

The pupa of *Chironomus decorus* Johannsen, 1905 – additional description and an unusual sexual dimorphism

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Abstract

In his original description of *Chironomus decorus*, Johannsen included a brief description of the pupa but with insufficient detail to differentiate it from other North American species, particularly those of the *decorus*-complex. In this note, further information of pupal characters, mostly derived from specimens reared from egg masses, are given which allow separation of these pupae from those of some other species, e.g., presence of frontal warts, and in the case of the males, to permit accurate identification by the presence of a small secondary tubercle.

Introduction

In his original description of *Chironomus decorus*, Johannsen (1905) included some information on the pupa, e.g., length (7-8 mm), color (dusky greenish brown, the colors of the imago showing through the integument), black chitinised lateral spur prominent and without teeth (i.e., a single terminal spine). He also included a figure of a pupa, but not detailed enough to permit identification, and a figure of the shagreen pattern on abdominal segments five and eight. Wülker et al. (2009) noted the identity of species 3a of Martin et al. (1979) as *C. decorus* Johannsen and figured the frontal apotome of a female pupa in their figure 6b to contrast the presence of frontal warts (larger than normal for the species with height equal to width at base) in *C. decorus* in contrast to *C. bifurcatus* where they are lacking.

This account expands the description of the pupal exuviae of males and females, mainly reared from egg masses. One of these characters, the cephalic tubercles, which are usually larger in males of *Chironomus*, is further differentiated in *C. decorus* and allows identification of the male pupae as belonging to this species.

Material and Methods

The material examined here included 4 females and 2 males all reared from two egg masses collected in Madison, Wisconsin, USA in May 1978 (UWI.5.1 Em#1 and UWI.6.3 Em#1). The identity of these egg masses was confirmed from cytology and morphological features, and for the latter egg mass by the mtCOI barcode sequence of a female larva (BOLD CoTW079-20). Other specimens included a reared male from Belzoni, Humphries Co., Mississippi (UMS.2.1 reared male DNA1) for which a mtCOI sequence is also in the Barcode of Life Data Systems database (BOLD CoTW095-20). Both specimens are in BOLD BIN: [BOLD:AAB7030](https://www.boldsystems.org/index.php/BOLD:AAB7030).

In addition to the reared specimens, I also examined pupae in the collection of Jim Sublette in New Mexico, material that is now in University of Minnesota Insect Collection, but not yet curated. Specifically, I have photographs of pupal spurs of a female and an unsexed specimen from New Mexico, as well as the cephalic tubercles of a male specimen from Yankton, South Dakota which are illustrated below (Figure 1). I have photographs of pupal spurs of a female and an unsexed specimen from New Mexico, as well as the cephalic tubercles of a male specimen from Yankton, South Dakota which are illustrated below.

Results and Conclusions

Many of the morphological characters are summarized in Table 1. These data indicate that while many characters have different mean values between males and females (usually higher in males), there is considerable overlap of the ranges. The main exception is in the ratio of length to basal diameter of the cephalic tubercles where the males have a higher value. This difference is further reflected in the presence of a secondary tubercle, with a small seta, in males (see Figure 1), but not in females. Further, *C. decorus* is the only species from North America with such a secondary tubercle, permitting the male pupa to be readily identified.

Table 1. Summary of the mean and range of some morphological characters of the pupae of *Chironomus decorus*.

	Females (5)		Males (3)	
	Mean	Range	Mean	Range
Length (mm)	8.17	7.4 - 9.3	9.36	8.13 - 10.2
Inner margin wing case (mm)	1.77	1.57 - 1.89	1.76	1.57 - 1.90
Length/width frontal warts	0.73	0.33 - 1.0	0.85	0.51 - 0.81
Cephalic tubercles (μm)	134.6	65 - 185	174.3	150 - 196
Length/width Cephalic tubercle	1.29	1.03 - 1.44	1.87	1.5 - 2.36
Frontal setae (μm)	at least 73	53+ - 105	at least 96	96+
Length/width secondary tubercle	absent	absent	1.33	1.1 - 1.6
Hooks on abdominal segment II	82	71 - 100	85	77 - 99
Appressed spines on spur	4.4	1 - 6	4.36	4 - 6
Swim fin taeniae (one side)	105	80 - 138	106	83 - 122

