A Study of the Relative Random/Non-Random Distribution Of Termitaria Found in Dominica

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Abstract

Plots were prepared and measurements were taken of the distribution of termitaria on the island of Dominica. Calculations were made using nearest neighbor analysis to characterize the distribution of termitaria in each plot. They were evaluated to determine if they displayed a clustered, random, or regular distribution. My four plots indicated a trend between random and regular distribution, favoring the latter.

Introduction

Members of the order Isoptera, termites are known for constructing highly specialized nests of various forms and in a variety of habitats (Triplehorn and Johnson). These are defined as termitaria (termitarium-singular), and in some areas of the world such as Australia, it has been noted that termitaria are distributed in an evenly spaced pattern across a landscape (J. Woolley, pers.com). This was a particular phenomenon that caught my attention due to the odd fact that the number of termitaria in a given area can be in the hundreds and still manage to be evenly distributed. I decided to examine this phenomenon in Dominica, West Indies. This study was conducted in order to find out

whether or not termitaria found in Dominica are randomly or non-randomly spaced. Based upon the fact that in Dominica termitaria are sometimes arboreal and therefore characterized by a three-dimensional, wooded landscape and the Australian case involves terrestrial nests in an area characterized by flat, rolling grasslands, the termitaria may also have different distributional characteristics correlating with their particular habitat. Two species of Nasutitermes (Termitidae) are reported to occur on Dominica: *Nasutitermes corniger* and *Nasutitermes ephratae*. These termites have Nasute soldiers and they construct conspicuous on the ground or in trees with mud-covered foraging trails leading up tree trunks. Although, *N. corniger* is reputed to construct termitaria with friable material and *N. ephratae* with carton-like material, I found that we could not use this trait to reliably distinguish between the two species in the field. I therefore recorded location of termitaria of Nasutitermes spp. and did not attempt to distinguish between them.

Materials and Methods

I conducted my study on Thursday, June 2, Saturday, June 4, and Tuesday, June 7, 2011. I set up a total of four plots, each 50 meters by 10 meters, two plots at the Springfield Estate (N 15.3466, W 61.37344, elev. 724 m; N 15.35159, W 61.36324, elev. 507 m) in moist forest habitat, and two in the Cabrits National Park (N 15.58452, W 61.47247, elev. 54 m & N 15.58619, W 61.47263, elev. 59 m) in seasonally dry forest. At each location, I searched for an area with a high density of termitaria that would be suitable.

Beginning at a tree flagged with biodegradable flagging tape, I sighted a bearing with the compass, flagging other trees along the line of sight until a 50-meter baseline was laid out. I measured out each distance between the flags and recorded it in my field

notebook. Using small pieces of rope I tied the 50 meter rope to the flagged trees along the transect. My plot was defined as 5 meters on either side of this 50-meter line. Beginning at the initial point, I searched along the line, looking roughly 5 meters to the left and 5 meters to the right for any observable termitaria. Once I discovered a termitarium, I used a 5-meter rope to confirm the termitarium was inside the plot area. If inside the plot, I measured its distance along the baseline and from the baseline using a 50-meter tape measure, recorded it as an X, Y coordinate. I also recorded where each termitarium was located (ground/tree) and what texture it consisted of (carton/crumbly). At Cabrits, I also recorded the height of the termitarium from the ground. I took a GPS (Magellan GPS) reading at the initial point of each plot site. I repeated this activity until I had a record of each termitarium in the plot area.

The data I collected were taken back to the Archbold Tropical Research and Education Center lab and entered into an Excel spreadsheet. I graphed each plot and calculated the distances of the nearest neighbor of each termitarium using the Pythagorean theorem. I took the nearest neighbor distances and used the nearest neighbor formula ($Rn = (\text{meanD}(obs)/0.5\sqrt{a/n})$) to calculate whether or not the termitaria actually appeared clustered, random, or regular on the plot. In the formula, *D* (obs) represents the mean of the nearest neighbor distances for each plot, *a* represents the area of my plot (500 m), and *n* represents the number of termitaria in each plot. A clustered distribution is represented by the value 0, random distribution by the value 1, and regular distribution by the value 2.15.

