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NOTE: *Argia anceps* Garrison, *A. carlcooki* Daigle (photo only), *A. lacrimans*, and *A. harknessi* Calvert have been found in Arizona

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A Synopsis of the Genus *Argia* of the United States with Keys and Descriptions of New Species, *Argia sabino, A. leonorae,* and *A. pima* (Odonata: Coenagrionidae)

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ABSTRACT

A synopsis of all 29 species of *Argia* occuring north of Mexico includes keys to both sexes based primarily on caudal appendage morphology in males and morphology of the mesostigmal plates in the females, diagnoses, distributional notes and diagnostic illustrations. Three new species, *A. leonorae* (*Holotype male.*—MEXICO: Nuevo Leon state, in FSCA), *A. pima* (*Holotype male.*- U.S.A.: Arizona, Pima Co., in USNM), and *A. sabino* (*Holotype male.* -U.S.A.: Arizona, Pima Co., in USNM) are described. The following nomenclatural changes are proposed: *Argia mista* Navás is considered a junior synonym of *A. extranea* (Hagen), *A. solita* Kennedy a junior synonym of *A. pallens* Calvert, *A. spegazzinii* Navás a junior synonym of *A. plana* Calvert, and *A. espinalensis* Navás a junior synonym of *A. translata* Hagen in Selys.

INTRODUCTION

This paper is the first of what will be several covering the systematics of the New World coenagrionid genus, *Argia*. I describe three new species from the United States which have been known for several years, so that they may be included in a forthcoming book on the Zygoptera of the United States by M.J. Westfall, Jr. and M. May. I also include a key, with illustrations for all 29 species of *Argia* occurring in the United States and Canada. Members of the genus are easily distinguished from all other Coenagrionidae by the following combination of characters: 1) wings stalked well before level of Ac so that distance between cessation of petiolation and origination of Ac (A in Fig. 100) is longer than Ac (B in Fig. 100) (in all other genera, the wings are stalked at level of Ac, or if before Ac, than that distance less or subequal to length of Ac), 2) both sexes with tibial spines longer than interval separating them (other genera, except for *Nehalennia*, have tibial spines shorter than interval separating them), and 3) males with a specialized pair of pad-like structures (tori, Fig. 1c) on the declivous posterodorsal surface of abdominal segment 10 (no such structures present in other genera).

The genus *Argia*, while confined to the New World (Calvert 1901), has long been known to be an extremely speciose group: over 150 names have been proposed, of which about 110 species may be considered valid. Selys (1865), Calvert (1901), and Fraser (1946) have described the problems of associating existing names with available specimens.

Calvert (1901, 1907) provided the first key for the Middle American fauna, in which he recognized 48 species: 18 of those taxa are known to occur in the United

States. Calvert's keys rely primarily on overall color pattern and allow the user to distinguish among groups of species using the illustrations of the caudal appendages for final species recognition. The keys, while still excellent for Middle America, are not adequate for the species occurring north of the Mexican border.

Byers (in Needham and Heywood 1929) provided the first key for both sexes of *Argia* from the United States and Canada. The key recognizes only 18 species, and much of the data for little-known southwestern species was abstracted primarily from their original descriptions. The key is superficial and relies primarily on color patterns, which vary significantly with age and geography. Walker (1953) provided an excellent key for the eight Canadian species. He used a combination of color pattern and structural characters and provided excellent illustrations for their determination.

All other keys were regional in nature. Examples are Calvert (1893) for Philadelphia, Kellicott (1899) for Ohio, Williamson (1900) for Indiana, Needham (1903) for New York state, Muttkowski (1908) for Wisconsin, Garman (1917) for Illinois, Pritchard and Smith (1956) for California, Johnson and Westfall (1970) for Florida, Johnson (1972b) for Texas, and Roemhild (1975) for Montana. Johnson's (1972b) key for Texas is especially valuable because it keys a large proportion of the species (15 of 29) of the United States, and because of good diagnostic illustrations using new characters first mentioned by Gloyd (1958) in her analysis of the species of *Argia* from Big Bend area of Texas. Dunkle (1990) provides excellent color illustrations of six species known from peninsular Florida. González and Novelo (1991) provide keys for species of *Argia* from the Biosphere Reserve of La Michilía in Durango state, Mexico. Six species known from the United States and another undescribed species are keyed. Excellent illustrations of the taxonomic characters accompany the keys.

Mrs. Leonora K. Gloyd, who died in 1993, began to revise the genus over 60 years ago, but, unfortunately, was unable to complete her studies. Over the years, I have studied the rich holdings of *Argia* at the UMMZ, where Gloyd had amassed one of the more extensive collections of the genus. I have also examined many of her notes and have begun to illustrate various views of the all-important caudal appendages. These illustrations, many of which are of homotypic or paratypic material, have been most helpful to me in identifying specimens. I have also seen and copied illustrations of the caudal appendages executed by Menger in Brussels and by Eager at the UMMZ. Finally, I have had the privilege of borrowing certain types which have verified my identifications.

METHODS

The present keys admit 29 species for the United States and Canada. They differ from previous keys in that I have relied primarily on morphological differences of structures associated with the last abdominal segment of the male, and with the mesostigmal plates of the female. The detailed illustrations of these structures are to be used with the keys. Color pattern can be useful, especially in the field or with properly preserved specimens; but it may change or darken with age, vary individually, or may become totally obscured by post mortem effects. Because of this, I have relied little on color pattern characters. Under species accounts, I include these differences when diagnosing among similar species.

The specialized terminology associated with the male tenth abdominal segment was given by Gloyd (1958). Three structures lie dorsally between the base of

the cerci (Fig. 1c). The toreola (toreolae pl.) lies directly between the bases of the cerci. This structure seems to be homologous to the epiproct, and I have used this term throughout. The epiproct is a bi- or trifoliate pad-like structure which presumably abuts against the base of the middorsal thoracic carina of the female during the tandem position (Fig. 36). A transversely elongate depressed planar structure, called a torifer (torifers pl.) lies above each cercus. On the ventral margin of each torus and above the cercus lies a pad-like torus (tori, plural), which is almost always convex. It varies among species, but in many it is transversely longer than high, and it occupies the lowermost portion of the recessed torifer. The tori presumably cushion against the base of the mesepisternum of the female. In Fig. 36, I illustrate the attachment of a preserved pair of *Argia lugens* (Hagen), with most of the base of the left mesepisternum removed, showing the dorsal view of the left torifer and torus. The dorsal surface of the left cercus is exposed because the left mesostigmal plate of the female has been removed.

Walker (1913) illustrated the probable attachment points between the male caudal appendages and the female mesostigmal plates of *A. moesta putrida* (Hagen) (= *A. moesta* (Hagen)). Of several pairs of *Argia lugens* which I collected in California (Fig. 34-36), one pair was preserved in situ (Fig. 35-36). The paraprocts and cerci act as a pincer device, the former abutting against the middle and posterior lobes of the prothorax, the latter overhanging the mesostigmal plates of the female.

The cercus in male *Argia* is a convex structure whose shape is modified specifically and offers the best clues in identification. The distal end of this structure may be entire or divided, but its tip is usually armed with at least one or more decumbent tooth or lobe. Their positioning along the margin is of paramount importance and proper exposure of this structure is necessary for reliable species identification. The paraproct forms a broad, roughly triangular structure which is modified specifically. Its tip rests upon the mediolateral depression of the middle lobe of the prothorax of the female (Fig. 78, 79). In most species, it is divided into an upper and lower branch, but some species have an unmodified unilobate paraproct.

For females, the shape of the mesostigmal plate (Fig. 37-67) is of paramount importance in diagnosing species. A mesostigmal lobe, when present, usually occupies the posteromesal margin of each plate, and the foliate expansion is often differentiated from the posterodistal margin of the plate. I have found the condition of the mesal border of the mesostigmal lobe to provide useful characters for diagnosing among some species. A thickened costate rim, or tubercle (Fig. 95-97) may be found at the base of the mesostigmal lobe where it meets the mesepisternum. A more prominent mesepisternal tubercle (Fig. 58, 94), when present, is located just posterior to the border of each mesostigmal plate. Their size and development vary specifically among some species. The morphology of the lateral arm of the middorsal thoracic carina where it meets the mesal margin of the mesostigmal lobe also varies specifically among some species. In some the arm may be separated from each lobe (as in Fig. 48) or adjacent (as in Fig. 57).

I have broken the keys into several subordinate keys which should more easily allow the inclusion of new species, if they are discovered. Some species key out more than once, allowing for different interpretations of character variability. The subordinate keys are not meant to imply natural (phylogenetic) groupings. The illustrations of the structures in this paper were made using a Wild M-8 microscope equipped with a camera lucida.

Under species accounts, app = appendages, mp = mesostigmal plates, thx =

thorax, FW = fore wing, HW = hind wing, and abd = abdomen. I give diagnoses, followed by brief notes on type depositions, and distributions. Full descriptions are given only for new species.

The following acronyms are used throughout the paper:

ASU	Arizona State University, Tempe
ANSP	Academy of Natural Sciences, Philadelphia
BMNH	British Museum (Natural History), London
CAS	California Academy of Sciences, San Francisco
DRP	Dennis R. Paulson collection, Seattle
FSCA	Florida State Collection of Arthropods, Gainesville
IBUNAM	Instituto de Biología, Universidad Nacional Autónoma de Mexico, Mexico City
IRSN	Institut Royal des Sciences Naturelles, Brussels
JJD	Jerrell J. Daigle collection, Tallahassee
KWK	Kenneth W. Knopf collection, Gainesville
MCZ	Museum of Comparative Zoology, Cambridge
MNHP	Muséum National d'Histoire Naturelle, Paris
NHMB	Naturhistorisches Museum, Vienna
RWG	Rosser W. Garrison collection, Azusa
RN	Rodolfo Novelo collection, Instituto de Ecología, Jalapa
SMEK	Snow Museum of Entomology, University of Kansas, Lawrence
SWD	Sidney W. Dunkle collection, Collin County Community College, Plano, Texas
UMMZ	Museum of Zoology, University of Michigan, Ann Arbor
USNM	National Museum of Natural History, Washington, D. C.
TWD	Thomas W. Donnelly collection, State University of New York, Binghamton
ZMH	Zoologiska Museum, Helsinki
ZMHB	Zoologisches Museum, Humboldt Universität, Berlin

Key to Males of *Argia* of the United States

Proper exposure of the caudal appendages is necessary for character discrimination. Most preserved specimens have the cercus resting against the paraproct. I have found that relaxing the caudal appendages in tap water and gently teasing them apart with a pair of forceps, or positioning the specimen against a small piece of balsa wood under the microscope and using minuten pins to mount the appendages in the desired position to be very useful. The whole specimen can then be placed in an acetone bath to promote dehydration. The appendages of the male often become encrusted with dirt, excrement, or other debris, and I have found that brushing them with a small brush aids in cleaning them.

1 Dorsum of mesothorax dark with metallic copper or red reflections (e.g., Fig. 68) ..... **Key M-1**

1' Dorsum of mesothorax pale, usually with dark middorsal stripe of varying width (Fig. 73, 75), or in some old males, entire front may be dark (Fig. 69) or entirely pruinose **2**

2(1') Cercus in dorsal view curving laterally (Fig. 3c), laterobasal margin with a well defined pale oval area; epiproct small, deeply cleft; dorsal margin of each torifer often (but not always) denticulate (Fig. 3a); southwestern Canada south through central California, Nevada, Utah ..... ***emma***

2' Cercus in dorsal view linear or curvilinear (e.g., Fig. 4c, 6c), laterobasal margin undifferentiated, epiproct variously shaped, but usually more prominent (e.g., Fig. 8c, 10c); dorsal margin of torifer smooth **3**

3(2') Epiproct about twice as long as wide, extending almost to tips of cerci (Fig. 4), acutely cleft apically; southeastern United States ..... ***bipunctulata***

3' Epiproct short, not extending much beyond base of cerci (e.g., Fig. 5, 6) **4**

4(3') Cercus in dorsomedial view widely divergent, upper branch a shorter, thick lobe, the other a longer, ventrally directed, blunt branch (Fig. 5a); southeastern Canada, south to Florida and west to Texas ..... ***tibialis***

4' Cercus in dorsomedial view not widely divergent, distal margin may be entire (Fig. 29a), dentate (Fig. 31), forked, or tridentate (Fig. 6) **5**

5(4') Mesal margin of cercus in dorsomedial view with a long, ventrally pointed tooth, followed distally by a smaller blunt tooth (Fig. 6a); southeastern Canada south to Florida and west to Bernalillo Co., New Mexico .... ***apicalis***

5' Mesal margin of cercus in dorsomedial view smoothly curved (e.g., Fig. 17a), with a small ventral tooth (e.g., Fig. 7a), or with a mesoventrally directed blunt lobe (e.g., Fig. 14a) **6**

6(5') Paraproct in lateral view not branched (Fig. 7b, 8b, 34) ..... **Key M-2**

6' Paraproct in lateral view divided into upper and lower branches (e.g., Fig. 12, 20) **7**

7(6') Cercus in dorsomedial view with a mesally or mesoventrally directed lobe (not tooth) along mesal edge followed along distal margin by a robust, obtuse black tooth (Fig. 11a, 12a, 13a, 14a, 15a, 16a,), or ventrally directed costate ridge (Fig. 10a) ..... **Key M-3**

7' Cercus in dorsomedial view with no mesally or mesoventrally directed lobe (Fig. 17a, 20a, 27a), usually armed with a decumbent tooth (e.g., Fig. 29a) or divided into subequal branches (e.g., Fig. 17a) **8**

8(7') Cercus in dorsal view linear, about twice as long as wide, sides approximately parallel, tip unidentate (Fig. 19c) or divided (Fig. 17c, 18c) ..... **Key M-4**

8' Cercus in dorsal view thick and stocky, less than twice as long as wide, sides curvilinear with apical margin often differentiated into divided branches (e.g., Fig. 17c), incurved teeth (e.g., Fig. 27c), or acutely pointed (Fig. 28c, 29c) **9**

9(8') Cercus in dorsomedial view appearing divided with subequal branches (e.g., Fig. 17a, 21a, 22a), or with a recessed inferior tooth appearing along mesal margin (e.g., Fig. 25a, 27a) ..... **Key M-5**

9' Cercus in dorsomedial view entire, but armed with a single decumbent tooth at extremity (Fig. 29a, 30a, 31a, 33a), or recessed toward mesal margin (Fig. 31a) ..... **Key M-6**

Key M-1 (metallic species)

1 Abdominal segments 3-7 or 8 predominantly dark with a narrow blue basal ring (Fig. 80); paraproct in lateral view with forked branches widely divergent (Fig. 1b); southern Texas south through South America .... ***cuprea***

1' Abdominal segments 3-6 predominantly violet, the distal 0.20-0.25 of each segment black (Fig. 81); paraproct in lateral view with forked branches only slightly bifid (Fig. 2b); central Arizona south through Baja California, central Mexico, and northern South America ..... ***oenea***

Key M-2 (paraprocts not branched)

1 Wings amber; torus large, transversely elongate, greater than width of cercus in dorsal view and occupying most of torifer (Fig. 7c); mediodistal margin of cercus in dorsomedial view evenly rounded with a small decumbent tooth (Fig. 7a); southern Texas and eastern Mexico ..... ***rhoadsi***

1' Wings hyaline; torus small, circular (Fig. 8a, c), or irregularly transverse (Fig. 9a), subequal or less than width of each cercus in dorsal view, and occupying lower margin of torifer **2**

2(1') Outer margin of torifer in dorsal view linear, epiproct totally exposed, its lateral margin not obscured by mesal margin of torus (Fig. 8c); torus small, circular or almost so, and less than width of epiproct in dorsal view (Fig. 8c); cercus in dorsal view bluntly quadrate, with mesal and lateral margins subequal; distal tooth on cercus usually anteapical when viewed dorsomedially (Fig. 8a); smaller species (HW 24-29 mm); southeastern Canada south to Florida, Mexico, and west to California ..... ***moesta***

2' Outer margin of torus in dorsal view convex, mesoposterior margin of torus overlying lateral margins of epiproct (Fig. 9c); torus transverse, greater than width of epiproct in dorsal view (Fig. 9c); cercus in dorsal view with mesal side longer than lateral side; distal tooth on cercus apical when viewed dorsomedially (Fig. 9a); larger species (HW 29-35 mm); Texas west to California, south through southern Mexico ..... ***lugens***

Key M-3 (mesal margin of cercus with mesally or mesoventrally directed lobe)

1 Mesal lobe of cercus small, ventrally recurved (Fig. 10a); apical margin of cercus in posterior view with no tooth, this area a black convex ridge (Fig. 10d); upper branch of paraproct usually roundly pointed with a small anteapical tooth; southern California, Arizona, New Mexico, Texas south through northern Mexico ..... ***hinei***

1' Mesal lobe of cercus easily visible, directed mesally or ventrally (Fig. 11a, 12a); apical margin of cercus in posterior view with a well developed tooth (Fig.11d, 12d), though in *A. pallens* (Fig. 13d) and *A. leonorae* (Fig. 11d), this tooth may be small; upper branch of paraproct usually terminating in a sharp tooth **2**

2(1') Fore wing postquadrangular cells 3; cercus in dorsal view with medial margin subequal to outer margin, so that cercus appears quadrate; mesal lobe small, somewhat recurved (Fig. 11a); distal tooth in posterior view small, inconspicuous, this structure much less prominent than mesal lobe (Fig. 11d); small species (hind wing 16-18 mm.); eastern and western Texas south through Nuevo Leon state, Mexico ..... ***leonorae***

2' Fore wing postquadrangular cells usually 4 (Fig. 100) rarely 3 or 5 (Fig. 101); cercus in dorsal view with mesal margin shorter than outer margin so that cercus appears elongate posterodistally (Fig. 12a-16a); distal tooth in posterior view prominent, easily visible, this structure as prominent as mesal lobe (Fig 12d-15d); larger species (hind wing 17-25 mm) **3**

3(2') Width of each torus about as wide as interval separating them (Fig. 12c) central and southern Oregon, California, Arizona, Baja California ..... ***agrioides***

3' Width of each torus wider than interval separating them (Fig. 13c-16c) .. **4**

4(3') Cercus in posterior view with distal tooth located medially, concave gaps on either side of tooth deep and subequal (Fig. 13d); largely reddish-violet species with narrow black stripes along humeral and third lateral sutures (as in Fig. 72, 77); Arizona south to Guatemala ..... ***pallens***

4' Cercus in posterior view with concave gap between mesal lobe and tooth deeper and more broadly U-shaped than outer concavity; outer margin of distal tooth tending to be confluent with tip of cercus (Fig. 14d. 15d); pale body coloration blue (*A. nahuana*) or violaceous (*A. fumipennis*) **5**

5(4') Cercus in posterior view with mesal lobe directed mesoventrally; distance between tip of mesal lobe and tooth about twice the distance between tooth and outer tip of cercus (Fig. 14d); pale body color blue; southern Oregon, California, Arizona, New Mexico, Texas, south into central Mexico ..... ***nahuana***

5' Cercus in posterior view with mesal lobe directed ventrally; distance between tip of lobe and tooth subequal to distance between tooth and outer tip of cercus (Fig. 15d); pale body color violaceous; widespread from Arizona east through eastern United States, northern and central Mexico ..... ***fumipennis***

Key M-4 (cercus linear, twice as long as wide in dorsal view)

1 Dorsum of abdominal segments 3-6 largely pale, only posterior 0.20 of each segment black; larger species (hind wing 23-24 mm); cercus in dorsal view robust toward base, tip divided with inner branch the longer (Fig. 17c); southern Texas south to Puebla state, Mexico ..... ***barretti***

1' Dorsum of abdominal segments 3-6 largely black; smaller species (hind wing 16-20 mm); cercus in dorsal view mostly linear, tip weakly divided (Fig. 18c) or supporting one tooth (Fig. 19c) **2**

2(1') Tip of cercus in dorsomedial view weakly divided, the inner branch a decumbent tooth, the outer branch a simple lobe (Fig. 18a); torus well defined, transverse (Fig. 18c); dorsal margin of lower branch of paraproct smooth (Fig. 18b); western United States ..... ***alberta***

2' Tip of cercus in dorsomedial view truncate, the mesal angle supporting a decumbent tooth (Fig. 19a); torus poorly defined, each lying at about 45° to the other (Fig. 19c); dorsal margin of lower branch of paraproct serrate (Fig. 19b); southern United States south through southern Mexico..... ***sedula***

Key M-5 (tip of cercus divided)

1 Cercus in dorsomedial view with inner branch distinctly longer than outer branch (Fig. 17a), paraproct longer than high, upper branch a broadly based triangle (Fig. 17b); rear of head mainly black; black middorsal stripe on thorax about 0.50-0.75 as wide as pale antehumeral stripe (Fig. 73); pale coloration blue; southern Texas south to Puebla state, Mexico ..... ***barretti*** (in part)

1' Cercus in dorsomedial view with branches equal (e.g., Fig. 20a, 21a, 22a); inner branch in some species forming a mesoventrally directed tooth (Fig. 23a, 25a, 26a, 27a); paraproct as high as or higher than wide (Fig. 21b, 22b, 23b, 25b, 27b) (except for *A. tezpi*, Fig. 20b); rear of head mainly pale (except for *A. tezpi*); black middorsal stripe and pale coloration variable **2**

2(1') Torus small, almost circular (Fig. 20c); cercus with outer branch a broad, convex lobe, much wider than narrow inner tooth (Fig. 20a, c); rear of head black; abdominal segments 3-7 black except for pale basal ring (Fig. 82); wings with a slight yellow coloration; occasional in southeastern Arizona and southwestern New Mexico, common in Baja California and western Mexico south through Costa Rica ..... ***tezpi*** (in part)

2' Torus transversely elongate, at least twice as long as wide (Fig. 21a, 22a, 23a, 25a, 26a, 27a); cercus with outer branch digit-shaped, longer than wide and subequal to or narrower than inner branch supporting decumbent tooth (Fig. 21a, 22a, 23a, 27a); rear of head chiefly pale; abdominal segments 3-7 with some pale coloration, at least on middle 0.50 (Fig. 83); wings hyaline **3**

3(2') Usually 3 postquadrangular cells in fore and hind wings; abdominal segments 4-6 dorsally each with an alternating pale, dark, pale, dark pattern as shown in Fig. 83 [Note: more northerly specimens (North Dakota) may have the first (basal) black band reduced to a pair of dorsolateral streaks.]; in dorsal view, width between cerci as great as width of cercus, and posterior margin of epiproct extending to but not surpassing level of tori (Fig. 21c); dorsal branch of paraproct a broadly based triangle (Fig. 21b); Texas, Oklahoma, South Dakota, Arizona, New Mexico, southern Nevada south through Mexico and Belize ... ***immunda***

3' With 4 or 5 postquadrangular cells in fore and hind wing (Fig. 100-101) (occasionally 3 in hind wing); abdominal segments 4-6 entirely pale except for posterior 0.20 of each segment (e.g., Fig. 113); cerci and paraprocts variable **4**

4(3') In dorsal view, width between cerci greater than width of cercus (Fig. 22c, 23c); upper branch of paraproct digit-shaped (Fig. 22b, 23b); ventral margin of abdominal segment 2 gently convex or almost linear at distal 0.50-0.60 (Fig.104-105) **5**

4' In dorsal view, width between cerci equal to or less than width of cercus (Fig. 25c, 26c, 27c); upper branch of paraproct a broadly shaped triangle (Fig. 25b, 27b); ventral margin of abdominal segment 2 usually (but not always, Fig. 102c) convexly angulate (Fig. 102a, b; 103) or broadly convex (as in Fig. #105) at distal 0.50-0.60 ..... **6**

5(4) Cercus in dorsomedial view with inner branch as long as outer branch, this structure not decumbent (Fig. 22a); in dorsal view, epiproct not extending beyond level of torus (Fig. 22c); pale body coloration violaceous, thorax with narrow dark middorsal stripe only 0.10 or less the width of mesepisternum, and dark humeral stripe not forked (Fig. 77); Arizona, New Mexico, south through Durango and Morelos states, Mexico ..... ***tonto***

5' Cercus in dorsomedial view with inner branch distinctly shorter than outer branch, this structure decumbent (Fig. 23a); in dorsal view, swollen epiproct extending beyond level of torus (Fig. 23c); pale body coloration blue, thorax with dark middorsal stripe greater than 0.40 width of mesepisternum, and upper end of humeral stripe forked (Fig. 113); Yavapai and Pima counties, Arizona, and Sonora state, Mexico ..... ***pima***

6(4) In dorsal view, distance between cerci about equal to width of each cercus (Fig. 26c); pale body coloration blue; southeastern Arizona south through Central America ..... ***tarascana***

6' In dorsal view; cerci almost approximate, distance between cerci less than width of each cercus (Fig. 27c); pale body coloration violaceous (Arizona) or blue (Jalisco state, Mexico), ... ***sabino***

Key M-6 (cercus armed with a single tooth)

1 Cercus in dorsomedial view longer along the mesal margin, this area ending in a tooth (Fig. 28a-30a) **2**

1' Cercus in dorsomedial view longer along the lateral margin (Fig. 31a) or rounded apically (Fig. 32a, 33a) **4**

2(1) Rear of head black; dorsum of abdominal segments 3-6 primarily black except for pale basal ring on each segment (as in Fig. 82); torus small, occupying distal margin of torifer (Fig. 28a, c) and paraproct with ventral branch longer and narrower than more robust dorsal branch (Fig. 28b); southern Ontario south to Georgia and west to Arizona, south through Venezuela, Colombia, and Peru ..... ***translata***

2' Rear of head pale; dorsum of abdominal segments 3-6 mostly pale, distal 0.10-0.25 of each segment black (Fig. 84); torus large, occupying most of torifer (Fig. 29a, c) or narrow and confined to distal margin of torifer (Fig. 30a, c); paraproct with ventral and dorsal branches subequal in length and size (Fig. 29b), or with dorsal branch larger and more prominent than ventral branch (Fig. 30b) **3**

3(2') Torus large, occupying most of torifer (Fig. 29a, c); cercus in lateral view with outer margin not strongly arched (Fig. 29b); usually with 4 postquadrangular cells in fore wing (Fig. 100), 3 in hind wing; southern British Columbia, western Alberta south through Montana, Washington through northern Arizona, Baja California ..... ***vivida***

3' Torus small, confined to distal margin of torifer (Fig. 30a, c); cercus in lateral view with outer margin strongly arched, exposing ventral medial margin (Fig. 30b); usually with 5 postquadrangular cells in fore wing (Fig. 101), 4 in hind wing; southeastern Arizona, southwestern New Mexico south through northern Mexico ..... ***munda***

4(1') Cercus in dorsomedial view longest distoposteriorly (Fig. 31a); paraproct in lateral view with ventral branch longer than dorsal branch, extending posteriorly beyond tip of cercus (Fig. 31b); with well defined black along tergites 9-10 (Fig. 87); pale coloration vivid blue; southeastern Arizona south through Central America ..... ***extranea***

4' Cercus in dorsomedial view rounded apically (Fig. 32a, 33a); paraproct in lateral view with ventral branch subequal to or shorter than dorsal branch, extending a little beyond tip of cercus (Fig. 32b, 33b); no ventral black on abdominal segments 9-10 (as in Fig. 88); pale coloration violaceous (southern Arizona, western New Mexico, through Mexico and Guatemala) or blue (central New Mexico through western Texas, Oklahoma north to South Dakota) ..... ***plana***

Key to Females of *Argia* of the United States Based Primarily on Morphology of Mesostigmal Plates

For females, careful examination of the mesostigmal lobe and plate is necessary. Relaxation and forward movement of the prothorax are usually necessary to expose those structures.

