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Short Communication

## Intersexuality in *Farrodes* Peters, 1971 (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) from Brazil

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### ABSTRACT

Gynandromorphism or intersexuality is a rare condition where the individual has male and female features. In this report we described two imagoes of *Farrodes xingu* Domínguez et al. (1996) from Brazil presenting intersex traits. We considered the arranged sexual characters as antero-posterior and bilateral. One individual has a male head, abdomen full of eggs and the subgenital plate with a malformed outset of penes (antero-posterior), while the other individual has half of the head with a male-like turbinate eye and the other half with a regular female-like one, and with malformed male genitalia (bilateral).

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In species displaying sexual dimorphism, an uncommon teratology can be detected when some individuals have male and female characteristics. These cases may be gynandromorphism or intersexuality, i.e. when the individual present a clear border between male and female characteristics it is considered a gynandromorph specimen, but if no clear border is evident it is usually considered an intersex (Grant and Masteller, 1987; Narita et al., 2010).

Soldán and Landa (1981) considered a gynandromorph an individual that shows characteristics of both sexes whereas the head usually only has the sexual characteristics of one sex and the abdomen often displays a bilateral arrangement of male and female portions, and those portions with the genetic constitution of the sex that it resembles. Some possible explanations for the gynandromorphic condition are from genetic disorders like the loss of X chromatin, disrupted cleavage of polar bodies, and polyspermic fertilization. Still according to Soldán and Landa (1981), intersexuality is usually connected with parasitism by mermithids worms and when the specimen presents underdeveloped male characters, such as turbinate eyes and deformations on sternum IX, it is usually an intersexual female.

Ephemeroptera is one of the 16 orders of insects with gynandromorphism or intersexuality records (Rafael et al., 2017). The first known record of a sexual teratology in Ephemeroptera was

described in an imago of *Baetis rhodani* (Pictet, 1843) (Baetidae) by Lestage (1922). Soldán and Landa (1981) compiled all the known records of gynandromorphism, intersexuality and teratologies in the order at that time (Spieth and Ide, 1939; Daggy, 1944; Landa, 1949; Berner, 1949, 1957; Belfiore, 1979) and since then just a few reports appeared.

After Soldán and Landa (1981) most of the records were in the family Baetidae: a gynandromorph in the genus *Dactylobaetis* Traver and Edmunds, 1968, now considered a junior synonym of *Camelobaetidius* Demoulin, 1966; an intersex of *Baetis tricaudatus* Dodds, 1923 with a perfectly developed turbinate eye on a half of the head and an underdeveloped on the other side; a male of the genus *Baetodes* Needham and Murphy, 1924 with an extra forceps on the eighth abdominal segment (Hubbard and Flowers, 1987) and seven cases of intersexuality, also on the genus *Baetodes* (Domínguez, 1984; Grant and Masteller, 1987); and finally, a bilateral gynandromorph *Baetis* sp. (Da-Silva and Pereira, 1993), a species that certainly belongs to another genus as *Baetis* is no longer reported from South America.

In other families just a few cases were recorded, a gynandromorph in *Ephoron leukon* Williamson, 1802 (Polymitarciidae) showing a male head with thorax and abdomen presenting bilateral arrangement of sex characters (McCafferty and Bloodgood, 1986). After that, two intersexes were registered, one intersex in *Paraleptophlebia moerens* McDunnough, 1924 (Leptophlebiidae) with half of the head with a turbinate eye and the other half without it, and another intersex in *Ameletus lineatus* Traver, 1932 (Ameletidae)

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with an underdeveloped pair of penes and quite developed, but asymmetrical turbinate eyes (Grant and Masteller, 1987). The last known record in Ephemeroptera is an individual of *Cinygmima* Kimmins, 1937 (Heptageniidae) presenting a bilateral arrangement of sexual characteristics of both sexes (Wu et al., 1993).

In this paper, we describe two individuals of *Farrodes xingu* Domínguez et al., 1996 (Leptophlebiidae) with male and female characteristics, one specimen with lateral and the other one antero-posterior differences. This is the third report on this subject in South America, the second in Brazil and the first in the genus *Farrodes* Peters, 1971. The subimagos were caught in light traps, reared to imagoes, preserved in 80% ethanol and deposited at the Laboratório de Organismos Aquáticos in the Universidade Estadual de Santa Cruz (LOA/UESC), Ilhéus, State of Bahia, Brazil (MZUESC Eph 0592). Pictures were taken using a stereomicroscope Leica EZ4 linked with a digital camera. A series of partially focused digital images were stacked using the program Combine ZP. Drawings were made with the aid of camera lucida and the final drawings were made with Adobe Illustrator CS5®. The identification of the species was possible due to the presence of other male imagoes in the same locality.

