

CLIMATIC CORRELATES IN PILL MILLIPEDES SPHAEROTHERIUM BRANDT, 1833.

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Abstract- The minimum temperature with the highest and lowest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833 was calculated. There was a correlation between the minimum temperature with the highest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* ($r=0.7714$, $r^2=0.5951$, $n=7$, $p=0.042245$). There was a correlation between the minimum temperature with the lowest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* ($r=0.912$, $r^2=0.8317$, $n=7$, $p=0.004206$). The mean annual temperature with the highest and lowest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833 was calculated. There was a correlation between the mean annual temperature with the highest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* ($r=0.7922$, $r^2=0.6276$, $n=7$, $p=0.033684$). There was a correlation between the mean annual temperature with the lowest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* ($r=0.9241$, $r^2=0.8725$, $n=7$, $p=0.002066$). The highest, lowest, and mean ocean water temperature were correlated with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833. There was a correlation between the highest ocean water temperature with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* ($r=-0.9576$, $r^2=0.917$, $n=7$, $p=0.000695$). There was a correlation between the lowest ocean water temperature with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* ($r=-0.8825$, $r^2=0.7788$, $n=7$, $p=0.008524$). There was a correlation between the mean ocean water temperature with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* ($r=-0.74236672$, Z score= -1.91146247 , $n=7$, $p=0.02797252$). The hours of sunshine each month was correlated with the month with the most and least daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833. There was a correlation between the hours of sunshine each month with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Pearson's $r=0.76982277$, Z score= 2.03978509 , $n=7$, $p=0.02068580$). There was a correlation between the hours of sunshine each month with the month with the lowest daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Pearson's $r=0.81607806$, Z score= 2.28992312 , $n=7$, $p=0.01101286$). The mean annual temperature with the highest average temperature across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833 was calculated. There was a correlation between the mean annual temperature with the highest average temperature across the distribution of pill millipedes *Sphaerotherium* ($r=0.9646$, $r^2=0.9305$, $n=7$, $p=0.000444$). There was a correlation between the mean annual temperature with the lowest average temperature across the distribution of pill millipedes *Sphaerotherium*

($r=0.9327$, $r^2=0.8699$, $n=7$, $p=0.002152$). These factors potentially determine the size of female pill millipedes. These factors potentially determine the size of female pill millipedes. The driest and wettest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833 was calculated. There was a marginal correlation between the driest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* ($r=-0.7366$, $r^2=0.5326$, $n=7$, $p=0.05782$; Pearson's $r=0.73655358$, Z score= 1.88580773 , $n=7$, $p=0.02966037$). There was a correlation between the wettest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* ($r=-0.9404$, $r^2=0.8844$, $n=7$, $p=0.00164$). The difference between the driest and wettest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833 was calculated. There was a correlation between the difference between the driest and wettest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* ($r=-0.9217$, $r^2=0.8495$, $n=7$, $p=0.000248$). Minimum precipitation was correlated with maximum precipitation and the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833. There was a correlation between the minimum precipitation with the maximum precipitation across the distribution of pill millipedes *Sphaerotherium* (Pearson's $r=-0.8568$, $r^2=0.7341$, $n=7$, $p=0.013777$). There was a correlation between the minimum precipitation with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Pearson's $r=-0.68117751$, Z score= -1.66261523 , $n=7$, $p=0.04819472$).

Keywords: driest, months, Pill Millipedes, wettest.

I. INTRODUCTION

Diplopoda are underrepresented in allometric analyses of SSD, although sexual differences are known in body mass, length, width and leg dimensions of over half the taxa studied [1-283]. 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 climatic factors across the distribution of pill

millipedes *Sphaerotherium* Brandt, 1833 was conducted.

II. MATERIALS AND METHODS

The climatic factors were obtained at <https://en.climate-data.org/africa/south-africa> across the distribution of seven pill millipedes *Sphaerotherium* Brandt, 1833 (<https://www.entomoljournal.com/archives/2018/vol6issue1/PartI/5-6-352-508.pdf>) (Appendix 1-21). A correlation between the factors was generated at <https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php>.

III. RESULTS

There was a correlation between the minimum temperature with the lowest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* (Fig. 1: $r=0.912$, $r^2=0.8317$, $n=7$, $p=0.004206$).

