SURFACE-AREA-TO-VOLUME IS RELATED TO SEXUAL SIZE DIMORPHISM ACROSS *CENTROBOLUS* COOK, 1897

Author's Name: Mark I. Cooper
Affiliation: University Of Stellenbosch, South Africa.
DOI No. – **08.2020-25662434**

Abstract

In this paper I test for a relationship between sexual size dimorphism (SSD) and surface-area-to-volume ratios in red millipedes Centrobolus Cook, 1897. SSD was related to surface-area-to-volume ratios in males (r=-0.39, Z score=-1.80, n=22, p=0.036)(y = -0.13x + 0.26). SSD was related to surface- area-to-volume ratios in females (r=-0.53, Z score=-2.56, n=22, p<0.01)(y = -0.19x + 0.39). Volumes were related to surface-area to volume ratios when males and female data were pooled (r=-0.46, Z score=-3.20, n=44, p<0.01) (y = -0.16 x + 0.32).

Key words: *sexual size, dimorphism, red millipedes, male, female*

INTRODUCTION

The 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 762-1016mm, a uniform 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 abundant shade and humidity at ground level. As essentially shade-loving Diplopoda, the members of the genus are especially well represented in these littoral forests of the eastern half of the subcontinent (Lawrence, 1967). Members of the genus all have polygynandrous mating systems with sperm competition and cryptic female choice (Cooper, 2016; Cooper, 2017; Cooper, 2019).

MATERIALS AND METHODS

Two morphometric parameters were used to obtain measurements, length and width, both of which were obtained from the published literature (Cooper, 2018; Cooper, 2019; Lawrence, 1967; Schubart, 1966). Surface areas were calculated based on the formula for the same cylinder $SA = 2\pi r(r+h)$ in *C. anulatus* Attems, 1934, and *C. inscriptus* Attems, 1928 (Cooper, 2019). These were divided by volumes (Cooper, 2019). The data were collected during the rainy season because in southern Africa millipede surface activity is strongly seasonal and related to feeding and reproduction (Dangerfield & Telford, 1991; Dangerfield et al. 1993) and this is also when population densities peak (Dangerfield, 1989). 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 (Acocks, 1975) 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. In the following season a single sampling effort involved hand collecting all individual millipedes on the ground and in shrubs and trees separately, with the former measured on the ground and the latter as in the trees (>30cm but <3m above ground surface). The two species were morphologically separated based upon the presence of yellow flashes, red legs, and red heads (*C. inscriptus*) vs. discrete red-black annulations without yellow flashes, black legs, and blackheads (*C. anulatus*). Surface-area-to-volume ratios were tested against volumes for correlations at https://www.gigacalculator.com/calculators/correlation-coefficient-calculator.php.

RESULTS

SSD was related to surface-area-to-volume ratios in males (Figure 1: r=-0.39163242, Z score=-1.80339304, n=22, p=0.03566320)(y = -0.12592366 · x + 0.26088089). SSD was related to surface-area-to-volume ratios in females (Figure 2: r=-0.52735362, Z score=-2.55637294, n=22, p=0.00528851)(y = -0.19471847 · x + 0.38900207). Volumes were related to surface-area to volume ratios when males and female data were pooled (Figure 3: r=-0.46215720, Z score=-3.20188813, n=44, p=0.00068271) (y = -0.16032716 · x + 0.32497403).

