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## Ergebnisse der Bhutan-Expedition 1972 des Naturhistorischen Museums in Basel

### Isoptera (Termites)

By M.L. Roonwal and O.B. Chhotani

**Abstract:** The termite (Isoptera) fauna of Bhutan has hitherto remained completely unknown, and the present is the first account of it. It is based on the collections made in southwestern and central Bhutan in 1972 by the Zoological Expedition of the Natural History Museum in Basel (Switzerland).

2. The 21 species so obtained belong to 3 families and 14 genera, as follows: KALOTERMITIDAE: *Neotermes*. RHINOTERMITIDAE: *Reticulitermes* and *Coptotermes*. TERMITIDAE: *Speculitermes*, *Euhamitermes*, *Microcerotermes*, *Odontotermes*, *Hypotermes*, *Microtermes*, *Nasutitermes* and *Bulbitermes*.

3. Three species, which are new to science, are described: *Euhamitermes urbanii*, *E. wittmeri* and *Procapritermes bhutanensis*.

4. The hitherto unknown imagoes of the following species are described: *Reticulitermes assamensis*, *Speculitermes rongrensis*, and *Pericapritermes dunensis*.

5. The zoogeography of Bhutan termites is discussed. The fauna is exclusively Oriental (overwhelmingly of the Indo-Chinese Sub-Region). Endemicity is low (14%) as compared to the contiguous "Assam Region" of northeastern India (58.8%).

Bhutan is a small, mountainous country (area 41,400 km<sup>2</sup>) near the northeast end of India and lies approximately between the latitudes 27°30'–28°30' N and longitudes 90°00'–92°20' E. Although the termite fauna of the surrounding area (to its south) has been fairly well studied (Assam, Meghalaya Arunachal Pradesh and Manipur, by Roonwal and Chhotani, 1962a, 1965; and West-Bengal, by Maiti, 1971), that of Bhutan remains totally unknown.

The present account, which is the first one on Bhutan termites, is based on the interesting collection made during 1972 by the Zoological Expedition of the Natural History Museum, Basel, Switzerland, especially by the entomologists Dr. W. Wittmer and Dr. C. Baroni Urbani. The collection was made from several localities in southwestern and central Bhutan (Fig. 1; Table 1) at altitudes ranging from 200–3400 m (c 660–11,160 ft) above mean sea-level. The ecology and other details of the area have been given by BARONI URBANI et al (1973).

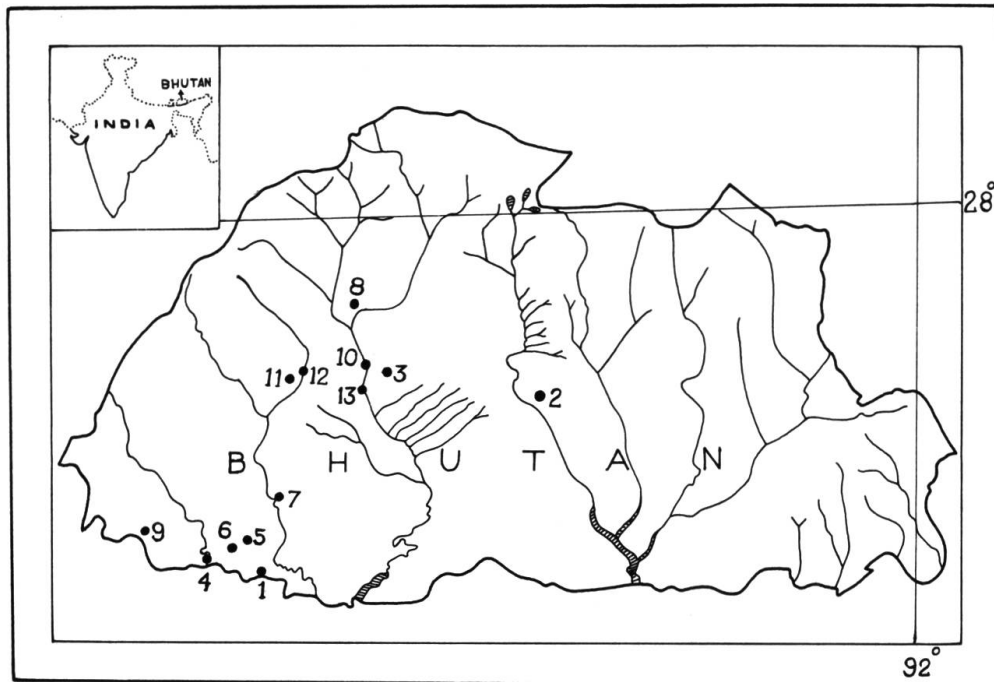


Fig. 1. Map of Bhutan, showing the collecting localities for Isoptera. 1. Balu Jhura. 2. Changra. 3. Kothoka-Gogona route. 4. Phuntsholing. 5. Phuntsholing-Kamjee route. 6. 14 km NE of Phuntsholing. 7. 87 km NE of Phuntsholing. 8. Punakha. 9. Samchi. 10. Sampa-Kothoka route. 11. Thimphu. 12. Thimphu river bank. 13. Wangdi Phodrang.

Table 1. Collecting stations for termites in Bhutan (1972).

|   | Approximate altitude above mean sea-level |            |
|---|---|------------|
|   | In metres                                 | In feet    |
| 1. Balu Jhura . . . . .                 | 200                                       | 656        |
| 2. Changra, 18 km S of Tongsa . . . . . | 1900                                      | 6234       |
| 3. Kothoka-Gogona route . . . . .       | 2600-3400                                 | 8531-11155 |
| 4. Phuntsholing . . . . .               | 200-400                                   | 656-1312   |
| 5. Phuntsholing-Kamjee route . . . . .  | 200-400                                   | 656-1312   |
| 6. 14 km NE of Phuntsholing . . . . .   | 200-400                                   | 656-1312   |
| 7. 87 km NE of Phuntsholing . . . . .   | 1700                                      | 5578       |
| 8. Punakha. . . . .                     | 1560                                      | 5118       |
| 9. Samchi . . . . .                     | 300                                       | 984        |
| 10. Sampa-Kothoka route . . . . .       | 1600-2600                                 | 5250-8530  |
| 11. Thimphu . . . . .                   | 2300-2500                                 | 7546-8202  |
| 12. Thimphu river bank. . . . .         | -   | -          |
| 13. Wangdi Phodrang. . . . .            | 1400                                      | 4593       |

The collection is comprehensive, and comprises 3 families, 14 genera and 21 species as given below. Of these, 3 species are new to science, and imagoes are described in a number of species where they were hitherto unknown. The composition briefly is:

| <i>Family</i>   | <i>No. of genera</i> | <i>No. of species</i> |
|-----------------|----------------------|-----------------------|
| Kalotermitidae  | 1                    | 1                     |
| Rhinotermitidae | 2                    | 2                     |
| Termitidae      | 11                   | 18                    |

Measurements: These were taken as defined in Roonwal (1970 a).

Types: Holotypes of new species have been deposited in the Naturhistorisches Museum (N.H.M.), Basel; and paratypes in the Zoological Survey of India (Z.S.I.), Calcutta, and the American Museum of Natural History (A.M.N.H.), New York.

Abbreviations used: *Castes*: Im., imagoes; Ny., nymphs; S., soldiers; W., workers. *Others*: H, maximum height; L, maximum length; W, maximum width.

