

# SURFACE AREA-TO-VOLUME RATIO IS RELATED TO HOURS OF SUNSHINE THROUGHOUT THE YEAR IN *CENTROBOLUS* COOK, 1897

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**Abstract-** Surface area-to-volume ratio was tested for a correlation with hours of sunshine throughout the year in forest red millipedes *Centrobolus*. Surface-area-to-volume ratio was related to hours of sunshine throughout the year in males (Pearson's  $r=0.54167894$ , Z score  $2.64379727$ ,  $n=22$ ,  $p=0.00409913$ ) and in females (Pearson's  $r=0.44390687$ , Z score  $2.07956978$ ,  $n=22$ ,  $p=0.01878244$ ).

**Keywords:** surface area, SSD, Red Millipedes.

## I. INTRODUCTION

Red millipedes are found in the southern African subregion with northern limits on the east coast being about  $-17^\circ$  latitude S and southern limits being  $-35^\circ$  latitude S. They are well represented in the littoral forests of the eastern half of the subcontinent [1-326]. It consists of taxonomically important species with 12 species considered threatened and includes nine vulnerable and three endangered species [326]. It occurs in all the forests of the coastal belt from the Cape Peninsula to Beira in Mocambique [325]. These worm-like millipedes have female-biased sexual size dimorphism [57].

Here, surface-area-to-volume ratio was tested for a correlation with hours of sunshine throughout the year in *Centrobolus* Cook, 1897.

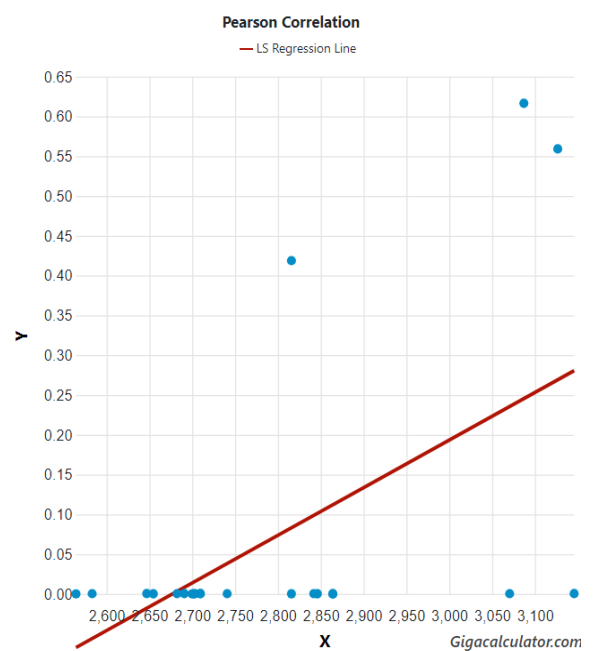
## II. MATERIALS AND METHODS

Surface-area-to-volume ratio for 22 species of southern African *Centrobolus* were obtained from published material [68]. These were correlated with hours of sunshine throughout the year and generated at <https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php>.

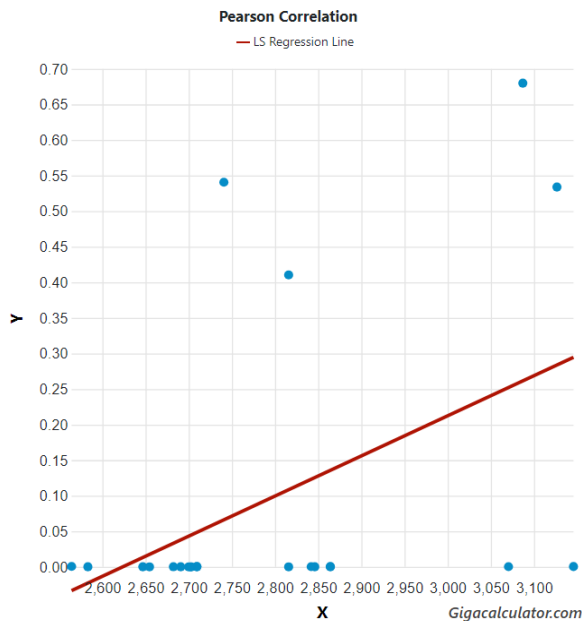
## III. RESULTS

Surface-area-to-volume ratio was related to hours of sunshine throughout the year in males (Fig. 1: Pearson's  $r=0.54167894$ , Z score  $2.64379727$ ,

$n=22$ ,  $p=0.00409913$ ) and in females (Fig. 2: Pearson's  $r=0.44390687$ , Z score  $2.07956978$ ,  $n=22$ ,  $p=0.01878244$ ).



**Fig. 1** Surface-area-to-volume ratio correlated hours of sunshine throughout the year in male *Centrobolus* Cook, 1897.



**Fig. 2 Surface-area-to-volume ratio correlated to hours of sunshine throughout the year in female *Centrobolus* Cook, 1897.**

#### IV. DISCUSSION

The significant differences between males and females in volumes are known in this genus [68]. There is a correlation between surface-area-to-volume ratios and hours of sunshine throughout the year in *Centrobolus*. This is an addition to one of the many correlated with body size in millipedes.

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**APPENDIX 1.** Male surface-area-to-volume ratios preceded by hours of sunshine throughout the year (h) for 22 species of *Centrobolus* Cook, 1897.

2690.72, 0.000510  
2709.47, 0.000486  
2740.74, 0.000365  
3145.74, 0.000485  
2846.04, 0.000245  
2815.76, 0.000218  
2703.13, 0.000294  
2699.92, 0.000136  
2709.47, 0.000393  
2583.18, 0.000335  
2864.06, 0.000156  
3087.04, 0.616435  
2646.85, 0.000510  
2815.76, 0.418711  
2654.59, 0.000220  
2702.09, 0.000223  
2864.06, 0.000169  
2682.25, 0.000357  
3126.58, 0.559114  
2841.89, 0.000422  
3070.45, 0.000349

2564.32, 0.000136

**APPENDIX 2.** Female surface-area-to-volume ratios preceded by hours of sunshine throughout the year (h) for 22 species of *Centrobolus* Cook, 1897.

2690.72, 0.000177  
2709.47, 0.000578  
2740.74, 0.540690  
3145.74, 0.000484  
2846.04, 0.000179  
2815.76, 0.000132  
2703.13, 0.000108  
2699.92, 0.000113  
2709.47, 0.000274  
2583.18, 0.000213  
2864.06, 0.000716  
3087.04, 0.679931  
2646.85, 0.000245  
2815.76, 0.4103607  
2654.59, 0.000138  
2702.09, 0.000113  
2864.06, 0.000135  
2682.25, 0.000314  
3126.58, 0.533940  
2841.89, 0.000335  
3070.45, 0.000318  
2564.32, 0.000751