

A Study on the Diversity of Termites with Reference to their Morphometrics and Mound Construction in Tezpur of Sonitpur District, Assam, India

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Abstract—Termites belonging to the order Isoptera of the class Insecta are very small social insects which generally have contrasting roles of both beneficial as decomposers and harmful as pest in different terrestrial ecosystems.

The present study aims to discover different species of termites in Tezpur of Sonitpur District of Assam, India with reference to their morphometrics and mound construction. The termites are collected from different locations of the study area by random sampling. The termite species discovered in the study area are *Odontotermes globicola*, *Odontotermes horni*, *Odontotermes obesus*, *Odontotermes redemanni*, and *Microtermes incertoides*. Among them *O. obesus* is the most abundant. The total body length of soldiers of *O. globicola*, *O. horni*, *O. obesus*, *O. redemanni*, and *M. incertoides* are found in the range of (3.5-4.0) mm, (7.7-9.0) mm, (4.4-5.4) mm, (5.5-5.9) mm and (3.4-4.3) mm respectively. The mandible-head indices of soldiers of *O. globicola*, *O. horni*, *O. obesus*, *O. redemanni*, and *M. incertoides* are found in the range of (0.70-0.80), (0.50-0.53), (0.53-0.61), (0.64-0.66) and (0.62-0.65) respectively. The number of antennal segments of soldiers of *O. horni* is 17 while that of *O. obesus* and *O. redemanni* is 16, *O. globicola* 15 and *M. incertoides* 14. The soldier of *O. horni* is the largest in size while that of *M. incertoides* is the smallest. Out of six species, *O. obesus* and *O. redemanni* are found to construct mound.

Introduction

Termites are very small, polymorphic and social insects belonging to the order Isoptera of the class Insecta. They are polyphagous insects which cause damage to almost anything containing cellulose- from the roots of crop in the ground to the woods in the buildings. They are soil inhabiting, either as mound builders or as subterranean nest builders.

There are over 2600 species of termites in the world [3], three hundred species of termites in India [10], 76 species in North-Eastern India and 25 species of termites have been recorded in Assam [1]. There are approximately 3105 species (living and fossil) and 330 (living and fossil) genera of termites in the world [7].

The first ever reference to a termite from North-eastern India is of Holmgren (1913) [6] who described the species *Odontotermes assamensis* [now a synonym of *O. obesus* (Rambur)] from Assam. The next work on the termites from North-eastern region is that of Silvestry (1914) [13] who worked out a collection obtained through an expedition of Abor Hills in Arunachal Pradesh by S. W. Kemp of the Zoological Survey of India, recording four species viz. *Odontotermes assamensis* Holmgren (syn. of *O. obesus*), *Odontotermes microdens* Silvestry, *Odontotermes feae* (Wasmann) and *Nasutitermes moratus* (Silvestry). Gardner (1945) [4] described the species *Reticulitermes assamensis*. Roonwal and Sen-Sarma (1960) [12] described the species *Neotermes megaoculatus lakhimpuri* from Assam.

The intraspecific morphological variation of individuals of termites and interspecific overlapping of measurements of certain body structures lead to confusion in identification of many termite species. Therefore morphometric analysis is important for termite identification. Though twenty five species of termites are recorded in Assam [1] but the survey was restricted to a few places only. From the literature it is found that the information regarding the diversity of termites in Tezpur of Sonitpur district of Assam, India is still fragmentary. The present study aims to discover different species of termites with their morphometrics and mound construction in the study area.

Materials and Methods

The termites (soldiers and workers) are collected from different locations of the study area by random sampling. The method of collection and preservation given by Pearce (2006) [9] is followed for the present study.

Identification of termites is done with the help of taxonomic keys of Roonwal & Chhotani (1989) [11] and Chhotani (1997) [2]. Identification is mainly based on the characters of soldiers. For identification, termites are normally examined in 70-80% ethyl alcohol in small dishes under binocular microscope. Measurements are taken with the aid of an ocular micrometer.

The study area: Tezpur is a town situated on the north bank of river Brahmaputra in Sonitpur district of Assam, India. It covers an area of 40 sq km lying between 26.61° to 26.73° N latitude and 92.72° to 92.8°E longitude. It is a plain area which has an average temperature 36°C during summer and 13°C during winter.