### Keys to families and genera of Bhutan termites

#### A. Keys to families

#### IMAGOES

1. Fontanelle absent; apical tibial spurs 3:3:3. Kalotermitidae
- Fontanelle present; apical tibial spurs 3:2:2. 2
2. Fontanelle without plate; left mandible with three marginal teeth; right mandible with a distinct subsidiary tooth at base of first marginal Rhinotermitidae
- Fontanelle with plate; left mandible with two marginal teeth; right mandible without any subsidiary tooth at base of first marginal (except in *Macrotermes*). Termitidae

#### SOLDIERS

1. Head without fontanelle and fontanelle gland; apical tibial spurs 3:3:3. Kalotermitidae
- Head with fontanelle and fontanelle gland; apical tibial spurs 3:2:2 or 2:2:2. 2
2. Pronotum flat. Rhinotermitidae
- Pronotum saddle-shaped. Termitidae

## B. Keys to genera

## IMAGOS

1. Fontanelle absent; pronotum flat but arched; posterior margin of first marginal tooth of left mandible subequal to anterior margin of second marginal. 1. *Neotermes* 2  
Fontanelle present; pronotum flat, not arched.
2. Fontanelle without plate; left mandible with three marginal teeth and right mandible with a distinct subsidiary tooth at base of first marginal. 3  
Fontanelle with plate; left mandible with two marginal teeth and right without any subsidiary tooth at base of first marginal (except in *Macrotermes*). 4
3. Second left marginal tooth as long as first; forewing scale only partly overlapping hindwing scale. 2. *Reticulitermes*  
Second left marginal tooth longer than first; forewing scale overlapping hindwing scale. 3. *Coptotermes*
4. Posterior margin of second marginal tooth of right mandible incurved. 5  
Posterior margin of second marginal tooth of right mandible straight. 8
5. Apical tooth of mandibles much longer than first marginal tooth; second marginal of left mandible much reduced. 4. *Procapritermes*  
Apical tooth of mandibles subequal to or slightly longer than first marginal tooth; second marginal of left mandible prominent. 6
6. Posterior margin of first marginal tooth of right mandible only slightly longer than its anterior margin. 5. *Pericapritermes*  
Posterior margin of first marginal tooth of right mandible much longer than its anterior margin. 7
7. Head with a large, ocellus-like mid-dorsal spot; large species. 6. *Speculitermes*  
Head with a small, round or oval mid-dorsal spot; smaller species. 7. *Euhamitermes*
8. First and second marginal teeth of left mandible separated by a uniformly incurved margin; labrum without sclerotised transverse band. 9

- First and second marginal teeth of left mandible separated by a deep cut in front of second marginal; labrum with a sclerotised transverse band. 11
9. Apical tibial spurs 3:2:2. 8. *Microcerotermes*  
Apical tibial spurs 2:2:2. 10
10. Fontanelle plate long and narrow. 9. *Nasutitermes*  
Fontanelle plate generally large and wide. 10. *Bulbitermes*
11. Right mandible with an indistinct subsidiary tooth at base of first marginal 11. *Macrotermes*  
Right mandible without any subsidiary tooth at base of first marginal 12
12. Antennae with 15–18 segments; postclypeus much paler than head-capsule; smaller species. 12. *Microtermes*  
Antennae with 19–20 segments; postclypeus slightly paler than head-capsule; larger species. 13
13. Fontanelle raised somewhat. 13. *Odontotermes*  
Fontanelle not raised. 14. *Hypotermes*

## SOLDIERS

1. Head not produced into a nasute; mandibles large and prominent. 2  
Head produced into a nasute; mandibles greatly reduced. 13
2. Head without fontanelle; pronotum almost as wide as head and flatly arched. 1. *Neotermes*  
Head with fontanelle; pronotum narrower than head and either flat or saddle-shaped. 3
3. Pronotum flat. 4  
Pronotum saddle-shaped. 5
4. Fontanelle large and prominent, lying at base of clypeus; head-capsule oval. 2. *Coptotermes*  
Fontanelle small, lying on head-dorsum much behind clypeus; head-capsule rectangular. 3. *Reticulitermes*
5. Mandibles asymmetrical, of the snapping-type. 6  
Mandibles symmetrical, of the biting-type. 7
6. Labrum faintly incurved at anterior margin and with short antero-lateral points. 4. *Pericapritermes*  
Labrum deeply incurved at anterior margin and with long antero-lateral points. 5. *Procapritermes*
7. Dimorphic; labrum with hyaline tip. 6. *Macrotermes*  
Monomorphic; labrum without hyaline tip. 8

- |     |   |    |
|-----|---|----|
| 8.  | Postmentum club-shaped, flat and not arched medially.   | 9  |
|     | Postmentum broad and arched medially.   | 11 |
| 9.  | Mandibles long, narrow and serrated. 7. <i>Microcerotermes</i>  |    |
|     | Mandibles thick, stout, not serrated, and with a tooth in middle.   | 10 |
| 10. | Mandibles very broad basally, and with a small to large tooth; smaller and paler species. 8. <i>Euhamitermes</i>      |    |
|     | Mandibles not very broad basally, and with a large tooth; larger and darker species. 9. <i>Speculitermes</i>          |    |
| 12. | Left mandible with crenulations in basal half and without any tooth. 10. <i>Hypotermes</i>                            |    |
|     | Left mandible without any crenulations in basal half and with a prominent tooth or a minute denticle.                 | 12 |
| 12. | Left mandible with a prominent tooth; large and stout species. 11. <i>Odontotermes</i>                                |    |
|     | Left mandible without any tooth, sometimes with a minute denticle; small and delicate species. 12. <i>Microtermes</i> |    |
| 13. | Head not constricted behind antennae. 13. <i>Nasutitermes</i>   |    |
|     | Head constricted behind antennae. 14. <i>Bulbitermes</i>  |    |

### Systematic account of Bhutan termites

#### Family I. KALOTERMITIDAE

#### Genus (1) *Neotermes* Holmgren

#### 1. *Neotermes bosei* Snyder 1933 (Fig.2)

*N. gardneri* Snyder 1933

SNYDER, 1949, pp.22, 25; ROONWAL and SEN-SARMA, 1960, p.152, synonymy and redescription.

Material: 5 vials, imagoes: Phuntsholing, 15. iv. 72, and 5.-6. v. 72; Samchi, 7-11. v. 72.

Measurements (mm), 4 imagoes:

Total length with wings 18.0-19.7; without wings 9.8-10.5

Head-width with eyes 1.93-2.03

Length of eyes 0.65-0.67

Pronotum (L × W) 1.17-1.40 × 2.10-2.20

Length of forewing 14.6-16.0; of hindwing 14.0-15.2.

