

## A UNIQUE MORPHOLOGY, COMMON TO THE PENES OF THE *CELAENURA* AND *NANOSURA* GROUPS OF *ISCHNURA* (ZYGOPTERA: COENAGRIONIDAE)

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*Received September 1, 1995 / Revised and Accepted November 11, 1995*

Three ischnuran spp. have an unusual "scoop" structure on their accessory penes. They represent the genera *Celaenura* and *Nanosura*, constructed by C.H. KENNEDY (1920, *Ohio J. Sci.* 21: 83-88) when he split the genus *Ischnura*. His hypothesis is based on other characters. Scanning electron micrographs of this character are provided. This character provides support for Kennedy's argument.

### INTRODUCTION

KENNEDY (1917) constructed the genus *Celaenura* to include *Ischnura denticollis* (Burm.) and the newly described species *Celaenura gemina* Kenn. Most recent researchers include both of these species in the genus *Ischnura* and treat *Celaenura* as a subgenus (DONNELLY, 1965; DAVIES & TOBIN, 1984). Both species are found in Western North America, but *Ischnura gemina*'s range is more restricted and confined to the area around San Francisco Bay (CORDOBA-AGUILAR, 1993; GARRISON & HAFERNIK, 1981; HAFERNIK & GARRISON, 1986; KENNEDY, 1917; LEONG & HAFERNIK, 1992). Both species are small, lack pale antehumeral stripes and are missing the paired basal spines on the penultimate segment of the penis that are characteristic of other ischnurans.

KENNEDY (1917) provides line drawings of the accessory penes of 15 ischnuran species. The only obvious qualitative difference between these penes involves the presence or absence of these basal spines. The hypothesized close relationship between the *Celaenura* species is based primarily on the lack of these basal spines. However, because of the high potential for homoplasy, the absence of characters is weak evidence for relatedness.

In this research, we use scanning electron microscopy to examine the penes of a

collection of ischnuran species and report a novel morphology common to both members of the *Celaenura* group as well as one other species, *Ischnura aurora* (Br.). KENNEDY (1920) distinguished *I. aurora* from other ischnurans based on a pair of mesothoracic hook-like horns found on the male. He constructed the genus *Nanosura* for this species. DAVIES & TOBIN (1984) classify *Nanosura* as a sub-genus of *Ischnura*. With the exception of the Indonesian archipelago, *I. aurora* is found in the region bounded by Pakistan, Tahiti, China, and Tasmania (ROWE, 1987).

### METHODS

Fifteen ischnuran species were examined using a JOEL JSM 35C Scanning Electron Microscope. Accessory penes were dissected from dried specimens and coated for 3 min with gold palladium using an Anatech Hummer IV sputter coater (NOVAK, 1993).

Species examined include: *Ischnura aurora* (Br.), *I. cervula* Sel., *I. damula* Calv., *I. demorsa* (Hag.), *I. denticollis* (Burm.), *I. elegans* (Vander L.), *I. gemina* (Kenn.), *I. graellsii* (Ramb.), *I. hastata* (Say), *I. kellicotti* (Wllmsn), *I. perparva* Sel., *I. posita* (Hag.), *I. pumilio* (Charp.), *I. ramburii* Sel. and *I. verticalis* (Say).

### RESULTS

Three of the 15 species, *Ischnura gemina*, *denticollis*, and *aurora*, possess a structure on their glans that we refer to as a scoop (Fig. 1). It has the appearance of a curved oriental fan and, in some unknown way, is probably involved in sperm displacement or positioning. The sculptured edges of the scoop vary interspecifically (Fig. 2).