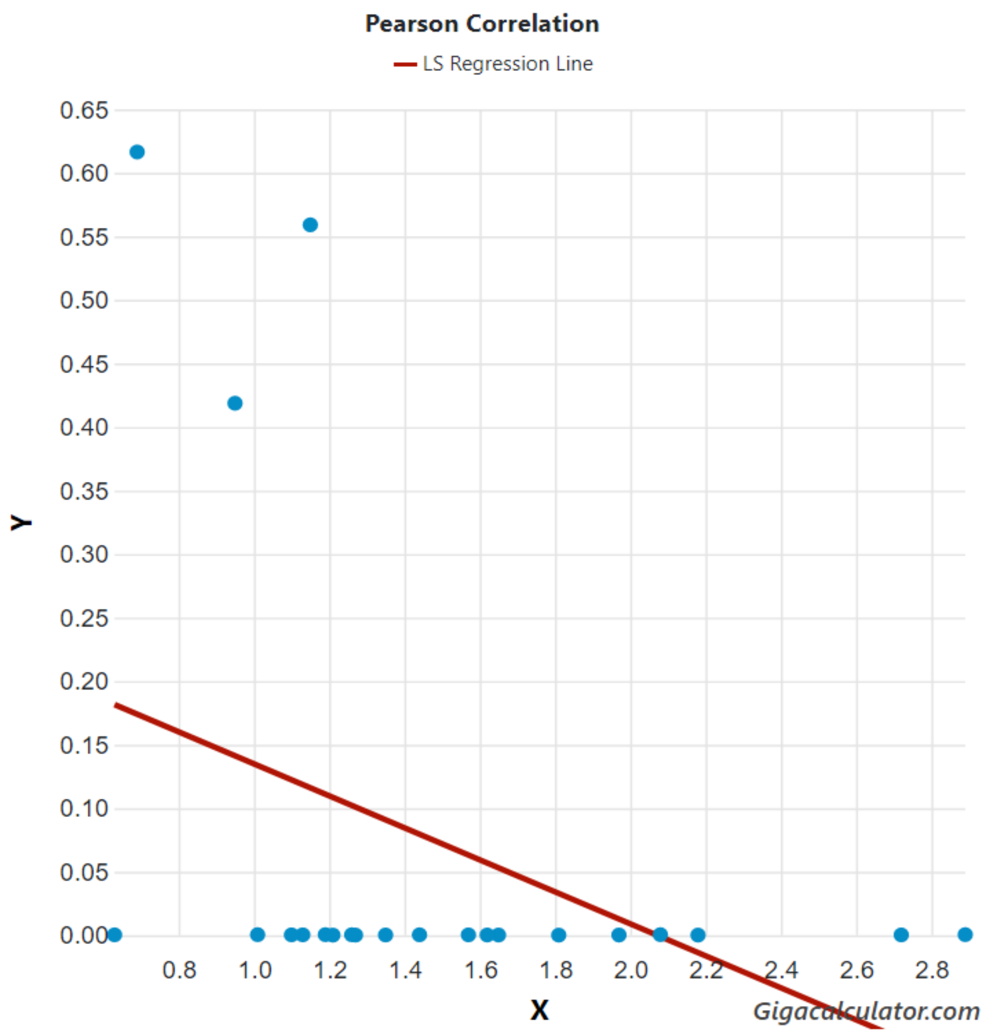

Figure 1. Relationship between SSD and surface-area-to-volume ratios in males in *Centrobolus* Cook, 1897.