1 Posteromesal margin of mesostigmal plate a narrow posteroexternally directed lobe (Fig. 37); larger species (HW 29-35 mm); two rows of cells between Cu_2 and hind margin of wing; California east to Texas and south through southern Mexico ..... ***lugens***

1' Posteromesal margin of mesostigmal plate with laminate lobe, if present, forming a posteriorly directed lobe (e.g., Fig. 39) or posteromesally directed lobe (e.g., Fig. 41); smaller species (HW < 29 mm); usually with only one row of cells between Cu_2 and hind margin of wing **2**

2(1') Anterior part of mesepisternum directly posterior to mesostigmal plate with a well-defined pit, the posterior border of which is costate (Fig. 38, 39) ..... **Key F-1**

2' Anterior part of mesepisternum directly posterior to mesostigmal plate undifferentiated (e.g., Fig. 40) or with a slight circular depression (Fig. 41) **3**

3(2') Dorsal surface of mesostigmal lamina with arcuate ridge overlying its median portion (Fig. 40); southeast Canada, most of United States south through Mexico ..... ***moesta***

3' Dorsal surface of mesostigmal lamina variously shaped, but without an arcuate ridge overlying its median portion **4**

4(3') Wings smoky or amber colored ..... **Key F-2**

4' Wings hyaline **5**

5(4') Black middorsal stripe of thorax a mere hairline (e.g., Fig. 71), medial black occupying less than 0.10 of each mesepisternum ..... **Key F-3**

5' Black middorsal stripe of thorax prominent (e.g., Fig. 75, 76), medial black occupying 0.25 or more of mesepisternum **6**

6(5') Postquadrangular cells in fore wing 3, in hind wing 2 or 3 [Note: All known females of *A. leonorae* (N = 4) have 3 postquadrangular cells in both fore and hind wings, but this species will key out using either couplet, because there may be occasional specimens with conditions stated in 6'.] ..... **Key F-4**

6' Postquadrangular cells in fore wing 4-5, in hind wing 3 to 5 ..... **7**

7(6') Hind margin of mesostigmal plate smoothly curved, linear; posteromesal margin undifferentiated, not forming a lamellate lobe overlying mesepisternum; lateral arms of middorsal carina largely confluent with posteromesal margin of plate (Fig. 46, 53) **8**

7' Hind margin of mesostigmal plate with posteromesal margin variously developed into a lobe or plate, often elevated above surface of mesepisternum, this process differing from posterodistal margin; lateral arms of middorsal carina usually not confluent with posteromesal border of plate; in some species, these arms hidden by mesostigmal plates (Fig. 42-45, 47-52, 54-67) **9**

8(7) Area between lateral arms of middorsal carina large, planar; distance between mesostigmal plates greater than width of each plate (Fig. 46); humeral stripe of equal width throughout and forked at upper end (e.g., Fig. 75); southern Ontario south to Florida and west to Texas ..... ***tibialis***

8' Area between lateral arms of middorsal thoracic carina small; distance between mesostigmal plates subequal or less than width of each plate (Fig. 53); humeral stripe vestigial and largely limited to suture at lower end (Fig. 76); eastern United States west to California, south through Mexico ..... ***immunda*** (in part)

9(7') Hind margin of mesostigmal plate with mesal lobes poorly developed, confluent with or extending slightly beyond hind margin of plate (Fig. 42, 52, 54-57). [Note: Individuals of *A. oenea* may key here (Fig. 59), but their mesostigmal lobes, though confluent with posterodistal margin of plate, are large and erect and should properly go to 9'.] ..... **Key F-5**

9' Hind margin of mesostigmal plate with well developed lobes which are different from posterodistal margin of plate; those lobes extending posteriorly beyond posterodistal margin of plate (Fig. 43-45, 48-50, 58-67) **10**

10(9') Mesostigmal lobes with posteriorly directed lobe finger-like, longer than wide (Fig. 43-45, 48, 50). [Note: Mesostigmal lobes of *A. tarascana* (Fig. 44-45) are about as wide as long, but the apical part of the lobe gradually narrows to a finger-like lobe.] ..... **Key F-6**

10' Mesostigmal lobes with posteriorly directed lobe broad, as wide as or wider than long (Fig. 58-67) **11**

11(10') Mesostigmal lobe explanate at base, becoming narrower posteriorly; outer margin of mesostigmal lobe with no angulate or acute notch (Fig. 58-62) ..... **Key F-7**

11' Mesostigmal lobe explanate distally, becoming narrower toward base; outer margin of mesostigmal lobe with an angular or acute notch (Fig. 63-67) ..... **Key F-8**

Key F-1 (Females with costate mesepisternal pits)

1 Mesepisternal pit circular, with a medially directed protuberance on outer margin; posterior margin of mesostigmal plate not supporting any posteriorly directed lobe (Fig. 38); southwestern Canada, northwestern United States south through central California, Nevada, and Utah ..... ***emma***

1' Mesepisternal pit irregularly shaped, with large foliate mesostigmal lobes overlying anterior margin of pit (Fig. 39); Arizona, New Mexico, western Texas south into Mexico ..... ***munda***

Key F-2 (Females with wings smoky or amber colored)

1 Mesepisternal tubercles erect, prominent (Fig. 58), in lateral view, this structure almost as high as foliate mesostigmal lobe (Fig. 94); wings smoky, occasional in southeastern Arizona and southwestern New Mexico; common in Baja California and western Mexico south through Costa Rica ..... ***tezpi*** (in part)

1' Mesepisternal tubercles lacking (e.g., Fig. 42, 91), or, if present (e.g., Fig. 44-45, 92), these structures much lower than foliate mesostigmal lobe; wings smoky or amber colored **2**

2(1') Distance between mesostigmal plates about 0.25 width of each mesostigmal plate; a slight to deep non-costate circular mesepisternal depression behind each mesostigmal lobe (Fig. 41); wings honey amber; southernmost Texas, and northeastern Mexico ..... ***rhoadsi***

2' Distance between mesostigmal plates about as wide as each mesostigmal plate (Fig. 42-45); no mesepisternal depression directly behind mesostigmal lobes **3**

3(2') Mesostigmal lobe forming a broadly elevated lobe whose medial tips lie perpendicular to the mesepisternum (Fig. 91); mesostigmal lobe not thumb-like, its edge confluent with posterodistal margin of mesostigmal plate (Fig. 42); wings pale translucent brown; widespread throughout United States and Mexico, south through Central America ..... ***sedula*** (in part)

3' Mesostigmal lobe forming a thumb-like lobe where medial tips lie at about 45° to mesepisternum (e.g., Fig. 92); mesostigmal lobes clearly differentiated from posterodistal margin of mesostigmal plate (Fig. 43-45) **4**

4(3') Mesostigmal lobes directed posteriorly or posteromesally (e.g., Fig. 43); wings dark brown; southeastern United States ..... ***fumipennis*** (in part)

4' Mesostigmal lobes directed posterodistally (Fig. 44, 45); wings slightly flavescent; southeastern Arizona south through northern Central America ..... ***tarascana*** (in part)

Key F-3 (Females with narrow middorsal stripe)

1 Mesostigmal lobe absent (Fig. 46) or forming a poorly developed, obtusely angulate lobe (Fig. 47) **2**

1' Mesostigmal lobe well developed, forming an enlarged, posteriorly or perpendicularly directed lobe (Fig. 42-45, 48-49) **3**

2(1) Mesostigmal lobe absent, posterior margin of mesostigmal plate forming a vertical ridge; divided arms of middorsal carina widely separated enclosing broad, chordate, planar, middorsal sinus (Fig. 46); arms of middorsal carina confluent with mesal margin of mesostigmal plates; middorsal stripe narrower than humeral stripe (as in Fig. 75); southern Ontario to Florida, west to Texas ..... ***tibialis*** (in part)

2' Mesostigmal lobe an obtusely angulate process; posterior margin of mesostigmal plate a low-lying ridge; divided arms of middorsal carina narrowly divided; arms not confluent with mesal margin of mesostigmal plates; middorsal sinus small, not planar (Fig. 47); narrow middorsal stripe (wider in some females from Florida) wider than vestigial humeral stripe, latter only with markings at suture (Fig. 71); southern Ontario south to Florida, west to Bernalillo Co., New Mexico ..... ***apicalis***

3(1') Mesostigmal lobe forming a broadly elongated angulate lobe whose medial tips lie almost perpendicular to mesepisternum (Fig. 42, 91); widespread in United States and Mexico ..... ***sedula*** (in part)

3' Mesostigmal lobe forming a distinct posteriorly directed thumb-like lobe, each lying at about 45° to mesepisternum (Fig. 43-45, 48-49, 92, 95-97) ... **4**

4(3') Anterior margin of mesepisternum directly underneath mesostigmal lobe with no tubercle, this area forming a concave juncture with base of mesostigmal lobe [Note: Examine this character from dorsoposterior view with good light.]; mesostigmal lobe planar, with no recurved area along medial margin (Fig. 95b). [Note: Some specimens of *A. fumipennis violacea* from the eastern United States have a reduced tubercle, but they are allopatric from *A. tarascana* and *A. hinei*.] **5**

4' Anterior margin of mesepisternum directly underneath mesostigmal lobe with a tubercle formed by recurved mesal border of mesostigmal lobe; mesostigmal lobe variable, appearing planar but with medial margin recurved (may be difficult to see in some *A. fumipennis* from the eastern United States) (Fig. 96b, 97b) **6**

5(4') Mesepisternal tubercle prominent (Fig. 92); mesal margin of mesostigmal lobe meeting mesepisternum at an obtuse rounded angle (Fig. 44-45); southeastern Arizona south through central Mexico [Note: These characters are based on specimens from Mexico, there being no voucher females from Arizona. Differences may exist in these most northerly populations.] ..... ***tarascana*** (in part)

5' Mesepisternal tubercle vestigial (Fig. 95a); mesal margin of mesostigmal lobe meeting mesepisternum at a rounded right angle (Fig. 48); southern California, Arizona, New Mexico, Texas south through northern Mexico ..... ***hinei***

6(4') Mesostigmal lobe mostly planar, its distal end not thickened (Fig. 96b); recurved mesal border of lobe forming low tubercle generally not visible in lateral view (Fig. 96a) [This tubercle tends to be absent in specimens from the eastern United States]; widespread from Arizona east through eastern United States, northern Mexico ..... ***fumipennis*** (in part)

6' Mesostigmal lobe distinctly thickened along distal margin (Fig. 97b); recurved mesal border of lobe forming a prominent tubercle visible in lateral view (Fig. 97a); Arizona, south to Guatemala ..... ***pallens***

Key F-4 (Females with 3 postquadrangular cells in fore wing)

1 A blunt, thumb-like lobe present on posteromesal margin of mesostigmal plate (Fig. 50); Texas and Nuevo Leon state, Mexico ... ***leonorae*** (in part)

1' Posteromesal margin of mesostigmal plate without prominent lobes (Fig. 53), or this area slightly convexly angulate (Fig. 51-52) **2**

2(1') Larger species (hind wing 22-24 mm); abdominal segments 8-9 pale; mesostigmal plate without prominent mesostigmal lobe, this area a smoothly curved costate ridge (Fig. 53); eastern United States west to California, south through Mexico ..... ***immunda*** (in part)

2' Smaller species (hind wing 16-21 mm); abdominal segments 8-9 with some black; posterior margin of mesostigmal plate with slightly convexly angulate lobes (Fig. 51-52) **3**

3(2') Abdominal segment 8 predominantly pale dorsally; segments 9, 10 mostly black; black humeral stripe broad, almost as wide as mesepimeron; mesostigmal plates as in Fig. 51; southeastern United States west to Texas ..... ***bipunctulata***

3' Abdominal segment 8 predominantly dark dorsally; segments 9, 10 black dorsally, pale laterally; black humeral stripe about 0.50 width of mesepimeron or less, at least at basal half; mesostigmal plates as in Fig. 52; California, Nevada, Utah, Colorado, northern Arizona east to Nebraska ..... ***alberta*** (in part)

Key F-5 (Females with outer margin of mesostigmal lobes confluent with posterodistal margin of mesostigmal plate)

1 Mesostigmal lobe with mesal tips perpendicular to mesepisternum (Fig. 91); Ontario, eastern United States west to California, south through central Mexico ..... ***sedula*** (in part)

1' Mesostigmal lobe lying at about 45° to mesepisternum (as in Fig. 95a-96a) **2**

2(1') Anterior end of middorsal thoracic carina forking at level of or just before mesostigmal plates; distance between mesal lobes narrow, much less than width of mesostigmal plate (Fig. 54); southern Oregon, California, Arizona, New Mexico, Texas, south into central Mexico ..... ***nahuana***

2' Anterior end of middorsal thoracic carina forking well behind level of mesostigmal plates; distance between mesal lobes subequal to width of mesostigmal plates (Fig. 52, 56-57) (except for *A. extranea*, Fig. 55) **3**

3(2') Distance between mesal lobes less than width of mesostigmal plate (Fig. 55); southern Arizona south through Central America ..... ***extranea***

3' Distance between mesal lobes subequal to width of mesostigmal plates (Fig. 52, 57) [Note: Distance between plates in *A. barretti* is slightly narrower than each plate (Fig. 56), but this species larger (hind wing 23-24 mm, postquadrangular cells in fore wing almost always 5) than *A. extranea* (hind wing 19-23 mm, postquadrangular cells in fore wing usually 4 or fewer)] **4**

4(3') Larger species (hind wing >23 mm); usually 5 postquadrangular cells in fore wing, 4 in hind wing; mesostigmal plates with mesal lobes acute, directed mesally (Fig. 56); southern Texas, northeastern Mexico ..... ***barretti***

4' Smaller species (hind wing <22 mm); usually 4 or 3 postquadrangular cells in fore wing, 4 to 2 in hind wing; mesostigmal plates with lobes poorly developed (Fig. 52) or obtusely angulate (Fig. 57) **5**

5(4') Mesostigmal plate with a short posteriorly directed obtusely angulate lobe (Fig. 57); central and southern Oregon, California, Arizona, Baja California ..... ***agrioides***

5' Mesostigmal plate with posteromesal margin slightly angulate, without posteriorly directed lobe (Fig. 52); California, Nevada, Utah, northern Arizona east to Nebraska ..... ***alberta*** (in part)

Key F-6 (Females with finger-like mesostigmal lobes longer than wide)

1 Anterior margin of mesepisternum directly underneath mesostigmal lobe with a tubercle formed by recurved mesal border of mesostigmal lobe (Fig. 43) [Note: Strong light and high magnification are necessary to see this structure. This tubercle appears reduced in some females of *A. fumipennis violacea* from the eastern United States.]; widespread from Arizona east through eastern United States and south through central Mexico ..... ***fumipennis*** (in part)

1' Anterior margin of mesepisternum directly underneath mesostigmal lobe with no tubercle, this area forming a concave juncture with base of mesostigmal lobe (Fig. 95b) [Note: This area may be difficult to see for *A. leonorae*, whose plates are more closely appressed to mesepisternum than those of *A. hinei* and *A. tarascana*.] **2**

2(1') Mesostigmal lobes recumbent, not easily visible in lateral view; in dorsal view, lobes directed posteromesally (Fig. 50) [Some specimens of *A. fumipennis violacea* from the eastern United States have a reduced tubercle formed by the medial margin of the mesostigmal lobes. Except for the number of postquadrangular cells (3 in *A. leonorae*, 4 in *A. fumipennis violacea*), I have not found other readily identifiable characters with which to separate these two species. See diagnosis under *A. fumipennis violacea* for further discussion.]; Texas and Nuevo Leon state, Mexico ..... ***leonorae*** (in part)

2' Mesostigmal lobes erect and easily visible in lateral view (Fig. 92, 95a); lobes directed posteriorly (Fig. 48) or posterodistally (Fig. 44-45) 3

3(2') Mesostigmal lobes directed posteriorly, mesal margin of lobe meeting orthogonally to middorsal carina (Fig. 48); California, Arizona, New Mexico, southern Texas, south into northern Mexico ..... ***hinei*** (in part)

3' Mesostigmal lobes directed posterodistally; mesal margin of lobe meeting middorsal carina at an obtuse angle (Fig. 44-45); southeastern Arizona, south through northern Central America ..... ***tarascana*** (in part)

Key F-7 (Females with explanate mesostigmal lobes, outer margin of lobe not notched)

1 Mesepisternal tubercles erect, prominent (Fig. 58); in lateral view, this structure almost as high as foliate mesostigmal lobe (Fig. 94); occasional in southeastern Arizona and southwestern New Mexico, common in Baja California, western and central Mexico and south through Costa Rica ... . ***tezpi***

1' Mesepisternal tubercles lacking or poorly developed (Fig. 59-62); in lateral view, this structure, if present, much lower than mesostigmal lobe (e.g., Fig. 92) 2

2(1') Mesostigmal lobes erect, confluent with remainder of posterior margin of mesostigmal plate (Fig. 59); dorsolateral areas of abdominal segments 8-9 with black (as in Fig. 90); central and southeastern Arizona, south through Central America ..... ***oenea***

2' Mesostigmal lobes differentiated from posterodistal margin of mesostigmal plate (Fig. 61-65); abdominal segments 8-9 pale (as in Fig. 84, 88) 3

3(2') Middorsal carina forking at vicinity of mesostigmal lobes (Fig. 60); humeral stripe forked at 0.50 (as in Fig.118), though with posteriorly directed arm sometimes disjunct (Fig.119); Sabino Canyon and Molino Basin, Pima Co., Arizona; Jalisco state, Mexico ..... ***sabino***

3' Middorsal carina forking well before vicinity of mesostigmal lobes (Fig. 61-62); humeral stripe not forked; this stripe abruptly narrowing at midlength (similar to Fig. 77) 4

4(3') Distance between mesostigmal plates greater than transverse width of each plate (Fig. 65); mesostigmal lobes prominent, strongly erect, and extending well above lateral arm of middorsal thoracic carina in lateral view (as in Fig. 93); larger species (HW 26-30 mm), usually 5 postquadrangular cells in FW (as in Fig. 101), 4 or 5 in HW; dorsolateral black on abdominal segments 3-6 usually in the form of incomplete stripes; central Arizona, southwestern New Mexico south to Cuernavaca, Mexico .... ***tonto*** (in part)

4' Distance between mesostigmal plates less than transverse width of each plate (Fig. 61-62); mesostigmal lobes less prominent, more closely appressed to mesepisternum and not extending much beyond lateral arm of middorsal thoracic carina in lateral view (similar to Fig. 92); smaller species (HW 20-26 mm), usually 4 postquadrangular cells in FW (as in Fig. 100), 3-4 in HW; black dorsolateral stripe on abdominal segments 3-6 usually broken into a basal and apical spot; widespread species in most of western and central United States south through central Mexico 5

5(4') Dorsolateral depression on middle lobe of prothorax shallow, almost parallel to suture between middle and hind lobes (Fig. 78); northwestern United States south to Baja California, northern parts of Arizona and New Mexico ..... ***vivida***

5' Dorsolateral depression of middle lobe of prothorax deep, oblique to diagonal to suture between middle and hind lobes of prothorax (Fig. 79); southern parts of Arizona, New Mexico, east through western Texas, Oklahoma north to South Dakota and south through Mexico and Guatemala ..... ***plana***

Key F-8 (Females with explanate mesostigmal lobes widened distally)

1 Distance between mesostigmal lobes less than width of mesostigmal lobe (Fig. 63); central and southern Arizona ..... ***pima***

1' Distance between mesostigmal lobes greater than width of mesostigmal lobe (Fig. 65-67) **2**

2(1') Posterior margin of mesostigmal lobe transverse or nearly so, about 0.50 width of mesostigmal plate (Fig. 65); mesepisternal tubercles lacking; dorsolateral areas of abdominal segments 8-9 with black confined to 0.50 or less of each segment; lateral areas of same segments largely unmarked (Fig. 89); central Arizona south to Cuernavaca, Mexico .... ***tonto*** (in part)

2' Posterior margin of mesostigmal lobe convex, lobe about 0.30 or less width of mesostigmal plate (Fig. 66-67); mesepisternal tubercles present, though may be poorly developed (Fig. 93); dorsolateral and lateral areas of abdominal segments 8-9 with longitudinal black markings, the superior stripe often darker than inferior stripe (Fig. 90) **3**

3(2') Mesal margin of mesostigmal lobe deflected posteriorly (best seen in oblique lateral view) (Fig. 98); mesepisternal tubercles present, but poorly developed; dark middorsal, humeral stripes and epicranial areas usually (but not always) with some metallic luster; southern Texas through northern South America ..... ***cuprea***

3' Mesal margin of mesostigmal lobe not deflected, the entire lobe planar (Fig. 99); mesepisternal tubercles present (Fig. 93); dark middorsal, humeral and epicranial areas never with a metallic luster; southern Ontario south to Florida and west to Arizona, south through Venezuela, Colombia, and Peru ..... ***translata***

Argia agrioides Calvert, 1895

Fig. 12-app, 57-mp

Argia agrioides Calvert, 1895:476

Diagnosis.—Males are morphologically similar to *A. nahuana*, *A. fumipennis violacea*, and *A. leonorae*. All possess a forked humeral stripe, and a mesoventrally or ventrally directed lobe is present along the mesal side of the cercus. *Argia agrioides* is widely sympatric with *A. nahuana* in California and southern Arizona, with *A. fumipennis violacea* only in southern Arizona, and is allopatric to *A. leonorae* (Table 2). In *A. agrioides*, the epiproct is as wide as each torus (Fig. 12c), while in *A. nahuana*, the epiproct is only about 0.25-0.30 as wide as each torus (Fig. 14c).

Similarly, the cercus of *A. agrioides* is narrower than that of *A. nahuana*. In posterior view, the distal tooth of *A. agrioides* is situated about equally between the distal and mesal sides of the cercus (Fig. 12d), but the tooth in *A. nahuana* is situated at about the distal 0.30 of the appendage (Fig. 14d).

Fully adult males of *A. fumipennis violacea* are violaceous, not blue as are *A. agrioides*, but post mortem preservation may render morphological separation difficult. The torus in *A. agrioides* (Fig. 12a, c) is comparatively narrower than in *A. fumipennis violacea* (Fig. 15a, c). In *A. agrioides*, black markings on the sides of abdominal segments 8-10 are lacking, or are reduced to small, incomplete streaks on abdominal segments 8-9 (as in Fig. 86). These lateral markings in all *A. fumipennis violacea* that I have seen are more extensive and often run the length of all three abdominal segments (Fig. 85).

The cercus of *A. agrioides* in dorsomedial and dorsal view is posterodistally elongate (Fig. 12a), but in *A. leonorae*, the whole cercus appears quadrate (Fig. 11a). The mesal lobe of *A. agrioides* is easily visible, and lies ventromesally (Fig. 12a), but in *A. leonorae*, the mesal lobe is small and tends to recurve ventrally beneath the cercus (Fig. 11a).

Females of *A. agrioides* may be confused with *A. nahuana*, *A. leonorae*, and *A. fumipennis violacea*, but can be distinguished from those species by their mesostigmal plates and surrounding structures. In *A. agrioides*, the distance between each mesostigmal lobe is as wide as one mesostigmal plate, and the middorsal carina divides well before the level of the mesostigmal lobes (Fig. 57). In *A. nahuana*, the interval between each mesostigmal lobe is much narrower than the width of one mesostigmal plate, and the middorsal carina divides near the mesostigmal lobes (Fig. 54).

Females of *A. agrioides* closely approach *A. leonorae*, but *A. agrioides* generally has 4 postquadrangular cells in the fore wing, compared to 3 in *A. leonorae*. In *A. agrioides*, the distal margin of the mesostigmal lobe is largely confluent with the posterior margin of the mesostigmal plate (Fig. 57), but in *A. leonorae*, the mesostigmal lobe is definitely digit-like, and undifferentiated from the posterior margin of the mesostigmal plate (Fig. 50). In *A. agrioides*, the middorsal carina divides well before the vicinity of the mesostigmal lobes, and the medial area enclosed with the arms is longitudinally furrowed (Fig. 57). In *A. leonorae*, the arms of the middorsal carina divide more proximally to the lobes, and a raised, transverse, thickened area connects the divided arms near the level of the mesostigmal lobes (Fig. 50).

Females of *A. agrioides* differ from *A. fumipennis violacea* in the morphology of the mesepisternum where it meets the mesostigmal lobe. In *A. agrioides*, this area is relatively undifferentiated (as in Fig. 95b), or there may be a low, slightly tumid area; but a well defined tubercle is present in the same location for specimens of *A. fumipennis violacea* from the western United States (Fig. 96b). The midthoracic triangle in *A. agrioides* is broad (Fig. 57) compared to the smaller, narrow area in *A. fumipennis violacea* (Fig. 43). The distal extremities of the middorsal thoracic arms are in close proximity to the mesal margin of the mesostigmal lobes in *A. agrioides*. Those of *A. fumipennis violacea* are separated from each lobe by a distance about equal to the width of each arm.

Types.— Calvert (1947) states that there are 10 ♂ and 5 ♀ of the original 48 ♂ and 26 ♀. He states the following :

"None of the [present] material of this species is listed in my paper of 1895 as from San José del Cabo in May, 1893; perhaps these so labeled now are of the lot I listed there as "not dated"; I cannot account for the discrepancy in date. I fix one of the Baja Purissima males in

the California Academy of Sciences, which bears my label "Original of pl. xv, fig. 14, Proc. Calif. Ac. Sci. (2)iv" as the lectotype (C. A. S. No. 5595) of *Argia agrioides*. The female from the same locality lacks abdominal segments 5-10 and I therefore fix one of the females from San José del Cabo, in the California Academy of Sciences as the lectallotype (C. A. S. No. 5596)."

Norm Penny has confirmed to me (pers. comm. 31 Aug. 1994) that the lecto- and allotype of *Argia agrioides* are in the CAS, and Donald Azuma (pers. comm. 4 Aug. 1994) has informed me that 5 ♂ and 1 ♀ paralectotypes are in the ANSP.

Distribution.—Gloyd (1958) cites *A. agrioides* only from Baja California. However, it is common and often sympatric with *A. nahuana* in California. Paulson and Garrison (1977) state that *A. agrioides* is common in California, where it has been taken as far north as Siskiyou Co. (Shasta River, 4.3 mi. N Yreka, 16 August 1973, 2 ♂, in coll. DRP). More recently, Valley (1993) reported this species from Oregon (Crook Co., Crooked River, 14 mi E of Post). Tucker (1907) lists this species from Colorado (Colorado Springs), but I concur with Evans (1988), who considers the record doubtful. La Rivers (1940) lists it from Nevada (Las Vegas, Stump Springs in Clark Co.), but reinspection of these specimens is necessary. They may represent *A. nahuana*. In Arizona, I have collected it in Maricopa Co. (Sycamore Cyn., 3.3 mi. WNW of Hwy. 87, and Cave Creek at end of Ocotillo Rd., Cave Creek), Yavapai Co. (seepage at Bagdad, and Santa Maria River at U.S. Hwy. 93), and as far south as Pima Co. (Lower Sabino Cyn., NE of Tucson). I have seen no specimens from mainland Mexico.

Argia alberta Kennedy, 1918

Fig. 18-app, 52-mp

Argia alberta Kennedy, 1918:257

Diagnosis.—The small size (HW 16-20 mm), predominantly dark coloration of the abdominal segments, and elongate, linear cerci (Fig. 18) distinguish this species from any other in the United States. *Argia alberta* can be confused only with *A. sedula*, but is distinguished in Key M-4.

Females of *A. alberta* have unspecialized mesostigmal lobes whose posteromesal margin is slightly angulate (Fig. 52). They may be confused with females of *A. agrioides*, but the mesostigmal lobes of the latter species are more prominent (Fig. 57).

Types.—Holotype ♂ and allotype ♀ (Calif.: Inyo Co., Laws, Owens River) in USNM (Flint 1991).

Distribution.—Primarily a Great Basin species found in southern Oregon (Lake Co., Abert Lake, June, UMMZ), northeastern California (Modoc Co., Surprise Valley, base of Warner Mtns., 6 Aug. 1934, UMMZ), the Owens Valley of California east through Idaho (Owyhee Co., Grandview, June, UMMZ), Montana, Nevada, western Kansas and Nebraska (Sioux Co., 13 mi SW Harrison, 13 July 1991, R.C. Rosche, Carl Cook collection), southeastern South Dakota, western Oklahoma, and south through northern Arizona (Apache Co., Lukachukai, Williams Cr. Nat'l Fish Hatchery, SE of Hon Dah, 19 June 1990, G.L. Harp; 4 and 19 mi N of Springerville, July and August, UMMZ); Mojave Co., Kaibab Indian Reservation, W of Fredonia; Navaho Co., Thompson Spring, 1/4 mi W of Rd. 182, 1.6 mi N of St. Hwy. 260, Pinetop, 17 June 1990, Phoebe Harp); and northern New Mexico (Otero Co., Game Reserve Pond, White Sands Nat'l Mon., August, UMMZ). The most southerly

known record for this species is at the Salton Sea in southern California (Riverside Co., Dos Palmas Preserve, 4.8 mi E of North Shore, elev -64 m, 29 May 1994, Jeffrey Cole).

Argia apicalis (Say, 1839)
Fig. 6-app, 47-mp, 70-♂ thx, 71-♀ thx

Agrion apicalis Say, 1839:40
Argia apicalis, Selys 1865:414 (42 separate)

Diagnosis.—Thoracic coloration (Fig. 70-71), distinctive morphology of the male cercus (Fig. 6a), and largely eastern U.S. distribution will distinguish this common species from all others. The narrow middorsal thoracic stripe and reduced humeral stripe of most specimens are conditions shared only with *A. emma* (Fig. 72), *A. pallens* and *A. tonto* (Fig. 77), but those three species are all far western in distribution, and their pale coloration is reddish-violaceous (*A. pallens*) or violaceous (*A. tonto*), not sky blue as in *A. apicalis*.

Females of *A. apicalis* are sometimes mistaken for pale blue individuals of *A. moesta*, but the mesostigmal lobes of *A. apicalis* (Fig. 47) are poorly developed and do not possess the overlapping rim present on the mesostigmal lobe of *A. moesta* (Fig. 40). Female thoracic pattern (Fig. 71) is similar to the female thoracic pattern of *A. emma* (as in Fig. 72) and *A. hinei*, but the former species possesses a circular mesepisternal pit (Fig. 38), and the latter species has well developed mesostigmal lobes (Fig. 49).

