmation or determinations by an authority constitute the locality records. Specific cases of questionable data appear in the Discussion. Distribution data by county for each species follow their respective keys and a cross-listing for records appears in the Appendix. This shows the parts of Texas where additional data are necessary.

KEY TO THE FAMILIES

1 a) Numerous antenodal and several quadrangle cross veins; wings not petiolate (Fig. 3 A); wings pigmented with some black, brown or

red in males, black, brown or nonpigmented in females ..... Calopterygidae

b) Two antenodal and no quadrangle cross veins; wings petiolate (Fig. 3 B, C; Fig. 4 A, B); wings nonpigmented or with translucent brown or amber 2

2 (1) a) Vein M_3 separating from M_{1-2} nearer the arculus than nodus (Fig. 3 B); stigma nearly twice as long as wide ..... Lestidae

b) Vein M_3 separating from M_{1-2} nearer the nodus than the arculus (Fig. 3 C; Fig. 4 A, B); stigma not twice as long as wide 3

3 (2) a) Vein Cu_2 absent or rudimentary; vein Cu_1 short forming anterior border to only 3 (rarely 4) cells distal to arculus (Fig. 4 A, B) ..... Protoneuridae

b) Vein Cu_2 and Cu_1 well developed, both enclosing several cells distal to arculus (Fig. 3 C) ..... Coenagrionidae

LESTIDAE

Two genera represent the family in Texas, *Archilestes* and *Lestes*. One species of *Archilestes* exists in the state, with other species occurring west and south into Mexico. *Lestes* occurs in both eastern and western hemispheres, and six (possibly seven) species inhabit Texas.

Lestids are characteristic about lake margins, ponds, or slow streams in frequently isolated colonies. They fly rather slowly and perch on emergent vegetation or trees with half-spread wings. The latter habit is typical of lestids, while other perched damselflies usually fold the wings together over the body if not engaged in a behavioral display. Clear petiolated wings separate lestids from calopterygids, and large body size together with the spread-wing perching trait distinguish the group from most coenagrionids. The long slender coenagrionid, *Teleallagma daeckii*, has nonlestid perching habits and pale bluish or tan body color.

KEY TO THE GENERA

1 a) Vein M_2 branches from M_1 one cell (occasionally 1.5 to 2 cells) distal to the nodus; hind wing length greater than 33 mm ..... *Archilestes grandis*

b) Vein M_2 branches from M_1 several cells distal to the nodus (Fig. 3 B); hind wing length less than 33 mm ..... *Lestes*

Archilestes Selys, 1862

Archilestes grandis is the largest damselfly in the Texas fauna (59-64 mm in body length), and the above key identifies both sexes. Figure 5 A illustrates the male abdominal appendages. The species occurs in association with both streams and ponds, otherwise its biology is unknown. Kennedy (1915) described behavior and habitat for the western species, *A. californica*.

DISTRIBUTION RECORDS FOR TEXAS

Bell, Brewster, Crosby, Dallas, Denton, Hays, Jeff Davis, Lubbock, Montague, Presidio, Travis, and Uvalde counties.

TABLE 2. BODY-LENGTH RANGES OF SPECIES IN MM GROUPED FROM SMALL TO LARGE.

Lestidae

L. disjunctus 34-44 mm
L. alacer 37-43 mm
L. forficula 38-40 mm
L. sigma 40-42 mm
L. simplex 42 mm (one male)
L. vigilax 42-47 mm
L. inaequalis 46-51 mm
Archilestes grandis 59-64 mm

Calopterygidae

Calopteryx
C. dimidiata 37-46 mm
C. maculata 37-57 mm

Hetaerina
H. americana 39-50 mm
H. titia 40-51 mm

Protoneuridae

Neoneura aaroni 32-34 mm
Protoneura cara 35-37mm

Coenagrionidae

Argia

A. bipunctulata 27-30 mm
A. alberta 28-31 mm
A. sedula 29-34 mm
A. fumipennis 29-34 mm
A. nahuana 32-34 mm
A. hinei 33-36 mm
A. immunda 33-36 mm
A. rhoadsi 33-37 mm
A. apicalis 35-37 mm
A. tibialis 35-38 mm
A. translata 36-40 mm
A. plana 36-40 mm
A. munda 38-40 mm
A. barretti 41-43 mm
A. moesta 41-46 mm
A. lugens 44-49 mm

Enallagma

E. basidens 22-27 mm
E. geminatum 22-28 mm
E. dubium 24-27 mm
E. traviatum 27-32 mm
E. divagans 29-33 mm
E. civile 29-39 mm
E. praevarum 30-33 mm
E. signatum 30-35 mm
E. vesperum 30-35 mm
E. carunculatum 30-36 mm
E. exsulans 30-38 mm
E. durum 31-38 mm
E. novaehispaniae 33-37 mm

Ischnura

I. posita 18-29 mm
I. verticalis 20-33 mm
I. denticollis 23-28 mm
I. demorsa 24-28 mm
I. kellicotti 26-32 mm
I. ramburii 29-35 mm
I. barberi 31-36 mm
I. prognatha 34-38 mm

Smaller Genera

Anomalagrion hastatum 20-25 mm
Nehalennia integricollis 20-25 mm
Telebasis salva 25-28 mm
Hesperagrion heterodoxum 26-29 mm
Teleallagma daeckii 39-44 mm

Lestes Leach, 1815

MALES.—A dorsal view study of abdominal appendages reveals their distinctive structural traits. The medial margins of the superior abdominal appendages typically possess a basal tooth followed distally by a differentiated apical tooth (pointed projection) or by one or two lobes (broad, rather convex, non-pointed projections). These lobes have either serrated or smooth medial margins. Shape (straight or sigmoid) and length of the inferior abdominal appendages are useful characters. The superior appendages are shorter than the inferior appendages (*L. inaequalis*), or the apical lobe or tooth on the medial margins of each superior appendage is anterior or posterior to distal ends of the inferior appendages. Serration on the medial margins of the superior appendages varies. A serrated margin occurs on the basal lobe of *L. vigilax* while its apical lobe is smooth, and the space between the basal and apical teeth of *L. disjunctus* is smooth or with variable serration. The basal tooth of the superior appendage in *L. disjunctus* varies from slender (as in Fig. 5D) to more blunt and the inferior appendages of that species project straight to the rear or toward the midline crossing each other to form a figure X. *Lestes alacer* is variable in the shape of the serrated lobe on the medial margin of the superior appendages, and the inferior appendages project straight toward the rear or slant slightly toward the midline. This variation in *L. alacer* raises a taxonomic problem with *L. simplex*. The description of both *L. alacer* and *L. simplex* appeared in the same paper by Hagen (1861) and Texas records of *L. simplex* exist (Calvert, 1901-1908; Williamson, 1914). L. K. Gloyd examined the Texas specimens (from Clifton, Bosque County) determined as *L. simplex* by Williamson (1914) and states (Pers. comm., 1969) "Specimens from Clifton, Texas, appear to me to be same as *L. alacer* from the type locality." Figure 5 H illustrates a specimen from Mexico determined as *L. simplex* by P. P. Calvert. As shown in that figure, the major differences from *L. alacer* are shape of the serrated lobe and stronger slant of the inferior appendages toward the midline. This specimen possesses a broad dark band oriented obliquely across each side of the thorax just above the metapleural suture. Such bands are absent or much less developed in *L. alacer*. Variation in *L. alacer* approaches *L. simplex* characters, and the female of *L. simplex* is unknown. All material available to the author or checked by authorities failed to provide Texas specimens of *L. simplex*, and its status (at least in Texas) remains questionable. Body length ranges, grouped from smallest to largest species including both sexes, appear in Table 2.

The largest Texas specimen of *L. disjunctus* seen by the author was 39 mm; the larger specimens are more northern records (Walker, 1953).

FEMALES.—*Lestes* females have indistinct structural differences, thus diagnosis largely uses color patterns. Females of *L. alacer, L. forficula,* and *L. sigma* are more modified in appearance by age than other Texas species. Females of *L. sigma* are rather nondescript individuals and may per-

haps be confused with females of *L. forficula*. Females of *L. sigma* and *L. forficula* have generally more pruinescence than other species.

KEY TO THE MALES

1 a) In dorsal view, inferior abdominal appendages greater in length than superior abdominal appendages (Fig. 5 B) ..... *inaequalis*
b) In dorsal view, superior abdominal appendages greater in length than inferior abdominal appendages (Fig. 5 C-H) 2

2 (1) a) In dorsal view, inferior abdominal appendages sigmoid in shape, slender in apical half, and with apices divergent (Fig. 5 C) ... *sigma*
b) In dorsal view, inferior abdominal appendages not sigmoid, may be slender or stout in shape, apices not divergent (Fig. 5 D-H) 3

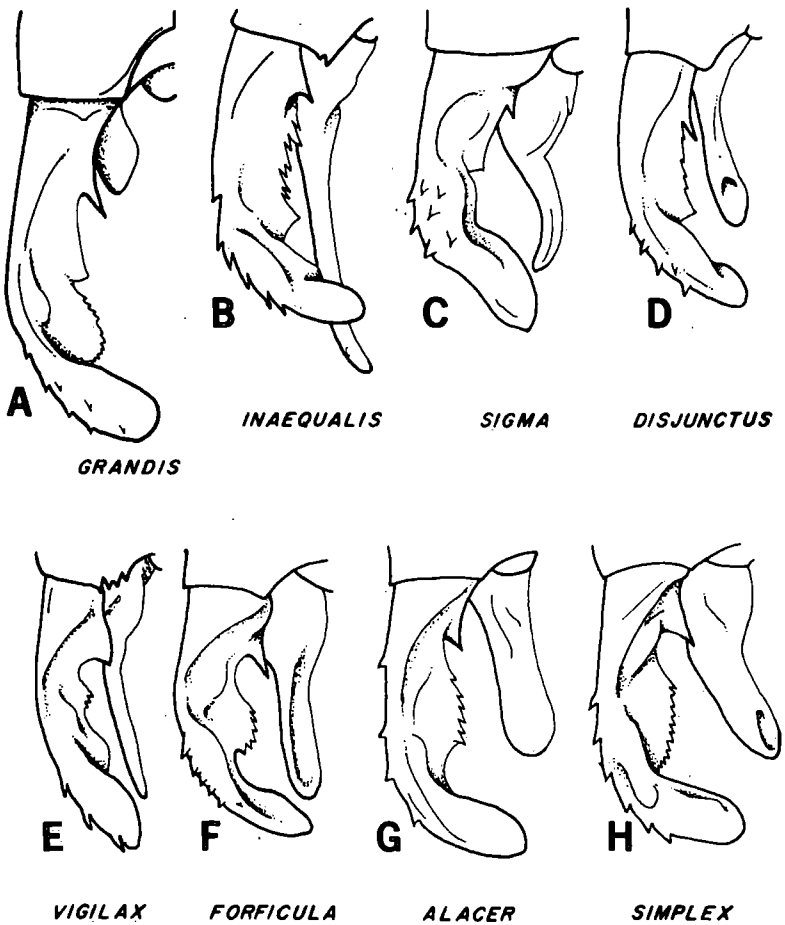

FIGURE 5. — Dorsal view of left superior and inferior male abdominal appendages in *Archilestes grandis* and *Lestes* species following sequence of determination in key.

3 (2) a) In dorsal view, medial margins of superior abdominal appendages with a distinct basal tooth and a more blunt apical tooth, the two teeth separated by variable degree of serration (Fig. 5 D); labrum pale blue ..... *disjunctus*

b) In dorsal view, medial margins of superior abdominal appendages with a distinct basal tooth, no differentiated apical tooth, but margins with one serrated lobe or two lobes—one smooth, one serrated—distal to basal tooth (Fig. 5 E-H); labrum bluish in *L. vigilax* 4

4 (3) a) In dorsal view, medial margins of superior abdominal appendages with two lobes distal to basal tooth—the more basal lobe somewhat serrated, the distal lobe smooth; inferior abdominal appendages long and slender, extending posteriorly beyond distal lobe of superior appendages (Fig. 5 E); dorsum of pterothorax with metallic green stripe ..... *vigilax*

b) In dorsal view, medial border of superior abdominal appendages with one differentiated, distinctly serrated lobe distal to basal tooth (Fig. 5 F-H)..... 5

5 (4) a) In dorsal view, inferior abdominal appendages long, extending beyond posterior level of serrated lobes on medial margins of superior appendages (Fig. 5 F); narrow metallic green stripes on dorsum of pterothorax but obscured by age with pruinescence..... *forficula*

b) In dorsal view, inferior abdominal appendages shorter, extending approximately to posterior level or less of serrated lobes on medial margins of superior appendages (see text) (Fig. 5 G,H); broad black or dark bronze stripe on dorsum of pterothorax, often obscured by pruinescence 6

6 (5) a) In dorsal view, medial margins of superior abdominal appendages with well-developed serrated lobe distinctly differentiated on its posterior end; inferior abdominal appendages rounded at apices, not curved mesially, (Fig. 5 G), see text..... *alacer*

b) In dorsal view, medial margins of superior abdominal appendages with serrated lobe not distinctly expanded and not terminating posteriorly in a distinct notch; inferior abdominal appendages slightly slanted towards each other, their apices bluntly pointed (Fig. 5 H), see text..... *simplex*

KEY TO THE FEMALES

1 a) Middorsal and humeral dark stripes only slightly distinguishable from grayish or yellowish-brown of pterothorax (irregular, elongate greenish spots may overlay middorsal and humeral stripes but lost with age; distinct blackish spot in posterior half of each antehumeral area, and an elongate blackish spot parallel and posterior to each humeral suture (latter spot may be obscured early by pruinescence and whole dorsal thoracic surface may become blackish with old age); abdomen predominantly dark brown without strongly contrasting pale areas..... *sigma*

b) Distinct and wide, dark middorsal and humeral thoracic stripes bordering narrow, pale antehumeral stripes, *or* only distinct, wide, dark middorsal thoracic stripe, humeral stripes absent, *or* thoracic dorsum pale brown to gray and black spots *not* present in antehumeral areas but two narrow metallic green stripes on each side,

one stripe near the middorsal carina, another stripe (smaller and more irregular) just posterior to each humeral suture; abdomen may be predominantly brown or have contrasting dark and pale pattern 2

2 (1) a) Dorsum of pterothorax brown to gray without typical middorsal and humeral dark stripes, two narrow metallic greenish stripes on each side of thorax, one stripe just lateral and parallel to the middorsal carina, one stripe (shorter and more irregular) posterior and parallel to the humeral suture..... *forficula*

b) Dorsum of pterothorax with wide distinct dark middorsal stripe; no combination of above characters..... 3

3 (2) a) Middorsal stripe wide and dark bronze to blackish in color, not reaching laterally to humeral suture, no dark humeral stripe, remainder of thoracic sides pale tan to brown, devoid of dark pattern lateral or posterior to the humeral sutures..... *alacer*

b) Middorsal and humeral stripes wide and dark bronze to greenish in color, antehumeral areas typically more narrow than either of above stripes, the humeral dark stripes often somewhat paler than middorsal stripe, occurring largely posterior to the humeral sutures ... 4

4 (3) a) Dark stripes on thoracic dorsum typically metallic green; hind wing length 27 mm or greater; distance across compound eyes usually 6 mm or greater..... *inaequalis*

b) Dark stripes on thoracic dorsum typically dull bronze or greenish-black; hind wing length usually less than 27 mm; distance across compound eyes usually less than 6 mm..... 5

5 (4) a) A dense cross vein reticulation developed between the principal longitudinal veins near apical margin of each wing, numerous small cells produced typically occuring as a double row about the apex .. *vigilax*

b) No or very few extra cross veins developed between principal veins that converge at the wing's apex, the associated cells becoming gradually smaller, extra interpolated cells few and typically limited to wing margin..... *disjunctus*

Female *L. simplex* unknown, see text.

DISTRIBUTION RECORDS FOR TEXAS

Lestes alacer: — Blanco, Bosque, Brazos, Caldwell, Crosby, Gonzales, Hill, Jeff Davis, Kimble, Lubbock, Matagorda, Reeves, and San Patricio counties.

Lestes disjunctus: — Aransas, Blanco, Brazos, Brewster, Colorado, Dallas, Hardin, Harris, Hunt, Jeff Davis, Jim Wells, Lamar, Lubbock, Montgomery, Nacogdoches, San Jacinto, San Patricio, Tarrant, Travis, Williamson, and Wilson counties.

Lestes forficula: — Bexar, Brazos, Cameron, Hidalgo, Kleberg, San Patricio, and Starr counties.

Lestes inaequalis: — Angelina and Harrison counties.

Lestes sigma: — Cameron, Gonzales, Kleberg, San Patricio, Starr, and Victoria counties.

Comments on a questionable species for Texas, *L. congener*, appear in the Discussion.

CALOPTERYGIDAE

Two genera, *Calopteryx* and *Hetaerina*, represent the family in Texas. *Calopteryx* species occur widely in the northern hemisphere, and *Hetaerina* species inhabit only North and South America, reaching their highest diversity in southern latitudes. Broad, non-petiolated wings and body colors of brown, metallic greens, blue and bronze distinguish these damselflies. Sexual dimorphism exists in wing pigments; males possess the brighter colors and females usually have much less wing pigment.

KEY TO THE GENERA

1 a) Median space without cross veins; coloration metallic green or bluish, little or no pale area; wing pigments blackish, red colors absent, stigma absent in males, present and distinctly white in females .... *Calopteryx*

b) Median space with several cross veins; body pattern with distinct pale areas adjacent to dark metallic stripe or diffuse brownish body; male fore wings possess basal red area with or without adjacent brownish area, small stigma usually in both sexes ..... *Hetaerina*

Calopteryx Leach, 1815

Color pattern differences given in the keys also allow field identification. Female *C. maculata* have fully pigmented wings as the male, but they are usually darker in the apical fourth and possess a distinct white stigma or pseudo-stigma (Tillyard, 1917). Teneral *C. maculata* have only smoky-gray wing colors. Female *C. dimidiata* occur in two forms; the wings have little to no pigment or the apical fourth is pigmented similar to the male pattern (Johnson and Westfall, 1970). Both female morphs have distinctive white stigmas.

KEY TO THE MALES

1 a) Wings translucent brown (in teneral specimens) to opaque black for full length; ventral surface of abdominal segments 9 and 10 whitish; inferior abdominal appendages two-thirds or greater length of superior abdominal appendages (Fig. 6 C) ..... *maculata*

b) Wings with basal five-sixths to three-fourths area clear, apical portion distinctly marked with brown or black pigment (Fig. 6 G); ventral surface of abdominal segments 9 and 10 black; inferior abdominal appendages less than two-thirds length of superior abdominal appendages (Fig. 6 D)..... *dimidiata*

KEY TO THE FEMALES

1 a) Wings possessing brownish-black pigment over full length, often with greater intensity in apical fourth; ventrolateral surface of pterothorax blackish..... *maculata*

b) Wings devoid of brownish-black pigment, or pigment restricted to apical fourth or less (Fig. 6 H); ventrolateral surface of pterothorax pale..... *dimidiata*

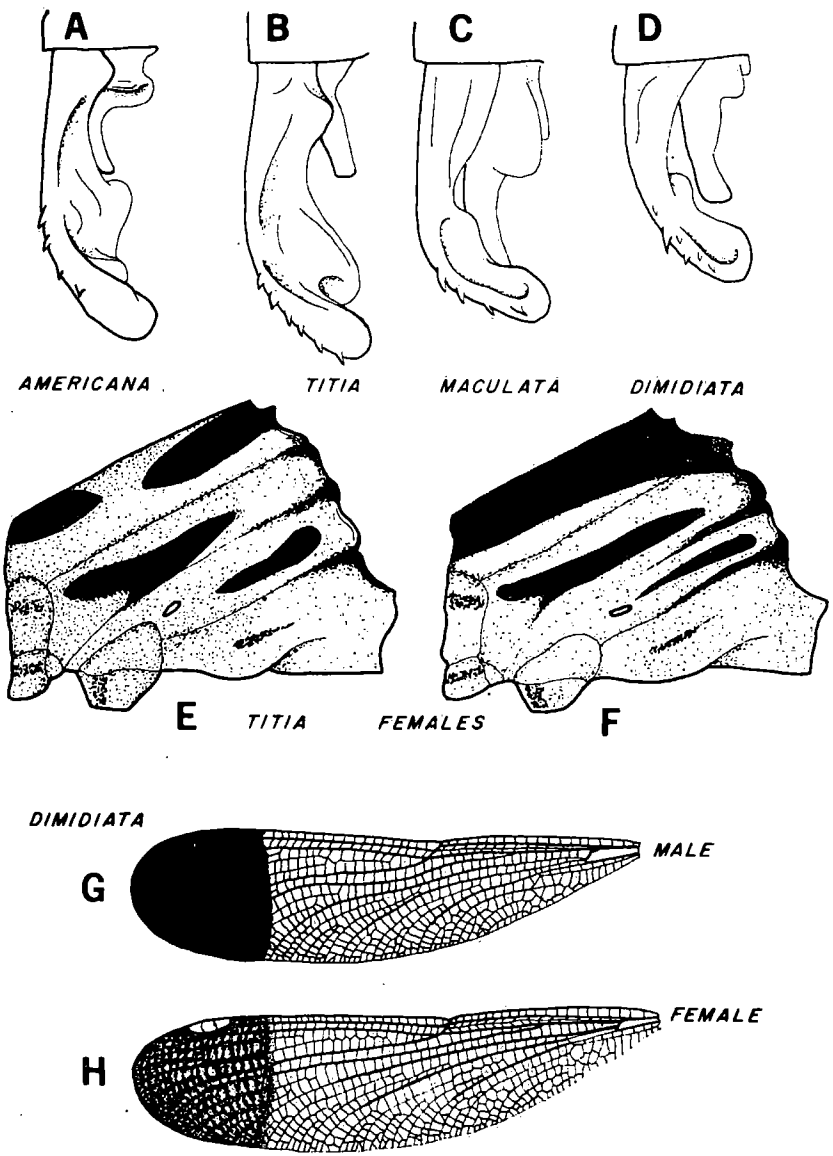

FIGURE 6. — A-D, dorsal (anterior ends uppermost) views of left superior and inferior abdominal appendages in calopterygids; left lateral views of thoracic patterns of females of the *Hetaerina titia* complex; E, *H. tricolor;* F. *H. titia;* wing patterns (fore wing only) in *Calopteryx dimidiata*: A, male; B, female.