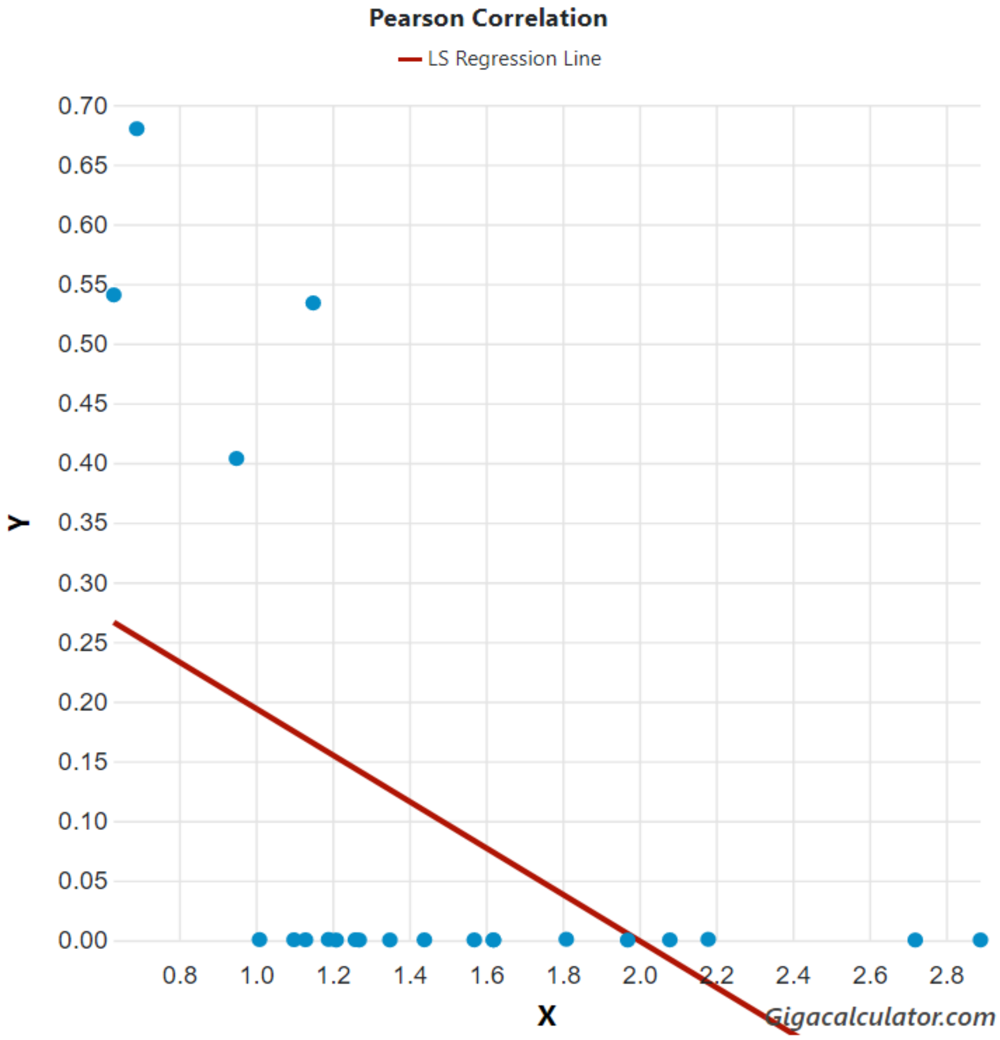

Figure 2. Relationship between SSD and surface-area-to-volume ratios in females in *Centrobolus* Cook, 1897.

