

EXTERNAL AND INTERNAL GENITAL STRUCTURES IN A
GYNANDROMORPH *ONYCHOGOMPHUS UNCATUS* (CHARP.)
(ANISOPTERA: GOMPHIDAE)

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A gynandromorph specimen from the Vidurle River, France, is described with respect to the external and internal genitalia. The specimen has been deposited in the S.I.O. collection.

INTRODUCTION

Accounts of mature adult gynandromorph dragonflies are few (RIS, 1929; SCHIEMENZ, 1953; PINHEY, 1958), but gynandromorphs are well known from studies of other insects, e.g. *Drosophila* (MORGAN & BRIDGES, 1919), *Bombyx mori* (GOLDSCHMIDT & KATSUKI, 1927) and several species of Hymenoptera (WHITING, 1929; ROTHENBUHLER et al., 1952; LAIDLAW & TUCKER, 1964). There are several processes which occur during or after fertilization which lead to the combination of male and female phenotype expressed in one individual (cf. LAUGE, 1986).

This short communication describes a balanced *Onychogomphus gynander*.

DESCRIPTION OF THE SPECIMEN

The specimen bears a general external resemblance to a female *Onychogomphus uncatatus* (Charp.) (Fig. 1A) since it lacks the distinctive claspers characteristic of the male in this species. The specimen was caught on the upper stretches of the Vidurle River in southern France (approx. 43°45'N 04°15'E) in pre-copula tandem flight with a male *O. uncatatus*. Before the pair were captured the male had been attempting to enter copula by swinging the gynander's abdomen upwards, but did not succeed in maintaining genital contact for more than one or two seconds.

MALE EXTERNAL GENITALIA

The second and third abdominal segments of the gynander bear deformed male secondary genitalia on the left-hand side (LHS) when viewing the specimen from the ventral surface with the head pointing distally (all references to "handedness" henceforth use this orientation). The seminal vesicle (first penis segment) is fully developed and intact on the LHS, but slightly deformed on the right-hand side (RHS); the second segment of the penis appears to bear no abnormalities; the third and fourth segments, however, are only complete on the LHS (Fig. 1C). The RHS of the fourth segment is clearly missing its lateral lobe and most of the dark coloured sclerotised cuticle. The secondary genitalia are permanently extruded from the genital fossa because of these structural abnormalities. Of the structures usually associated with the penis and genital fossa only a partly formed hamulus exists on the LHS. Like the penis, it too protrudes from the genital fossa.

FEMALE EXTERNAL GENITALIA

The genital plate on the 8th sternite is well developed on the RHS, however a cleft runs from the mid-line to the right margin of the 8th sternite (Fig. 1B). The

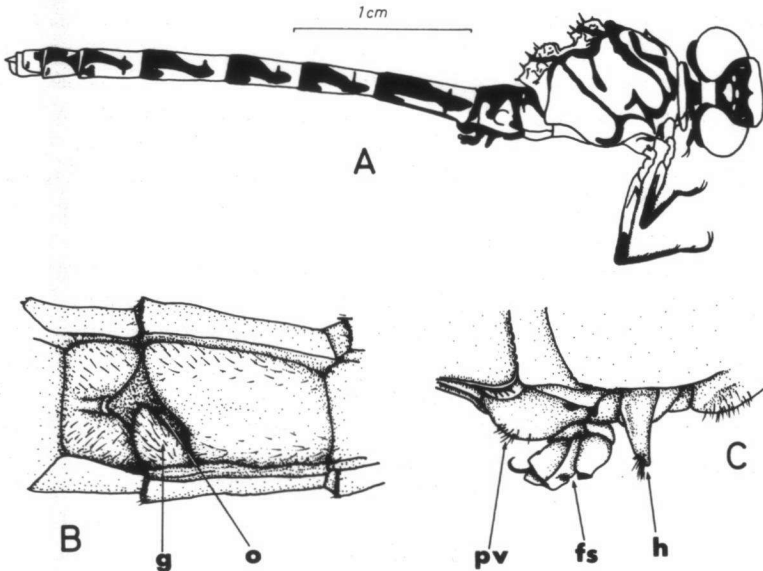


Fig. 1. *Onychogomphus uncatatus* (Charp.), gynandromorph: (A) lateral view of the dried specimen; — (B) ventral view of the female external genitalia (g = genital plate, — o = genital orifice); — (C) lateral (LHS) view of the male external genitalia (pv = penis vesicle, — fs = fourth segment of penis, — h = hamule).

genital plate is absent on the LHS. The genital orifice was functional and open at the time of capture; arthrodistal membrane is attached to the anterior margin of the 9th sternite and is continuous with the arthrodistal membrane of the internal genitalia. The 9th sternite shows a central ridge which joins the indented anterior margin with a "tip".

