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THE UNION OF *ARGIA FUMIPENNIS* (BURMEISTER, 1839) WITH *ARGIA VIOLACEA* (HAGEN, 1861), AND THE RECOGNITION OF THREE SUBSPECIES (ODONATA)[1]

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THE IDENTITY OF *Argia fumipennis* (Burmeister), a common species of the southeastern United States, has been based largely on the brown color of the wings. In specimens from the southern part of its range the color is very dark, but northward there is a marked lessening of the brown until the wings are merely smoky and color can no longer serve as a means of distinguishing *fumipennis* from the slightly smoky to clear-winged *Argia violacea* (Hagen) where the ranges of the two meet or overlap. A study of structural characters in more than 2000 specimens has revealed nothing in either males or females by which *fumipennis* and *violacea* can be separated. On this basis they are to be regarded as of the same species, but because of the distributional pattern of each form and the great contrast in wing color, except near the meeting of their ranges, they should be recognized as subspecies. The extent of overlap in North Carolina, a part of the area where the two blend or individuals of each intermingle, is being studied and defined by Mr. R. D. Cuyler who lives where it occurs. However, it is not with these two forms that the present paper is primarily concerned but with one in peninsular Florida that is readily distinguished from the typical *fumipennis* by the abdominal color pattern of the males.

The type of *fumipennis*, a female, described by Burmeister in 1839 from "Kentucki" has yellowish brown wings that are like those of males and females from near the northern limits of the brown-winged form in North Carolina, South Carolina, Georgia, Alabama, Mississippi, and from western Tennessee. It can be assumed, then, that the type and these specimens represent the same species as well as the

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same subspecies even though no more *fumipennis* from Kentucky are known. The males from this area and those with darker wings from the southern parts of these states, from Louisiana east of the Mississippi River, and most of those from Florida west of the Suwannee River, have an abdominal color pattern like that of *violacea* in which most of the dorsum of each of segments 2–6 is violet. A dark-winged male from "l'Amerique septentrionale" described under the name of *obscura* by Rambur in 1842 and synonymized with *fumipennis* by Selys in 1865, p. 403 (reprint p. 31), also has violet dorsal markings on the abdomen and can thus be associated with the form which includes the type female. This specimen, being the first of the opposite sex to be described, is the allotype of *fumipennis*.

If the name *violacea* is retained for the well-known and widely distributed form with clear wings, then the peninsular Florida form, in which the male differs from both *violacea* and typical *fumipennis* in abdominal color pattern, should also be recognized. The three forms of *Argia fumipennis,* accordingly, are: *A. fumipennis fumipennis* (Burmeister), with the wings smoky to dark brown and the dorsum of each of abdominal segments 2–6 in the males mostly violet; *A. fumipennis violacea* (Hagen) (*new status*), with the wings clear to slightly smoky and dorsum of each of abdominal segments 2–6 and sometimes also of 7 mostly violet; and *A. fumipennis atra,* new subspecies described below.

Argia fumipennis atra, new subspecies

DESCRIPTION.—Wings very dark brown. Color pattern: Head and thorax of males and females as in *f. fumipennis* and *f. violacea*. Abdomen: In the male, segment 1 mostly dark brown dorsally and laterally; segment 2 with a pale middorsal hairline (type ♂) or with a slender goblet-shaped dull violet spot that may be fairly distinct or quite obscure; segments 3–7 dark brown or brown-black usually with an indistinct lighter basal ring, and sometimes with the dark area still darker in the apical sixth of segments 3–6; segment 7 all black; segments 8–10 blue on dorsum, black on lower sides from base to apex. In the female, the black or dark brown areas of the abdomen are usually more extensive than in *f. fumipennis* and *f. violacea,* but not sufficiently different or constant to be reliable in distinguishing *f. atra* and *f. fumipennis*. The females of these two subspecies are best identified by association with the males and by the geographical pattern of distribution. However, females of *atra* always have dark brown wings whereas those

of *f. fumipennis* from the northern part of the range have light yellowish brown or smoky wings.

MATERIAL EXAMINED.—Holotype (male) and allotype (female): Enterprise, Volusia Co., Florida, April 26, 1921, J. H. Williamson; in the E. B. Williamson Collection of the Museum of Zoology, University of Michigan.

Paratypes, 438 ♂, 181 ♀, are in private collections and public institutions as indicated in the list below by the following abbreviations: ANSP—Academy of Natural Sciences of Philadelphia; B—George H. Bick; BB—Alice F. and George H. Beatty, III; H—P. D. Harwood; INHS—Illinois Natural History Survey; KU—Kansas University; M—B. E. Montgomery; P—D. R. Paulson; Ris—F. Ris Collection, Senckenberg Museum, Frankfort a. M., Germany; UF—University of Florida; UMMZ—University of Michigan; and USNM—United States National Museum.