Types.—Say's types are apparently lost.

Distribution.—Distributed over the eastern United States and southern Ontario. The northwesternmost records for this species are Cass and Grand Forks counties, North Dakota (Bick *et al.* 1977). The southwesternmost record appears to be New Mexico (Bernalillo Co., Albuquerque, Rio Grande Bosque near Rio Grande Nature Center St. Park, 21 June 1990, G.L. Harp; Eddy Co., Malaga, July, CAS), and Chaves Co., 3500 ft., Bitter Lake Nat'l Wildlife Refuge, nr Roswell, 22 Aug., M.A. and H.E. Evans). This species has also been taken in southern Texas (Hidalgo Co., Santa Ana Nat'l Wildlife Refuge and Bentson State Park, 20 Aug. 1977, DRP, pers. comm. 15 Sept, 1994), indicating a probable occurrence in Tamaulipas State, Mexico. *Argia apicalis* has been collected in Mexico (Nuevo Leon state, Rio Las Lajas at Mex. Hwy. 40, 2 mi N of China, June, DRP).

Remarks.—Johnson (1972a), and Johnson and Westfall (1970) note populations of *A. apicalis* with atypical thoracic patterns in northcentral Florida, which is apparently at the edge of its range. Some of the males have a wide humeral stripe (see Dunkle 1990, Fig. 63), and females from this region also have well developed dark middorsal and humeral stripes.

Argia barretti Calvert, 1902
Fig. 17-app, 56-mp, 73-♂ thx

Argia barretti Calvert, 1902a:87

Diagnosis.—This large (HW 23-24 mm) blue species is uniquely characterized by the linear, strongly bifid condition of the cercus (Fig. 17a, c). The inner branch is longer than the outer branch. Another species with a bifid cercus is the far western, largely blue *A. alberta*, but its small size (HW 18-19 mm), allopatric

distribution, and difference in the shape of the cercus easily distinguish the two. Within the restricted range of *A. barretti* (southern Texas), only *A. cuprea* has a bifid cercus (Fig. 1), but the branches are equal, and the metallic condition of the thorax (Fig. 68) easily distinguishes it from *A. barretti* (Fig. 73).

The mesostigmal lobes of *A. barretti* (Fig. 56) resemble those of *A. extranea* (Fig. 55) and *A. oenea* (Fig. 59). *Argia extranea* is a smaller species (HW 18-23 mm), and the medial margin of the mesostigmal lobe does not form an acutely rounded lobe as in *A. barretti*. The posteromesal margin of the lobe in *A. extranea* meets the lateral arm of the middorsal thoracic carina as a low lobe only a little higher than the raised costate arm. In *A. barretti*, this part of the lobe is more perpendicular and is raised well above the lateral arm of the middorsal thoracic carina. The lobe also forms more of a distinct medially directed lobe. *Argia barretti* (southern Texas) and *A. extranea* (southeastern Arizona) are allopatric. Although body markings are similar between their females, the humeral stripe in all *A. extranea* which I have examined is abruptly broadened at the basal half from the mostly hairline stripe (similar to Fig. 77). In *A. barretti*, the stripe is also abruptly widened, but its upper part is thicker (Fig. 73). The mesostigmal lobe of *A. oenea* is transversely higher than that of *A. barretti* (compare shadows of the mesostigmal lobes shown in Fig. 56 and Fig. 59). The distance between the mesostigmal plates is subequal to the transverse width of each plate for *A. oenea*. In *A. barretti*, each plate is distinctly longer than the interval separating them. In the United States, *A. barretti* is allopatric from *A. oenea* (southern Arizona), and the middorsal thoracic stripe in *A. oenea* occupies at least half the width of each mesepisternum. In *A. barretti*, this stripe is narrower and occupies the mesal 0.33 or less of the mesepisternum.

Types.—Holotype ♂ in the ANSP.

Distribution.—This primarily Mexican species occurs from Puebla state, Mexico, north along the east coast through southern Texas as far north as Kimble and Travis counties, west of Austin (Johnson and Westfall 1972). It is the northernmost representative of three closely related species. Of the others, A. pipila Calvert is probably parapatric with *A. barretti* in southern Mexico, and *A. insipida* Hagen in Selys apparently replaces *A. pipila* in northern South America.

Argia bipunctulata (Hagen, 1861)

Fig. 4-app, 51-mp

Agrion bipunctulatum Hagen, 1861:90
Argia bipunctulata, Hagen in Selys, 1865:415 (43 separate)

Diagnosis.—An Eastern species whose small size (HW 12-17 mm) and elongate epiproct (Fig. 4c) are unique. The large, white, deeply cleft epiproct well surpasses the level of the tori and is almost as long as the cercus. In the eastern United States, *A. bipunctulata* is the only species which normally has three postquadrangular cells. All other species in that region possess 4 or 5.

Females of *A. bipunctulata* have very poorly developed mesostigmal lobes (Fig. 51) and are similar in this respect to the allopatric, far western *A. alberta*. They are easily distinguished by the characters in key F-4.

Types.—Lectotype ♂ by present designation: "Neu Georgi/[illegible]", "Hagen [printed]", MCZ 12205. Another male in the MCZ labeled "bipunctullatum/ Charp." is a pseudotype. Hagen (1861:90) strongly implies that he had only one male at the time of the original description. The pseudotype male has 12 postnodal crossveins on both fore wings, not 11 as stated in the original description. Because

there may have been more than one specimen, I am designating the male as lectotype rather than holotype. In MCZ.

Distribution.—Occurs throughout the eastern United States from New Hampshire, Ohio, and Michigan as far south as northern Florida, and as far west as Kansas and the extreme eastern edge of Texas (Huggins 1978, Dunkle 1990). Often associated with sphagnum seepages.

Argia cuprea (Hagen, 1861)

Fig. 1-app, 66-mp, 98-mp, lateral view, 68-♂ thx, 80-abd, 106-rear margin of ♀ prothx

Agrion cupreum Hagen, 1861:96
Argia cuprea, Hagen in Selys, 1865:409 (35 separate)

Diagnosis.—Males of *A. cuprea* are easily distinguished from all other U.S. congeners except *A. oenea*, by the solid metallic copper mesepisternum (Fig. 68). The largely black abdominal segments of *A. cuprea* (Fig. 80) easily distinguish it from the mostly pale condition of the only other cupreous *Argia* in the United States, *A. oenea* (Fig. 81). The male cerci are remotely similar to those of *A. barretti*, and they are diagnosed under that species. The shape of the paraprocts in *A. oenea* will distinguish that species from *A. cuprea*. These two metallic species are allopatric. The blue *A. cuprea* is known in the United States only from southern Texas, while the violaceous *A. oenea* is known only from Arizona.

Females of *A. cuprea* have strongly explanate mesostigmal lobes (Fig. 66) and may be confused with females of *A. translata* (Fig. 67) and *A. tezpi* (Fig. 58). However, the mesal margin of the mesostigmal lobe, when viewed in oblique lateral view (Fig. 98), is deflected posteriorly. Both other species have completely planar mesostigmal lobes (Fig. 93, 94, 99). The hind lobe of the prothorax in *A. cuprea* has a swollen tubercle along the distal third (Fig.106). The tubercle makes the hind lobe appear angulate when viewed from certain angles. In *A. translata* and *A. tezpi*, this tubercle is much less evident or absent. Correspondingly, the hind lobe of these two species is evenly curved (Fig. 107). In the field, the dark markings of the thorax usually (but not always) have some metallic luster. There is no hint of metallic coloration in the other two species.

Types.—I have been unable to trace the location of the type of *Agrion cupreum*. The original description is a composite of two species, a male from "Cordova, Mexico (Saussure)"; and an unspecified number of specimens from "Venezuela (Appun)". Later (Hagen in Selys 1865), Hagen corrected his error, limiting the name *cupreum* to a single male from "Mexique", and all the Venezuelan examples were applied to a new species, *A. orichalcea*. When I visited the MCZ in 1991 to prepare a type catalog of the Odonata, I was able to find 3 ♂ and 1 ♀ syntypes of *A. orichalcea*, but I was unable to recognize the male of *Agrion cupreum*.

Distribution.—This species occurs along streams in southern Texas in Bandera, Kendall, Real, and Uvalde counties (Flint 1993, pers. obs.), and occurs as far south as Guatemala. It seems to be restricted to the eastern and southernmost parts of Mexico. The specimens reported as *A. cuprea* by Calvert (1895) from Baja California were later (Calvert 1899) described by him as *A. tezpi*.

Argia emma Kennedy, 1915
Fig. 3-app, 38-mp, 72-♂ thx

Argia emma Kennedy, 1915:271

Diagnosis.—Males of this far northwestern violaceous species are easily distinguished from all other congeners by the linear, laterally curved cerci (Fig. 3a, c). A pale area at the laterobasal area of the cercus and usually (but not always) a denticulate torifer (Fig. 3a) are unique to the species.

Females are unique in having the circular, costate mesepisternal pits (Fig. 38). The narrow middorsal stripe (Fig. 72) and violaceous color of the males will separate this species from all others in the field.

Types.—Holotype male and allotype female in USNM (Flint 1991).

Distribution.—Southwestern Canada (southcentral British Columbia) east through northeastern Montana (Roemhild 1975) and South Dakota (Custer, Meade, Pennington Cos., Bick *et al.* 1977), south through central California and central Utah (Piute Co., Provonsha 1975), eastern Colorado (Evans 1988), and Nebraska (Blaine and Thomas counties, UMMZ).

Remarks.—This species was well described and illustrated by Kennedy (1915), who illustrated variability in the head markings. He compared this species to *A. funebris* (Hagen) because it keyed to that species in the Biologia Centrali Americana (Calvert 1901). However, I have studied the holotype of *A. funebris* and verify that these species are not closely related.

Argia extranea (Hagen, 1861)
Fig. 31-app, 55-mp, 87-♂ abd

Agrion extraneum Hagen, 1861:92
Argia extranea, Hagen in Selys, 1865:399 (27 separate)
Argia mista Navás, 1934:70, NEW SYNONYMY

Diagnosis.—Males of this species are unlikely to be confused with any others within its range (southeastern Arizona) in the United States. The strongly divided paraprocts have the attenuated lower branch extending well beyond the level of the cercus (Fig. 31b), which should easily separate it from *A. munda* (Fig. 30b), *A. plana* (32b), and *A. tarascana* (Fig. 25b). Other characters separating these species are given in Key M-6.

Females of *A. extranea* are distinguished from other sympatric congeners by the morphology of the mesostigmal lobes. They form a low, gently arcuate ridge (Fig. 55). In *A. nahuana* (Fig. 54), *A. tarascana* (Fig. 44-45), *A. agrioides* (Fig. 57), and *A. plana* (Fig. 62), the mesostigmal lobe is more prominent and differentiated from the posterodistal margin of the mesostigmal plate. Females of *A. extranea* may be confused with *A. immunda* (Fig. 53), but the mesostigmal lobe in the latter species is absent, and the interspace between the plates is subequal to each plate. In *A. extranea*, the interspace between the plates is distinctly less than the transverse width of each plate.

In the field, the vivid blue coloration of the males will easily distinguish *A. extranea* from *A. munda* and *A. plana*, which, in Arizona, are violaceous. Prominent ventrolateral streaks of black are present on abdominal segments 8-10 in *A. extranea* (Fig. 87), but those areas are unmarked in *A. plana* (as in Fig. 88).

Types.—Of *extranea*: holotype ♂ in MCZ with following labels: "14. *A. extranea* /

♂ / renvoyer", "Tampico/ T. Temperéz[?].", MCZ 12187. Hagen's brief description implies that he had only one male; of *mista*: holotype ♂ in MNHP.

Distribution.—Occurring in the United States only in southeastern Arizona along small desert streams (Cochise, Pima, and Santa Cruz counties) north to Maricopa Co. (Verde River, 4.5 mi N Rio Verde Junction, 2 April 1988, 1 male, RWG). It is not yet known from southwestern New Mexico, but records from Cochise Co., Arizona (San Bernardino Ranch, 17 me E of Douglas, RWG) indicate a probable occurrence in New Mexico. *Argia extranea* occurs southward all over Mexico and into Panama and possibly Colombia. In much of Central America, *A. extranea* is, along with an undescribed species related to *A. fissa* Selys, one of the most, if not the most frequently encountered species, of this genus.

Remarks.—Calvert (1902a) describes and figures apparent geographic variations in this common species. He notes that the "relative and absolute length of the lower branch of the [paraproct] increases in specimens from north to south; i.e., in those from Mexico to Costa Rica; nevertheless, at least one male from Texolo in Vera Cruz [state] has this branch quite as long as in individuals from Central America. I have not been able to find any correlation in coloration with differences in length of this branch."

In comparing females of *A. extranea* and *A. vivida*, Calvert (1902a) notes:

> "There seem to be no colour-differences between females [of these two species], all variations of [*A. extranea*] being shown by [*A. vivida*]... The distinction between the females of these two species, based on the form of the mesostigmal laminae (and I can find no other), is employed because all the females from central America and southern Mexico, where *A. extranea* males, but no *A. vivida* males are known, agree in having the laminae rounded and less prominent in comparison with the angular and more conspicuous laminae of the females from northern localities, where *A. vivida* males, but not *A. extranea* males, are known. It should be remarked here that twenty-three of the females above enumerated from Texolo have the mesostigmal laminae as represented in fig. 3, Tab. IV, i.e. much more conspicuous than in other *A. extranea*, and with black slightly predominating over blue on the thoracic dorsum; their identification as *A. extranea* may, perhaps, be open to question" and "*A. extranea* and *A. vivida* are undoubtedly near relatives and, judging from the males alone, exist side by side at Texolo and Cuernavaca."

My preliminary analysis of *A. extranea* from northern and southern localities within its range corroborates the range of variation that Calvert suggests, and it is possible that two species are involved. However, if this is so, Hagen's type would be synonymous with material taken from southern Arizona. Further study of the species will be forthcoming in a paper on *Argia* from Mexico.

The males and females of *A. extranea* from Texolo which Calvert commented upon are almost certainly the same as ones I have seen from this region in Veracruz state. It is a large, common, undescribed violaceous species which I am sure is not specific with *A. extranea*. As stated under *A. vivida*, I have not seen bona fide specimens of this species from mainland Mexico. In central Veracruz is a species similar to *A. vivida* which I believe to be separate from *A. vivida*. My data for *A. vivida* show it penetrating into Baja California and only into northern Arizona north of the Mogollon Rim. Thus, *A. vivida* and *A. extranea*, in my opinion, are allopatric.

Argia mista was described from a single male from "San Juan de Sehotuhuacán [probably San Juan Teotihuacan]", Mexico. In response to a request by L.K. Gloyd, M.J. Westfall was able to examine the type of *A. mista* in September, 1973. It appeared to him to represent *A. extranea*. Unless contrary evidence is forthcoming, I am considering the two names synonymous.

Argia fumipennis (Burmeister, 1839)

Fig. 15-16-app, 43-mp, 96-mp, lateral and posterior views, 74-♂ thx, 85-♂ abd

Agrion fumipenne Burmeister, 1839:819
Argia obscura Rambur, 1842:256
Argia fumipennis, Selys, 1865:403 (31 separate)

Diagnosis.—This is a wide-ranging, extraordinarily variable species which has been separated into three subspecies (see below) based on wing color and overall body markings. The male cerci have a well-developed decumbent medial lobe (not tooth) (Fig. 15a, 16a) which allies this species with *A. hinei*, *A. leonorae*, *A. agrioides*, *A. pallens*, and *A. nahuana*. They are separated in Key M-3. Further characters are elucidated under each subspecies characterized below.

Females of *A. fumipennis* morphologically resemble *A. pallens*, *A. hinei* and *A. leonorae*. The variability expressed in *A. fumipennis* and its similarity to other species necessitate the keying of this species to several sections in the female keys. Further differences are given under each subspecies.

Key to Subspecies of *Argia fumipennis*

(Note: discrimination among these taxa is difficult where two subspecies intergrade)

1 Wings completely hyaline to slightly smoky; southeastern Canada south through northern Alabama and west through the Dakotas and central Arizona, south through Durango, Mexico ..... ***fumipennis violacea***

1' Wings smoky to dark brown throughout; confined to southeastern United States, including North Carolina, south through Florida and west to western Tennessee and Mississippi **2**

2(1') Dorsum of abdominal segments 3-6 black in males; peninsular Florida ..... ***fumipennis atra***

2' Dorsum of abdominal segments 3-6 violaceous in males; western Tennessee, south through Mississippi and east to North Carolina, and Florida panhandle ..... ***fumipennis fumipennis***

Argia fumipennis atra Gloyd, 1968

Fig. 16-app, 75-♂ thx

Argia fumipennis atra Gloyd, 1968b:2

Diagnosis.—The strongly smoky wings of this subspecies will separate it from all other congeners except *A. f. fumipennis*. Males can be distinguished by the characters given in the key. According to Gloyd (1968b), females of *A. fumipennis atra* and *A. fumipennis fumipennis* cannot be separated except by locality.

Types.—Holotype ♂ and allotype ♀ in UMMZ.

Distribution.—Gloyd (1968b) provided a detailed analysis of the distribution of this subspecies. It occurs in Florida west of the Suwanee River, northeast to St. Marys River.

Argia fumipennis fumipennis (Burmeister, 1839)

Agrion fumipenne Burmeister, 1839:819
Argia obscura Rambur, 1842:256
Argia fumipennis, Selys, 1865:403 (31 separate)
Argia fumipennis fumipennis, Gloyd, 1968b:2

Diagnosis.—See under *A. fumipennis atra*.

Types.—Holotype ♀ of *fumipennis* in MCZ, holotype of *obscura* presumably in IRSN.

Distribution.—Gloyd (1968b) notes that the holotype, from "Kentucki" (possibly mislabeled as to locality as no other *A. f. fumipennis* are known from present day Kentucky), is similar to populations inhabiting the Southeast from Mississippi, Alabama, Georgia, and North Carolina, south through the panhandle of Florida. This subspecies, according to Gloyd (1968b), overlaps and intergrades with *A. fumipennis violacea*. Such intergrades contain varying degrees of wing darkening. Further studies are needed to determine the areas of intergradation.

Argia fumipennis violacea (Hagen, 1861)

Fig. 15-app, 43-mp, 96-mp lateral and posterior views, 74-♂ thx, 85-abd

Agrion violaceum Hagen 1861:90
Argia violacea, Hagen in Selys, 1865:404 (32 separate)
Argia fumipennis violacea, Gloyd, 1968b:2

Diagnosis.—Males of the eastern and northern United States are easily distinguished by thoracic markings (Fig. 74) and morphology of abdominal appendages (Fig. 15). However, they are readily confused with a complex of five closely related species (*A. agrioides, A. leonorae, A. hinei, A. nahuana, A. pallens*) in the southwestern United States. The cerci of all of these species possess a medially or mesoventrally directed lobe (not tooth) along the mesal edge, followed along the distal margin by a robust black tooth or ventrally directed costate ridge.

Differences between males of *A. agrioides* and *A. fumipennis violacea* are discussed under the former species.

Males of *A. leonorae* are smaller (HW 16-18 mm) than *A. fumipennis violacea* (HW 20-21 mm), and the fore wings of *A. leonorae* almost always have only 3 postquadrangular cells, compared to 4 for *A. fumipennis violacea*. In *A. leonorae*, the cercus in dorsal and dorsomedial view appears quadrate (Fig. 11a). The mesal lobe is small, and because it tends to recurve ventrally under the cercus, is difficult to see. The distal tooth in *A. leonorae* is small and less conspicuous than the mesal lobe (Fig. 11d). In *A. fumipennis violacea*, the outer margin of the cercus is longer than the mesal margin (Fig. 15a), the mesal lobe is prominent and extends ventromesally, and the distal tooth is as prominent as the mesal lobe (Fig. 15c).

Argia hinei has often been confused with *A. fumipennis violacea* (Gloyd 1958, Johnson 1972b), but males of both species are easily distinguished by morphology of the caudal appendages. In *A. hinei*, the distal end of the cercus forms a transverse ventral costate ridge which is best seen in posterior view (Fig. 10d), and the cercus, when viewed dorsally or dorsomedially (Fig. 10a, c), is quadrate. In *A. fumipennis violacea*, a well-defined tooth is present at the distal margin of the cercus (Fig. 15d), and the outer margin of the cercus is distinctly longer than the mesal margin (Fig. 15a, c). The apical margin of the upper branch of the paraproct in *A. hinei* (Fig. 10b)

is rounded with a small anteapical tooth; the same structure in *A. fumipennis violacea* forms a tooth (Fig. 15b). Abdominal segment 8 of *A. fumipennis violacea* is 1.5 to 2.0 (mean = 1.7, N = 25) times longer than abdominal segment 9 (Fig. 85). In *A. hinei*, abdominal segment 8 is comparatively longer, 1.7 to 2.0 (mean = 1.8, N = 25) times longer than abdominal segment 9 (Fig. 86). Both species are sympatric in parts of southern Arizona, where the extent of dark lateral markings along abdominal segments 8-10 provides a reliable means of recognition in the field. In *A. hinei*, these markings are restricted to a few areas along the posterior parts of segments 8 and 9 (Fig. 86); but in *A. fumipennis violacea*, the markings tend to run the full length of abdominal segments 8-10 (Fig. 85).

Some males of *A. fumipennis violacea* from Arizona and New Mexico are very similar to *A. pallens*, so care must be exercised in distinguishing between them. Couplet 4 of Key M-3 will usually distinguish the two species, but the cerci will need to be relaxed and spread apart from the paraprocts, and the tips of the cerci must be cleaned with a fine brush so that the armature can be seen. In the field, *A. pallens* has a delicate reddish-violet color unlike the strictly violaceous color in *A. fumipennis violacea*. All *A. fumipennis violacea* which I have seen have some black markings on the epicranium, and the humeral stripe is usually (but not always) forked (Fig. 74). In *A. pallens*, the epicranium is usually entirely pale, and the narrow humeral stripe is never forked.

Males of *A. nahuana* and *A. fumipennis violacea* are distinguished in couplet 5 of Key M-3.

Females of *A. fumipennis violacea* may be confused with females of *A. agrioides*, *A. hinei*, *A. leonorae*, and *A. pallens*. *Argia agrioides* is diagnosed under that species. In zones of sympatry, females of *A. hinei* can always be distinguished from *A. fumipennis violacea* by couplet 4 of Key F-3. Other morphological differences separate the two species. In *A. hinei*, the mesostigmal lobe is narrower and the mesal margin of the mesostigmal lobe gently curves medially to connect with the lateral arm of the middorsal thoracic carina (Fig. 48). In *A. fumipennis violacea*, the mesostigmal lobe is broader and, because there is a recurved medial tubercle (Fig. 96), this structure does not form a gentle curve connecting to the lateral arm of the middorsal thoracic carina.

Female *A. leonorae* usually have 3 postquadrangular cells in the hind wing, not 4 as usually found in *A. fumipennis violacea*. Females of *A. fumipennis violacea* from the southwestern United States differ from all females of *A. leonorae* which I have examined by the presence of the medially recurved margin of the mesostigmal lobe and corresponding tubercle (Fig. 96b). The mesostigmal lobe of *A. leonorae* does not possess a recurved border and is like *A. hinei* in this condition (Fig. 95). However, I have examined specimens of *A. fumipennis violacea* from Alabama (Blount Co.) and New York (Thompkins Co.) which have a reduced recurved border. Because these eastern specimens have more extensive black thoracic markings, they closely resemble *A. leonorae* (except for the difference in postquadrangular cells). The mesostigmal lobes of the eastern *A. fumipennis violacea* appear to be slightly broader and more erect than in *A. leonorae*, and the transverse width of the mesostigmal plate appears to be relatively greater than in *A. leonorae*. These differences are best detected by direct comparison and, unfortunately, I have not been able to find other morphological differences with which to separate them.

Differences between females of *A. fumipennis violacea* and *A. pallens* are given in couplet 6 of Key F-3. Epicranial and thoracic pattern differences discussed above for the male will usually serve to aid in distinguishing between females. However,

some females of *A. fumipennis violacea* from New Mexico have almost no markings on the epicranium.

Females of *A. fumipennis violacea* and *A. nahuana* are discussed under the latter species.

Tables 1 and 2 summarize the more important field characteristics and geographic affinities for the six species:

Types.—Lectotype ♂ of *Agrion violaceum* by present designation: "Virginia/ Berkeley Springs/ O. Sacken", "A. violatum", "Hagen [printed]" MCZ 12191. The lectotype is pinned with a paralectotype female. Other paralectotypes include 2 ♂ and 3 ♀. One ♂ and 2 ♀ have the same data as the lectotype. The other ♂ and ♀ have the following data: "Maryland 944/ Uhler 1854". All specimens in MCZ.

Distribution.—A widely distributed subspecies occurring from Nova Scotia, New Brunswick, Quebec and Ontario, Canada, into Maine and south through northern Alabama, North Carolina, west through Wisconsin and Colorado (Evans 1988), South Dakota (Bick *et al.* 1977), southeastern Montana (Roemhild 1975), south into New Mexico (Chaves Co., Bottomless Lakes State Park, in RWG) and Arizona (several sites in central and southern parts of the state, in RWG), and Durango state, Mexico (Corralitos), south through Hidalgo state (González, pers. comm.). It has not been collected in California, Nevada, or the western desert areas of Arizona.

Remarks.—As indicated above in the diagnosis, this subspecies varies greatly in body markings and, in the females, in morphology of the mesostigmal lobes. Individuals from southwestern deserts of Arizona and New Mexico have greatly reduced thoracic stripes. The middorsal thoracic stripe is narrow, usually occupying 0.10 of the mesepisternum. In the eastern United States, the stripe usually occupies 0.25 or more of the sclerite. The humeral stripe is usually forked, broadly so in eastern U.S. populations (as in Fig. 75), but the posterior arm may be vestigial (Fig. 74) or lacking in southwestern phenotypes. As mentioned above, some females of *A. fumipennis violacea* from the eastern United States have a reduced basal tubercle on the mesostigmal lobe which otherwise characterizes southwestern specimens.

This subspecies and *A. hinei* are often sympatric, but allotopic in riparian areas in southern Arizona. *Argia fumipennis violacea* appears to frequent slower-moving, deeper water streams, especially where there are dirt banks with grassy vegetation. *Argia hinei* seems to select shallower, rocky or boulder-strewn areas of the same streams.

Argia hinei Kennedy, 1918

Fig. 10-app, 48-mp, 95-mp, posterior view, 86-♂ abd

Argia hinei Kennedy, 1918:258.

Diagnosis.—Males of this violaceous species have a lobe on the medial side of the cercus, and they may be confused with *A. agrioides*, *A. fumipennis violacea*, *A. leonorae*, *A. nahuana*, and *A. pallens*. This species differs from all of the others in two unique characters: 1) the distal end of the cercus, when viewed posteriorly (Fig. 10d) has a ventrally directed transverse costate rim; all other species (Fig. 11d, 12d, 13d, 14d) possess a tooth, and 2) the upper end of the paraproct ends in a rounded lobe with a smaller anteapical tooth preceding it (Fig. 10a, b); all other species have the upper branch of the paraproct terminating in a tooth (Fig. 11a, b, 12a, b, 13a, b, 14a, b).

some females of *A. fumipennis violacea* from New Mexico have almost no markings on the epicranium.

Females of *A. fumipennis violacea* and *A. nahuana* are discussed under the latter species.

Tables 1 and 2 summarize the more important field characteristics and geographic affinities for the six species:

Types.—Lectotype ♂ of *Agrion violaceum* by present designation: "Virginia/ Berkeley Springs/ O. Sacken", "A. violatum", "Hagen [printed]" MCZ 12191. The lectotype is pinned with a paralectotype female. Other paralectotypes include 2 ♂ and 3 ♀. One ♂ and 2 ♀ have the same data as the lectotype. The other ♂ and ♀ have the following data: "Maryland 944/ Uhler 1854". All specimens in MCZ.

Distribution.—A widely distributed subspecies occurring from Nova Scotia, New Brunswick, Quebec and Ontario, Canada, into Maine and south through northern Alabama, North Carolina, west through Wisconsin and Colorado (Evans 1988), South Dakota (Bick *et al.* 1977), southeastern Montana (Roemhild 1975), south into New Mexico (Chaves Co., Bottomless Lakes State Park, in RWG) and Arizona (several sites in central and southern parts of the state, in RWG), and Durango state, Mexico (Corralitos), south through Hidalgo state (González, pers. comm.). It has not been collected in California, Nevada, or the western desert areas of Arizona.

Remarks.—As indicated above in the diagnosis, this subspecies varies greatly in body markings and, in the females, in morphology of the mesostigmal lobes. Individuals from southwestern deserts of Arizona and New Mexico have greatly reduced thoracic stripes. The middorsal thoracic stripe is narrow, usually occupying 0.10 of the mesepisternum. In the eastern United States, the stripe usually occupies 0.25 or more of the sclerite. The humeral stripe is usually forked, broadly so in eastern U.S. populations (as in Fig. 75), but the posterior arm may be vestigial (Fig. 74) or lacking in southwestern phenotypes. As mentioned above, some females of *A. fumipennis violacea* from the eastern United States have a reduced basal tubercle on the mesostigmal lobe which otherwise characterizes southwestern specimens.