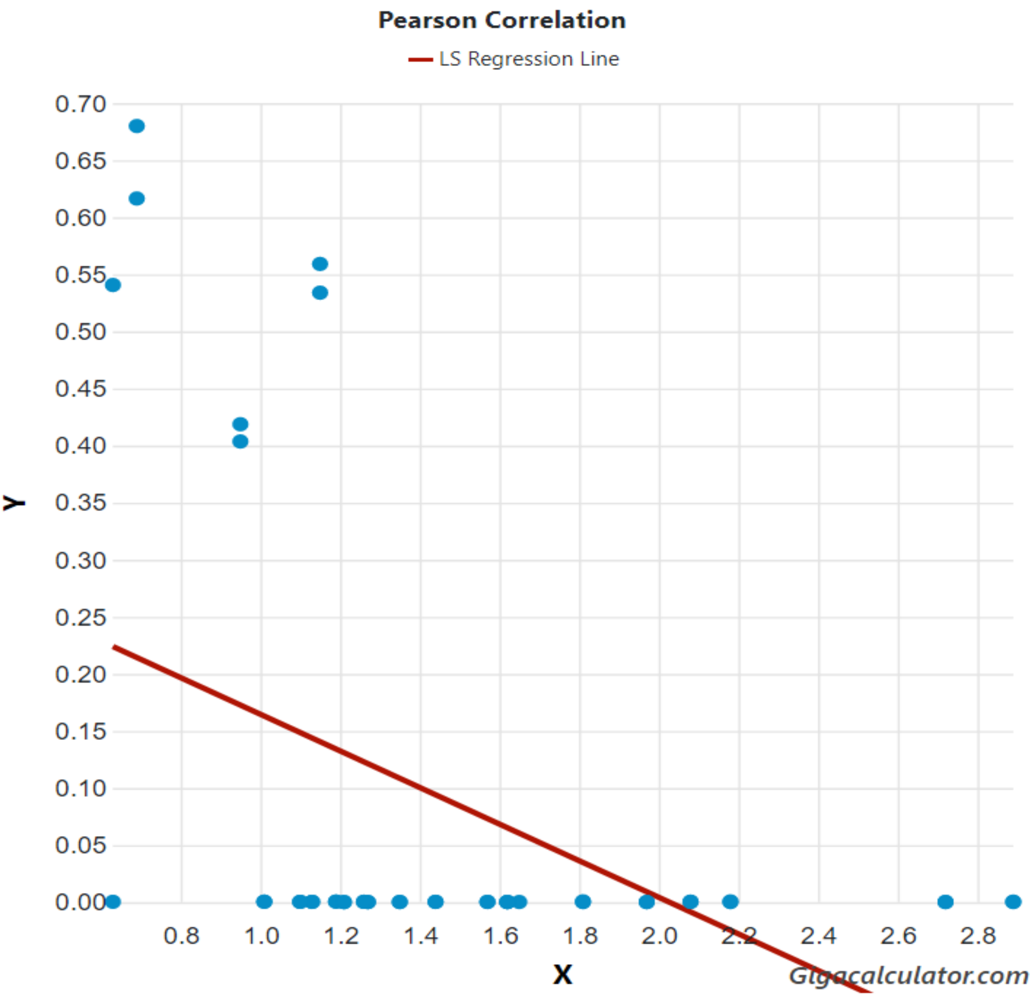

Figure 3. Relationship between SSD and surface-area-to-volume ratios in *Centrobolus* Cook, 1897.

DISCUSSION

New relationships between SSD and surface-area-to-volume ratios are documented here in both males and females in the genus of red millipedes *Centrobolus*. Four species showed above average surface-area-to-volume ratios; including *C. promontorius*, *C. richardii*, and *C. titanophilus* males as well as *C. decoratus*, *C. promontorius*, *C. richardii*, and *C. titanophilus* females.

REFERENCES

1. Acocks JPH. 1975. Veld Types of South Africa. Memoirs of the Botanical Survey of South Africa, No. 40. Pretoria: Botanical Research Institute.
2. Cooper M. 2016. Post-insemination associations between males and females in the Diplopoda. JOURNAL OF ENTOMOLOGY AND ZOOLOGY STUDIES, 4(2): 283-285. DOI: 10.22271/j.ento.2016.v4.i2d.908.
3. Cooper MI. 2017. Allometry of copulation in worm-like millipedes. Journal of Entomology and Zoology Studies, 5(3): 1720-1722. DOI: 10.22271/j.ento.2017.v5.i3x.03.
4. Cooper MI. 2018. Allometry for sexual dimorphism in millipedes (Diplopoda). Journal of Entomology and Zoology Studies, 6(1): 91-96.
5. Cooper M. 2019. Julid and spirobolid millipede gonopod functional equivalents. Journal of Entomology and Zoology Studies, 7(4): 333-335. DOI: 10.22271/j.ento.2019.v7.i4f.5465.
6. Cooper M. Xylophagous millipede surface area to volume ratios are size dependent in