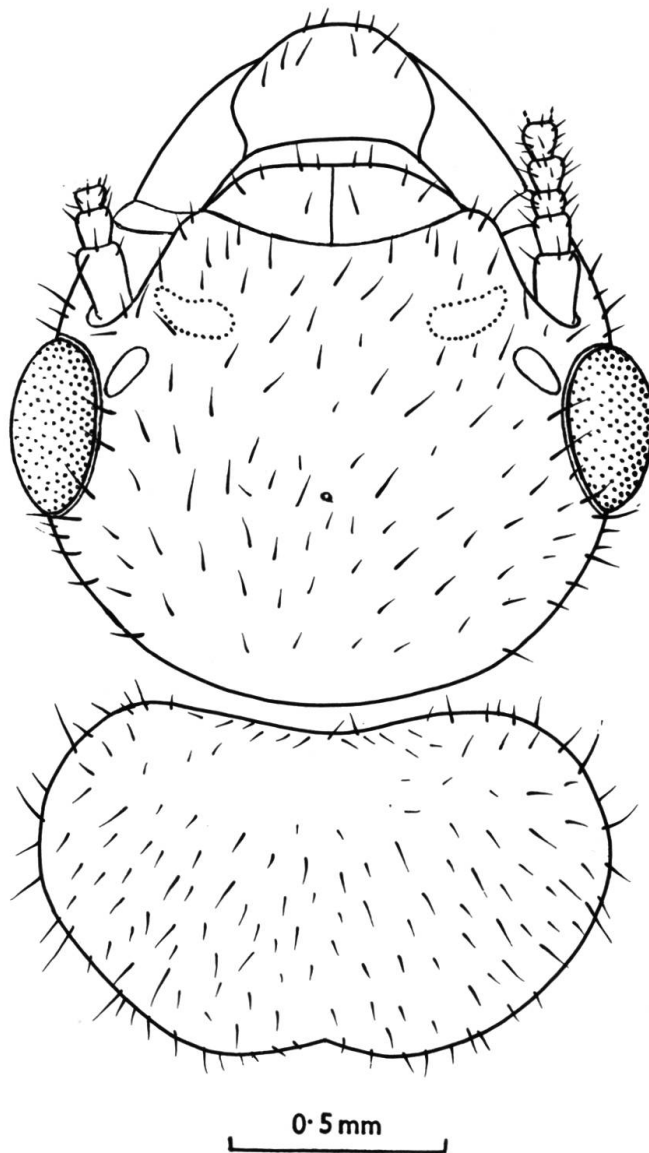


Fig. 2. *Neotermes bosei* Snyder. Head and pronotum of imago, in dorsal view.

Distribution: BHUTAN: Phuntsholing, 200–400 m; Samchi, 300 m. INDIA: Dehra Dun and vicinity (Uttar Pradesh), 600 m; Samsing (West Bengal).

Remarks: This is a damp-wood termite. For its biology, see ROONWAL (1970b); and ROONWAL and SEN-SARMA (1955).

Family II. RHINOTERMITIDAE  
 Subfamily (a) HETEROTERMITINAE  
 Genus (2) *Reticulitermes* Holmgren

2. *Reticulitermes assamensis* Gardner 1945 (Fig. 3; Table 2)

SNYDER (1949, p. 71) treats *R. assamensis* Gardner as a synonym of *R. chinensis* Snyder 1923. For reasons given under "Remarks" we regard *assamensis* as a valid species; the soldier is described by GARDNER (1945) and is also illustrated in ROONWAL and CHHOTANI (1962 a). The hitherto unknown imago of *assamensis* is described below.

Material: A dealate imago, and several soldiers and workers: Sampa-Kothoka, 9. vi. 72.

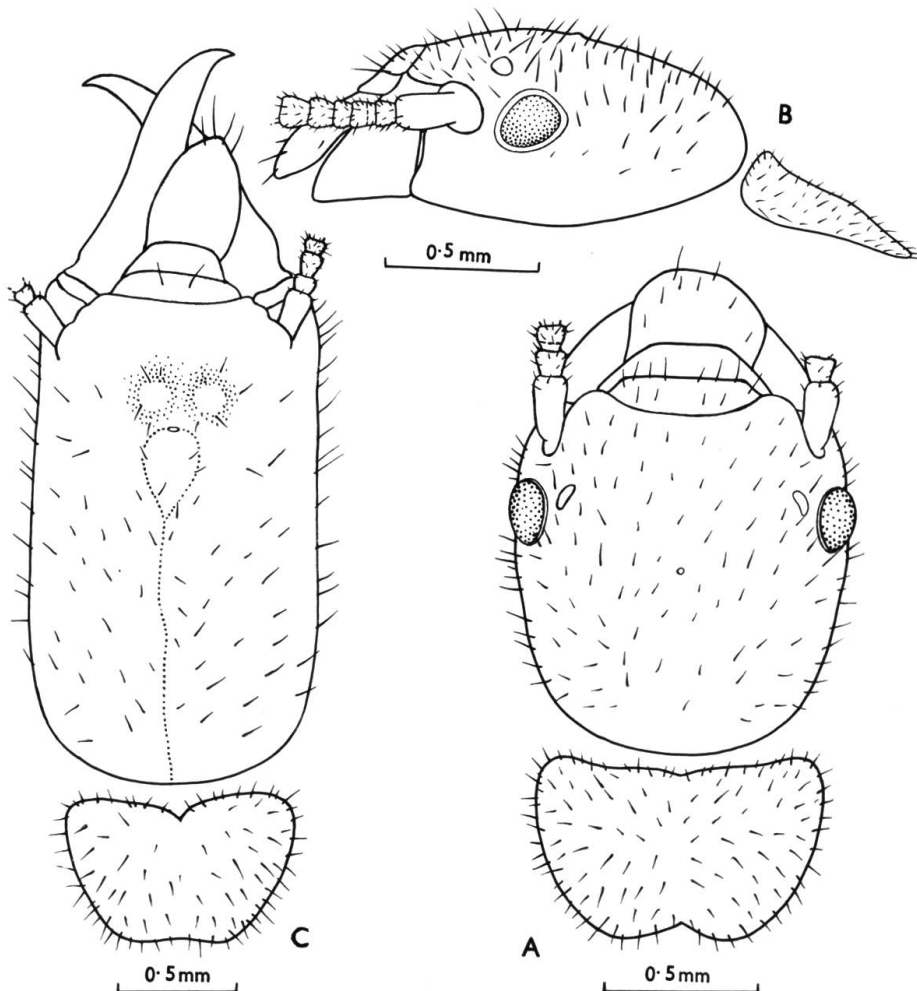


Fig. 3. *Reticulitermes assamensis* Gardner. A. Imago, head and pronotum in dorsal view. B. Same, in side view. C. Soldier, head and pronotum in dorsal view.

Table 2. Range of measurements (mm) of Bhutan imagoes of *Reticulitermes assamensis*, *Speculitermes rongrensis* and *Pericapritermes dunensis*.

| Items  | <i>Reticulitermes<br/>assamensis</i><br>(1 ex.) | <i>Speculitermes<br/>rongrensis</i><br>(3 exs.) | <i>Pericapritermes<br/>dunensis</i><br>(5 exs.) |
|--|---|---|---|
| 2. Total length with wings . . . . .               | ?   | 18.0 -18.6                                      | 14.1 -15.1                                      |
| 2. Total length without wings . . . . .            | 6.4   | 8.8 -10.6                                       | 7.4 -8.0  |
| 3. Head-length to tip of labrum . . . . .          | 1.50  | 1.80-2.05                                       | 1.40-1.48                                       |
| 4. Head-length to mandible-base . . . . .          | 1.10  | 1.17-1.27                                       | 0.90-1.00                                       |
| 5. Max. head-width with eyes . . . . .             | 1.10  | 1.67-1.77                                       | 1.27-1.30                                       |
| 6. Max. head-height . . . . .                      | 0.70  | 0.67-0.73                                       | -   |
| 7. Mid-dorsal spot of head (L × W) . . . . .       | -   | 0.21-0.27 × 0.17-0.20                           | -   |
| 8. Postclypeus (L × W) . . . . .                   | 0.17 × 0.50                                     | 0.27-0.30 × 0.67-0.77                           | 0.20 × 0.57                                     |
| 9. Fontanelle plate (L × W) . . . . .              | -   | -   | 0.10-0.12 × 0.05                                |
| 10. Labrum (L × W) . . . . .                       | 0.33 × 0.40                                     | 0.43-0.47 × 0.57-0.60                           | 0.30-0.37 × 0.43-0.50                           |
| 11. Eyes (L) . . . . .                             | 0.23  | 0.43-0.47                                       | 0.37-0.40                                       |
| 12. Ocelli (L × W) . . . . .                       | L, 0.07-0.09                                    | 0.18-0.19 × 0.13-0.17                           | 0.17-0.20 × 0.10-0.13                           |
| 13. Min. eye-ocellus distance . . . . .            | 0.07  | 0.07-0.10                                       | 0.05-0.07                                       |
| 14. Min. eye-antenna distance . . . . .            | 0.05  | 0.07-0.09                                       | 0.03  |
| 15. Pronotum (L × W) . . . . .                     | 0.6 × 0.9                                       | 0.73-0.87 × 1.30-1.50                           | 0.61-0.67 × 1.03-1.07                           |
| 16. Length of forewing (including scale) . . . . . | ?   | 14.4-16.0                                       | 12.7-13.2                                       |
| 17. Ditto, hindwing . . . . .                      | ?   | 12.5-14.5                                       | 12.0  |