This subspecies and *A. hinei* are often sympatric, but allotopic in riparian areas in southern Arizona. *Argia fumipennis violacea* appears to frequent slower-moving, deeper water streams, especially where there are dirt banks with grassy vegetation. *Argia hinei* seems to select shallower, rocky or boulder-strewn areas of the same streams.

Argia hinei Kennedy, 1918

Fig. 10-app, 48-mp, 95-mp, posterior view, 86-♂ abd

Argia hinei Kennedy, 1918:258.

Diagnosis.—Males of this violaceous species have a lobe on the medial side of the cercus, and they may be confused with *A. agrioides*, *A. fumipennis violacea*, *A. leonorae*, *A. nahuana*, and *A. pallens*. This species differs from all of the others in two unique characters: 1) the distal end of the cercus, when viewed posteriorly (Fig. 10d) has a ventrally directed transverse costate rim; all other species (Fig. 11d, 12d, 13d, 14d) possess a tooth, and 2) the upper end of the paraproct ends in a rounded lobe with a smaller anteapical tooth preceding it (Fig. 10a, b); all other species have the upper branch of the paraproct terminating in a tooth (Fig. 11a, b, 12a, b, 13a, b, 14a, b).

Females are morphologically similar to the five species enumerated above. The mesostigmal lobe of *A. hinei* does not have a recurved medial border when viewed posteriorly (Fig. 95a), and this character will separate it from females of *A. pallens* (Fig. 97) and western populations of *A. fumipennis violacea* (Fig. 96a). Differentiation of *A. hinei* from *A. agrioides* is discussed under the latter species. The transverse width of the mesostigmal plates in *A. hinei* is subequal to the distance between the plates (Fig. 48); the corresponding difference in *A. nahuana* is less than the width of one plate (Fig. 54).

Females of *A. leonorae* typically possess 3 postquadrangular cells in the fore wing, *A. hinei* typically possess 4. The mesostigmal lobes of both species are similar, but the lobe in *A. hinei* is dorsoposteriorly erect and prominent (Fig. 48, 95a); and that of *A. leonorae* is not prominent and barely rises above the lateral arms of the middorsal thoracic carina. In *A. hinei*, the mesal margin of the mesostigmal lobe forms a continuous U-shaped connection to the lateral arm of the middorsal thoracic carina. In *A. leonorae*, the mesal margin of the mesostigmal lobe disappears and there is a small gap between it and the lateral arm of the middorsal thoracic carina.

Differences between *A. hinei* and *A. fumipennis violacea* and *A. nahuana* are given under those species.

Types.—Holotype♂ and paratype from Calif.: Ventura Co., Fillmore, 7 Aug. 1915, by C.H. Kennedy, in UMMZ.

Distribution.—Southern California as far north as Santa Barbara Co. (Kennedy 1918), east through Arizona, southern Nevada (Clark Co., Red Rock Cyn. Rec. Lands Scenic Loop Drive-White Rock, 13 June 1990, 1 ♂, G.H. Harp, RWG), New Mexico and western Texas, south into northern Mexico (Sinaloa State, 27.9 mi NE of Concordia, Aug., FSCA; Coahuila State, 5.6 mi W Cuatro Cienegas, Cuatro Cienegas Basin, 11 August 1968, W.L. Minckley, RWG), and Baja California Norte (Diablito Cyn, E face of San Pedro Martir, April, UCB).

Argia immunda (Hagen, 1861)

Fig. 21-app, 53-mp, 76-♀ thx, 83-abd

Agrion immundum Hagen 1861:93
Argia immunda, Hagen in Selys, 1865:401 (29 separate)

Diagnosis.—Males of this distinctive species are easily identified by the combination of alternating pale, black, pale, black markings on abdominal segments 4-6 (Fig. 83) and possession of 3 (rarely 4) postquadrangular cells in the fore wing. No other species in the United States has a similar color pattern. The short, stubby, divided cerci are similar to those of *A. pima*, but the shape of the paraprocts is different (Fig. 21b, 23b). The epiproct of *A. pima* surpasses the level of the tori (Fig. 23c); in *A. immunda*, the epiproct extends to the level of the tori (Fig. 21c).

Females can be recognized by their relatively large size (HW 22-24 mm), possession of normally only 3 postquadrangular cells in the fore wing, and the lack of mesostigmal lobes (Fig. 53). *Argia alberta* is a smaller (HW 16-19 mm) species with only 3 postquadrangular cells in the fore wing, but a poorly developed, angulate mesostigmal lobe is present (Fig. 52); and the species is generally smaller (HW16-20 mm).

Types.—Lectotype♂ by present designation: "Tampico/ Terres chaudes. [probably written by Henri L.F. Saussure]", "Hagen [printed]". MCZ 12202. Paralectotypes: 3 ♂, 1♀. 1♂, 1♀ with same data plus "23. A. immundum/ ♂ [or

@]female à renvoyer"; 2 ♂ with same locality data as lectotype, also with color notes in German by Carl Robert Osten Sacken. In MCZ.

Distribution.—Bick *et al.* (1977) report this species from South Dakota (Carter, Fall River Cos.) with the following comments:

"In the U.S., *A. immunda* is reported from TX (Johnson 1972[b]), OK (Bick and Bick 1957) and recently from southwestern SD as a disjunct northern population (Provonsha and McCafferty 1977). Although their map shows this species in NM, KS, AR, we know of no published records from these states. The southwestern SD collections are approximately 1030 km north of WASHITA, southwestern OK (Bick and Bick 1957), the northernmost published locality in the main range. Provonsha and m[sic]cCafferty suggest that the warm water at Hot Brook, SD provided the unique environment for the presence of this species in a northern climate. Because one of our collections was 59 km from Hot Brook, it appears that more than one population of this species occurs in SD. Further, only one of our 4 collections was associated with warm (27°C) water. Clearly this species is more widespread in SD than formerly realized and seemingly is not dependent on warm water."

To these records, I add: New Mexico: Eddy Co., Pecos River at Carlsbad, 30 July 1984, 1 ♂ (RWG); Nevada: Nye Co., Big Spring, 31 May 1955, 1 ♀ (RWG); Arizona: Santa Cruz Co., Monkey Springs, 4.2 mi SE of Sonoita, 4600 ft, 4 Nov. 1972, 1 ♂ (RWG); California: Inyo Co., Resting Springs, 30 May 1955, 1 ♂ (RWG). Its occurrence in central California, Nevada, and Arizona is apparently sporadic. *Argia immunda* occurs primarily along the east coast and central part of Mexico into Belize.

Argia leonorae Garrison, n. sp.
Fig. 11-app, 50-mp, 111-body of holotype, head and thx of paratype ♂, 112-body of allotype

Holotype male.—Head (Fig. 111) black with pale postocular spots not touching blue line at rear of occiput; a pair of small blue spots, each anterolateral to lateral ocellus; anterior margin of black beyond median ocellus forming a T; antennae black, anterior surface of scape blue, remainder of face blue except for small medial mark at base of labrum; labium ivory blue; rear of head largely pale with area lateral to occipital foramen black.

Prothorax largely black dorsally, pale at sides with black surrounding pale blue spot on dorsolateral margin of middle lobe; lateral 0.30 of hind margin of prothorax pale; synthorax (Fig. 111) blue, becoming paler laterally with following areas black: broad middorsal stripe, occupying medial 0.50 of each mesepisternum, margin of antealar crest, anterior 0.50 of mesenfraepisternum, broad humeral stripe, forked at upper 0.30 with upper arm about 0.50 width of lower arm of stripe; upper end of humeral stripe connecting with subalar carina and forming a narrow, attenuated stripe at upper 0.4 of second lateral suture; a narrow metapleural stripe. Metasternum pale with narrow line of black medially. Legs blue, paler medially with top and outer sides of femora largely black, becoming successively broader distally; inner surface of tibiae and armature black. Wings hyaline, venation brown, postnodal cs: FW 11-10 (left and right wing, respectively); HW 9-9; origin of M2: FW at sixth postnodal in both wings, HW at fifth postnodal in both wings; postquadrangular cells: 3 in all wings; pterostigma surmounting 1 cell in all wings.

Abdomen (Fig. 111) largely blue with successively greater amounts of black on posterior parts of abdominal segments. Segment 1 blue with a small anteroventral

spot, and a dorsal spot on basal 0.40 of segment; segment 2 with an irregular dorsolateral stripe, constricted at medial 0.50 and expanded at posterior 0.75 so that it touches other stripe dorsally, a small black spot laterally on 0.50 of segment; apical 0.40 of segment 3 black with a pale spot distolaterally; segments 4-5 similar to segment 3, but black successively extending anteriorly to 0.50, and distolateral spots gradually disappearing; segments 6-7 similar to preceding segments, but dorsal black extending to dorsal 0.10 (segment 6) or narrowly touching base (segment 7); segments 8-10 blue with black ventrally extending anteriorly to 0.50 of segment 8.

Torus (Fig. 11) elongate transversely, occupying all but upper part of torifer; epiproct white, narrow, extending beyond level of tori; area around epiproct black (Fig. 11c); cercus small, quadrangular, with a small decumbent lobe at mesoposterior end followed distally by a smaller triangular tooth (Fig. 11d); cercus in lateral view (Fig. 11b) with mesal lobe visible; paraproct about twice as long as cercus, divided, upper branch pointed, lower branch rounded.

HW 17 mm, abdomen 23 mm.

Allotype female. Similar to male but pale colors tan. Head (Fig. 112) with dorsal black reduced, isolating transverse mark anterior to median ocellus, and postocular spots larger; humeral stripe of thorax (Fig. 112) forked at midlength, the anterior branch a mere hairline to near upper end of stripe where it widens; metapleural stripe narrower than in holotype. Postnodal cs: FW 10-10, HW 9-9; origin of M2: FW at seventh postnodal in both wings, HW at fifth postnodal in both wings; postquadrangular cells: 3 in all wings; pterostigma surmounting 1 cell in all wings.

Abdomen (Fig. 112) with black as follows: small dorsal black at base of segment 1; dorsolateral stripe on segment 2 similar to that of male, but reduced and separated at middle and dorsally; segments 3-5 with distal 0.30 black with a dorsolateral extension on each side extending anteriorly to basal 0.20 of segment, a small posteroventral spot barely connected to black above; segments 6-7 similar to segments 3-5 but dorsolateral area of black coalescing dorsally obscuring (segment 6) or eliminating (segment 7) middorsal pale stripe; segments 8-9 with dorsolateral bands of black with a narrow middorsal pale line on segment 8, this line wider on segment 9; a paler inferior stripe on segments 8 and 9; segment 10 largely pale with a wash of brown on dorsolateral areas.

Mesostigmal plate (Fig. 50) triangular, with a costate rim; mesostigmal lobe not well developed, a recessed digit-like structure barely higher than lateral arm of middorsal thoracic carina, each lobe directed mesoposteriorly, its outer margin continuous with posterodistal margin of plate; its medial margin thickened but not recurved posteriorly, ending on mesepisternum and not connecting to lateral arm of middorsal thoracic carina; area between branches of middorsal thoracic carina small, with a raised transverse swollen area at its anterior end.

HW 17 mm, abdomen 22 mm.

Holotype male.— MEXICO: Nuevo Leon state, Municipio de Garcia, Parque Turistico Nacataz, 4 July 1987 (M.J. Westfall, Jr., and A. Contreras). Allotype ♀ taken in tandem with paratype ♂: same data as holotype. Both in FSCA.

Etymology.—Named in honor of the late Leonora K. Gloyd, diligent odonate worker and researcher and specialist on the genus *Argia*.

Remarks.— Variability in the paratypes is expressed in the extent of the dark markings on the epicranium and thorax. Some specimens (Fig. 111b: Texas, Reeves Co.) have the postocular spots considerably reduced, the blue line at rear of occiput lacking, and the upper fork of the synthoracic humeral stripe broadly joined. The

dorsal black on segments 3-6 may also be more extensive, reaching the basal 0.10 of segments 3-4.

Paratype measurements. Males (N = 32): HW 15-19 mm, abdomen 21-26 mm, postnodal crossveins (FW/HW) 9-12/9-10; origin of M2: 5.5-7/4-6; postquadrangular cells 3-4/3. Females (N = 3): HW 16-18 mm, abdomen 22 mm, postnodal crossveins 10-11/8-9; origin of M2: 5.7-6/5; postquadrangular cells 3/3.

Diagnosis.— Males of this small blue species are similar in morphology of appendages to *A. agrioides*, *A. fumipennis violacea*, *A. hinei*, *A. nahuana*, and *A. pallens*, all of which possess a ventrally directed median lobe on the cercus. Differences between *A. leonorae* and *A. agrioides*, *A. fumipennis violacea*, *A. hinei*, and *A. nahuana* are given under those species and Key M-3. *Argia leonorae* has similar morphology to *A. pallens*, but the quadrate cercus (Fig. 11a) (outer side of cercus longer than medial side in *A. pallens*, Fig. 13a), and smaller distal tooth in *A. leonorae* (Fig. 11d) than in *A. pallens* (Fig. 13d) will easily separate the two species. Thoracic markings are also different. In *A. leonorae* (Fig. 111a, b), the middorsal stripe is broader than in *A. pallens* (similar to Fig. 77), and *A. leonorae* is blue, not reddish-violet as is *A. pallens*.

Females of these six species are also diagnosed under their respective species headings, as for males. Females of *A. leonorae* have 3 postquadrangular cells in the fore wing, not 4 as in *A. pallens*; and the mesostigmal lobe of *A. leonorae* is not recurved medially, nor is there a tubercle at the base of the mesostigmal lobe as there is for *A. hinei*.

Biology.—Little is known of the biology of this small species. It apparently frequents small streams or seepages. I collected this species along Mustang Creek in Williamson Co., Texas, in August, 1975. The creek was a small muddy-banked rivulet which supported the following species of *Argia*: *A. immunda*, *A. moesta*, *A. apicalis*, *A. translata*, and *A. nahuana*. Paulson (pers. comm. 15 Sept. 1994) collected two males (not examined) in Bandera Co., Texas (Rio Sabinal, 22 Aug. 1977) at scattered sedge-ridden swales above the main stream along with *A. cuprea*, *A. fumipennis violacea*, *A. immunda*, *A. nahuana*; *Argia translata* was taken along the main stream. The small size of *A. leonorae* may cause the collector to overlook it, and I confused it with the larger *A. nahuana* when I first collected it.

Remarks.—This species was first collected in Brooks Co., Texas, in 1928, and T.W. Donnelly collected it at Balmorhea State Park in 1954. Leonora K. Gloyd for many years had planned to name it after Balmorhea State Park. Both the manuscript scientific name and its common appellation, "Balmorhea Damselfly," have been widely used in correspondence.

Distribution.—Argia leonorae is known from widely scattered counties in Texas and from Nuevo Leon, Mexico. I suspect that further collecting will show it to occur in southeastern New Mexico and in other areas of southern and central Texas. Although the species is represented by a small series from Nuevo Leon state, it probably occurs in surrounding states in northern Mexico.

Additional material examined.— 32 male and 3 female paratypes as follows: TEXAS: Brooks Co., 25 July 1928, L.D. Beames, 1 ♀ (UMMZ); DeWitt Co., McCoy Creek at Rt. 183, 25 June 1975, K.W. Knopf, 7♂, ♀ (KWK, RWG, FSCA) Reeves Co., Balmorhea State Park, canal, T.W. Donnelly, 2♂ (TWD, FSCA?); Williamson Co., Taylor, Mustang Creek, by Carlos G. Parker Blvd. (= Loop 427), 15 Aug. 1975, R.W. Garrison, 2 ♂ (RWG), 17 Aug. 1975, 1♀, R.W. Garrison (RWG); 25 Aug. 1975, J.E. Hafernik, Jr., 1 ♂ (RWG); Taylor, 26 May 1978, C.E. Williams and L.K. Gloyd, 2 ♂ (UMMZ); MEXICO, Nuevo Leon state, same data as holotype and allotype, 18 ♂ (FSCA, BMNH, USNM, IBUNAM, RWG).

Argia lugens (Hagen, 1861)
Fig. 9-app, 34, 35, 36-app, mp, 37-mp, 69-♂ thx

Agrion lugens Hagen, 1861:95
Hyponeura lugens, Hagen in Selys, 1865:382 (10 separate)
Argia lugens, Gloyd, 1968a:272

Diagnosis.—Males are easily separated from all other species by their large size (HW 29-32 mm) and, when mature, by their overall pruinose black condition (Fig. 69). The appendages (Fig. 9, 34) resemble those of the smaller (HW 24-28 mm) *A. moesta* (Fig. 8), but are easily separated by couplet 2 of Key M-2.

Females are easily distinguished by the unique condition of the mesostigmal lobes (Fig. 37). It is the only species from the United States which has narrow posterodistally pointed mesostigmal lobes.

Types.—Holotype ♀ with following labels: "Hyp. lugens Hag./ Mexique [in Hagen's hand]" and small red label printed with "Typus" (examined). In ZMHB. Hagen (1861) described this species from one female which under "Hab."is stated: "Mexico (Mühlenpford; Berlin Museum)".

Distribution.—Western Texas (Gloyd 1958), western Oklahoma (Bick and Bick 1957), New Mexico, southern Utah (Provonsha 1975), south central Colorado (Baca Co., Bick 1978; Huerfano Co., Walsenburg, Cuchara Cyn, Aug, FSCA, UMMZ), central and southern Arizona, and California north to Oregon (Paulson and Garrison 1977), Mexico south through Durango, Nayarit and Hidalgo states (González and Novelo, pers. comm.), Oaxaca (Rio Grande, 4.9 mi E and 35.7 mi N Oaxaca, Aug), and Chiapas (22.6 mi NE Tuxtla Gutierrez, Rio Escopetazo, Aug, both from unpublished records from UMMZ).

Remarks.—This species shows great ontogenetic change, and the pale thoracic color of females may be tan, sky blue, or a deep red brown. The males, when young, have a broad middorsal stripe which is interrupted by an incomplete pale narrow line on either side of the middorsal carina; a humeral and post humeral stripe usually connected medially; a vestige of a midlateral stripe at the upper 0.50 of the thorax; and a well defined metathoracic stripe. The entire thorax of mature males becomes totally covered with a black, matte pruinosity which becomes paler on the metathorax (Fig. 69). Females have similar but less extensive thoracic markings, and the posthumeral stripe may become isolated. Old females have some pruinosity near the venter of the thorax, but they do not become pruinose like the males.

Rodolfo Novelo has sent me some females from Mexico (Hidalgo: Tecozautla; arroyo San José del Desierto), in which the mesostigmal lobes are not as elongate as shown in Fig. 37.

Argia lugens is similar to the larger, Mexican *A. funkei*, which I will treat in a subsequent paper on the genus from Middle America.

In arid areas of southern California and central and southern Arizona, *A. lugens* is one of the most conspicuous zygopterans at small desert rock-laden streams. The old pruinose males are active and difficult to net as they sit on emergent rocks and boulders.

Argia moesta (Hagen, 1861)
Fig. 8-app, 40-mp

Agrion moestum Hagen, 1861:94
Argia moesta, Hagen in Selys, 1865:384 (12 separate)
Agrion putridum Hagen, 1861:96
Argia putrida, Hagen in Selys, 1865:385 (13 separate)
Argia intruda Williamson 1912:200

Diagnosis.—A large distinctive species whose males are separated from all other species except *A. lugens* by the unbranched paraproct, and unique shape of the cerci (Fig. 8). The morphological differences between *A. moesta* and *A. lugens* are presented in couplet 2 of Key M-2. Females of *A. moesta* are unique in possessing a mesostigmal lobe with a dorsal arcuate ridge as shown in Fig. 40. Critical examination and proper exposure of the mesostigmal lobe will be necessary to detect this character.

Types.—Of *moestum*: Lectotype ♂ by present designation: "July/ 16", "Pecos River/ Texas", "Hagen [printed]", "MCZ 12169", also 2 ♂, 5 ♀ paralectotypes with similar data, all in MCZ. Of *putrida*: 3 male, 3 female syntypes with following data: 1 male, 1 female: "48 [printed]", Maryland (48)/ Uhler 1858", "Hagen [printed]"; 1 ♂, 1 ♀: "Virginia/ Berkeley Springs/ O. Sacken.", "Hagen [printed]"; 1 ♂, 1 ♀: "Upper Wisconsin/ River Uhler/ 1860", "Hagen [printed]", all with label MCZ 12171, in MCZ. Of *intruda*: Lectotype ♂ by present designation: "Wistar, Oklahoma./ August 2, 1907/ Frank Collins; *Argia intruda*/ Williamson/ TYPE - pp. 196-203./ Ent. News Vol. XXIII 1912./ Det. by E.B. Williamson [both labels by Leonora K. Gloyd]". No type was specified in the original description based on 15 males and 17 females.

Distribution.—A common and widely distributed species. It occurs from western Ontario, southern Quebec, New Brunswick, and Nova Scotia in Canada south into Florida and west to southern California. The northwesternmost range for *A. moesta* appears to be central eastern Utah (Provonsha 1975). It occurs as far south in Mexico as the states of Chihuahua, Nuevo Leon, Tamaulipas, Jalisco, Michoacan, and Morelos.

Remarks.—Next to *A. translata*, *A. moesta* is probably the most widely distributed species or *Argia*, occurring from about 45°N latitude in Canada to about 20°N in Mexico. It is subject to great amounts of ontogenetic and geographic variation (see Johnson 1973), but is one of only two U.S. species whose males become entirely pruinose (*A. lugens* is the other.) In most parts of its range, females of *A. moesta* have a narrow, hairlike middorsal stripe (similar to Fig. 71), but phenotypes with a broad middorsal stripe and well developed forked humeral stripes (similar to Fig. 75) arise in parts of Florida. Dunkle (1990) illustrates this dark color form of the female. Similar differences in abdominal patterns can also be seen. For example, some far western females have almost immaculate abdomens, narrow dorsolateral stripes are present to some degree on segments 3-5 or 6, and the last four segments may be unmarked. In specimens from Florida, the dorsolateral stripes are more expansive so that the entire dorsum of segments 1-9 is black, except for a narrow middorsal line.

Argia munda Calvert, 1902

Fig. 30-app, 39-mp

Argia vivida var. *munda* Calvert, 1902a:96
Argia rita Kennedy, 1919a:17
Argia munda, Gloyd, 1958:17

Diagnosis.—Males of *A. munda* are easily identified by the strongly arched, dome-like condition of the cercus (Fig. 30b), which exposes the ventral part of that structure. The narrow rimlike tori (Fig. 30c) will distinguish *A. munda* from *A. vivida* (Fig. 29c), *A. extranea* (Fig. 31c), and *A. plana* (Fig. 32c, 33c).

In females, the unusual condition of the mesepisternum (Fig. 39) will easily separate *A. munda* from all other congeners.

Types.—Of *munda*: Lectotype ♂ by present designation: "Arizona/ C.U. Lot 35 [printed]", "munda", "MCZ/ 12209". Paralectotypes: 1 ♂, 1 ♀ with same data; 4 ♂: "Rio Verde/ Mexico/ E. Palmer." According to Calvert (1902a:104), the type locality for specimens from "C.U. Lot 35" is probably near the Graham Mountains in Arizona. Of *rita*: Holotype ♀ in SMEK.

Distribution.—Sporadically along desert streams in south central and southeastern Arizona, southern New Mexico (Grant Co., Gallinas Canyon, 6900 ft., July, FSCA), and one record from west Texas (Gloyd 1958), south into northern Mexico (Chihuahua, Durango and San Luis Potosí states, González and Novelo 1991). La Rivers (1940) lists it from Clark County, Nevada, as *A. rita*, but this probably a misidentification.

Remarks.—Overall body coloration of *A. munda* is pale violet, and its thoracic markings are similar to the sympatric, more widely distributed *A. plana*.

Argia nahuana Calvert, 1902

Fig. 14-app, 54-mp

Argia agrioides var. *nahuana* Calvert, 1902a:99
Argia nahuana, Gloyd, 1958:18
Argia saalasi Valle, 1942:164

Diagnosis.—Males are most similar to *A. agrioides, A. fumipennis, A. hinei, A. leonorae*, and *A. pallens* in appendage morphology. All are separated in Key M-3. *Argia nahuana* is further contrasted with all of the above species (except *A. pallens*) under their respective species accounts. Couplet 4 of Key M-3 will separate *A. pallens* from *A. nahuana*. The middorsal thoracic stripe in *A. nahuana* is almost as wide as the pale antehumeral stripe (as in Fig. 74), but that of *A. pallens* is a mere hairline (as in Fig. 77). The medial lobe of the cercus in *A. nahuana* is directed primarily medially, and is thus easily seen in dorsal view (Fig. 14c). This structure in all other related species is directed more ventrally and is less visible in dorsal view (Fig. 10c, 11c, 12c, 13c, 15c).

Females of *A. nahuana* are at once distinguished from all other congeners by the broad transverse expanse of each mesostigmal lobe. The mesostigmal plates are transversely longer than the interval separating them (Fig. 54). *Argia rhoadsi* (Fig. 41) also has the mesostigmal lobes approaching one another medially, but that species has a different plate morphology, and the shallow mesepisternal pit of *A. rhoadsi* is lacking in *A. nahuana*. Females of *A. nahuana* may be confused with those of *A. sabino* (Fig. 60) because of the narrow interspace between the mesostigmal

lobes and because the middorsal thoracic carina forks at the level of the mesostigmal lobes. However, the mesostigmal lobe of *A. sabino* forms a broadly posteriorly directed explanate lobe, while that of *A. nahuana* forms a more narrow, medially acute lobe whose medial margin parallels the diverging arm of the middorsal thoracic carina.

Types.—Of *nahuana*: Calvert (1902a) figures the cercus of a male from Mexico City, so that specimen would serve as the holotype. A series of syntypes is in the BMNH (Kimmins 1970), but the one which served as fig. 62ss, plate 4, is lodged in ANSP (Azuma, pers. comm.). Of *saalasi*: lectotype ♂ and 2 paralectotype ♀ in ZMH (Hämäläinen 1982).

Distribution.—More widely distributed than its close relative, *A. agrioides*, *Argia nahuana* occurs from southern Oregon (Josephine Co., Illinois River, near 8 Dollar Mtn, 6 Aug. 1992, 1 ♂, Illinois River State Park, near Cave Jct, 7 Aug. 1992, 3 ♂, all collected by Richard Orr, in coll. R. Orr and RWG), south throughout central California and into northern Baja California (4 mi SW of La Zapopita, Valle de Trinidad, April, LACM), and east through Inyo Co., California (slough nr. gravel quarry, end of Five Bridges Rd., 3 mi N of Bishop, 2 Sept. 1983, ♂★ ♀, in RWG), New Mexico (Catron, Grant, Lincoln, and Eddy counties, all in RWG), and as far east as Gonzales Co., Texas, north to Oklahoma (Bick and Bick 1957), Kansas (north to Donipehn Co., Huggins *et al.* 1976, Huggins 1978), Colorado (Baca and Bent counties, Bick 1978; and Prowess Co., Evans 1988), extreme southwestern Utah (Provonsha 1975), and southern Nevada (La Rivers 1940: Note: These specimens, listed from Las Vegas and Stump Springs, Clark Co., as *A. agrioides* probably represent *A. nahuana*.). The species occurs as far south as Mexico City, Guadalajara, Aguascalientes (Calvert 1902a), Durango, Hidalgo, Morelos (González, pers. comm.), and Michoacan states (Lago de Costzeo, 7 July 1947, T.H. Hubbell, 1 ♀, UMMZ).

Remarks.—Hämäläinen (1982) designated a lectotype of *A. saalasi* and concluded that it was a junior synonym of *A. nahuana*.

Argia oenea Hagen in Selys, 1865
Fig. 2-app, 59-mp, 81-♂ abd

Argia oenea Hagen in Selys, 1865:407 (35 separate)

Diagnosis.—This is the only species of *Argia* within its range in the United States whose males have a solid metallic copper mesepisternum (similar to Fig. 68). It can only be confused with *A. cuprea*, which is found in the United States only in Texas. Males of both species are diagnosed under *A. cuprea*.

The female of *A. oenea* has a broadly formed mesostigmal lobe (Fig. 59) which is erect. The morphology of the lobe is similar to that of *A. extranea* (Fig. 55), but the lobe in *A. extranea* is not as well developed, nor is it as erect as in *A. oenea*. The morphology of the mesostigmal lobe also resembles that of *A. barretti*: the two species are diagnosed under *A. barretti*.