Results

Raw data collected for each plot is presented in Appendix 1. The calculated nearest neighbor analysis values for each plot were as follows: plot #1=1.213, plot #2=1.903, plot #3=1.189, & plot #4=2.10.

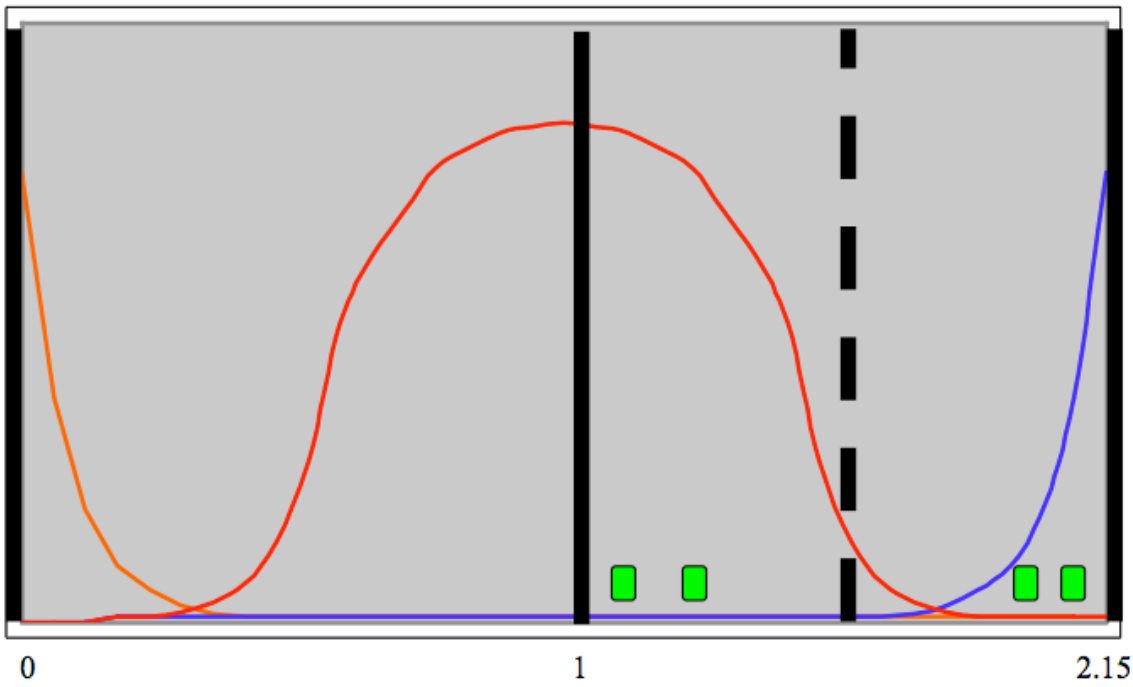
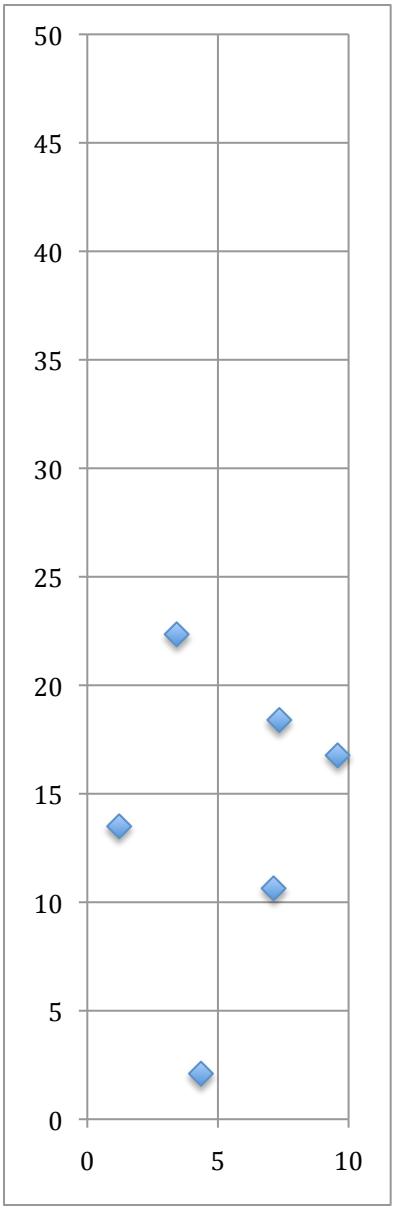
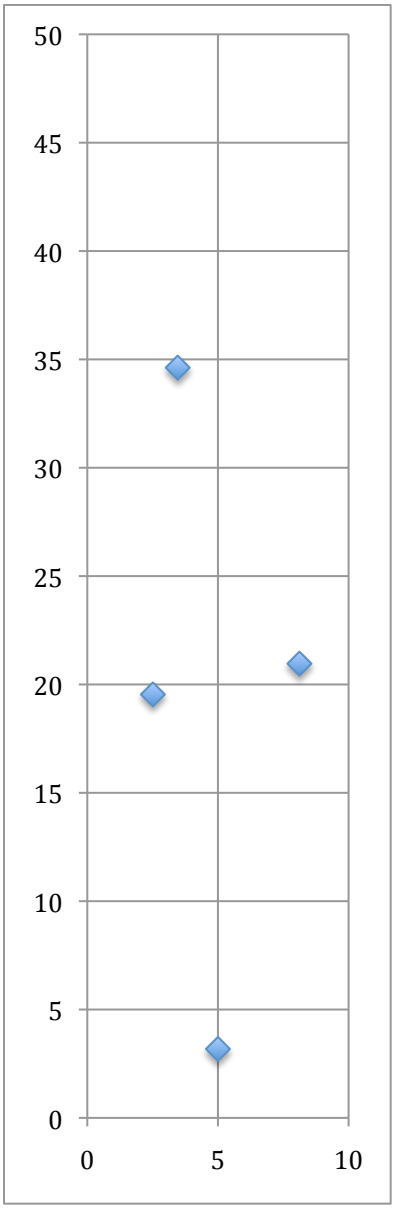