Results

A total of five species are recorded in the study area during the present survey. The discovered termite species of different collecting sites are presented in Table 1. The measurements of different body parts of soldiers of termite species are presented and compared in Table 2 along with their mandibular tooth position and mound construction..

1) Taxonomic description of Soldier of *Odontotermes globicola* (Wasmann)

Body color is whitish to pale yellow. Total body length lies in the range 3.50-4.0 mm. Head capsule is oval, dark yellowish brown, converging anteriorly. Head is thinly hairy and body is moderately hairy. Each Antenna has 15 segments. The labrum is triangular and pointed in front. Left mandible has a prominent tooth near its tip and the right mandible has a small tooth at about its distal third. Postmentum is short, broad and arched and sides are convex, anteriorly converging. The pronotum is saddle shaped and notched at anterior margin.

Mound construction: The species does not construct mounds and is found under decaying logs. They construct small chambered nest.

2) Taxonomic description of soldier of *Odontotermes horni* (Wasmann)

The colour of the head-capsule is yellowish to reddish brown. Abdomen is whitish to pale yellow. Total body-length varies from 7.7mm to 9.00 mm. Head-capsule is subrectangular; sides substraight very slightly converged in front of antennae. Each antenna with 17 segments; segment 3 much shorter than 2; 4 almost as long as 2; 5 shorter than 4. The labrum is tongue-shaped with rounded tip. Left mandible bears a large prominent

Table 1: List of termite species discovered in different sites of Tezpur of Sonitpur District, Assam

Sites	GPS Location	Collected from	Name of species
Site 1	N-26.656719 E-92.765978	Wood	<i>Odontotermes horni</i> (Wasmann)
Site 2	N-26.618701 E-92.854261	Mound	<i>Odontotermes obesus</i>
Site 3	N-26.61416 E-92.852388	Decaying log	<i>Odontotermes globicola</i> (Wasmann)
Site 4	N-26.615905 E-92.852541	Wood	<i>Odontotermes horni</i> (Wasmann)
Site 5	N-26.803753 E-92.708518	Decaying wood	<i>Microtermes incertoides</i>
Site 6	N-26.690065 E-92.693787	Wood	<i>Odontotermes horni</i> (Wasmann)
Site 7	N-26.696764 E-92.681863	Mound	<i>Odontotermes redemanni</i> (Wasmann)
Site 8	N-26.744508 E-92.64109	Mound	<i>Odontotermes obesus</i> (Rambur)
Site 9	N-26.759872 E-92.647482	Mound	<i>Odontotermes obesus</i> (Rambur)
Site 10	N-26.818204 E-92.681324	Wood	<i>Odontotermes horni</i> (Wasmann)
Site 11	N-26.803753 E-92.708518	Decaying wood	<i>Microtermes incertoides</i> Holmgren
Site 12	N-26.658963 E-92.791317	Decaying wood	<i>Microtermes incertoides</i> Holmgren
Site 13	N-26.823886 E-92.710361	Wood	<i>Odontotermes horni</i> (Wasmann)
Site 14	N-26.800536 E-92.778595	Mound	<i>Odontotermes obesus</i> (Rambur)
Site 15	N-26.619092 E-92.857176	Mound	<i>Odontotermes obesus</i> (Rambur)
Site 16	N-26.625729 E-92.844776	Mound	<i>Odontotermes obesus</i> (Rambur)
Site 17	N-26.751202 E-92.632524	Mound	<i>Odontotermes obesus</i> (Rambur)
Site 18	N-26.744855 E-92.641224	Mound	<i>Odontotermes obesus</i> (Rambur)
Site 19	N-26.803753 E-92.708518	Decaying wood	<i>Microtermes incertoides</i>
Site 20	N-26.658963 E-92.791317	Decaying wood	<i>Microtermes incertoides</i>

tooth near the base of middle third. Right mandible has a minute tooth a little below the level of tooth on left mandible. Postmentum is subrectangular and the sides swelling out in proximal third. Pronotum is saddle shaped, anterior margin with median notch.

Mound construction : The species is yet not known to construct earthen mound.

