

MORPHOMETRIC VARIATIONS IN A TERMITE *ODONTOTERMES GIRIENSIS* (ROONWAL AND CHHOTANI)

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Abstract: For the study of Morphometric Variations of *Odontotermes giriensis*, samples from three different nests, were statistically analysed for variability. Based on Manhattan distance, the relationship among the three population samples is described.

Key Words: termite, Imago, Soldier, Morphometric variability, *Odontotermes giriensis*.

INTRODUCTION

Odontotermes giriensis Roonwal and Chhotani is a humid zone termite, occurring in Bangladesh and India Chhotani (1997). It has been collected from cowdung and dead barks etc, under a cover of earthen sheath on trees. It usually makes underground nest. This species has not been recorded from Pakistan. Since the identification of the termites is based on the measurements of different body parts, which show variations, the present study can help in understanding the degree of variations in samples collected from the geographic range of the species.

MATERIALS AND METHODS

The present study is based on the preserved material available in the collection of Prof. Dr. Muzaffar Ahmad, present in the custody of Prof. Dr. M. Saeed Akhtar. Specimens from the samples were picked up at random and measured under stereoscopic binocular microscope with built in magnification changer. Measurements were taken with the aid of calibrated ocular micrometer. Diagrams of the mandibles and postmentum were prepared with the help of camera lucida.

Taxonomic terms and measurements used in the present study are as explained by Emerson (1945, 1952). Ahmad (1965) and Akhtar (1975). Population samples of the species have been compared according to Manhattan Distance (Mayr and Ashlock, 1991).

RESULTS

Odontotermes giriensis Roonwal and Chhotani

Odontotermes giriensis: M.L. Roonwal and O.B. Chhotani, 1962; Ahmad, 1965; Akhtar, 1975; Thakur, 1981; Chhotani, 1997.

IMAGO:

The imago of *O. giriensis* Roonwal and Chhotani is characterized by head capsule subcircular, depressed in region of fontanelle. Ocelli, separated from eyes by about their long diameter; and also by same distance from antennae. Postclypeus weakly swollen, length much less than width. Length of head to base of mandibles, 1.80-1.90 mm; maximum width of head, 2.30-2.40 mm; maximum diameter of eye, 0.53-0.55 mm; minimum diameter of eye, 0.45-0.50 mm; eye ocellus distance, 0.25-0.32 mm; ocellus antennal distance, 0.26-0.33 mm. Postclypeus length, 0.30-0.35 mm; width of postclypeus, 0.90-0.95 mm; length of pronotum, 1.20-1.25 mm; width of pronotum, 2.13-2.15 mm (from Chhotani, 1997).

SOLDIER:

The soldier of *O. giriensis* Roonwal and Chhotani is characterized by antennae not uniformly coloured; head capsule oval, longer than broad; sides convex, narrowed anteriorly. Mandibles long, sabre-shaped, weakly incurved at tips; shorter than head capsule. Left mandible with a sharp tooth at about distal fourth. Postmentum subrectangular; sides abruptly converging in distal fourth.

Material Examined

Bangladesh

- A. Adampur, soldiers and workers, collected by N.K. Malik, in a log, 17.11.1968, determined by M.S. Akhtar.
- B. Madhupur (latitude 24°32'N, longitude 90°03'E), soldiers and workers, collected by N.K. Malik, determined by M.S. Akhtar, 4.11.1968.
- C. Rasulpur (latitude 28°42'N, longitude 77°01'E), soldiers and workers, collected by M. Arshad, in a mound, 9.11.1970, determined by M.S. Akhtar.

Results

There was significant variance component (F, 13.08; d.f., 2:16; $P < 0.01$) among nest samples for length of head to side base of mandibles. The coefficient of variability varied from 2.16 – 6.11 mm (Table: 1). For the pooled data, the coefficient of variability for this parameter was 6.39 (Table: 2).

For width of head at side base of mandibles, there was also significant variance component (F, 29.20; d.f., 2:16; $P < 0.05$).

Maximum width of head varied from 1.05 – 1.33 mm; and there was significant variance component ((F, 87.54; d.f., 2:16; $P < 0.05$). The analysis of variance revealed significant differences in other parameters also and F values are indicated in Table 1. However for the parameter, tooth of left mandible from tip, there was non-significant variance component (F, 1.09; d.f., 2:16; $P > 0.05$).