Both species are stream forms with *C. dimidiata* having less ecological tolerance. See Johnson and Westfall (1970) for references to ecology.

DISTRIBUTION RECORDS FOR TEXAS

Calopteryx dimidiata: — Hardin and San Jacinto counties.

Calopteryx maculata: — Anderson, Angelina, Bastrop, Bowie, Cherokee, Collin, Dallas, Denton, Grayson, Gregg, Grimes, Hemphill, Houston, Marion, Montgomery, Nacogdoches, Robertson, Rusk, Shelby, Walker, and Wood counties.

Hetaerina Hagen, 1853

Sequential development of wing patterns during teneral stages may lead to incorrect determinations. In *H. titia* the color patterns are pale brown in both wing pairs soon after emergence, and only hind wing spots in males of *H. americana* are initially brown. Both fore and hind wing spots become deep red with age in *H. americana*, and the fore wings of mature *H. titia* males have both red and brown areas. Hind wing spots in male *H. titia* remain brown but veins within the spots may be red. The wings of *H. titia* females are rarely clear, but are more typically diffuse brown. The wings of *H. americana* females have no wing pigment or possess diffuse brown to orange basal spots. The female condition is not an age effect, and the variation in *H. americana* is similar to that mentioned for *Calopteryx dimidiata*, possibly representing a sex-limited dimorphism.

KEY TO THE MALES

1 a) Red spot at base of fore wing bordered distally by no pigment or brownish-black area extending variable distance toward wing tip, hind wing brown and varying from basal spot to entire wing (Fig. 7); pigmentation paler in teneral specimens ..... *titia* complex

b) Red spot at base of fore and hind wings, may reach distally to nodus; apical wing areas nonpigmented; red color limited to fore wing in teneral specimens with hind wing spot brown ..... *americana*

KEY TO THE FEMALES

1 a) Abdomen brown on ventrolateral surface, slightly lighter, if any, in color than dorsum; dorsum of head and abdomen dark brown; thorax brown with broad metallic green stripe on either side of median carina, or stripe isolated into two elongated spots (Fig. 6 E, F) ..... *titia* complex

b) Abdomen pale-colored on ventrolateral surface, and distinctly contrasting with metallic green dorsum; dorsum of head and abdomen metallic green, latter usually with a pale basal ring per segment; dorsum of thorax with broad metallic green stripe on either side of median carina ..... *americana*

Hetaerina titia as recognized in the above key is a highly polymorphic species or includes two species, *H. titia* and *H. tricolor*. These two taxa now appear as synonyms; however, several observations are inconsistent with this interpretation (Johnson, 1963). The male abdominal appendages are highly variable in *H. americana* (Calvert, 1901-1908). Figure 6 A and B illustrates appendages of both *H. americana* and *H. titia*.

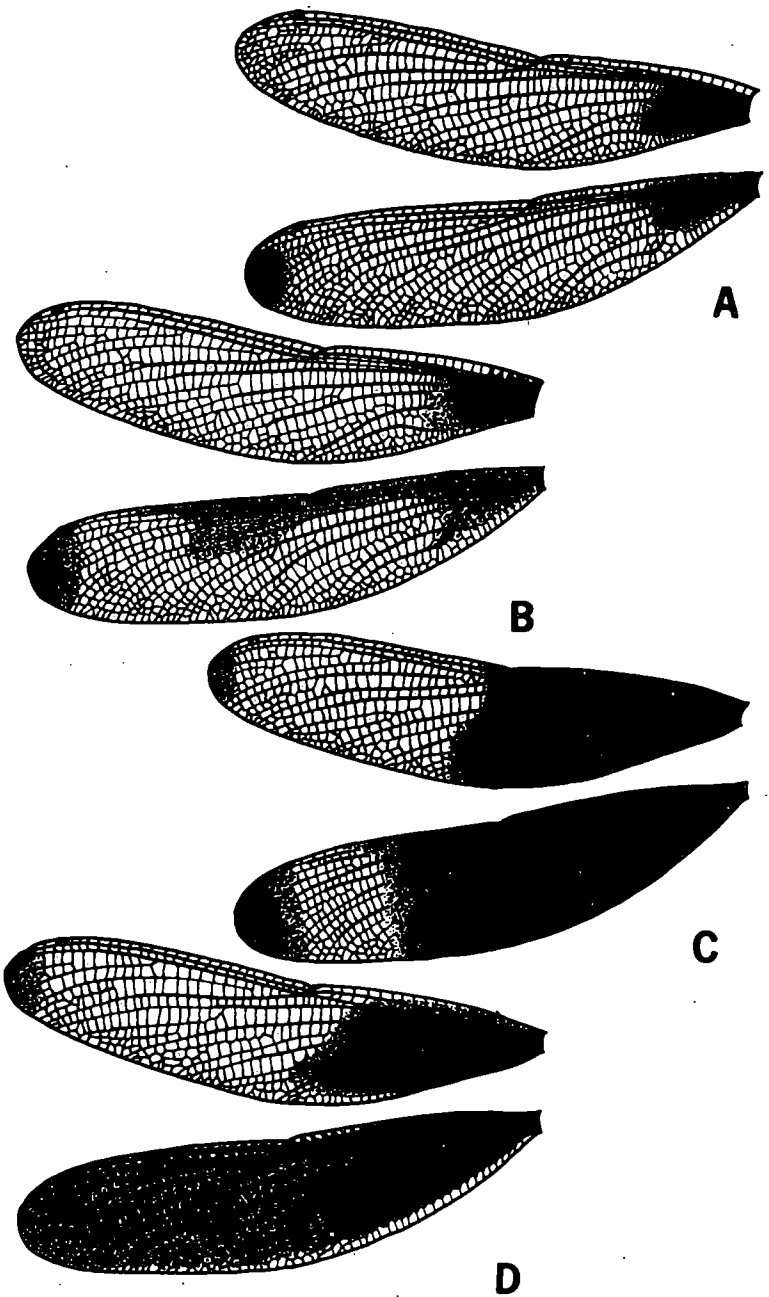

FIGURE 7. — Selected male patterns in left fore and hind wings of the *Hetaerina titia* complex; *H. tricolor* characterized by type A.

DISTRIBUTION RECORDS FOR TEXAS

Hetaerina americana: — Baylor, Bexar, Blanco, Bosque, Brazos, Brewster, Caldwell, Cherokee, Childress, Colorado, Comal, Cooke, Crosby, Dallas, Denton, Fayette, Gillespie, Goliad, Gonzales, Gregg, Grimes, Hays, Hill, Jeff Davis, Jim Wells, Kendall, Kerr, Kimble, Limestone, Llano, Lubbock, Medina, Menard, Palo Pinto, Pecos, Presidio, Randall, Real, Reeves, Robertson, San Jacinto, San Patricio, Sutton, Travis, Uvalde, Val Verde, Victoria, Williamson, Wilson, and Zavala counties.

Hetaerina titia (and *tricolor*): — Angelina, Bexar, Bosque, Brazos, Caldwell, Colorado, Comal, Dallas, Denton, Fayette, Goliad, Gonzales, Grimes, Guadalupe, Hays, Jackson, Jim Wells, Kendall, Kimball, McLennan, Polk, Presidio, San Jacinto, San Patricio, Robertson, Travis, Uvalde, Victoria, and Webb counties.

Comments on two questionable species for Texas, *H. sempronia* and *H. vulnerata*, appear in the Discussion.

PROTONEURIDAE

Two genera, *Protoneura* Selys 1857 and *Neoneura* Selys 1860, represent the family in Texas, each genus by one species. Higher diversity characterizes the family in the neotropical region. The key gives characteristic venation and diagnostic traits in male appendages and female mesostigmal plates. The sexes of *P. cara* have similar stripe and color pattterns (pale orange colors bordered by bronze stripes). Initially, *P. cara* appears similar to *Enallagma signatum* while in flight. *Neoneura aaroni* males develop a copperish-red thoracic dorsum at maturity, while their females are light brown without distinctive pattern. Immature teneral males and all females of *N. aaroni* are similar to several species while in flight.

KEY TO THE SPECIES

1 a) One subquadrangular cell in each wing (Fig. 4 A); well developed dark bronze stripe pattern and light yellow to orange antehumeral areas in both sexes; superior abdominal male appendage in lateral view as long or slightly longer than inferior appendage (Fig. 16 I); females' mesostigmal plates' medial corners raised and curved anteriorly (Fig. 11 N, O); body length 35-37 mm..... *Protoneura cara*

b) Two subquadrangular cells in each wing (Fig. 4 B, x_1 and x_2); mature males with copperish-red on dorsum of mesothorax and anterior of head and face; females light tan with reduced stripe pattern; superior abdominal male appendage in lateral view slightly shorter than inferior appendage (Fig. 16 J); females' mesostigmal plates possessing posteriorly projecting lobes (Fig. 11 M); body length 32-34 mm..... *Neoneura aaroni*

Stream habitats are typical for both species. Williamson (1914) described the habitat of *N. aaroni* as ". . . deep pools in small streams with drift or overhanging bushes near at hand."

DISTRIBUTION RECORDS FOR TEXAS

Neoneura aaroni: — Caldwell, Goliad, Gonzales, Medina, Nueces, San Patricio, and Victoria counties.

Protoneura cara: — Hidalgo, Kendall, Medina, Uvalde, and Val Verde counties.

COENAGRIONIDAE

Eight genera including forty species represent the family in Texas. *Anomalagrion*, *Hesperagrion*, and *Teleallagma* are monotypic genera; *Nehalennia* and *Telebasis* occur in the state with a single species in each genus; *Argia*, *Enallagma*, and *Ischnura* have 15, 12, and 8 species respectively. *Enallagma* and *Ischnura* have their highest species diversity in North America although both genera are almost cosmopolitan in distribution. *Nehalennia* occurs in North America and the palearctic, and the remaining five genera have neotropical and nearctic distributions.

A separate generic key for males and females avoids unduly long key couplets. An external exudate, pruinescence, having a white or bluish-gray color, may obscure body patterns in old individuals. A drop of acetone or alcohol temporarily reduces this effect.

Female determination in the Coenagrionidae relies largely on the mesostigmal plates. A generalized dorsal view of mesostigmal plate morphology appears in Figure 2 E following Walker (1953). The middorsal thoracic carina, MC, bifurcates at the anterior end of the mesothorax and typically terminates into ridges or flattened plates (rami), RM. This middorsal area consists of a median pit, MPT, between the two rami of the dorsal carina, an anterior carina, ACF, forming a forward, transverse margin and two lateral carinae, LCF. These carinae or ridges collectively constitute the frame. A mesostigmal plate, MP, occurs laterally on each side of the frame. A mesothoracic spiracle (mesostigma) occurs inconspicuously below the anterior margin of each plate. The plates may have lobes projecting rearward from the posterior margins, and ridges oriented transversely or obliquely across the plate, however, such distinctive structures are often absent. Color pattern and size identify many females; however, the structural characteristics of the plates give more reliable determinations. Study of the plates requires a strong light source and at least a 20 X magnification. In addition, a forward flexure of the head and prothorax is helpful, as the hind lobe of the prothorax typically overlies the plates.

Species identified in these keys are members of monotypic genera or the only representatives of their genus in Texas. Additional data appear for such species under Smaller Genera.

KEY TO THE GENERA: MALES

1 a) Majority of spines on 2nd and 3rd tibiae long, distance between spines approximately one-half of spine length (Fig. 1 E); dorsoapical margin of abdominal segment 10 with torifer and usually distinct tori (Fig. 2 A, B) ..... *Argia*

b) Majority of spines on 2nd and 3rd tibiae short, distance between spines greater than one-half of spine length (Fig. 1 D); dorsoapical margin of abdominal segment 10 without torifer and tori but may possess bifid prominence or spine, if above tibial spines long and thoracic dorsum metallic green then dorsoapical margin of abdominal segment 10 serrated and body length less than 30 mm 2

2 (1) a) Thoracic dorsum solid metallic green to bronze and abdominal dorsum predominantly greenish-black with some blue on segments 8, 9, and 10; dorsoapical margin of abdominal segment 10 serrated, not elevated into bifid prominence and abdominal appendages in lateral view as in Fig. 16 K; ave. body length 24-27 mm ..... *Nehalennia integricollis*

b) No such combination of characters 3

3 (2) a) Abdominal length 34 mm or greater; Cu_2 terminating near midway point between nodus and origin of M_2; petiole of wing usually extends distally to anal crossing; dorsal thoracic stripe narrow and humeral stripes reduced to elongate spots; superior abdominal appendages in lateral view with distinct ventrally-directed lobe (Fig. 17 H); ave. body length 40-44 mm ..... *Teleallagma daeckii*

b) No such combination of characters 4

4 (3) a) Thoracic dorsum with black dorsal stripe having distinct lateral tooth in posterior half and finely divided by pale-colored carina; antehumeral areas and thoracic sides reddish brown, abdominal dorsum red; abdominal appendages in lateral view as in Fig. 17 I; ave. body length 26-30 mm ..... *Telebasis salva*

b) No such combination of characters 5

5 (4) a) Abdominal segment 10 without spine on dorsoapical margin and superior abdominal appendage distinctly bifid, upper lobe curved dorsoposteriorly reaching above margin of 10th segment and lower arm transversely expanded and directed ventrally (Fig. 17 F, G); anterior margin of stigma usually shorter than posterior margin; see text for color pattern variation; ave. body length 29-33 mm ..... *Hesperagrion heterodoxum*

b) No such combination of characters 6

6 (5) a) Stigma of fore wing removed from wing margin (Fig. 4 E); abdominal segment 10 elevated into spine, superior abdominal appendage with distinct dorsoposteriorly directed arm in lateral view (Fig. 17 J); ave. body length 23-27 mm ..... *Anomalagrion hastatum*

b) Stigma of fore wing not removed from wing margin; abdominal segment 10 and appendages not as in Fig. 17 J 7

7 (6) a) M_2 separating from M_{1-2} near 5th and 4th postnodals or beyond in the fore and hind wings respectively; abdominal segment 10 not elevated on dorsoapical margin; stigma similar in fore and hind wings ..... *Enallagma*

b) M_2 separating from M_{1-2} near the 4th (or 3rd) and 3rd (or 2nd) postnodals in the fore and hind wings respectively; abdominal segment 10 may or may not have elevation on dorsoapical margin developed into spine-like process; stigma color *may* differ between fore and hind wings in well-matured individuals 8

8 (7) a) Abdominal segment 10 elevated on dorsoapical margin into spine-like process bifid at tip (Fig. 16 A-D, F); if process absent or poorly developed, inferior abdominal appendage extends posteriorly beyond apical level of superior appendage and latter appendage with distinct ventrally-directed lobe (Fig. 16 E); stigma *may* differ in fore and hind wings ..... *Ischnura*

b) Abdominal segment 10 not elevated and inferior abdominal appendage shorter than superior appendage, or if not, superior abdominal

appendage with ventrally-directed lobe; stigma similar in fore and hind wings ..... *Enallagma*

KEY TO THE GENERA: FEMALES

1 a) Majority of spines on 2nd and 3rd tibiae long, distance between spines approximately one-half of spine length (Fig. 1 E); if body length less than 30 mm, then pale antehumeral stripe bordered by distinct dark middorsal and humeral stripes ..... *Argia*

b) Majority of spines on 2nd and 3rd tibiae short, distance between spines greater than one-half of spine length (Fig. 1 D); if spines longer, then body length less than 30 mm and thoracic dorsum metallic green without antehumeral pale stripes 2

2 (1) a) Thoracic dorsum solid metallic green to bronze, abdominal dorsum predominantly greenish-black; abdominal segment 8 without vulvar spine, such as Fig. 2 C; mesostigmal plates in dorsal view as in Fig. 15 V; ave. body length 24-27 mm ..... *Nehalennia integricollis*

b) No such combination of characters 3

3 (2) a) Abdominal length 34 mm or greater; Cu_2 terminating near midway point between nodus and origin of M_2; petiole of wing usually extends distally to anal crossing; stripe pattern reduced or absent, pale colors brownish; abdominal segment 8 with vulvar spine, such as Fig. 2 D ..... *Teleallagma daeckii*

b) No such combination of characters 4

4 (3) a) Thoracic dorsum with dark dorsal stripe having distinct lateral tooth in posterior half and finely divided by pale-colored carina; antehumeral areas, thoracic sides, and abdominal dorsum brown; hind lobe of prothorax with two tooth-like projections directed anteriorly (Fig. 11 J, K); ave. body length 26-30 mm ..... *Telebasis salva*

b) No such combination of characters 5

5 (4) a) Anterior lateral margin of mesostigmal plates raised into a distinct ridge, truncated sharply on medial end (Fig. 15 W); thoracic dorsum completely pale, or with well-developed middorsal stripe, humeral stripes absent or faint, *or* dorsum predominatly dark with antehumeral areas separated into two pale spots on each side; black not predominating on all abdominal segments 3-9, see additional color notes in text; stigma usually shorter on anterior margin than on posterior margin; M_2 separation typically near 5th and 4th postnodals in fore and hind wings respectively; fore wing length 19-21 mm or greater; ave. body length 29-33 mm ..... *Hesperagrion heterodoxum*

b) No such combination of characters 6

6 (5) a) Sternum of abdominal segment 8 with a vulvar spine (Fig. 2 D) 7

b) Sternum of abdominal segment 8 without a vulvar spine (Fig. 2 C) 13

7 (6) a) Distinct dorsal and humeral blackish thoracic stripes bordering pale antehumeral stripes; antehumeral colors include light tan, blues, and green 8

b) Distinct dorsal thoracic stripe present as solid line or finely divided on the carina, or absent; pale thoracic area lateral to dorsal stripe (if present) orange, brown, or bluish; never with distinct humeral stripe (latter may be represented by small isolated spots) 11

8 (7) a) M_2 separating from M_{1-2} near the 5th and 4th postnodals or beyond

on the fore and hind wings respectively..... *Enallagma*

b) M_2 separating from M_{1-2} near the 4th and 3rd (or 2nd) postnodals on the fore and hind wings respectively.....9

9 (8) a) Body length less than 30 mm; mesostigmal plates with low even ridges on anterior and posterior margins, slightly expanded at posterior lateral corner (Fig. 15 U); postocular spots obscured and no dark stripe on metapleural suture..... *Anomalagrion hastatum*

b) Body length 30 mm or greater, *or* one or more of the following traits present: mesostigmal plates raised vertically on edge or with distinctive ridges (Fig. 15 J, N, Q, S); postocular spots distinct; dark stripe on metapleural suture; prominence on mesothorax just posterior to each mesostigmal plate (Fig. 15 B); humeral stripe divided longitudinally by inserted pale line.....10

10 (9) a) Postocular spots triangular in shape occupying most of postocular area and their apices directed anteriorly, or spots circular in shape and abdominal segment 8 partly blue; mesothoracic dorsum posterior to mesostigmal plates without raised knobs; dark humeral stripe (if present) never divided longitudinally by pale line..... *Ischnura*

b) Postocular spots elongated transversely with or without connection to pale postocular bar (bar may be absent), if spots circular in shape abdominal segment 8 largely black; either raised knobs on mesothoracic dorsum posterior to mesostigmal plates, or humeral stripes longitudinally divided by inserted pale line..... *Enallagma*

11 (7) a) M_2 separating from M_{1-2} near the 5th and 4th postnodals or beyond on the fore and hind wings respectively.....12

b) M_2 separating from M_{1-2} near the 4th and 3rd (or 2nd) postnodals on the fore and hind wings respectively.....13

12 (11) a) Dorsum of thorax with dorsal black stripe bordered by orange laterally which becomes dark brown or greenish with age (dorsal stripe obscured in older individuals); transverse postocular spots and bar broadly confluent with pale of rear head area but spots, bar and rear head areas obscured by black at early age..... *Ischnura*

b) Dorsum of thorax with or without dorsal black stripe, pale areas lateral to stripe pale blue or bluish-brown; distinct bluish postocular spots with well defined borders, often with pale postocular bar; these patterns not obscured with age..... *Enallagma*

13 (6) a) Mesostigmal plates with low even ridges on anterior and posterior
(11) margins, slightly expanded at posterior lateral corner (Fig. 15 U); body length less than 30 mm; dark middorsal thoracic stripe; humeral stripe faint, or absent; pale antehumeral stripe not divided into spots; abdominal segments 8, 9 and 10 black; no dark stripe on metapleural suture..... *Anomalagrion hastatum*

b) Mesostigmal plates with one of following attributes present; raised vertically on edge, with transverse diagonal ridges, or with distinct ridge development on anterior or posterior margins (Fig. 15 N-S); *if these traits absent* (such as Fig. 15 M, T) one or more of the following traits present: body length 30 mm or greater, antehumeral pale areas divided into 2 spots (requires close examination in mature specimens due to presence of pruinescence), or abdominal segments 8, 9 and 10 largely pale and dark stripe on metapleural suture..... *Ischnura*

Argia Rambur, 1842

MALES.—Reliable species diagnosis in males requires examination of abdominal appendages and the tenth abdominal segment. Diagrams of the terminal abdominal morphology for a typical male appear in Figure 2 A, B. A depressed V or U-shaped area with apex pointing anteriorly and bordered by raised ridges occurs in the dorsal surface of the tenth abdominal segment and forms part of its apical margin. The area is the torifer, tor. The posterior border of the torifer separates into two ridges by an indentation at the midline. These ridges are perpendicular or oblique to the midline, and each ridge bears a pad-like structure, the torus, t. The tori in dorsal view are either circular or elongate structures. The elongate tori are swollen pads or form thin, rim-like borders of the torifer ridges. If the tori are narrow, posterior borders to convex torifer ridges, they are obliquely rather than transversely elongate. Torus shape and transverse distance between medial corners of the two tori are useful in species identification. Torus width refers to its transverse axis, and length is the distance through the pad from front to rear. Tori exist with width and length approximately equal or with width exceeding length. In dorsal view, shape of the tori varies slightly in some species. For example, each transversely elongate torus shown for *A. plana* in Fig. 9 P has the two transverse borders essentially parallel. In other specimens, each torus is slightly ovoid-shaped. Construction of the key takes these variations into consideration. The tori are whitish or similar to the color of the torifer ridge, a change apparently associated with aging. Figures show the tori in solid black.