Types.—This species was described from one male from "Corbova (Mexique), Terres-Chaudes, par de Saussure. — Tampico", and is stated to be in the Hagen collection ("Coll. Hagen."). There is a specimen in the MCZ which does not carry an MCZ type label. Its data are "Tampico./ (T[erres] Chaudes.", "A. calidum. N.A.N. p. 93/ Nota [illegible]/ on *A. oenea* -/ at [?] cuprea. jun." A penciled note by L.K. Gloyd reads: "probably/ *A. oenea* L.K.G." This was the specimen tentatively

identified as *Agrion calidum* by Hagen (1861:93) and was probably one of the syntypes used in the original description of that species: "I saw a male taken at the same place (Tampico [Mexico]), allied to this species [*A. calida*], but the epistoma was brassy-green, the sides of the thorax had no middle black line; the appendages destroyed. Is it a distinct species?" I examined this specimen at the MCZ in 1991. It lacked the last four abdominal segments. The original description appearing four years after Hagen had written about this one, describes the type with abdominal segments "8-10 pale blue". Thus this specimen cannot be the type of *A. oenea*. I have been unable to locate the type.

Distribution.—In the United States, confined to Arizona. The species was first recorded in the United States from Cochise Co. in extreme southeastern Arizona by Gloyd (1932), but it has subsequently been found in Pima, Maricopa, Yavapai, Pinal, and Mohave counties. A male in the collection at ASU (Mohave Co., Grand Canyon, tributary to Colorado River at mile 204.5, Spring Creek, 24 June 1982) represents the most northerly record for this primarily tropical species. *Argia oenea* occurs south into Baja California Sur and is common in most of mainland Mexico south through Costa Rica and Panama.

Remarks.—*Argia oenea*, like *A. plana*, assumes two color forms. Specimens from near the type locality (Cordoba, in Veracruz state), throughout eastern and possibly central Mexico south into Central America are blue. All individuals which I have seen from Baja California, Arizona, Sinaloa, and as far south as Morelos state in Mexico are violaceous. Novelo (pers. comm., 28 Jan. 1994) states that violaceous forms of *A. oenea* occur in Morelos, Guerrero, and western Hidalgo states, and that males from San Luis Potosí, Veracruz, eastern Hidalgo, Puebla, and Oaxaca have abdominal segment 3 violet, and segments 4-6 blue. He indicates that the violaceous coloration may be associated with forms found in xeric areas. I have detected no morphological differences between these forms, nor do I know if they intergrade. More collections of this species in the center of distribution of the two forms will be needed to clarify the situation. I consider both forms to represent *A. oenea*.

Argia pallens Calvert, 1902, new status
Fig. 13-app, 49-mp, 97-mp, posterior view

Argia violacea var. *pallens* Calvert, 1902a:98
Argia solita Kennedy, 1918:256, NEW SYNONYMY.

Diagnosis.—The male of this species possesses a mesal lobe which allies it with *A. agrioides*, *A. fumipennis*, *A. hinei*, *A. leonorae*, and *A. nahuana*. It is diagnosed under each of those species. The hairlike middorsal thoracic stripe (as in Fig. 77) will distinguish it from all other members within its range.

Females of *A. pallens* are also diagnosed under each of the species mentioned above. The thin middorsal thoracic stripe, morphology of the mesostigmal lobe (Fig. 49), and the prominent tubercle at the base of the posteromesal margin of the mesostigmal lobe (Fig. 97) will identify this species.

Types.—Of *pallens*: The primary illustration of this variety was of a male from Tucson, Arizona (Calvert 1902a); the female mesostigmal plate illustrated in the same work was from Guadalajara and is in the BMNH (Kimmins 1970). Calvert (1902b), states that the types are "in Colls. Adams, Godman, Deam", but I have not been able to locate the male which served as the figure for Calvert (1902a). It is not listed from the BMNH by Kimmins (1970), nor did I see it in the UMMZ or MCZ. According to Gloyd's unpublished distributional notes on this species, she exam-

ined a male "cotype" (Tucson, Arizona, 24 April 1896) in 1935. She makes no mention as to repository or whether this specimen served as the principal figure in Calvert (1902a). Even though I have not seen the type, the description and figures by Calvert (1902a) leave no doubt that this name should be applied in the sense used here. Of *solita*: Holotype male in MCZ.

Distribution.—In the United States, apparently restricted to Arizona south of the Mogollon Rim. My northernmost record is Yavapai Co. (Santa Maria River at U.S. Hwy. 93, 8 Oct. 1990, 2♂, RWG, in RWG), and it has been collected commonly in Jalisco, Morelos, Puebla, Guerrero, and Oaxaca states in Mexico (Calvert 1902a), González (pers. comm.). Calvert (1907) and Paulson (pers. comm. 15 Sept. 1994) record it from Guatemala.

Remarks.—Examination of the holotype of *A. solita* shows it to be the same species as *A. violacea* var. *pallens* described by Calvert (1902a) from Tucson, Arizona. Consequently, *A. solita* is considered a junior synonym of *A. pallens*. For many years, Leonora K. Gloyd had indicated by correspondence to several odonatists that *A. pallens* was specifically distinct from *A. fumipennis* and that *A. pallens* and *A. solita* were synonymous. However, she never published her opinion. Little has been written on this species, and as late as 1953, Walker (1953) continued to list *A. pallens* as a subspecies under *A. violacea* as follows: "S.C. and Ala. to Ariz. (subsp. *pallens*) n.e. through Okla. and Kans. to Minn., Wis., Mich., Ont., Que., Me., N.B., and N.S.: also s. of U.S. - Tex. To Guatemala (*pallens*)." Kiauta and Kiauta (1980), in their study on the cytology of various species of *Argia*, apparently misinterpreted Walker's statement, evidenced as follows: "We are not acquainted with the subspecies *pallens* Calv., recorded from South Carolina and Alabama to Arizona, Mexico and Guatemala (cf. CALVERT, 1908; MUTTKOWSKI, 1910; WALKER, 1953." I have not seen any specimens of *A. pallens* from the U. S. A. outside of Arizona, though I suspect it may occur in southwestern New Mexico. The specificity of *A. pallens* is not only vindicated by specific differences elaborated in the key and under the species account of *A. fumipennis violacea*, but both species have been collected together at several sites in southcentral and southern Arizona. Specimens of both species are easily separated by overall color pattern in the field.

Argia pima Garrison, n. sp.
Fig. 23-app, 63-mp, 105-abd segment 2, 113-body of holotype,
114-body and thx of allo-and paratypes

Holotype male.—Head (Fig.113). Labium pale blue, remainder of head blue with small black medial spots at base of labrum. Black on epicranium reduced with narrow longitudinal line separating large postocular spot from cross bar of blue on occiput; small pale spot anterolateral to lateral ocellus; anterior margin of black with anterolateral offshoot extending to base of antennae; antennae black, rear of head chiefly pale, with small area around occipital foramen black.

Prothorax blue, black above with following areas pale: transverse band on frontal lobe, large dorsolateral spot on middle lobe, narrow medial spot and lateral 0.30 of posterior lobe. Pale areas of synthorax (Fig. 105) blue, with broad black middorsal stripe as wide as pale antehumeral stripe; black humeral stripe extending from base of mesinfraepisternum and forming a broad lobe at base of mesepimeron, then constricting to 0.30 width of pale humeral stripe; black humeral stripe divided at midheight, anterior branch a thin line along first lateral suture, with slight enlargement at dorsal 0.10 of thorax, posterior fork broad, 0.30 as wide

as pale antehumeral stripe, directed posterodorsally toward but not touching black at subalar carina; third lateral suture with narrow black stripe. Wings with venation black; pterostigma dark brown, surmounting 1.5 cells in all wings; postnodals: 16/13; postquadrangular cells: FW 5/5; HW 4/4, M2 at FW 7.5-8; HW 6/6. Coxae and trochanters pale except for black on dorsum of trochanters; femora black dorsally, pale ventrally; tibiae black on inner surface, black along exterior side on pro- and mesothoracic tibiae, remainder pale; tarsi and armature black.

Abdomen (Fig. 113) blue, segment 1 pale with dorsal black spot at basal 0.40; segment 2 with black dorsolateral stripe extending to 0.75 of segment, its end forming an inverted triangle extending to but not connecting above, annulus black; segment 3 with an incomplete band of black at posterior 0.8 of segment, followed by a similar ring of blue at distal 0.90 of segment, annulus black; segments 3-5 with apical 0.20 of each segment, including annulus, black; this black not meeting dorsally on segment 4, separated by a narrow middorsal line on segment 5, and connecting dorsally on segment 6; segment 7 similar to segment 6 but with lateral prolongation of black extending to basal 0.15 of segment; segments 8-10 pale with a touch of black at lower posterior margin of segment 8.

Torifer (Fig. 23a, c) triangular, with narrow rim of black around margin of epiproct; torus prominent, transversely twice as wide as long, occupying lower 0.50 of torifer, each torus transversely wider than the distance between them; epiproct prominent, pale blue, bilobed with a recessed small median lobe, extending beyond level of tori. Cercus (Fig. 23a) pale, a little longer than wide, with a single black decumbent tooth visible in dorsomedial view and as prominent as distal tip of cercus so that cercus appears equally bifid; mesal margin convex in dorsomedial view; in lateral view, cercus triangular, with inner tooth visible; paraproct a little longer than cercus, divided, with anterior lobe forming an arcuate parallel-sided digit; posterior branch blunt, forming a broadly based triangle (Fig. 23b).

Penis with fourth segment forming a narrow, pointed hyaline lobe; mesal (inner) side with a long filamentous flagellum.

HW 24 mm, abdomen 32 mm.

Allotype female tan with head and thoracic patterns similar to male but with black areas on epicranium more extensive (Fig. 114a), and with posterior fork of humeral stripe meeting black area below subalar carina. Wings with venation black, pterostigma brown, surmounting 1.5 cells in right FW and left HW, 2 cells in other wings; postnodal crossveins: FW 17/17, HW 15/15; postquadrangular cells: 4 in all wings; M2 originating at or near seventh crossvein in both fore wings, at sixth crossvein in left HW, at 6.5 crossvein in right HW.

Abdomen (Fig. 114a) tan with more extensive black markings than in male as follows: segment 2 with complete dorsolateral black stripe, expanding at distal 0.80, their ends not touching dorsally, remainder of stripe narrow, annulus black and with an anterodorsal offshoot of black at posteroventral margin of segment; segment 3 similar to segment 2 but stripes incomplete at basal 0.10 of segment; segments 4-6 similar to segment 3 but with ventroposterior black merging with dorsolateral black and gradually isolating pale posteroventral spot on segment 5, and obliterating this spot on segment 6; segment 7 similar to segment 6, but with small posteroventral pale spot, and with ventrolateral black extending anteriorly to basal 0 .40 of segment, and with dorsolateral black connecting above anteriorly to basal 0.15 of segment; segment 8 pale except for a pair of dorsolateral spots at basal 0.50 of segment, these separated middorsally by a narrow pale line, an

irregular spot at posteroventral margin; segment 9 pale with further reduced pair of dorsolateral spots as for segment 8; segment 10 and cerci pale.

HW 26 mm, abdomen 30 mm.

Holotype male.—U.S.A.: Arizona; Pima Co., Upper Sabino Canyon, about 3 mi N of visitor center, NE of Tucson, 22 Sept 1988 (R.W. and J.A. Garrison). Allotype female with same data as holotype. Both in USNM.

Etymology.—Named for the Pima Indians of southern Arizona.

Remarks.—Variability is expressed primarily in the thoracic markings among the paratypes from Arizona and Mexico. The two males from Yavapai County are more juvenile and are larger (HW 26-27 mm, abdomen 33-35 mm) and have less extensive black markings than the series from Sabino Canyon (HW 22-25 mm, abdomen 29-32 mm). Most of the males (19 of 26), including the only known male from Mexico, have the posterior fork of the humeral stripe connecting with the black margin below the subalar carina (as in Fig. 114a). Similarly, a majority (5 of 9) of the females from Sabino Canyon and the single female from Mexico have the posterior fork of the humeral stripe connecting with the subalar carina (Fig. 114a). All three paratypes from Yavapai County have an unconnected posterior fork (as in Fig.114b), and one (Fig. 114c) has the posterior fork isolated from the humeral stripe. Most females are tan, but two from Sabino Canyon are mostly blue along the metathorax and lateral margins of the abdomen.

The mesostigmal plates are variable in this species. Most, including all females from Sabino Canyon, have the outer margin of the mesostigmal lobe meeting the mesostigmal plate at an acute angle when viewed anterodorsally. One female from Yavapai County, and the single female from Sonora state, Mexico, differ in having the outer margin of the mesostigmal lobe meeting the mesostigmal plate in a gentle curve, similar to that of most *A. lacrimans* examined.

Paratype measurements: Males (N = 29): HW 22-27 mm, abdomen 29-35 mm, postnodal crossveins (FW/HW) 12-17/12-16; origin of M2 7.5-9/6-7.7; postquadrangular cells 4-5/4-5. Females (N = 11): HW 23-28 mm, abdomen 27-34 mm; postnodal crossveins 16-18/13-16; origin of M2 7-9/6-7; postquadrangular cells 4-6/4-5.

Diagnosis.—This species' nearest ally is *A. lacrimans* (Hagen), a species not known to occur in the United States. Hagen's original description (1861) is brief and is based on two incomplete females. Calvert (1902a) described and illustrated the male. The lectotype female (here designated) with following handwritten data:"Cordoba/Mexique/T[erres]. chaudes.", "Hagen [printed]", "8. *A. lacrimans* ♀ / à renvoyer", MCZ# 12175), is illustrated in Fig. 64 (mesostigmal plates) and 116 (body). I illustrated the male body pattern of this species from Veracruz (Fig. 115a), and appendages (Fig. 24) and thorax (Fig. 115b) of another from Morelos state in Mexico. The black humeral stripe in all specimens, including the types, from Veracruz state, Mexico, has the upper end abruptly narrowed (Fig. 115a, 116), while all those examined from western Mexico (Fig.115b) have the upper end of the humeral stripe gradually narrowing. Comparisons of the appendages and mesostigmal lobes of all these specimens convince me that all represent *A. lacrimans*.

The two species may be differentiated by the following key:

Males

Cercus in dorsomedial view (Fig. 24a) with mesal tooth obscured, strongly decumbent and not readily visible; distal branch long, prominent, so that cercus appears unequally branched; dark humeral stripe not forked (Fig.115a, b); larger species (HW 26-28 mm); Sonora south through central Mexico ..... ***lacrimans***

Cercus in dorsomedial view (Fig. 23a) with mesal tooth prominent, readily visible so that cercus appears equally branched; dark humeral stripe always forked (Fig. 113); smaller species (HW 21-27 mm); Yavapai, Pima counties, Arizona, Sonora state, Mexico ..... ***pima***

Females

Distance between mesostigmal lobes approximately equal to or greater than the transverse width of each lobe (Fig. 64); outer margin of mesostigmal lobe usually meeting base of mesostigmal plate at an obtuse angle, or curved obtusely (Fig. 64); dark humeral stripe not forked (Fig. 116); larger species (HW 27-29 mm) ..... ***lacrimans***

Distance between mesostigmal lobes distinctly less than transverse width of each lobe (Fig. 63); outer margin of mesostigmal lobe usually (but not always) meeting base of mesostigmal plate at an acute angle; humeral stripe forked (Fig. 114a,-c); smaller species (HW 23-28 mm) ..... ***pima***

Males of *A. pima* are easily separable from *A. tarascana* (Fig. 25-26) and *A. sabino* (Fig. 27) by the shape of the upper branch of the paraproct. In *A. pima*, this branch is a narrow, linear or curvilinear digit-shaped structure, but in the other two species, it is a broadly based triangle. The epiproct of *A. sabino* (Fig. 27c) and *A. tarascana* (Fig. 26c) is distinctly narrower than the transverse width of each torus, but in *A. pima*, the epiproct is large, swollen, and is about as wide as the transverse width of one torus (Fig. 23c).

Females of *A. pima* are separable from *A. sabino* and *A. tarascana* by the shape of the mesostigmal lobes. They are large, broad distally, and meet the lateral arm of the middorsal thoracic carina at an acute angle (Fig. 63). These lobes in *A. sabino* and *A. tarascana* meet the lateral arm of the middorsal thoracic carina at an obtuse angle (Fig. 44, 45, 60).

In the field, *A. pima* can usually be separated from *A. sabino*, with which it is sympatric in Sabino Canyon, Arizona, by the condition of the black humeral stripe. In *A. pima*, the upper 0.50 of the stripe forms a narrow, hair-like line (Fig.113-114), while this area is wider in *A. sabino* (Fig. 117-119). All known males of *A. sabino* within its distribution in the United States are violaceous (two males from Jalisco state, Mexico, are blue). All known males of *A. pima* and *A. tarascana* are blue.

Biology.—Argia pima is a stream species. Enrique González and I collected a few specimens in tandem over small riffles of Sabino Creek at the upper part of the canyon. At Fossil Creek, In Yavapai County, young adults were taken on bare patches of ground about 10 m from a small stream. As with other species of *Argia* found in the largely arid areas of the southwestern United States, abundance can vary from year to year, presumably due to the unpredictable nature of summer

rains. Sidney Dunkle found this species abundant in Sabino Canyon in September 1983, but Enrique González and I saw and collected only a few specimens in September 1988. I suggest that a general lack of odonatological collecting, coupled with variable annual precipitation rates, have contributed to an underestimation of the range of this species. Collection dates range from 2 August through 23 September.

Distribution.— This species is known from only three localities, two (Yavapai and Pima counties) in Arizona, and northern Sonora, Mexico. The pair from Sonora was collected with a pair of *A. lacrimans*.

Additional material examined (29 ♂, 11 ♀ paratypes): U.S.A., Arizona: Yavapai Co.: Sycamore Spring, Fossil Creek Rd., Forest Road 708, Coconino Nat'l. Forest, 2 August 1992, J.A. Garrison, Michael and Matthew Van Dam, Carol Fujita, 2 ♂, 3 ♀ (RWG); Pima Co.: Sabino Cyn., 7 mi NE of Tucson, 20 Sept. 1955, T.W. Donnelly, 3♀ (TWD), 9 Sept 1983, 23 ♂, 1 ♀ (♀ in tandem with ♂), S.W. Dunkle (SWD, JJD, RWG, BMNH), same data as holotype, 1 ♀ (RWG), same data as holotype but 23 Sept 1989, J.J. Daigle, 2 ♂, 1 ♀ (JJD); MEXICO, Sonora state: small river W of Yecora on Rte 16, 23 Aug 1986, Boris Kondratieff, 1 ♂, 1 ♀ (SWD).

Argia plana Calvert, 1902

Fig. 32-33-app, 62-mp, 79-prothorax, 110 - penis

Argia vivida var. *plana* Calvert, 1902a:96
Argia plana, Gloyd, 1958:19
Argia spegazzinii Navás 1934:69, NEW SYNONYMY

Diagnosis.—The shape of the male cercus in mediodorsal view (Fig. 32a, 33a) is diagnostic. Males are likely to be confused with the allopatric *A. vivida* (Fig. 29), but the two species differ in the shape and placement of the decumbent apical tooth, which was well described by Gloyd (1958) and is pointed out in Key M-6.

Females are extremely similar to *A. vivida*, and the mesostigmal plates of both species (Fig. 61, 62) appear indistinguishable. Gloyd (1958) pointed out the differences in the mediolateral depression of the middle thoracic lobe; and it is only by this character that I have been able to distinguish the two species morphologically.

In the field, male *A. plana* may be confused with *A. extranea*, *A. hinei*, *A. fumipennis violacea*, *A. nahuana*, and *A. munda*. *Argia plana* is a larger species (HW 21-24 mm) than *A. hinei* (HW 16-20 mm) and *A. fumipennis violacea* (HW 18-21 mm). The latter two species also have a well defined streak of black (*A. fumipennis violacea*, Fig. 85) or vestiges of such a streak (*A. hinei*, Fig. 86) on abdominal segments 8-10. In contrast, *A. plana* is almost always void of ventral streaks (as in Fig. 88). *Argia extranea* approaches *A. plana* in size, but like *A. fumipennis violacea* and *A. hinei*, it has black ventral markings on abdominal segments 8-10 (Fig. 87). *Argia munda*, like *A. plana*, lacks ventral streaks of black on abdominal segments 8-10, but *A. munda* almost always has 5 postquadrangular cells (Fig. 101), while *A. plana* usually has 4 (as in Fig. 100). In Arizona and western New Mexico, male *A. plana* are violaceous, those of *A. nahuana* and *A. extranea* are blue. The black humeral stripe is usually forked in *A. nahuana*, *A. hinei*, and *A. fumipennis violacea*, but not so in *A. plana*.

Females of these species approach one another more closely and may be difficult to distinguish in the field. Examination of the mesostigmal lobes will distinguish them.

Types.—The holotype of *A. vivida* var. *plana* was described from the Sierra de las Aguas, Escondidas, Guerrero, Mexico, and is in the BMNH (Kimmins 1970). In the

MCZ are one ♂ (Mexico: Guerrero: Omilteme), 3 ♂ and 2 ♀ (Arizona: C.U. Lot 35), all of which served in the original description of Calvert (1902a). One of the Arizona males is labeled as a cotype. In 1935, L.K. Gloyd examined these specimens and determined that a pair of the Arizona specimens was actually *A. nahuana*. I also examined the series at the MCZ in 1991 and concur with her opinion. Of *spegazzinii*: holotype ♂ in MNHP (see under Remarks).

Distribution.—Widely distributed from central Arizona, New Mexico, extreme southeastern Colorado (Bick and Hornuff 1974), east through Texas, Missouri, Arkansas, Kansas, Iowa, and north to southeastern South Dakota (Bick *et al.* 1977), south through Mexico into Guatemala (Chimaltenango Dept. 12.0 mi SE of Tecpan, 3♂, 1♀; Solola Dept., Rio Nahulate, 3-6 km S Santa Catarina, 2000 m, 2 ♂, 1♀, all in FSCA). In Arizona, south of the Mogollon Rim, *Argia plana* is one of the most commonly observed damselflies at streams. The farthest western records are in extreme western Yavapai County (Santa Maria River at U.S. Hwy. 93, ♂ ♀ in tandem, RWG). I have seen no records of this species from Mohave, La Paz, or Yuma counties in Arizona, and it is replaced in California by the similar *A. vivida*.

Remarks.—Gloyd (1958) raised *A. vivida* var. *plana* of Calvert to species status based on morphological differences from *A. vivida*. *Argia plana* appears in two color forms. In Arizona and western New Mexico, all males of *A. plana* that I have seen are violaceous. In eastern New Mexico east through western Texas and north into the central Great Plains states, males of *A. plana* are blue like *A. vivida*. Gloyd (1958) cites a combination of blue and violet forms, and specimens with a combination of both colors, from the Big Bend region of Texas. The two color forms probably intergrade somewhere in central New Mexico, but that state has been poorly sampled for its Odonata. I have collected blue *A. plana* as far west as Lincoln Co. (stream at U.S. Hwy. 380 and Rd. B27, E of Capitan, and Rio Hondo at NM Hwy 395, E of Hondo, in RWG). I agree with Gloyd (1958), who states that "... all specimens taken in the region between the Mississippi River and the Rocky Mountains, some of which have been recorded in the literature by various authors as *vivida*, are actually a blue form of *plana*."

As with *Argia mista*, Navás described *A. spegazzinii* from a single male from "San Juan de Sentuhuacán" [probably San Juan Teotihuacan], Mexico. M.J. Westfall examined the type and concluded it to be conspecific with *A. plana*. Until there is evidence to the contrary, I am considering *A. spegazzinii* a junior synonym of *A. plana*.

Argia rhoadsi Calvert, 1902
Fig. 7-app, 41-mp

Argia rhoadsi Calvert, 1902a:92

Diagnosis.—The distinctively shaped epiproct, large, transverse tori, and unbranched paraproct (Fig. 7) easily distinguish males of this tropical species from all others in our area.

Females are easily identified by the large, foliate mesostigmal lobes, each of which is transversely wider than the distance separating them (Fig. 41). Unique to *A. rhoadsi* is the shallow mesepisternal pit immediately posterior to each mesostigmal lobe. Each pit has a swollen area encircling the depression, but this condition is not nearly as demarcated as in females of *A. emma* (Fig. 38) and *A. munda* (Fig. 39).

In the field, both sexes of *A. rhoadsi* are identified by the slightly amber coloration of the wings.

Type.—Holotype ♂ in BMNH (Kimmins 1970).

Distribution.—*Argia rhoadsi* is an eastern Mexican species which has been collected only in extreme southern Texas in Cameron County (Johnson 1972b). It has been collected in the Mexican states of Nuevo Leon (Calvert 1902a), Tamaulipas, San Luis Potosi, Hidalgo, Puebla, and Veracruz (E. González, pers. comm., and several records from L.K. Gloyd's notes).

Argia sabino Garrison, n. sp.

Fig. 27-app, 60-mp, 102-abd segment 2 of holo-and paratypes, 117-body of holotype, 118-thx of paratype ♂, 119-body of allotype

Holotype male.—(Fig. 117) Labium pale violet gray, remainder of face violaceous with following areas dark: narrow transverse stripe on vertex behind lateral ocelli, with median extension surrounding anterior ocellus, a small lateral offshoot from median ocellus, narrow mediodistal projection extending posteriorly, and spot at posterodistal part of occiput (Fig. 117); antennae black, rear of head largely pale with smudge of black laterad to occipital foramen; narrow black line bordering large postocular spot not visible in dorsal view.

Prothorax violaceous, black above with following areas pale: medial part of frontal lobe, large dorsolateral spot on middle lobe (Fig. 117), small dorsal spot and lateral 0.30 of posterior lobe. Pale areas of synthorax (Fig. 117) violaceous, paler lateroventrally with following areas black: middorsal stripe about as wide as pale antehumeral stripe, all of mesostigmal plates except for lateralmost part; black outlining antealar crest isolating small pale spot immediately posterior to crest, continuing along subalar carina as shown in Fig. 117; humeral stripe twice as wide on ventral 0.50, an isolated remnant of posterior fork of humeral stripe on upper part of mesepimeron, narrow third lateral stripe dusted with pruinosity, narrow smudge of brown at lateroposterior corner of metepimeron. Wings with venation black, pterostigma dark brown, surmounting 1 1/2 cells in all wings; postquadrangular cells: FW 4/5, HW 4/4, M_2 originating at 8/8, HW 7/7. coxae and trochanters pale except for black on dorsum of trochanters; femora black superiorly, pale ventrally; tibiae black on inner surface and along exterior side; remainder pale; tarsi and armature black.

Abdomen (Fig. 117) violaceous, segment 1 pale; segment 2 with black dorsolateral stripe extending to 0.75 of segment, expanding dorsolaterally but not connecting above (Fig. 102a), annulus black, its ventral margin forming a prominent angulation at distal 0.20; segment 3 with distal band of black connecting above, occupying distal 0.25 of segment, an incomplete, narrow, pale band between larger black one and black annulus; segment 4 similar to segment 3, but black slightly more extensive, and pale distal band reduced to small lateral spot; segments 5-6 like segment 4, but black occupying distal 0.30 of segment 5, distal 0.50 of segment 6, no remnant of pale distal band present on these segments; segment 7 mostly black, except for pale basal ring, slightly elongated middorsally; segment 8 pale except for dark posteroventral spot; segments 9, 10, and appendages pale.

Torifer (Fig. 27c) triangular, marked with black medially, torus about 3x as long transversely as high, confined to ventral part of torifer, epiproct prominent, with a median ridge, about as wide as each torus when viewed dorsoposteriorly (Fig. 27a). Cercus (Fig. 27) a little longer than wide, with a singly prominent ventral tooth, mesal margin gently convex in dorsomedial view (Fig. 27a) in lateral view (Fig. 27b), cercus acuminate distally, distal tooth visible; paraproct (Fig. 27a,b)

broadly triangular, slightly longer than cercus, bilobed, anterior lobe bluntly pointed, about twice as large as ventral branch.

Penis (paratypes) with fourth segment trowel-like, narrowed at middle 0.50, a small, slightly chitinized spine on ventral side at base.

Allotype female. (Fig. 119) Head similar to male but with pale areas tan. Pro- and synthorax as for male, but pale areas tan, becoming lighter ventrally; isolated posterior arm of black humeral stripe smaller than in male, a dusting of white pruinosity on lateroventral margin of metepimeron and metasternum. Wings with venation black, pterostigma brown, surmounting 1 1/2 cells in all wings, postquadrangular cells: FW 4/4, HW 3/3; M_2 originating at or near 8/8 in fore wings, HW at or near 7/7.

Abdomen (Fig. 119) tan, with more extensive black markings than in male, as follows: segment 2 with complete dorsolateral black stripe, expanding at distal 0.25, their ends not touching dorsally; segment 3 like segment 2, but these stripes incomplete at basal 0.10, and connecting dorsally at distal 0.15, a small ventrolateral, irregular black spot touching dorsolateral stripe at distal 0.15 of segment, annulus black; segments 4-6 similar to segment 3, but with black becoming more extensive, increasingly reducing size of pale posteroventral spot; segment 7 with dorsolateral stripe incomplete at basal 0.10, a similar ventrolateral spot paralleling dorsolateral stripe with area between becoming darkened; segment 8 pale except for small posterolateral spot; segments 9-10 and cerci pale; ovipositor not surpassing distal margin of segment 10. Mesostigmal plates of paratype (Fig. 60) with raised lamellae, the width of each plate about as great as distance between them.