forests. Arthropods, 8(4): 127-136.
7. Cooper, Mark. Does sexual size dimorphism vary with longitude in forest millipedes Centrobolus Cook, 1897? International Journal of Recent Research in Thesis and Dissertation.2022; 3(1): 1-5. https://www.paperpublications.org/issue/IJRRTD/Issue-1-January-2022-June-2022.4.
8. Cooper, Mark. Does sexual size dimorphism vary with latitude in forest millipedes CentrobolusCook, 1897? Int. J. Re. Res. Thesis Diss. 2022; 3(1): 6-11. https://www.paperpublications.org/issue/IJRRTD/Issue-1-January-2022-June-2022.5.
9. Cooper, Mark. Does sexual size dimorphism vary with temperature in forest millipedes Centrobolus Cook, 1897? Acta Entomol. Zool. 2022; 3(1): 08-11. https://doi.org/10.33545/27080013.2022.v3.i1a.51.6.
10. Cooper, Mark. DOES SEXUAL SIZE DIMORPHISM VARY WITH MONTH WITH THE HIGHEST NUMBER OF RAINY DAYS IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897. Universe Int. J.Interdiscip. Res. 2(9): 9-14.https://www.doi-ds.org/doilink/03.2022-63261534/UIJIR.7.
11. Cooper, Mark. PAIR-WISE COMPARISON OF SEXUAL SIZE DIMORPHISM AMONG NINE FACTORS IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897. Universe Int. J. Interdiscip. Res.2(9): 31-33. https://www.doi-ds.org/doilink/03.2022-75935617/UIJIR.8.
12. Cooper, Mark. Does sexual size dimorphism vary with female size in forest millipedes Centrobolus Cook, 1897? Acta Entomol. Zool. 3(1): 15-18. https://doi.org/10.33545/27080013.2022.v3.i1a.57.
13. DOI: https://www.doi-ds.org/doilink/10.2022-52233387/UIJIR www.uijir.com
14. Cooper, Mark. Does sexual size dimorphism vary with hours of sunshine throughout the year in forest millipedes Centrobolus Cook, 1897? Acta Entomol. Zool. 3(1): 19-25. DOI:https://doi.org/10.33545/27080013.2022.v3.i1a.58.10.
15. Cooper, Mark. DOES SEXUAL SIZE DIMORPHISM VARY WITH SPECIES RICHNESS IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897? Universe Int. J. Interdiscip. Res. 2(10): 25-29. https://www.doi-ds.org/doilink/04.2022-91496952/UIJIR.11.
16. Cooper, Mark. PAIR-WISE COMPARISON OF SEXUAL SHAPE DIMORPHISM AMONG FIFTEEN FACTORS IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897. Universe Int. J. Interdiscip. Res.2(10): 9-14. https://www.doi-ds.org/doilink/04.2022-18727172/UIJIR.12.
17. Cooper, Mark Ian. Five factors effecting copulation duration in the breeding season in forest millipedes Centrobolus Cook, 1897. Zoological and Entomological Letters. 2(1): 17-22. https://www.zoologicaljournal.com/archives/2022.v2.i1.A.26.13.
18. Cooper, Mark. Does sexual size dimorphism vary with time in red millipedes Centrobolus Cook,1897? Zool. Entomol. Lett. 2(1): 30-35. https://www.zoologicaljournal.com/archives/2022.v2.i1.A.29.14.
19. Cooper, Mark. Mating frequencies of sympatric red millipedes differ across substrate due to absolute abundances. Acta Entomol. Zool. 2022; 3(1): 34-39. DOI: https://doi.org/10.33545/27080013.2022.v3.i1a.62.15.
20. Cooper, Mark. Does sexual size dimorphism vary with maximum and minimum temperatures in red millipedes Centrobolus Cook, 1897? Zool. Entomol. Lett. 2022; 2(1): 60-65. https://www.zoologicaljournal.com/archives/2022.v2.i1.B.34.16.
21. Cooper, Mark. Does sexual size dimorphism vary with sex ratio in red millipedes Centrobolus Cook, 1897? Zool. Entomol. Lett. 2022; 2(1): 66-68. https://www.zoologicaljournal.com/archives/2022.v2.i1.B.35.17.
22. Cooper, Mark. Millipede mass: Intersexual differences. Zool. Entomol. Lett. 2022; 2(1): 69-

70. https://www.zoologicaljournal.com/archives/2022.v2.i1.B.36.18.