Between the torus-bearing ridges on the torifer's posterior surface at the midline are two swellings or tubercles, the toreale, to. Description of the toreale generally refers to their shape seen in dorsal view. The toreale project posteriorly, are typically small, and their apical tips may terminate anterior, on line with, or posterior to the rear margin of the tori. The relative length of the toreale measured in this fashion has value in species identification. The toreale of *A. bipunctulata* are disproportionately long, reaching rearward for at least two-thirds length of the superior abdominal appendage, SA. The toreale are whitish or similar to the torifer's color.

The inferior abdominal appendage, I A, in lateral view bears a dorsally-directed superior lobe, SL, and in all but four Texas species (*A. moesta, A. lugens, A. rhoadsi,* and *A. bipunctulata*) an inferior lobe, IL. The latter lobe arises from the appendage's lower posterior margin, and its shape in lateral view has diagnostic value. It is blunt (deeper than long at its base) or tapers to the apex (as long or longer than depth at base). On the dorsal or dorsolateral surface of the inferior abdominal appendage and just anterior to base of superior lobe, a tooth or blunt prominence occurs in *A. rhoadsi, A. hinei,* and *A. tibialis*. In dorsal view, the inferior lobes of *A. sedula* typically curve inward; however, if the appendages are

widely spread, they appear to point directly rearward. Other Texas argians have lobes pointing rearward and the medial margins taper outward. The superior lobe in lateral view is blunt or ends in a pointed tooth-like tip; however, this portion of the appendage varies (in lateral view) in some species. The lateral profile view of the inferior abdominal appendage in *A. nahuana, A. plana* and *A. immunda* in particular may vary from figures given for these species. Their inferior lobe appears more blunt in some individuals than others; however, the key should effectively separate these species bearing in mind this possible variation.

The apical and medial margins of the superior abdominal appendage in dorsal view are convex, bifid, etc. These appendages in some species are difficult to see clearly when intact on the specimen. An oblique dorsolateral view facing the specimen from a posterior angle often reveals the most definitive structure. Figures illustrate appendages in this position if the key uses the trait. The superior abdominal appendages have less diagnostic value in lateral view; however, appendages in *A. munda* and, to a lesser extent, *A. hinei* when viewed laterally reveal portions of their ventral surfaces. Appendages of other species when viewed laterally reveal ventral surfaces only when in atypical positions. A tooth, usually black, typically occurs at the apical or subapical surface of the appendage and a blunt process may arise from the medial surface. The apical tooth is laterally visible or hidden behind the superior lobe of the inferior abdominal appendage, depending on articulation of the appendages.

Argian species occur over a range of 20 mm in body length, and this trait is helpful in diagnosing species near the limits of length distribution. Body length ranges, grouped from smallest to largest species including both sexes, appear in Table 2. Adult size probably varies with environmental conditions and duration of the larval stage; consequently, small variations from the measurements in Table 2 may occur.

Color and stripe patterns are not well-suited for species determination in an argian fauna of 15 or 16 species. An experienced observer can identify individuals in the field with such characters; however, color tones are particularly unreliable in a key. Colors fade in museum specimens, have reversible changes in life for some species and pruinescence effect adds further differences. Stripe patterns show little change if any with aging (except through pruinescence); nevertheless, limited taxonomic value lies in thoracic stripes due to intraspecific variability. The abdominal stripe and spot patterns are less variable.

Distinct dark middorsal and humeral stripes occur in *A. bipunctulata, A. rhoadsi, A. moesta, A. tibialis, A. translata* and *A. sedula.* Their humeral stripes are broader than the suture and the stripe usually forks somewhat at its posterior third in *A. tibialis, A. sedula,* and *A. rhoadsi,* and either forks or encloses a pale spot in *A. bipunctulata.* A forked stripe bifurcates as its name implies. The humeral stripe of *A. moesta* is largely posterior to the suture and often obscured by pruinescence. A pale stripe occurs within the posterior half of the humeral stripe in *A. translata.* The

middorsal stripe is as wide or wider than the antehumeral stripe in all above species excepting *A. tibialis*.

The middorsal stripe is usually narrower or no wider than the pale antehumeral area in *A. plana, A. hinei, A. munda, A. immunda, A. fumipennis* and *A. nahuana*. Humeral stripes of these species are narrow with a posterior bifurcation or an interrupted stripe results in the posterior third of its length. An interrupted stripe is broad at its anterior half, confined to the humeral suture or lost in the posterior two-thirds and reappears as a spot at the upper end of the suture. Forked stripes typically occur in *A. immunda, A. fumipennis* and *A. nahuana,* while interrupted or terminated stripes occur in *A. munda, A. hinei* and *A. plana*.

The following three species are intermediate or distinct from above groups. The dark middorsal and humeral stripes of *A. barretti* are distinct and narrower than the pale antehumeral areas. The humeral stripe is not forked or interrupted yet margins of the stripes are not parallel. The dark middorsal stripe of *A. apicalis* is absent or confined to the carina, and the humeral stripe exists as an anterior elongate spot; however, exceptional individuals of *A. apicalis* may occur. Such males of *A. apicalis* have a full-length humeral stripe of varying width; the females may have both broad middorsal and humeral stripes. In Florida, this variation in *A. apicalis* correlates with geographic distribution (Johnson and Westfall, 1970). Such variants were absent in Texas material examined by the author; however, patterns approaching the Florida types rarely occur in Texas (Gloyd, per comm.). The dark middorsal stripe of *A. lugens* is no wider than the carina, and a dark line occurs laterally in each antehumeral area becoming confluent with the middorsal stripe at the latter's posterior end. The humeral stripe forks.

Antehumeral areas are typically bluish in *A. rhoadsi, A. sedula, A. nahuana,* and *A. barretti;* violet or purple in *A. lugens, A. tibialis, A. translata, A. immunda, A. fumipennis*; and bluish-violet in *A. hinei* and *A. munda*. This area is blue or violet in *A. plana* and *A. apicalis,* cream or tan colored in *A. bipunctulata* and *A. moesta,* and usually obscured in the latter. Lower sides of the pterothorax have paler colors in all species. Pale abdominal colors are blue in *A. barretti* and *A. nahuana*; blue or bluish-violet in *A. rhoadsi, A. sedula, A. immunda, A. munda, A. hinei* and *A. plana*; violet in *A. fumipennis*; and blue anteriorly, violet posteriorly in *A. bipunctulata*. Other species have inconspicuous pale areas on the abdomen. Wings are occasionally diffuse pale brown in *A. sedula,* apparently characteristically amber in *A. rhoadsi,* but remain transparent in both species. Other species and most *A. sedula* possess clear wings.

FEMALES – The females of many species have small structural differences; consequently, *A. alberta, A. apicalis, A. moesta,* and *A. nahuana* have two and *A. sedula* has three routes for determination in the key. Structural characters used in female diagnosis are as follows. The anterior carina (as in Fig. 2 E) is visible or hidden in the lateral view of a meso-

stigmal plate. The carina in lateral view appears as a dorsally-directed projection in the anterior fourth or third of the plate (see figures of *A. apicalis*, *A. tibialis*, and *A. munda*). The dorsal thoracic carina bifurcates or divides at the anterior end of the mesothorax into pear-shaped, ovally flattened pads or into two narrow and erect ridges terminating between the mesial borders of the mesostigmal plates. Both pads and ridges are the rami of the dorsal thoracic carina. Location of the bifurcation occurs at a point (1) approximately even with or just rearward of the posterior borders of the mesostigmal plates, or (2) distinctly posterior to the plates.

The mesostigmal plates have their posterior margins smoothly rounded or expanded rearward into lobes. If lobes exist, they are (1) distinct thumb-like projections, with length about equal to or greater than width of the lobe's base, or (2) broad-based, convex projections. The latter category of projections appear as lobes to some workers and only as raised prominences to others. Couplet 8 in the key requires a decision on the presence of a lobe; however, both alternates in the couplet identify species with weakly developed lobes. A distinct depression may occur in the mesothoracic surface underlying each posterior lobe of the mesostigmal plates. The depression is a vertical-sided pit in *A. munda*, and a cone-shaped opening in *A. lugens* and *A. moesta*. Shallow depressions occur in other species but have no semi-circular margins. Females of *A. hinei* and *A. fumipennis* are similar in structure, and the following character supplements the key. A small knob or tubercle exists at the base of the posterior lobe of the mesostigmal plates in *A. fumipennis*, best seen in oblique posterior view. A strong, concentrated light source and good magnification usually verify its presence. The tubercle is absent in *A. hinei* and this species is absent from most of Texas. Distributions for body size fall within the measurements in Table 2. Pale colors in females are typically brown or shades of tan, and reduced stripe patterns frequently exist compared with conspecific males. See note on *A. apicalis* under males. Dark stripe and spot patterns on abdominal segments vary between many species. The fifth and sixth segments are easiest to score for these patterns, and Figure 12 illustrates the major variations. Female *A. immunda* frequently possess pale, small grayish flecks or spots in the antehumeral areas; female *A. sedula* may have grayish dots at the base of hairs on the thoracic dorsum, but the mesostigmal plates are very different from *A. immunda*.

The keys include *A. alberta*, a likely addition to the Texas fauna as indicated in the Discussion.

KEY TO THE MALES

1 a) Toreale long in dorsal view, reaching ⅔ length of superior abdominal appendage (Fig. 8 B); inferior abdominal appendage in lateral view not bifid (Fig. 8 A); body length less than 30 mm; fore wing length usually less than 17 mm; usually 3 antenodal postquadrangular cells in fore wing; dorsum of abdominal segments 3-6 blue with black apical rings ..... *bipunctulata*

b) Toreale short in dorsal view, reaching at most slightly posterior to apical margin of tori; inferior abdominal appendage in lateral view bifid, *or* if not, 5 or more antenodal postquadrangular cells in fore wing; body length greater than 30 mm; fore wing length greater than 17 mm; abdominal color pattern variable.....2

2 (1) a) In lateral view, apical margin of inferior abdominal appendage rounded, blunt, without inferior lobe (Fig. 8 C, E, G); wings amber *or* body length greater than 40 mm.....3

b) In lateral view, apical margin of inferior abdominal appendage with superior and inferior lobes, latter lobe may occur only as an angulate

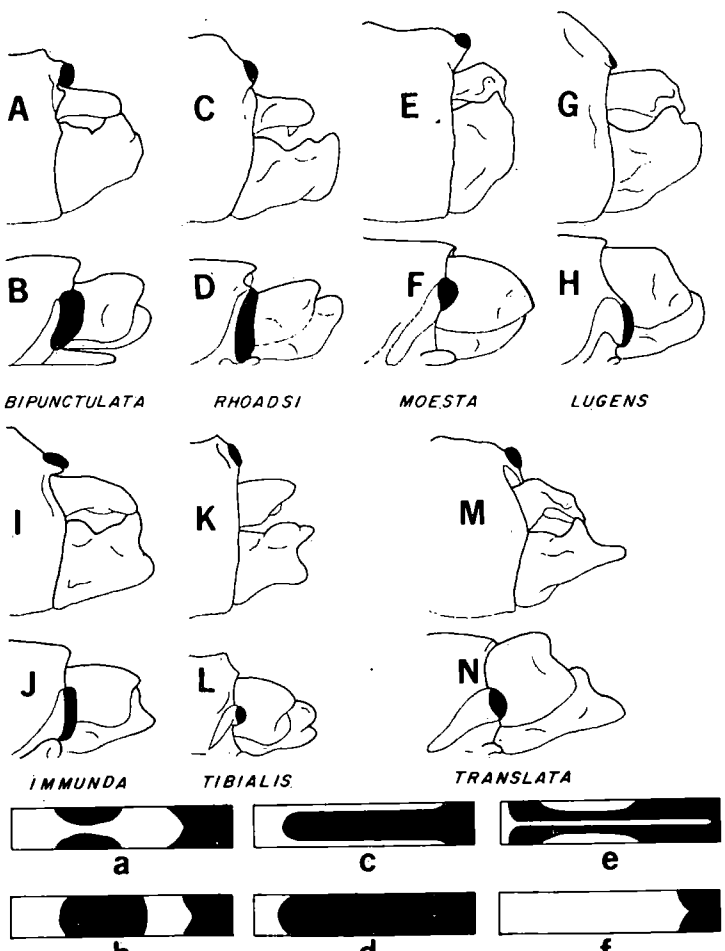

FIGURE 8. — A-N, left lateral and dorsal right side (anterior end to the left) views of male abdominal appendages in *Argia* species, tori shown in black; a-f, dorsal patterns (anterior end to the left) of abdominal segments 5 and 6 in male argians.

blunt process arising from lower apical margin of the inferior abdominal appendage and directed posteriorly (Fig. 8 I, K, M; Fig. 9); if wings brownish, inferior abdominal appendage with distinct tapered inferior lobe 5

3 (2) a) In dorsal view, tori transversely elongated pads, at least twice as wide as long (Fig. 8 D); inferior abdominal appendage in lateral view with a dorsally-directed tooth just anterior to superior lobe (Fig. 8 C); typically 4 antenodal postquadrangular cells in fore wing; dorsum of abdominal segments 8, 9, and 10 pale blue, black if present reduced and limited to lateral sides of segments; wings light amber; body length less than 40 mm ..... *rhoadsi*

b) In dorsal view, tori are circular knobs (Fig. 8 F) or reduced to thin pads confined to apical ridge of torifer (Fig. 8 H); inferior abdominal appendage in lateral view with a single small dorsally-directed tooth on apex of superior lobe (Fig. 8 E, G); 5 or more antenodal postquadrangular cells in fore wing; dorsum of abdominal segments 8, 9 and 10 largely black; wings clear; body length greater than 40 mm. 4

4 (3) a) In dorsal view, tori are circular knobs (Fig. 8 F); distinct bluish-white pruinescence on dorsum of head and thorax in nonteneral individuals; dark middorsal thoracic stripe wider than dorsal carina... ..... *moesta*

b) In dorsal view, tori are thin pads confined to apical ridge of torifer (Fig. 8 H); bluish-white pruinescence greatest on lower sides of pterothorax; dark middorsal thoracic stripe largely confined to carina with a parallel dark stripe on either side in antehumeral area. ..... *lugens*

5 (2) a) Dorsum of abdominal segments 5 and 6 with an anterior to posterior pattern sequence of pale, dark, pale, dark (Fig. 8 a, b); inferior lobe of inferior abdominal appendage in lateral view rounded, deeper at its base than long and apical margin of tori extends posteriorly beyond tips of toreale (Fig. 8 I, J) ..... *immunda*

b) Dorsum of abdominal segments 5 and 6 pale with black apical rings or black with pale basal rings (Fig. 8 e-f); inferior lobe of inferior abdominal appendage in lateral view distinctly pointed, as long or longer than deep at its base *or*, if not, apical margin of tori not extending posteriorly beyond tips of toreale 6

6 (5) a) Dorsum of abdominal segments 5 and 6 predominantly black with pale basal rings (Fig. 8 c-e) 7

b) Dorsum of abdominal segments 5 and 6 predominantly pale with black apical rings (Fig. 8 f) 11

7 (6) a) Dorsum of abdominal segment 8 black or mostly black; torus not wider than long (Fig. 8 L, N) 8

b) Dorsum of abdominal segment 8 pale, (very reduced black area if any); torus wider than long (Fig. 9 B, D; Fig. 18 B) 9

8 (7) a) In lateral view, inferior lobe of inferior abdominal appendage not projecting posteriorly well beyond superior lobe (Fig. 8 K); abdominal segments 9 and 10 pale ..... *tibialis*

b) In lateral view, inferior lobe of inferior abdominal appendage projecting posteriorly well beyond superior lobe (Fig. 8 M); abdominal segments 9 and 10 partly black ..... *translata*

9 (7) a) In dorsal view, inferior lobes of the inferior abdominal appendage have inward curved apical tips and tori obliquely elongate on apical margin of torifer (Fig. 9 B)..... *sedula*

b) In dorsal view, inferior lobes of the inferior abdominal appendage have laterally divergent curvature from medial base to apical tips or lobes directed straight to the rear; tori distinct, raised, bean-shaped pads (Fig. 9 D; Fig. 18 B)..... 10

10 (9) a) In dorsal view, superior abdominal appendage's apical margin oblique to longitudinal axis of abdomen (Fig. 18 B); distinct dark middorsal and humeral stripes; body length 31 mm or less.. *alberta*

b) In dorsal view, superior abdominal appendage's apical margin appears slightly trifid or convex without oblique alignment to abdominal axis (Fig. 9 D); thoracic stripe pattern typically reduced but see text; body length 35 mm or greater..... *apicalis*

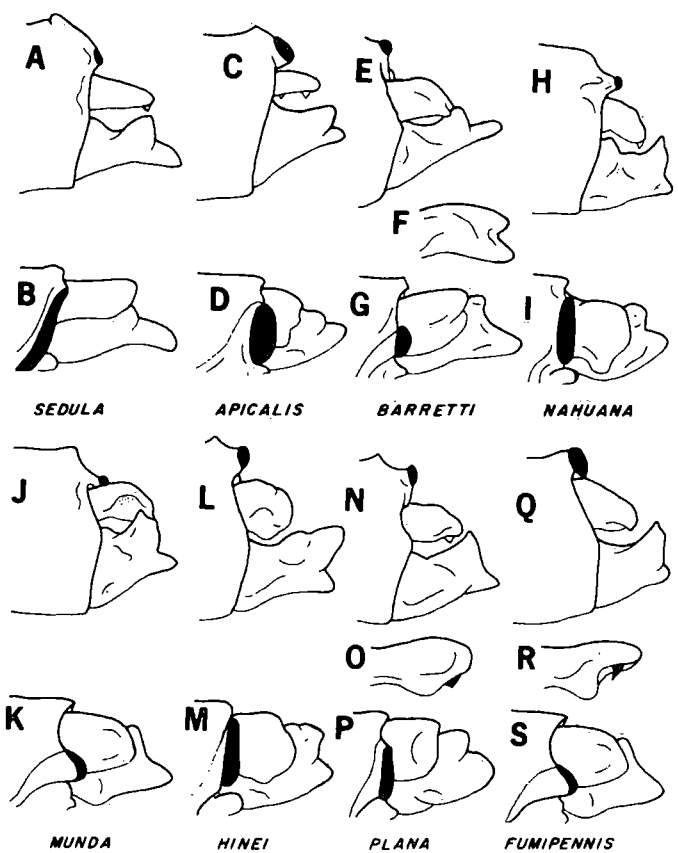

FIGURE 9. — Male abdominal appendages in *Argia* species, tori shown in black, F, O, and R are disarticulated superior abdominal appendages in posterior oblique view, otherwise orientation same as Fig. 8.

