

MALE SURFACE AREA TO VOLUME RATIO CORRELATES WITH FEMALE SURFACE AREA TO VOLUME RATIO AND POTENTIALLY ALSO SPECIES RICHNESS IN PILL MILLIPEDES *SPHAEROTHERIUM* BRANDT, 1833.

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Abstract- The male surface area to volume ratio was correlated with the female surface area to volume ratio across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833. There was a correlation between the male surface area to volume ratio with the with the female surface area to volume ratio across the distribution of pill millipedes *Sphaerotherium* ($r=-0.9126$, $r^2=0.8328$, $n=7$, $p=0.00136$). Male surface area to volume ratio was related to species richness (P-value calculator: Z score=2.021174, $n=2, 6$, $p=0.043262$). Female surface area to volume ratio was also related to species richness (P-value calculator: Z score=3.194887, $n=2, 6$, $p=0.001399$).

Keywords: dimorphism, Pill Millipedes.

I. INTRODUCTION

Diplopoda are underrepresented in allometric analyses of sexual size dimorphism (SSD), although sexual differences are known in body mass, length, width and leg dimensions of over half the taxa studied [1-380]. Size differences occur with factors such as color, sexes, species, urbanisation and water relations. Diplopoda resemble the majority of invertebrates where SSD is reversed. SSD has consequences for the outcome of sexual encounters in diplopod mating. The macro-evolutionary patterns are being resolved in the class Diplopoda.

In the present study, a correlation between the male and female surface area to volume ratios is performed across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833 was conducted.

II. MATERIALS AND METHODS

Male and female surface area was calculated at <https://www.omnicalculator.com/math/area-of-sphere> from the widths of seven millipede species (<https://www.entomoljournal.com/archives/2018/vol6issue1/PartI/5-6-352-508.pdf>) (Appendix 1 & 2). Species richness was determined from a

latitudinal diversity gradient at [http://www.iaees.org/publications/journals/arthropods/articles/2020-9\(4\)/latitudinal-gradient-in-species-richness-of-Sphaerotherium.pdf](http://www.iaees.org/publications/journals/arthropods/articles/2020-9(4)/latitudinal-gradient-in-species-richness-of-Sphaerotherium.pdf). A correlation between the three factors was generated at <https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php> and <https://www.gigacalculator.com/calculators/p-value-significance-calculator.php>. A minimum sample size of two was inputted into the p-value calculator as the samples for male surface area and minimum temperature were means.

III. RESULTS

There was a correlation between the male surface area to volume ratio with the with the female surface area to volume ratio across the distribution of pill millipedes *Sphaerotherium* (Fig. 1: $r=-0.9126$, $r^2=0.8328$, $n=7$, $p=0.00136$).

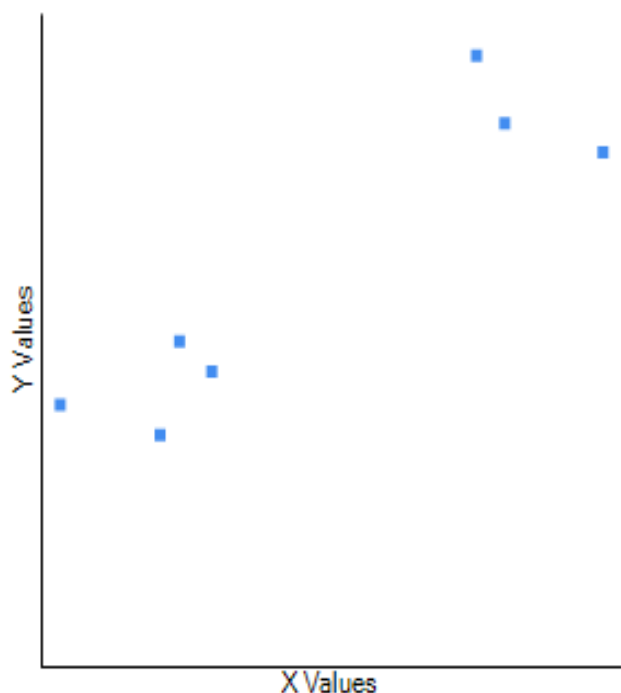


Fig. 1 A positive correlation between the male surface area to volume ratio with female surface area to volume ratio across the distribution of pill millipedes *Sphaerotherium*.

Male surface area to volume ratio was related to species richness (P-value calculator: Z score=2.021174, n=2, 6, p=0.043262). Female surface area to volume ratio was also related to species richness (P-value calculator: Z score=3.194887, n=2, 6, p=0.001399).

IV. DISCUSSION

The significant effect of weather on males and females in size are known in this genus. There is a positive correlation between the male and female surface area to volume ratios. Lower surface area to volume ratios were associated with lower species richness while higher surface area to volume ratios were associated with higher species richness. This is an addition to one of the many relationships of body size in pill millipedes. Both factors correlated with species richness.

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APPENDIX 1. The male surface area to volume ratios (1/mm) followed by female surface area to

volume ratios (1/mm) in seven pill millipedes

Sphaerotherium Brandt, 1833.

0.19355, 0.1613 (25)

0.5, 0.3158 (25)

0.27907, 0.1818 (25)

0.25, 0.14286 (9)

0.26087, 0.2 (25)

0.4286, 0.375 (25)

0.4444, 0.3333 (25)