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Sexual bimaturism in the millipede *Centrobolus inscriptus* Attems (Spirobolida: Trigonulidae)

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Abstract

Millipedes have determinate growth and adult body sizes are fixed. In the sexually size dimorphic genus *Centrobolus* intergenerational sexual differences in body size was examined in a population of *C. inscriptus*. Millipedes were measured with minimum measurement error and volumetric body size calculated according to $l\pi r^2$. Four male and five female stadia were detected in the population and figured. One evolutionary explanation for the extra female stage is fecundity selection for larger female size. This is preliminary evidence for sexual bimaturism in arthropods.

Keywords: allometry, bimaturism; *Centrobolus*, body size, diplopod, millipede, stadia

1. Introduction

Millipedes have asymptotic or determinate growth which means that adult body sizes are fixed and can be measured with minimum error [1-2]. *Centrobolus* millipedes follow Rensch's Rule because females are larger than males and regression in this dimorphism increase with size on a slope or gradient of 0.85 which is less than 1.0 [3]. Proximate causes for sexual dimorphism are sexual bimaturism and fecundity selection [4-5]. There is overwhelming evidence for fecundity selection which maintains there is an age-specific force of natural selection. Little evidence exists for sexual bimaturism. The pattern of stadia in a population of the millipede *C. inscriptus* was examined. The null hypothesis was that there is no difference in the number of male versus female stadia.

2. Materials and Methods

Millipedes were hand sampled from a population of *Centrobolus inscriptus* at Twin Streams Farm (28° 55' S; 31° 45' E) during the rainy season (1996). Males and females were measured in the same manner using the same scale so that both measurement and intrinsic errors were alike for both sexes. Body length (mm) and width (mm) were measured with vernier scale calipers, mass (accurate to 0.01 g) taken by placing animals directly on a Mettler balance, for all the males and females. Size was perceived as body volume by using the formula for a cylindrical bauplan: $l\pi r^2$; where l is the length and r the radius of the cylinder.

3. Results

Separate stadia were identified based originally on length and width for each sex in *C. inscriptus*. *C. inscriptus* females have an extra stadia compared to males. Four male and five female stadia were detected in the population (Figure 1). The additional female stages were evident as the final two adult stadia, which were larger than 2300mm³. A single large male was found in this population.

4. Discussion

There was a difference between the numbers of male versus female stadia in *C. inscriptus* (Figure 1). Female Julida millipedes live longer and undergo more moults, and hence attain more segments and a larger diameter than males [4]. Significant size differences exist between species in a community, and also between different stadia of a species of European millipedes [5, 6]. The extra female stadia in the *C. inscriptus* population supports sexual bimaturism and fecundity selection [4, 7]. Also the evidence would support sexual bimaturism if maturity is reached by stadia III in *C. inscriptus*. This finding appears similar to the pattern in the life-history of the millipede *Nopoiulus kochii* [8]. It differs from the life history of *Cylindroiulus* spp. and thus is not consistent among all Julidan millipedes [9]. This is preliminary evidence for sexual bimaturism.

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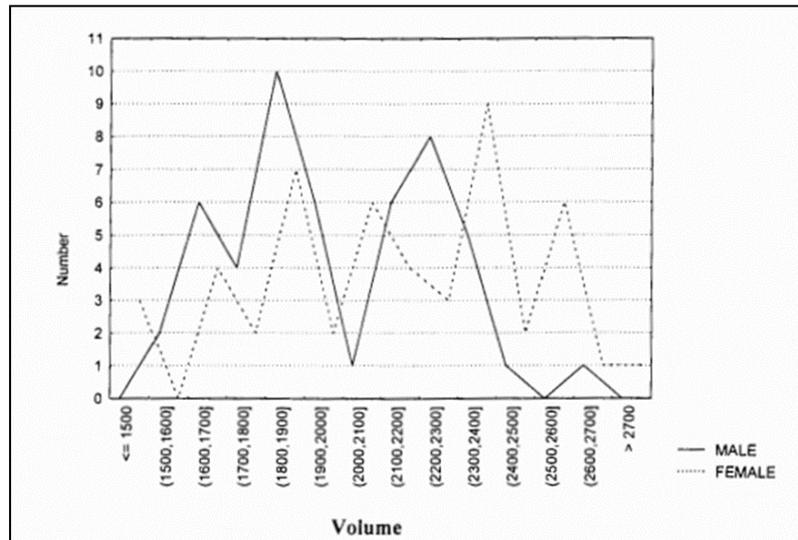


Fig 1: The sexual differences in the distribution of body volumes (mm^3) calculated for the millipede *Centrobolus inscriptus* from a population sampled during the mating season.

5. Conclusion

Differences in the number of male and female stadia in *C. inscriptus* provide preliminary evidence for sexual bimaturism under Rensch's Rule in arthropods.

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