CHAPTER - V

POPULATION STUDIES OF THE TERMITE *O. wallonensis*

5.1. Introduction

Andrews (1911) and Grasses (1939) studied the total population and relative percentage of various castes in different species of the Macrotermiteanae. Holdway *et al* (1935) Basalingappa (1970) recorded the population of termite which varied per nest. Role of termite in an ecosystem is very important because of their highly destructive and beneficial nature. Their food value to a number of arthropod and vertebrate predators is immense hence they play vital a role in the food chain in the ecosystem.

Estimation of the population have been reported in *O. obesus* from Dehra Dun reported by Gupta in (1953). The highest population of subterrenian termite in trinida rain forest were reported by Sand (1965a) from Trinida rain forest and suggests that the total mound population and biomass of termite varied from species to species. Information regarding the relationship between the mound size and total population of some termites has been reported by Holdway *et.al* (1935), Veerana (1982) in mound building termite and Rajagopal (1985) in *O. wallonensis* from Bangalore (India). Basavalingappa (1972) recorded the population of termite which varied from 23,672 to 530,765 per nest in *O. assmuthi*.

Seasonal fluctuation of different caste of termite in different months of the year were studied by sand (1965a) in Odontotermes in Nigeria and Veeranna and Basalingappa (1982) in *O. obesus* and *O. wallonensis* species, Rajgopal (1985) in *O. redemanni* from Shantiniketan India. Among various castes fluctuation only the soldier caste in a colony has been discussed by Miller and Noirot CH (1969) and Sen Sarma and mishra (1978). The distribution of various castes in different part of the mound nest was described by Darlington (1977) in Macrotermes and Veeranna 1982 in *O. wallonensis*.

In India there are more than 40 species of termite recorded particularly from the sub-famiy Macrotermitiniae. A very few species are studied by some authors viz. Gupta (1953), Basalingappa (1972) Agarwal (1976) Rajgopal (1985). Since there are no reports
regarding population studies of *O. wallonensis* from Bidar district. In the present investigation following aspects have been studied.

a) Density of termite population from each unit of fungus comb the total population and percentage of various castes

b) Distribution studies

c) Seasonal population fluctuation studies

### 5.2. Materials and Methods

The mound nest of the termite *O. wallonensis* on Naubad area in Bidar served as the material for the present investigation. Mound of different dimensions were selected for the study of total population, Population density (from each unit of fungus comb) and percentage of different castes. The mound nests having more or less equal dimensions were selected to study the fluctuation of population and different castes of the colony in different months of the year. The studies were made from December 2008 to November 2009 monthly, 3 mound more or less equal dimensions were selected for the study. The mound were cut open so as to expose the vaults with fungus combs. All the fungus combs from different part of the nest were collected and weighed. Samples of fungus combs (100 gm each) from different part of the nests, at random were taken into thick polythene packets such polythene packets were closed immediately and number of small perforations were made for aeration to keep the inner surface dry to avoid sticking of termite to the polythene packets as well as to the fungus comb. Maximum care was taken to prevent the escape of termite from the packets. All the sample were brought to the laboratory and kept in refrigerator for 4-6 hours to make the termite in active and immobile. Later each unit of 100 gm. fungus comb was taken out bit by bit made it into smaller fragments spreaded on black paper, then different castes were sorted out and counting has been done by the method adapted by Rajgopal and Veeresh (1978) and Bhattacharya (1989). The population of termite colonies estimated by counting the various castes of termite from fungus comb, distributed indifferent region of the nest. Individual of each castes, adult worker, adult soldier, nymphaal soldier which are identifiable based on their well developed mandibles. The nymphaal instar include undifferentiated soldier and worker and reproductive nymphs (showing wing buds) and
Imagoes (alates) going to form king and queen. The total population of the entire fungus comb in the nest was calculated by the formula

Total population of the mound = \( \frac{X \times Y}{100} \)

where,

\( X \) = The average number of total termites of all castes from each unit of fungus comb

\( Y \) = Total weight (gm) of entire fungus comb from the mound nest.