The length of left mandible, which is often considered, very important in diagnosis of different species of the genus *Odontotermes*, varied from 0.72 – 0.82 mm. As regards the frequency distribution, maximum number of individuals (8) measured 0.77 – 0.81 mm. The coefficient of variability for the pooled data was 4.19 (Table: 2).

Table 1: Internest Morphometric variations in taxonomic parameters of the soldier caste of *Odontotermes giriensis* Roonwal and Chhotani. Samples followed by similar letters indicate non-significant differences in mean values by 't'-test ($P > 0.05$).

Nest Sample	N	O.R	\bar{X}	S.D.	S.E.	95% C.I	C.V
Length of head to side base of mandibles							
A	3	1.38-1.44	1.4133	0.0306	0.0176	1.3374-1.4892	2.16
B	10	1.23-1.31	1.2840	0.0422	0.0133	1.2538-1.3142	3.28
C	6	1.13-1.33	1.2200	0.0746	0.0304	1.1417-1.2983	6.1
F. 13.08; d.f., 2:16; $P < 0.01$.							
Width of head at sidebase of mandible							
A	3	0.74	0.74	-	-	-	-
B	10	0.63-0.70	0.65600	0.03098	0.00980	0.63383-0.67817	4.72
C	6	0.59-0.63	0.60667	0.01506	0.00615	0.59086-0.62247	2.48
F. 29.20; d.f., 2:16; $P < 0.01$.							

Width of head at the posterolateral ends of antennal carinae

A ^a	3	0.96-0.98	0.97333	0.01155	0.00667	0.94465-1.002	1.18
B ^{ab}	10	0.82-0.98	0.9080	0.0518	0.0164	0.8709-0.9451	5.70
C ^b	6	0.84-0.98	0.8800	0.0566	0.0231	0.8206-0.9394	6.43

F. 3.46; d.f., 2:16; P>0.05.

Maximum width of head

A	3	1.25-1.33	1.2967	0.0416	0.0240	1.1932-1.400	3.20
B	10	1.19-1.27	1.2220	0.02533	0.00800	1.20390-1.240	2.07
C	6	1.05-1.11	1.07167	0.02229	0.00910	1.0482-1.0950	2.07

F. 87.54; d.f., 2:16; P<0.01.

Length of left mandible

A ^a	3	0.80-0.82	0.81333	0.01155	0.00667	0.78465-0.84202	1.42
B ^a	10	0.74-0.82	0.79200	0.03011	0.00952	0.77045-0.81355	3.80
C	6	0.72-0.78	0.75667	0.02338	0.00955	0.73212-0.78121	3.08

F. 5.52; d.f., 2:16; P>0.025.

Tooth of left mandible from tip

A	3	0.20	0.20	-	-	-	-
B	10	0.20	0.20	-	-	-	-
C	6	0.18-0.20	0.19333	0.01033	0.00422	0.18249-0.20417	5.34

F. 1.09; d.f., 2:16; P>0.05.

MORPHOMETRIC VARIATIONS IN TERMITE

Length of pronotum

A ^a	3	0.49-0.51	0.50333	0.01155	0.00667	0.47465-0.53202	2.29
B ^a	10	0.49-0.51	0.50400	0.00966	0.00306	0.49709-0.51091	1.91
C ^a	6	0.47-0.49	0.48333	0.01033	0.00422	0.47249-0.49417	2.13

F. 8.43; d.f., 2:16; P<0.01.

Width of pronotum

A ^a	3	0.92-0.94	0.93333	0.01155	0.00667	0.90465-0.96202	1.23
B ^a	10	0.90-0.98	0.92600	0.02319	0.00733	0.90941-0.94259	2.50
C	6	0.78-0.86	0.8267	0.0301	0.0123	0.7951-0.8583	3.64

F. 34.87; d.f., 2:16; P<0.05.

Length of postmentum

A	3	0.78-0.82	0.8000	0.0200	0.0115	0.7503-0.8497	2.50
B ^b	10	0.72-0.76	0.7100	0.0600	0.0190	0.6671-0.7529	8.45
C ^b	6	0.74-0.76	0.74667	0.01033	0.00422	0.73583-0.75751	1.38

F. 4.68; d.f., 2:16; P<0.05.

Width of postmentum

A ^a	3	0.53-0.57	0.5500	0.0200	0.0115	0.5003-0.5997	3.63
B ^a	10	0.51-0.53	0.52200	0.01033	0.00327	0.51461-0.52939	1.97
C ^a	6	0.49-0.53	0.51333	0.01506	0.00615	0.49753-0.52914	2.93

