

DOES EJACULATE VOLUME VARY WITH ABSOLUTE ABUNDANCE IN *CENTROBOLUS* COOK, 1897?

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Abstract- Ejaculate volume and absolute abundances were checked for correlations in the red millipede genus *Centrobolus*. There was a significant relationship between male and female abundances (pooled) with ejaculate volumes ($r=0.63$, Z score= 1.66 , $n=8$, $p<0.05$). This suggests the pattern of mate guarding was positively associated with absolute abundance and the intensity of intra-male competition.

• I. INTRODUCTION

The millipede genus *Centrobolus* Cook, 1897 is found in the temperate South African subregion, its northern limits on the east coast of southern Africa being about -17° latitude South (S) and its southern limits being about -35° latitude S^[4, 30]. It consists of taxonomically important species with 12 species considered threatened and includes nine vulnerable and three endangered species^[33]. It occurs in all the forests of the coastal belt from the Cape Peninsula to Beira in Mocambique^[32]. Common with wormlike millipedes is the absolute abundance known to differ in several populations of the genus^[28]. These worm-like millipedes show female-biased Sexual Size Dimorphism (SSD)^[3-26]. Absolute abundance is seasonal and triggered by precipitation and may determine the ejaculate volume which correlates with the copulation durations^[13, 29-31].

Ejaculate volumes and absolute abundance are tested for a correlation with each other during the breeding season in the pachybolid millipede genus *Centrobolus*. The aim is to determine if there is a correlation between absolute abundance and ejaculate volume across several species.

• II. MATERIALS AND METHODS

Two species belonged to the genus *Centrobolus* Cook, 1897^[1]. The absolute abundance during the breeding season was obtained for *C. anulatus* and *C. inscriptus*^[6]. The number of individual

millipedes was hand collected, counted, and sexed *in situ* from the Mick's Park Conservation area in Twin Streams farm (Mtunzini) over a period of up to 3 days early and late in a season. Body size was obtained by calculating the volumes (cylindrical) using the lengths and widths of species which were inputted into the formula for a cylinder's volume (<https://byjus.com/volume-of-a-cylinder-calculator>)^[2]. The ejaculate volume was calculated as the disintegrations per minute^[4]. Ejaculate volume and absolute abundance during early and late in the breeding season were checked for correlations using the Pearson Correlation Coefficient calculator (<https://www.gigacalculator.com/calculators/correlationcoefficient-calculator.php>). Tests for normality were conducted.

• III. RESULTS

There was a significant relationship between male and female abundances (pooled) with ejaculate volumes (Figure 1: $r=0.63046242$, Z score= 1.65957221 , $n=8$, $p=0.04850025$).

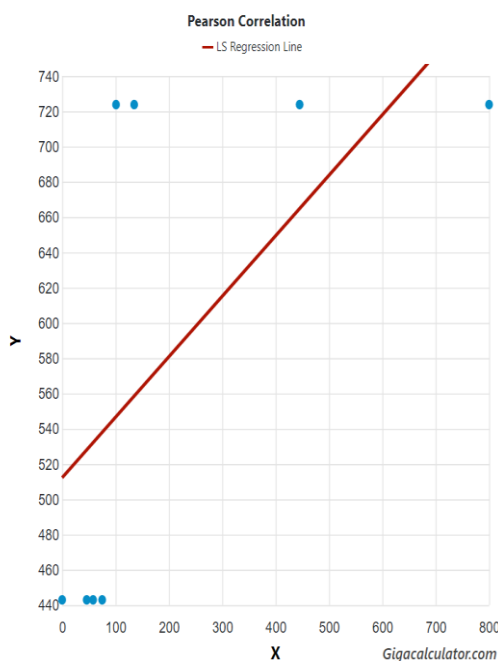


Figure 1. Relationship between male and female abundances (pooled) and ejaculate volumes in *Centrobolus*.

• IV. DISCUSSION

A significant relationship was found between absolute abundance and ejaculate volumes in sympatric *Centrobolus* was found. *Centrobolus* has absolute abundances which correlate with ejaculate volume. This study found absolute abundance recorded in *Centrobolus* was positively related to ejaculating volumes. So the absolute abundance probably determined the opportunity for selection, degree of polygynandry, and jaculate volume in these species. This study supports using absolute abundance as a correlate of ejaculate volume across *Centrobolus*. Examples of ejaculate volume varying with absolute abundance are unknown. Ejaculate volume variation with the absolute abundance occurs during seasonal activity patterns in species such as millipedes [27, 28]. Absolute abundance can bias the ejaculate volume and covary with many other factors depending on the time and place in the season. Spatial changes in habitat preference are known in *C. fulgidus* and *C. richardii* [29]. These differences are linked to the effects of SSD differences (65%) between the latter two species. Similarly, ejaculate volumes may be usefully investigated and compared with this study.

Copulation duration was positively related to absolute abundances across *Centrobolus*. Low ejaculate volumes (in *C. anulatus*) were associated with low absolute abundances and large ejaculate volumes (in *C. inscriptus*) were associated with high absolute abundances. This suggests the pattern of mate guarding is positively associated with absolute abundance and the intensity of intra-male competition [31]. This implies the probability of a female remating is a function of male density [35].

• V. CONCLUSION

Ejaculate volumes varied systematically with the absolute abundance in two *Centrobolus* species. Higher ejaculate volumes occurs with higher absolute abundance.

APPENDIX.

Absolute abundances followed by ejaculate volumes (DPM) in two species of *Centrobolus*. *C. inscriptus* has (280.79 dpm) higher ejaculate volumes.

101, 723.79
 445, 723.79
 0, 443
 58, 443
 800, 723.79
 135, 723.79
 75, 443
 46, 443

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