11 (6) a) In dorsal view, apical end of superior abdominal appendage bifid, oblique dorsolateral view of medial surface often required to confirm structure (Fig. 9 F, G); distance between medial corners of tori greater than width of one torus; black stripe on lateral sides of abdominal segments 8, 9 and 10 ..... *barretti*

b) In dorsal view, superior abdominal appendage with apical margin convex, transversely or obliquely straight, or slightly sigmoid, and ventrally or medially-directed prominence (tooth) may occur on medial margin; distance between medial corners of tori less than width of one torus, *or* if not, sides of abdominal segments 8, 9 and 10 without black stripe 12

12 (11) a) In dorsal view, looking directly downward at midline, medial margin of superior abdominal appendage with blunt tooth, same appendage with convex apical margin (Fig. 9 I); pale thoracic and abdominal colors blue ..... *nahuana*

b) In dorsal view, looking directly downward at midline, no distinct tooth or process arising from medial margin of superior abdominal appendage, any such process typically seen only from oblique dorsolateral view and associated with pale thoracic and abdominal colors of violet or bluish-violet 13

13 (12) a) Tori in dorsal view thin, nonraised, obliquely elongated pads on convex apical margin of torifer (Fig. 9 K); superior abdominal appendage in lateral view, appears hollowed-out on ventral surface giving dome-shaped dorsal margin (Fig. 9 J), same appendage possesses pointed apical tooth; toreale tips not posterior to apical margin of tori ..... *munda*

b) Tori in dorsal view, transversely elongated pads (Fig. 9 M, P), *or* obliquely elongated (Fig. 9 S) and body length 34 mm or less; if ventral surface of appendage visible in lateral view (slightly in *hinei*), toreale tips project posterior to apical margin of tori 14

14 (13) a) Inferior abdominal appendage in lateral view with a small prominence or swelling projecting from its dorsal or dorsolateral surface just anterior to base of appendage's superior lobe (Fig. 9 L); superior abdominal appendage in lateral view typically exposing ventral surface of its small medial projection (Fig. 9 L), same appendage in dorsal view with convex apical margin (white hairs may obscure margin) (Fig. 9 M) ..... *hinei*

b) Inferior abdominal appendage in lateral view without prominence on dorsal surface anterior to base of superior lobe (Fig. 9 N, Q), but anterior margin of superior lobe may be convex; superior abdominal appendage in lateral view exposing little if any of appendage's medial structure (Fig. 9 N, Q), same appendage in dorsal view with apical margin transversely or obliquely straight or slightly sigmoid (Fig. 9 P, S) 15

15 (14) a) No black stripe on lateral sides of abdominal segments 8, 9 and 10; in oblique dorsolateral view, a single blackish tooth projects ventrad from superior abdominal appendage's subapical surface (Fig. 9 O) ..... *plana*

b) Black stripe on lateral sides of abdominal segments 8, 9 and 10; in oblique dorsolateral view, a tooth projects ventrad from superior abdominal appendage's subapical margin *and* a blunt tooth projects

ventrad from medial margin (Fig. 9 R).....*fumipennis*

KEY TO THE FEMALES

1 a) Wings distinctly amber or pale brown, yet translucent.....2
b) Wings clear, devoid of color.....3

2 (1) a) In dorsal view, distinct, posteriorly-directed lobes on mesostigmal plates; wings amber.....*rhoadsi*

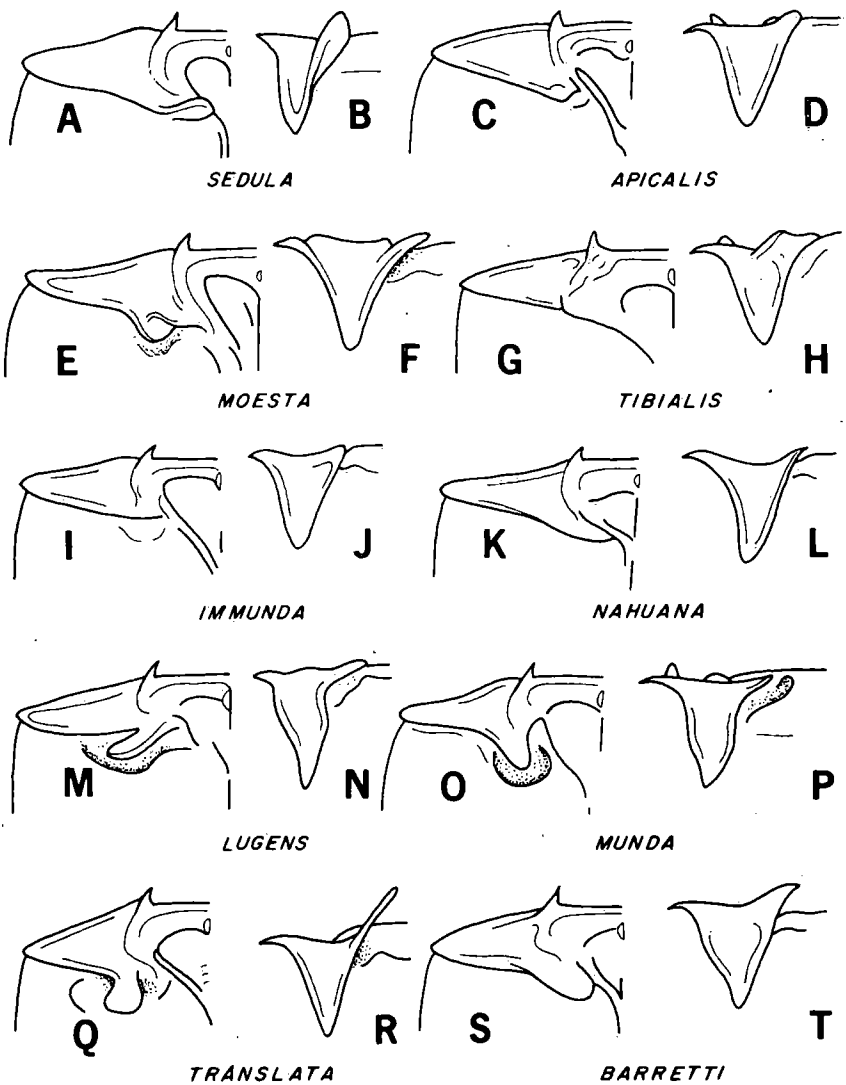

FIGURE 10. — Dorsal, left side (anterior end uppermost) and left lateral views of mesostigmal plates in female *Argia* species.

b) In dorsal view, distinct, mesially-directed lobes on mesostigmal plates, raised into upturned ridges (Fig. 10 A, B); wings pale brown ..... *sedula*

3 (1) a) Three antenodal postquadrangular cells in fore wing; no thumb-like lobes projecting posteriorly from rear margin of mesostigmal plates, (lobe-like mesial corner of plates' rear margins directed mesially and pale antehumeral stripe narrower than dark middorsal stripe in *A. bipunctulata)* 4

b) Four or more antenodal postquadrangular cells in fore wing, *or* if less, thumb-like lobes arising from posterior margins of each mesostigmal plate are directed rearward and pale antehumeral stripe wider than dark middorsal stripe 5

4 (3) a) Abdominal segment 8 pale dorsally; segments 5 and 6 black dorsally with pale basal rings (Fig. 12 a, m) ..... *bipunctulata*

b) Abdominal segment 8 predominently black dorsally; segments 5 and 6 with dorsal black constricted at midsegment, occasionally separated into 2 spots ..... *alberta*

5 (3) a) Pterothorax without distinct dark stripes, middorsal and humeral stripes absent or reduced to sutures, often irregular spot for humeral stripe 6

b) Pterothorax with distinct dark middorsal or humeral stripes or both stripes; middorsal stripe may be wide, narrow, subdivided by pale carina, or restricted to carina; a dark stripe may occur in each antehumeral pale area; humeral stripe forked, interrupted, or terminated in posterior half, if stripe entire its longitudinal borders may or may not be parallel 8

6 (5) a) In dorsal view, thoracic carina bifurcates into raised ridges diverging between posterior medial corners of mesostigmal plates, plates without posterior lobes (Fig. 10 C); anterior carina usually visible in lateral view of plate (Fig. 10 D); humeral stripe variable, usually represented by elongate anterior spot, or absent ..... *apicalis*

b) In dorsal view, thoracic carina bifurcates between posterior medial corners of mesostigmal plates as flat, pear-shaped pads and plates with distinct posterior lobes (Fig. 10 A, E); anterior carina not visible in lateral view of plate (Fig. 10 B, F) 7

7 (6) a) Stigma surmounts 1 cell (Fig. 4 D), rarely 1.5 cells; lobes of mesostigmal plates directed mesially and raised into elevated ridges (Fig. 10 A, B); abdominal color pattern usually a pale uniform tan (Fig. 12 1, u) ..... *sedula*

b) Stigma surmounts 1.5 to 2 cells (Fig. 4 C); lobes of mesostigmal plates directed posteriorly; in dorsal view, a low ridge curves over mesial half of each above lobe (oblique posterior view often required) (Fig. 10 E, F); abdominal color pattern with distinct lateral dark brown spots or stripes (Fig. 12 j, q) ..... *moesta*

8 (5) a) In dorsal view, no lobes projecting rearward beyond posterior border of mesostigmal plates (Fig. 10 C, G, I, K; Fig. 18 C) 9

b) In dorsal view, distinct lobes arising from posterior border of mesostigmal plates (Fig. 10 A, M, O, Q, S; Fig. 11 A, C, F) 13

9 (8) a) In lateral view of mesostigmal plate, anterior carina visible (Fig. 10 D, H); black pattern on dorsolateral surface of abdominal segments 5 and 6 continuous stripe; not constricted along midsegment

(Fig. 12 a, b, c, m, p).....10

b) In lateral view of mesostigmal plate, anterior carina not visible (or barely so) (Fig. 10 J, L; Fig. 18 D); black pattern on dorsolateral surface of abdominal segments 5 and 6 broken into apical and post-basal spots, or if spots connected, resulting stripe constricted about midsegment (Fig. 12 h-k, o, r, more black on *alberta*); humeral stripe variable.....11

10 (9) a) In dorsal view, thoracic carina bifurcates into raised ridges diverging between posterior medial corners of mesostigmal plates (Fig. 10 C)..... *apicalis*
(very few *A. apicalis* will be carried this far in the key, see text)

b) In dorsal view, thoracic carina bifurcates between posterior medial corners of mesostigmal plates as flat pear-shaped pads (Fig. 10 G); humeral stripe typically forked..... *tibialis*

11 (9) a) Thoracic carina in dorsal view bifurcates into rami just posterior to mesostigmal plates (Fig. 10 K)..... *nahuana*

b) Thoracic carina in dorsal view bifurcates into widely diverging rami well behind mesostigmal plates (Fig. 10 I; Fig. 18 C).....12

12 (11) a) Mesial posterior borders of mesostigmal plates raised into broad-based rims or 'lobes' with their ventral surfaces slightly visible in lateral view (Fig. 18 D); antehumeral areas brownish with no small gray spotting; body length usually less than 32 mm..... *alberta*

b) Mesial posterior borders of mesostigmal plates occur as blunt, low prominences with their ventral surfaces not visible in lateral view (Fig. 10 J); antehumeral areas brownish, purple, or bluish and often with pale grayish spots; body length usually greater than 32 mm..... *immunda*

13 (8) a) In dorsal view, lobe on posterior border of each mesostigmal plate with a low, curved ridge over mesial half of its base (Fig. 10 E); a shallow pit beneath each lobe but lobes not converging toward midline; elongated dark stripe rarely in each antehumeral area. *moesta*

b) In dorsal view, no ridge over base of lobe on posterior border of mesostigmal plates, if distinct pit beneath lobes, lobes are either distinctly diverging from or converging toward midline (Fig. 10 A, K, M, O, Q, S; Fig. 11 A, C, F; Fig. 18 C).....14

14 (13) a) In dorsal view, thoracic carina bifurcates well behind mesostigmal plates into widely diverging rami (Fig. 18 C); no deep pits posterior to plates; 'lobes' arising from rear mesial border of plates more like up-turned edges..... *alberta*

b) In dorsal view, thoracic carina bifurcates just posterior to, or even with, rear border of mesostigmal plates (Fig. 10 A, K, M, O, Q, S; Fig. 11 A, C, F).....15

15 (14) a) In dorsal view, lobes of mesostigmal plates directed mesially, and raised into elevated ridges (Fig. 10 A); ventral surface of upturned lobe exposed in lateral view (Fig. 10 B); dark stripe pattern poorly defined, borders of stripes obscured..... *sedula*
(very few *A. sedula* will be carried this far in the key)

b) In dorsal view, lobes of mesostigmal plates not directed mesially, or if so, little or no ventral surface of lobe visible in lateral view; dark stripes wide or narrow but well defined from bordering pale areas 16

16 (15) a) In dorsal view, posterior lobes of mesostigmal plates distinctly diverging (Fig. 10 M); 5 (or 6) antenodal postquadrangular cells in fore wing; middorsal stripe largely restricted to carina, elongated dark stripe in each antehumeral area often confluent with middorsal stripe posteriorly ..... *lugens*

b) In dorsal view, posterior lobes of mesostigmal plates not diverging; 4 (or less) antenodal postquadrangular cells in fore wing; middorsal stripe variable, no dark elongated bands in antehumeral areas..17

17 (16) a) Distinct deep pit occurs in dorsum of pterothorax just posterior to each mesostigmal plate, lobe of each plate overlying pit from dorsal view (Fig. 10 O); anterior carina visible in lateral view (Fig. 10 P); middorsal stripe narrow, often divided by pale carina; humeral stripe narrow, usually interrupted; dark pattern on dorsolateral surface of abdominal segments 5 and 6 in 2 spots or a stripe constricted about midsegment (Fig. 12 f, g, n, o)..... *munda*

b) No deep pit posterior to mesostigmal plates, shallow indentation with sloping margin may occur; anterior carina not visible in lateral view; middorsal and humeral stripes variable.....18

18 (17) a) In dorsal view, posterior lobes of mesostigmal plates slightly constricted at base (Fig. 10 Q); in lateral view, lobe raised into thin linear projection (Fig. 10 R); middorsal stripe wider than one antehumeral area; humeral stripe wide with inserted pale stripe in posterior half; abdominal segments 5 and 6 black dorsally (thin pale middorsal line may occur) with pale basal rings (Fig. 12 a-c, m, p) ..... *translata*

b) In dorsal view, posterior lobes of mesostigmal plates not basally constricted (Fig. 10 K, S; Fig. 11 A, C, F); middorsal stripe narrower than antehumeral area; humeral stripe narrow, sides nonparallel, forked, or interrupted; abdominal segments 5 and 6 variable in pattern.....19

19 (18) a) In dorsal view, apex of posterior lobe on mesostigmal plates directed mesially, lines drawn through longitudinal axes of two lobes intercept in obtuse angle at midline (Fig. 10 S); dark pattern on abdominal segments 5 and 6 in nonconstricted stripe (Fig. 12 d, e, n, s)... ..... *barretti*

b) In dorsal view, posterior lobe or border of mesostigmal plates broadly rounded, directed upward or rearward into low ridge (Fig. 10 K; Fig. 11 A); dark pattern on abdominal segments 5 and 6 in 2 spots or stripe constricted at midsegment (Fig. 12 i-k, o, r, t), *or* lobes on mesostigmal plates thumb-like and directed slightly mesad with lines drawn through longitudinal axes of 2 lobes intercepting in acute angle at midline (Fig. 11 C, F).....20

20 (19) a) In dorsal view, posterior lobe of mesostigmal plates broad-based, rounded (Fig. 11 A); in lateral view, lobe lies close over dorsum of pterothorax (Fig. 11 B); abdominal segment 8 pale dorsally... *plana*

b) In dorsal view, posterior margin of mesostigmal plates smoothly curved, no lobe-like projection extending rearward (Fig. 10 K), *or* with distinct, thumb-like lobes arising from posterior margin of plates (Fig. 11 C, F); abdominal segment 8 with black markings dorsally..... 21

21 (20) a) In dorsal view, posterior margin of mesostigmal plate scarcely lobe-

like, and barely extending rearward over pterothorax (Fig. 10 K); dorsooblique view reveals 'lobe' as low, thin, broad ridge. *nahuana*

b) In dorsal view, posterior lobes of mesostigmal plates exist as distinct thumb-like projections (Fig. 11 C, F).....22

22 (21) a) In posterior dorsooblique view, posterior lobe of mesostigmal plate column-like (Fig. 11 E).....*hinei*

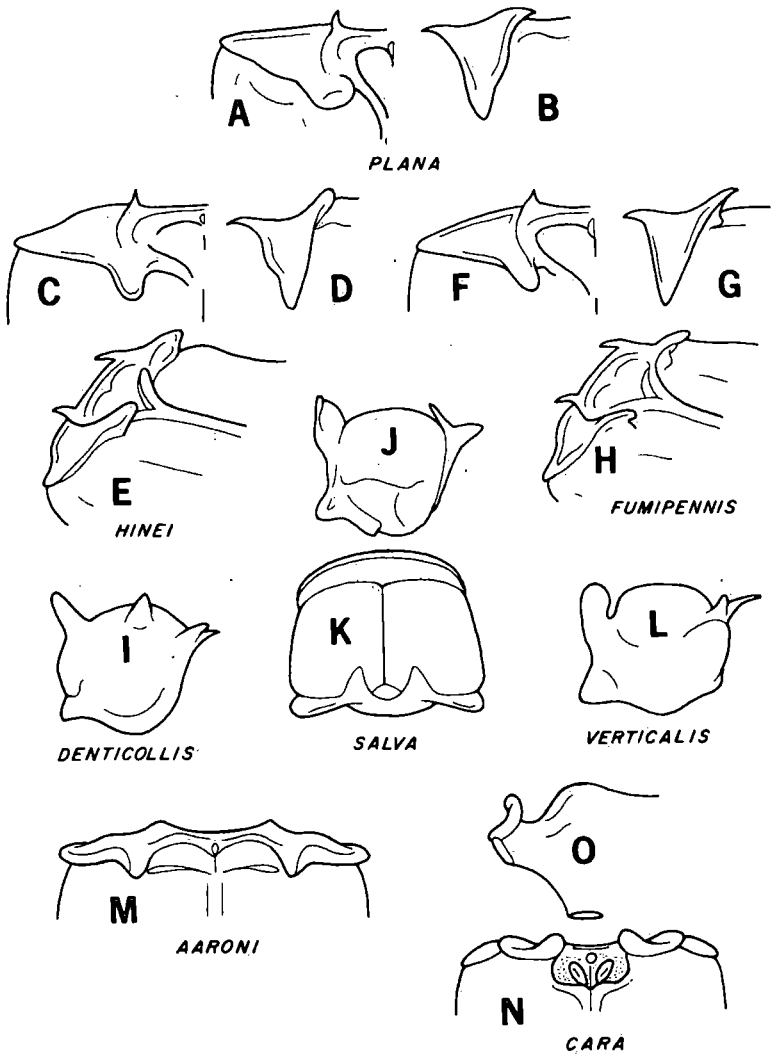

FIGURE 11. — A-H, mesostigmal plates in female argians, E and H posterior oblique views, otherwise orientation same as Fig. 10, I-L, female structures in identified species: I, J, and L, left lateral views of prothorax; K, dorsal view of prothorax; M, N, dorsal views and O, left lateral view of mesostigmal plates..

b) In posterior dorsooblique view, posterior lobe of mesostigmal plate transversely flattened, slightly concave on ventral surface (Fig. 11 H) ..... *fumipennis*

Argia species typically inhabit stream-riverine conditions; however, lake shores, springs, and small seepage areas often support populations. *Argia bipunctulata* usually occurs about small seepage sites, and ecological studies will likely reveal specific habitats for other species. Unlike most damselflies, many argians prefer bare soil and rocks for perch sites.

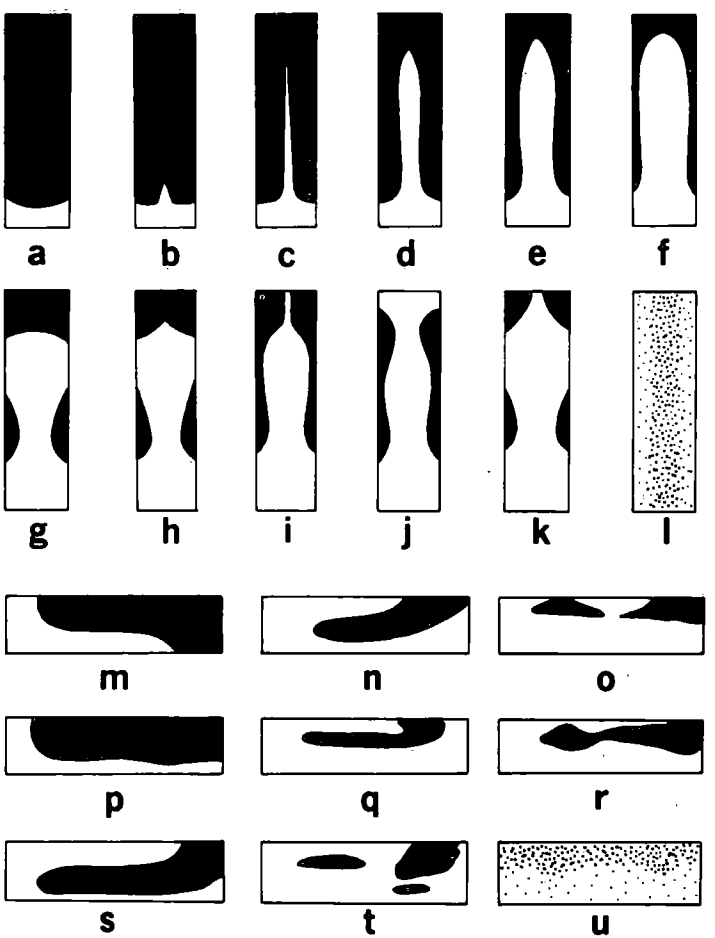

FIGURE 12. — a-l, dorsal patterns (anterior end uppermost) and m-u, left lateral patterns of abdominal segments 5 and 6 in female argians.

DISTRIBUTION RECORDS FOR TEXAS

Argia apicalis: Angelina, Bexar, Bosque, Brazos, Caldwell, Cameron, Chambers, Cherokee, Collin, Colorado, Cooke, Dallas, Denton, Falls, Fannin, Fayette, Goliad, Gonzales, Grayson, Gregg, Grimes, Guadalupe, Harris, Harrison, Hidalgo, Hunt, Jim Wells, Karnes, Kendall, La Salle, Leon, Liberty, Limestone, Lubbock, Marion, Matagorda, McLennan, Medina, Montgomery, Morris, Orange, Panola, Robertson, Rusk, San Jacinto, San Patricio, Shackelford, Tarrant, Travis, Victoria, Walker, Williamson, and Wilson counties.

Argia barretti: Comal, Hays, Kimble, Travis, and Uvalde counties.

Argia bipunctulata: Cherokee, Gregg, Panola, San Jacinto, and Wood counties.

Argia fumipennis: Austin, Bexar, Blanco, Bosque, Brewster, Cooke, Gillespie, Gregg, Grimes, Harrison, Jeff Davis, Kendall, Kinney, Marion, Montgomery, Presidio, Reeves, Robertson, Rusk, San Jacinto, Travis, Uvalde, Val Verde, and Williamson counties.

Argia hinei: Brewster and Jeff Davis counties.

Argia immunda: Bexar, Bosque, Blanco, Brazos, Brewster, Caldwell, Comal, Crosby, Dallas, Denton, Guadalupe, Gillespie, Grimes, Hays, Hidalgo, Jeff Davis, Jim Wells, Kendall, Kerr, Kimble, Medina, Polk, Reeves, Robertson, Rusk, San Saba, Tom Green, Travis, Uvalde, Val Verde, Williamson, Wilson, and Wood counties.

