

SURFACE AREA-TO-VOLUME RATIO IS RELATED TO TEMPERATURE IN *CENTROBOLUS* COOK, 1897

M. I. Cooper

University of South Africa.

Abstract- Surface area-to-volume ratio was tested for a correlation with temperature in forest red millipedes *Centrobolus*. Surface-area-to-volume ratio was marginally related to temperature in males (Spearman's $r=-0.33692008$, Z score= -1.48440801 , $n=22$, $p=0.06885039$) and was related in females (Spearman's $r=-0.38692405$, Z score= -1.72811582 , $n=22$, $p=0.04198369$).

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° latitude S and southern limits being -35° latitude S. They are well represented in the littoral forests of the eastern half of the subcontinent [1-326]. 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 temperature 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 temperature and generated at <https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php>.

III. RESULTS

Surface-area-to-volume ratio was marginally related to temperature in males (Fig. 1: Spearman's $r=-0.33692008$, Z score= -1.48440801 , $n=22$, $p=0.06885039$) and was related in females (Fig. 2: Spearman's $r=-$

0.38692405 , Z score= -1.72811582 , $n=22$, $p=0.04198369$).

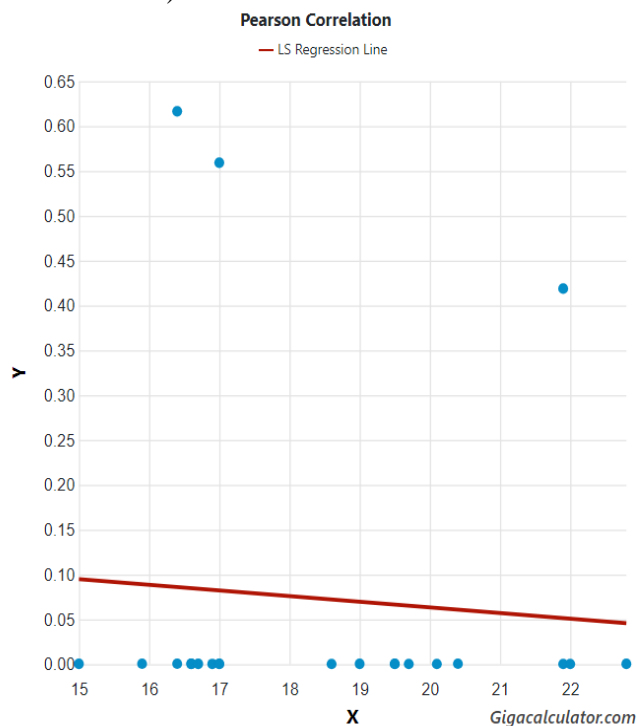


Fig. 1 Surface-area-to-volume ratio marginally correlated with temperature in male *Centrobolus* Cook, 1897.

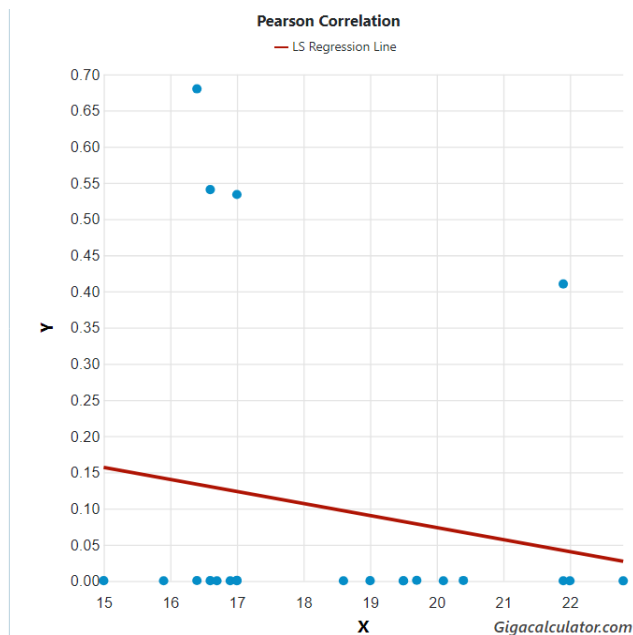


Fig. 2 Surface-area-to-volume ratio correlated to temperature in female *Centrobolus* Cook, 1897.

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 temperature in *Centrobolus*. This is an addition to one of the many correlated with body size in millipedes.

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 16.4, 0.000484
 16.9, 0.000179
 21.9, 0.000132
 22.8, 0.000108
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 16.6, 0.000274
 16.7, 0.000213
 17.0, 0.000716
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 22.0, 0.000113
 18.6, 0.000135
 19.0, 0.000314
 17.0, 0.533940
 17.0, 0.000335
 15.0, 0.000318
 19.7, 0.000751

APPENDIX 1. Male surface-area-to-volume ratios preceded by temperature (degrees Celsius) for 22 species of *Centrobolus* Cook, 1897.

- 15.9, 0.000510
 20.4, 0.000486
 16.6, 0.000365
 16.4, 0.000485
 16.9, 0.000245
 21.9, 0.000218
 22.8, 0.000294
 19.5, 0.000136
 16.6, 0.000393
 16.7, 0.000335
 17.0, 0.000156
 16.4, 0.616435
 19.5, 0.000510
 21.9, 0.418711
 20.1, 0.000220
 22.0, 0.000223
 18.6, 0.000169
 19.0, 0.000357
 17.0, 0.559114
 17.0, 0.000422
 15.0, 0.000349
 19.7, 0.000136

APPENDIX 2. Female surface-area-to-volume ratios preceded by temperature (degrees Celsius) for 22 species of *Centrobolus* Cook, 1897.

- 15.9, 0.000177
 20.4, 0.000578