

MALE SECOND POLAR MOMENTS OF INERTNESS ARE RELATED TO COPULATION DURATION IN FOREST RED MILLIPEDES *CENTROBOLUS COOK*, 1897

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Abstract- Male second polar moments of area were correlated with copulation duration in red millipedes *Centrobolus*. Male second polar moments of area were correlated with copulation duration ($r=0.89176172$, Z score= 2.02298207 , $n=4$, $p=0.02153743$) ($y = 0.26540367 \cdot x + -270.89039785$).

Keywords: Polar, Area, SSD, Red Millipedes

I. INTRODUCTION

Red millipedes are found in the southern African subregion with northern limits on the east coast being about -17° latitude S and southern limits being -35° latitude S. They are well represented in the littoral forests of the eastern half of the subcontinent [1-299]. It consists of taxonomically important species with 12 species considered threatened and includes nine vulnerable and three endangered species [226]. It occurs in all the forests of the coastal belt from the Cape Peninsula to Beira in Mocambique [225]. These worm-like millipedes have female-biased sexual size dimorphism [57].

Here, second polar moments of inertia for females are correlated with copulation duration in *Centrobolus* Cook, 1897.

II. MATERIALS AND METHODS

Horizontal tergite width measurements for four species of southern African *Centrobolus* were obtained from published material [57]. These were halved to get radii (r). The second polar moments of area (mm^4) were calculated based on the equation $\pi/2 \cdot r^4$ for females (Appendix 1). A correlation between female second polar moments of area with SSD was generated at <https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php>. Tests for normality were conducted at <https://www.statskingdom.com/kolmogorov-smirnov-test-calculator.html>.

III. RESULTS

Male second polar moments of area were correlated with copulation duration (Figure 1: $r=0.89176172$, Z score= 2.02298207 , $n=4$, $p=0.02153743$) ($y = 0.26540367 \cdot x + -270.89039785$). Results of the lilliefors test indicated that there is a significant difference from the normal distribution in males' second polar moments of area, ($D(22) = .2$, $p = .0255$). Male and female second polar moments of area were significantly different ($Z=-3.961070$, $W=4.00$, $n=22$, $p=0.0000746146$).

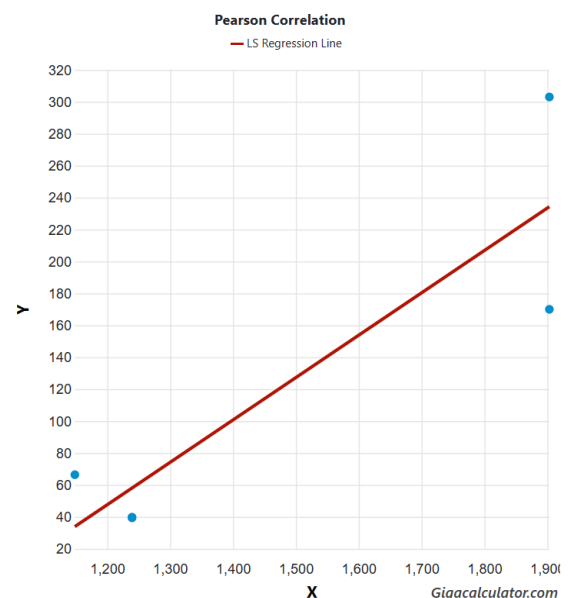


Figure 1. Correlation between the male second polar moment of area and copulation duration in *Centrobolus* Cook, 1897.

IV. DISCUSSION

The significant differences between males and females in second polar moments of area are known in this genus. There is a correlation between male second polar moments of area and

copulation duration is given. This is an addition to one of the many correlated with body size in millipedes. An alternative calculation including body length is another option in calculating the second polar moments of area in these millipedes with cylindrical body shapes.

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APPENDIX 1. Second polar moments of area (mm^4) and copulation duration (min.) for male *Centrobolus* Cook, 1897.

1903.39062, 170

1148.50596, 66.4

1239.43386, 39.8

1903.39062, 303

1239.43386, 39.4