Argia lugens: Brewster, Crosby, Jeff Davis, Lubbock, Presidio, and Reeves counties.

Argia moesta: Anderson, Angelina, Baylor, Bexar, Blanco, Bosque, Brazos, Brewster, Burnet, Caldwell, Cherokee, Collin, Comal, Cooke, Crosby, Dallas, Denton, Fannin, Fayette, Gillespie, Goliad, Gonzales, Grayson, Gregg, Grimes, Guadalupe, Hays, Hidalgo, Hill, Howard, Jeff Davis, Jim Wells, Kendall, Kerr, Kimble, Liberty, Limestone, Llano, Marion, Matagorda, Maverick, McLennan, Medina, Montgomery, Palo Pinto, Pecos, Polk, Presidio, Randall, Reeves, San Jacinto, San Patricio, Starr, Tom Green, Travis, Uvalde, Val Verde, Victoria, Walker, Webb, Williamson, Wilson, and Zavala counties.

Argia munda: Jeff Davis county.

Argia nahuana: Blanco, Bosque, Brewster, Collin, Cooke, Crosby, Dallas, Hays, Hill, Jeff Davis, Kendall, Kimble, Menard, Presidio, Reeves, Robertson, San Saba, Tom Green, Travis, Uvalde, and Williamson counties.

Argia plana: Blanco, Bosque, Brewster, Collin, Crosby, Culberson, Dallas, Hill, Jeff Davis, McLennan, Presidio, San Saba, and Wood counties.

Argia rhoadsi: Cameron county.

Argia sedula: Austin, Bee, Bexar, Blanco, Bosque, Brazos, Burnet, Caldwell, Cameron, Cherokee, Collin, Colorado, Comal, Cooke, Dallas, Denton, Dimmit, Fayette, Gillespie, Goliad, Gonzales, Grayson, Grimes, Guadalupe, Harris, Hays, Hidalgo, Hill, Jeff Davis, Jim Wells, Kendall, Kerr, Kimble, Kinney, Liberty, Limestone, Lubbock, Matagorda, McLennan, Medina, Menard, Montgomery, Pecos, Polk, Presidio, Reeves, Rusk, San Jacinto, San Patricio, Starr, Sutton, Robertson, Tom Green, Travis, Uvalde, Val Verde, Victoria, Webb, Williamson, Wilson, and Zavala counties.

Argia tibialis: Angelina, Brazos, Franklin, Gregg, Grimes, Hardin, Henderson, Jackson, Leon, Liberty, Matagorda, Montgomery, Morris, Nacogdoches, Orange, Polk, Rusk, San Jacinto, Tyler, Victoria, Walker, and Wood counties.

Argia translata: Bexar, Blanco, Bosque, Brazos, Caldwell, Collin, Comal,

Cooke, Dallas, Denton, Fayette, Gillespie, Gonzales, Grimes, Guadalupe, Hays, Hidalgo, Hill, Howard, Kendall, Kimble, Limestone, McLennan, Medina, Palo Pinto, San Patricio, Travis, Uvalde, Val Verde, Williamson, and Wilson counties.

Enallagma Charpentier, 1840

MALES – Identification of males requires examination of the superior abdominal appendages for an attached tubercle-like structure. The key recognizes the presence of the tubercle only if it forms part of the appendage's lateral profile (Fig. 13 A; Fig. 18 E). Medial projections not detectable in lateral view are not tubercles in this sense, (*E. durum* for example). Tubercles are usually paler in color than the appendage but darken with age.

Stripe patterns in *Enallagma* species are similar between the sexes; however, pale areas are more colorful in adult males than females. Species with blue colors in males are *E. basidens, E. civile, E. divagans, E. durum, E. exsulans, E. geminatum, E. praevarum,* and *E. traviatum.* Purple and blue colors exist in males of *E. novaehispaniae.* Species with yellowish, orange, or reddish colors in the mature males are *E. signatum, E. vesperum,* and *E. dubium,* the latter species possessing reddish color. Teneral individuals may differ in color of the pale areas; for example, *E. signatum* is light blue in the immature stage. Such teneral effects are of short duration, and *Enallagma* species typically change less with age than argians and female ischnurans. Polymorphic variation occurs in the postocular spot patterns of some species (Johnson, 1964).

Body size aids in recognizing species. Body length ranges, grouped from smallest to largest species including both sexes, appear in Table 2. *Teleallagma daeckii* has the general appearance of a pale bluish *Enallagma*; however, it is typically greater than 40 mm in body length.

FEMALES – Identification of females requires study of the prothoracic dorsum, mesostigmal plates, anterior dorsum of the mesothorax, antenodal postquadrangular cell number, and stripe patterns. The middle lobe of the prothorax possesses a pair of shallow pits on its dorsum in several species. This trait requires close attention; for instance, the pits of *E. dubium* occur anteriorly on a black middle lobe and casual observation may miss them. The pits are shallow, rather wide depressions in *E. signatum* and they do not appear pit-like. The mesostigmal plates possess distinctive structural differences for several species and their dorsal view is most useful. The dorsal view of prothoracic pits and mesostigmal plates usually requires a forward flexure of the specimen's head. The dorsum of the mesosthorax posterior to the rear margin of the mesostigmal plates possesses, in several species, a pair of elevated knob or ridge-like projections (Fig. 15 B, C). These structures, visible in dorsal view, are most distinct when viewed at an oblique lateral angle. Cross veins between the

longitudinal veins M_4 and Cu_1 and from the quadrangle outward to the level of the subnodus form the antenodal postquadrangular cells.

Female stripe patterns are similar to conspecific males; however, pale-colored areas occur in shades of tan or brown, or these areas are occasionally bluish typical of the conspecific male. Walker (1953) suggested that this variation represents sex-limited dimorphism similar to *Ischnura*. Pale and dark color patterns on the terminal abdominal segments are often obscured with a coating of silt if the females have recently oviposited. Acetone or alcohol and a fine brush will remove such material.

Females of *E. carunculatum*, *E. civile*, and *E. praevarum* are similar and their separation requires care. The mesostigmal plates of *E. civile* have no ridge or prominence crossing the plate's midsection in an anterior to posterior direction. The lateral anterior margin of each mesostigmal plate curves distinctly upward. Pale colors are frequently greenish or bluish-brown rather than tan. Females of *E. carunculatum* and *E. praevarum* have a ridge or prominence diagonally crossing the mesostigmal plate in an anterior to posterior direction developing a depression restricted to the anterior medial half of each plate. The depressions differ as described in the key. Pale colors in *E. praevarum* are often light tan to brown while *E. carunculatum* is greenish or bluish-brown. These color traits are not characteristic of all individuals, possibly change with age, and fade in museum specimens. The rear margin of the hind lobe of the prothorax is typically concave in *E. praevarum* and convex in *E. carunculatum* and *E. civile*; however, occasional *E. praevarum* possess such lobes with a squarish rear margin. Also, occasional *E. carunculatum* and *E. civile* have lobes with a squarish margin.

The keys include *E. carunculatum*, a likely species for Texas as indicated in the discussion.

KEY TO THE MALES

1 a) Superior abdominal appendage in lateral view with distinct tubercle lying between dorsal and ventral lobes of the appendage or protruding from apical end of appendage (Fig. 13 A; Fig. 18 E).....2
b) Superior abdominal appendage in lateral view without such a tubercle..... 3

2 (1) a) Tubercle of superior abdominal appendage overlaid in lateral view by dorsal lobe of appendage (Fig. 13 A).....*civile*
b) Tubercle of superior abdominal appendage not overlaid in lateral view by dorsal lobe of appendage (Fig. 18 E).....*carunculatum*

3 (1) a) Superior abdominal appendage in lateral view notched on dorso-apical margin with only distinct ventral lobe (Fig. 13 B), or appendage bifid with dorsal and ventral lobes, the latter equal to or greater in length than the dorsal lobe (Fig. 13 C-E).....4
b) Superior abdominal appendage in lateral view elongate with small tooth or distinct ventral lobe directed downward (Fig. 13 F-H, J-L), or appendage bifid with divergent dorsal and ventral lobes, the latter shorter in length than the dorsal lobe (Fig. 13 I).....7

4 (3) a) Inferior abdominal appendage in lateral view greater in length

than superior abdominal appendage.....5
b) Inferior abdominal appendage in lateral view equal to or less than length of superior abdominal appendage.....6
5 (4) a) Dorsum of abdominal segments 3-6 black except narrow blue basal rings (Fig. 14 B); body length 28 mm or less; ventral lobe of superior abdominal appendage curved dorsally (Fig. 13 B).....

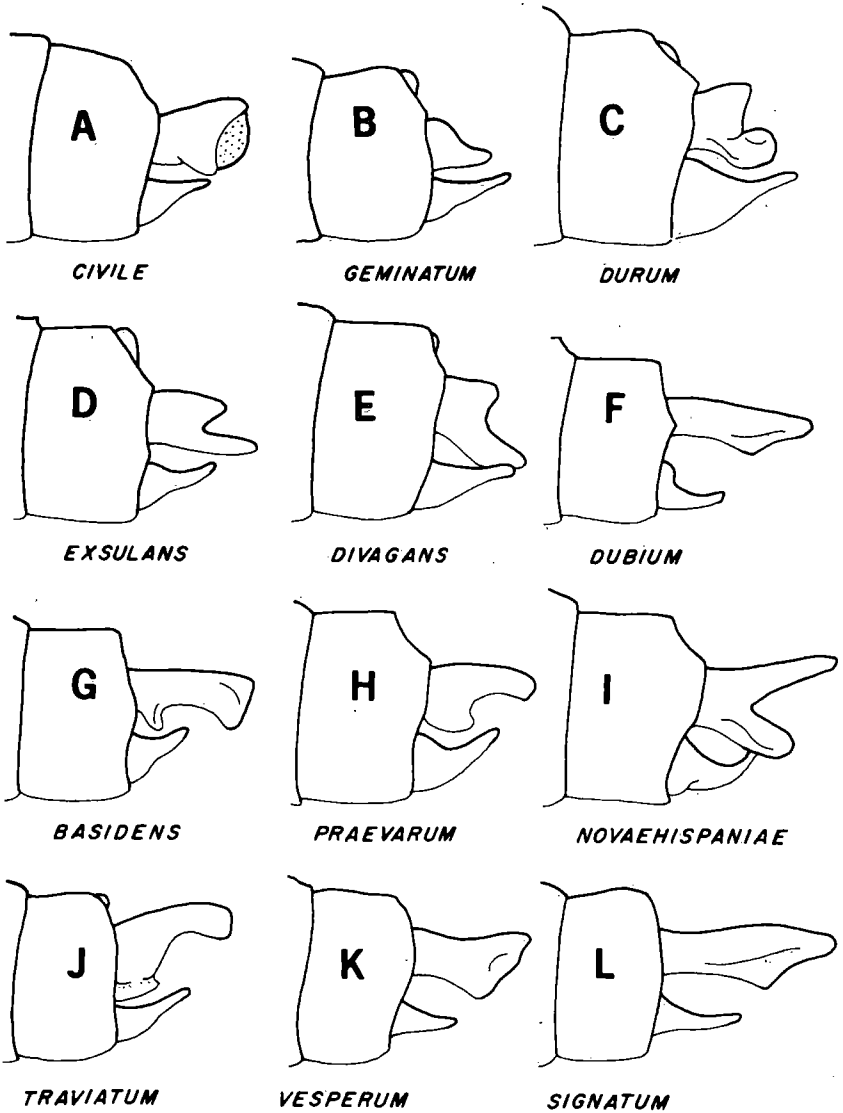

FIGURE 13. — Male abdominal appendages in *Enallagma* species following sequence of determination in key. Orientation same as lateral views in Fig. 8.

..... *geminatum*

b) Dorsum of abdominal segments 3-6 blue except black spots in apical half (Fig. 14 C); body length 31 mm or greater; ventral lobe of superior abdominal appendage curved mesially (Fig. 13 C) with small tubercle seen in dorsal view..... *durum*

6 (4) a) Superior abdominal appendage with two lobes directed poster-

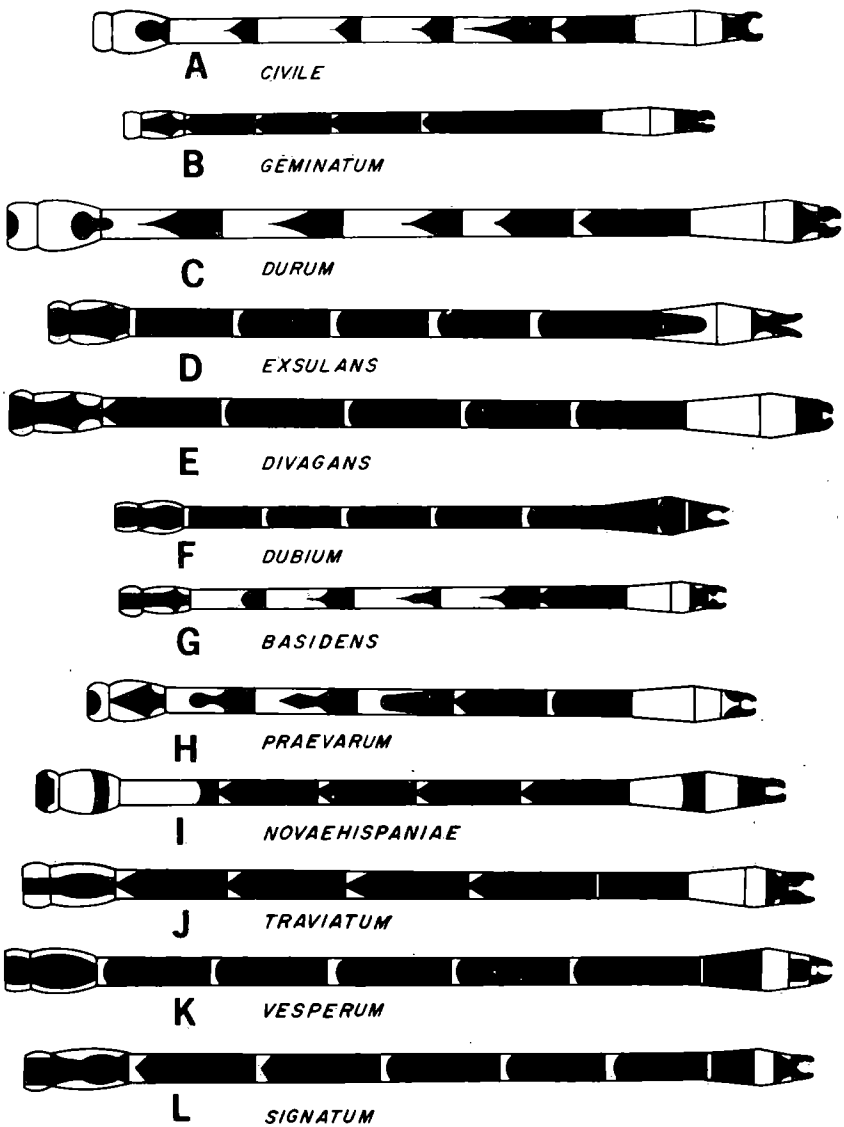

FIGURE 14. — Dorsal (anterior end to the left) views of male abdominal patterns in *Enallagma* species following sequence of determination in key.

iorly in lateral view (Fig. 13 D); dorsum of abdominal segment 9 blue or purple, segment 8 partly black (Fig. 14 D)..... *exsulans*

b) Superior abdominal appendage in lateral view with rounded knob for dorsal lobe and ventral lobe directed ventroposteriorly (Fig. 13 E); dorsum of abdominal segments 8 and 9 blue (Fig. 14 E)..... *divagans*

7 (3) a) Dorsum of abdominal segments 8, 9, and 10 black (Fig. 14 F); body length 28 mm or less; first 2 antennal segments black; antehumeral stripe narrower than humeral stripe..... *dubium*

b) Dorsum of abdominal segments 8 or 9 or both predominantly blue or yellowish-orange (Fig. 14 G-L); no such combination of other above characters..... 8

8 (7) a) Dorsum of abdominal segments 8 and 9 predominantly blue or purple (Fig. 14 G-J)..... 9

b) Dorsum of abdominal segment 9 predominantly blue or orange, segment 8 black (Fig. 14 K, L)..... 13

9 (8) a) Dorsum of abdominal segments 4 and 5 with basal half (or third in some *E. praevarum*) pale blue (bluish-brown in some museum specimens) (Fig. 14 G, H)..... 10

b) Dorsum of abdominal segments 4 and 5 with basal half predominantly black (Fig. 14 I, J)..... 11

10 (9) a) Humeral stripe longitudinally divided by pale stripe; body length 27 mm or less..... *basidens*

b) Humeral stripe not longitudinally divided by pale stripe; body length 30 mm or greater..... *praevarum*

11 (9) a) Superior abdominal appendage in lateral view distinctly bifid with divergent lobes, the inferior lobe extending posteriorly beyond level of inferior abdominal appendage (Fig. 13 I); pale body color purple (or blue and purple); prothorax predominantly black..... *novaehispaniae*

b) Superior abdominal appendage in lateral view not distinctly bifid (Fig. 13 H, J), the inferior lobe not extending posteriorly beyond level of inferior abdominal appendage; pale body color blue; prothorax predominantly blue or black..... 12

12 (11) a) Inferior lobe of superior abdominal appendage scarcely visible in lateral view (Fig. 13 J); prothorax with distinct dorsal and two lateral pale blue spots on middle lobe; postclypeus without black markings; distinct pale spots bordering ocelli region..... *traviatum*

b) Inferior lobe of superior abdominal appendage distinctly visible in lateral view (Fig. 13 H); prothorax predominantly black; postclypeus with distinct black transverse band; very small or no pale spots bordering ocelli region..... *praevarum*

13 (8) a) Dorsum of abdominal segment 9 blue; humeral stripe reduced to hair line and usually restricted to suture for most of its length..... *vesperum*

b) Dorsum of abdominal segment 9 orange or yellow in mature individuals, (in teneral specimens compare abdominal appendages and dark stripe pattern); humeral stripe distinct and not restricted to suture..... *signatum*

KEY TO THE FEMALES

1 a) Middle lobe of prothorax with pair of depressions or pits on the dorsal or dorsolateral surface.....2
b) Middle lobe of prothorax without pair of pits.....4

2 (1) a) Dorsum of mesothorax without pair of elevated, knob-like projections just rearward of mesostigmal plates' posterior margins (Fig. 15 A); body length 30 mm or greater.....*vesperum*
b) Dorsum of mesothorax with pair of elevated, knob-like projections posterior to mesostigmal plates (Fig. 15 B, C).....3

3 (2) a) Body length 27 mm or less; fore wing length 16 mm or less; postnodal veins 7 or less; middle prothoracic lobe black.....*dubium*
b) Body length 30 mm or greater; fore wing length 19 mm or greater;

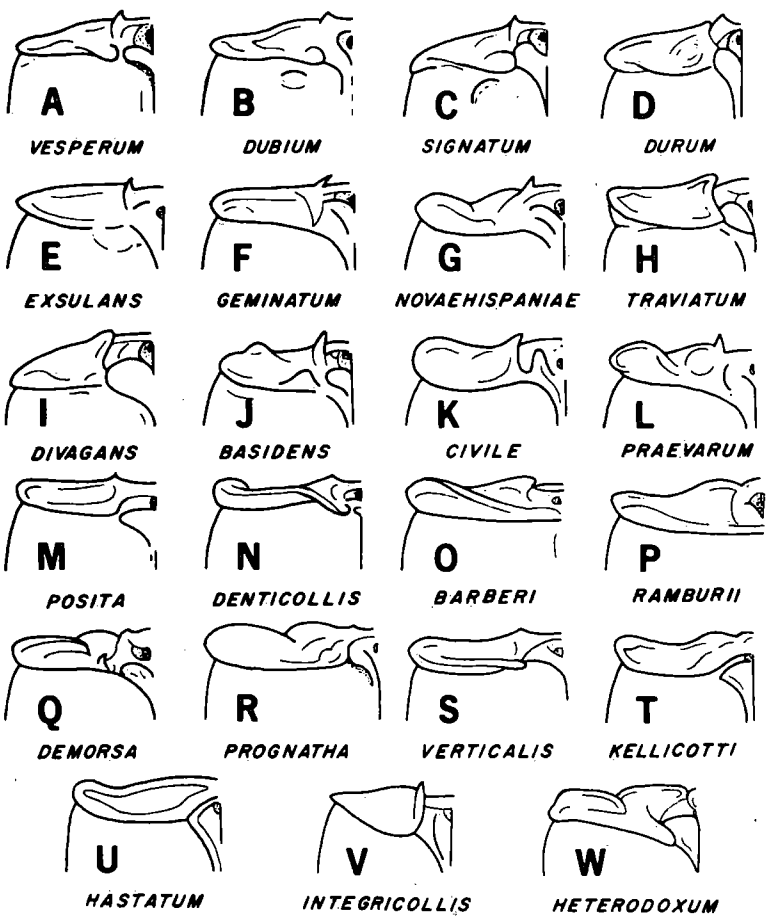

FIGURE 15. — Female mesostigmal plates in *Enallagma* species, A-L; in *Ischnura* species, M-T; in *Anomalagrion*, *Nehalennia*, and *Hesperagrion*, U, V, and W. *Enallagma* and *Ischnura* figures follow sequence of determination in respective keys. Orientation same as dorsal views of Fig. 10.

postnodal veins 8 or greater; middle prothoracic lobe with pale spot pattern ..... *signatum*

4 (1) a) Antenodal postquadrangular cells in wings 4 to 5 5
b) Antenodal postquadrangular cells in wings 2 to 3 6

5 (4) a) Dark humeral stripe distinct and not divided longitudinally ..... *durum*
b) Dark humeral stripe longitudinally divided by pale brownish line overlying humeral suture ..... *exsulans*

6 (4) a) Abdominal segment 8 pale excepting short middorsal black stripe, *or* black with distinct basal, apical or lateral rings or spots 7
b) Abdominal segment 8 black over entire dorsum excepting very narrow apical ring 10

7 (6) a) Abdominal segment 8 with two pale lateral spots separated by middorsal black stripe along entire length of segment; body length 28 mm or less ..... *geminatum*
b) Abdominal segment 8 without such a pale-dark color pattern; body length 29 mm or greater (*E. traviatum* rarely less) 8

8 (7) a) Abdominal segment 9 black dorsally; dorsum of abdominal segment 8 pale with black apical band (often wedge-shaped) over apical third ..... *novaehispaniae*
b) Abdominal segment 9 blue (pale); black if present confined to basal border 9

9 (8) a) Lateral apices of mesostigmal plates prominently elevated (Fig. 15 H); middorsal thoracic stripe usually divided longitudinally by pale dorsal carina ..... *traviatum*
b) Lateral apices of mesostigmal plates not distinctly elevated from mesothoracic border (Fig. 15 I); middorsal thoracic stripe not longitudinally divided (for full length) by pale carina ..... *divagans*

10 (6) a) Humeral stripe divided longitudinally for part of its length by inserted or overlying pale stripe 11
b) Humeral stripe well developed and not longitudinally divided by pale color pattern 12

11 (10) a) Body length less than 30 mm; distinct elevated projections on anterior and posterior borders of mesostigmal plates (Fig. 15 J) ..... *basidens*
b) Body length 35 mm or greater; mesostigmal plates without distinct elevations (Fig. 15 E) ..... *exsulans*

12 (10 a) In dorsal view, lateral half of anterior margin of each mesostigmal plate curved upward, posterior margins of plates with little if any elevation; a shallow, trough-like transverse depression exists uninterrupted from mesial to lateral ends of each plate (Fig. 15 K), (see text) ..... *civile*
b) In dorsal view, lateral half of each mesostigmal plate elevated into prominence bordered mesially by diagonal ridge (Fig. 15 L), *or* each plate with elevated ridge oriented diagonally between posterior mesial and anterior lateral borders (Fig. 18 F); a circular or ovoid depression developed in anterior, medial half of each plate (Fig. 15 L; Fig. 18 F) 13

13 (12) a) In dorsal view, depression in anterior medial half of each mesostigmal plate circular (Fig. 15 L); margin of prothoracic hind lobe

slightly concave (see text)..... *praevarum*

b) In dorsal view, depression in anterior medial half of each mesostigmal plate ovoid, axis of depression oriented diagonally between posterior mesial and anterior lateral borders of plate (Fig. 18 F); margin of prothoracic hind lobe typically convex (see test)..... ..... *carunculatum*

General collecting experience suggests considerable habitat specificity between *Enallagma* species but ecological studies on the subject are unavailable.