The same method was followed by studying population density per 100gm unit in different months of the year.

To study the distribution of termite, the fungus combs from different part of the mound nest (peripheral region above the ground level, Peripheral region at ground level, between peripheral and the central region and central region) were collected separately from the field nests and counting were made as stated above. For the first time the population from the royal chamber was determined by whole count method by taking out royal chamber from the mound nests and brought them into the laboratory. Sometime counting of the termites was made on the spot in the field whenever the royal chamber was damaged while opening the mound. The data obtained in the present study with regard to total population height and circumference of the mound nests of the termite *O. wallonensis* were calculated statistically by using simple correlation test student t - test was applied for testing the level of significance of correlation. The linear regression study was carried out to find out the relation between the height and circumference of the mound with total weight of the fungus comb of the mound with total population in the mound. An exponential equation \( y = a \times b^x \) was fitted to the data on the height circumference and total weight of the fungus comb \((x)\) and total population of the colony \((y)\) (Table -4).

**5.3. Observations**

Observations made on dimensions of the mound nests total weight of the fungus comb, population density total population and percentage of various castes in the mound of *O.wallonensis* are shown in Table-5. Dimensions of the mounds of *O.wallonensis* such as the height and circumference varied from 13 cm. to 115 cm. and 71 cm. to 470
cm. respectively. Total weight of the fungus comb in the nests varied from 0.24 to 33.92 kg. From one termite mound measuring 115 cm in height total weight of the fungus comb was exceptionally quite high weighing 33.92 kg. Population density of a unit (100 gm) of fungus comb varied from 329 to 4320. The total population of termite in the mound nest of the termite *O. wallonensis* varied from 59.80 to 1185510 respectively. The percentage of various castes in the nests varied considerably the number and percentage of nymphs varied from 5128 to 974215 while those of adult workers, adult soldiers and nymphal soldiers varied from 690 to 62,155 and 130 to 36200 and 32 to 18900 respectively. (Table-6). Relationship of total population weight of fungus comb and mound size was calculated by using simple correlation test. Height, circumference and total weight of the fungus comb with total population height and circumference of the mound showed highly significant correlation (Table-4). The estimated values of regression constants (a) and (b) were, 7.866 and 0.256 height and circumference 12.462 and 0.06613 respectively. Similarly the calculated values of exponential (a&b) were 8945.6 and 3.52 height and circumference 1858.7 and 5.01, 36069 and 0.734 total height of the fungus comb respectively. The fluctuation in the population of *O. wallonensis* in different months of the year is shown in the (Table-6). The percentage of adult workers, nymphal soldiers, and nymphal instar were recorded in different months of the year 2008-09 which varied from 5.32 to 12.20, 1.21 to 3.09, 84.92 to 92.23 respectively. The reproductive nymph were observed in the mound nest only from Jan to May months. In some mound the reproductive nymphs were also found in the month of September and October. The percentage of reproductive nymphs varies from 0.10 to 0.60.

The population density and the percentage composition of different castes in different parts of the fungus comb and the royal chamber are given in Table-7. The adults workers, adult minor workers, adult soldiers, nymphal soldiers and nymphal instar were found in all the regions of the fungus comb and also in the royal chamber. The percentages of all the castes distributed in different regions of the fungus comb and royal chamber are found to be varied.
5.4. Discussion