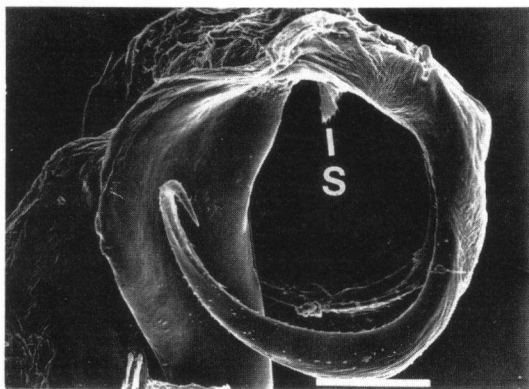


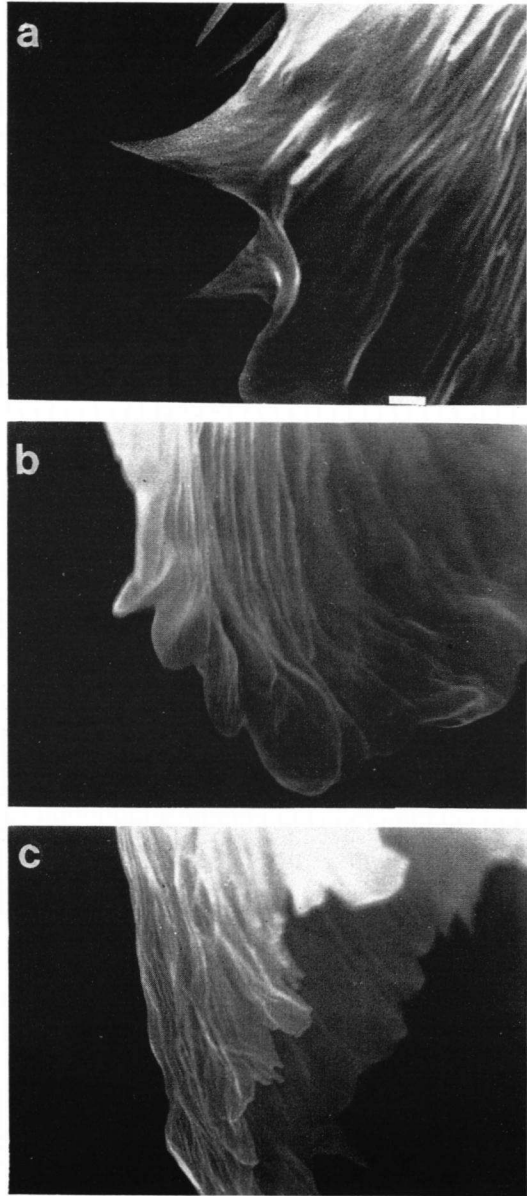
Fig. 1. The accessory penes of *Ischnura gemina* showing the location of the scoop (S) – [Scale bar = 100  $\mu$ m].

### DISCUSSION

The scoop is a character found in only 3 of the 15 ischnuran species examined. Interestingly these 3 species were previously separated from the *Ischnura* by KENNEDY (1917, 1920) using different characters. The scoop constitutes a potential synapomorphy that more convincingly relates *I. denticollis* with *I. gemina*, than does missing basal spines. ROBINSON & ALLGEYER (1996) also report that these species are the only 2 ischnurans that primarily use tandem guarding during oviposition. This further strengthens the case for a strong relationship be-

Fig. 2. The sculptured edges of the scoops of: (a) *I. gemina*; – (b) *I. denticollis*; and – (c) *I. aurora*. – [Scale bar = 1  $\mu$ m].

tween this pair, as does their predilection for hybridization with each other (LEONG & HAFERNIK, 1992). Surprisingly, the scoop links the two species missing basal spines with *Nanosura* which has the longest basal spines of any species we examined. *I. aurora*, despite being the smallest ischnuran examined, has basal spines that average 238.6  $\mu$ m, while *I. hastata*, the species having the next longest basal spines, has spines averaging 159.7  $\mu$ m. KENNEDY (1920) included *I. hastata* with *I. prognata* (Hag.) in their own genus *Anomalura*. Of the remaining species examined, the mean length of basal spines is 90.3  $\mu$ m. An apparent autapomorphy of *I. aurora* is that its basal spines curve in the opposite direction from those of other ischnurans.



#### ACKNOWLEDGEMENTS

We thank A. CORDERO, R. ROWE, and G. SPICER for providing some specimens used in this research.

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