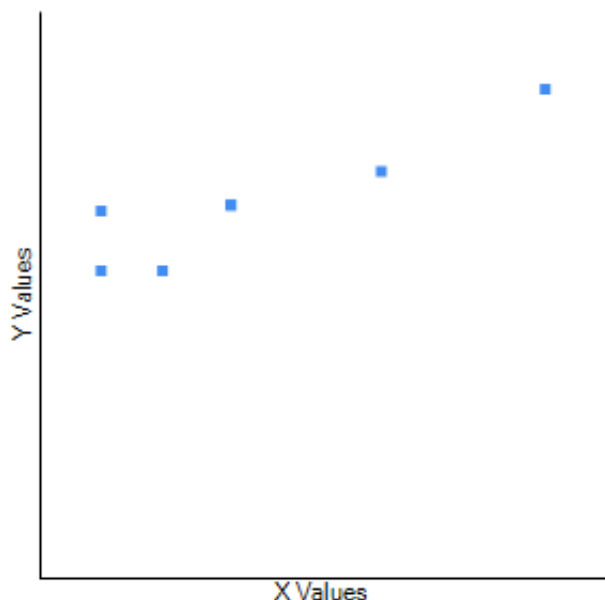


Fig. 1 A correlation between the minimum temperature with the lowest ocean water temperature across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the minimum temperature with the highest ocean water temperature across the distribution of pill

millipedes *Sphaerotherium* (Fig. 2: $r=0.7714$, $r^2=0.5951$, $n=7$, $p=0.042245$).

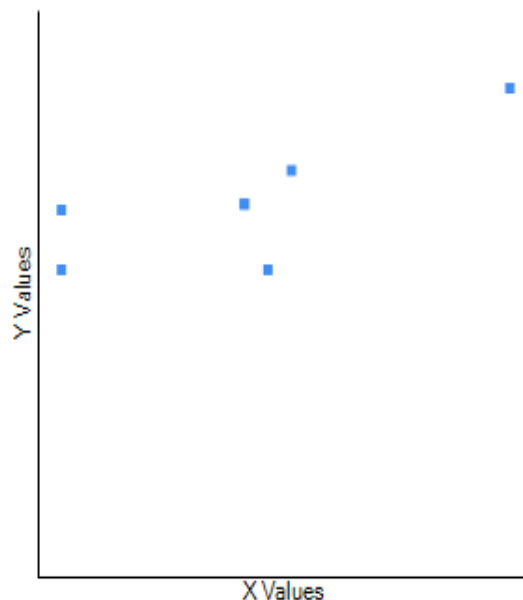


Fig. 2. A correlation between the minimum temperature with the highest ocean water temperature across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the mean annual temperature with the highest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* (Fig. 3: $r=0.7922$, $r^2=0.6276$, $n=7$, $p=0.033684$).

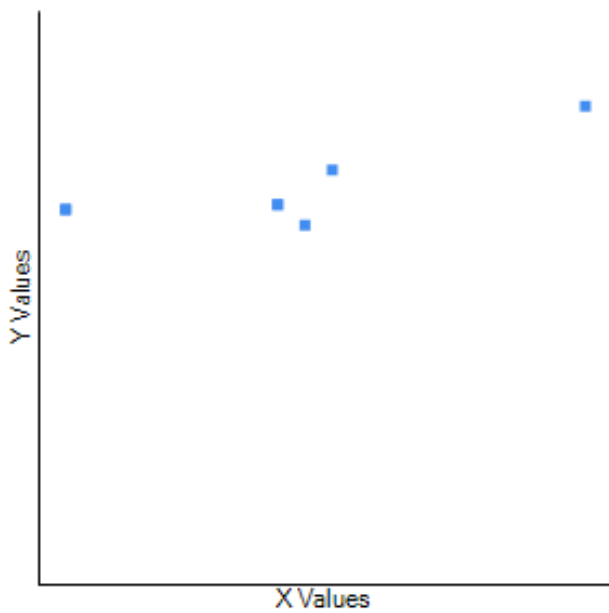


Fig. 3. A correlation between the mean annual temperature with the highest ocean water temperature across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the mean annual temperature with the lowest ocean water temperature across the distribution of pill millipedes *Sphaerotherium* (Fig. 4: $r=0.9241$, $r^2=0.8725$, $n=7$, $p=0.002066$).