#### Description:

IMAGO, dealate (Figs.3 A,B; Table 2): Head dark mahogany, shining; postclypeus, antennae, postmentum, wing scales, coxae, femora, abdominal tergites and sternites blackish brown; pronotum yellow; tibiae, proximal one-fourth brownish, rest yellowish; tarsi yellowish. Head and body fairly densely hairy.

Head-capsule long, oval, narrowed posteriorly; length to base of mandibles equal to width with eyes. Fontanelle minute, faintly raised. Eyes small, oval, weakly projecting; separated from lower margin of

head by a distance approximately equal to their long diameter. Ocelli small, rounded; separated from eyes by long diameter of ocellus. Antennae broken, only 15 segments of left antenna present; segment 1 longest, cylindrical; 2 about half of 1, cylindrical; 3 short and broad; 4 shortest. Clypeus divided into an ante- and a postclypeus. Anteclypeus hyaline, trapezoidal; postclypeus slightly swollen, paler medially, length about one-third of width. Labrum broadly tongue-shaped; wider than long. Pronotum yellowish; slightly narrower than head with eyes; anterior margin faintly wavy, with a prominent median notch; posterior margin convex, deeply notched medially. Legs with tibial spur formula 3:2:2; tarsi 4-segmented. Forewing scale covering only the basal portion of hindwing scale. Abdomen oblong. Cerci 2-jointed, 0.17 mm long.

Measurements (mm), 3 soldiers:

|  |                       |
|--|-----------------------|
| Total length with mandibles . . . . .  | 6.0 –6.5              |
| Head-length to mandible-base . . . . . | 2.10–2.30             |
| Head-width . . . . .                   | 1.20–1.30             |
| Length of mandible (left) . . . . .    | 1.00–1.13             |
| Pronotum (L × W) . . . . .             | 0.57–0.60 × 0.90–0.97 |

For imagoes, see Table 2.

Distribution: BHUTAN: Sampa-Kothoka, 1600–2600 m. INDIA: Hilly northeastern area: West Bengal (Samsing), Meghalaya (Shillong), and Assam (Sadiya).

Remarks: *R. assamensis* is distinguishable from *R. chinensis* as follows:

Imago: Pronotum, tibia and tarsi yellowish (vs. dark castaneous brown in *chinensis*).

Soldier: (i) Frontal region of head well raised above posterior level of head into a pair of frontal protuberances (vs. either not raised or only weakly raised).

### Subfamily (b) COPTOTERMITINAE

#### Genus (3) *Coptotermes* Wasmann

### 3. *Coptotermes heimi* (Wasmann 1902) (Fig. 4)

*C. parvulus* Holmgren 1913

SNYDER 1949, p.79; ROONWAL and CHHOTANI 1962b, p.38, synonymy and re-description.

Material: 4 vials, imagoes. Samchi, 300 m, 7–11.iv.72; Thimphu, 2300–2500 m, 29.iv.72; Thimphu river bank, 29.iv.72; Kothoka-Gogona, 2600–3400 m, 10.vi.72.

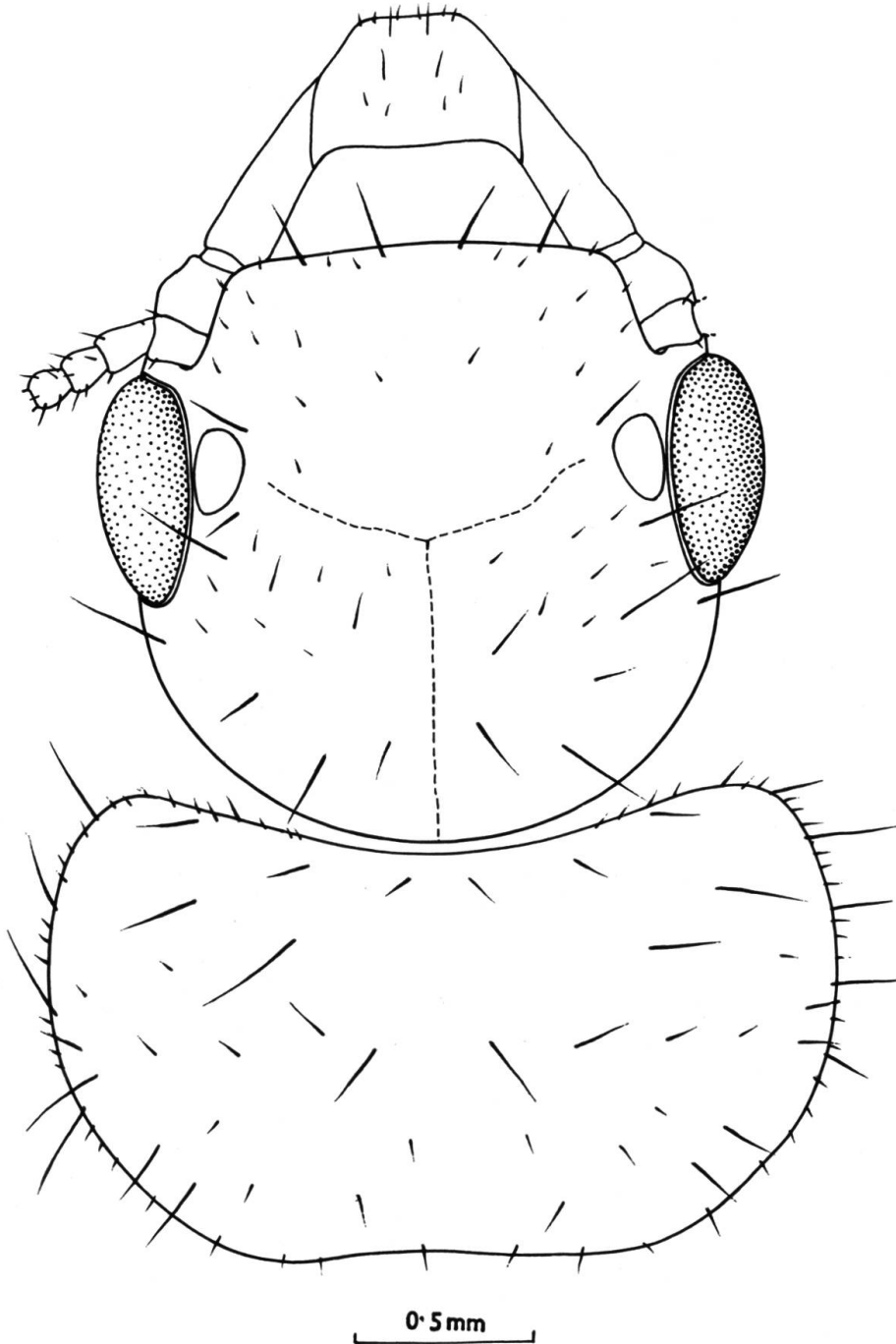


Fig. 4. *Coptotermes heimi* (Wasmann). Head and pronotum, of imago, in dorsal view.

