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DOES (PREDICTED) MASS CORRELATE WITH MATING FREQUENCIES IN *CENTROBOLUS* COOK, 1897?

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Abstract

Mass and mating frequencies were checked for correlations in the red millipede genus Centrobolus. *There was a significant relationship between male and female mass with mating frequencies (r=0.55, Z score=2.06, n=14, p=0.02). This suggests the pattern of mating frequencies was positively associated with male and female mass.*

Keywords: *Correlate, Mating, Centrobolus*

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, 31]. 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 body mass known to differ in several populations of the genus [29]. These worm-like millipedes show female-biased Sexual Size Dimorphism (SSD) [3-27].

Mass and mating frequencies 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 mass and mating frequencies across several species.

MATERIALS AND METHODS

Two species belonged to the genus *Centrobolus* Cook, 1897 [1]. The mass during the breeding season was predicted for *C. anulatus* and given for *C. inscriptus* (equivalent to a South African 10-cent piece) [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]. Mass and mating frequencies 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.

MATERIALS AND METHODS

Least-Squares Regression Line for male volume on male mass: $y = 647.99104427 \cdot x + 350.41578448$ (Figure 2). Least-Squares Regression Line for female volume on female mass: $y = 642.76693997 \cdot x + 634.87814532$ (Figure 3). *C. inscriptus* mean male mass (2.00 g and 2.48 g) and female mass (1.97 g and 2.00 g) were given [2]. *C. anulatus* volumes were given. These were substituted into the least-squares regression line equations and x (mass) was solved for *C. anulatus*. Mass was tested for correlations with mating frequencies, sex ratios, abundance, tarsal pad length,

and ejaculate volumes. Correlations were manufactured at https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php.

RESULTS

After substituting shape size into the least-squares regression equation and solving for the mass of *C. anulatus,* the mass of *C. anulatus* was predicted to be 2.12747419 g in males and 2.21561154 g in females (Appendix). Mass was correlated with mating frequencies (r=0.55165751, Z score=2.05883060, n=14, p=0.01975517). Mass was not correlated with abundance (r=0.01455306, Z score=0.06669522, n=24, p=0.47341210). Mass was not correlated with sex ratio (r=0.07357919, Z score=0.33779268, n=24, p=0.36775978). Mass was not correlated with tarsal pad length (r=-0.15673572, Z score=-0.27373061, n=6, p=0.39214589). Mass was not correlated with ejaculate volume (r=-0.15673572, Z score=-0.27373061, n=6, p=0.39214589).

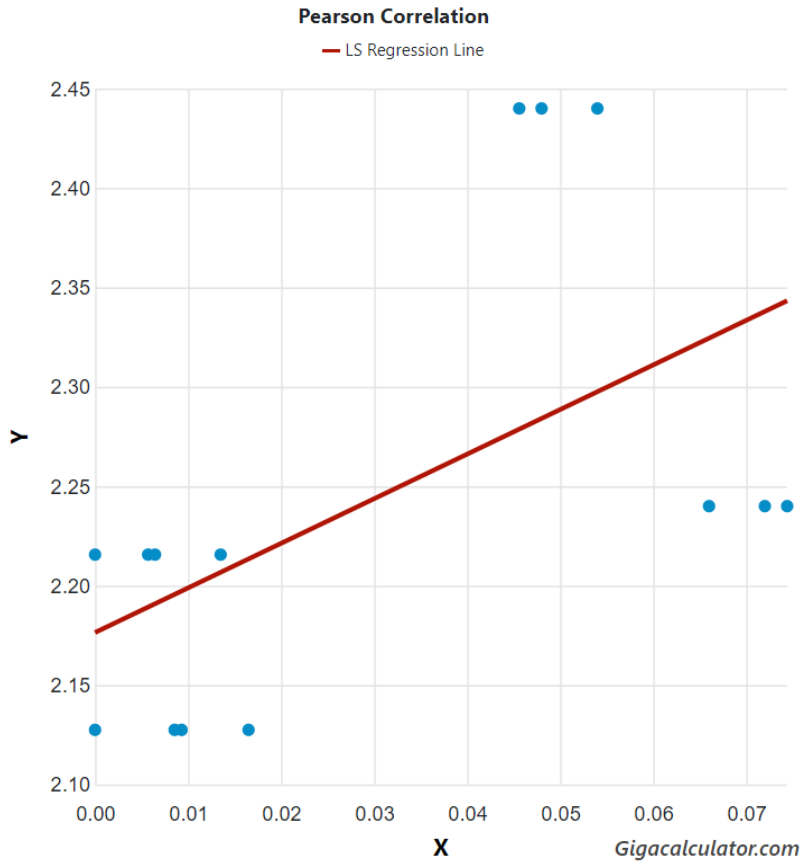

Figure 1. Regression line between mass (y) and mating frequencies (x) in Centrobolus.