All paratypes are from Florida (Fig. 1) and collected in the following counties.—**Alachua:** M (3 ♀), UF (3 ♂, 5 ♀), UMMZ (8 ♂, 2 ♀), USNM (1 ♂). **Charlotte:** P (2 ♂), UMMZ (1 ♂, 3 ♀). **Clay:** P (4 ♂, 2 ♀), UF (6 ♂, 1 ♀), UMMZ (1 ♂). **Columbia-Swannee line:** P (3 ♂). **De Soto:** USNM (1 ♀). **Duval:** INHS (1 ♂). **Glades:** BB (1 ♂), P (1 ♂). **Hamilton:** UMMZ (1 ♂, 1 ♀). **Hardee:** UF (2 ♂). **Hendry:** P (2 ♂, 1 ♀). **Hernando:** UMMZ (1 ♂). **Highlands:** BB (12 ♂, 10 ♀), KU (2 ♂, 2 ♀), P (88 ♂, 34 ♀), UMMZ (3 ♂, 1 ♀). **Hillsborough:** BB (1 ♂), UMMZ (4 ♂, 2 ♀), USNM (2 ♂, 2 ♀). **Lake:** INHS (3 ♂, 1 ♀), P (1 ♂), Ris (2 ♀), UMMZ (1 ♂, 3 ♀). **Lee:** KU (2 ♀), M (1 ♂), P (1 ♂, 1 ♀), Ris (2 ♂), UF (2 ♂), UMMZ (7 ♂, 1 ♀), USNM (2 ♂). **Levy:** ANSP (20 ♂, 12 ♀). **Liberty:** UMMZ (2 ♂). **Manatee:** BB (2 ♂, 1 ♀), UMMZ (1 ♂, 3 ♀). **Marion:** BB (12 ♂, 3 ♀), P (1 ♂, 1 ♀), UF (6 ♂, 2 ♀), UMMZ (6 ♂, 2 ♀). **Martin:** P (2 ♂, 1 ♀). **Nassau:** P (6 ♂, 2 ♀), UF (1 ♂). **Okeechobee:** P (5 ♂, 1 ♀). **Orange:** ANSP (3 ♂), BB (34 ♂, 4 ♀), INHS (1 ♂, 2 ♀), H (2 ♂), UF (16 ♂, 22 ♀). **Osceola:** UF (1 ♂). **Palm Beach:** P (2 ♂, 1 ♀). **Pasco:** UMMZ (1 ♀). **Pinellas:** M (30 ♂), Ris (18 ♂, 13 ♀), UF (10 ♂, 2 ♀), UMMZ (8 ♂, 2 ♀), USNM (4 ♂, 1 ♀). **Polk:** P (1 ♂, 1 ♀), UMMZ (10 ♂, 3 ♀), USNM (7 ♂, 8 ♀). **Putnam:** BB (15 ♂), UMMZ (6 ♂, 2 ♀). **St. Lucie:** P (2 ♂). **Sarasota:** M (2 ♀), UF (3 ♂). **Seminole:** UF (10 ♂, 2 ♀). **Suwannee:** UMMZ (1 ♂). **Volusia:** M (2 ♂), UF (1 ♀), UMMZ (13 ♂, 5 ♀), USNM (2 ♂, 1 ♀). **Marion, Putnam,** or **Volusia?** (Lake George): ANSP (3 ♂).

SEASONAL RANGE.—February 3 to December 26, according to dates of collection for the material studied.

If only a few selected specimens had been studied I might have been tempted to describe *atra* as a distinct species. The brown color pattern appears to be a genetic character that is the same in teneral and fully mature males and not one that changes with age. In some specimens slight differences in anal appendages of the males and in

the mesostigmal laminae of the females were noticed, but they seemed to be individual variations. Perhaps structural differences began to develop when Florida was more or less an aggregate of islands and the population was divided. Then when the sea-water barriers no longer separated them they began to merge into a unit again as the differences were not great enough to prevent interbreeding. The restoration of a land connection between peninsular Florida and the mainland is more recent and this may account in part for the present rather sharp dividing line between the subspecies *fumipennis* and *atra*. This line on the west seems to be the Suwannee River and on the northeast the vicinity of St. Marys River. The only specimens of *atra* (2 ♂) from west of the Suwannee River were taken in Liberty County where the ancient Torreya shrubs grow. A few miles north of this area, all specimens examined (55 ♂, 14 ♀) are typical *f. fumipennis*.

The absence of *atra*, as well as all species of *Argia*, from the southern tip of Florida (Dade, Monroe, Broward, and Collier counties) can be explained by the lack of suitable habitat. Dr. Paulson who has done intensive collecting of Odonata in this area wrote concerning *atra* (*in lit.*, March 5, 1968), "It is so common when you get up into the stream habitats that we can confidently state its absence from the southern tip."