23. Cooper, Mark Ian. Do copulation duration and sexual size dimorphism vary with absolute abundance in red millipedes Centrobolus Cook, 1897? Acta Entomol. Zool. 2022; 3(1): 51-54. https://www.actajournal.com/archives/2022.v3.i1.A.64.https://doi.org/10.33545/27080013.2022.v3.i1a.64.19.
24. Cooper, Mark. DOES SEXUAL SIZE DIMORPHISM VARY WITH FEMALE LENGTH IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897? Universe Int. J. Interdiscip. Res. 2(12): 1-7. https://www.doi-ds.org/doilink/05.2022-69939779/UIJIR.
25. Cooper, Mark. DOES SEXUAL SIZE DIMORPHISM VARY WITH PRECIPITATION IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897? Munis Entomology and Zoology. 17(2): 1185-1189. https://www.munisentzool.org/Issue/abstract/does-sexual-size-dimorphism-vary-with-precipitation-in-forest-millipedes-centrobolus-cook-1897_13813.21.
26. Cooper, Mark I. Do copulation durations of sympatric red millipedes vary seasonally with mating frequencies? Int. J. Re. Res. Thesis Diss. 2022; 3(1): 85-90. https://doi.org/10.5281/zenodo.6613001.22.
27. Cooper, Mark I. The inverse latitudinal gradients in species richness of Southern African millipedes. Int. J. Re. Res. Thesis Diss. 2022; 3(1): 91-112. https://doi.org/10.5281/zenodo.6613064.
28. DOI: https://www.doi-ds.org/doilink/10.2022-52233387/UIJIR.
29. Cooper, Mark Ian. DOES SEXUAL SIZE DIMORPHISM VARY WITH LOG SEXUAL SIZE DIMORPHISM IN RED MILLIPEDES CENTROBOLUS COOK, 1897? Universe Int. J. Interdiscip.Res. 2022; 2(12): 52-54.https://www.doi-ds.org/doilink/06.2022-83544225/UIJIR.24.
30. Cooper, M. THE MOMENTS OF INERTIA TIE-UP WITH SEXUAL SIZE DIMORPHISM IN RED MILLIPEDES CENTROBOLUS COOK, 1897. Int. J. Re. Res. Thesis Diss. 2022; 3(1): 127-129. https://doi.org/10.5281/zenodo.6656536.25.
31. Cooper, M. THE MOMENTS OF INERTIA TIE-UP WITH PRECIPITATION, NUMBER OF RAINY DAYS, LOWEST RELATIVE HUMIDITY, AND AVERAGE TEMPERATURE IN RED MILLIPEDES CENTROBOLUS COOK, 1897. Int. J. Re. Res. Thesis Diss. 2022; 3(1): 130-145. https://doi.org/10.5281/zenodo.6659980.26.
32. Cooper, Mark Ian. Is a prominent sternite related to spine length, spine number, copulation duration, and male width in Centrobolus Cook, 1897?. Acta Entomol. Zool. 2022; 3(2): 01-05. https://www.actajournal.com/archives/2022.v3.i2.A.68.https://doi.org/10.33545/27080013.2022.v3.i2a.68.27.
33. Cooper, Mark Ian. Do copulation duration and sexual size dimorphism vary with relative abundance in red millipedes Centrobolus Cook, 1897? Acta Entomol. Zool. 2022; 3(1): 06-09. https://www.actajournal.com/archives/2022.v3.i2.A.69.https://doi.org/10.33545/27080013.2022.v3.i2a.69.28.
34. Cooper, Mark Ian. Is mass correlated with width among red millipedes Centrobolus Cook, 1897? Zool. Entomol. Lett. 2022; 2(1): 81-85. https://www.zoologicaljournal.com/archives/2022.v2.i1.B.38.29.
35. Cooper, M. I. THE MONTH WITH THE HIGHEST NUMBER OF RAINY DAYS, AVERAGE AND WARMEST TEMPERATURES, DAILY HOURS OF SUNSHINE, AND RAINFALL ACROSS THE DISTRIBUTION OF PILL MILLIPEDES SPHAEROTHERIUM BRANDT, 1833. Universe Int.

J.Interdiscip. Res. 2022; 3(1): 1-10. https://www.doi-ds.org/doilink/06.2022-62322612/UIJIR.URL: http://hdl.handle.net/10019.1/125463.30.

36. Cooper, M. I. FEMALE VOLUME, LOWEST HOURS OF SUNSHINE, MONTH WITH THE HIGHEST NUMBER OF RAINY DAYS, RAINFALL, AND TEMPERATURES IN THE COOLEST AND WARMEST MONTHS OF THE YEAR ARE RELATED TO LATITUDE (AND LONGITUDE) ACROSS THE DISTRIBUTION OF PILL MILLIPEDES SPHAEROTHERIUM BRANDT, 1833. Universe Int. J.Interdiscip. Res. 2022; 3(1): 11-22. https://www.doi-ds.org/doilink/06.2022-51527898/UIJIR.URL: http://hdl.handle.net/10019.1/125464.31.
37. Cooper, M. THE TIE-IN OF MALE BODY WIDTH ON COPULATION DURATION IN CENTROBOLUS COOK, 1897. Universe Int. J. Interdiscip. Res. 2022; 3(1): 45-47. https://www.doi-ds.org/doilink/06.2022-88932399/UIJIR.
38. Cooper, M. Ian. IS A PROMINENT STERNITE RELATED TO MOMENTS OF INERTIA IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research& Development. 2022; 8(12): 26-28. http://www.ijesird.com/1_june_22.PDF.
39. Cooper, M. Ian. IS COPULATION DURATION RELATED TO MOMENTS OF INERTIA IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research& Development. 2022; 8(12): 29-31. http://www.ijesird.com/2_june_22.PDF.
40. Cooper, M. Ian. 2022. COPULATION DURATION IS RELATED TO EJACULATING VOLUME IN CENTROBOLUS INSCRIPTUS (ATTEMS, 1928). International Journal of Engineering ScienceInvention Research & Development. 2022; 8(12): 32-40.http://www.ijesird.com/3_june_22.PDF. DOI: https://www.doi-ds.org/doilink/10.2022-52233387/UIJIR www.uijir.com.
41. Cooper, M. Ian. Is a prominent sternite related to mass in Centrobolus Cook, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(1): 1-4. http://www.ijesird.com/1_jul_22.PDF.36.
42. Cooper, Mark Ian. Does sex ratio vary with absolute abundance in red millipedes CentrobolusCook, 1897? International Journal of Engineering Science Invention Research & Development.2022; 9(1): 5-8. http://www.ijesird.com/2_jul_22.PDF.
43. Cooper, M. Ian. Does copulation duration vary with absolute abundance in red millipedesCentrobolus Cook, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(1): 9-11. http://www.ijesird.com/3_jul_22.PDF.
44. Cooper, M. Ian. Are a prominent sternite, coleopod spine length, and spine number related to mating frequencies in Centrobolus Cook, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(1): 12-15. http://www.ijesird.com/4_jul_22.PDF.
45. Cooper, M. I. Are coleopod spine length and number related to weather in Centrobolus Cook, 1897? International Journal of Engineering Science Invention Research & Development. 2022;9(1): 16-23. http://www.ijesird.com/5_jul_22.PDF.
46. Cooper, M. I. Are coleopod spine length and number related to mass in Centrobolus Cook, 1897?International Journal of Engineering Science Invention Research & Development. 2022; 9(1):24-26. http://www.ijesird.com/6_jul_22.PDF.41.
47. Cooper, Mark I. Is mass related to latitude, longitude, and weather in Centrobolus Cook, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(1):27-32. https://www.ijesird.com/7_jul_22.PDF.
48. Cooper, M. Ian. ARE MATING FREQUENCIES RELATED TO ABSOLUTE ABUNDANCE IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(1): 33-37. https://www.ijesird.com/8_jul-22.PDF.43.