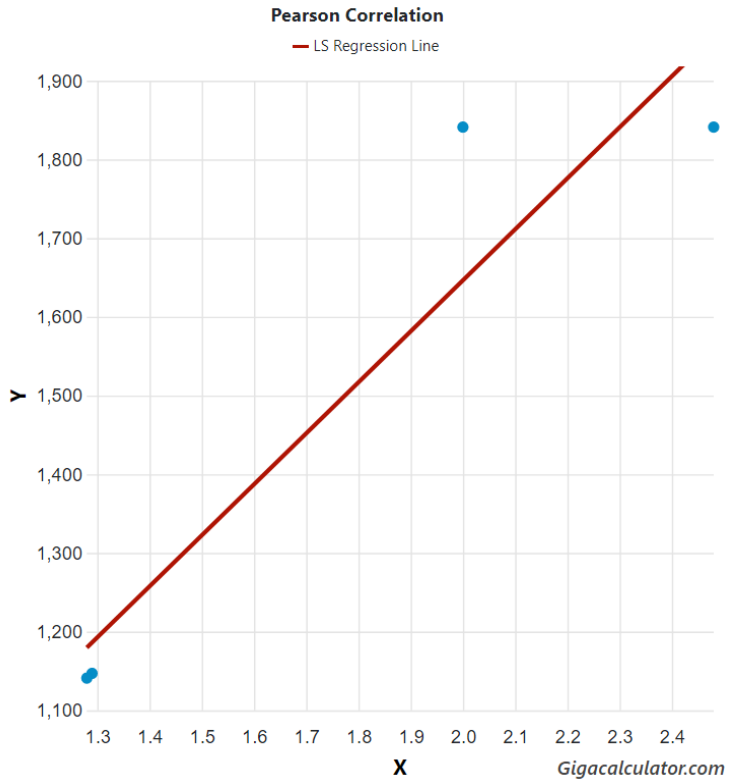

Figure 2. Regression of male shape size on mass in Centrobolus.

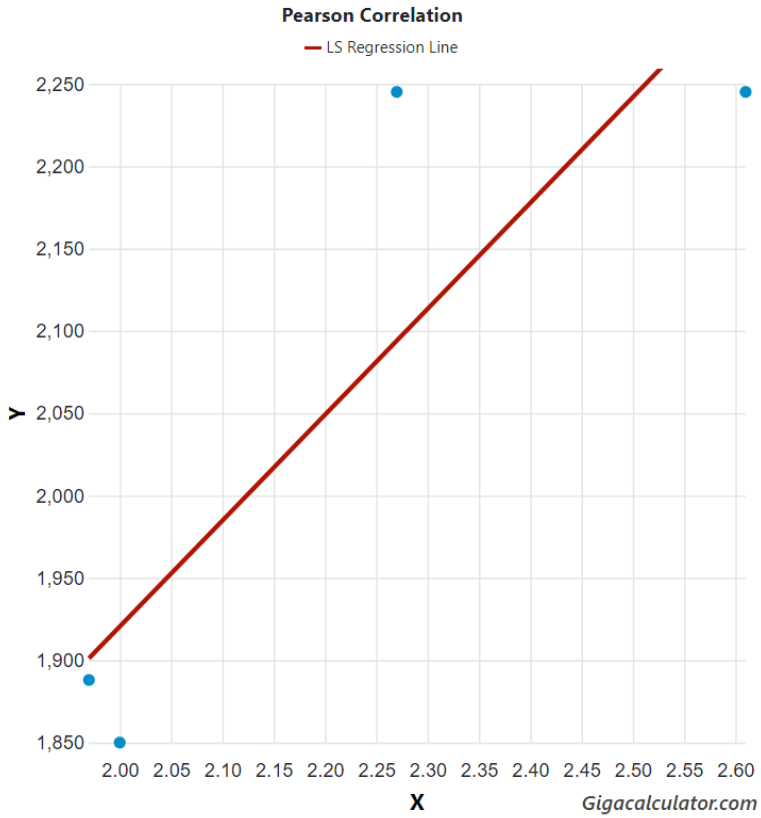

Figure 3. Regression of female shape size on mass in Centrobolus.

DISCUSSION

A significant relationship between mass and mating frequencies in sympatric *Centrobolus* was found. *Centrobolus* has a mass that correlates with mating frequencies. This study found mass recorded and predicted in *Centrobolus* was positively related to mating frequencies. So the mating frequencies are probably determined by the opportunity for selection, degree of polygynandry, and body size in these species. This study supports using mass as a correlate of mating frequency across *Centrobolus*. Examples of mating frequency varying with body mass are unknown. Mass variation with the mating frequencies may occur during seasonal activity patterns in species such as millipedes [28-30]. The relationship between mass and mating frequency supports size-assortative mating in *Centrobolus*.

APPENDIX

0, 2.12747419 (*C. anulatus*).
0, 2.21561154 (*C. anulatus*).
0.0165 2.12747419 (*C. anulatus*).
0.0135, 2.21561154 (*C. anulatus*).
0.066, 2.24 (*C. inscriptus*).
0.054, 2.44 (*C. inscriptus*).
0.0744, 2.24 (*C. inscriptus*).
0.0456, 2.44 (*C. inscriptus*).
0.0093, 2.12747419 (*C. anulatus*).
0.0057, 2.21561154 (*C. anulatus*).
0.072, 2.24 (*C. inscriptus*).
0.048, 2.44 (*C. inscriptus*).
0.00855, , 2.12747419 (*C. anulatus*).
0.00645, 2.21561154 (*C. anulatus*).
0.0396, 2.24 (*C. inscriptus*).
0.0804, 2.44 (*C. inscriptus*).

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