## Measurements (mm), 5 imagoes:

|                                |                          |                       |
|--------------------------------|--------------------------|-----------------------|
| Total length with wings        | 12.0–14.0; without wings | 7.0–8.1               |
| Head-width with eyes . . . . . |                          | 1.43–1.57             |
| Length of eyes . . . . .       |                          | 0.43–0.47             |
| Length of ocelli . . . . .     |                          | 0.13–0.17             |
| Pronotum (L × W) . . . . .     |                          | 0.83–0.90 × 1.30–1.40 |
| Length of forewing . . . . .   |                          | 10.6–11.8             |
| Length of hindwing . . . . .   |                          | 10.0–11.0             |

Distribution: BHUTAN: As above, 300–3400 m. Elsewhere: Widely distributed in India and Pakistan (Roonwal and Chhotani, 1962b; Roonwal, 1970b).

Remarks: It is highly destructive to wood-work everywhere (ROONWAL, 1959, 1970b). Its swarming in Bhutan in April agrees with the general condition in the humid areas (West Bengal, etc.); in the drier parts of India it swarms during the monsoon (June–August).

Family III. TERMITIDAE  
Subfamily (a) AMITERMITINAE\*  
Genus (4) *Speculitermes* Wasmann

4. *Speculitermes rongrensis* Roonwal and Chhotani 1962 (Fig. 5; Table 2)

*Speculitermes cyclops rongrensis* ROONWAL and CHHOTANI 1962a, p. 314.

Material: 6 vials, imagoes and workers. Thimphu river bank, 29. iv. 72; Samchi, 300 m, 7–11. v. 72; Phuntsholing, 200–400 m, 13. v. 72.

## Description:

The species was originally described from workers; the soldier caste is unknown as in most members of the genus (vide Roonwal and Chhotani 1966). The hitherto unknown imago is described below.

IMAGO (Fig. 5; Table 2): Head blackish brown, area around antennae and postclypeus paler; labrum yellowish brown with blackish tinge; antennae brownish; pronotum brown; wings colourless, transparent; legs pale brown; abdominal tergites pale blackish-

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\*) SANDS (1972), in a study of the soldierless genera of Africa, has eliminated the subfamily Amitermitinae and distributed its various genera between the Apicotermitinae and the Termitinae. We consider these changes premature until the allied Oriental and South American genera are better understood.

brown; sternites paler. Head and body densely hairy, with a thick mat of minute hairs and several longish bristles; wings hairy along margins and with a few small hairs near distal and posterior margins. Total length with wings 18.0–18.6, without wings 8.8–10.6 mm.

Head-capsule subcircular, slightly depressed around mid-dorsal spot; epicranial suture faintly marked; with two pale, oval spots, one on either side above ocelli, and a raised point in front of mid-dorsal spot; mid-dorsal spot large, suboval or subtriangular, slightly swollen, and raised. Eyes subrounded, almost equidistant from antennae, ocelli and lower margin of head. Ocelli suboval; separated by less than their short diameter from eyes and a little less than their long diameter from antennae. Postclypeus subtrapezoidal, pilose, weakly swollen, and divided into two halves by a longitudinal groove; anterior margin weakly concave. Anteclypeus apilose, hyaline, narrower than post-

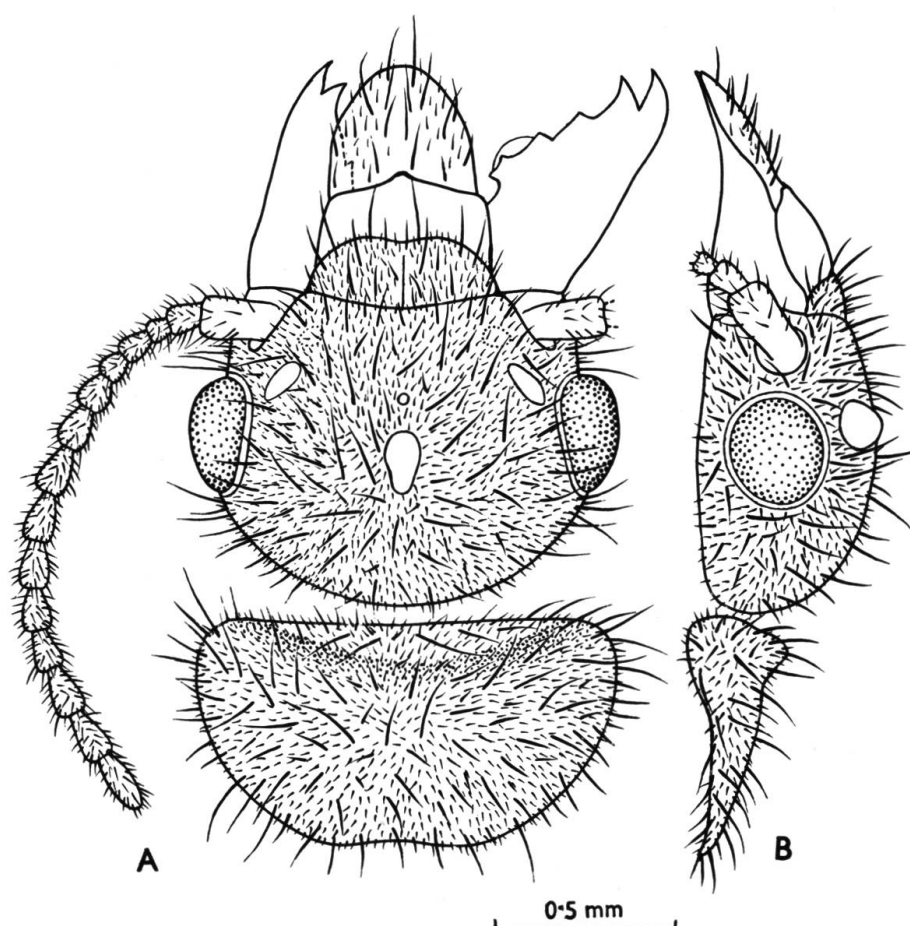


Fig. 5. *Speculitermes rongrensis* Roonwal and Chhotani. Head and pronotum of imago. A. Dorsal view. B. Side view.

clypeus; with a pale yellowish arc-shaped marking. Labrum broadly tongue-shaped, with a hyaline tip; broader than long; with several short hairs and a few long ones. Antennae with 15 segments; segment 3 shorter than 2. Mandibles of the *Speculitermes*-type, with an apical and two prominent marginal teeth. Pronotum trapezoidal, slightly raised anteriorly; much broader than long and a little narrower than head with eyes; anterior margin substraight to weakly incurved, without a median notch; posterior margin with prominent median notch. Posterior margins of meso- and metanota deeply notched. Legs long, hairy; tarsi 4-segmented; tibial spurs 2:2:2, dorsal spur on foretibia absent; empodium absent. Wings almost colourless and transparent; forewing scale not covering hindwing scale; distal half of wing-membrane covered with numerous simple, rod-shaped and V-shaped 'micrasters'. Forewing: Costa-subcosta thick, and with short hairs all along. Radius short thick, joining the costa-subcosta just outside scale. Radial sector running close and parallel to costa-subcosta up to distal tip. Media arising independently and running throughout the length of wing a little above middle, and giving off 3-4 branches in distal third. Cubitus thin, with 10-12 branches. Hindwing: Media arising from radial sector just outside scale; rest as in forewing. Abdomen oblong. Cerci short, 2 segmented. Styli absent.