INTERNAL GENITALIA

Dissection of the gynander soon after capture revealed well-developed female internal genitalia. The ovaries were full of mature eggs and the organs of sperm storage were fully developed but devoid of sperm. The vagina was intact and communicated with the exterior.

DISCUSSION

The described specimen is clearly a balanced gynander as regards external genitalia. Moreover, the specimen shows male external genital characters on the LHS whilst its female external genital characters are developed on the RHS. In this context it bears some resemblance to the specimen described by PINHEY (1958). The *Onychogomphus* specimen described herein showed female internal genitalia: it possessed what appeared to be fully functional sperm storage organs and ovaries. The organs of sperm storage were probably empty because the incomplete genital plate hindered the maintenance of genital contact during copulation (as observed at the time of capture). During copulation male anisopteran dragonflies grasp the female genital plate with their hamuli and thereby maintain genital contact (JOHNSON, 1972); presumably abnormalities in the genital plate of the type described here are sufficient to prevent proper genital contact and therefore intromission.

Because the mode of sex determination in dragonflies is usually by XO and XX chromosomes (refs in CORBET, 1962) it seems possible that gynandromorphism in this order may be derived from the loss of an X chromosome during the first cleavage of a XX zygote as in *Drosophila* (MORGAN, 1914; MORGAN & BRIDGES, 1919). Examples of odonate gynanders are usually "balanced", i.e. individuals show 50% male and 50% female external features. LAUGE (1986) suggests that the loss of an X chromosome during the first cleavage would produce balanced XX-XO gynanders.

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REFERENCES

- CORBET, P.S., 1962. *A biology of dragonflies*. Witherby, London.
- GOLDSCHMIDT, R. & K. KATSUKI, 1927. Erblicher Gynandromorphismus und somatische Mosaikbildung bei *Bombyx mori* L. *Biol. Zbl.* 47: 45-54.
- JOHNSON, C.G., 1972. Tandem linkage, sperm translocation and copulation in the dragonfly *Hagenius brevistylus*. *Am. Midl. Nat.* 31: 39-46.
- LAIDLAW, H.H. & K.W. TUCKER, 1964. Diploid tissue derived from accessory sperm in the honey bee. *Genetics* 50: 1439-1442.
- LAUGE, G., 1985. Sex determination: Genetic and epigenetic factors. In: G.A. Kerkut & L.I. Gilbert, [Eds], *Comprehensive insect physiology, biochemistry and pharmacology*, Vol. 1, pp. 295-318, Pergamon, Oxford.
- MORGAN, T.H., 1914. Mosaics and gynandromorphs in *Drosophila*. *Proc. Soc. exp. Biol. Med.* 11: 171-172.
- MORGAN, T.H. & C.B. BRIDGES, 1919. Contributions to the genetics of *Drosophila melanogaster*. I. The origin of gynandromorphs. *Publs. Carnegie Instn* 278: 1-122.
- PINHEY, E.C.G., 1958. Records of dragonflies from the Zambezi and Rhodesia; a revision of the genus *Platycypha*; a gynandromorph dragonfly from Uganda. *Occ. Pap. natn. Mus. Sth Rhod.* (B) 22: 115-126.
- RIS, F., 1929. Gynandromorphismus bei Odonaten. *Mitt. schweiz. ent. Ges.* 14: 97-102.
- ROTHENBUHLER, W.C., J.W. GOWEN & O.W. PARK, 1952. Androgenesis with zygogenesis in gynandromorphic honey bees. *Science* 115: 637-638.
- SCHIEMENZ, H., 1953. Ein idealer Fall von Gynandromorphismus bei *Aeschna cyanea* Müll. *Beitr. Ent.* 3: 563-570.
- WHITING, P.W., 1928. Mosaicism and mutation in *Habrobracon*. *Biol. Bull.* 54: 289-306.