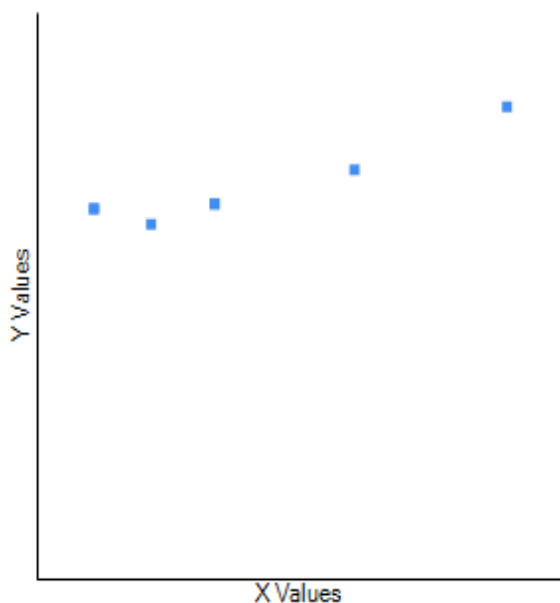


Fig. 4. A correlation between the mean annual temperature with the lowest ocean water temperature across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the highest ocean water temperature with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Fig. 5: $r=-0.9576$, $r^2=0.917$, $n=7$, $p=0.000695$).

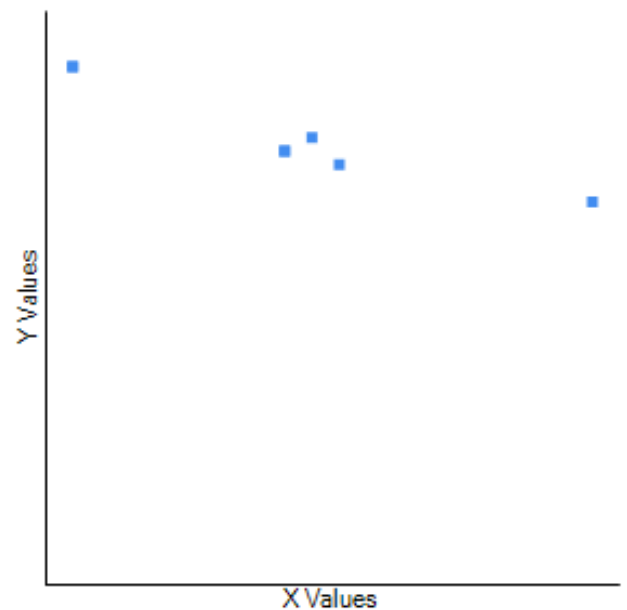


Fig. 5. A negative correlation between the highest ocean water temperature with month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the lowest ocean water temperature with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Fig. 6: $r=-0.8825$, $r^2=0.7788$, $n=7$, $p=0.008524$).

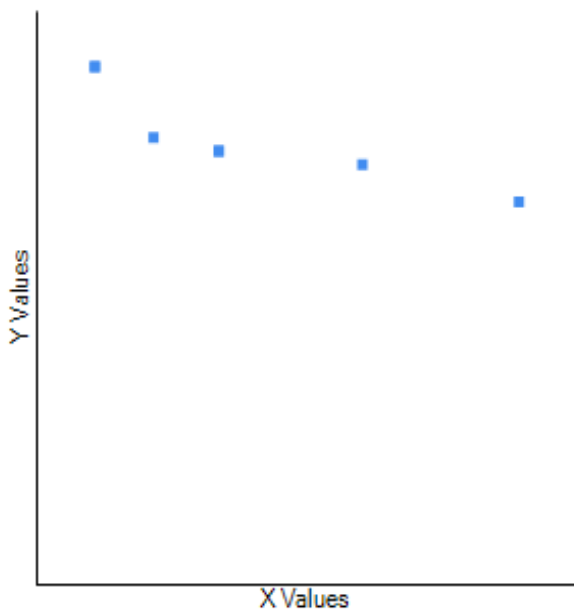


Fig. 6. A negative between the lowest ocean water temperature with month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the mean ocean water temperature with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Fig. 7: $r=-0.74236672$, Z score= -1.91146247 , $n=7$, $p=0.02797252$).