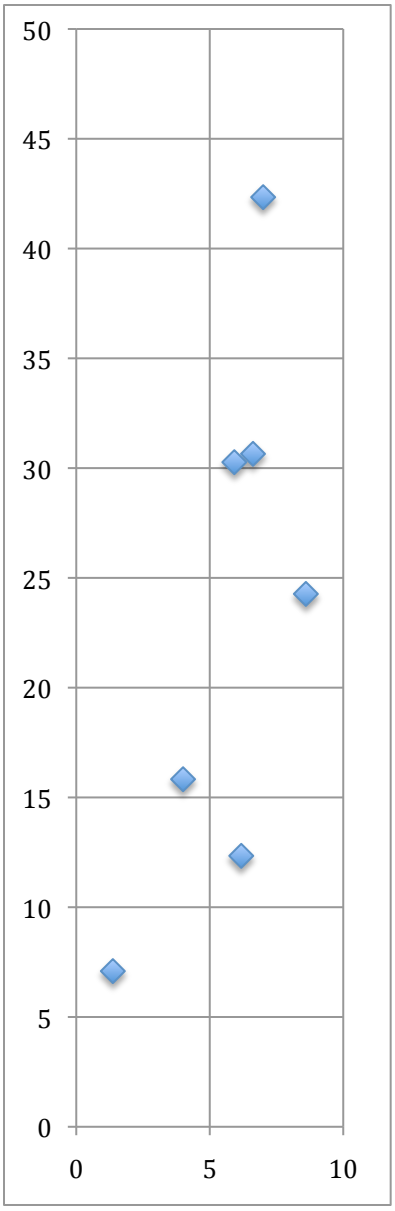
Fig.1. Illustration of expected distribution of a large sample size of Clustered (Orange, Mean approaches 0), Random (Red, Mean centers on 1), and Regular (Blue, Mean approaches 2.15) Spacing. My data points represented by green boxes. Mean for my data set is 1.601, indicated by a dashed black bar.



