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AIR PRESSURE IS NOT RELATED TO SPECIES RICHNESS IN PILL MILLIPEDES *SPHAEROTHERIUM* BRANDT, 1833

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***Abstract*- Air pressure was tested for a relationship with species richness in pill millipedes *Sphaerotherium*. There were no differences between air pressure at the distribution of 1 and 3 species (Z-test:, P-value=0.21, Z score=0.81, 3,3), 7 and 9 species (Z-test: P-value=0.28, Z-score=0.59; n=9, 7), 9 and 25 species Z-test: P-value=0.42, Z-score=-0.19, n=23, 7), 3 and 7 species (Z-test: P-value=0.22, Z-score=-0.78; n=7, 6), or 25 species and the rest (Z-test: P-value=0.15, Z score=-1.02, n=23, 22). This suggests air pressure was not related to species richness in *Sphaerotherium*.**

***Keywords*: diversity; gradient; latitude; richness; species.**

I. INTRODUCTION

Species richness is the number of different species represented in an ecological community, landscape or region [4-7]. Species richness and biodiversity increase from the poles to the tropics for a wide variety of terrestrial and marine organisms and is referred to as a latitudinal diversity gradient (LDG) [17, 29]. Inverse LDG includes aphids, Chinese litter-dwelling thrips, diving beetle subfamily (Colymbetinae), European bryophytes, freshwater zooplankton, Holarctic tree frogs, ichneumonids, marine benthic algae, marine bivalves (Anomalodesmata), New World snake tribe (Lampropeltini), North American breeding birds, penguins, (peracarid) crustaceans, pitcher plant mosquito, pond turtles, Shallow-water molluscs, shorebirds, southeastern United States trees, subarctic forests and tropical leaf-litter ant communities [21, 22, 23, 25, 26, 28, 32, 33; 37, 38, 42].

The LDG was measured and tested in the Oniscomorph forest millipede genus *Sphaerotherium* Brandt, 1833 [9]. This forest clade belonging to the Order Sphaerotheriida is distributed along the eastern coast of southern Africa consisting of species with concentrations around coastal bush and forests [1, 2, 8, 15, 16, 19, 24, 34, 39, 40, 41, 43]. Here species richness in pill millipedes are tested for correlations with air pressure.

II. MATERIALS AND METHODS

45 of 49 valid species were identified as belonging to the genus *Sphaeotherium* Brandt, 1833 [16]. These were tabulated and known localities also listed [9]. Localities were obtained from Hamer [16]. GPS coordinates were obtained from internet sources for known localities using the locality followed with the keyword “GPS”. Latitude and longitude coordinates were obtained. When co-ordinates were not in decimal degrees, they were subsequently converted to decimals in dividing the seconds in 60 and adding these to the minutes which were together divided through 60 to get the decimal behind or following the degree. Species accepted were in accordance with MilliBase (http://www.millibase.org). Species richness correlations with latitude were given [9]. Air pressure was calculated for each type locality. P-value calculations were produced between air pressure at neighbouring species richness and between the highest species richness and the rest (Appendix 1). A test for normality of air pressure data was performed at https://www.statskingdom.com/kolmogorov-smirnov-test-calculator.html. The outcome of this test determined what P-value test would be used in comparing the data of air pressure across species richness. If the data were normal a T-test would be used while if the data were not normal a Z-test is used. The P-value calculator can be found at https://www.gigacalculator.com/calculators/p-value-significance-calculator.php.

III. RESULTS

There were no differences between air pressure at 1 and 3 species (Z-test:, P-value=0.208816, Z score=0.810535, 3,3), 7 and 9 species (Z-test: P-value=0.277249, Z-score=0.591034; n=9, 7), 9 and 25 species Z-test: P-value=0.424227, Z-score=-0.191090, n=23, 7), between 3 and 7 species (Z-

test: P-value=0.216748, Z-score=-0.783225; n=7, 6), or 25 species and the others (Z-test: P-value=0.154176, Z score=-1.018687, n=23, 22). Results of the lilliefors test indicated that there is a significant difference from the normal distribution (D(45) =0.19, p = 0.000243).

IV. DISCUSSION

Sphaerotherium are a Gondwanan relict [18]. *Sphaerotherium* are more temperate and show a general decline in LDG [5, 6, 7, 30, 44, 46]. Other groups showing an inverse LDG includes aphids, Chinese litter-dwelling thrips, diving beetle subfamily (Colymbetinae), European bryophytes, freshwater zooplankton, Holarctic tree frogs, ichneumonids, marine benthic algae, marine bivalves (Anomalodesmata), New World snake tribe (Lampropeltini), North American breeding birds, penguins, peracarid crustaceans, pitcher plant mosquito, pond turtles, Shallow-water molluscs, shorebirds, southeastern United States trees, subarctic forests and tropical leaf-litter ant communities [21, 22, 23, 25, 26, 28, 32, 33; 37, 38, 42].

There may be an evolutionary preference for temperate environments appearing to have led to climatic constraints on dispersal based primarily on precipitation or temperature seasonality gradients [20, 32]. LDG depends on proximate factors affecting processes of speciation, extinction, immigration, and emigration and in *Sphaerotherium* these factors are dependent on size which have been investigated in *Sphaerotherium* based on temperature, precipitation and latitude [10-12]. LDG may relate to body size in *Sphaerotherium* probably which does not agree with the trends in other taxa such as birds and fishes [45]. The trend of a small body size associated with the inverse LDG is expected to be similar to the weak tendency found in mammals [14].

Although air pressure has been associated with species richness in red millipedes no relationship was found in the pill millipedes *Sphaerotherium* [13].

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Appendix 1. Air pressure (Pa) followed by mean species richness in *Sphaerotherium.*

85556.60, 9
86404.73, 7
88987.01, 25
101217.52, 25
85556.60, 9
91594.51, 25
88987.01, 25
100776.65, 7
94406.69, 9
94323.32, 7
101217.52, 25
101217.52, 25
88987.01, 25
82260.82, 7
94421.16, 25
101146.85, 25
94406.69, 9
99085.80, 25
94550.04, 1
98649.97, 7
97895.21, 9
100592.51, 1
99035.51, 3
84889.15, 3
101002.63, 7
89663.01, 1
99597.56, 25
101217.52, 25
100697.17, 9
85593.69, 25
84337.14, 9
88020.22, 3
83274.52, 25
99306.29, 7
100775.23, 25
93215.22, 25
100758.33, 25
101217.52, 25
101217.52, 25
89663.01, 9
94841.70, 25
100489.42, 25
83274.52, 25
88987.01, 25
100564.98, 9