Holotype male.—U.S.A. Arizona: Pima Co.: Upper Sabino Canyon, about 3 mi N of visitor center, NE of Tucson, 22 Sept. 1988 (R.W. and J.A. Garrison). Allotype female: Sabino Canyon, 7 Sept. 1961 (T.W. Donnelly). Both in USNM.

Etymology.—Named for Sabino Canyon, Arizona.

Remarks.—All but two male paratypes are from the type locality, collected at various stations along Sabino Creek over several years. Much variability is expressed in the forked humeral stripe. The posterior branch ranges from well developed (Fig. 118) to a well defined, isolated streak (Fig. 117, holotype), to a considerably reduced isolated stripe (as in Fig. 119). All specimens that I have examined have vestiges of the posterior branch. The genital lobe of *A. sabino*, though prominent, varies from convexly angulate (Fig. 102a, b) to gently curved (Fig. 102c).

Two paratype males from Jalisco, Mexico, differ from those from Sabino Canyon in being blue instead of violaceous. In dorsal view, the cerci are not as close together as for those from Arizona, but I believe the two males, despite the 1500 km distance from the type locality, fall within the variation expressed by this species.

Female thoracic markings show similar variation to that of males.

Paratype measurements: Males (N = 21): HW 21-26 mm, abdomen 26-32 mm, postnodal crossveins (FW/HW) 14-18/12-15; origin of M_2 6-8/6-7; postquadrangular cells 4-5/3-4. Females (N = 6): HW 22-25 mm, abdomen 27-30 mm; postnodal crossveins 12-16/12-16; origin of M_2 6-8/5-7; postquadrangular cells 4-5/3-4.

Diagnosis.—*Argia sabino* appear to be morphologically distinguishable from its nearest ally, *A. tarascana*, only by the characters stated in Key M-5, couplet 6. The close approximation of the cerci in *A. sabino* (Fig. 27c) is also manifested by the correspondingly close approximation of the mesostigmal plates (Fig. 60). In *A. tarascana*, the cerci (Fig. 26c) and mesostigmal plates (Fig. 44) are farther apart.

The relationship between *A. sabino* and *A. tarascana* is unclear. The latter species

is found from southwesternmost Arizona into most of Mexico and Central America. It is variable in thoracic markings. Most specimens that I have examined have a forked humeral stripe, or vestiges of the posterior branch. Others, including the holotype (Fig. 120), have no trace of a posterior branch. All *A. tarascana* that I have seen are blue. I have no evidence that both species are sympatric throughout their ranges, though in the United States, they are separated by less than 200 miles. I recognize *A. sabino* as a distinct species because a parallel occurrence in morphology of appendages occurs with two other closely related species in Mexico. One of them, *A. fissa* Selys, originally described from Colombia, consists of males with approximate cerci and nearly approximate, transverse tori. The other species is undescribed but occurs abundantly from Costa Rica well into northern Mexico. The condition of the cerci mirrors that of *A. tarascana*, with both the tori and cerci more widely separated, exposing the epiproct. Further comments on the variability of *A. tarascana* are given under that species.

Males of *A. sabino* and *A. tarascana* may be confused with *A. pima* and *A. lacrimans* (a species not found in the United States), but the morphology of the caudal appendages will separate the two groups as given under the diagnosis of *A. pima*. The genital lobe of the former two species is always prominent and may either be angulate or convexly curved. The latter two species have a genital lobe that is only slightly convex or linear.

Biology.—The two males from Jalisco were taken on a "rocky stream in rocky hills." Enrique González and I collected *A. sabino* on large boulders near the stream's edge in Upper Sabino Canyon in September 1988. Despite an intensive search, we were unable to find pairs in tandem or females. Other species of *Argia* found at the type locality are listed under *A. pima*. In August 1992 I returned to Sabino Canyon in the hopes of finding more females. However, only one male *A. sabino* was found in the morning hours along the trail leading from the road.

As with many Odonata from the southwestern United States, *A. sabino* may occur in numbers one year and be rare in other years. This sporadic occurrence is probably tied to earlier conditions of precipitation which, in the Southwest, can fluctuate widely from year to year. Although *A. sabino* is known primarily in the United States from Sabino Canyon, I collected a male from nearby Molino Basin Forest Camp east of Sabino Canyon. Further collecting in the Santa Catalina and nearby mountain ranges will probably show *A. sabino* to be more widespread.

Collection dates range from 24 July to 20 September.

Additional material examined (46♂, 7♀ paratypes): U.S.A., Arizona: Pima Co.: Sabino Canyon, 7 mi NE of Tucson, 18 Sept. 1954, T.W. Donnelly, 1♂ (TWD); 20 Sept. 1955, 1♂, 1♀ (not in copula) (TWD); 6♂, 2♀ (TWD, RWG), same data as holotype, R.W. and J.A. Garrison and E. González, 30♂ (RWG, IBUNAM, USNM, BMNH, FSCA, UMMZ, SWD, TWD, RN); same data as holotype but 23 Sept. 1989, J.J. Daigle, 1♂, 1♀ (JJD); same data as holotype but 5 August 1992, R.W. Garrison, 1♂; Molino Basin Forest Camp, Santa Catalina Mtns., 24 July 1984, R.W. and J.A. Garrison, 1♂; MEXICO: Jalisco: rocky stream in rocky hills, Rte. 41 [at] K 7-8, N of Guadalajara, ca. 4900 ft., 4 Aug. 1966, R. Cruden, 2♂ (UMMZ, RWG).

Argia sedula (Hagen, 1861)
Fig. 19-app, 42-mp, 91-mp, lateral view

Agrion sedulum Hagen 1861:94
Argia sedula, Selys 1865:411 (39 separate)

Diagnosis.—Males of this distinctive species possess elongate cerci (Fig. 19), because of which it may be confused with *A. alberta* (Fig. 18), but the two species are easily distinguished in Key M-4.

The combination of amber-colored wings and strongly erect mesostigmal lobe (Fig. 42), which is almost perpendicular to the mesepisternum (Fig. 91) will generally serve to distinguish females of *A. sedula*.

Argia sedula is sexually dimorphic. In males, the middorsal and humeral bands are broad (similar to Fig. 75, but upper end of humeral stripe not branched); female thoracic pattern is similar to that of *A. apicalis* (Fig. 71), but the mesostigmal lobes and area immediately behind these plates are black. In contrast to the well-marked blue and black male, the female is generally pale tan with some degree of darkening on abdominal segments 2-8, but some females from xeric areas in the Southwest have an almost immaculate abdomen. Some females collected in Florida are largely dark across the medial half of the mesepisternum (there is a pale area on each side of the middorsal carina), and the anterior half of the mesepimeron, and the dorsal abdominal segments may also be largely black.

Types.—Lectotype ♂ by present designation: "Virginia/ Berkeley Springs/ O. Sacken", "40. *A. sedula* ♂ / à renvoyer", "Hagen [printed]", MCZ 12201. There is also a paralectotype male with the following data: "Acq8", "Pecos River/ Texas", "41 *A. sedula* ♂?/ Texas/ à renvoyer", "Hagen [printed]". Both in MCZ.

Distribution.—Occurs from southern Ontario (Walker 1953), southern Michigan and Pennsylvania, south through Florida and west through Texas, Oklahoma, Kansas, Colorado, Wyoming, Nevada, and xeric areas of southern California. It is widely distributed in Mexico, occurring in Sonora, Chihuahua, Durango, Coahuila, Nuevo Leon, and Tamaulipas states south through Veracruz and Puebla states in the east (E. González, D. Paulson, pers. comm.).

Argia tarascana Calvert, 1902
Fig. 25-26-app, 44-45-mp, 92-mp, lateral view, 120 - body of holotype

Argia tarascana Calvert 1902a:90

Diagnosis.—This species is similar to *A. pima* and especially to *A. sabino*, and is diagnosed under those two species.

Types.—Holotype ♂ (Fig. 25, 120) in BMNH. The posterior abdominal segments of the holotype have been compressed laterally so that the right side of the paraproct is overlain by the right cercus and torus (Fig. 25c).

Remarks.—This species is subject to variation in extent of black on the thorax and abdomen. As stated under *A. sabino*, considerable variation exists in the condition of the black humeral stripe. It is forked in many specimens, or the posterior branch may be vestigial or entirely absent. The upper end of the humeral stripe may also be abruptly narrowed above the basal 0.25, or it may irregularly narrow above, before expanding slightly again at the base of the wing. I have seen specimens (Arizona, Cochise Co.) with the entire dorsum of abdominal segment 7 black, except for the basal 0.10, while others (e.g., Mexico, Morelos state) have a narrow

black lateral stripe on the apical 0.50 of that segment. As with *A. sabino*, the prominent genital lobe may be convexly angulate or convexly curved.

Two males from Mexico (Durango state: Arroyo Temazcal, Reserva de la Biosfera La Michilia) differ from typical *A. tarascana* in that the cerci are closer together when viewed dorsally. Although this condition is reminiscent of *A. sabino*, there is still a decided difference in this character in the two species.

I have seen no females from the United States, but all that I have examined from Mexico have a non-bifurcate humeral stripe, a condition also noted by Calvert (1902a).

Distribution.—Known in the United States only from Cochise County, Arizona (Westfall 1990). It is widely distributed in Mexico, where it has been taken in Durango, Zacatecas, Jalisco, Guanajuato, Hidalgo, Michoacan, Morelos, Veracruz, Guerrero, and Oaxaca states (Calvert 1902a, E. González, pers. comm.).

Argia tezpi Calvert, 1902

Fig. 20-app, 58-mp, 94-mp, lateral view, 82-abd seg 5-10

Argia cupraea, Calvert 1895:479
Argia tezpi Calvert 1902a:77

Diagnosis.—This dark species may be confused with males of *A. translata* and *A. cuprea*, but the shape of the epiproct (Fig. 20c) is unique. The outer branch of the cercus is about 3-4 times as wide as the mesal branch. The cercus of *A. translata* (Fig. 28c) is unbranched, and that of *A. cuprea* (Fig. 1c) is divided into two equal branches.

Females are likely to be confused with *A. translata*, but the morphology of the mesostigmal lobe and mesepisternal tubercle (Fig. 94) distinguishes them. Compared with *A. translata* (Fig. 93), the mesostigmal lobe of *A. tezpi* is deflected posteriorly, and the prominent mesepisternal tubercle is almost as high as the mesostigmal lobe. In *A. translata*, the tubercle is low and does not extend as high as the erect mesostigmal lobe. *Argia tezpi* may be confused with *A. cuprea*, and both species are diagnosed under the latter species.

In the field, *A. tezpi* is easily distinguished from all other similar species by the slight infumation in the wings: *A. translata* and *A. cuprea* have hyaline wings.

Types.—The lectotype ♂ of *A. tezpi* is in the CAS as reported by Calvert (1947): "The type of *tezpi* (C.A.S. No. 5597) was specified in the Introduction to the same Biologia volume, p. xxix, as San José del Cabo, coll. Acad. Sci., and with a lectallotype (C.A.S. No. 5598) is included in the second group . . . ." Leonora K. Gloyd examined the lectotype in December, 1945.

Remarks.—Calvert (1902a) remarked that the slight metallic reflection present on the thorax and abdomen led originally (Calvert 1895) to ascribe specimens from Baja California to *A. cuprea*. I have noticed slight hints of metallic coloration along the dark thoracic stripe, but this condition is not the brilliant metallic copper found in *A. cuprea* and *A. oenea*.

Distribution.—*Argia tezpi* is a neotropical species which has been taken in the United States at two localities: southeastern Arizona (Cochise Co., Southwest Research Station, 5 mi W of Portal, 18-21 June 1956, M.J. Westfall, in FSCA), and southern New Mexico (Hidalgo Co., stream 18 mi S of Rodeo, 6 June 1966, C. Johnson, in FSCA). Clifford Johnson had also sent to L.K. Gloyd just before she died (June 1993) some specimens collected at a rocky stream near Silver City, Grant Co., New Mexico, which she identified as *A. tezpi*. Unfortunately, the specimens were not returned to Johnson before Gloyd's death, and the specimens have not been

available for study. *Argia tezpi* is abundant throughout Baja California Sur and occurs in Sinaloa, Nayarit, Jalisco, Michoacan states in Mexico south through Oaxaca and Chiapas states, into Guatemala, Honduras, Nicaragua, and Costa Rica. As Calvert (1907) noted, it appears to replace *A. translata* along the Pacific side of Mexico.

Argia tibialis (Rambur, 1842)

Fig. 5-app, 46-mp

Platycnemis tibialis Rambur 1842:241
Trichocnemys tibialis, Selys 1857:464
Argia tibialis, Selys 1865:413 (41 separate)
Agrion fontium Hagen 1861:91
Agrion binotatum Walsh 1862:387

Diagnosis.—The unusual morphology of the cercus (Fig. 5a) will easily distinguish *A. tibialis* from all other congeners.

In contrast to the intricately shaped cerci of the male, a mesostigmal lobe is lacking in the female (Fig. 46), but the broadly triangular area between the diverging arms of the middorsal carina is unique: all other species have this triangular area less extensive.

Types.—Of *tibialis*: holotype ♀ presumably in IRSN; of *fontium*: 3♂, 2♀ syntypes as follows: ♂: "Virginia/ Berkeley Springs/ O. Sacken", "Agr fontium/ Hag.", "Hagen [printed]"; ♂, 2♀: "Florida/ O. Sacken/ March 1854", "Hagen [printed]"; ♂: "Georgia Abbot/ Escher Zollickofer", "A. blandum/ nobis." Only the Virginia ♂ possesses a red MCZ type label (# 12203), but I am sure that the other 2♂, 2♀ are also part of the syntype series; of *binotatum*: lost.

Remarks.—According to Dunkle (1990), females from Florida occur in two color forms, one brown, the other blue. The latter is figured in his work.

Distribution.—Occurring from one locality in southernmost Ontario (Walker 1953) and in the eastern United States from New Jersey, Michigan, Wisconsin and southeastern Minnesota, south through the northern panhandle of Florida and west through eastern Kansas, eastern Oklahoma, and eastern Texas. According to Gloyd's extensive distribution notes, from which the above distribution is abstracted, there is a ♀ in the "Austrian National Museum [NHMV?] labeled from Colorado. The specimen may be mislabeled as to locality, or it may be a stray. *Argia tibialis* has not been taken in Mexico.

Argia tonto Calvert, 1902

Fig. 22-app, 65-mp, 77-male thx, 89-abd seg 8-10, 104-abd segment 2

Argia tonto Calvert 1902a:89

Diagnosis.—Thoracic design of the male (Fig. 77), morphology of the cercus (Fig. 22a), and limited distribution in the United States (Arizona, southwestern New Mexico) serve to distinguish this large species. The paraproct (Fig. 22b) is divided and the upper branch is digit-shaped, much as that of *A. pima* (Fig. 23d); however, the inner branch of the cercus is subequal to or longer and more prominent than the external branch. In *A. pima*, the inner branch of the cercus is more decumbent, so that the external branch appears longer (Fig. 23a).

Females are distinguished by the broad, expansive mesostigmal lobes (Fig. 65).

These structures are separated by an interval greater than the transverse width of a single lobe. The distance between these lobes is less than the width of a mesostigmal lobe in *A. pima* (Fig. 63).

In the field, males of *A. tonto* are easily recognized by their large size (HW 26-28 mm), possession of 5-6 postquadrangular cells in the fore wing, and 4-5 in the hind wing, by the hairlike black middorsal black stripe on the thorax (Fig. 77), and overall violaceous color. Within its range, *A. pallens* has a similar thoracic pattern, but is smaller (HW 19-22 mm), possesses 4 postquadrangular cells in the fore wing and 3 in the hind wing, and in life is reddish-violet. *Argia tonto* seems to prefer wooded streams in mountains or foothills, while *A. pallens* seems to prefer more open desert streams. I have not collected both species together.

Females of *A. tonto* have a wider middorsal thoracic stripe than the males and, in the field, they may be mistaken for females of *A. plana*. Besides the size difference between the two species (*A. tonto* HW 26-30 mm, 5, rarely 6, postquadrangular cells in fore wing; *A. plana* HW 22-26 mm, 4 postquadrangular cells in fore wing), in *A. plana* the dorsum of abdominal segments 8 and 9 is almost always unmarked; in *A. tonto*, a pair of small dorsolateral spots is present at the base of each segment (Fig. 89).

Types.—The holotype ♂ is in the ANSP.

Distribution.—Another tropical species occurring in the United States only in central and southeastern Arizona and southwestern New Mexico. In Mexico, it has been collected as far east as Nuevo Leon (Villa de Santiago, Hd. Vista, 17 June 1940, H. Hoogstraal, 1♂, 1♀, UMMZ, Chihuahua, Durango, and Morelos states (Calvert 1902a, E. González, pers. comm.). According to notes by L.K. Gloyd, M.J. Westfall sent to her a male from the MCZ labeled from Port-au-Prince, Hayti, collected by William Mann. Her notes indicate that the specimen is very likely mislabeled as to locality. To date, no species of *Argia* are known from the Greater Antilles.

Argia translata Hagen in Selys, 1865

Fig. 28-app, 67 mp, 93-mp, lateral view, 99-mp, dorsolateral view, 107-rear margin of ♀ prothx

Argia translata Hagen in Selys, 1865:410 (38 separate)
Argia espinalensis Navás, 1935:36, NEW SYNONYMY

Diagnosis.—Males of this predominantly dark-colored species may be confused with *A. tezpi*, but are diagnosed under that species.

Females may be confused with *A. tezpi* and *A. cuprea*, and are diagnosed under those species.

Types.—Of *translata*: syntype ♂: "P[uerto] Cabello", "Hagen [printed]", MCZ 12199. The syntype lacks the last 7 abdominal segments. At least one other male and a female with the same data were available to Hagen at the time of the original description, but I cannot find those specimens. Pending their discovery, and due to the missing abdominal appendages, I am refraining from designating the syntype as lectotype. Of *espinalensis*: holotype ♂: "Espinal/ (Colombia)/ VII·18" [white label, handwritten in ink in Navás' hand], "*Argia / espinalensis* Nav. [written by Navás] / det. Navás S.J. [printed, all on pale blue label", "Typus [written on pink label]", in FSCA. The holotype is lacking the right hind wing and the last 6 abdominal segments.

Distribution.—*Argia translata* occurs from southern Canada (Walker 1953) and southern New York in Broome Co. (Donnelly 1992) south through northern

Georgia (Madison Co., 1.8 mi S Carlton, S Fork of Broad River, 14 July 1954, W.H. Cross, 1 ♀ (FSCA), and west to Missouri, Oklahoma, Texas, New Mexico (Eddy Co., Pecos River at Carlsbad, 30 July 1984, 5 ♂, RWG, Arizona (Yavapai Co., Oak Creek at Cornville, 3500 ft., 4 Sept. 1983, 1 ♂, 1 ♀ in tandem, S.W. Dunkle, ex SWD in RWG; Maricopa Co., Cave Creek at end of Ocotillo Rd., Cave Creek, 4 Aug. 1992, RWG, 3 ♂, 1 ♀ (1 pr. in tandem), RWG, Pima Co., Sabino Canyon, N of Tucson, 5 Aug. 1992, R.W. Garrison, 1 ♂, RWG. Pritchard (1982) figures it from Florida, but I have seen no records nor is it listed from that state by Johnson and Westfall (1970). The species occurs abundantly along the eastern part of Mexico through Central America and into South America east through Surinam (several specimens examined by L.K. Gloyd from J. Belle collection) and south through northern Peru (Depto. Tumbes, Rio Tumbes, 9-11 August, several specimens in USNM and RWG, and Depto. San Martin, Prov. Lamas, Sivia, Rio Apurime, 760 m, 10-21 June 1941, several specimens, F. Woytkowski, all in UMMZ).

Argia translata has the widest distribution of any congener, occurring from New York and southern Ontario, Canada (42°03'N and 42°24'N, respectively) south through northern (about 3°30'S) and northcentral Peru (about 6°S). It can be an abundant species in the eastern United States, eastern Mexico, and Venezuela, and western Ecuador (D. Paulson, pers. comm., 15 Sept. 1994) but its occurrence in the western United States (Arizona) is irregular.

Remarks.—This species is subject to a great amount of ontogenetic change. Males usually have the middorsal thoracic stripe covering the medial half or more of each mesepisternum. Occasional specimens may have the entire sclerite black so that there is no pale line separating this area from the forked humeral stripe. The latter stripe may be forked near the base or form a broad, continuous stripe encircling a pale spot at the upper humeral suture (similar to Fig. 75). Other males are entirely dark to the obsolete midlateral suture except for a narrow pale stripe at outer 0.80 of mesepisternum. Abdominal markings on segments 8-10 are also variable. Some have dorsal and lateral pale markings on these segments, and others have a pale area united to the basal 0.50 of segment 9.

Females have less extreme markings than the males. The humeral stripe is usually forked at the base with the thicker branch extending diagonally upward toward the wing base. Abdominal segments 8-10 are often marked as in Fig. 90; others have their pale lateral areas almost obliterated with black.

Navás (1935) described *Argia espinalensis* from one male collected at Espinal, Colombia, in August, 1918. In June, 1935, L.K. Gloyd carefully compared the holotype with examples of *A. translata* from Mariquita, Colombia, and concluded that they were the same. At the time of her examination, the all-important caudal appendages were present, allowing her positive identification of *A. espinalensis*. I have examined the holotype, which now lacks the last 6 abdominal segments, and can see no appreciable differences between the head and body pattern for *A. translata*. The head and thorax are crushed, but the markings are clearly visible.

Argia vivida Hagen in Selys, 1865

Fig. 29-app, 61-mp, 78-prothorax, 84, 88-abdomen, 108-thx, 109-penes

Argia vivida Hagen in Selys 1865:406 (34 separate)
Argia kurilis Hagen in Selys 1865:400 (28 separate)

Diagnosis.—Both sexes of this species are most similar to the allopatric *A. plana* and are diagnosed under that species. Further comments on *A. vivida* and Mexican

A. extranea appear under the latter species.

Types.—Holotype ♂: "Cala. [printed]", "California/ Cap. St. Lucas/ Xanthus 1860", "28. *A. vivida*/ ♂ / à renvoyer". MCZ 12190. There is a female ("July 5", "Pecos River/ Texas", "24. *A vivida*/ ♀ / à renvoyer", "= *immunda*") which Hagen (1865) referred to *A. vivida* with doubt. This female was determined by L.K. Gloyd in 1935 to be *A. immunda*. I accept the statement by Hagen (1865:407 [35 reprint]): "Le mâle type, du Cap Saint-Lucas Californie [now Baja California], par Xanthus. . ." as holotype designation. Of *kurilis*: Holotype ♀: "kurilische Id.", "Mus. Petrog", "17. *A. kurilis*/ ♀ / à renvoyer", MCZ 12184. Both in MCZ.

Distribution.—Occurring from southeast British Colombia and southwest Alberta southeast through southwestern South Dakota (Bick *et al.* 1977), south through northwestern New Mexico (San Juan, Sierra, Taos counties, specimens in FSCA and CSU), and northern Arizona (Apache Co., Lukachukai, 7 July 1972, O. Franke, M. Cazier, ASU and RWG; Coconino Co., Havasu Creek at Havasupai Campground and Moenave, J.M. Davidson, M. Cazier, all from specimens in ASU and RWG; Grand Canyon, Bright Angel Trail, 3500 ft., 12 July (no year), several specimens in USNM and ANSP), west into California and south through Baja California. In her unpublished notes, Gloyd lists a ♂ from Grant County, New Mexico (Gallinas Cyn, Gila Nat'l. Forest, 8 July 1978, FSCA), which places this species in an area where it would probably occur with violaceous populations of *A. plana*. Reexamination of this specimen is necessary to confirm its identity. The southeastern most distribution in California, according to Gloyd's unpublished records, are a male and two females collected 1 mi. W. of Parker Dam, Riverside Co., 23 Feb. 1951, C. McNeill and P. Adams (Univ. Calif. Berkeley collection). It is apparently absent along coastal Washington west of the Cascades (D. Paulson, pers. comm. 15 Sept. 1994). As stated under *A. extranea*, *A. vivida* has thus far not been taken in mainland Mexico.

Specimens from the midwestern United States (e.g., Williamson 1932) identified as *A. vivida* are misidentifications of blue forms of *A. plana* (Gloyd 1958).

Remarks.—This is another widely distributed far western species which is subject to individual and geographic variation. The humeral stripe in males from the United States lacks a posterior fork, and the upper 0.25 to 0.30 of the humeral stripe is abruptly narrowed to a fine line (Fig. 108d), is vestigial (Fig. 108c), or gradually narrows until just before the wing base (Fig. 108e). The humeral stripe of specimens from Baja California Sur (Loreto) commonly has a posterior branch (Fig. 108f, g), a condition also noted by Calvert (1895). Presumably, this change to the forked condition is clinal, but more material from Baja California Norte is needed to confirm this possibility. I also illustrate two males of *A. vivida* from Banff, Alberta, kindly supplied to me by A.E. Pritchard, one of which has a well-developed posterior fork (Fig. 108a), and another with an isolated posterior branch (Fig. 108b). The forked condition appears to be common in individuals from southern Canada. Isolated anterolateral black streaks are always present on abdominal segments 3-6 (Fig. 84), but some individuals have these streaks connecting to the posterior black on segment 6. One male from Banff, Alberta, has the streaks connecting with the posterior black on all abdominal segments.

Kennedy (1919b), in his illustrations of the penes of *Argia*, illustrates (Fig. 850-851) a specimen from Colorado under the manuscript name "*A. melita*." which he was apparently planning to describe but never did. In Gloyd's locality notes, she noted two phenotypes of *A. vivida* based on morphology of the penis. The typical form has a blunt apical lobe (Fig. 109a) and is characteristic of specimens from

Washington, Oregon, California west of the Sierra Nevada and Baja California. According to her notes, all males of *A. vivida* east of this region which she examined have a penis as shown in Fig 109c and 109d, and these correspond to Kennedy's "*A. melita.*" Some specimens from the intervening area (e.g., Nevada Co., Donner Camp Picnic Area of Prosser Creek Reservoir, off Calif. Hwy. 89, 5700 ft.) have a slight elongation of the apical lobe (Fig. 109b), and a specimen from Inyo Co. (slough at gravel quarry, end of Five Bridges Rd., 3 mi N of Bishop) shows marked attenuation of this structure (Fig. 109c). Finally, a specimen from Nevada (Elko Co., small stream 3 mi S of Wild Horse Reservoir, by Nevada Hwy 43, 6000 ft) has an elongate tip similar to that shown for Fig. 109d. Thus, my examination of several specimens of male *A. vivida* corroborates the existence of two forms as indicated by Gloyd in her unpublished notes. Gloyd did not assume the existence of two sibling species, nor do I think that specimens east of the Sierra Nevada should be named, due to evidence of intergradation in some areas of the Sierra Nevada. Specimens from Washington and Oregon should be examined for similar evidence of intergradation.

The penis of *A. plana* (Fig. 110) lacks a flagellar tip characteristic of the eastern specimens of *A. vivida* (Fig. 109c, d). As stated under *A. plana*, this species and *A. vivida* appear to be allopatric. Though closely related, they differ in appendage and penis morphology. Far western *A. vivida* from southern California are separated from the nearest western populations of *A. plana* by the Colorado Desert. Both of these have a similar penis morphology (Fig. 109a, b, and 110). There could be parapatry or sympatry between the two species in central Arizona, northern New Mexico, and along the easternmost range of *A. vivida* (where these individuals may come into contact with blue forms of *A. plana*). The dissimilar penis morphology between these forms (Fig. 109c, d, and 110) suggests a possible isolating mechanism, but a further analysis of their distributions will be needed to support this hypothesis.

Although the name *Argia kurilis* has page priority to *A. vivida*, I agree with Gloyd (1941), who chose the latter name to represent this common species.

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This paper would not have been possible without the help of the late Mrs. Leonora K. Gloyd. I owe special appreciation and gratitude to her. She guided me through the intricacies of this large and most difficult genus. Her letters are full of replies to the seemingly endless barrage of questions I asked her over the years. I regret that she was not able to realize her life-long dream of monographing this genus. But she had over the last 60 or so years accumulated much statistical and locality information on almost all described species. These copious notes, graciously loaned me by Mark O'Brien of the University of Michigan after Mrs. Gloyd's death in 1993, facilitated the completion of this paper. I hope that this paper fulfills part of her dream.

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REFERENCES CITED

Bick, G.H. 1978. New state records of United States Odonata. Notul. Odonatol. 1(2):17-19.

Bick, G.H. and L.E. Hornuff. 1974. New records of Odonata from Montana and Colorado. Proc. Entomol. Soc. Washington. 76(1):90-93.