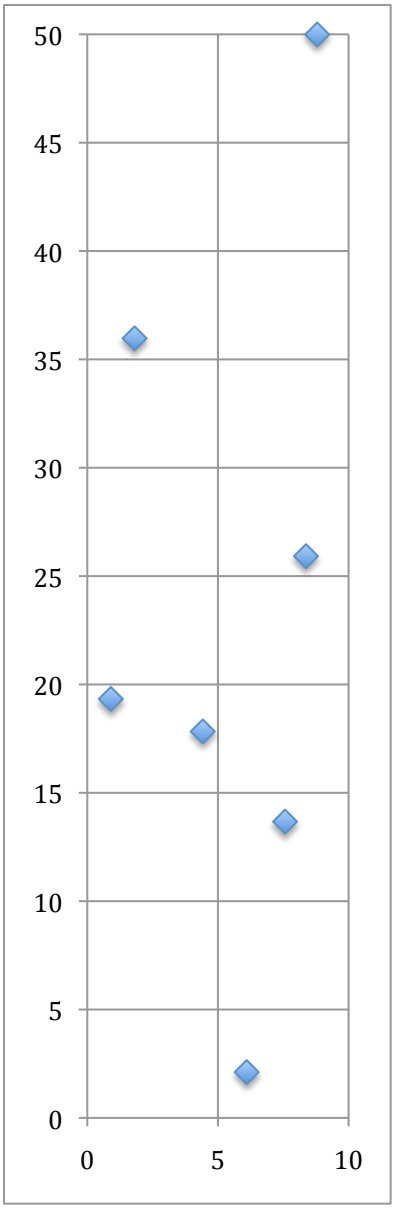
Plot #1



Plot # 2



Plot # 3



Plot # 4

Discussion

Provided a large sample size, a clustered distribution would trend toward a value of 0, a random distribution would be represented by a normal distribution over a value of 1, and a regular distribution would trend toward a value of 2.15 (Fig. 1). Due to the small size of my sample set, my data distributed between 1 and 2.15. The mean of my data was 1.601, which suggests the values were over 1 and displays a regulatory distribute trend. It is striking that all nearest neighbor values exceed 1.0, and one value (Plot #4, 2.10) is close to the theoretical maximum value for a regular distribution of 2.15. Given the limits of this study, I cannot answer the question fully as to whether my data differ in a statistically significant way from a mean of 1. However, this is indicative enough of potential support for my hypothesis of regular distribution to justify further investigation into this question. It is interesting to note that for each 500 m^2 plot, there was a narrow range of 4 and 7 termitaria. This indicates that there was a relatively consistent density of termitaria per 500 m^2, instead of a random number of nests. This held across two very different vegetation formations as well, transitional forest and tropical dry forest.

Acknowledgments

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References Cited

1. Triplehorn, Charles A. and Johnson, Norman F., *Borror and Delong's Introduction to the Study of Insects, 7th Edition*, Thomson Brooks Cole, 2005, 252 pp.

2. James B. Woolley, pers.com, 2011.

Appendix I. Spatial locations and characteristics of all termitaria in each plot.

Plot #	Colony #	meters from baseline	meters along baseline	nearest neighbor	distance to nearest neighbor	texture	location
1	1	4.35	2.1	2	8.98	carton	ground
1	2	7.13	10.64	3	6.57	carton	ground
1	3	1.22	13.5	2	6.57	carton	ground
1	4	7.35	18.4	5	2.76	carton	ground
1	5	9.58	16.77	4	2.76	carton	ground
1	6	3.42	22.35	4	5.57	carton	ground
2	1	5	3.18	2	5.81	unknown	ground
2	2	2.51	19.54	3	5.79	carton	ground
2	3	8.12	20.96	2	5.79	carton	ground
2	4	3.46	34.62	3	14.43	carton	ground
3	1	1.37	7.09	2	7.12	carton	ground
3	2	6.18	12.34	3	4.11	carton	tree
3	3	4	15.83	2	4.11	carton	tree
3	4	8.6	24.27	5	6.57	carton	tree
3	5	5.92	30.27	6	0.80	carton	tree
3	6	6.62	30.65	5	0.80	carton	ground
3	7	7	42.34	6	11.70	carton	ground
4	1	6.1	2.11	2	11.65	carton	ground
4	2	7.57	13.67	3	5.22	carton	ground
4	3	4.42	17.83	4	3.83	carton	ground
4	4	0.9	19.33	3	3.83	carton	ground
4	5	8.37	25.92	4	9.96	carton	ground
4	6	1.81	35.97	5	12.00	carton	ground
4	7	8.8	49.99	6	15.67	carton	ground