F. 7.60; d.f., 2:16; P<0.05.

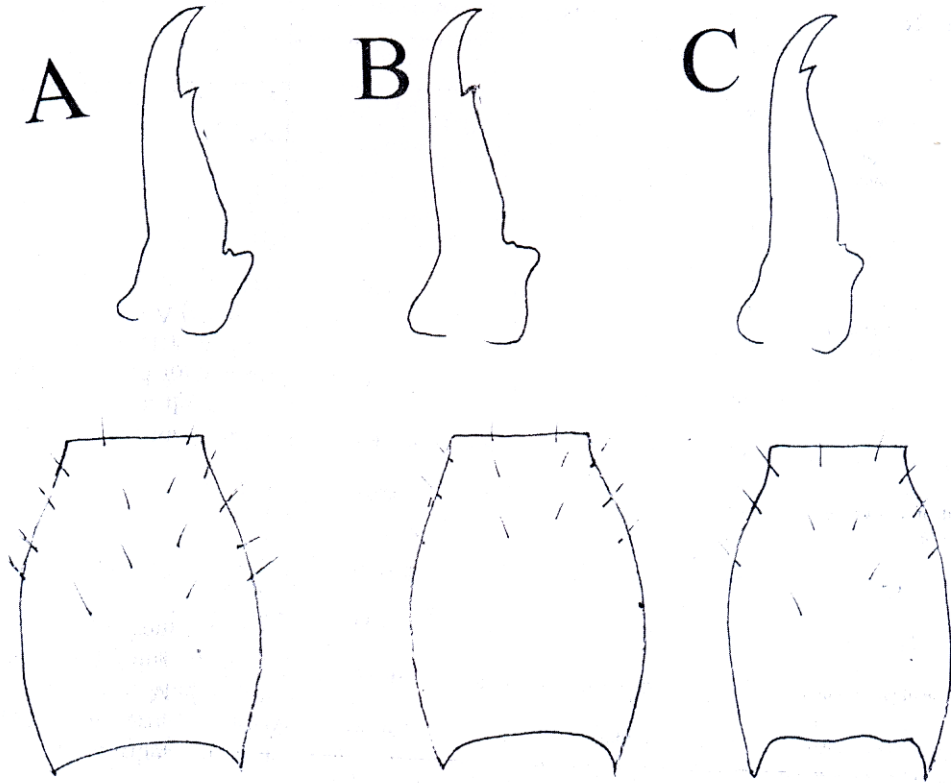


Fig. 1: Variations in Mandibles and Postmentum of the soldier caste of *O-Giriensis* Roonwal and Chhotani from localities A -C

Table 2: Statistics for various parameters used in this study for *O. giriensis* Roonwal and Chhotani, all localities combined.

Parameters	N	O.R.	X	S.D.	S.E.	C.I. (95%)	C.V.
Length of head to sidebase of mandibles	19	1.13-1.44	1.28	0.0818	0.0188	1.24-1.32	6.39
Width of head at sidebase of mandible	19	0.59-0.74	0.65	0.0502	0.0115	0.63-0.68	7.72
Width of head at the posterolateral ends of antennal carinae	19	0.82-0.98	0.91	0.0567	0.0130	0.88-0.94	6.23
Maximum width of head	19	1.05-1.33	1.19	0.0881	0.0202	1.14-1.23	7.40
Length of left mandible	19	0.72-0.82	0.78	0.03273	0.00743	0.77-0.80	4.19
Tooth of left mandible from tip	19	0.18-0.20	0.20	0.00918	0.00211	0.19-0.20	4.59
Length of pronotum	19	0.47-0.51	0.49	0.02394	0.00549	0.48-0.50	4.88
Width of pronotum	19	0.78-0.98	0.89	0.0536	0.0123	0.87-0.92	6.02
Length of postmentum	19	0.72-0.82	0.75	0.02697	0.00619	0.74-0.76	3.59
Width of postmentum	19	0.49-0.57	0.52	0.01744	0.00400	0.52-0.53	3.35

INDICES:

i) Mandibular Tooth Index (TLT/LLM)

The index value varied from 0.22-0.28. The mean values were 0.24, 0.25 and 0.25 for samples A, B and C, respectively (Map I). Sample from locality A (Adampur) had the highest value of coefficient of variability (C.V. = 10.5) (Table 3) and was more variable for this parameter.

ii) Head Mandibular Index (LLM/LHSBM)

The index value varied from 0.55-0.68. The mean values were 0.57, 0.62 and 0.62 for samples A, B and C, respectively (Map I). Sample from locality C (Rasulpur) was more variable (C.V. = 6.41) (Table 3).

iii) Head Width Mandibular Index (LLM/MWH)

The index value varied from 0.61-0.73. The mean values were 0.63, 0.65 and 0.69 for samples A, B and C, respectively (Map I). Sample from locality B (Madhupur) was more variable (C.V. = 4.31) (Table 3).

