SPATIAL DISTRIBUTION OF NESTS OF *CORNITERMES CUMULANS* (ISOPTERA: TERMITIDAE) IN A PASTURE IN THE MUNICIPALITY OF RIO CLARO (SP) , BRAZIL

DISTRIBUIÇÃO ESPECIAL DOS NINHOS DE *CORNITERMES CUMULANS* (ISOPTERA: TERMITIDAE) EM UMA ÁREA DE PASTAGEM NO MUNICÍPIO DE RIO CLARO (SP), BRASIL

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ABSTRACT

The nests of *Cornitermes cumulans* were detected as randomly distributed in a pasture in the municipality of Rio Claro, São Paulo, Brazil. The mean distance between each nest and its closest neighboring nest influenced their mean volume at the level (mean volume = 27.002 + 4.508 nearest neighbor distance; r= 0.155**, n = 61). Although the distribution pattern of the nests of *Cornitermes cumulans* was random, competition may be one of the limiting factors for the growth of the colonies which could support the hypothesis that this pattern is tending toward an aggregation, or is, at a larger scale, an aggregating pattern.

Key Words: *Cornitermes cumulans*; termites; density; Isoptera; spacing patterns; spatial distribution

RESUMO

Os ninhos de *Cornitermes cumulans* apresentaram um padrão de distribuição espacial aleatório em uma área de pastagem no município de Rio Claro, São Paulo, Brasil. A distância média entre cada ninho e seu vizinho mais próximo influenciou o volume médio desses ninhos (volume médio = 27,002 + 4,508 distância ao vizinho mais próximo; r = 0,155**, n = 61). Embora o padrão de distribuição dos ninhos de *Cornitermes cumulans* tenha sido aleatório, a competição pode ser um dos fatores limitantes ao crescimento de suas colônias suportando a hipótese de que esse padrão está tendendo à agregação, ou de ser agregado, em uma escala maior.

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Palavras chaves: *Cornitermes cumulans;* densidade; Isoptera; padrão espacial; ditribuição espacial

INTRODUTION

Most of the termites species are restricted to the tropics and the family Termitidae is the most numerous group (KRISHNA, 1969).

Due to the great diversity of these insects in Brazil and to the importance role that they play in the ecosystem, studies about their ecology are very important. The explanation about the spatial distribution of the populations is fundamental in studies of this nature, since the environmental necessities and the behavioral patterns are distinct in the different species and dispersal in each one of them follows a discrete pattern (ELLIOTT, 1977).

In studies on community ecology, the nature of the spatial distribution of members or respective colonies may be as informative as their abundance. Through the evaluation of the aggregation pattern or species in a community, we can obtain information about the factors that influence their distribution, the intra and inter-specific interactions and about the carrying capacity of the environment (SPAIN et al., 1986).

Since the genus *Cornitermes* is exclusively neotropical and one of the most abundant mound builders termites in Brazilian savannas and forests (ARAÚJO, 1970), the aim of this paper was to study the spatial distribution of *Cornitemes cumulans*'s nests.

METHODS

This study was undertaken between May and June, 1994 in an area close to km 102 of the Washington Luis highway, Rio Claro (SP), Brazil (22^o 24' S; 47^o 33' W).

This area is a pasture with an inclination varying from + 2^o 43' to – 4^o 30' , and completely covered by the grass *Paspalum notatum*, popularly known as " Batatais" grass, without the occurrence of weeds.

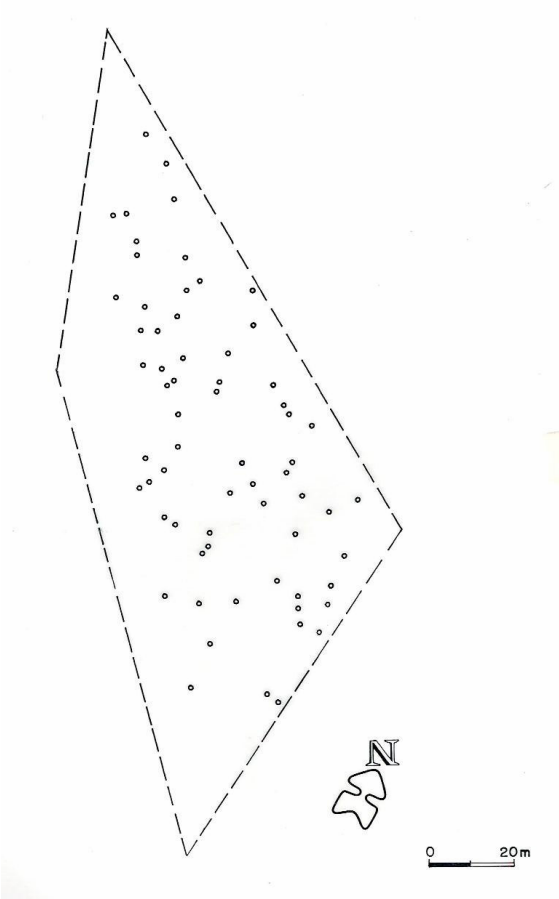
Sampling was carried out in 7, 156 m^2 and initially a map of the nest distribution was made (Fig. 1) using the standard alidade (Wild – precision of 10') and a stadia rod. Later, the distance from each nest to its closest neighbor (r_i) was calculed to test the randon variation using the index R of Clark and Evans (1954). This index is calculated by measuring r_i and calculating the mean distance:

($r = å r_i / n$) defining $R = r / E(r)$.

where $E(r) = 1/2Ö d$,

and $d = N/A$, the density of the termite nest in number of nests/m^2.

Figure 1. Dispertion of nests of *Cornitermes cumulans* in a pasture in the municipality of Rio Claro (São Paulo), Brazil.



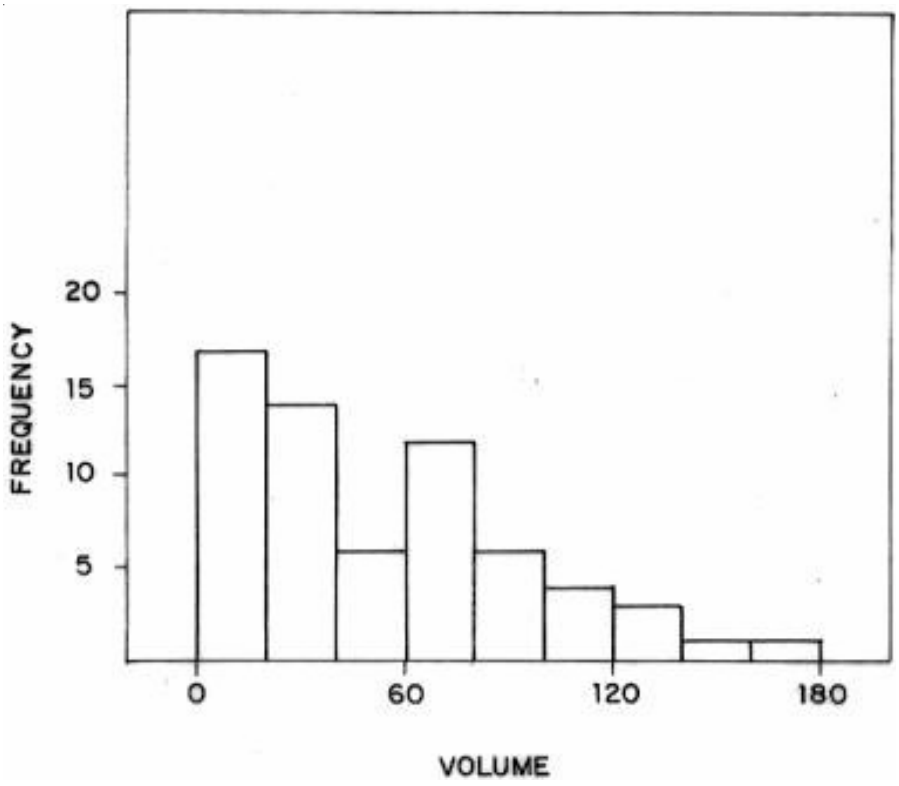
Clark and Evans (1954) showed that 0£ R£ 2.1491. When R = 0, there is a limit situation of a complete aggregation; when R = 2.1491, the limit situation is of a completely uniform pattern, resulting in a triangular lattice. When R = 1 the pattern of distribution of individuals is random. Petrere (1985) demonstrate that VAR (R) = 0.2732/ n. The test t = (R-1)/ÖVAR (R) was undertaken with n-1 degrees of freedom.

The diameter and height of all nests that were not damaged or deformed and were alive (n = 63) were measured and the mean value used to calculated their volume. In this case, it was considered that the nests showed a cone shape; thus, the formula V = p/ 3 . r^2h was used, r = d/2 = radius and h = nest height. These volumes were distributed in classes of 20 dm^3 (Fig. 2).

Using the mean volume, small colonies with a volume approximately two times less than the mean were considered small; intermediate colonies were those situated in the class immediately above or below the mean class and large colonies were approximately double the mean size.

A regression was run between the mean volumes and the distance of two nearest nests. When the nearest nests was damaged, the pair was discarded from regression calculation. This fact explains the difference between the number of nests considered for the regression (n = 61) and the total number sampled (n = 65).