In the present study, there was a considerable variation in the total population which varied 5,980 to 118,551 in the mound of *O.wallonensis* measuring from 13cm to 115cm in height and 71cm to 602cm in circumference has been observed by Holdaway *et. al.* (1935). Rajagopal and Veeresh (1984) reported that, the increase in the height and circumference of the mound with the increase in height of the fungus garden (comb) this is to commensurate with the growth of the population in the colony. Gupta (1953) had recorded the height and diameter of the mound. While estimating population, the relation between mound size and density of the population was not shown. The percentage ratio of different caste in termite varied considerably. The nymphal instar of *O.wallonensis* constitute bulk of population, percentage of different castes such as adult workers, adult soldier, nymphal soldier and nymphal instar varies (Table-6). Mitra and Murkharji (1949) studied that, percentage of soldier workers and nymph in the fungus garden of *Odontotermes* species showing highest percentage of nymphal instars due to continuous hatching of the egg cluster in the fungus garden inside the mound nest. The sexual nymphs were observed from January to May, sometimes up to the September and October months. Their number was maximum in February and March months. The fully developed alates were observed in the mound only for two months in April and May as they were ready and waiting for the suitable weather condition for swarming. An average total population density per 100gm fungus comb in the mound of *O.wallenensis* was found to varied one month to another (Table-6). The total population of nymphal instar was found to be highest than workers and soldiers. The highest percentage of nymphal instar in the fungus comb was due to the continuous hatching. In addition, various function such as foraging, for construction and repair of nest to attend royal couple or transfer the eggs from royal chamber to different parts of the fungus comb for incubation etc. Rajagoal (1979) studied that, there was great a predation of nymphal instara during foraging and mound construction than the adults. Agrawal (1976) also studied a considerable fluctuation of nymphal population in other *Odontotermes* species. Its shows that adult workers were found dominantly in the months of January, February, October and December. This variation may be because of sample taken from peripheral region, which will be located quite away from the central region, where the eggs were rarely
The soldier castes of *O. wallonensis* was found to be vary as compared to the percentage of workers (Table-6). Bhattacharyya (1989) has reported that soldier caste was completely absent in December in the fungus comb of other *Odontotermes* species. The workers formed the second largest groups in the colonies of *O. wallonensis* found throughout the year. Lowest percentage of workers was noticed during October, December and February which are active in foraging period. The maximum percentage of workers noticed from June to August. During which period foraging activity was found reduced due to un favorable condition viz wind, rain etc. The distribution of different caste in different parts of the mound nest shows considerable interest (Table- 7). Darlinton (1977) studied the distribution of various caste of termites in different parts of the mound nest and stated that the peripheral fungus comb consists major workers and minor workers. The major workers and soldiers are lesser in the basal part of mound where minor workers constituted more. In the present study of the distribution of various caste of *O. wallonensis* in different part of mound was found to be varied.

The distribution of various caste in mound building species dependent upon their functional behaviour. They found maximum number of workers in peripheral for construction of the nest. The minor workers were recorded maximum number in royal chamber. The high percentage of major workers in the peripheral region above and at ground level may be due to additional turretes and construction of fungus comb. The percentage of major workers in the royal chamber was less than that of minor workers. The percentage distribution of minor workers was similar to that of major workers in all the regions of the mound nest. But their percentage varied as shown in the Table -7. The minor workers formed most dominant group in the royal chamber. The high percentage of minor workers in the royal chamber might be due to their attending to royal couple for transporting continuously laid eggs by the queen. In the royal chamber the percentage of soldiers was found in decreasing order in the peripheral region at ground level (2.65 ± 0.18), central region (4.20 ± 0.5), peripheral region above ground level (3.20 ± 0.05), and the region between peripheral and central portion of the mound as shown in the Table-7. The concentration of soldiers population in royal chamber might be for guarding royal couple. The presence of large numbers of soldiers in royal chamber might be facing the enemies and invasion of predating ants. The percentage of nymphal instar was maximum
(90.80 ± 0.20) in the central region followed by the region between peripheral and central portion of the mound (89.59 ± 0.75), the peripheral region at ground level (80.50 ± 1.05), the peripheral region above the ground level (74.58 ± 1.75). The percentage of nymphal instar in royal chamber was (17.29 ± 1.15). The presence of high population of nymphal instar in central region of mound is attributed to fact that continuously laid eggs are deposited in huge cluster mass in this region.