DISTRIBUTION RECORDS FOR TEXAS

Enallagma basidens: — Bexar, Blanco, Bosque, Bowie, Burnet, Caldwell, Cameron, Cherokee, Collin, Colorado, Cooke, Dallas, Denton, Fannin, Franklin, Gillespie, Grayson, Gregg, Grimes, Hidalgo, Hill, Hunt, Jim Wells, Kendall, Kinney, Liberty, Lubbock, Marion, Medina, Montgomery, Nueces, Reeves, Robertson, San Jacinto, Travis, Uvalde, Val Verde, Victoria, Wilson, Wise, Wood, and Zavala counties.

Enallagma civile: — Aransas, Bexar, Blanco, Bosque, Brazos, Brooks, Brewster, Burnet, Cameron, Childress, Collin, Crosby, Dallas, Denton, Dimmit, Franklin, Gillespie, Grayson, Guadalupe, Hidalgo, Hill, Houston, Howard, Hunt, Jackson, Jeff Davis, Jim Wells, Kennedy, Kimble, Kleberg, Lubbock, McLennan, Matagorda, Maverick, Pecos, Presidio, Raines, Reeves, Robertson, Runnels, San Jacinto, San Patricio, Starr, Travis, Uvalde, Van Zandt, Victoria, Webb, Wilbarger, Willacy, and Wood counties.

Enallagma divagans: — Austin, Brazos, Franklin, Lamar, Gregg, Grayson, San Jacinto, and Walker counties.

Enallagma dubium: — Harris and San Jacinto counties.

Enallagma durum: — Matagorda and San Patricio counties.

Enallagma exsulans: — Angelina, Bosque, Brazos, Caldwell, Gregg, Grimes, Hays, Hill, Kendall, Liberty, Marion, Nacogdoches, Robertson, Rusk, San Jacinto, Tom Green, Val Verde, and Wilson counties.

Enallagma geminatum: — Harris, Matagorda, Panola, and San Jacinto counties.

Enallagma novaehispaniae: — Comal, Hays, Hidalgo, Uvalde, Val Verde, and Wilson counties.

Enallagma praevarum: — Blanco, Gillespie, Jeff Davis, Presidio, Reeves, Sutton, and Uvalde counties.

Enallagma signatum: — Anderson, Austin, Burnet, Colorado, Denton, Grimes, Harris, Hays, Hunt, Liberty, Marion, Matagorda, San Jacinto, San Patricio, Uvalde, Victoria, Walker, Wilson, and Wise counties.

Enallagma traviatum: — Grayson, Harrison, Liberty, Marion, and Rusk counties.

Enallagma vesperum: — San Jacinto and Wood counties.

Comments on a questionable species for Texas, *E. boreale,* appear in the Discussion.

Ischnura Charpentier, 1840

MALES.—Male ischnurans have species-specific color patterns and distinctive abdominal appendages. The following observations generally eliminate errors in their identification. The apical margin of abdominal

segment 10 raises into a prominence usually pointed toward the apex in *I. barberi, I. ramburii, I. denticollis, I. verticalis,* and *I. posita*; however, this prominence is distinctly smaller than the spine developed on the same margin in *I. prognatha* and *I. demorsa.* Only *I. kellicotti* has a 10th abdominal segment without a raised apical margin. The superior abdominal appendage of *I. ramburii* in lateral view may appear slightly bifid with a blunt lateral lobe, depending on articulation of the appendage. The bifid nature of *I. prognatha's* superior appendage in lateral view is distinct with slender lobes or arms. The bifid condition of the inferior abdominal appendages of *I. demorsa* is diagnostic for that species in Texas, and is visible in both lateral and dorsal view; however, the latter view must have the longitudinal axis of the 10th segment perpendicular to the line of vision to insure seeing the bifid condition.

The antehumeral pale stripes (totally absent in *I. denticollis*) are more narrow in width than the middorsal and humeral dark stripes. In *I. posita,* each stripe typically separates into an elongated anterior and a circular posterior spot having an exclamation mark-pattern. Nonetheless, infrequent individuals of *I. posita* occur with the spots connected resulting in a medially constricted stripe. Large samples of *I. ramburii* and *I. verticalis* occasionally have individuals with their antehumeral stripes separated into two spots, and similar variation may occur in other ischnurans.

The eighth and ninth abdominal segments (and also the 10th segment in *I. kellicotti*) possess a pattern of blue and black: a reduced or absence of abdominal blue color is characteristic of *I. posita.* The variation between species in this trait largely involves the extent of black on lateral sides of the eighth and ninth abdominal segments. Black pattern on the sides of segment eight in *I. demorsa* varies from total absence to a wide line, the latter being the typical condition. The key uses only such abdominal patterns as a primary diagnostic difference in couplet six involving species without conflicting variation to our knowledge. Use of all color patterns requires caution. Variation of pattern on the ninth abdominal segment of *I. ramburii* was the basis for the taxonomic recognition of *Ischnura credula* or *I. ramburii credula* by different authorities. The variation has geographic correlation in some areas (Paulson, 1966); however, the two types are widely sympatric.

Ischnurans frequently have shape and color differences in the stigma of fore and hind wings of males. This difference is absent in *I. posita,* occurs in color although weakly developed in *I. demorsa, I. denticollis, I. barberi, I. verticalis, I. ramburii,* and is distinct for color in *I. kellicotti.* Both shape and color differences characterize fore and hind stigmas of male *I. prognatha.*

Range in body length within *Ischnura* species has a seasonal correlation. Larger specimens characterize early season collections, and smaller individuals appear in late summer or fall. The wide range in body length of adults probably indicates different generations experiencing different larval durations. Table 2 gives the species from smallest to largest minimal

body length including both sexes.

FEMALES.—The female key relies largely on structure of mesotigmal plates, as color patterns have a complex variation involving a sex-limited female dimorphism. One form, the andromorph, possesses the species-specific color pattern shared with the male, and the second form, the heteromorph, differs in color and usually stripe pattern. These morphs develop soon after emergence. Some species retain distinctiveness of the morphs throughout life, while morphs of other species superficially change with age by pruinescence, giving all females an outwardly similar appearance. A few species have only one of the above morphs. All species in Texas possess both morphs except *I. prognatha* and *I. posita*. These species possess only the andromorph in *I. posita* and the heteromorph in *I. prognatha*. Age changes, other than pruinescence, further complicate use of color. Whereas male and female *I. posita* are similar in pattern following emergence, females soon develop a bluish-gray dorsum of both thorax and abdomen through pruinescence. If this effect causes difficulty at couplet 2, a drop of acetone applied to the thorax usually reveals the basic pattern temporarily. Female *I. prognatha* pass through a color change typical of most heteromorphic females. Soon after emergence, a dark dorsal thoracic stripe exists bordered by orange thoracic sides, and humeral stripes are absent. The orange areas become tan to dark brown, often greenish, with age, but females are always distinct from males. The heteromorphic female *I. denticollis* have dark dorsal and humeral stripes with tan pale areas. The andromorphic *I. denticollis* females (apparently very rare) are similar to conspecific males in having no pale antehumeral areas. Heteromorphic female *I. ramburii* are basically similar to *I. prognatha* females but the middorsal thoracic stripe is typically wider and pale areas more brownish. Heteromorphic female *I. barberi* are variable having no thoracic stripes or a well developed middorsal and faint humeral stripes. Both female morphs in *I. ramburii* and *I. barberi* develop little pruinescence and retain their distinctness through life. Heteromorphic female *I. verticalis*, *I. prognatha* and *I. ramburii* are generally similar in thoracic pattern immediately following emergence. Females of *I. verticalis* develop pruinescence over most of the thorax and abdomen resulting in a bluish-gray color. Within two days, *I. verticalis* females of both morphs are similar in general appearance and distinguishable only by close examination and application of acetone to the thorax. The morph pattern in *I. kellicotti* and *I. demorsa* differs as follows. Both female morphs possess the thoracic stripe pattern shared with males; however, andromorphs have the typical bluish (*I. kellicotti*), or greenish (*I. demorsa*) pale-colored areas characteristic of males while heteromorphs have a brown or orange color. This difference exists unchanged by age in *I. kellicotti* but is largely lost in *I. demorsa* similar to changes in *I. verticalis*. Pruinescence-effect and color changes with age occurring in females of *I. demorsa*, *I. posita*, *I. verticalis*, and *Anomalagrion hastatum* produce individuals similar in outward appearance. Structural characters are necessary for their reliable diagnosis.

A statement of additional variations may eliminate confusion with other groups. The M_2 vein of the fore wing originates closer to the 4th and 5th postnodals in males and females respectively for *I. prognatha* while both sexes in *Ischnura* usually have an M_2 origin nearer the 4th postnodal. Some species are also sexually dimorphic for postnodal vein number (Johnson, 1969). The vulvar spine is variable in some *Ischnura* species, and its diagnostic value reduced. All females of *I. posita* examined or reported were without spines, and it is probably absent in this species.

KEY TO THE MALES

1 a) Inferior abdominal appendage in lateral view serrated and extending posteriorly beyond apical level of superior abdominal appendage (Fig. 16 A); dorsum of abdominal segments 8 and 9 black rarely with small bluish area); antehumeral pale areas usually divided into 2 spots having an exclamation mark pattern..... *posita*

b) Inferior abdominal appendage in lateral view not serrated (Fig. 16 B-H); dorsum of abdominal segments 8 or 9 or both predominantly blue; antehumeral pale areas absent or as continuous stripes (very rarely divided into 2 spots).....2

2 (1) a) Dorsum of mesothorax solid black with metallic green lustre, pale antehumeral areas absent; abdominal appendages in lateral view no greater in length than ½ of segment 10's length (Fig. 16 B); abdominal segments 8 and 9 blue dorsally with distinct black lateral stripes..... *denticollis*

b) Dorsum of mesothorax with distinct pale antehumeral areas; no such combination of above characters.....3

3 (2) a) Superior abdominal appendage in lateral view bifid with distinct mesial lobe directed ventrad, lateral lobe of same appendage directed posteriorly; apical dorsal margin of abdominal segment 10 prolonged into distinct spine (Fig. 16 C); abdominal segment 8 black dorsally; body length greater than 30 mm..... *prognatha*

b) Superior abdominal appendage in lateral view not bifid (slightly so in *I. ramburii* depending on articulation of appendages) (Fig. 16 D-H); apical dorsal margin of abdominal segment 10 not raised into distinct spine (except in *I. demorsa* which is always less than 30 mm in body length); abdominal segment 8 predominantly blue dorsally.....4

4 (3) a) Inferior abdominal appendage in lateral view bifid with lobe on ventral margin curved mesially, in dorsal view, both lobes of inferior abdominal appendage project posteriorly beyond superior appendage (Fig. 16 D; Fig. 17 A); abdominal segment 8 blue dorsally, usually black stripe laterally; segment 9 completely blue..... *demorsa*

b) Inferior abdominal appendage not bifid, confirm with lateral and dorsal views (Fig. 16 E-H; Fig. 17 B-E); abdominal segments 8 and 9 not as above.....5

5 (4) a) In dorsal view, each superior abdominal appendage long as or longer than wide (Fig. 17 B); in lateral view, dorsally-directed lobe of inferior abdominal appendage may be hidden by overlying superior appendage (Fig. 16 E); abdominal segments 8 and 9 blue

dorsally with black lateral stripe, segment 10 black dorsally with 2 blue spots; pale areas of pterothorax bluish; postocular pale spots large and triangular..... *kellicotti*

b) In dorsal view, each superior abdominal appendage wider than long (Fig. 17 C-E); abdominal segments 8 and 9 variable, segment 10 black; pale areas of pterothorax greenish; postocular spots small and circular..... 6

6 (5) a) Abdominal segment 8 blue dorsally with distinct black lateral stripe or rectangular mark; in dorsal view, apical margins of superior abdominal appendages taper laterally from base to apex (Fig. 17 C).. ..... *verticalis*

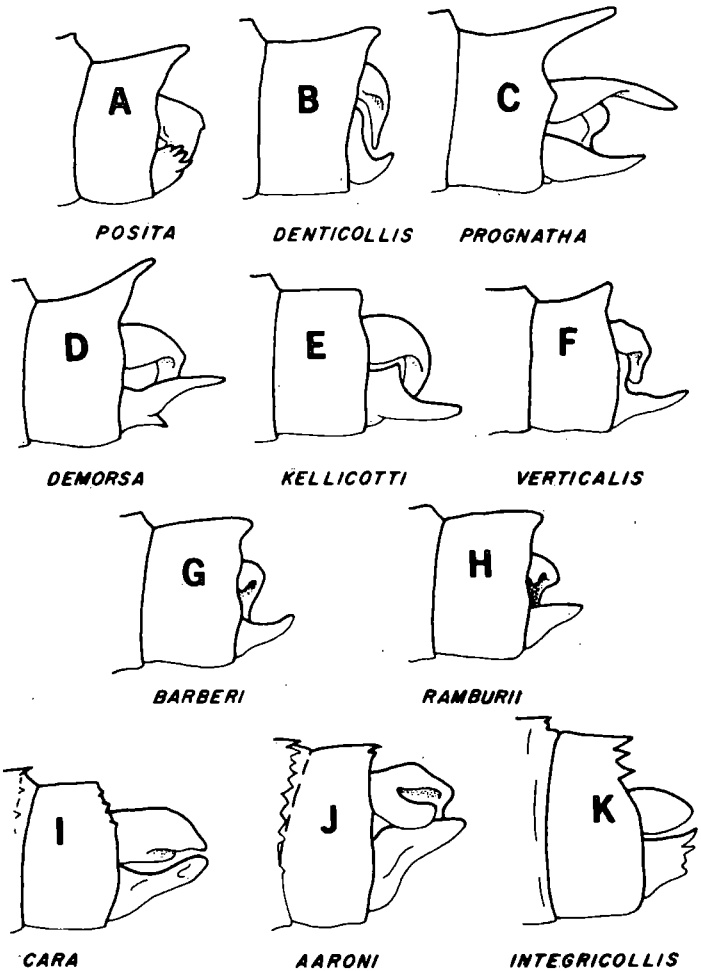

FIGURE 16. — Male abdominal appendages in *Ischnura* species, A-H; in protoneurids, I and J; in *Nehalennia*, K. Orientation same as lateral views of Fig. 8.

b) Abdominal segment 8 completely blue (except occasional very narrow basal rings); in dorsal view, superior abdominal appendages with concave or sigmoid apical margins but not distinct lateral divergence (Fig. 17 D, E) 7

7 (6) a) In lateral view, inferior abdominal appendage with dorsal margin concave and apical tip curved dorsally (Fig. 16 G); abdominal segment 9 completely blue ..... *barberi*

b) In lateral view, inferior abdominal appendage with dorsal margin not concave, apical tip of appendage directed posteriorly or mesially (Fig. 16 H); abdominal segment 9 with variable amount of dorsal black markings ..... *ramburii*

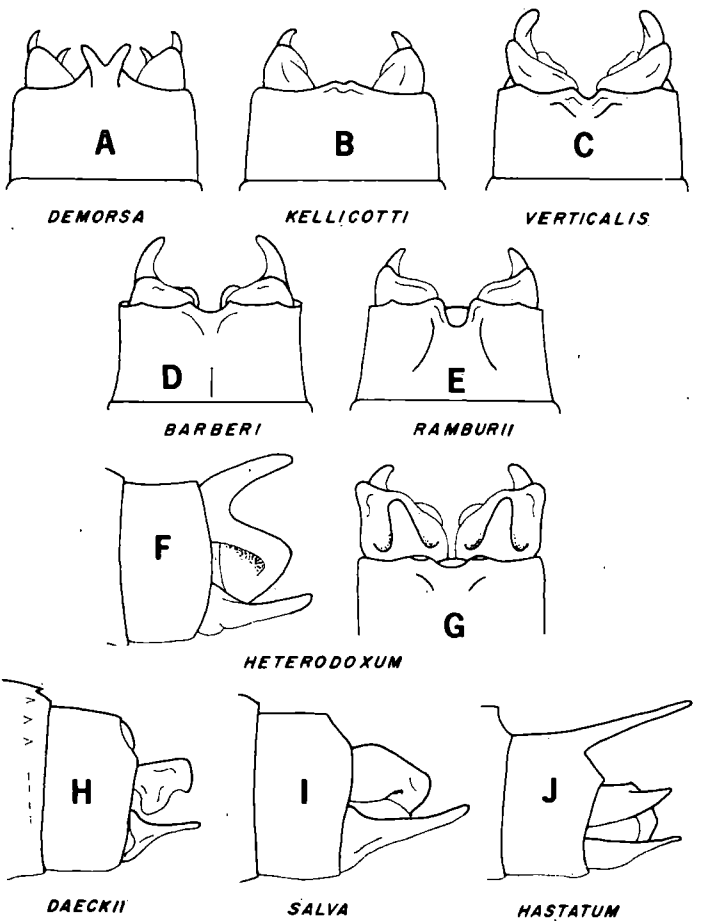

FIGURE 17. — Dorsal views of male abdominal appendages in *Ischnura* species, A-E; lateral and dorsal views in *Hesperagrion*, F and G; lateral views in *Teleallagma*, *Telebasis* and *Anomalagrion*, H, I and J. Lateral view orientation same as Fig. 8.