3) Taxonomic description of soldier of *Odontotermes obesus* (Rambur)

Total body length lies in the range 4.4-5.4 mm. Head capsule is oval and faintly converging anteriorly. Head is thinly and body moderately pilose. Each antenna with 16 segments and segment 2 is sub equal to 3 and 4 combined. The labrum is tongue shaped with broadly rounded anterior margin. Left mandible has a sharp, prominent tooth at apical third and the right mandible has a minute tooth a little below level of the tooth on the left mandible. Postmentum is sub rectangular. Pronotum is saddle-shaped, anterior lobe semicircular and anterior margin notched.

Mound construction: The species constructs sub conical earthen mounds.

4) Taxonomic description of soldier of *Odontotermes redemanni* (Wasmann)

The head-capsule is oval and yellowish to dark yellowish brown in color. Head and pronotum sparsely and abdomen is densely hairy. Total body-length varies from 5.5mm to 5.9 mm. It resembles *O. obesus* very much. Each antenna is 16 segmented, segment 4 shortest. Labrum tongue-shaped; anterior margin broadly rounded. Mandibles are long, slender, sabre-shaped, incurved distally. The left mandible has a prominent tooth near the apical third. Tooth on the right mandible is little below the level of tooth of the left mandible. The postmentum is moderately swollen, sub rectangular. Pronotum is saddle-shaped, notched medially at anterior margin, posterior margin faintly notched.

Mound construction: It builds massive, multilocular-type, subconical mounds.

Table 2: Measurements (mm) of different body parts of soldier of termite species with their mandibular tooth position, antennal segments and mound construction.

Parameters	Obtained range of measurements (mm)				
	<i>Odontotermes globicola</i>	<i>Odontotermes horni</i>	<i>Odontotermes obesus</i>	<i>Odontotermes redemanni</i>	<i>Microtermes incertoides</i>
Total length of the body	3.50-4.00	7.70-9.00	4.40-5.40	5.50-5.90	3.40-4.30
Length of the head to the lateral base of mandible	1.00	2.4-2.80	1.3-1.6	1.35-1.40	0.80-0.90
Width of head	0.84-0.90	1.90-2.10	1.00-1.30	1.00-1.10	0.79-0.80
Head-Index (width/length)	0.84-0.90	0.73-0.76	0.78-0.84	0.76-0.83	0.87-0.98
Length of mandible	0.70-0.80	1.20-1.50	0.8-0.90	0.90	0.55
Mandible-head index (Left mandible length/Head length)	0.7-0.8	0.50-0.53	0.53-0.61	0.64-0.66	0.62-0.65
Antennal segments	15	17	16	16	14
Length of postmentum	0.50-0.60	1.80-2.00	0.90-1.00	0.80-0.90	0.50
Width of postmentum	0.30-0.40	0.70-0.90	0.50-0.60	0.50-0.60	0.35-0.30
Length of pronotum	0.38-0.48	0.80-0.90	0.50-0.60	0.50-0.60	0.30
Width of pronotum	0.50-0.60	1.50-1.70	0.70-1.00	0.70-0.90	0.40-0.50
Position of tooth on left mandible	Near tip	Prominent tooth near base of middle third	Distal third	Distal third	Absent
Position of tooth on right mandible	Distal third	minute tooth a little below level of tooth on left mandible	Little below level of tooth on left mandible	Little below level of tooth on left mandible	Absent
Mound construction	No	No	Yes	Yes	No

5) Taxonomic description of soldier of *Microtermes incertoides* Holmgren

Head-capsule is oval and yellow in color. Total body-length varies from 3.40 to 4.30 mm. Each antenna is with 14 segments; segment 2 is sub equal to segment 3 & 4 combined. Labrum is lancet-shaped, extending up to two third of mandible and the tip is narrow and pointed. Mandibles are thin, delicate, slightly incurved anteriorly. Tooth is absent in both mandibles. Postmentum is little longer than wide and the sides are faintly convex. Pronotum is saddle-shaped and has a notch at the anterior part and incurved medially at posterior margin.

Mound construction: The species does not construct mounds and is found under decaying logs.