Bick, G.H., and J.C. Bick. 1957. The Odonata of Oklahoma. Southw. Naturalist. 2(1):1-18.

Bick, G.H., J.C. Bick and L.E. Hornuff. 1977. An annotated list of the Odonata of the Dakotas. Florida Entomol. 60(3):149-166.

Burmeister, H.C.C. 1839. Handbuch der Entomologie. 2(2), 2. Neuroptera, Berlin, Enslin. 757-1050.

Calvert, P.P. 1893. Catalogue of the Odonata (dragonflies) of the vicinity of Philadelphia, with an introduction to the study of this group of insects. Trans. Am. Entomol. Soc. 20(3):152a-272.

Calvert, P.P. 1895. The Odonata of Baja California, Mexico. Proc. Cal. Acad. Sci. Ser. 2. Vol 4:463-558.

Calvert, P.P. 1899. Odonata from Tepic, Mexico, with supplementary notes on those of Baja California. Proc. Calif. Acad. Sci. Zool. 1:371-418.

Calvert, P.P. 1901. Odonata, in Biologia Centrali Americana: Insecta Neuroptera. R.H. Porter & Dulau Co., London. pp. 17-72.

Calvert, P.P. 1902a. Odonata, in Biologia Centrali Americana: Insecta Neuroptera. R.H. Porter & Dulau Co., London. pp. 73-128.

Calvert, P.P. 1902b. Illustrations of Odonata:—*Argia* by Hermann A. Hagen. With a list and bibliography of the species by Philip P. Calvert. Bull. Mus. Comp. Zool. Harvard. 39(4):103-120.

Calvert, P.P. 1907. Odonata, in Biologia Centrali Americana: Insecta Neuroptera. R.H. Porter & Dulau Co., London. pp. 309-404.

Calvert, P.P. 1947. The Odonate collections of the California Academy of Sciences from Baja, California and Tepic, Mexico, of 1889-1894. Proc. Cal. Acad. Sci. (Fourth Series). 23(41):603-609.

Dunkle, S.W. 1990. Damselflies of Florida, Bermuda and the Bahamas. Scientific Publishers, Gainesville. ix + 148 pp.

Evans, M.A. 1988. Checklist of the Odonata of Colorado. Great Basin Natur. 48(1):96-101.

Flint, O.S., Jr. 1991. The Odonata collection of the National Museum of Natural History, Washington, U.S.A. Adv. Odonatol. 5:49-58.

Flint, O.S., Jr. 1993. A short trip to Texas. Argia, the news journal of the Dragonfly Society of America. 5(1): 16-17.

Fraser, F.C. 1946. Notes on Amazonian Odonata in the Leeds Museum. Trans. R. Entomol. Soc. Lond. 96(2): 11-46.

Garman, P. 1917. The Zygoptera, or damselflies, of Illinois. Bull. Ill. St. Lab. Nat. Hist. 12(4): 411-587.

Gloyd, L.K. 1932. Four new dragonfly records for the United States. (Odonata). Entomol. News. 43(7): 189-190.

Gloyd, L.K. 1958. The dragonfly fauna of the Big Bend region of Trans-Pecos, Texas. Occ. Pap. Mus. Zool. Univ. Mich. 593: 1-23.

Gloyd, L.K. 1968a. The synonymy of *Diargia* and *Hyponeura* with the genus *Argia* (Odonata: Agrionidae: Argiinae). Mich. Entomol. 1(8): 271-274.

Gloyd, L.K. 1968b. The union of *Argia fumipennis* (Burmeister, 1839) with *Argia violacea* (Hagen, 1861), and the recognition of three subspecies (Odonata). Occ. Pap. Mus. Zool. Univ. Mich. 658: 1-6.

González-Soriano, E., and R. Novelo-Gutierrez. 1991. Odonata de la Reserva de la Biosfera de la Michilia, Durango, Mexico. Parte I. Imagos. Folia Entomol. Mex. 81: 67-105.

Hagen, H. 1861. A synopsis of the Neuroptera of North America. Smiths. Inst. Misc. Coll., Washington. 347 pp.

Hämäläinen, M. 1982. The identity of *Argia saalasi* Valle, 1942 (Zygoptera: Coenagrionidae). Notul. Odonatol. 1(10): 163.

Huggins, D.G. 1978. Additional records of Kansas Odonata. Tech. Publ. State Biol. Survey Kans. 6: 1-35.

Huggins, D.G., P.M. Liechti and D.W. Roubik. 1976. Species accounts for certain aquatic macroinvertebrates from Kansas (Odonata, Hemiptera, Coleoptera and Sphaeriidae). IN New records of the Fauna and Flora of Kansas for 1975, J. Caldwell ed. Tech. Publ. State Biol. Survey Kansas. 1: 13-77.

Johnson, C. 1972a. An analysis of geographical variation in the damselfly, *Argia apicalis*. (Zygoptera: Coenagrionidae). Canad. Entomol. 104: 1515-1527.

Johnson, C. 1972b. The damselflies (Zygoptera) of Texas. Bull. Fla. State Mus. Biol. Sci. 16(2): 55-128.

Johnson, C. 1973. Ovarian development and age recognition in the damselfly, *Argia moesta* (Hagen, 1961)(Zygoptera: Coenagrionidae). Odonatologica. 2(2): 69-81.

Johnson, C. with M.J. Westfall, Jr. 1970. Diagnostic keys and notes on the damselflies (Zygoptera) of Florida. Bull. Fla. State Mus. Biol. Sci. 15(2):45-89.

Kellicott, D.S. 1899. The Odonata of Ohio. A descriptive catalogue of the dragonflies known in Ohio with keys for their determination. Odonata. Ohio State Acad. Sci. Special Papers. No. 2, 114 pp.

Kennedy, C.H. 1915. Notes on the life history and ecology of the dragonflies (Odonata) of Washington and Oregon. Proc. U.S. Nat. Mus. 49: 259-345.

Kennedy, C.H. 1917. Notes on the life history and ecology of the dragonflies (Odonata) of Central California and Nevada. Proc. U.S. Nat. Mus. 52: 483-635.

Kennedy, C.H. 1918. New species of Odonata from the southwestern United States. Part I. Three new argias. Canad. Entomol. 50(7): 256-261.

Kennedy, C.H. 1919a. A new species of *Argia*. (Odonata). Canad. Entomol. 51: 17-18.

Kennedy, C.H. 1919b. The phylogeny of the Zygoptera. Cornell University, Ithaca. 295 pp. (Thesis).

Kiauta, B. and M.A.J.E. Kiauta. 1980. Introduction to the cytotaxonomy of the odonate genus *Argia* Rambur (Zygoptera: Coenagrionidae). Odonatologica. 9(1): 35:5-6.

Kimmins, D.E. 1970. A list of the type-specimens of Odonata in the British Museum (Natural History) Part III. Bull. Brit. Mus. (Nat. Hist.). 24(6): 171-205.

La Rivers, I. 1940. A preliminary synopsis of the dragonflies of Nevada. Pan-Pac. Entomol. 16(3): 111-123.

Muttkowski, R.A. 1908. Review of the dragonflies of Wisconsin. Bull. Wis. Nat. Hist. Soc. 6(1-2): 57-123.

Muttkowski, R.A. 1910. Catalogue of the Odonata of North America. Bull. Mus. Milwaukee. 1:1-207.

Navás, R.P.L. 1934. Insectos de Méjico. Bol. Soc. Entomol. España. 16(4/6):68-75.

Navás, R.P.L. 1935. Odonatos de Colombia. Bol. Soc. Entomol. España. 17:33-38.

Needham, J.G. 1903. Aquatic insects in New York State. Part 3. Life histolries of Odonata suborder Zygoptera. N.Y. State Mus. Bull. pp. 218-279.

Needham, J.G. with H.B. Heywood. 1929. A handbook of the dragonflies of North America. Charles C. Thomas Pub., Springfield. viii + 372 pp.

Paulson, D.R. and R.W. Garrison. 1977. A list and new distributional records of Pacific Coast Odonata. Pan-Pac. Entomol. 53(2):147-160.

Pritchard, A.E. and R.F. Smith. 1956. Odonata, pp. 106-153. IN: R.L. Usinger (ed.). Aquatic insects of California. Univ. Calif. Press, Berkeley. 508 pp.

Pritchard, G. 1982. Life-history strategies in dragonflies and the colonization of North America by the genus *Argia* (Odonata: Coenagrionidae). Adv. Odonatol. 1:227-241.

Provonsha, A.V. and W.P. McCafferty. 1977. Odonata from Hot Brook, South Dakota with notes on their distribution patterns. Entomol. News. 88(1-2):23-28.

Rambur, P. 1842. Histoire Naturelle des insectes: Neuropteres. Libraire Encyclopedique de Roret, Paris. xvii + 534 pp.

Roemhild, G. 1975. The damselflies (Zygoptera) of Montana. Montana Agr. Exp. Sta. Res. Rep. 87:1-53.

Say, T. 1839. Descriptions of new North American neuropterous insects, and observations on some already described. J. Acad. Nat. Sci. Phila. 8:2-41.

Selys, E. M. 1857. Neuroptères de l'Isle de Cuba. IN: Ramon de la Sagra. Histoire physique, politique, et naturelle de l'Île de Cuba. Paris. Animaux articulés. 7:435-473.

Selys, E. M. 1865. Synopsis des Agrionines, 5me légion: Agrion. Bull Acad. Belg. (2) 20:375-417 (1-45 separate)

Valle, K.J. 1942. A small list of Odonata from U.S.A. collected summer 1928 by Mr. Prof. U. Saalas and Mrs. Anna-Liisa Saalas. Soumen Hyonteistieteellinen Aikakauskirja (Ann. Entomol. Fennici). 8(2):163-166.

Valley, S. 1993. Noteworthy records of Oregon Odonata. Argia, the news journal of the Dragonfly Society of America. 5(2):6.

Walker, E.M. 1913. Mutual adaptation of the sexes of *Argia putrida*. Canad. Entomol. 45(9):277-279.

Walker, E.M. 1953. The Odonata of Canada and Alaska. Vol. 1. Univ. of Toronto Press, Toronto. xi+292pp.

Walsh, B.D.. 1862. List of the Pseudoneuroptera of Illinois contained in the cabinet of the writer, with descriptions of over forty new species, and notes on their structural affinities. Proc. Acad. Nat. Sci. Phila. 14:361-402.

Westfall, M.J., Jr. 1990. Descriptions of larvae of *Argia munda* Calvert, *A. plana* Calvert, *A. tarascana* Calvert, and *A. tonto* Calvert (Zygoptera: Coenagrionidae). Odonatologica. 19(1):61-70.

Williamson, E.B. 1900. The dragonflies of Indiana. 24th Ann. Rep. Dep. Geol. Nat. Resources Indiana. 229-333, 1003-1011.

Williamson, E.B. 1932. Dragonflies collected in Missouri. Occ. Pap. Mus. Zool. Univ. Mich. 240:1-40.

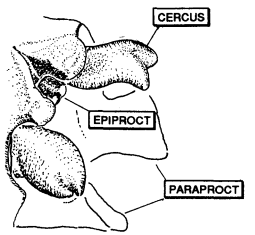
Williamson. E.B. 1912. The dragonfly *Argia moesta* and a new species (Odonata). Entomol. News. 23(5):196-203.

Table 1. Field characteristics separating males of six similar species of *Argia*.

Species	Pale Body Coloration (♂)	Humeral Stripe Forked? (♂, ♀)	Postquadrangular Cells, FW (♂, ♀)
agrioides	blue	usually	4f.
violacea	violet	usually (Fig. 74)	usually 4
hinei	violet	usually	4
leonorae	blue	yes (Fig. 111)	3
nahuana	blue	usually	4
pallens	reddish-violet	no	4

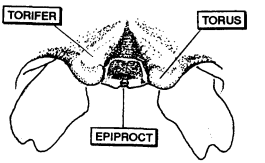
Table 2. Geographic affinities among males of six similar species of *Argia*.

Species	Distribution	*violacea*	*hinei*	*leonora*	*enahuana*	*pallens*
agrioides	OR, CA, Baja Calif.	sympatric only in AZ	sympatric only in AZ	allopatric	sympatric CA, OR	sympatric only in AZ
f. *violacea*	central U.S. to AZ, E to FL, central Mexico	—	sympatric only in AZ	sympatric? only in TX	sympatric only in AZ	sympatric only in AZ
hinei	AZ, CA, Sonora		—	allopatric	sympatric only in AZ	sympatric only in AZ
leonorae	TX, Nuevo Leon, Mexico			—	sympatric only in TX	allopatric
pallens	AZ S to Guatemala				—	sypatric only in AZ

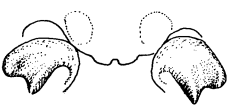


a. dorsomedial view

b. lateral view



c. dorsal view

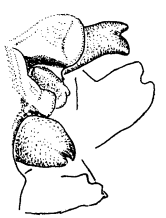


d. posterior view

1 mm

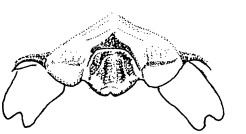
Figs. 1-67

1. cuprea
TEX.: Uvalde Co.



a. dorsomedial view

b. lateral view

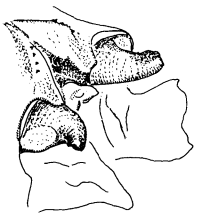


c. dorsal view

d. posterior view

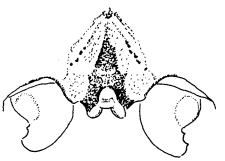
2. oenea
ARIZ.: Maricopa Co.

FIGURES 1-2. Male caudal appendages. Note: Most figures show four views as follows: a, dorsomedial view; b, lateral view; c, dorsal view; d, posterior view.



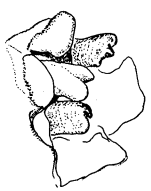
a. dorsomedial view

b. lateral view



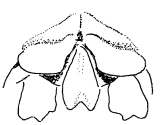
c. dorsal view

3. emma
CALIF.: Stanislaus Co.



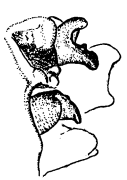
a. dorsomedial view

b. lateral view



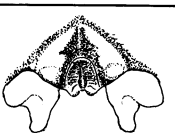
c. dorsal view

4. bipunctulata
ALA.: Blount Co.

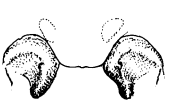


a. dorsomedial view

b. lateral view



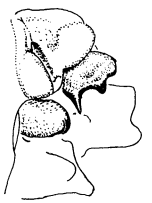
c. dorsal view



d. posterior view

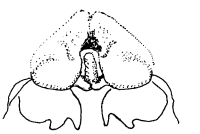
5. tibialis
TEX.: San Jacinto Co.

FIGURES 3-5. Male caudal appendages. See legend for Fig. 1-2 for explanation.



a. dorsomedial view

b. lateral view



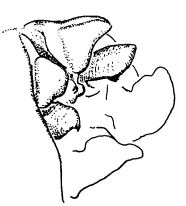
c. dorsal view

6. apicalis
TEX.: Crockett Co.

a.

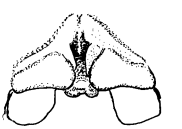
MEX.: Nuevo Leon State

b.

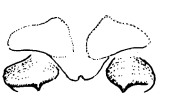


a. dorsomedial view

b. lateral view



c. dorsal view

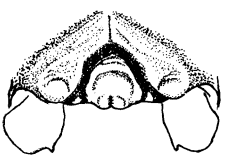


d. posterior view

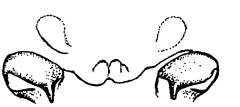
7. rhoadsi
TEX.: Cameron Co.

a. dorsomedial view

b. lateral view



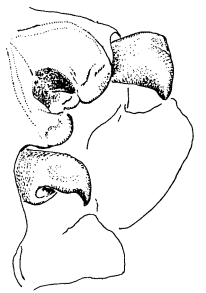
c. dorsal view



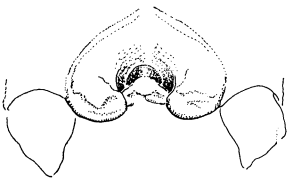
d. posterior view

8. moesta
CALIF.: Riverside Co.

FIGURES 6-8. Male caudal appendages. See legend for Fig. 1-2 for explanation.



a. dorsomedial view



c. dorsal view

9. lugens

ARIZ.: Maricopa Co.

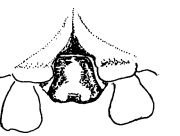
a.

ARIZ.: Cochise Co.

b.

a. dorsomedial view

b. lateral view



c. dorsal view

COSTATE RIDGE

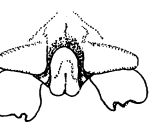
d. posterior view

10. hinei

ARIZ.: Pima Co.

a. dorsomedial view

b. lateral view



c. dorsal view

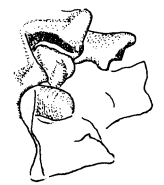
MESOVENTRALLY DIRECTED LOBE

d. posterior view

11. leonorae

HOLOTYPE

FIGURES 9-11. Male caudal appendages. See legend for Fig. 1-2 for explanation.



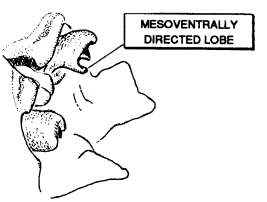
a. dorsomedial view

b. lateral view

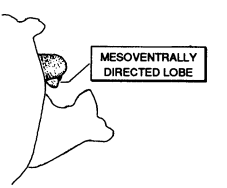
12. agrioides
ARIZ.: Cochise Co.

c. dorsal view

d. posterior view

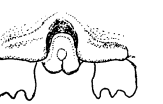


a. dorsomedial view



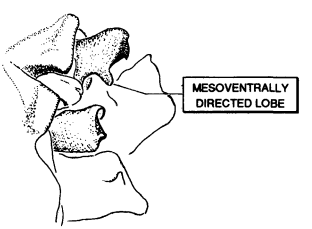
b. lateral view

13. pallens
ARIZ.: Pima Co.



c. dorsal view

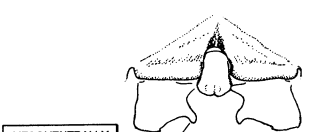
d. posterior view



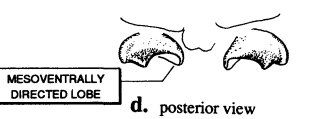
a. dorsomedial view

b. lateral view

14. nahuana
CALIF.: Riverside Co.

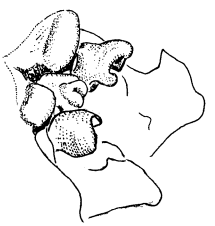


c. dorsal view



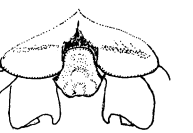
d. posterior view

FIGURES 12-14. Male caudal appendages. See legend for Fig. 1-2 for explanation.



a. dorsomedial view

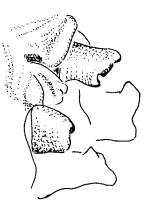
b. lateral view



c. dorsal view

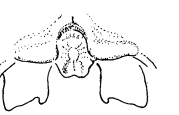
d. posterior view

15. fumipennis violacea
ARIZ.: Cochise Co.



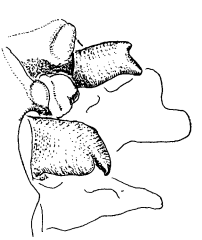
a. dorsomedial view

b. lateral view

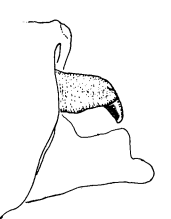


c. dorsal view

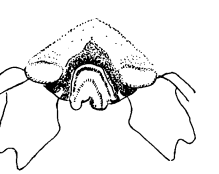
16. fumipennis fumipennis



a. dorsomedial view



b. lateral view



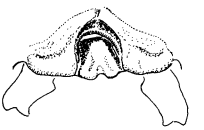
c. dorsal view

17. barretti
TEX.: Kerr Co.

FIGURES 15-17. Male caudal appendages. See legend for Fig. 1-2 for explanation.

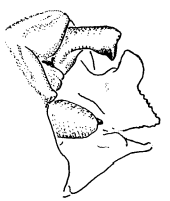
a. dorsomedial view

b. lateral view

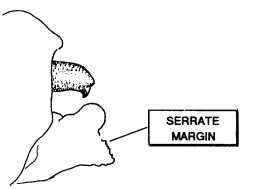


c. dorsal view

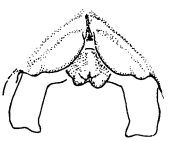
18. alberta
CALIF.: Inyo Co.



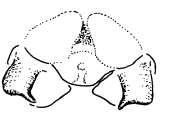
a. dorsomedial view



b. lateral view

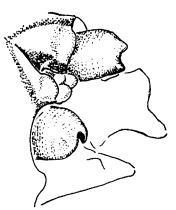


c. dorsal view



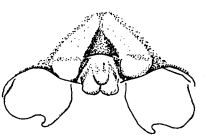
d. posterior view

19. sedula
ARIZ.: Maricopa Co.



a. dorsomedial view

b. lateral view



c. dorsal view

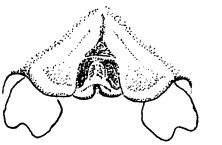
d. posterior view

20. tezpi
MEX.: Morelos State

FIGURES 18-20. Male caudal appendages. See legend for Fig. 1-2 for explanation.

a. dorsomedial view

b. lateral view

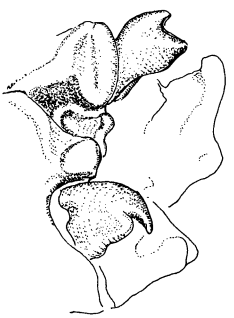


c. dorsal view

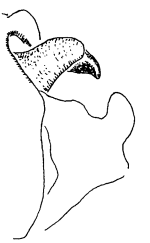
d. posterior view

21. immunda

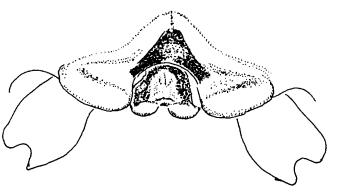
TEX.: Williamson Co.



a. dorsomedial view



b. lateral view



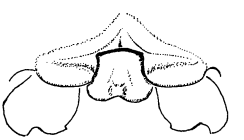
c. dorsal view

22. tonto

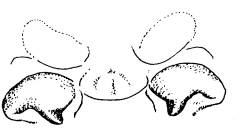
ARIZ.: Coconino Co.

a. dorsomedial view

b. lateral view



c. dorsal view

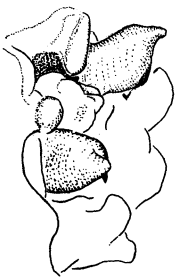


d. posterior view

23. pima

HOLOTYPE

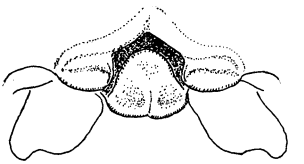
FIGURES 21-23. Male caudal appendages. See legend for Fig. 1-2 for explanation.



a. dorsomedial view

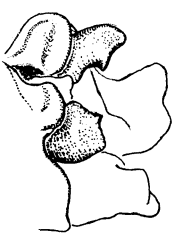
b. lateral view

[24. lacrimans]
MEX.: Morelos State



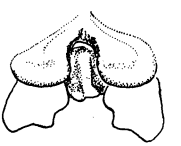
c. dorsal view

d. posterior view



a. dorsomedial view

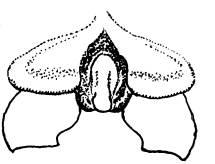
b. lateral view



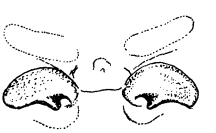
c. dorsal view

25. tarascana
HOLOTYPE

a. dorsomedial view



c. dorsal view



d. posterior view

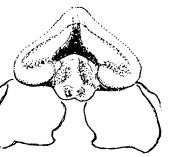
26. tarascana
MEX.: Durango State

FIGURES 24-26. Male caudal appendages. See legend for Fig. 1-2 for explanation.

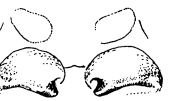
a. dorsomedial view

b. lateral view

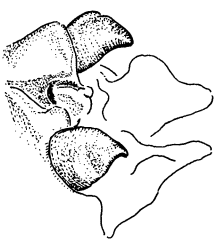
27. sabino
HOLOTYPE



c. dorsal view



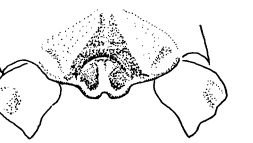
d. posterior view



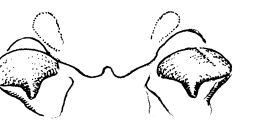
a. dorsomedial view

b. lateral view

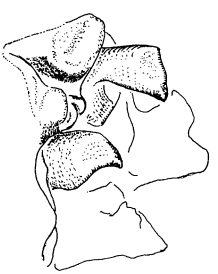
28. translata
ARIZ.: Maricopa Co.



c. dorsal view



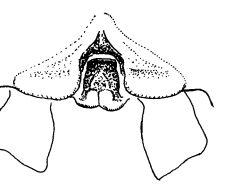
d. posterior view



a. dorsomedial view

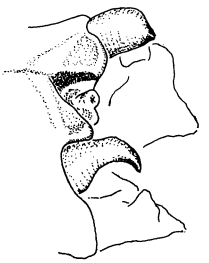
b. lateral view

29. vivida
CALIF.: Riverside Co.



c. dorsal view

FIGURES 27-29. Male caudal appendages. See legend for Fig. 1-2 for explanation.



a. dorsomedial view

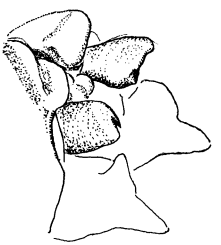
b. lateral view

30. munda

ARIZ.: Pima Co.

c. dorsal view

d. posterior view

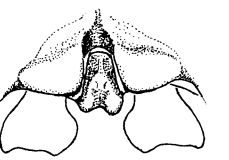


a. dorsomedial view

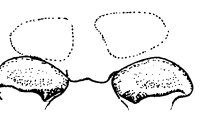
b. lateral view

31. extranea

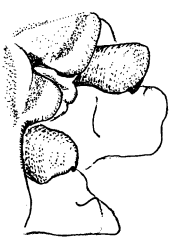
ARIZ.: Pima Co.



c. dorsal view



d. posterior view

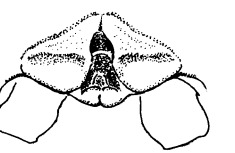


a. dorsomedial view

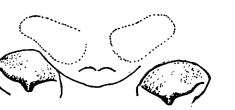
b. lateral view

32. plana (violet form)

ARIZ.: Yavapai Co.

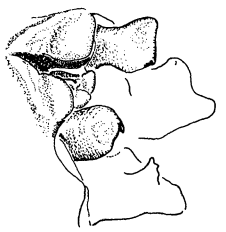


c. dorsal view



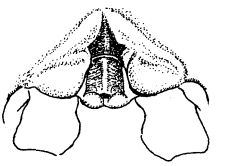
d. posterior view

FIGURES 30-32. Male caudal appendages. See legend for Fig. 1-2 for explanation.



a. dorsomedial view

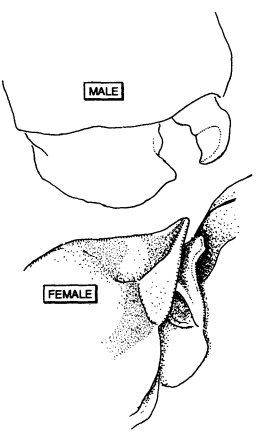
b. lateral view



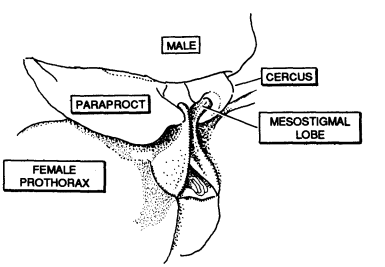
c. dorsal view

d. posterior view

33. plana (blue form)
TEX.: Jeff Davis Co.)

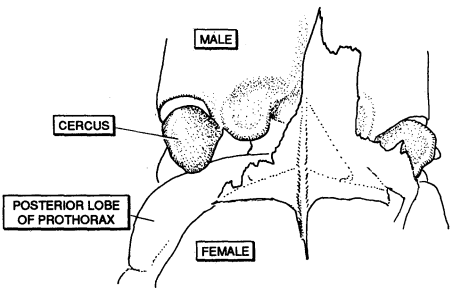


34. lugens
CALIF.: Los Angeles Co.

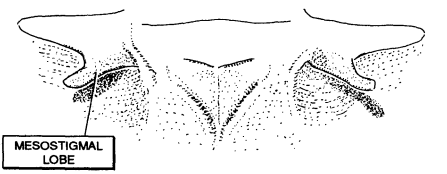


35. lugens
lateral view of preserved pair in tandem (same data as Fig. 34)

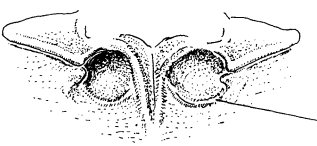
FIGURES 33-35. 33, male caudal appendages. See legend for Fig. 1-2 for explanation, 34, male caudal appendages and female prothorax and base of mesepisternum, lateral view, 35, male caudal appendages and female prothorax and base of mesepisternum, preserved pair in tandem, lateral view.



