SURFACE AREA-TO-VOLUME RATIO ARE RELATED TO SECOND POLAR MOMENTS OF INERTNESS IN *CENTROBOLUS* COOK, 1897

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Abstract- Surface area-to-volume ratio was tested for a correlation with second polar moments of inertness in forest red millipedes *Centrobolus*. Surface-area-to-volume ratio was related to second polar moments of inertness in males (Spearman's r=-0.47267156, Z score=-2.17404474, n=22, p=0.01485083) and in females (Spearman's r=-0.54596943, Z score=-2.59367598, n=22, p=0.00474783).

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 [1-297]. 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, surface-area-to-volume ratio was tested for a correlation with second polar moments of inertness

correlation with second polar moments of inertness 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 second polar moments of inertness and generated at https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php.

III. RESULTS

Surface-area-to-volume ratio was related to second polar moments of inertness in males (Fig. 1: Spearman's r=-0.47267156, Z score=-2.17404474, n=22, p=0.01485083) and in females (Fig. 2:

Spearman's r=-0.54596943, Z score=-2.59367598, n=22, p=0.00474783).

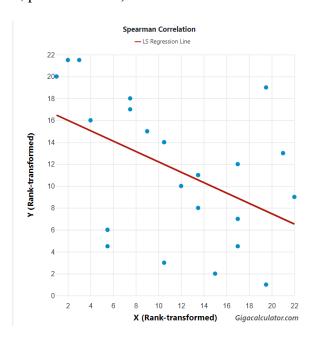


Fig. 1 Surface-area-to-volume ratio correlated to second polar moments of inertness in male *Centrobolus* Cook, 1897.

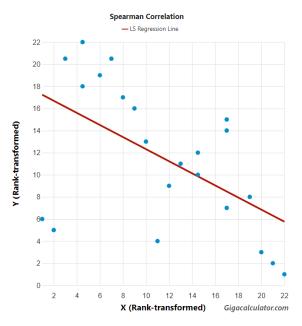


Fig. 2 Surface-area-to-volume ratio correlated to second polar moments of inertness in female *Centrobolus* Cook, 1897.

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 second polar moments of inertness in *Centrobolus*. This is an addition to one of the many correlated with body size in millipedes.

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- [321] Cooper Mark. SPECIES RICHNESS IS MARGINALLY RELATED TO LENGTH IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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- [333] Cooper Mark. WIDTH IS RELATED TO HIGHEST TOTAL HOURS OF SUNSHINE IN A MONTH IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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- [339] Cooper Mark. MATING FREQUENCIES ARE RELATED TO MAXIMUM OCEAN WATER TEMPERATURES IN COASTAL FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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- [377] Cooper Mark. CURVED SURFACE AREA IS RELATED TO HIGHEST OCEAN WATER TEMPERATURES IN COASTAL FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
- [378] Cooper Mark. PRECIPITATION IS RELATED TO HIGHEST OCEAN WATER TEMPERATURES IN COASTAL FOREST REDMILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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- [390] Cooper Mark. CURVED SURFACE AREA IS RELATED TO SPECIES RICHNESS IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
- [391] Cooper Mark. CURVED SURFACE AREA IS RELATED TO SECOND POLAR MOMENTS OF INERTIA IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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- [393] Cooper Mark. CURVED SURFACE AREA IS RELATED TO LONGITUDE IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
- [394] Cooper Mark. LOWEST NUMBER OF DAILY HOURS OF SUNSHINE IN A DAY IS RELATED TO LONGITUDE IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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- [396] Cooper Mark. MINIMUM TEMPERATURE IS RELATED TO LATITUDE IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
- [397] Cooper Mark. MINIMUM TEMPERATURE IS RELATED TO LONGITUDE IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
- [398] Cooper Mark. TEMPERATURE IS RELATED TO LONGITUDE IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
- [399] Cooper Mark. PRECIPITATION IS RELATED TO LONGITUDE IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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- [401] Cooper Mark. HIGHEST TOTAL HOURS OF SUNSHINE IN A MONTH IS RELATED TO LONGITUDE IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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- [404] Cooper Mark. SPECIES RICHNESS IS NOT RELATED TO DISTANCE TO THE NEAREST AIRPORT IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
- [405] Cooper Mark. MATING FREQUENCY IS RELATED to DISTANCE TO THE NEAREST AIRPORT IN FOREST RED MILLIPEDES CENTROBOLUS COOK, 1897. (In Prep.).
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APPENDIX 1. Surface-area-to-volume ratios followed by male second polar moments of inertness (mm⁴) for 22 species of *Centrobolus* Cook, 1897.

402.123860, 0.000510 1239.43386, 0.000486

644.124670, 0.000365 402.123860, 0.000485

981.747706, 0.000245

1148.50596, 0.000218

766.498501, 0.000294

1903.39062, 0.000136 44.1246700, 0.000393

66.4985010, 0.000335

2321.06144, 0.000156

263.833465, 0.616435

1239.43386, 0.000510

766.498501, 0.418711 1148.50596, 0.000220

1335.65692, 0.000223

263.833465, 0.000169

588.749544, 0.000357

443.869501, 0.559114

588.749544, 0.000422 402.123860, 0.000349

2035.75204, 0.000136

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APPENDIX 2. Surface-area-to-volume ratios followed by female second polar moments of inertness (mm⁴) for 22 species of *Centrobolus* Cook, 1897.

2035.75204, 0.000177

644.124670, 0.000578

488.784066, 0.540690

588.749544, 0.000484

644.124670, 0.000179

3358.57870, 0.000132

3771.48199, 0.000108

3165.33069, 0.000113

766.498501, 0.000274

644.124670, 0.000213

7820.54505, 0.000716

186.284035, 0.679931

1658.13276, 0.000245

1437.37682, 0.4103607

1157.57002, 0.1105007

2174.89962, 0.000138 4970.09776, 0.000113

3771.48199, 0.000135

833.844037, 0.000314

537.024006, 0.533940

1148.50596, 0.000335

766.498501, 0.000318

7101.91201, 0.000751