49. Cooper, M. Ian. DOES COPULATION DURATION VARY WITH SEX RATIO IN THE RED MILLIPEDE CENTROBOLUS INSCRIPTUS (ATTEMS, 1928)? International Journal of Engineering Science Invention Research & Development. 2022; 9(1): 38-40. https://www.ijesird.com/9_jul_22.PDF.44.
50. Cooper, M. Ian. IS A PROMINENT STERNITE RELATED TO WEATHER IN CENTROBOLUS COOK,1897? International Journal of Engineering Science Invention Research & Development. 2022;9(1): 41-44. https://www.ijesird.com/10_jul_22.PDF.
51. Cooper, M. Ian. ARE MATING FREQUENCIES RELATED TO SEX RATIO IN CENTROBOLUS COOK,1897? International Journal of Engineering Science Invention Research & Development. 2022;9(1): 45-48. https://www.ijesird.com/11_jul_22.PDF.46.
52. Cooper, M. Ian. ARE MATING FREQUENCIES RELATED TO SEXUAL SIZE DIMOROPHISM IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(1): 49-51. https://www.ijesird.com/12_jul_22.PDF.
53. Cooper, Mark. ARE MATING FREQUENCIES RELATED TO MOMENTS OF INERTIA ACROSS THE SEXES IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(1): 52-55. https://www.ijesird.com/13_jul_22.PDF.
54. Cooper, M. Ian. ARE MATING FREQUENCIES RELATED TO TARSAL PAD LENGTH IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research& Development. 2022; 9(2): 1-4. https://www.ijesird.com/1_aug_22.PDF.
55. Cooper, Mark. IS COPULATION DURATION RELATED TO TARSAL PAD LENGTH IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(2): 65-67. https://www.ijesird.com/3_aug_22.PDF.
56. Cooper, Mark. ARE ABSOLUTE ABUNDANCES RELATED TO TARSAL PAD LENGTH IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(2): 68-70. https://www.ijesird.com/4_aug_22.PDF.51.
57. Cooper, M. Ian. ARE MATING FREQUENCIES RELATED TO MALE AND FEMALE SIZE IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research& Development. 2022; 9(2): 71-76. https://www.ijesird.com/5_aug_22.PDF.52.
58. Cooper, Mark. DOES EJACULATE VOLUME VARY WITH ABSOLUTE ABUNDANCE IN RED MILLIPEDES CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(2): 77-79.https://www.ijesird.com/6_aug_22.PDF.
59. Cooper, M. Ian. THE MOMENTS OF INERTIA TIE-UP WITH FEMALE SIZE, HOURS OF SUNSHINE THROUGHOUT THE YEAR, LATITUDE, LONGITUDE, AND MINIMUM TEMPERATURE IN RED MILLIPEDES CENTROBOLUS COOK, 1897. Universe Int. J. Interdiscip. Res. 2022; 3(2): 6-12.https://www.doi-ds.org/doilink/08.2022-76913842/UIJIR.
60. COOPER, Mark I. ARE MATING FREQUENCIES RELATED TO EJACULATE VOLUMES IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research& Development. 2022; 9(3): 93-95. https://www.ijesird.com/aug_ten.PDF.
61. Cooper, Mark. 2022. DOES SEXUAL SIZE DIMORPHISM VARY WITH FEMALE WIDTH IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897? Munis Entomol. Zool. 17(supplement): 1562-1565. https://www.munisentzool.org/Issue/abstract/does-sexual-size-dimorphism-vary-with-female-width-in-forest-millipedes-centrobolus-cook-1897_13854.56.
62. Cooper, Mark. 2022. DOES SEXUAL SIZE DIMORPHISM VARY WITH THE HIGHEST TOTAL HOURS OF SUNSHINE IN A MONTH IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897?