Measurements: See Table 2.

WORKER: Described by Roonwal and Chhotani (1962a) from the Assam area (Garo, Khasi and Jaintia Hills). The Bhutan examples are slightly longer and measure as follows (in mm; 5 exs.):

|  |                       |
|--|-----------------------|
| Total length . . . . .                     | 5.6 -7.0              |
| Head-length to mandible base . . . . .     | 1.03-1.10             |
| Head-width . . . . .                       | 1.23-1.33             |
| Max. diameter of mid-dorsal spot . . . . . | 0.10-0.11             |
| Pronotum (L × W) . . . . .                 | 0.40-0.44 × 0.70-0.77 |

Distribution: BHUTAN: As above, 300-2500 m. INDIA: Eastern Himalayas: Meghalaya (Garo, Khasi and Jaintia Hills).

Affinities: Originally described as a subspecies of *S. cyclops*, the study of the imago now warrants the recognition of *rongrensis* as a full species. It is separable from *S. cyclops* as follows:

Worker: (i) Mid-dorsal spot smaller (0.10-0.12 vs. 0.12-0.15 mm). (ii) Postclypeus shorter than half its width and less swollen, vs. longer and greatly swollen). (iii) Thoracic and abdominal tergites heavily chitinized and with a median line (vs. not so).

Imago: The large mid-dorsal spot in *S. rongrensis* indicates its grouping with *S. cyclops* Wasmann and *S. dharwarensis* Roonwal and Chhotani; from these, however, it differs as follows:

From *S. cyclops*: Body darker, wings paler; head-width with-eyes larger (1.67–1.77 vs. 1.40 mm); ocelli larger (length 0.18–0.19 vs. 0.13 mm).

From *S. dharwarensis*: Head-with-eyes larger (1.67–1.77 vs. 1.50 mm); postclypeus shorter compared to width; mid-dorsal spot, eyes and ocelli larger.

#### Genus (5) *Euhamitermes* Holmgren

Two species are known from Bhutan from imagoes only; they can be separated as follows:

Larger and darker. Head-width with eyes 1.20 mm; pronotum-width 1.10–1.17 mm; fontanelle plate large, oval (length 0.13, width 0.097–0.10 mm); forewings longer, 12.2–12.3 mm.

*urbanii* sp. n.

Smaller and paler. Head-width with eyes 1.03–1.13 mm; pronotum-width 0.93–1.03 mm; fontanelle plate small, roundish (length 0.05–0.07, width 0.04–0.05 mm); forewings shorter, 10.2–11.2 mm.

*wittmeri* sp. n.

#### 5. *Euhamitermes urbanii* sp. n. (Fig. 6; Table 3)

Material: Two male imagoes, Changra, 22. vi. 72.

Description:

IMAGO, ♂ (Fig. 6; Table 3): Head blackish brown, paler anteriorly, and with a darker streak between ocelli; postclypeus and pronotum yellowish brown; antennae paler; wings transparent, faintly brownish; abdominal tergites brown; sternites paler, yellowish medially; legs brownish yellow. Head and body thickly pilose, with short hairs and a few long hairs; abdominal pleura weakly hairy. Total length with wings 14.6–14.7, without wings 7.5–8.1 mm.

Head subcircular, broader than length to base of mandibles; depressed weakly around fontanelle plate; epicranial suture not visible; with a minute pale, raised spot in front of fontanelle plate and one oval spot on either side in front of ocelli. Fontanelle plate oval, fairly large

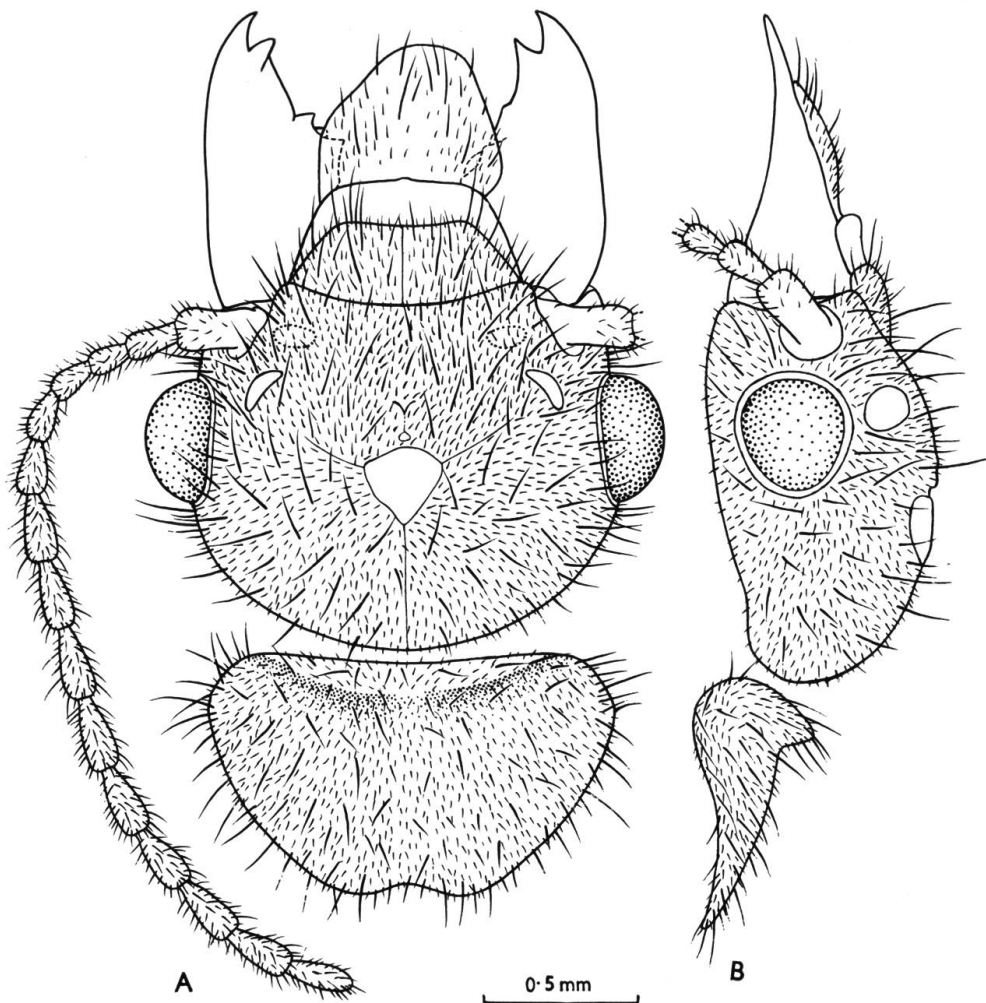


Fig. 6. *Euhamitermes urbanii* sp.n. Head and pronotum of imago. A. Dorsal view. B. Side view.

and depressed. Eyes subcircular. Ocelli oval, translucent, separated from eyes by about half their short diameter, and from antennae by their short diameter. Postclypeus weakly swollen, pilose; length less than half the width. Anteclypeus apilose, translucent; projecting in front medially. Labrum broadly tongue-shaped, densely hairy, with short and long hairs. Antennae with 15 segments; segments 3, 4 and 5 subequal, shorter than 2. Mandibles of the *Euhamitermes*-type, each with an apical and two marginal teeth; apical finger-like and pointed. In left mandible, 1st marginal only slightly smaller than apical; 2nd widely separated from 1st. In right mandible 1st marginal subequal to apical; otherwise as in left mandible. Pronotum slightly narrower than head with eyes; anteriorly raised a little; anterior margin substraight or

faintly concave, without a median notch; posterior margin weakly incurved medially. Meso- and metanotum deeply and angularly incised posteriorly. Legs long, hairy; apical tibial spurs 3:2:2; dorsal apical spur of foretibia present or absent (present only in left leg of holotype); tarsi 4-jointed. Wing-membranes transparent, covered with numerous simple 2- or 3-armed micrasters; hairy along margins, sometimes with a few short hairs near distal margin. Forewing: Costa-subcosta, thick, brownish. Radius short, meeting the costa-subcosta just outside scale.