5.5. Summary

The total population of colony dependent on the dimension of the mound and weight of the fungus comb. The number and percentage of different castes are varied. The population density of unit weight of 100gm fungus garden and total population of termite O.wallonensis in the mound nest varied. The presence of sexual forms in the nest was observed from January to May and also in September. The population density of major worker was more in peripheral region above the ground level and followed by peripheral region at ground level. The region between peripheral and central portion of the mound and central region the population density of minor workers was more in royal chamber for the purpose of feeding the royal couple and transporting of eggs to the fungus comb. The fungus comb in central region of mound was cluster of eggs hence nymphal instar were found in large number. The workers form the second largest group in the termite colonies were found throughout the year, thus distribution of various caste in different parts of the mound found to be varied on the basis of the division of labour due to deposition of eggs in clusters.
Table-4 The characteristics of fungus comb with co-efficient values.

A) Simple, correlation test between size of the mound and total population and weight of fungus comb.

B) Regression of the weight of the fungus comb (Y) with height and Circumference (X)

C) Exponential equation of total population (Y) with a) height, b) Circumference and c) total weight of fungus comb.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Co-efficient value(r)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Height of the mound</td>
</tr>
<tr>
<td>A. i) Total population</td>
<td>0.794 (0.002)</td>
</tr>
<tr>
<td>ii) Weight of the fungus comb</td>
<td>0.853</td>
</tr>
<tr>
<td>iii) Circumference of the mound</td>
<td>0.938</td>
</tr>
</tbody>
</table>

B. \[Y = 7.866 + 0.256 \text{ (Height)}\]
\[Y = 12.462 + 0.06613 \text{ (circumference)}\]

C. \[Y = (8945.6) (3.52) \text{ (Height)}\]
\[Y = (1858.7) (5.01) \text{ (Circumference)}\]
\[Y = (36069) (0.734) \text{ (Fungus comb height)}\]

N = 11 DF = 9

Note: - Values are significant at 0.001 levels.
Table – 5: comparative account of various fungus combs with respect to different castes of *O. wallonensis* (Wasman)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Height cm.</th>
<th>Circumference cm.</th>
<th>Total weight of the fungus comb kg.</th>
<th>Population density/100 gm fungus comb</th>
<th>Total population of the termites in the mound</th>
<th>Number of different castes</th>
<th>Reproductive Mymphs* imagoes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adult workers</td>
<td>Adult soldiers</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>71</td>
<td>0.24</td>
<td>2490</td>
<td>5980</td>
<td>690</td>
<td>130.00</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>190</td>
<td>1.37</td>
<td>3390</td>
<td>46480</td>
<td>2505</td>
<td>115.00</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>270</td>
<td>2.27</td>
<td>3010</td>
<td>68330</td>
<td>7410</td>
<td>240.00</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
<td>310</td>
<td>3.40</td>
<td>3112</td>
<td>105810</td>
<td>9350</td>
<td>1890.00</td>
</tr>
<tr>
<td>5</td>
<td>53</td>
<td>320</td>
<td>4.32</td>
<td>329</td>
<td>14213</td>
<td>13150</td>
<td>3950.00</td>
</tr>
<tr>
<td>6</td>
<td>54</td>
<td>330</td>
<td>5.42</td>
<td>2015</td>
<td>109220</td>
<td>9150</td>
<td>3250.00</td>
</tr>
<tr>
<td>7</td>
<td>61</td>
<td>350</td>
<td>7.25</td>
<td>2385</td>
<td>172930</td>
<td>16250</td>
<td>6850.00</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
<td>380</td>
<td>8.02</td>
<td>2112</td>
<td>16930</td>
<td>13550</td>
<td>2540.00</td>
</tr>
<tr>
<td>9</td>
<td>95</td>
<td>375</td>
<td>10.92</td>
<td>2314</td>
<td>252690</td>
<td>30200</td>
<td>3210.00</td>
</tr>
<tr>
<td>10</td>
<td>94</td>
<td>602</td>
<td>12.35</td>
<td>3090</td>
<td>381620</td>
<td>3.2209</td>
<td>10500</td>
</tr>
<tr>
<td>11</td>
<td>100</td>
<td>430</td>
<td>18.75</td>
<td>4320</td>
<td>810010</td>
<td>62155</td>
<td>15200</td>
</tr>
<tr>
<td>12</td>
<td>115</td>
<td>470</td>
<td>33.92</td>
<td>3495</td>
<td>1185510</td>
<td>1552</td>
<td>36200.00</td>
</tr>
</tbody>
</table>
Table – 6: Total population and percentage of different castes of the *O.wallonensis* (Wasman) during the period from January 2008 - December 2009