In all of the material of *fumipennis fumipennis* and *f. atra* studied only three males collected by Dr. M. J. Westfall in Nassau County on September 13, 1939, and one male collected by Dr. D. R. Paulson from a small stream south of Folkston in southern Charlton County, Georgia, appear to be intermediates. Another male from Nassau County, taken by Dr. Westfall at the same time and place as the three intermediates and six males from the same county collected by Dr. and Mrs. D. R. Paulson, April 18, 1965, are typical *atra*. Of the four intermediates, all have abdominal segment 7 entirely black and dorsum of 8–10 blue; one male has violet on dorsum of segments 2–3 and a violet basal ring on each of segments 4–6; one male has violet on each of segments 2–4 and a basal violet ring on 3–6; one male has violet on segments 2–5 which is narrowed in proximal half on 4 and on 5 reduced to a narrow ring and middorsal stripe appearing at 2/5 the length of the segment and extending to the apical 6th; and the male from Georgia has a violet goblet-shaped dorsal spot on segment 2, violet on segment 3 to apical 5th, on segment 4 narrowly middorsally to about the apical third (exact termination indistinct), and on 5 only a violet middorsal notch

at base. The dark areas on segments 1 to 6 are dark brown to black.

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LITERATURE CITED

BURMEISTER, HERMANN. 1839. Handbuch der Entomologie. Zweiter Bande, Pp. i–xii, 757–1050. Berlin: Theod. Chr. Friedr. Enslin.

HAGEN, HERMANN. 1861. Synopsis of the Neuroptera of North America. Pp. i–xvii + 1–347. Washington: Smithsonian Institution.

RAMBUR, PIERRE. 1842. Histoire naturel des insectes. Nevropteres, Pp. i–xvii + 1–534. Paris: Libraire Encyclopedique de Roret.

SELYS-LONGCHAMPS, M. EDMOND DE. 1865. Synopsis des Agrionines, 5^{me} légion: Agrion. Bulletins de l'Academie Royale de Belgique, 2^{me} serie, Tome XX, No. 8, Pp. 375–417 (reprint p. 1–45).

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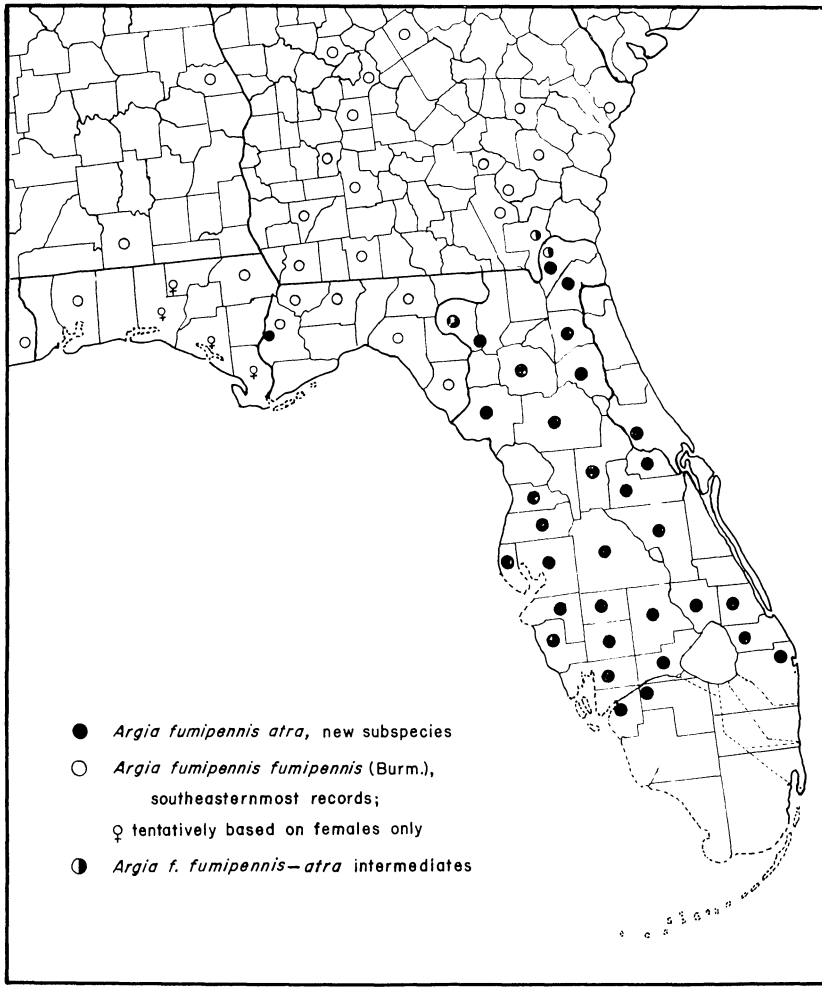

FIG. 1. Map of distributional records by counties in Florida and southern parts of Alabama and Georgia.