Munis Entomol. Zool. 17(supplement): 1596-1602. https://www.munisentzool.org/Issue/abstract/does-sexual-size-dimorphism-vary-with-the-highest-total-hours-of-sunshine-in-a-month-in-forest-millipedes-centrobolus-cook-1897_13858.

63. Cooper, Mark. 2022. DOES SEXUAL SIZE DIMORPHISM VARY WITH BODY MASS IN FOREST MILLIPEDES CENTROBOLUS COOK, 1897? Munis Entomol. Zool. Suppl. 17(supplement): 1621-1624. https://www.munisentzool.org/Issue/abstract/does-sexual-size-dimorphism-vary-with-body-mass-in-forest-millipedes-centrobolus-cook-1897_13861.
64. COOPER, MARK. IS SIZE OR SSD RELATED TO ABUNDANCE IN CENTROBOLUS COOK, 1897?International Journal of Engineering Science Invention Research & Development. 2022; 9(3):96-102. https://www.ijesird.com/sep_one.PDF.
65. COOPER, MARK IAN. IS A PROMINENT STERNITE RELATED TO SEX RATIOS AND ABUNDANCE IN CENTROBOLUS COOK, 1897? International Journal of Engineering Science Invention Research & Development. 2022; 9(3): 103-106. https://www.ijesird.com/sep_two_6.PDF.
66. Cooper, Mark I. DOES SEXUAL SIZE DIMORPHISM VARY WITH FEWEST DAILY HOURS OF SUNSHINE IN RED MILLIPEDES CENTROBOLUS COOK, 1897? Universe Int. J. Interdiscip. Res.2022; 3(3): 89-92. https://www.doi-ds.org/doilink/09.2022-94655978/UIJIR.61.
67. COOPER, MARK. DOES (PREDICTED) MASS CORRELATE WITH MATING FREQUENCIES IN CENTROBOLUS COOK, 1897? Universe Int. J. Interdiscip. Res. 2022; 3(4): 14-19. https://www.doi-ds.org/doilink/09.2022-18461239/UIJIR.
68. COOPER, MARK I. IS MASS CORRELATED WITH LENGTH AMONG RED MILLIPEDES CENTROBOLUS COOK, 1897? Universe Int. J. Interdiscip. Res. 2022; 3(5): . https://www.doi-ds.org/doilink/10.2022. (SUBMITTED).
69. COOPER, MARK IAN. ARE COLEOPOD SPINE LENGTH AND NUMBER RELATED TO MOMENTS OF INERTIA IN CENTROBOLUS COOK, 1897? CHAPTER (ACCEPTED).
70. Dangerfield JM. Abundance and diversity of soil macrofauna in northern Botswana. Journal of Tropical Ecology. 1997 Jul;13(4):527-538. DOI: 10.1017/s0266467400010695.
71. Dangerfield JM, Telford SR. 1991. Seasonal activity patterns of Julid millipedes in Zimbabwe. J. Trap. Ecol. 7, 281-285.
72. Dangerfield jM, Telford SR. 1993. Ingestion of mineral soil/litter mixtures and faecal pellet production in the southern African millipede Alloporus uncinatus (Attems). Pedobiologia 37, 159-166.
73. Lawrence RF. 1967. The Spiroboloidea (Diplopoda) of the eastern half of Southern Africa*. Annals of the Natal Museum, 18(3): 607-646
74. Schubart O. 1966. Diplopoda III. South African Animal Life, 12: 1-227.