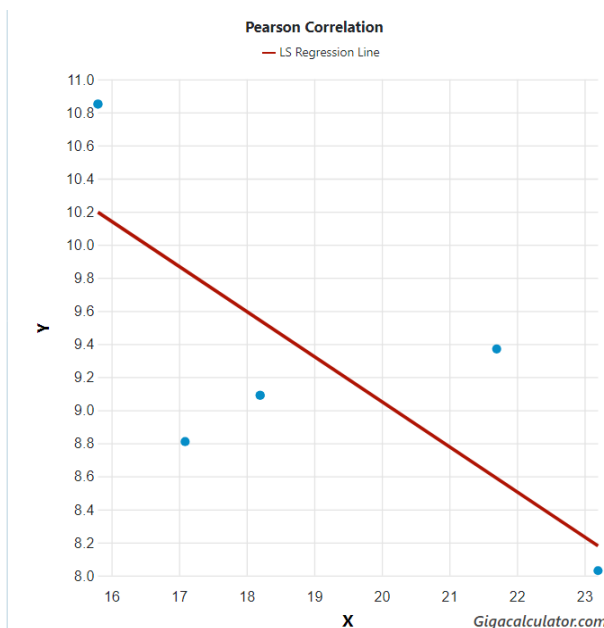


Fig. 7. A negative correlation between the mean ocean water temperature with month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the hours of sunshine each month with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Fig. 8: Pearson's $r=0.76982277$, Z score= 2.03978509 , $n=7$, $p=0.02068580$).

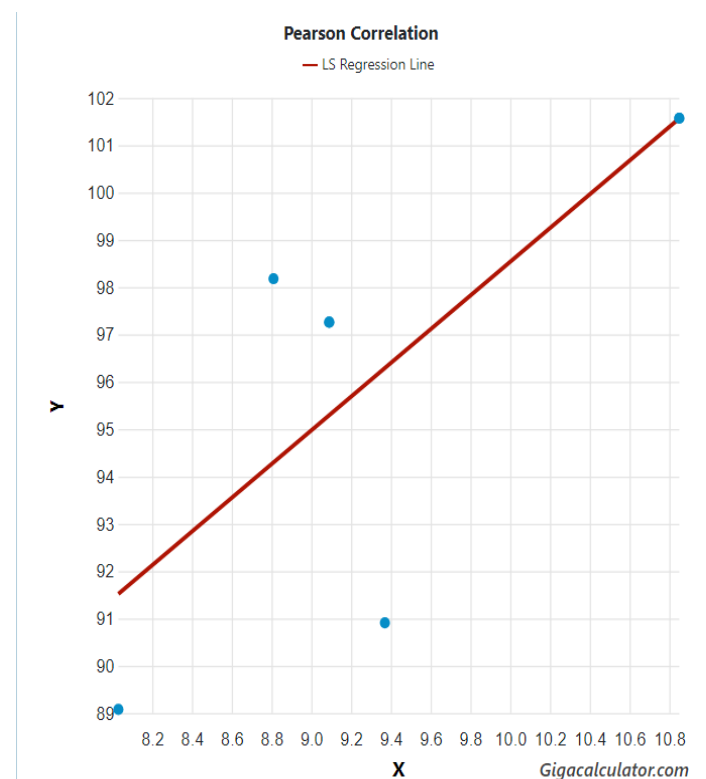


Fig. 8. A positive negative correlation between the hours of sunshine each month with month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the hours of sunshine each month with the month with the lowest daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Fig. 9: Pearson's $r=0.81607806$, Z score= 2.28992312 , $n=7$, $p=0.01101286$).

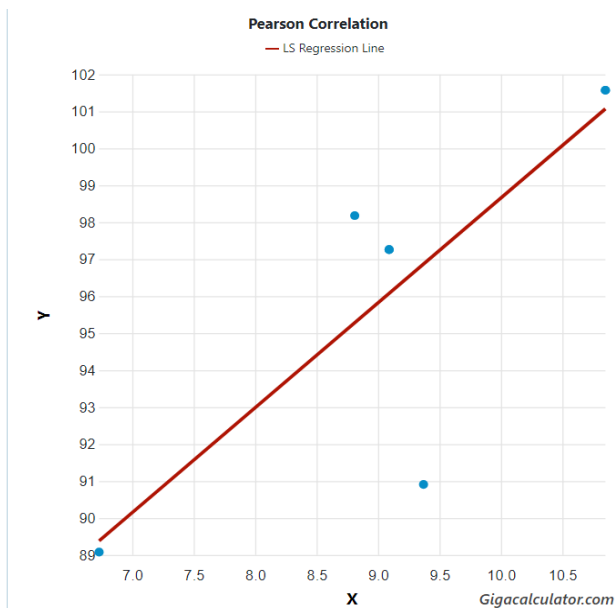


Fig. 9. A positive negative correlation between the hours of sunshine each month with month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the mean annual temperature with the highest average temperature across the distribution of pill millipedes *Sphaerotherium* (Fig. 10: $r=0.9646$, $r^2=0.9305$, $n=7$, $p=0.000444$).