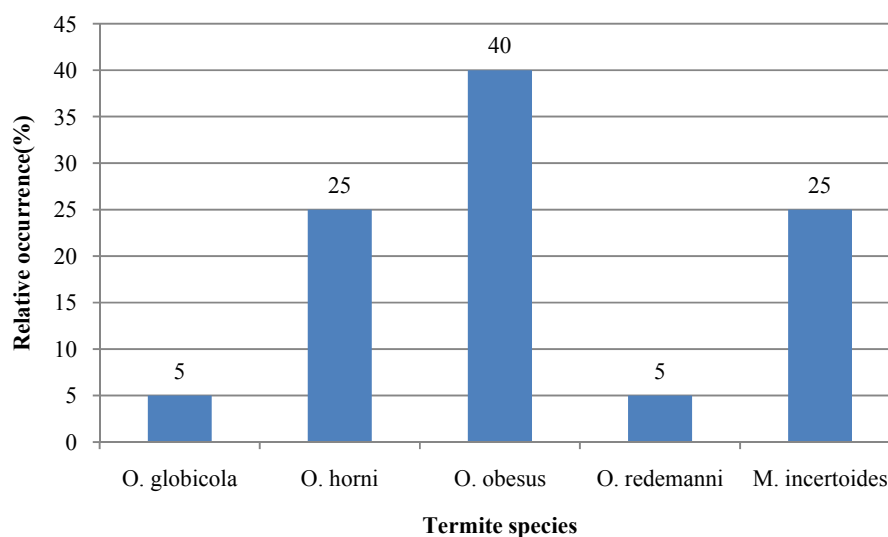


Fig. 1: Showing the percentage of relative occurrence of termite species discovered in Tezpur

Discussion

Odontotermes obesus is the most widely distributed species with relative occurrence 40% while *O. globicola* and *O. redemanni* have scanty distribution with relative occurrence 5% in the study area (Fig. 1). Soldier of *Odontotermes horni* is the largest and soldier of *Microtermes incertoides* is the smallest among all the species (Table 2). Head index of *M. incertoides* is found the highest while that of *O. horni* is the least. Head indices of both *O. obesus* and *O. redemanni* are in the similar range. It is observed that larger the size of soldiers smaller is the value of mandible-head indices. *O. obesus* and *O. redemanni* are almost similar except the size of antennal segments 2, 3 & 4. There is no tooth in both the mandible of *M. incertoides*. The number of antennal segments is found highest (17) in *O. horni* and lowest (14) in *M. incertoides*. *O. obesus* and *O. redemanni* have similar number of antennal segments of 16 while *O. globicola* has 15 antennal segments. It is observed the 4th segment of the antenna is the shortest in *O. redemanni* but Mukherjee *et al.* (2008) [8] reported that *O. redemanni* has another type with 17 antennal segments with the third segment shortest. Chhotani.(1997) [2] also reported that *O. obesus* has another type with 17 antennal segments with the third segment shortest. Out of five species, two species *O. obesus*, and *O. redemanni* are found to construct mound. Their pattern of mound construction is similar to that described by Chhotani (1997) [2]. *O. obesus* is reported to construct mounds of five different types [5]. The mounds of *Odontotermes redemanni* are massive and larger than that of *O. obesus* (Fig.7).

Conclusion

During the present study only five species of termites are discovered in the study area. The discovered species are *Odontotermes globicola*, *Odontotermes horni*, *Odontotermes obesus*, *Odontotermes redemanni* and *Microtermes incertoides*. Among them *O. obesus* is the abundant. *O. horni* is the largest and *M. incertoides* is the smallest among all the species. Out of five species, only two species, *O. obesus* and *O. redemanni* are found to construct mound. The mounds of *O. redemanni* are massive. It needs further study to investigate the factors responsible for their distributional pattern and also their mound building behavior.

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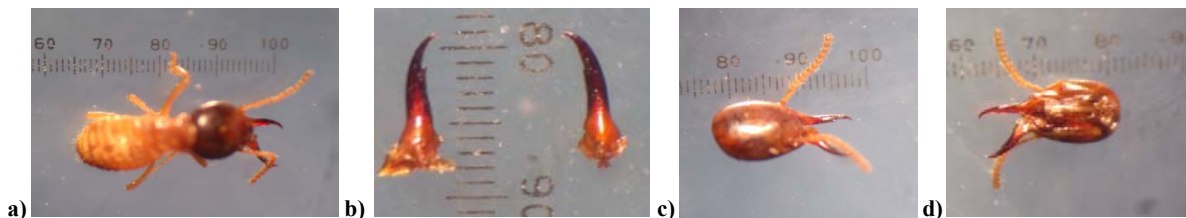