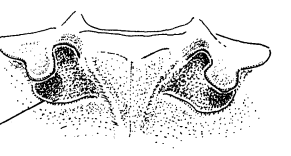
36. lugens
same as Fig. 35, but dorsal view and with most of female mesepisternum removed, showing cerci of male



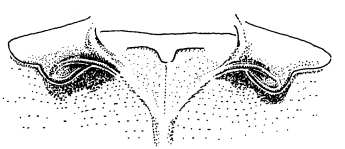
37. lugens
ARIZ.: Maricopa Co.



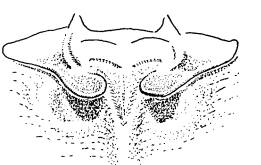
38. emma
IDAHO: Twin Falls Co.



39. munda
ARIZ.: Pima Co.

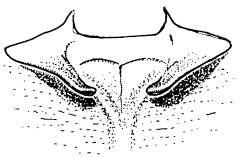


40. moesta
CALIF.: Riverside Co.

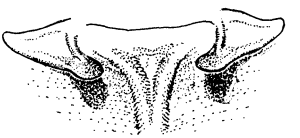


41. rhoadsi
TEX.: Cameron Co.

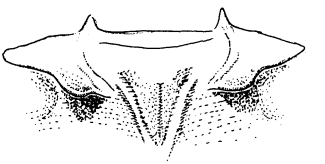
FIGURES 36-41. 36, male caudal appendages and female prothorax and base of mesepisternum, preserved pair in tandem, dorsoposterior view, 37-41, mesostigmal plates of females, dorsal view.



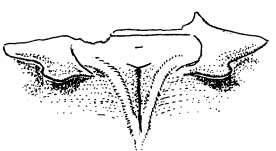
42. sedula
ARIZ.: Maricopa Co.



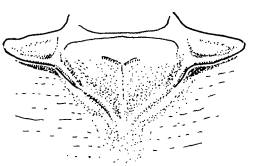
43. fumipennis violacea
ARIZ.: Cochise Co.
(in tandem with male)



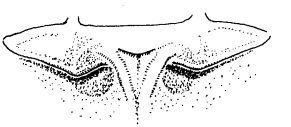
44. tarascana
MEX.: Morelos State



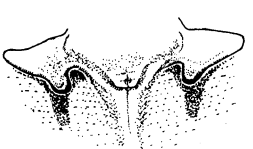
45. tarascana
MEX.: Puebla State



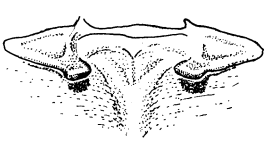
46. tibialis
TEX.: San Jacinto Co.



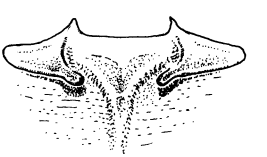
47. apicalis
TEX.: Williamson Co.



48. hinei
ARIZ.: Cochise Co.
(in tandem with male)



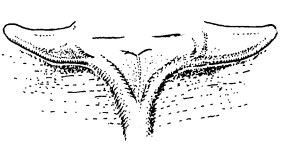
49. pallens
ARIZ.: Maricopa Co.



50. leonorae
ALLOTYPE

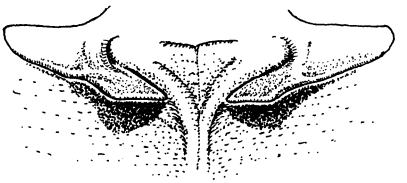
51. bipunctulata
ALA.: Blount Co.

52. alberta
CALIF.: Inyo Co.

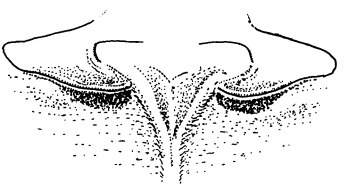


53. immunda
TEX.: Williamson Co.

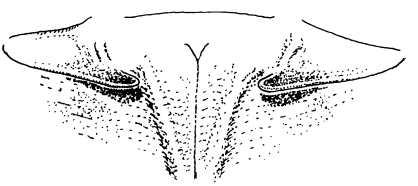
FIGURES 42-53. Mesostigmal plates of females, dorsal view.



54. nahuana
CALIF.: Riverside Co.

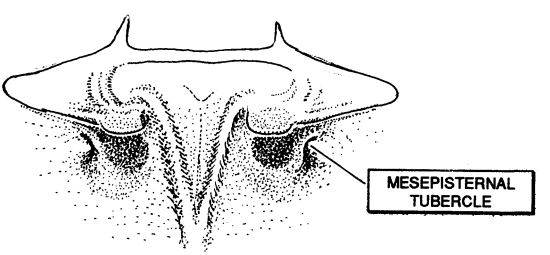


55. extranea
ARIZ.: Pima Co.

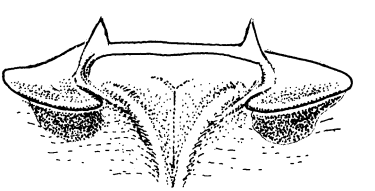


56. barretti
TEX.: Kerr Co.

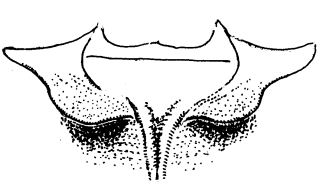
57. agrioides
ARIZ.: Maricopa Co.



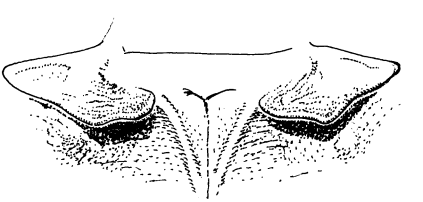
58. tezpi
MEX.: Baja Calif. Sur
(in copula with male)



59. oenea
ARIZ.: Maricopa Co.

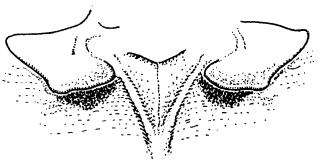


60. sabino
ARIZ.: Pima Co.
(in copula with male)

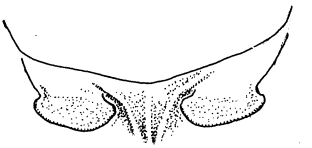


61. vivida
CALIF.: Riverside Co.

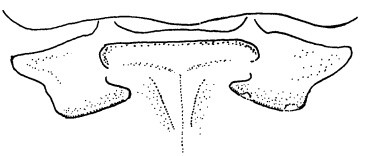
FIGURES 54-61. Mesostigmal plates of females, dorsal view.



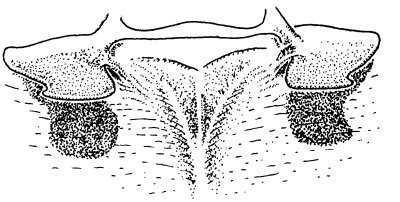
62. plana
ARIZ.: Yavapai Co.



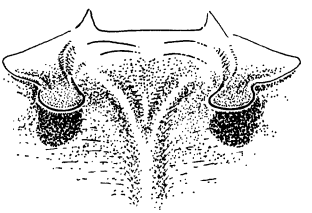
63. pima
ARIZ.: Pima Co.



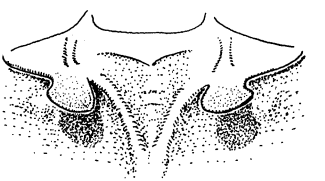
[64. lacrimans]
LECTOTYPE



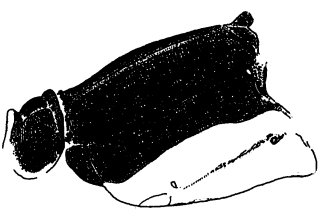
65. tonto
ARIZ.: Gila Co.



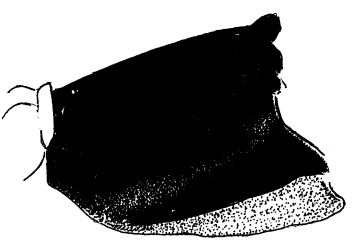
66. cuprea
TEX.: Real Co.



67. translata
ARIZ.: Maricopa Co.



68. cuprea
male, TEX.: Uvalde Co.

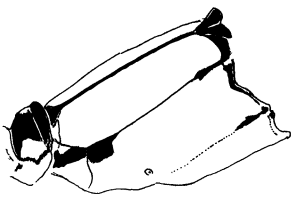


69. lugens
male, CALIF.: Tulare Co.

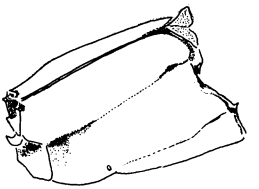
4 mm

Figs. 68-77

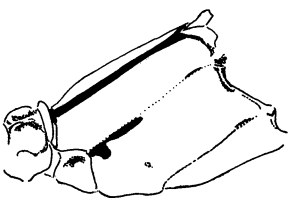
FIGURES 62-69. 62-67, mesostigmal plates of females, dorsal view, 68-69, thorax, laterodorsal view.



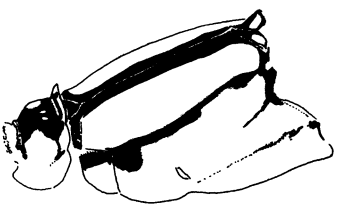
70. apicalis
male, TEX.: Crockett Co.



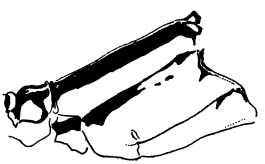
71. apicalis
female, TEX.: Williamson Co.



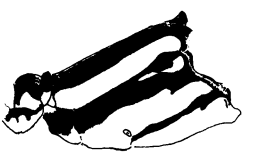
72. emma
male, CALIF.: Stanislaus Co.



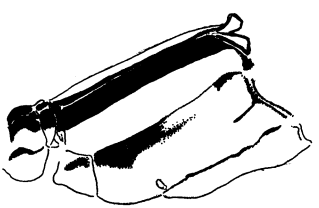
73. barretti
male, TEX.: Kerr Co.



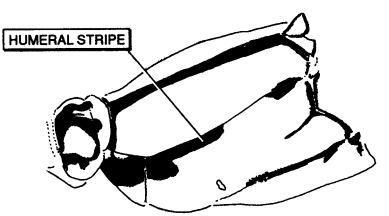
74. fumipennis violacea
male, ARIZ.: Cochise Co.



75. fumipennis atra
male, FLA.: Alachua Co.

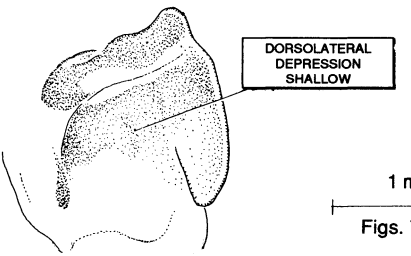


76. immunda
female, TEX.: Real Co.



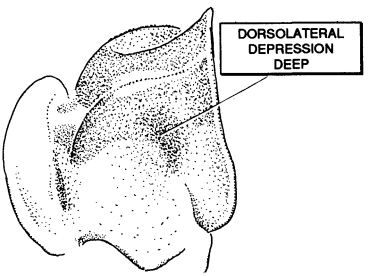
77. tonto
male, ARIZ.: Gila Co.

FIGURES 70-77. Thorax, laterodorsal view.



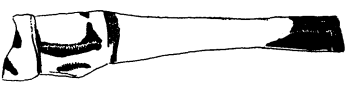
1 mm

Figs. 78-79



78. vivida
female, CALIF.: Riverside Co.
dorsolateral view of prothorax

79. plana
female, TEX.: Jeff Davis Co.
dorsolateral view of prothorax



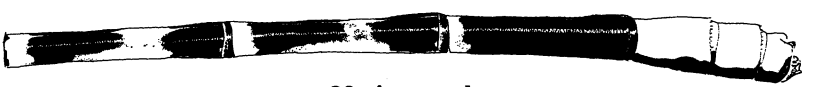
80. cuprea
male, TEX.: Uvalde Co.
dorsolateral view of abdominal
segments 1-3

4 mm

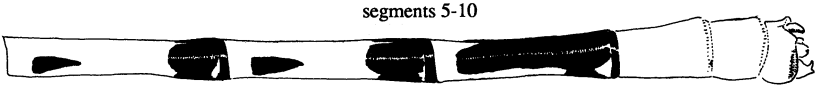
Figs. 80-84

81. oenea
male, ARIZ.: Maricopa Co.
dorsolateral view of abdominal
segments 1-3

82. tezpi
male, MEX.: Baja Calif. Sur
dorsolateral view of abdominal
segments 5-10

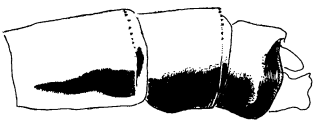


83. immunda
male, TEX.: Real Co.
dorsolateral view of abdominal
segments 5-10

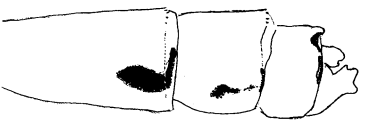


84. vivida
male, CALIF.: Riverside Co.
dorsolateral view of abdominal
segments 5-10

FIGURES 78-84. 78-79, prothorax, laterodorsal view, 80-81, abdominal segments 1-3, dorsolateral view, 82-84, abdominal segments 5-10, dorsolateral view.

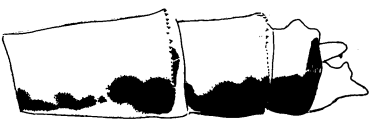


85. fumipennis violacea
male, ARIZ.: Cochise Co.
lateral view of abdominal
segments 8-10

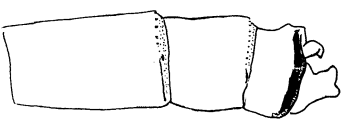


86. hinei
male, ARIZ.: Cochise Co.
lateral view of abdominal
segments 8-10

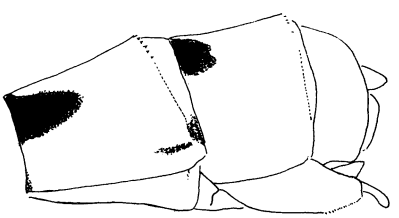
2 mm
Figs. 85-90



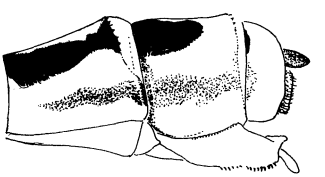
87. extranea
male, ARIZ.: Pima Co.
lateral view of abdominal
segments 8-10



88. vivida
male, CALIF.: Riverside Co.
lateral view of abdominal
segments 8-10



89. tonto
female, ARIZ.: Gila Co.
lateral view of abdominal
segments 8-10



90. cuprea
female, TEX.: Real Co.
lateral view of abdominal
segments 8-10

1 mm
Figs. 91-99

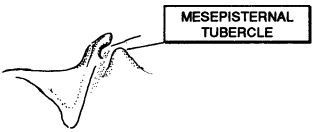
Fig. 91-94: female mesostigmal plate, left lateral view

91. sedula
ARIZ.: Maricopa Co.

92. tarascana
MEX.: Puebla State

FIGURES 85-92. 85-90, abdominal segments 8-10, lateral view, 91-92, female mesostigmal plate, left lateral view.

93. translata
ARIZ.: Maricopa Co.

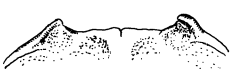


94. tezpi
MEX.: Baja Calif. Sur

Fig. 95-97:
a. female mesostigmal plate, left lateral view

b. female mesostigmal plates, dorsoposterior view

a.



b.

95. hinei
ARIZ.: Cochise Co.

a.

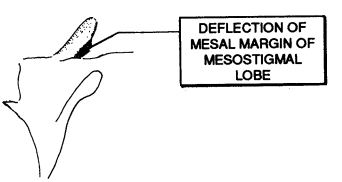
b.

96. fumipennis violacea
ARIZ.: Cochise Co.

a.

b.

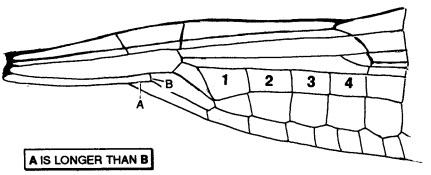
97. pallens
ARIZ.: Maricopa Co.



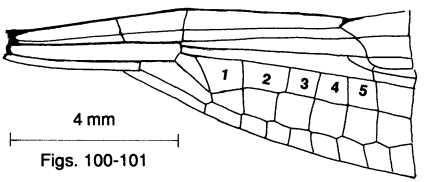
98. cuprea
TEX.: Real Co.

99. translata
ARIZ.: Maricopa Co.

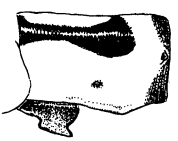
FIGURES 93-99. 93-94 female mesostigmal plate, left lateral view, 95a-97a, female mesostigmal plate, left lateral view, 95b-97b, female mesostigmal plate, dorsoposterior view, 98-99, female mesostigmal plates, oblique left lateral view.



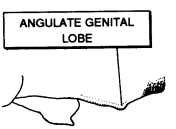
100. vivida
male, CALIF.: Riverside Co.



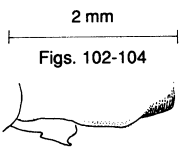
101. munda
ARIZ.: Pima Co.



a. HOLOTYPE

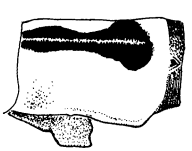


b. PARATYPE
Sabino Cyn.

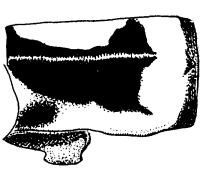


c. PARATYPE
Molino Basin

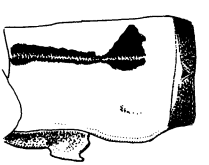
102. sabino (males)



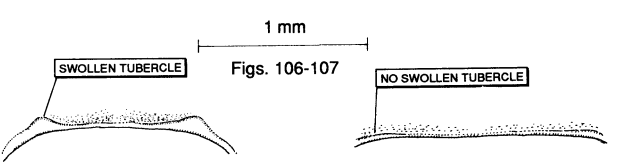
103. tarascana
male, ARIZ.: Cochise Co.



104. tonto
male, ARIZ.: Gila Co.



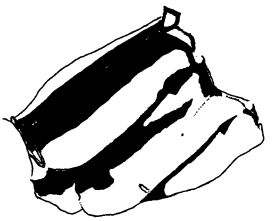
105. pima (PARATYPE)
male, ARIZ.: Yavapai Co.



106. cuprea
female, TEX.: Real Co.

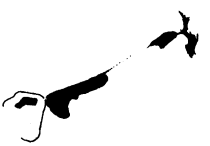
107. translata
TRINIDAD

FIGURES 100-107. 100-101, base of fore wings, 102-105, male abdominal segment 2, 106-107, hind lobe of prothorax, dorsoposterior view.



a. CANADA: Alberta

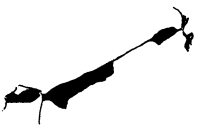
b. CANADA: Alberta



c. CALIF.: Stanislaus Co.

4 mm

Fig. 108



d. UTAH: Uinta Co.

e. UTAH: Uinta Co.

f. BAJA CALIF. SUR

g. BAJA CALIF. SUR

108. vivida (males)

a. CALIF.: Riverside Co.

c. CALIF.: Inyo Co.

1 mm

Figs. 109-110

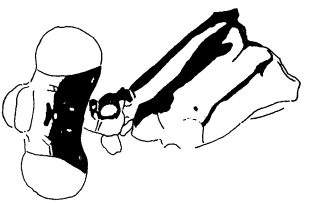
b. CALIF.: Nevada Co.

d. NEV.: Elko Co.

109. vivida (penes, lateral and dorsal views)

FIGURES 108-109. 108, male thorax, dorsolateral view (Figures b-g show dark humeral stripe only), 109, penes, lateral (left figure) and dorsal (right figure) views.

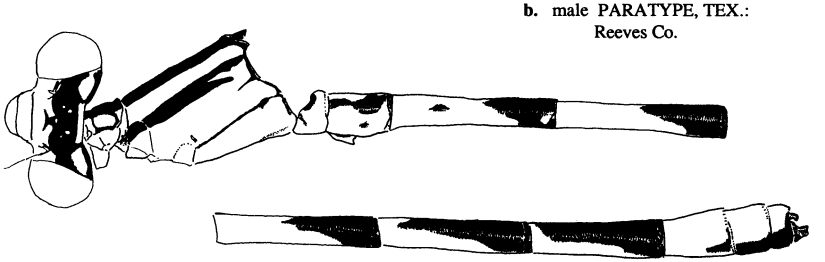
110. plana (penis)
ARIZ.: Maricopa Co.



4 mm

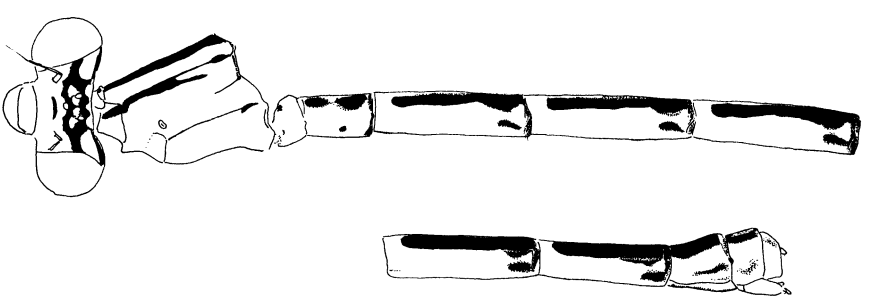
Figs. 110-120

b. male PARATYPE, TEX.: Reeves Co.



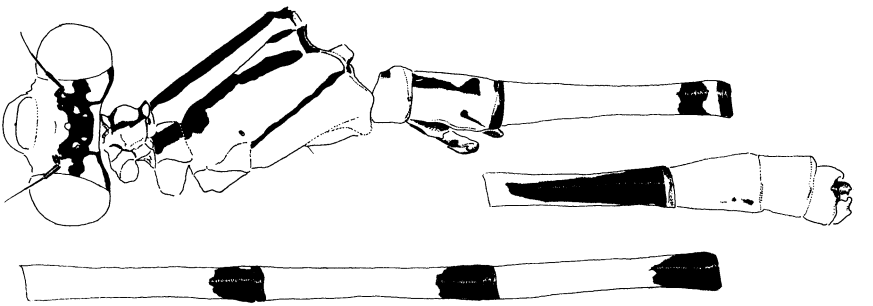
a. male, HOLOTYPE

111. leonorae

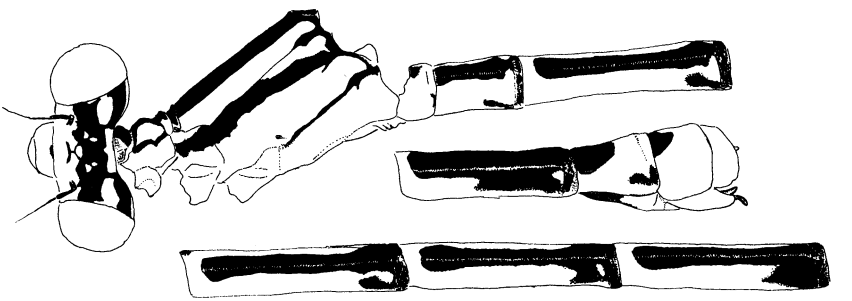


112. leonorae
ALLOTYPE

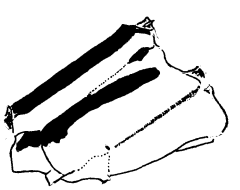
FIGURES 110-112. 110, penis, lateral (left figure) and dorsal (right figure) views, 111-112, body, lateral view.



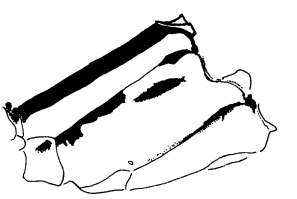
113. pima
HOLOTYPE



a. ALLOTYPE



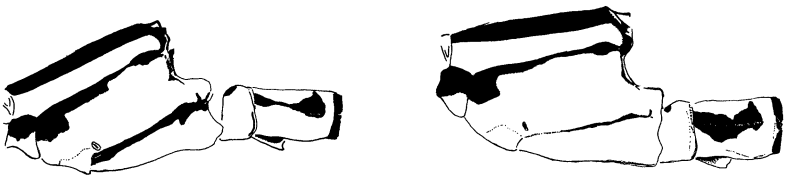
b. female PARATYPE



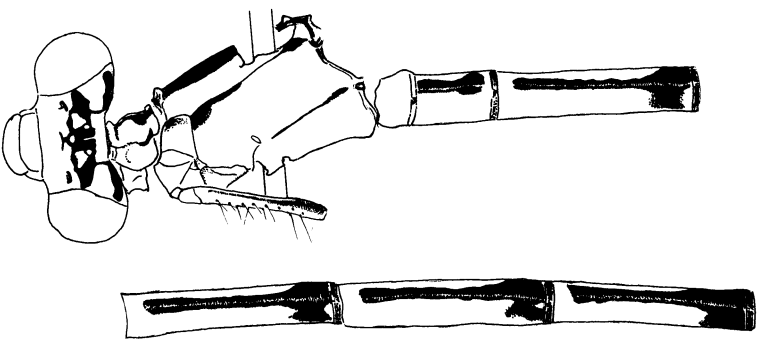
c. female PARATYPE

114. pima

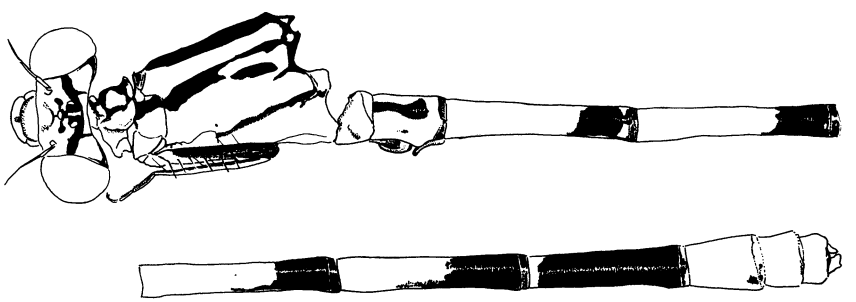
FIGURES 113-114. Body, lateral view. Note: b-c show only synthorax.



a. MEX.: Veracruz State **[115. lacrimans,** males] b. MEX.: Morelos State

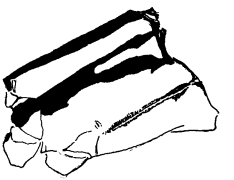


[116. lacrimans,
HOLOTYPE]

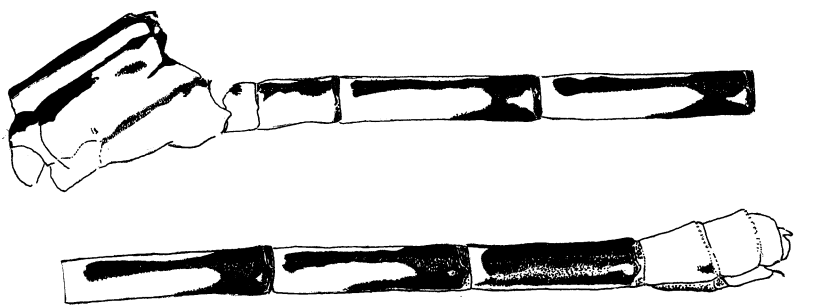


117. sabino
HOLOTYPE

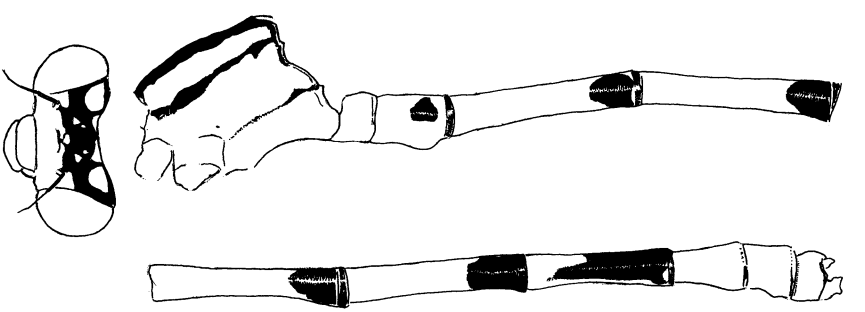
FIGURES 116-117. Body, lateral view. Note: a-b show only synthorax and abdominal segments 1-2.



118. sabino
PARATYPE MALE



119. sabino
ALLOTYPE



120. tarascana
HOLOTYPE

FIGURES 118-120. 118, synthorax, 119-120, body, lateral view.