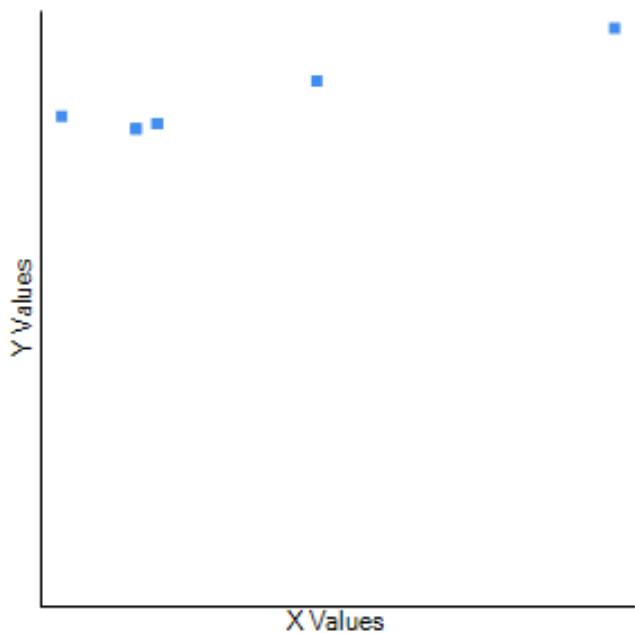


Fig. 10. A correlation between the mean annual temperature with the highest average temperature

across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the mean annual temperature with the lowest average temperature across the distribution of pill millipedes *Sphaerotherium* (Fig. 11: $r=0.9327$, $r^2=0.8699$, $n=7$, $p=0.002152$).

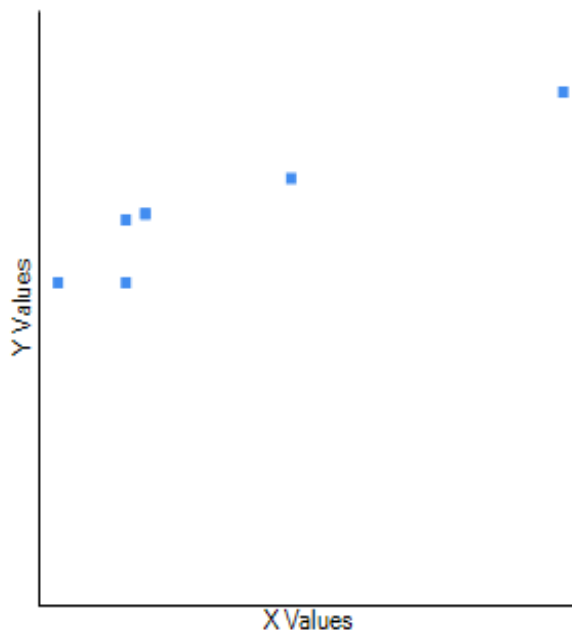


Fig. 11. A correlation between the mean annual temperature with the lowest average temperature across the distribution of pill millipedes *Sphaerotherium*.

There was a marginal correlation between the driest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* (Fig. 12: $r=-0.7366$, $r^2=0.5326$, $n=7$, $p=0.05782$).