Our study suggests that both specimens are intersex individuals because they do not show an evident clear border between male and female characteristics as described in the literature.

## Description

### Material examined

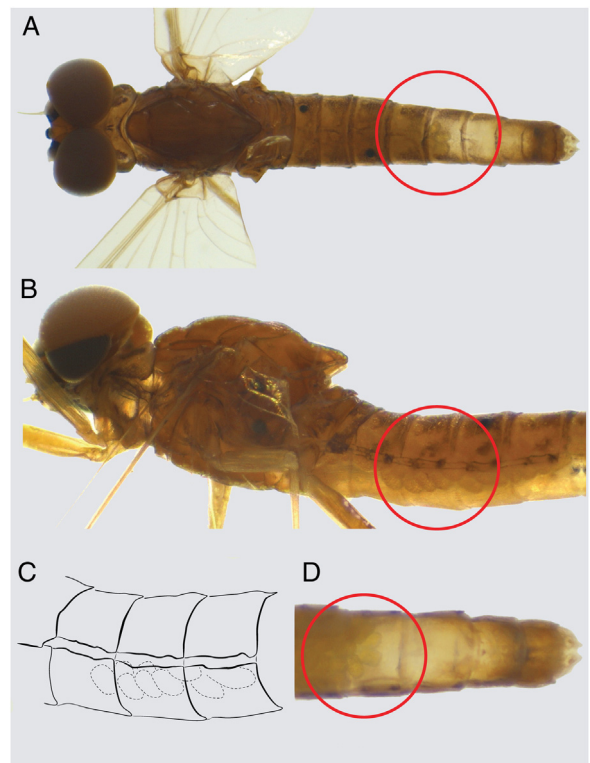
02 imagoes. Brazil, State of Mato Grosso, Nova Xavantina, Córrego Ponte de Pedra, 06-XII-2006, lighth trap, Calor A.R., Mateus, S. And Mariano, R.

*Farrodes xingu* Specimen 1 (Fig. 1)

Intersex: anterior region male, posterior region female (Fig. 1A and B). Head: typical male head with tubinate eyes. Abdomen: entirely filled with eggs (Fig. 1); genitalia: presenting a morphology of male subgenital plate with a malformed outset of penis.

*Farrodes xingu* Specimen 2 (Fig. 2)

Intersex: right half male, left half female. Head: Half of the head with a male turbinate eye and the other half with a female eye (Fig. 2A); thorax and abdomen: typical of a male of *Farrodes* species; genitalia (Fig. 2B): showing a morphology of male and

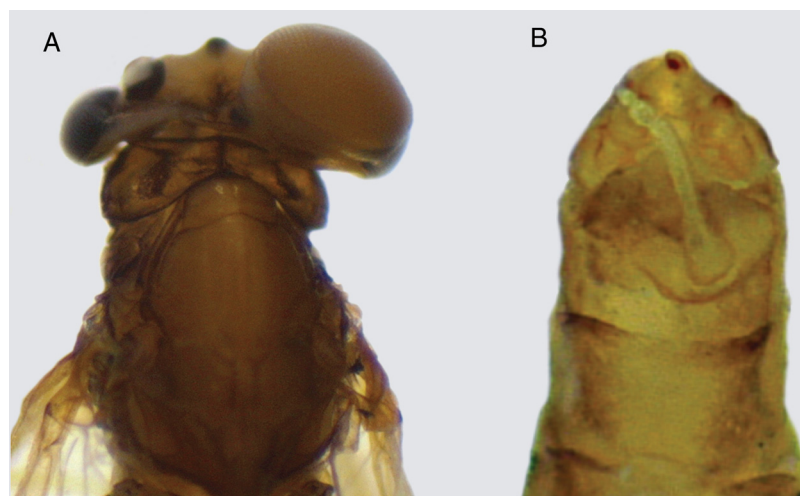


**Fig. 1.** Imago 1 of *Farrodes xingu*: (A) dorsal view, red circle showing the eggs on abdomen; (B) lateral view, red circle showing the eggs on abdomen; (C) segments II–IV with mass of eggs; (D) segments VI–X, red circle showing the mass of eggs and the malformed genitalia (ventral view).

female subgenital plate with a malformed genitalia; presence of a developed forceps on the right side.

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**Fig. 2.** Imago 2 of *Farrodes xingu*: (A) dorsal view, left side female head and the right side male head; (B) malformed genitalia.

## Conflicts of interest

The authors declare no conflicts of interest.

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