KEY TO THE FEMALES

1 a) Prothoracic middle lobe in lateral view with distinct tooth-like projection on dorsolateral surface (actually pair of projections present, one on either side) (Fig. 11 I); mesostigmal plates in dorsal view appear to stand on edge and tilt forward (Fig. 15 N)..... *denticollis*

b) Prothoracic middle lobe smoothly convex on dorsolateral surface, no tooth-like projection present (Fig. 11 L); mesostigmal plates in dorsal view not standing on edge but variable in degree of ridge formation (Fig. 15 M, O-T)..... 2

2 (1) a) Each antehumeral pale area divided into elongate anterior and circular posterior spots; mesostigmal plates in dorsal view with transverse depressions produced by low ridges on anterior and posterior margins (Fig. 15 M); dorsum of abdominal segments 8 and 9 black ..... *posita*

b) Each antehumeral pale area occurs as a narrow continuous stripe bordered by dark middorsal and humeral stripes (humeral stripe may be absent); mesostigmal plates with unequally developed ridges on anterior and posterior margins (if no pronounced ridge differences, dorsum of abdominal segments 8 and 9 predominantly pale or body length 29 mm or greater)..... 3

3 (2) a) In dorsal view, posterior margins of mesostigmal plates meet at midline forming a continuous ridge transversely crossing mesothorax along a straight or slightly curved line, no indentation of this margin at midline about apical ends of rami arising from median thoracic carina (Fig. 15 O, P)..... 4

b) In dorsal view, posterior margins of mesostigmal plates not continuous at midline and not transversely crossing mesothorax along straight or slightly curved line; distinct concave indentation at midline between plates' posterior margins, indentation occupied by distinct rami of median thoracic carina..... 5

4 (3) a) In dorsal view, distinct oblique ridge crossing each mesostigmal plate from anterior lateral corner to posterior margin near midline, attaining greatest height near lateral edge (Fig. 15 O)..... *barberi*

b) In dorsal view, no distinct ridge on mesostigmal plates, posterior lateral margins slightly raised and expanded, and plates' anterior margins with variable degree of sigmoid shape (Fig. 15 P)..*ramburii*

5 (3) a) In dorsal view, mesostigmal plates' anterior margins developed into distinct ridges having truncated medial borders, a distinct tooth or tubercle arising at the plates' posterior medial corners (Fig. 15 Q); body length less than 30 mm; (lobe on anterior margin and the blunt, raised prominence of posterior medial corner of each plate in *I. prognatha* much less distinctive than similarly-placed structures on *I. demorsa's* plates, and associated with individuals greater than 30 mm in body length)..... *demorsa*

b) In dorsal view, mesostigmal plates' anterior margins not developed into ridge as above (lateral half lobe-like in *I. prognatha*), and tooth-like projection absent from posterior medial corner of each plate or as blunt prominence (Fig. 15 R-T)..... 6

6 (5) a) In dorsal view, mesostigmal plates with convex lobe over lateral half of anterior margin (Fig. 15 R); body length greater than 34 mm..... *prognatha*

b) In dorsal view, mesostigmal plates with no lobe on anterior margins; body lengths 33 mm or less.....7

7 (6) a) In dorsal view, posterior margin of mesostigmal plate raised into a distinct ridge for greater part of its length (Fig. 15 S); dorsum of abdominal segment 8, 9 and 10 black or gray (except in teneral stages of andromorphic individuals); pruinescence largely obscuring pattern in mature individuals.....*verticalis*

b) In dorsal view, posterior margins of mesostigmal plates not developed into a ridge (Fig. 15 T); dorsum of abdominal segments 8, 9 and 10 predominantly pale; pruinescence absent or weakly developed in all ages.....*kellicotti*

Habitat differences occur between ischnuran species (Johnson, 1966), but this behavior rarely aids species identification. The close association of *I. kellicotti* with lily pads, *Nuphar*, has been described (Johnson and Westfall, 1970).

DISTRIBUTION RECORDS FOR TEXAS

Ischnura barberi; — Crockett, Pecos and Ward counties.

Ischnura demorsa: — Brewster, Culberson, Jeff Davis, Presidio, and Reeves counties.

Ischnura denticollis: — Brewster, Garza, Jeff Davis, and Presidio counties.

Ischnura kellicotti: — San Jacinto county.

Ischnura posita: — Anderson, Bosque, Brazos, Burnet, Cameron, Cherokee, Collin, Colorado, Cooke, Dallas, Denton, Grayson, Gregg, Harrison, Hays, Hunt, Jim Wells, Liberty, Marion, Menard, Polk, Rusk, San Jacinto, Sutton, Robertson, Upshur, Val Verde, Victoria, Walker, Wilson, and Wood counties.

Ischnura prognatha: — San Jacinto county.

Ischnura ramburii: — Angelina, Aransas, Brazos, Brazoria, Burnet, Caldwell, Cameron, Chambers, Colorado, Dallas, Denton, Galveston, Goliad, Gonzales, Gregg, Harris, Harrison, Hidalgo, Jackson, Jefferson, Jim Wells, Kennedy, Kimble, Kleberg, Liberty, Live Oak, Lubbock, Marion, Matagorda, Polk, Panola, Refugio, Rusk, San Jacinto, San Patricio, Robertson, Tom Green, Travis, Val Verde, Victoria, Walker, and Williamson counties.

Ischnura verticalis: — Cooke, Grayson, and Lubbock counties.

Comments on two questionable species for Texas, *I. damula* and *I. perparva*, appear in the Discussion.

SMALLER COENAGRIONID GENERA

Anomalagrion Selys, 1857

Anomalagrion hastatum: — Females of this small damselfly are similar to female *Ischnura posita, verticalis* or possibly *demorsa*. Female *A. hastatum* pass through a color change similar to heteromorphic ischnurans. Early stages following emergence have a dark dorsal thoracic stripe bordered by orange. Dark humeral stripes are absent. The orange areas become brown, and whitish pruinescence develops along the lower lateral sides of the pterothorax. The changes produce a pale, narrow lateral border to the dor-

sal stripe; at this stage faint humeral stripes appear. Abdominal segments 1-5 and 6-10 are predominantly orange and black respectively; however, aging changes the whole abdominal dorsum to a bluish-gray. A vulvar spine occurs in some females; however, it is always quite small if present. Males are distinct in the field with their slender, yellow-orange abdomen. Lentic habits with emergent vegetation are characteristic.

DISTRIBUTION RECORDS FOR TEXAS:

Aransas, Austin, Blanco, Bosque, Brazos, Brazoria, Brooks, Burnet, Cameron, Chambers, Collin, Colorado, Cooke, Dallas, Denton, Goliad, Gregg, Guadalupe, Hardin, Harris, Harrison, Hidalgo, Hunt, Jim Wells, Kendall, Kleberg, Lamar, Madison, Marion, Matagorda, Montgomery, Orange, Panola, Polk, Reeves, Rusk, San Jacinto, San Patricio, Robertson, Travis, Upshur, Uvalde, Victoria, Walker, Williamson, and Wise counties.

Hesperagrion Calvert, 1902

Hesperagrion heterodoxum.—Abdominal appendages and mesostigmal plates in the male and female respectively identify this species; however, color and stripe patterns are exceptionally variable. Calvert (1901-1908) assumed the differences represented aging effects and described several stages from tenerals to mature adults. I cultured numerous larvae through metamorphosis and observed color patterns in breeding adults in southwestern New Mexico providing additional evidence. All males shortly after emergence are brownish-yellow other than a dark middorsal thoracic stripe and a dark longitudinal line on the dorsum of abdominal segments 4-7. At maturity the yellowish areas of the abdomen turn to orange-red on segments 8, 9 and 10: segments 1, 2 and 3 are orange or greenish-yellow. The dorsum of the head is black excepting large red postocular spots, the face is pale tan excepting a black transverse band on the postclypeus, the prothorax is dorsally black and the dorsum of the pterothorax is black laterally to at least the humeral suture, and the pale antehumeral areas exist as two isolated spots (rarely connected). Pale areas of the pterothorax are blue or cream in color. The femur and tibia develop black stripes laterally. Females at emergence occur in one of two patterns. Most females are brownish-yellow without any dark stripe pattern. Suture lines are somewhat darker, especially on the head; the postocular region is frequently dark brown but without definite postocular spots. Other females at emergence possess the color and stripe pattern described above for teneral males. Calvert's description of the variation is not clear relative to the condition he associated with maturity for females; however, two female types exist at maturity in *H. heterodoxum* as with many *Ischnura* species.

At maturity, heteromorphic females remain brownish-yellow without any dark pattern (excepting actual suture lines). The color becomes fully brown or tan and loses all yellow attributes. Such females mate, oviposit, and judging from the condition of wings and exocuticle, they reach ad-

vanced age for a damselfly without further change in color or pattern. Andromorphic females are similar to males at maturity except that abdominal segments 9 and 10 are black, and segment 9 is blue dorsally with a black apical band while segments 1-7 are dorsally black. Reddish postocular spots develop but the surrounding black color spreads with age and the spots are lost. Females emerging with a male-like pattern become andromorphic types at maturity. These andromorphic females also mate and oviposit. Males and andromorphic females do, in fact, change considerably in color pattern from teneral stage to maturity. If only museum specimens were available for comparison, color patterns at emergence unknown, and maturity, judged by mating behavior, unassociated with color patterns, recognition of dimorphic females would be unlikely.

Males are not similar to other species in Texas, whereas heteromorphic females are similar in flight to several coenagrionids. Characteristic habitats are small streams in the xeric southwest.

DISTRIBUTION RECORDS FOR TEXAS

Brewster, Culberson, Jeff Davis, and Presidio counties.

Nehalennia Selys, 1850

Nehalennia integricollis:—Both sexes of *N. integricollis* have a solid greenish-bronze thoracic dorsum without pale antehumeral regions. The abdominal segments are dorsally dark-green or bronze excepting some blue on segments 8, 9 and 10 in the males. Lentic habitats are typical for the species.

DISTRIBUTION RECORDS FOR TEXAS

Montgomery and San Jacinto counties.

Teleallagma Kennedy, 1920

Teleallagma daeckii:—A long, slender abdomen, greater than 34 mm in length, and pale body colors distinguish this damselfly. Males are pale blue; females are brown to green-yellow, and both sexes have reduced dark stripe patterns. These characters effectively separate *T. daeckii* from other Texas coenagrionids. Perching habit (wings folded together over the back) and color pattern eliminate confusion with lestids. Margins of swamps and lentic water describe our current knowledge of preferred habitats.

DISTRIBUTION RECORD FOR TEXAS

Montgomery County.

Telebasis Selys, 1865

Telebasis salva:—The males are the only damselflies in Texas with a bright red abdomen, brownish-red thorax, and a middorsal dark thoracic stripe having a tooth-like notch laterally on each side in the posterior half. Females possess the characteristic middorsal dark stripe, but have brown bodies and are less distinct when observed in flight. Habitats include both lentic and lotic situations.

DISTRIBUTION RECORDS FOR TEXAS

Bexar, Blanco, Bosque, Brazos, Brewster, Burnet, Caldwell, Crosby, Culberson, Dallas, Denton, Gillespie, Grayson, Grimes, Hays, Hidalgo, Hill, Jeff Davis, Jim Wells, McCulloch, Menard, Reeves, Robertson, Travis, Uvalde, Val Verde, Victoria, Williamson, and Wilson counties.

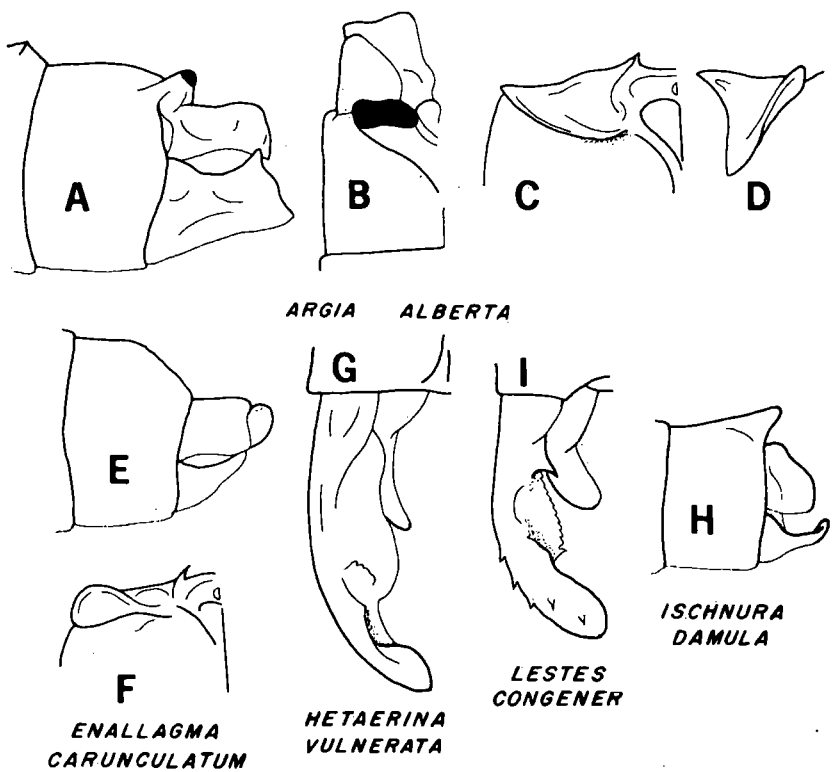

FIGURE 18. — Possible additions to Texas fauna. Male structures, A, B, E, G-I; female structures, C, D, F. Orientation same as preceeding figures.

Discussion

Questionable Records and Synonyms. — The literature carries several references to species occurring in Texas without adequate documentation, and Table 3 lists these species. The case of *Lestes simplex* appears under that genus. Erroneous determinations account for the following records. Calvert's (1893) references to *Lestes forcipatus* was actually *L. disjunctus* (see Walker, 1953), and Tinkham's (1934) record for *L. unguiculatus* was actually a specimen of *Argia plana* (see Gloyd, 1958).

Table 3. Unsubstantiated Records for the Texas Damselfly Fauna

Erroneous or questionable literature records for Damselflies in Texas. See Discussion Text.

Lestes congener Hagen 1861
Lestes dryas Kirby 1890
Lestes forcipatus Rambur 1842
Lestes simplex Hagen 1861
Lestes unguiculatus Hagen 1861
Hetaerina sempronia Hagen 1853
Hetaerina vulnerata Hagen 1853
Amphiagrion saucium (Burmeister) 1839
Enallagma cyathigerum (Charpentier) 1840
Ischnura perparva Selys 1876

Probable additions to the Texas Damselfly Fauna. See Text.

Lestes congener Hagen 1861
Argia alberta Kennedy 1918
Enallagma boreale Selys 1876
Enallagma carunculatum Morse 1891
Ischnura damula Calvert 1901

Donnelly, who described *Enallagma westfalli* in 1964, now considers it as *E. traviatum westfalli* (Donnelly, pers comm., 1970). References to other species for Texas exist, but the localities given are only 'Texas', determinations are questionable, and actual specimens are unavailable for examination. These records include *Lestes congener* listed for Texas in several publications, but all such records trace to Hagen (1861). Calvert (1901-1908) listed *Ischnura perparva* from Texas (near San Antonio) on the basis of one male. The species has otherwise a northwestern distribution. All references to *I. perparva* from Texas trace to this one record, and I am considering it unsubstantiated until confirmed by additional collecting. Calvert (1901-1908) listed *Hetaerina sempronia* for Texas on the basis of three males reported in 1875 but not actually seen by Calvert. The variability of *H. titia* may account for these records. Some *H. titia* appear similar to *H. sempronia* in wing pattern. Currently no firm record of *H. sempronia* is available for Texas. Tucker (1908) reported on Odonata from Plano, Texas, (north of Dallas) including *H. vulnerata*. Wing patterns are quite similar in both *H. vulnerata* and *H. americana;* however, the abdominal appendages in dorsal view of *americana* have a distinct lobe on the medial margins and the same margins in *vulnerata* are without lobes (Fig. 6 A and Fig. 18 G). *Hetaerina vulnerata* occurs in southwest New Mexico and south in Mexico and this geographical pattern casts

strong doubt on the central Texas record. I assume Tucker had *H. americana*, a highly variable species with at least five synonyms (see Needham and Heywood, 1929).

An unpublished thesis on the Odonata of Texas submitted to Trinity University, San Antonio, in 1952 by P. N. Albright lists, among other species, *Lestes congener, L. dryas, L. unguiculatus, Amphiagrion saucium, Enallagma cyathigerum*, and *Hetaerina sempronia*. Albright's specimens are not available, and the source of his determinations is not clear. Acceptance of these species for Texas requires documentation by specimens with verified determinations.

From the above questionable species, *Lestes congener* may exist in Texas as it reaches southern New Mexico and *Ischnura damula* exists as a probable species on the same basis. *Lestes congener* males are distinct from other Texas lestids in structure of abdominal appendages. Each inferior abdominal appendage in dorsal view extends posteriorly no further than the midpoint of the serrated lobe on the superior appendage (Fig. 18 I). Each antehumeral pale area in *Ischnura damula* exists as two spots, and the superior abdominal appendage in lateral view is deeper at its base than the appendage is long. (Fig. 18 H). *Enallagma boreale* occurs at low elevations in central New Mexico, and its appearance in west Texas is possible. Descriptions of these three species are in Walker (1953).

Bick and Bick (1957) summarized the Odonata distributions in Oklahoma. *Argia alberta* and *Enallagma carunculatum* occurred respectively in Harmon and Cimarron Counties, Oklahoma, adjoining Texas in the panhandle area. *Enallagma carunculatum* occurs also in Roosevelt County, New Mexico, adjoining Texas. These two northern species may well have populations in Texas and the keys include them. *Ischnura barberi* occurred

TABLE 4. SYNONYMS FOR TEXAS DAMSELFLIES APPEARING IN POST-1900 LITERATURE

Species:	Synonym:
Calopteryx dimidiata	*Agrion dimidiatum* (Burmeister) 1839
Calopteryx maculata	*Agrion maculatum* Beauvois 1805
Hetaerina titia	*Hetaerina tricolor* (Burmeister) 1839[1]
Argia fumipennis violacea	*Argia violacea* (Hagen) 1861
Argia lugens	*Hyponeura lugens* Hagen 1861
Argia moesta	*Argia putrida* Hagen 1861 and *Argia intruda* Williamson 1912
Argia munda	*Argia vivida munda* Calvert 1902 and *Argia rita* Kennedy 1919
Argia nahuana	*Argia agrioides nahuana* Calvert 1902
Argia plana	*Argia vivida plana* Calvert 1902
Enallagma novaehispaniae	*Enallagma coecum novae-hispaniae* Calvert 1907
Ischnura barberi	*Ischnura utahensis* Muttkowski 1910
Ischnura ramburii	*Ischnura ramburii credula* Hagen 1861 and *Ischnura credula* Hagen 1861
Teleallagma daeckii	*Telagrion daeckii* Calvert 1903 and *Enallagma daeckii* (Calvert) 1903

[1] See discussion under the genus *Hetaerina*.

in Jackson County, Oklahoma, adjoining Texas far east of its easternmost Texas county record. Data for *I. barberi* are probably very incomplete. Louisiana records (Bick, 1957) reveal no species west of the Mississippi River not also occurring in Texas. Damselfly distribution in the Mexican states adjacent to the Texas border is not well known.

Most synonyms appeared prior to 1900 and rarely occur in the literature. Synonyms published after 1900 appear in Table 4. Needham and Heywood (1929) placed the genus *Neoneura* in the family Coenagrionidae. The family name Agriidae often appears for Calopterygidae, while Coenagriidae frequently appears for Coenagrionidae. The name Agrionidae has a confusing history representing at different times both Calopterygidae and Coenagrionidae. Minor spelling variations of names occurred with usage (examples, *Lestes inequalis; Ischnura ramburi; Teleallagma daecki;* and *Heterina).*

GEOGRAPHICAL DISTRIBUTION. – The wide range of habitats within Texas and its geographic location produce convergence of typically eastern, western, and neotropical faunas. Many species consequently have range limits in the state and the following distributional patterns result.

Statewide distribution, where suitable habitat occurs, exists for the following damselflies. Species occurring across most of the United States, parts of Canada and south into Mexico are *Hetaerina americana, Argia moesta, A. sedula,* and *Enallagma civile. Argia fumipennis violacea* and *Enallagma basidens* occur widely in the east, north, south, and west to at least Arizona. *Telebasis salva* occurs widely in the west, Kansas and Louisiana to the north and east respectively.

The following species have their western limits of distribution within Texas, also occur north or both north and south into Mexico, and have their westernmost Texas county records in parentheses. *Lestes disjunctus* (Jeff Davis), *L. inaequalis* (Angelina), *L. vigilax* (Walker), *Calopteryx dimidiata* (San Jacinto), *C. maculata* (Hemphill), *Hetaerina titia* (Presidio), *Argia apicalis* (Lubbock), *A. bipunctulata* (Wood), *A. tibialis* (Victoria), *Enallagma divagans* (Grayson), *E. dubium* (Harris), *E. durum* (San Patricio), *E. exsulans* (Val Verde); *E. geminatum* (Matagorda), *E. signatum* (Uvalde), *E. traviatum* (Grayson), *E. vesperum* (Wood). *Ischnura kellicotti* (San Jacinto), *I. posita* (Val Verde), *I. prognatha* (San Jacinto), *I. ramburii* (Lubbock). *I. verticalis* (Lubbock), *Anomalagrion hastatum* (Reeves), *Nehalennia integricollis* (Montgomery), and *Teleallagama daeckii* (Montgomery). Three of these eastern species have more western populations than indicated above. Smith and Pritchard (1956) report *I. ramburii* in California. I can trace no confirmation for the California record, and the species is apparently absent in xeric parts of west Texas and the southwest although abundant farther south in Mexico. *Ischnura posita* has apparently reached the Hawaiian Islands yet it has failed to colonize western North America (Zimmerman, 1948). Calvert (1903) gives one record of *I. verticalis* from

New Mexico. That species may occur over much of north Texas judging from Bick and Bick's (1957) report of the Odonata of Oklahoma.

The following species have their eastern limits of distribution within Texas, also occur north or both north and south into Mexico, and have their easternmost county records in parentheses. *Archilestes grandis* (Dallas), *Lestes alacer* (Matagorda), *Argia lugens* (Crosby), *A. nahuana* (Robertson), *A. plana* (Wood), *Enallagma praevarum* (Blanco), *Ischnura barberi* (Crockett), *I. demorsa* (Brewster), and *I. denticollis* (Garza).

The following species reach Texas from the south or southwest and have their northernmost county records in parentheses. *Lestes forficula* (Brazos), *L. sigma* (Gonzales), *Neoneura aaroni* (Caldwell), *Protoneura cara* (Kendall), *Argia barretti* (Kimble), *A. hinei* (Brewster), *A. munda* (Jeff Davis). *A. rhoadsi* (Cameron), *Enallagma novaehispaniae* (Hays), and *Hesperagrion heterodoxum* (Brewster).

Two species occurring in Texas are apparently absent from New Mexico and Louisiana but range north and south of the state. These species with eastern and westernmost county records respectively are *Argia immunda* (Rusk, Jeff Davis) and *A. translata* (Brazos, Howard).