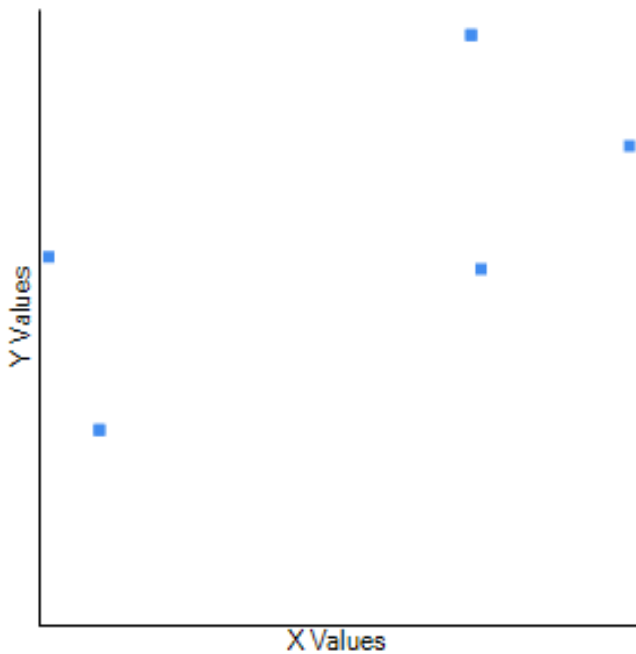


Fig. 12. A correlation between the driest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the wettest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* (Fig. 13: $r=-0.9404$, $r^2=0.8844$, $n=7$, $p=0.00164$).

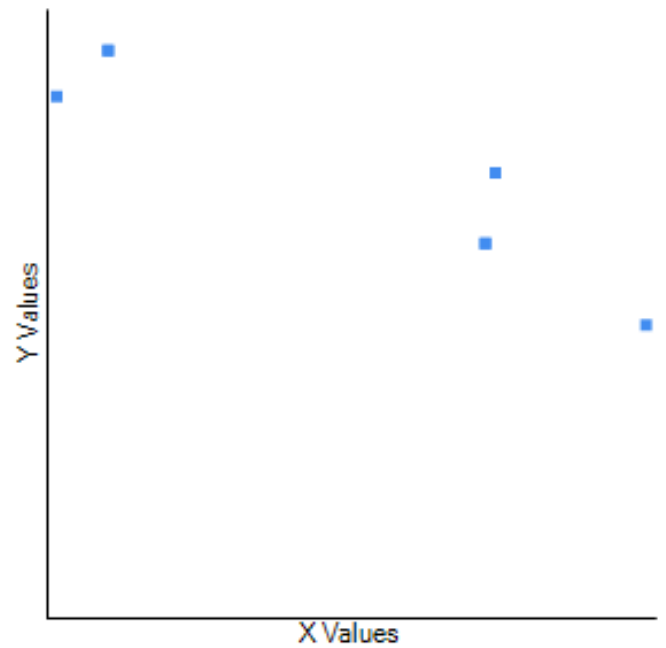


Fig. 13. A correlation between the wettest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between between the difference between the driest and wettest months with the distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* (Fig. 14: $r=-0.9217$, $r^2=8495$, $n=7$, $p=0.000248$).

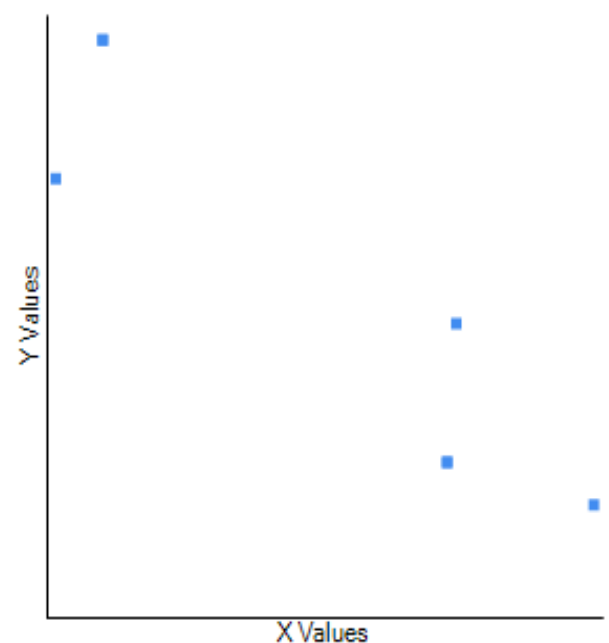


Fig. 14. A correlation between between the difference between the driest and wettest months with the distance to the closest airport across the distribution of pill millipedes

Sphaerotherium .

There was a correlation between the minimum precipitation with the maximum precipitation across the distribution of pill millipedes *Sphaerotherium* (Fig. 15: Pearson's $r=-0.8568$, $r^2=0.7341$, $n=7$, $p=0.013777$).

