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K. J. Tennessen
Wautoma, WI

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K. J. Tennessen
P.O. Box 585
Wautoma, WI 54982

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K. J. Tennessen
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Gynandromorphs in the genera *Ophiogomphus* Selys, 1854 and *Ischnura* Charpentier, 1840 (Odonata: Gomphidae, Coenagrionidae)

K. J. Tennessen
P.O. Box 585
Wautoma, WI 54982

Abstract. A gynandromorph of *Ophiogomphus smithi* Tennessen and Vogt from Wisconsin and a gynandromorph of *Ischnura hastata* (Say) from Alabama are described. The specimens appear to be bilateral in that they display mostly left/right separation of male and female characters.

Introduction

Reports of individual dragonflies having both male and female characteristics are rare, only about two dozen such individuals having been documented (Gloyd 1971, 1975; May 1988). To date, such unusual individuals have been found in only six families of Odonata, namely Calopterygidae, Coenagrionidae, Aeshnidae, Gomphidae, Corduliidae, and Libellulidae; most known specimens are Anisoptera. I have examined two specimens that have a mix of male and female features, a gomphid, *Ophiogomphus smithi* Tennessen and Vogt, and a coenagrionid, *Ischnura hastata* (Say). Following the definition of Gordh and Headrick (2001), that gynandromorphism is the presence of both male and female features in one individual, these two specimens can be considered gynandromorphs. Their main morphological attributes are described below. The specimens are deposited in the Florida State Collection of Arthropods, Gainesville, Florida.

Ophiogomphus smithi is very restricted in geographic distribution, being known only from west-central WI and northeast IA (Tennessen and Vogt 2004). *Ischnura hastata* is one of the smallest odonates in the Western Hemisphere but has a large geographic range, occurring in southern Ontario, the entire eastern U.S., west to Colorado and southern California, the Antilles, Mexico, Central America, and South America (Westfall and May 2006). It also occurs in the Azores, where the population is composed of only females; this is the only known case of parthenogenesis in Odonata (Cordero Rivera et al. 2005).

Gynandromorph of *Ophiogomphus smithi*

COLLECTION DATA: WISCONSIN, Eau Claire County, Eau Claire River, Co. Rd. D, 16 June 1994, leg K. J. Tennessen.

HEAD. On the right side of the occiput, there is an acute anterior horn and a blunt posterior horn, normal for females of this species (Tennessen and Vogt 2004), but on the left side no horns are discernible, which resembles the male condition.

THORAX. The right fore wing (length 29.5 mm) and hind wing (length 28.0 mm) are fully formed. The right hind wing lacks a distinct basal triangle and the hind angle is rounded, typical of females of this species and gomphid females in general. The left fore wing (length 28.0 mm) is slightly shorter than the right, and the left hind wing, although atrophied (length about 18.0 mm), has a distinct basal triangle and the hind angle is angulate, typical of males. It is fairly well developed out to the nodus, but has only 8 antenodal crossveins (normally 9-10 in males, 9-11 in females); the wing is shortened distal to the nodus, the veins are thickened, and the cells are small.

ABDOMEN. Length 31.0 mm, which is small for either sex (range 31.5-34.5 mm for normal males, 31.0-33.5 mm for normal females; Tennessen and Vogt 2004). The auricles on segment 2 are male-like, although the one on the right side is slightly smaller and misshaped. Segments 2 and 3 bear male accessory genitalia: the anterior and posterior hamules are well developed on the left side but atrophied on the right

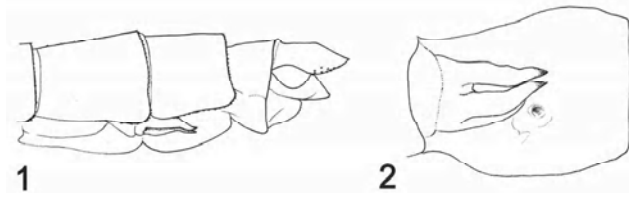


Figure 1-2. *Ophiogomphus smithi* Tennessen and Vogt, adult. **1)** Abdominal segments 8-10 + anal appendages, ventrolateral view. **2)** Abdominal segment 9 sternite and vulvar lamina, ventral view.

side; the genital ligula is nearly fully formed but is angled to the left and slightly twisted, probably because its base on the right side is poorly developed. The sternum of segment 9 has a nearly fully formed ovipositor (Fig. 1), although it is slightly narrower than in normal females and the arms curve to the left (Fig. 2). On the sternum, to the right of the ovipositor, there is a small cavity that is probably a vestigial male genital opening (Fig. 2). The anal appendages are formed as in normal males (Fig. 1); the left cercus is 1.55 mm long,

which is at the small end of the range of measurements for male cerci, 1.56-1.78 mm, as given by Tennessen and Vogt (2004). The dorsal color pattern of segments 1-10 is more like that of typical males than females.