SEASONAL DISTRIBUTION.—The seasonal distribution or adult flight season of most species extends over spring and summer months and may persist into cool weeks of early fall. Many dragonflies (Anisoptera) apparently have an obligate diapause associated with a massed, synchronized spring or early summer emergence. Such species consist of a homogenous adult age group, growth patterns require at least a full year's cycle, often longer, and adults vanish from the scene when their average life expectancy expires. Most damselflies appear to differ from this pattern by having growth controlled in a faculative manner. As soon as temperature conditions in the spring permit, emergence begins and continues throughout much of the summer.

Emergence in north Texas may therefore be several weeks later than for the same species in southern parts of the state. The populations have a heterogeneous age structure, and growth rates may permit more than one generation in a year. The lestids, calopterygids, and larger coenagrionids appear to require, for most species and habitats, a year's life cycle. The smaller coenagrionids may have two to three generations in a year. Life cycles are typically longer in species restricted to streams than in forms characteristic of lentic habitats. The date of emergence will vary from year to year for a given habitat as local climate varies. In areas where warm springs occur (ex. Palmetto State Park), adults fly earlier than in surrounding habitats having lower temperatures. Adults in southern counties will likewise exist later into the fall season than counterparts to the north and may have twice the generation number a year.

For these reasons, a comprehensive knowledge of flight seasons will require more ecological data than currently available. A few exceptions to these generalizations exist. The form of *Hetaerina titia* known as *tricolor* is characteristically a spring form in central Texas (Johnson, 1963).

The records for *Enallagma divagans* suggest it to be a spring to early summer species and notes for *Archilestes grandis* and *Lestes congener* point to late summer and fall flight seasons.

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Appendix

Zygoptera known from Texas Counties

Anderson Co.
Calopteryx maculata
Argia moesta
Enallagma signatum
Ischnura posita

Andrews Co. (no records)

Angelina Co.
Lestes inaequalis
Hetaerina titia
Argia apicalis
Argia moesta
Argia tibialis
Enallagma exsulans
Ischnura ramburii

Aransas Co.
Lestes disjunctus
Calopteryx maculata
Enallagma civile
Ischnura ramburii
Anomalagrion hastatum

Archer Co. (no records)

Armstrong Co. (no records)

Atascosa Co. (no records)

Austin Co.
Argia fumipennis
Argia sedula
Enallagma divagans
Enallagma signatum
Anomalagrion hastatum

Bailey Co. (no records)

Bandera Co. (no records)

Bastrop Co.
Calopteryx maculata

Baylor Co.
Hetaerina americana
Argia moesta

Bee Co.
Argia sedula

Bell Co.
Archilestes grandis

Bexar Co.
Lestes forficula
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Telebasis salva

Blanco Co.
Lestes alacer
Lestes disjunctus
Hetaerina americana
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuna
Argia plana
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Enallagma praevarum
Anomalagrion hastatum
Telebasis salva

Borden Co. (no records)

Bosque Co.
Lestes alacer
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Enallagma exsulans
Ischnura posita
Anomalagrion hastatum
Telebasis salva

Bowie Co.
Calopteryx maculata
Enallagma basidens

Brazoria Co.
Ischnura ramburii
Anomalagrion hastatum

Brazos Co.
Lestes alacer
Lestes disjunctus
Lestes forficula
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Argia tibialis
Argia translata
Enallagma civile
Enallagma divagans
Enallagma exsulans
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva

Brewster Co.
Archilestes grandis
Lestes disjunctus
Hetaerina americana
Argia fumipennis
Argia hinei
Argia immunda
Argia lugens
Argia moesta
Argia nahuana
Argia plana
Enallagma civile
Ischnura demorsa
Ischnura denticollis
Hesperagrion heterodoxum
Telebasis salva

Briscoe Co. (no records)

Brooks Co.
Enallagma civile
Anomalagrion hastatum

Brown Co. (no records)

Burleson Co. (no records)

Burnet Co.
Argia moesta
Argia sedula
Enallagma basidens
Enallagma civile
Enallagma signatum
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva

Caldwell Co.
Lestes alacer
Hetaerina americana
Hetaerina titia
Neoneura aaroni
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma basidens
Enallagma exsulans
Ischnura ramburii
Telebasis salva

Calhoun Co. (no records)

Callahan Co. (no records)

Cameron Co.
Lestes forficula
Lestes sigma
Argia apicalis
Argia rhoadsi
Argia sedula
Enallagma basidens
Enallagma civile
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum

Camp Co. (no records)

Carson Co. (no records)

Cass Co. (no records)

Castro Co. (no records)

Chambers Co.
Argia apicalis
Ischnura ramburii
Anomalagrion hastatum

Cherokee Co.
Calopteryx maculata
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia bipunctulata
Argia moesta
Argia sedula
Enallagma basidens
Ischnura posita

Childress Co.
Hetaerina americana
Enallagma civile
Clay Co. (no records)
Cochran Co. (no records)
Coke Co. (no records)
Coleman Co. (no records)
Collin Co.
Calopteryx maculata
Argia apicalis
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Ischnura posita
Anomalagrion hastatum
Collingsworth Co. (no records)
Colorado Co.
Lestes disjunctus
Hetaerina americana
Argia apicalis
Argia sedula
Enallagma basidens
Enallagma signatum
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Comal Co.
Hetaerina americana
Hetaerina titia
Argia barretti
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma novaehispaniae
Comanche Co. (no records)
Concho Co. (no records)
Cooke Co.
Hetaerina americana
Argia apicalis
Argia fumipennis
Argia moesta
Argia nahuana
Argia sedula
Argia translata
Enallagma basidens
Ischnura posita
Ischnura verticalis
Anomalagrion hastatum
Coryell Co. (no records)
Cottle Co. (no records)
Crane Co. (no records)
Crockett Co.
Ischnura barberi
Crosby Co.
Archilestes grandis
Lestes alacer
Hetaerina americana
Argia immunda
Argia lugens
Argia moesta
Argia nahuana
Argia plana
Enallagma civile
Telebasis salva
Culberson Co.
Argia plana
Ischnura demorsa
Hesperagrion heterodoxum
Telebasis salva
Dallam Co. (no records)
Dallas Co.
Archilestes grandis
Lestes disjunctus
Calopteryx maculata
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva
Dawson Co. (no records)
Deaf Smith Co. (no records)
Delta Co. (no records)

Denton Co.
Archilestes grandis
Calopteryx maculata
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Enallagma signatum
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva

De Witt Co. (no records)
Dickens Co. (no records)
Dimmit Co.
Argia sedula
Enallagma civile

Donley Co. (no records)
Duval Co. (no records)
Eastland Co. (no records)
Ector Co. (no records)
Edwards Co. (no records)
Ellis Co. (no records)
El Paso Co. (no records)
Erath Co. (no records)
Falls Co.
Argia apicalis

Fannin Co.
Argia apicalis
Argia moesta
Enallagma basidens

Fayette Co.
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia moesta
Argia sedula
Argia translata

Fisher Co. (no records)
Floyd Co. (no records)
Foard Co. (no records)
Fort Bend Co. (no records)
Franklin Co.
Argia tibialis
Enallagma basidens
Enallagma civile
Enallagma divagans

Freestone Co. (no records)
Frio Co. (no records)
Gaines Co. (no records)
Galveston Co.
Ischnura ramburii

Garza Co.
Ischnura denticollis

Gillespie Co.
Hetaerina americana
Argia fumipennis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Enallagma praevarum
Telebasis salva

Glasscock Co. (no records)
Goliad Co.
Hetaerina americana
Hetaerina titia
Neoneura aaroni
Argia apicalis
Argia moesta
Argia sedula
Ischnura ramburii
Anomalagrion hastatum

Gonzales Co.
Lestes alacer
Lestes sigma
Hetaerina americana
Hetaerina titia
Neoneura aaroni
Argia apicalis
Argia moesta
Argia sedula
Argia translata
Ischnura ramburii

Gray Co. (no records)
Grayson Co.
Calopteryx maculata
Argia apicalis
Argia moesta
Argia sedula
Enallagma basidens

Grayson Co. — Continued
Enallagma civile
Enallagma divagans
Enallagma traviatum
Ischnura posita
Ischnura verticalis
Telebasis salva

Gregg Co.
Calopteryx maculata
Hetaerina americana
Argia apicalis
Argia bipunctulata
Argia fumipennis
Argia moesta
Argia tibialis
Enallagma basidens
Enallagma divagans
Enallagma exsulans
Ischnura posita
Ischnura ramburii
Anomalgrion hastatum

Grimes Co.
Calopteryx maculata
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia sedula
Argia tibialis
Argia translata
Enallagma basidens
Enallagma exsulans
Enallagma signatum
Telebasis salva

Guadalupe Co.
Hetaerina titia
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma civile
Anomalagrion hastatum

Hale Co. (no records)
Hall Co. (no records)
Hamilton Co. (no records)
Hansford Co. (no records)
Hardeman Co. (no records)

Hardin Co.
Lestes disjunctus
Calopteryx dimidiata
Argia tibialis
Anomalagrion hastatum

Harris Co.
Lestes disjunctus
Argia apicalis
Argia sedula
Enallagma dubium
Enallagma geminatum
Enallagma signatum
Ischnura ramburii
Anomalagrion hastatum

Harrison Co.
Lestes inaequalis
Argia apicalis
Argia fumipennis
Enallagma traviatum
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum

Hartley Co. (no records)
Haskell Co. (no records)

Hays Co.
Archilestes grandis
Hetaerina americana
Hetaerina titia
Argia baretti
Argia immunda
Argia moesta
Argia nahuana
Argia sedula
Argis translata
Enallagma exsulans
Enallagma novaehispaniae
Enallagma signatum
Ischnura posita
Telebasis salva

Hemphill Co.
Calopteryx maculata

Henderson Co.
Argia tibialis

Hidalgo Co.
Lestes forficula
Protoneura cara
Argia apicalis
Argia immunda

Hidalgo Co. — Continued
Argia moesta
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Enallagma novaehispaniae
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva
Hill Co.
Lestes alacer
Hetaerina americana
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Enallagma basidens
Enallagma civile
Enallagma exsulans
Telebasis salva
Hockley Co. (no records)
Hood Co. (no records)
Hopkins Co. (no records)
Houston Co.
Calopteyx maculata
Enallagma civile
Howard Co.
Argia moesta
Argia translata
Enallagma civile
Hudspeth Co. (no records)
Hunt Co.
Lestes disjunctus
Argia apicalis
Enallagma basidens
Enallagma civile
Enallagma signatum
Ischnura posita
Anomalagrion hastatum
Hutchinson Co. (no records)
Irion Co. (no records)
Jack Co. (no records)
Jackson Co.
Hetaerina titia
Argia tibialis
Enallagma civile
Ischnura ramburii
Jasper Co. (no records)
Jeff Davis Co.
Archilestes grandis
Lestes alacer
Lestes disjunctus
Hetaerina americana
Argia fumipennis
Argia hinei
Argia immunda
Argia lugens
Argia moesta
Argia munda
Argia nahuana
Argia plana
Argia sedula
Enallagma civile
Enallagma praevarum
Ischnura demorsa
Ischnura denticollis
Hesperagrion heterodoxum
Telebasis salva
Jefferson Co.
Ischnura ramburii
Jim Hogg Co. (no records)
Jim Wells Co.
Lestes disjunctus
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Enallagma basidens
Enallagma civile
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva
Johnson Co. (no records)
Jones Co. (no records)
Karnes Co.
Argia apicalis
Kaufman Co. (no records)
Kendall Co.
Hetaerina americana
Hetaerina titia
Protoneura cara
Argia apicalis
Argia fumipennis
Argia immunda

Kendall Co. — Continued
Argia moesta
Argia nahuana
Argia sedula
Argia translata
Enallagma basidens
Enallagma exsulans
Anomalagrion hastatum
Kenedy Co.
Enallagma civile
Ischnura ramburii
Kent Co. (no records)
Kerr Co.
Hetaerina americana
Argia immunda
Argia moesta
Argia sedula
Kimble Co.
Lestes alacer
Hetaerina americana
Argia barretti
Argia immunda
Argia moesta
Argia nahuana
Argia sedula
Argia translata
Enallagma civile
Ischnura ramburii
King Co. (no records)
Kinney Co.
Argia fumipennis
Argia sedula
Enallagma basidens
Kleberg Co.
Lestes forficula
Lestes sigma
Enallagma civile
Ischnura ramburii
Anomalagrion hastatum
Knox Co. (no records)
Lamar Co.
Lestes disjunctus
Enallagma divagans
Anomalagrion hastatum
Lamb Co. (no records)
Lampasas Co. (no records)
La Salle Co.
Argia apicalis
Lavaca Co. (no records)
Lee Co. (no records)
Leon Co.
Argia apicalis
Argia tibialis
Liberty Co.
Argia apicalis
Argia moesta
Argia sedula
Argia tibialis
Enallagma basidens
Enallagma exsulans
Enallagma signatum
Enallagma traviatum
Ischnura posita
Ischnura ramburii
Limestone Co.
Hetaerina americana
Argia apicalis
Argia moesta
Argia sedula
Argia translata
Lipscomb Co. (no records)
Live Oak Co.
Ischnura ramburii
Llano Co.
Hetaerina americana
Argia moesta
Loving Co. (no records)
Lubbock Co.
Archilestes grandis
Lestes alacer
Lestes disjunctus
Hetaerina americana
Argia apicalis
Argia lugens
Argia sedula
Enallagma basidens
Enallagma civile
Ischnura ramburii
Ischnura verticalis
Lynn Co. (no records)
Madison Co.
Anomalagrion hastatum
Marion Co.
Calopteryx maculata
Argia apicalis
Argia fumipennis
Argia moesta
Enallagma basidens

Marion Co. — Continued
Enallagma exsulans
Enallagma signatum
Enallagma traviatum
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Martin Co. (no records)
Mason Co. (no records)
Matagorda Co.
Lestes alacer
Argia apicalis
Argia moesta
Argia sedula
Argia tibialis
Enallagma civile
Enallagma durum
Enallagma geminatum
Enallagma signatum
Ischnura ramburii
Anomalagrion hastatum
Maverick Co.
Argia moesta
Enallagma civile
McCulloch Co.
Telebasis salva
McLennan Co.
Hetaerina titia
Argia apicalis
Argia moesta
Argia plana
Argia sedula
Argia translata
Enallagma civile
McMullen Co. (no records)
Medina Co.
Hetaerina americana
Neoneura aaroni
Protoneura cara
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma basidens
Menard Co.
Hetaerina americana
Argia nahuana
Argia sedula
Ischnura posita
Telebasis salva
Midland Co. (no records)
Milam Co. (no records)
Mills Co. (no records)
Mitchell Co. (no records)
Montague Co.
Archilestes grandis
Montgomery Co.
Lestes disjunctus
Calopteryx maculata
Argia apicalis
Argia fumipennis
Argia moesta
Argia sedula
Argia tibialis
Enallagma basidens
Anomalagrion hastatum
Nehalennia intergricollis
Teleallagma daeckii
Moore Co. (no records)
Morris Co.
Argia apicalis
Argia tibialis
Motley Co. (no records)
Nacogdoches Co.
Lestes disjunctus
Calopteryx maculata
Argia tibialis
Enallagma exsulans
Navarro Co. (no records)
Newton Co. (no records)
Nolan Co. (no records)
Nueces Co.
Neoneura aaroni
Enallagma basidens
Ochiltree Co. (no records)
Oldham Co. (no records)
Orange Co.
Argia apicalis
Argia tibialis
Anomalagrion hastatum
Palo Pinto Co.
Hetaerina americana
Argia moesta
Argia translata
Panola Co.
Argia apicalis
Argia bipunctulata

Panola Co. — Continued
Enallagma geminatum
Ischnura ramburii
Anomalagrion hastatum
Parker Co. (no records)
Parmer Co. (no records)
Pecos Co.
Hetaerina americana
Argia moesta
Argia sedula
Enallagma civile
Ischnura barberi
Polk Co.
Hetaerina titia
Argia immunda
Argia moesta
Argia sedula
Argia tibialis
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Potter Co. (no records)
Presidio Co.
Archilestes grandis
Hetaerina americana
Hetaerina titia
Argia fumipennis
Argia lugens
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Enallagma civile
Enallagma praevarum
Ischnura demorsa
Ischnura denticollis
Hesperagrion heterodoxum
Raines Co.
Enallagma civile
Randall Co.
Hetaerina americana
Argia moesta
Reagan Co. (no records)
Real Co.
Hetaerina americana
Red River Co. (no records)
Reeves Co.
Lestes alacer
Hetaerina americana
Argia fumipennis
Argia immunda
Argia lugens
Argia moesta
Argia nahuana
Argia sedula
Enallagma basidens
Enallagma civile
Enallagma praevarum
Ischnura demorsa
Anomalagrion hastatum
Telebasis salva
Refugio Co.
Ischnura ramburii
Roberts Co. (no records)
Robertson Co.
Calopteryx maculata
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia fumipennis
Argia immunda
Argia nahuana
Argia sedula
Enallagma basidens
Enallagma civile
Enallagma exsulans
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva
Rockwall Co. (no records)
Runnels Co.
Enallagma civile
Rusk Co.
Calopteryx maculata
Argia apicalis
Argia fumipennis
Argia immunda
Argia sedula
Argia tibialis
Enallagma exsulans
Enallagma traviatum
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Sabine Co. (no records)
San Augustine Co. (no records)

San Jacinto Co.
Lestes disjunctus
Calopteryx dimidiata
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia bipunctulata
Argia fumipennis
Argia moesta
Argia sedula
Argia tibialis
Enallagma basidens
Enallagma civile
Enallagma divagans
Enallagma dubium
Enallagma exsulans
Enallagme geminatum
Enallagma signatum
Enallagma vesperum
Ischnura kellicotti
Ischnura posita
Ischnura prognatha
Ishnura ramburii
Anomalagrion hastatum
Nehalennia integricollis

San Patricio Co.
Lestes alacer
Lestes disjunctus
Lestes forficula
Lestes sigma
Hetaerina americana
Hetaerina titia
Neoneura aaroni
Argia apicalis
Argia moesta
Argia sedula
Argia translata
Enallagma civile
Enallagma durum
Enallagma signatum
Ischnura ramburii
Anomalagrion hastatum

San Saba Co.
Argia immunda
Argia nahuana
Argia plana

Schleicher Co. (no records)

Scurry Co. (no records)

Shackelford Co.
Argia apicalis

Shelby Co.
Calopteryx maculata

Sherman Co. (no records)

Smith Co. (no records)

Somervell Co. (no records)

Starr Co.
Lestes forficula
Lestes sigma
Argia moesta
Argia sedula
Enallagma civile

Stephens Co. (no records)

Sterling Co. (no records)

Stonewall Co. (no records)

Sutton Co.
Hetaerina americana
Argia sedula
Enallagma praevarum
Ischnura posita

Swisher Co. (no records)

Tarrant Co.
Lestes disjunctus
Argia apicalis

Taylor Co. (no records)

Terrell Co. (no records)

Terry Co. (no records)

Throckmorton Co. (no records)

Titus Co. (no records)

Tom Green Co.
Argia immunda
Argia moesta
Argia nahuana
Argia sedula
Enallagma exsulans
Ischnura ramburii

Travis Co.
Archilestes grandis
Lestes disjunctus
Hetaerina americana
Hetaerina titia
Argia apicalis
Argia barretti
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia sedula

Travis Co. — Continued
Argia translata
Enallagma basidens
Enallagma civile
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva
Trinity Co. (no records)
Tyler Co.
Argia tibialis
Upshur Co.
Ischnura posita
Anomalagrion hastatum
Upton Co. (no records)
Uvalde Co.
Archilestes grandis
Hetaerina americana
Hetaerina titia
Protoneura cara
Argia barretti
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia sedula
Argia translata
Enallagma basidens
Enallagma civile
Enallagma novaehispaniae
Enallagma praevarum
Enallagma signatum
Anomalagrion hastatum
Telebasis salva
Val Verde Co.
Hetaerina americana
Protoneura cara
Argia fumipennis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma basidens
Enallagma exsulans
Enallagma novaehispaniae
Ischnura posita
Ischnura ramburii
Telebasis salva
Van Zandt Co.
Enallagma civile
Victoria Co.
Lestes sigma
Hetaerina americana
Hetaerina titia
Neoneura aaroni
Argia apicalis
Argia moesta
Argia sedula
Argia tibialis
Enallagma basidens
Enallagma civile
Enallagma signatum
Ischnura posita
Ischnura ramburii
Anomalagrion hastatum
Walker Co.
Calopteryx maculata
Argia apicalis
Argia moesta
Argia tibialis
Enallagma divagans
Enallagma signatum
Ischnura posita
Ischnurar ramburii
Anomalagrion hastatum
Waller Co. (no records)
Ward Co.
Ischnura barberi
Washington Co. (no records)
Webb Co.
Hetaerina titia
Argia moesta
Enallagma civile
Wharton Co. (no records)
Wheeler Co. (no records)
Wichita Co. (no records)
Wilbarger Co.
Enallagma civile
Willacy Co.
Enallagma civile
Williamson Co.
Lestes disjunctus
Hetaerina americana
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia sedula

Williamson Co. — Continued
Argia translata
Ischnura ramburii
Anomalagrion hastatum
Telebasis salva
Wilson Co.
Lestes disjunctus
Hetaerina americana
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Enallagma basidens
Enallagma exsulans
Enallagma novaehispaniae
Enallagma signatum
Ischnura posita
Telebasis salva
Winkler Co. (no records)
Wise Co.
Enallagma basidens
Enallagma signatum
Anomalagrion hastatum
Wood Co.
Calopteryx maculata
Argia bipunctulata
Argia immunda
Argia plana
Argia tibialis
Enallagma basidens
Enallagma civile
Enallagma vesperum
Ischnura posita
Yoakum Co. (no records)
Young Co. (no records)
Zapata Co. (no records)
Zavala Co.
Hetaerina americana
Argia moesta
Argia sedula
Enallagma basidens

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