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Month</th>
<th>Total weight of the fungus comb Kg</th>
<th>Population density/ 100gm of fungus comb</th>
<th>Total population</th>
<th>Percentage of different castes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adult workers</td>
</tr>
<tr>
<td>1</td>
<td>January</td>
<td>7.15</td>
<td>3925.00</td>
<td>28163.50</td>
<td>5.32</td>
</tr>
<tr>
<td>2</td>
<td>February</td>
<td>6.95</td>
<td>2716.00</td>
<td>191762.0</td>
<td>7.25</td>
</tr>
<tr>
<td>3</td>
<td>March</td>
<td>5.50</td>
<td>18.03.00</td>
<td>101020.0</td>
<td>8.20</td>
</tr>
<tr>
<td>4</td>
<td>April</td>
<td>5.42</td>
<td>3322.00</td>
<td>91052.0</td>
<td>9.60</td>
</tr>
<tr>
<td>5</td>
<td>May</td>
<td>6.32</td>
<td>3100.00</td>
<td>199984.0</td>
<td>8.20</td>
</tr>
<tr>
<td>6</td>
<td>June</td>
<td>5.61</td>
<td>2706.00</td>
<td>15181.0</td>
<td>9.81</td>
</tr>
<tr>
<td>7</td>
<td>July</td>
<td>6.12</td>
<td>2015.00</td>
<td>130320.0</td>
<td>9.98</td>
</tr>
<tr>
<td>8</td>
<td>August</td>
<td>6.95</td>
<td>2505.00</td>
<td>1621460.0</td>
<td>12.20</td>
</tr>
<tr>
<td>9</td>
<td>September</td>
<td>6.67</td>
<td>2616.00</td>
<td>174402.0</td>
<td>7.50</td>
</tr>
<tr>
<td>10</td>
<td>October</td>
<td>6.99</td>
<td>2681.00</td>
<td>187408.0</td>
<td>7.71</td>
</tr>
<tr>
<td>11</td>
<td>November</td>
<td>5.41</td>
<td>3425.00</td>
<td>180593.0</td>
<td>7.78</td>
</tr>
<tr>
<td>12</td>
<td>December</td>
<td>7.33</td>
<td>2402.00</td>
<td>176067.0</td>
<td>6.40</td>
</tr>
</tbody>
</table>

Note: Replication 3 mound nest.
Table - 7: Percentage distribution of various castes of *O. wallonensis* (Wasman) in different parts of the mound nests

<table>
<thead>
<tr>
<th>Percentage of Various Castes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Different Parts of mound</strong></td>
</tr>
<tr>
<td>Nest</td>
</tr>
<tr>
<td>Peripheral region above ground level</td>
</tr>
<tr>
<td>Peripheral region at ground level</td>
</tr>
<tr>
<td>The region between peripheral and central portion of the mound</td>
</tr>
<tr>
<td>Central region</td>
</tr>
<tr>
<td>Royal chamber</td>
</tr>
</tbody>
</table>

Replication : 3 mounds
Fig. 4: Percentage distribution of various castes *O. wallonensis* (Wasman) of in different parts of the mound nests.