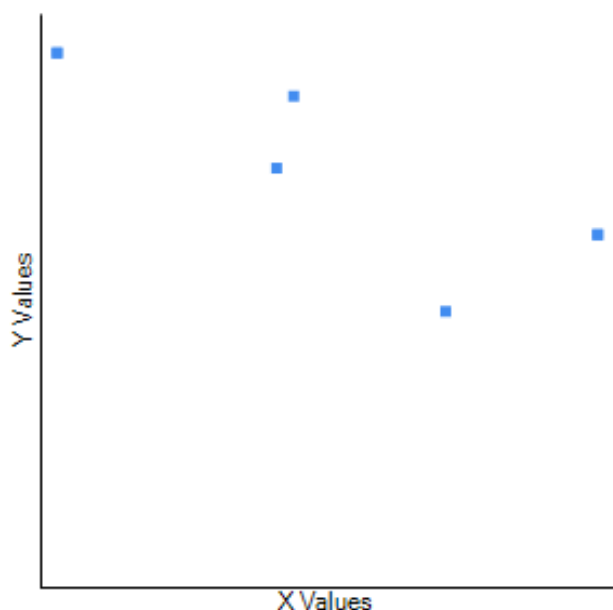


Fig. 15. A negative correlation between the minimum precipitation with the maximum precipitaion across the distribution of pill millipedes *Sphaerotherium*.

There was a correlation between the minimum precipitation with the month with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium* (Fig. 16: Pearson's $r=-0.68117751$, Z score= -1.66261523 , $n=7$, $p=0.04819472$).

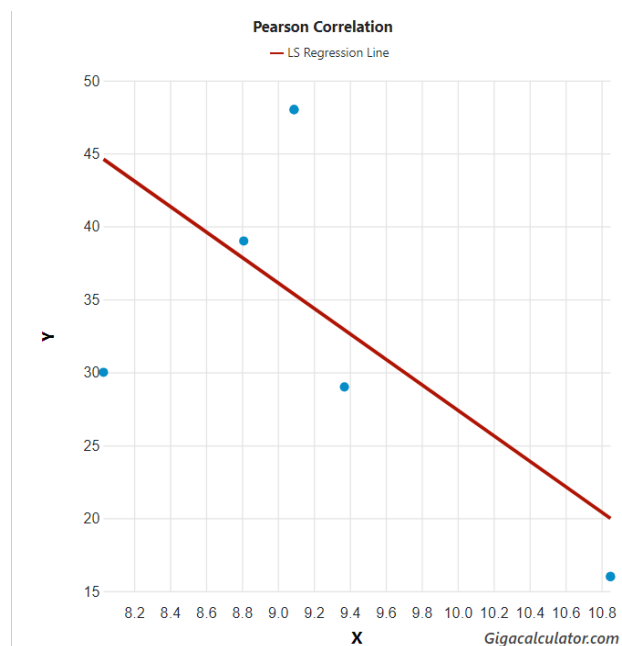


Fig. 16. A negative correlation between the minimum precipitation with the most daily hours of sunshine across the distribution of pill millipedes *Sphaerotherium*.

IV. DISCUSSION

The significant effect of weather on males and females in size are known in this genus. There is a correlation between the minimum temperature with the highest and lowest ocean water temperature. There is a correlation between the mean annual temperature with the highest and lowest ocean water temperature. There are correlations between the highest and lowest ocean water temperature and month with the most daily hours of sunshine. There is a positive correlation between the hours of sunshine each month and month with the most/least daily hours of sunshine. There is a correlation between the mean annual temperature with the highest and lowest average temperature. There is a correlation between driest months and there difference with the distance to the closest airport. There are correlations between the minimum precipitaion, the month with the most daily hours of sunshine, and maximum precipitation. This is an addition to one of the many potential environmental effects on body size in pill millipedes.

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APPENDIX 1. The minimum temperature (degrees Celsius) in seven pill millipedes *Sphaerotherium* Brandt, 1833.

13.2
10.9
13.0
17.3
14.4

13.2
10.9

APPENDIX 2. The lowest ocean water temperature (degrees Celsius) across seven pill millipedes *Sphaerotherium* Brandt, 1833.

16.20
15.20
14.30
20.80
18.4

16.20
14.30

APPENDIX 3. The highest ocean water temperature (degrees Celsius) across seven pill millipedes *Sphaerotherium* Brandt, 1833.