Fig 2: Different body parts of soldier of *Odontotermes globicola*. a) Dorsal view of body, b) Left and right mandible, c) Dorsal view of head, d) Ventral view of head

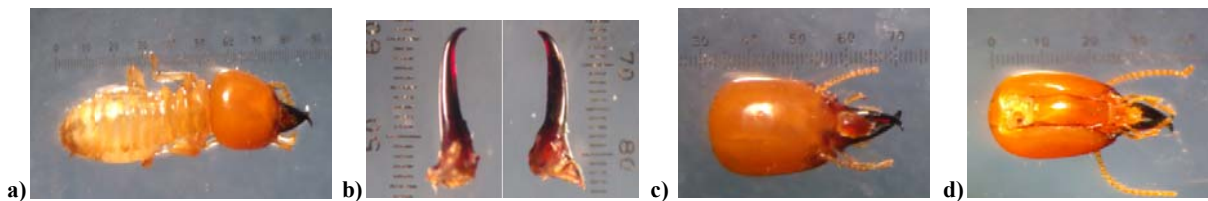


Fig 3: Different body parts of soldier of *Odontotermes horni*. a) Dorsal view of body, b) Left and right mandible, c) Dorsal view of head, d) Ventral view of head

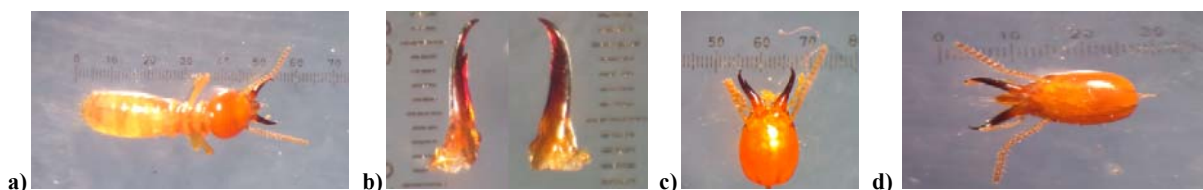


Fig 4: Different body parts of soldier of *Odontotermes obesus*. a) Dorsal view of body, b) Left and right mandible, c) Dorsal view of head, d) Lateral view of head

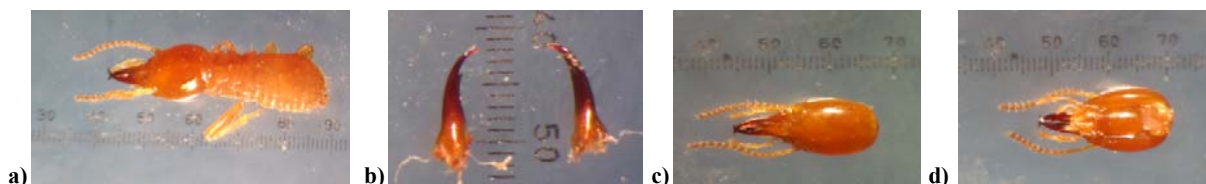


Fig 5: Different body parts of soldier of *Odontotermes redemanni*. a) Dorsal view of body, b) Left and right mandible, c) Dorsal view of head, d) Ventral view of head

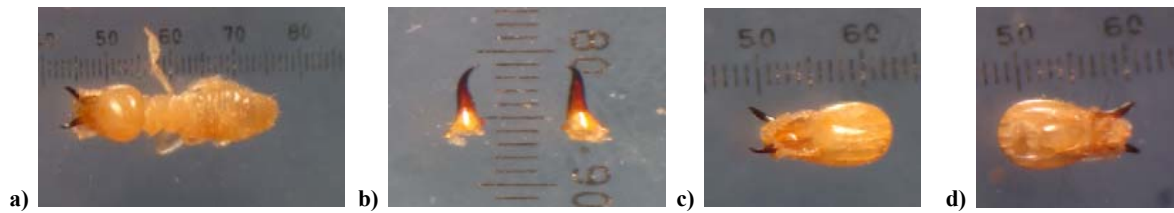


Fig 6: Different body parts of soldier of *Microtermes incertoides* . a) Dorsal view of total body, b) Left and right mandible, c) Dorsal view of head, d) Ventral view of head



Fig 7: a) Soil tubes made by *O. globicola* b) Mound of *O. obesus* c) Big mound of *O. redemanni* d) Soiltube by *M. incertoides*