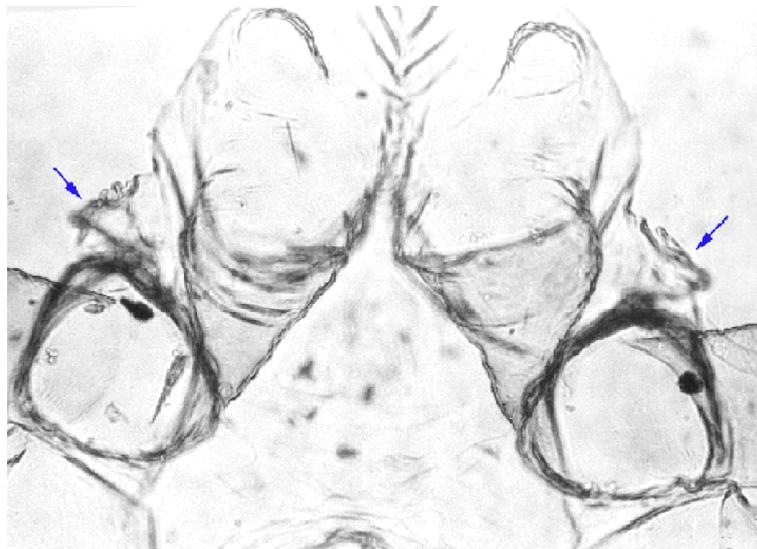


Figure 1. Cephalic tubercles and frontal warts of a male pupa of *C. decorus* from Yankton, South Dakota. The small secondary tubercles, with a small subapical seta, are indicated by arrows.

For females, only the presence of frontal warts provides a potential means of eliminating a number of species where frontal warts are known to be absent. The difficulty is that very few pupal descriptions make any mention of them. This may be in large part due to the statement in the Holarctic pupal diagnosis of the genus *Chironomus* (Pinder and Rice 1986) that frontal warts are absent in the genus. Aside from the present species, there are only two species for which their presence is confirmed: *C. melanescens* (Keyl 1962) (Martin 2015, Fig. 1b), where their length of about 55 μm will probably identify the pupae of that species, and *C. decorus* group species 2 of Butler *et al.* 1995 in which they are slightly larger in the females but largely overlap with the size range in *C. decorus* and can only be separated if there are more than 6 spines (up to 11) on the spurs. The pupal key of Langton and Visser (2003) makes it clear that they are commonly present in the subgenera *Chaetolabis* and *Einfeldia*, but that pupae of those subgenera have other differences to those of *Chironomus* (s.s.). A further impediment to clearly identifying, particularly the female pupae, is that there is no description of the pupae of at least 12 Nearctic species, and only a note of the number of spines on the pupal spur for a further 11 species – of which only *C. crassicaudatus* (9-19 spines, Sublette & Sublette 1971) does not overlap with the number in *C. decorus*. However, they can be separated from *C. anonymus*, *C. bifurcatus*, *C. blaylocki*, *C. staegeri*, *C. stigmaterus*, *C. dilutus*, and *C. pallidivittatus*, which are confirmed to lack frontal warts.

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References

- Butler, M.G., Kiknadze, I.I., Cooper, J.K. and Siirin, M.T. 1995. Cytologically identified *Chironomus* species from lakes in North Dakota and Minnesota, USA. In Cranston P.S. (Ed.) *Chironomids, from Gene to Ecosystems*. Proceedings of the 12th International Symposium on Chironomidae, Canberra, January 23-26, 1994, CSIRO, Canberra. pp. 31-37.
- Johannsen, O.A. 1905. Aquatic nematoceros Diptera II. Chironomidae, pp. 16-37, In Needham, I.G., Morton, K.I., and Johannsen, O.A.(Ed.) *May flies and midges of New York. Third report on aquatic insects.* - *Bulletin of the New York State Museum* 86 [=Ent. 23]: 7-352.
- Langton, P.H., & Visser, H. 2003. Chironomidae exuviae. A key to pupal exuviae of the West Palaearctic Region. Amsterdam: Biodiversity Center of ETI. Copyright 2008 ETI.
- Martin, J. 1979. Chromosomes as tools in taxonomy and phylogeny of Chironomidae (Dipt.). - *Entomologica Scandinavica* 10: 67-74.
- Martin, J. 2015. Identification of *Chironomus (Chironomus) melanescens* Keyl, 1962 in North America. - *CHIRONOMUS Journal of Chironomid Research* 28: 40-44. DOI: <https://doi.org/10.5324/cjcr.v0i28.1898>
- Pinder, L.C.V., & Reiss, F. 1986. 10. The pupae of Chironominae (Diptera: Chironomidae) of the Holarctic region – Keys and diagnoses. - *Entomologica Scandinavica Supplement* 28: 299-456.
- Sæther, O.A. 1980. Glossary of chironomid morphology terminology (Diptera: Chironomidae). - *Entomologica Scandinavica Supplement* 14: 1-51.
- Sublette, J.E. & Sublette, M.F. 1971. B. Description of the immature stages and adults of the *Chironomus staegeri* group. - *Studies Natural Sciences (Portales, N.M.)* 1(1): 6-21.
- Wülker, W., Martin, J., Kiknadze, I.I., Sublette, J.E. & Michiels, S. 2009. *Chironomus blaylocki* sp.n. and *C. bifurcatus* sp.n., North American species near the base of the *decorus*-group (Diptera: Chironomidae). - *Zootaxa* 2023: 28-46.

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