



E-ISSN: 2788-8428  
 P-ISSN: 2788-8436  
 ZEL 2022; 2(2): 17-20  
 Received: 06-04-2022  
 Accepted: 08-05-2022

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## Sexual dimorphism across latitude in pill millipedes (Diplopoda)

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### Abstract

Sexual size dimorphism (SSD) was investigated across latitudes in southern African members of the pill millipede genus *Sphaerotherium*. Body width was extracted from published material (1928) and used to compare interspecific variation in mean calculated volumes using a morphometric approach. Based on the formula for a sphere ( $\frac{4}{3} \cdot \pi \cdot r^3$ ), volume was calculated in seven given species. A positive relationship between SSD and latitude ( $R = 0.71$ ;  $Z$  score = 1.78,  $n=7$ ,  $P = 0.04$ ) was established.

**Keywords:** Allometry, pill millipede, Rensch's rule, *sphaerotherium*

### 1. Introduction

Diplopoda is currently being studied concerning SSD, and intersexual differences are appearing in body mass, length, width, and leg dimensions in diverse taxa [8, 29, 30, 35, 37, 54, 66]. Mensural differences can be detected in characters including sexual characters, urbanization, and hydraulic relations [4, 6]. Millipedes compare similarly with arthropods showing female-biased or reversed SSD [11-27]. Sexual dimorphism can determine reproductive events [1, 11-27, 58]. The relationship between body size and SSD can either be hypoallometrical or hyperallometrical if there are decreasing or increasing rates of SSD with increases in body size [11-27, 51, 52, 62]. This rule is often attributed to non-natural selection [2, 7, 9, 28]. The corroboration is including pill millipedes [47].

Sexual dimorphism in pill millipedes with 60 or more species is investigated [27]. Males and females can conglobate [65]. Like other millipedes, these pill millipedes have female-biased SSD [11-27]. A latitudinal relationship with SSD was investigated here.

### 2. Material and Methods

Seven pill millipedes' (1) body width (mm) was extracted from published data [3] and males were compared to females with a matched-pairs test. Total body size estimated from horizontal dorsal tergite. SSD was taken to be female volume divided by male volume with an index and subtraction of one [39]. A model was given [45].

#### 2.1 Statistical analysis

SSD is compared across latitude at <https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php>.

### 3. Results

In seven measurements of mean species SSD width was marginally related to latitude ( $r = 0.60730501$ ,  $Z$  score = 1.40928094,  $n = 7$ ,  $p = 0.07937611$ ). SSD crossed latitude (Figure 1:  $R = 0.71032308$ ;  $Z$  score = 1.77567134,  $n=7$ ,  $P = 0.03789350$ ) ( $\hat{y} = 0.65731968 \cdot x + 24.9646722$ ).

### 4. Discussion

SSD showed the linear relationship or correlation here typical of taxa with reversed SSD [5, 10, 34, 36, 38, 40-44, 46-50, 53, 55-57, 59-60, 48-53]. Identification of SSD across latitude is generated without a phylogenetic approach [61, 63, 64]. As many pill millipedes are arboreal one may also imply interspecific competition as a driver of SSD [33]. The new relationship proposed between SSD and latitude is an opportunity to increase the sample sizes given. The filling of the gap between the most and least dimorphic species across latitude is required to secure the significance of this relationship though it may not have any genetic grounding it is interesting as it questions the causality of SSD. It is most likely a relationship that has evolved through intersexual competition.

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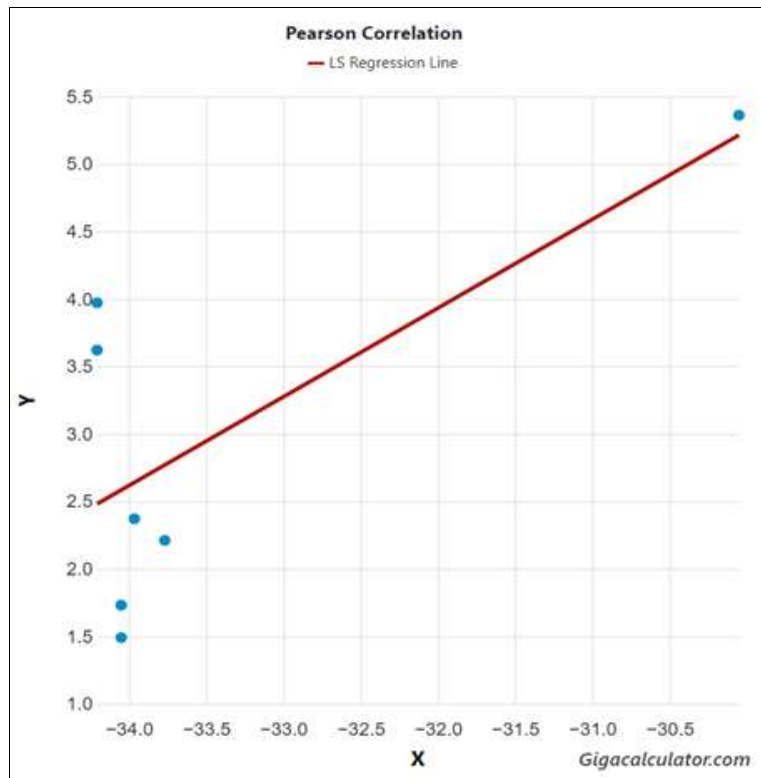


Fig 1: The linear relationship between SSD and latitude in *Sphaerotherium*.

## 5. Conclusion

A new relationship between latitude and SSD in *Sphaerotherium* pill millipedes is proposed.

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