Table 3. Measurements (mm) of Bhutan imagoes of *Euhamitermes urbanii* sp. n. and *E. wittmeri* sp. n.

| Items                                    | <i>E. urbanii</i>   |           | <i>E. wittmeri</i>  |           |
|--|---------------------|-----------|---------------------|-----------|
|  | Range (2 exs.)      | Holotype  | Range (8 exs.)      | Holotype  |
| 1. Total length with wings . .           | 14.6–14.7           | 14.6      | 12.3–13.2           | 12.6      |
| 2. Total length without wings .          | 7.4–8.1             | 8.1       | 7.0–8.3             | 7.0       |
| 3. Head-length to tip of labrum .        | 1.40–1.50           | 1.50      | 1.30–1.37           | 1.33      |
| 4. Head-length to mandible-base .        | 0.90–0.97           | 0.90      | 0.77–0.83           | 0.77      |
| 5. Max. head-width with eyes             | 1.20                | 1.20      | 1.03–1.13           | 1.07      |
| 6. Max. head-height . . . .              | 0.53                | 0.53      | 0.47–0.50           | 0.48      |
| 7. Fontanelle plate (L × W) .            | 0.13×0.09–0.10      | 0.13×0.09 | 0.05–0.07×0.04–0.05 | 0.07×0.05 |
| 8. Postclypeus (L × W) . . . .           | 0.18–0.20×0.53      | 0.18×0.53 | 0.17–0.20×0.49–0.51 | 0.17–0.50 |
| 9. Labrum (L × W) . . . .                | 0.33–0.37×0.40–0.43 | 0.33×0.40 | 0.33–0.37×0.35–0.43 | 0.33×0.37 |
| 10. Eyes (L) . . . .                     | 0.31–0.33           | 0.31      | 0.29–0.33           | 0.31      |
| 11. Ocelli (L × W) .                     | 0.13–0.15×0.11      | 0.15×0.11 | 0.13–0.15×0.10–0.11 | 0.13×0.10 |
| 12. Min. eye-ocellus distance            | 0.05                | 0.05      | 0.03–0.05           | 0.05      |
| 13. Min. eye-antenna distance            | 0.03–0.04           | 0.04      | 0.03–0.07           | 0.05      |
| 14. Pronotum (L × W) . . . .             | 0.67×1.10–1.17      | 0.67×1.17 | 0.60–0.67×0.93–1.03 | 0.60×0.93 |
| 15. Length of forewing (including scale) | 12.2–12.3           | 12.2      | 10.2–11.2           | 10.8      |
| 16. Ditto, hindwing                      | 11.6                | 11.6      | 9.8–10.2            | 10.0      |

Radial sector thick, running parallel to costa-subcosta. Media arising independently and giving off 2–3 branches distally. Cubitus weak, with 9–10 branches to posterior margin. Hindwing: Media arising from radial sector in wing-membrane, and either without or with 2–3 branches distally; rest as in forewing. Abdomen elongate. Cerci short, 2-jointed; styli absent.

Measurements: See Table 3.

Types: Holotype imago in N.H.M., Basel; paratype in Z.S.I., Calcutta.

Distribution: BHUTAN: Only Changra, 1900 m, the type-locality.

Affinities: *E. urbanii* imago is separable from the second Bhutan species, *E. wittmeri*, as in the key above. From other allied species it differs as follows:

From *E. hamatus* (Holmgren) (Malaya): Darker; ocelli larger and closer to eyes (length 0.13–0.15 vs. 0.10–0.13 mm; eye-ocellus distance 0.05 vs. 0.06–0.12 mm); fontanelle plate larger; distal end of wing-membrane with fewer hairs (vs. with numerous hairs).

From *E. lighti* (Snyder) (North India): Darker; ocelli closer to eyes; fontanelle plate larger; wings longer.

#### 6. *Euhamitermes wittmeri* sp. n. (Fig. 7; Table 3)

Material: Imagoes and workers, 3 vials. Thimphu river, 29.iv.72 (Im., W., one vial); Samchi, 7–11.v.72 (Im. only, 2 vials).

Description:

IMAGO (Fig. 7; Table 3): Head blackish brown, with a darker streak between ocelli; postclypeus and antennae pale yellowish brown; pronotum pale yellowish brown medially, brownish laterally and at posterior margin; legs pale yellowish; wings transparent, with faint brownish tinge; abdominal terga brown, paler than head; sterna yellowish, each with a pale brownish spot near side margin. Head and body thickly pilose with a thick coat of short hairs and a few longer bristles; abdominal pleura show sexual dimorphism, in males sparsely hairy, in females densely covered with hairs. Total length with wings 12.3–13.2, without wings 7.0–8.3 mm.

Head-capsule subcircular, broader than length to based of mandibles; depressed around fontanelle; epicranial suture faint; with a

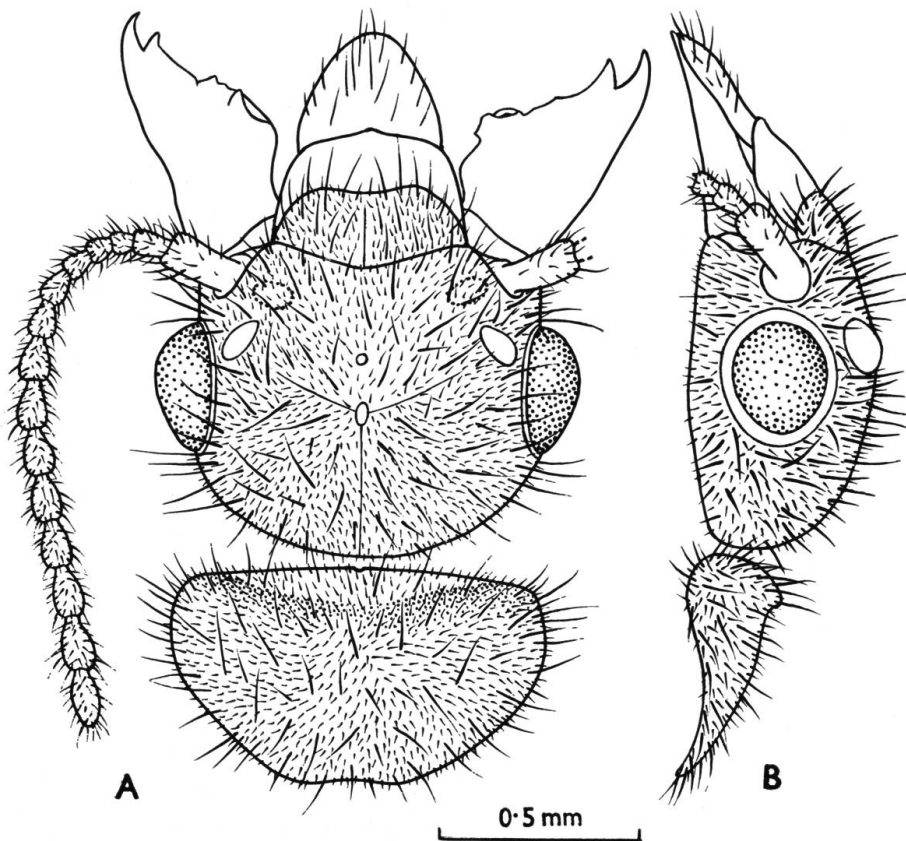


Fig. 7. *Euhamitermes wittmeri* sp. n. Head and pronotum of imago. A. Dorsal view. B. Side view.