Cluster Analysis:

Further comparison was made by considering all the parameters for Manhattan distance re-arranged by similarity (Table 6). Sample A (Bangladesh: Adampur) and B (Bangladesh: Madhupur) form the primary cluster at value of 6. Sample C (Bangladesh: Rasulpur) joins the cluster AB to form secondary cluster at an average value of 10. Specimens from locality A and B, therefore, are more closely related than that of locality C (Fig. 1).

DISCUSSION

The tooth of left mandible from tip, varied from 0.18-0.20 mm in the pooled data (Table 2). For the pooled data, the highest value of coefficient of variability (C.V. = 7.72) was recorded for width of head at sidebase of mandibles. Width of postmentum is more stable character in this specimen and less variable (C.V. = 3.35) (Table 2). Specimens from locality A (Bangladesh: Adampur) are the largest.

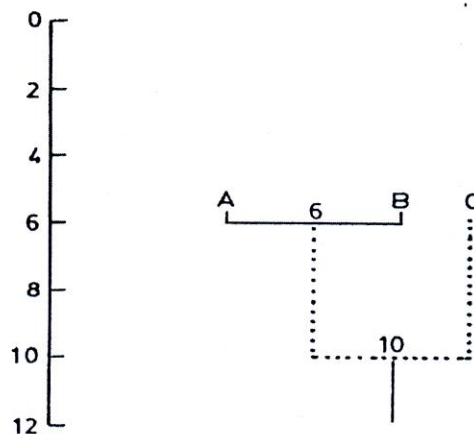
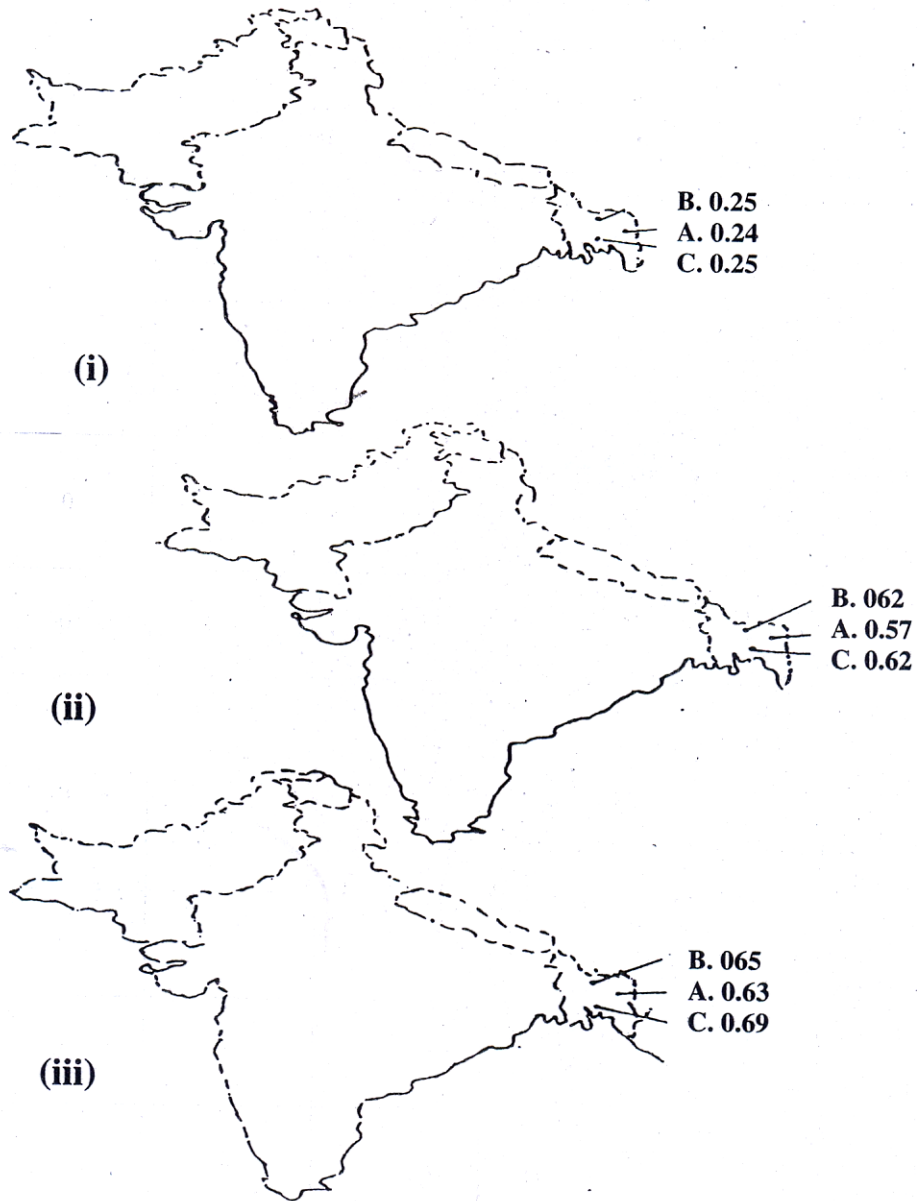


