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ABUNDANCE VARIES WITH MINIMUM TEMPERATURE IN RED MILLIPEDES CENTROBOLUS COOK, 1897

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Abstract- **In this paper, I check for correlations between the abundance of males and females and average temperature, minimum temperature, maximum temperature, precipitation, humidity, rainy days, and average Sun hours in red millipedes *Centrobolus* Cook, 1897. I found correlations between abundance and minimum temperature (r=-0.72934109, Z score=-2.07354647, n=8, p=0.01906066) (y = -0.00336932 · x + 21.84392080). Increases of +1.2°C in minimum temperature contributed to decreases in the abundance. When the standard deviation (243.24473, n=2) for the abundance of *C. inscriptus* was substituted into the equation the temperature was estimated to be 21.024351°C. Similarly, when the standard deviation (41.01219, n=2) for *C. anulatus* was substituted into the equation the temperature was estimated to be 21.705738°C. Therefore the accuracy of the temperature prediction differed by 0.681387°C for differences in S.D. between sympatric species. The absolute abundance recorded for *C. anulatus* gave estimated temperatures of 21.843921°C (0) and 21.843921°C (58) which were identical while the absolute abundances recorded for *C. inscriptus* gave estimated temperatures of 21.503619°C (101) and 20.344573°C (445) which differed by 1.159046.**

I. INTRODUCTION

A forest genus of diplopods belonging to the Order Spirobolida found along the eastern coast of southern Africa was the subject of this study. The millipede genus Centrobolus is found in the temperate South African subregion, its northern limits on the east coast of southern Africa being about -17° latitude S. It occurs in all the forests of the coastal belt from the Cape Peninsula to Beira in Mocambique. While the coastal forests of the South-West and Eastern Cape are mist belt temperate forests, those of the Transkei, Natal, Zululand, and Mocambique are somewhat different, being better described as East Coast Bush, they are developed almost entirely in a narrow strip of the litoral on a dune sand substratum, and are more tropical in aspect and composition than those to the west of them. There is a summer rainfall of 762-1016 mm, a uniform environmental temperature, and an absence of frost; the component trees of the coastal bush with their abundant creepers and lianes, while not usually reaching a height of more than 11 meters, provide a dense covering with ample shade and humidity at ground level. As essentially shade-loving Diplopoda, the members of the genus are especially well represented in these litoral forests of the eastern half of the subcontinent [1-81].

In this paper, I check for correlations between the abundance of males and females and average temperature, minimum temperature, maximum temperature, precipitation, humidity, rainy days, and average Sun hours in red millipedes *Centrobolus* Cook, 1897.

II. MATERIALS AND METHODS

The data were collected during the rainy season because in southern Africa millipede surface activity is strongly seasonal and related to feeding and reproduction and this is also when population densities peak. The two species of millipedes were sampled in their indigenous tropical coastal forest habitat at Twin Streams Farm, Mtunzini, South Africa (28°55'S; 31 °45'E). It is within this part of the typical coastal forest belt that *C. anulatus* and *C. inscriptus* are in geographical sympatry. An area of forest with continuous tree canopy cover was delimited and all sampling occurred within those bounds. In the first season, two temporally separate sampling efforts were made and the OSR was measured early in the season (DECEMBER) and late in the season (FEBRUARY). Seven weather patterns for December and February were obtained from https://en.climate-data.org/africa/south-africa/kwazulu-natal/mtunzini-772733/.
Correlations between abundance and weather factors (one at a time versus abundance) were produced at https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php.

III. RESULTS

I found correlations between abundance and minimum temperature (Figure 1: r=-0.72934109, Z

score=-2.07354647, n=8, p=0.01906066) (y = -0.00336932 · x + 21.84392080).

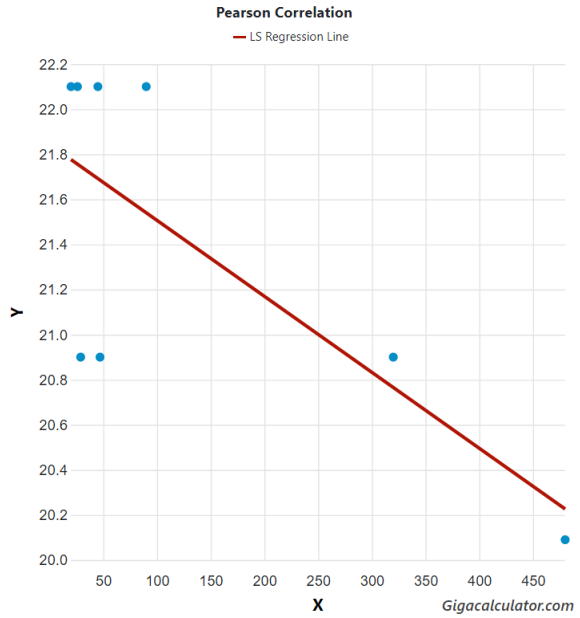

Figure 1. Correlation between abundance and minimum temperature in two species of *Centrobolus*.

IV. DISCUSSION

Differences of +1.2°C in minimum temperature contributed to differences in the abundance of *C. anulatus* and *C. inscriptus*. When the standard deviation (243.24473, n=2) for the abundance of *C. inscriptus* was substituted into the equation the temperature was estimated to be 21.024351°C. Similarly, when the standard deviation (41.01219, n=2) for *C. anulatus* was substituted into the equation the temperature was estimated to be 21.705738°C. Therefore the accuracy of the temperature prediction differed by 0.681387°C for differences in S.D. between sympatric species. The absolute abundance recorded for *C. anulatus* gave estimated temperatures of 21.843921°C (0) and 21.843921°C (58) which were identical while the absolute abundances recorded for *C. inscriptus* gave estimated temperatures of 21.503619°C (101) and 20.344573°C (445) which differed by 1.159046.

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