Figure 2. Number of nests of *Cornitermes cumulans* per volume class (dm^3).



RESULTS

In the 7,156 m sampled, 65 nests of *Cornitermes cumulans* were found, that is equivalent 90.83 nests per hectare.

Inquiline species were observed in most of these nests, one of which was abandoned and six were totally occupied by other species.

The spatial distribution of these species was random (R = 0.956: p> 0.05) and the mean distance between each termite nest and its closest neighbor was 5.02 ± 2.35m (n = 65).

The nests presented a mean volume of 52.85 ± 40.24 dm^3 (n = 63). The porcentage of small nests (volume less than 25 dm^3) was 33.8 % whereas that of the

intermediate nests (from 25 to 95 dm^3) and large nests (over 95 dm^3) was 52.3 % and 13.8%, respectively. Only two nests (3.2%) presented volumes over 145 dm^3.

The distance between each nest and its closest neighbor had an influence over their mean volume at the 5% and1% levels (mean volume = 27.002 + 4.508 nearest neighbor distance; $r = 0.155^{**}$; n = 61).

DICUSSION

Although the spatial distribution of a population is rarely random, this kind of pattern can be found in sites where the population density is low (ELLIOTT, 1977). Due to the fact that *Cornitermes cumulans* presented this kind of distribution, we presume that the density of it's populations in this area is relatively low without intraspecific competition for resources as food and space. However, this picture is altered when we view the results obtained through regression analysis where the mean volumes of nearest neighbor colonies decrease as they become closer to one another. According to Domingos (1985), intra and intespecific competition is probably the factor that limits the growth of colonies of *Armitermes euamignathus* and *Armitermes festivellus*, when the distance between them lessens.

Buschini (1999a) found that *Nasutitermes* sp. had a regular distribution and a significant relationship between the nest distance and their volumes. According this Author, this result suggesting intraspecific competition for, probably, reduced resources as food and space. As Buschini (1999b), it is possible that in this species the availability of resources, mainly space and/or food affects the rate of growth of its colonies. This kind of pattern has been commonly attributed to the settling of foraging territory, which is maintained through inter and intraspecific competition (LEE and WOOD, 1971).

A positive correlation was found between the size of the nests of *Nasutitermes exitiosus* and the distance from the closest neighbor by Lee and Wood (1971). For this Authors, the larger the nest, the greater is the necessity of spacing between them.

The use of resources by an organism results from the combination of its necessities with the availability of these resources in the environment and with their variation in time and space (BROWN, 1990). It is possible that with the increase in density and consequently a reduction of resources, the random pattern found in this area may, in a larger stage, pass from random to another type due to intraspecific competition. Although this competition is still not influencing the distribution pattern of the nests, it is already interfering with their growth.

Colonies of termites do not grow indefinitely. In many species, the growth rate of the colonies declines as their growth increases. Young colonies grow rapidly and then become stable for a few years. This stop in the growth is related to the energy balance of the

colony (BANERJEE, 1975) and with the availability of resources (JONES et al., 1981). The largest volume found in this study was 165.3 dm^3 and only two nests (3.2%) presented volumes above 145 dm^3. Barros-Ferreira (1994), while working with 37 nests of *Cornitermes cumulans* in a pasture, obtained a mean volume of 244.2 dm^3, and the greatest volume was equal to 544.5 dm^3, which corresponds to 3.3 times the greatest volume found in the present paper. Competition may be one of the limiting factors for the growth of the colonies in this area, which would support the hypothesis that the distribution pattern found is tending toward an aggregation or is already, at a larger scale, an aggregating pattern.

One must also emphasize is that factors such as the handling of the area and the possible interference of bovine cattle in the availability of food for the termites. Wood et al. (1977), compared natural areas and agricultural ecosystems in Nigeria and found that both the density and the diversity of the termites are influenced by the mechanical management of the soil, structure of environment, type of culture and time since this was installed. Buschini (1999b) suspected that such factors as fire and the presence of the cattle exercised some influence on the growth of the nests of *Nasutitermes* sp. at a Cerrado area in Brazil.

It is important to consider that the random spatial distribution obtained in this study may be too related to the total area of the community under study. *Constrictotermes cyphergaster* presented a regular pattern inside an area of 1.5 ha, which constituted, however, the only aggregation of nests in an area of 10 ha (GODINHO et al, 1989). According to Horne and Schneider (1995), spatial variance of observed measures such as density, treated as a biologically important quantity, changes value depending on the scale of measurement. For Hurlbert (1990) the degree of aggregation in nature is always strongly a function of special scale. Moreover, here in Brazil the farmers usually try to destroy termites nests. Probably, this was another factor that explain this kind of spatial distribution found.

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