Fig. 2: Phenogram: Manhattan distance of the soldier samples of *O. giriensis* Roonwal & Chhotani. Primary clusters are indicated by solid lines, secondary clusters by dotted lines. The scale on the left is a distance measure.

Table 3: Statistics of various indices used in this study for *O. giriensis* Roonwal and Chhotani.

Nest Sample	N	O.R	\bar{X} *	S	S.E	C.I	C.V
i) Mandibular Tooth Index (TLT/LLM)							
A	3	0.22-0.27	0.24	0.0252	0.0145	0.18-0.30	10.5
B	10	0.24-0.27	0.25	0.01252	0.00396	0.24-0.26	5.00
C	6	0.23-0.28	0.25	0.01761	0.00719	0.24-0.27	7.04
*Average mean value = 0.25.							
ii) Head Mandibular Index (LLM/LHSBM)							
A	3	0.57-0.58	0.57	0.00577	0.00333	0.56-0.59	1.01
B	10	0.60-0.68	0.62	0.02394	0.00757	0.60-0.63	3.86
C	6	0.55-0.66	0.62	0.0398	0.0163	0.58-0.66	6.41
*Average mean value = 0.60.							
iii) Head Width Mandibular Index (LLM/MWH)							
A	3	0.62-0.64	0.63	0.01155	0.00667	0.60-0.65	1.83
B	10	0.61-0.70	0.65	0.02807	0.00888	0.63-0.67	4.31
C	6	0.68-0.73	0.69	0.0250	0.0102	0.66-0.72	3.62
*Average mean value = 0.66.							



Map-1: Geographic variations in the Indices of (i) TLT/LLM, (ii) LLM/LHSBM, (iii) LLM/MWH of soldiers of *O. giriensis* Roonwal & Chhotani from three populations. (A, Adampur; B, Madhupur; C, Rasulpur).

Table 4: Data Matrix

Parameters	A	B	C
Length of head to side base of mandibles (1.23-1.27) = 1 Less than this range = 0 More than this range = 2	2	2	0
Width of head at side base of mandibles (0.59-0.63) = 1 Less than this range = 0 More than this range = 2	2	2	1
Width of head at posterolateral ends of antennal carinae (0.92-0.96) = 1 Less than this range = 0 More than this range = 2	2	0	0
Maximum width of head (1.20-1.24)=1 Less than this range = 0 More than this range = 2	2	1	0
Length of left mandible (0.77-0.81) = 1 Less than this range = 0 More than this range = 2	1	1	0
Distance of tooth from tip (0.18-0.22)=1 Less than this range = 0 More than this range = 2	1	1	1
Length of pronotum (0.47-0.51) = 1 Less than this range = 0 More than this range = 2	1	1	1
Width of pronotum (0.88-0.92) = 1 Less than this range = 0 More than this range = 2	2	2	0
Length of postmentum (0.72-0.76) = 1 Less than this range = 0 More than this range = 2	2	0	1
Width of postmentum (0.49-0.53) = 1 Less than this range = 0 More than this range = 2	2	1	1

Table 4: Similarity Matrix: Manhattan distance.

	Taxa		
	A	B	C
A	X	6	12
B	6	X	8
C	12	8	X

Table 5: Similarity Matrix: Manhattan distance rearranged by similarity.

	Taxa		
	B	A	C
B	X	6	8
A	6	X	12
C	8	12	X

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