Whether or not this individual could have mated is unknown, as would be its mating preference. Although the male-like anal appendages appear capable of holding a female in tandem, the misshaped male accessory genitalia on segments 2 and 3 probably would not function properly for transferring sperm. The external morphological features indicate that the left side of the body is predominantly male, the right side predominantly female, although most of the sexual characteristics of both male and female are fully developed. A web site maintained by Roy Beckemeyer (<http://www.windsofkansas.com/gynandro.html>) has a photograph of a live *Sympetrum frequens* Selys gynandromorph; the left wings are shorter than those on the right side, indicating they are of male origin. This left/right separation may occur in most odonate gynandromorphs.

Gynandromorph of *Ischnura hastata*

COLLECTION DATA: ALABAMA, Escambia County, pond near junction of Co. Rd. 53 & Hwy. 29, 6 May 1993, leg K. J. Tennessen.

HEAD. Pattern as in mature female.

THORAX. Color pattern consists of a wide black middorsal stripe and olive/tan mesepisternum (patterned as in typical mature females; see Lam 2004, p. 84, for excellent color illustrations of male and immature and mature female color patterns). Wing length (fore wing 15.1 mm, hind wing 14.1 mm) fits within the range for normal females, in which the hind wing varies from 11.5-15.0 mm (Westfall and May 2006). The shape and size of the pterostigma match that of typical females.

ABDOMEN. Length (21.2 mm) fits within the range for females (17.5-22.0 mm; Westfall and May 2006). Dorsal color is black and yellow; the dorsum of segments 1-3 is black and segment 4 is mostly black but with an elongate yellow stripe on the left side; segments 5-7 appear to be half male, half female, as the left side is yellow (in typical males nearly entirely yellow) and the right side is mostly black (in typical females entirely black). The apical segments (8-10) have asymmetrical yellow and black blotches (Fig. 3 and 5). The sternite of segment 2 has a small medial hole (Fig. 4), and although this opening indicates slight intrusion of male genital features, I could not discern any definite structure within the cavity under 50x magnification. There is also a small apical black scar on the left side. The ovipositor is incomplete and malformed. Only one pair of gonapophyses is visible and these are on the right side but curve left (Fig. 5 and 6); the single valve on the right side also curves left and upward; the stylus is similar to that of typical females. The cerci, in dorsal and lateral view, are shaped as in females. The paraproct is rounded on the right side, as in typical females, but the left side has a curved apical arm shaped nearly exactly as in typical males (Fig. 3 and 5).

As in the *O. smithi* specimen, the left side of this damselfly has male features whereas the right side is mainly female. In overall body stature, it is more female-like. It does not seem likely that this individual could have mated with either a male or a female, as the anal appendages would not be capable of holding a female and the malformed ovipositor would probably prevent sperm transfer. It also seems

improbable that it could have laid eggs with the incomplete ovipositor. The only previous reports of a gynandromorph in Coenagrionidae were by Calvert (1919), who listed a specimen of *Enallagma vesperum* as “gynandromorphic” but gave no further details, and Haritonova (1987), who described a specimen of *Ischnura fountainei* Morton that resembled a male but had female genitalia.

Discussion

The two gynandromorphs described in this paper appear to be bilateral, or “balanced,” in that they possess predominantly male characteristics on one side and female characteristics on the other side. Such individuals are believed to result from the loss (or non-disjunction) of an X chromosome in early cleavage (Siva-Jothy 1987). Moreover, the *Ophiogomphus* specimen appears to be a genetic mosaic, indicating that non-disjunction of X chromosomes occurred more than once during embryogenesis.

Neither of the individuals was engaged in reproductive behavior when I collected them, and I did not dissect them when they were fresh, so I cannot comment on the male/female condition of the internal reproductive organs.

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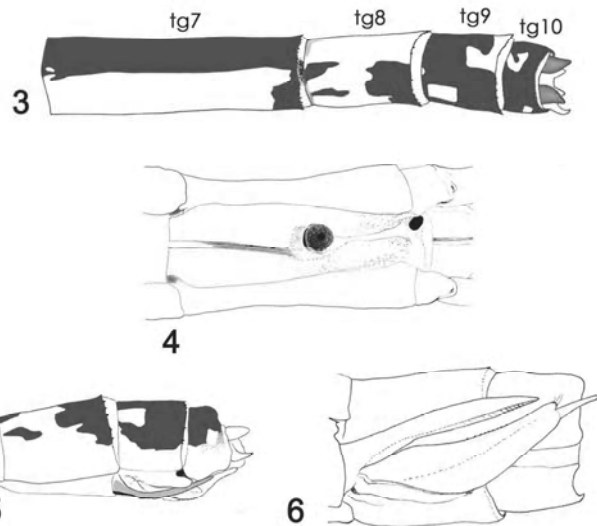


Figure 3-6. *Ischnura hastata* (Say), adult. **3)** Abdominal segments 7-10 + anal appendages, dorsal view. **4)** Abdominal segment 2, ventral view. **5)** Abdominal segments 8-10 + appendages, lateral view. **6)** Ovipositor, ventral view.