21.30
21.70
18.20
25.80
22.1

21.30
18.20

APPENDIX 4. The mean annual temperature (degrees Celsius) in seven pill millipedes *Sphaerotherium* Brandt, 1833.

16.6
15.7
16.4
20.9
18.1

16.6
16.4

APPENDIX 5. The highest ocean water temperature (degrees Celsius) across seven pill millipedes *Sphaerotherium* Brandt, 1833.

21.30
21.70
18.20
25.80
22.1

21.30
18.20

APPENDIX 6. The lowest ocean water temperature (degrees Celsius) across seven pill millipedes *Sphaerotherium* Brandt, 1833.

16.20

15.20
14.30
20.80
18.4
16.20
14.30

APPENDIX 7. The highest ocean water temperature (degrees Celsius) followed by month with the most daily hours of sunshine in seven pill millipedes *Sphaerotherium* Brandt, 1833.

21.30
21.70
18.20
25.80
22.1
21.30
18.20

9.09
9.37
10.85
8.03
8.81
9.09
10.85

APPENDIX 8. The highest ocean water temperature (degrees Celsius) followed by month with the most daily hours of sunshine in seven pill millipedes *Sphaerotherium* Brandt, 1833.

16.20
15.20
14.30
20.80
18.4
16.20
14.30

9.09
9.37
10.85
8.03
8.81
9.09
10.85

APPENDIX 9. The mean ocean water temperature (degrees Celsius) followed by month with the most daily hours of sunshine in seven pill millipedes *Sphaerotherium* Brandt, 1833.

18.20, 9.09
21.70, 9.37
15.80, 10.85
23.20, 8.03
17.09, 8.81
18.20, 9.09
15.80, 10.85

APPENDIX 10. The hours of sunshine each month preceded by month with the most daily hours of sunshine in seven pill millipedes *Sphaerotherium* Brandt, 1833.

9.09, 97.26
9.37, 90.91
10.85, 101.57
8.03, 89.08
8.81, 98.18
9.09, 97.26
10.85, 101.57

APPENDIX 11. The hours of sunshine each month (h) preceded by month with the lowest hours of sunshine in seven pill millipedes *Sphaerotherium* Brandt, 1833.

9.09, 97.26
9.37, 90.91
10.85, 101.57
6.73, 89.08
8.81, 98.18
9.09, 97.26
10.85, 101.57

APPENDIX 12. The mean annual temperature (degrees Celsius) in seven pill millipedes *Sphaerotherium* Brandt, 1833.

16.6
15.7
16.4
20.9
18.1
16.6
16.4

APPENDIX 13. The highest temperature (degrees Celsius) across seven pill millipedes *Sphaerotherium* Brandt, 1833.

20.3
20.6
20.1
24.3
22.1
20.3
20.1

APPENDIX 14. The lowest temperature (degrees Celsius) across seven pill millipedes *Sphaerotherium* Brandt, 1833.

13.2
10.9
13.0
17.3
14.4
13.2
10.9

APPENDIX 15. The driest months (mm) in seven pill millipedes *Sphaerotherium* Brandt, 1833.

48
29
16
30
39
48
16

APPENDIX 16. The distance to the closest airport across the distribution of seven pill millipedes *Sphaerotherium* Brandt, 1833.

61.52
62.72
17.12
11.09
80.45
61.52
17.12

APPENDIX 17. The wettest months (mm) in seven pill millipedes *Sphaerotherium* Brandt, 1833.

74
88
112

103
58
74
112

APPENDIX 18. The difference between the driest and wettest months (mm) in pill millipedes *Sphaerotherium* Brandt, 1833.

26
49
96
73
19
26
96

APPENDIX 19. The distance to the closest airport across the distribution of pill millipedes *Sphaerotherium* Brandt, 1833.

61.52
62.72
17.12
11.09
80.45
61.52
17.12

APPENDIX 20. Minimum precipitation followed by maximum precipitation in seven pill millipedes *Sphaerotherium* Brandt, 1833.

48
29
16
30
39
48
16

74
88
112
103
58
74
112

APPENDIX 21. Minimum precipitation preceded by month with the most daily hours of sunshine in seven pill millipedes *Sphaerotherium* Brandt, 1833.

9.09, 48
9.37, 29
10.85, 16
8.03, 30
8.81, 39
9.09, 48
10.85, 16