minute pale spot a little in front of fontanelle plate, and a faint, oval spot on either side above ocelli. Fontanelle plate small, depressed, translucent, round to oval. Eyes suboval; nearly equidistant from ocelli, antennae and lateral margin of head. Ocelli oval, translucent, separated from eyes by half their short diameter, and from antennae by about their short diameter. Postclypeus weakly incurved anteriorly; weakly swollen; length less than half of width. Anteclypeus translucent, apilose; weakly projected in front medially. Labrum broad, tongue-shaped, with a few long hairs. Antennae with 15 segments; segment 3 shortest. Mandibles of the *Euhamitermes* type; as in *E. urbanii* above. Pronotum slightly narrower than head, anteriorly somewhat raised; anterior margin substraight or weakly convex, with a faint median notch; posterior margin slightly incurved medially. Meso- and metanota deeply and angularly incised posteriorly. Legs long, hairy; apical tibial spurs 3:2:2; tarsi 4-segmented. Wing membranes, wing veins, and abdomen as in *E. urbanii* above.

Measurements: See Table 3.

WORKER: Head and thorax whitish to cream-coloured; abdomen greyish, gut contents showing through the transparent sclerites; moderately pilose. Head subcircular, with a small, white medial spot. Antennae with 14 segments; segment 3 slightly smaller than 2; 4 shortest. Mandibles as in imago. Pronotum saddle-shaped. Foretibia slightly swollen. Apical tibial spurs 3:2:2; outer spur of foretibia, generally minute or absent. Tarsi 4-segmented.

Measurements (mm, 3 exs.):

|  |           |
|--|-----------|
| Total length . . . . .                 | 4.4–4.6   |
| Head-length to mandible-base . . . . . | 0.70      |
| Head-width . . . . .                   | 0.87      |
| Width of pronotum . . . . .            | 0.50–0.53 |

Types: Holotype imago (from Samchi), in N.H.M., Basel; paratype imagoes and paramorphotype workers, in N.H.M., Basel, Z.S.I., Calcutta, and A.M.N.H., New York.

Distribution: BHUTAN: Samchi, 300 m (the type-locality) and Thimphu river bank.

Affinities: Imagoes of *E. wittmeri* differ from the other Bhutan species, *E. urbanii* as in the key above; and from other allied species as follows:

From *E. hamatus* (Holmgren) (Malaya): Darker (head blackish brown vs. rusty to dark brown). Ocelli larger (0.13–0.15 vs. 0.10–0.13 mm) and closer to eyes (eye-ocellus distance 0.03–0.05 vs. 0.06–0.12 mm). Wing-membranes with few minute hairs (vs. with numerous hairs).

From *E. lighti* (Snyder) (North India): Darker; head narrower (width 1.03–1.13 vs. 1.15–1.30 mm); ocelli larger and closer to eyes, wings transparent (vs. dirty brown).

## Genus (6) *Microcerotermes* Silvestri

### 7. *Microcerotermes beelsoni* Snyder 1933 (Fig. 8)

SNYDER 1949, p. 133; PRASHAD, THAPA, and SEN SARMA 1967, p. 14.

Material: 2 vials, soldiers and workers. Punakha, 1560 m, 8.vi.72.

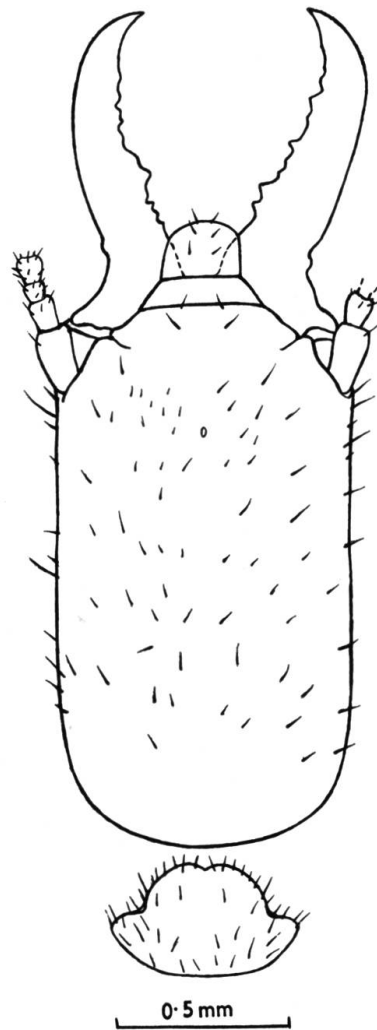


Fig. 8. *Microcerotermes beesoni* Snyder. Head and pronotum of soldier, in dorsal view.

Measurements (mm), 4 soldiers:

|  |                       |
|--|-----------------------|
| Total length . . . . .                 | 4.8 –5.7              |
| Head-length to mandible-base . . . . . | 1.47–1.60             |
| Head-width . . . . .                   | 0.87–0.90             |
| Length of mandibles (left) . . . . .   | 0.87–0.93             |
| Pronotum (L × W) . . . . .             | 0.30–0.33 × 0.53–0.60 |

Distribution: BHUTAN: As above. INDIA: North India (Uttar Pradesh, Delhi, Madhya Pradesh).

Subfamily (b) **TERMITINAE**  
Genus (7) **Procapritermes** Holmgren

The soldiers of the two species found in Bhutan can be separated as follows:

Smaller; fairly densely hairy. Head-length to mandible-base 2.18 mm; mandibles longer in comparison to head (index Left mandible length/Head-length to mandible-base 0.96); in left mandible the inner margin of flat, swollen distal end straight, and terminal beak large. *bhutanensis* sp. n.

Larger; less hairy. Head-length to mandible-base 2.23–2.50 mm; mandibles shorter (index Left mandible length/Head-length to mandible-base 0.62–0.87); in left mandible the inner margin of flat, swollen distal end convex, and terminal beak small.

*tikadari* (Roonwal and Chhotani)

8. **Procapritermes bhutanensis** sp. n. (Figs. 9; Table 4)

Material: One soldier, Thimphu, 29.iv.72 (mixed with a soldier of *P. tikadari*, and a dealate king and queen of *Procapritermes* sp.; also some workers).

Description:

**SOLDIER** (Fig. 9; Table 4): Head yellowish golden on sides and reddish near base of mandibles; mandibles blackish; body creamy white. Head and body densely pilose. Total length with mandibles 7.8 mm.

Head-capsule subrectangular, sides weakly convex; width about two-thirds of length; frons weakly inclined in front, with two faint curved ridges in front of fontanelle; median suture stopping short of half the head-length from posterior margin. Fontanelle small, transverse, situated at about three-fourths of head-length to base of mandibles from posterior margin; fontanelle gland prominent. Eyes and ocelli absent. Antennae with 14 segments; segment 2 a little shorter than half of 1; 3 a little longer than 2; 4 shortest. Labrum asymmetrical; anterior margin incurved; anterolateral corners produced into pointed processes. Mandibles strongly asymmetrical; slightly shorter than head-length to base of mandibles. Left mandible bent and curved in proximal half; tip with a prominently incurved beak; portion below the tip strongly swollen, with inner margin straight. Right mandible blade-

like, with a pointed tip and weakly incurved outer margin. Postmentum shorter than half the head-length; broader distally, and with a weakly

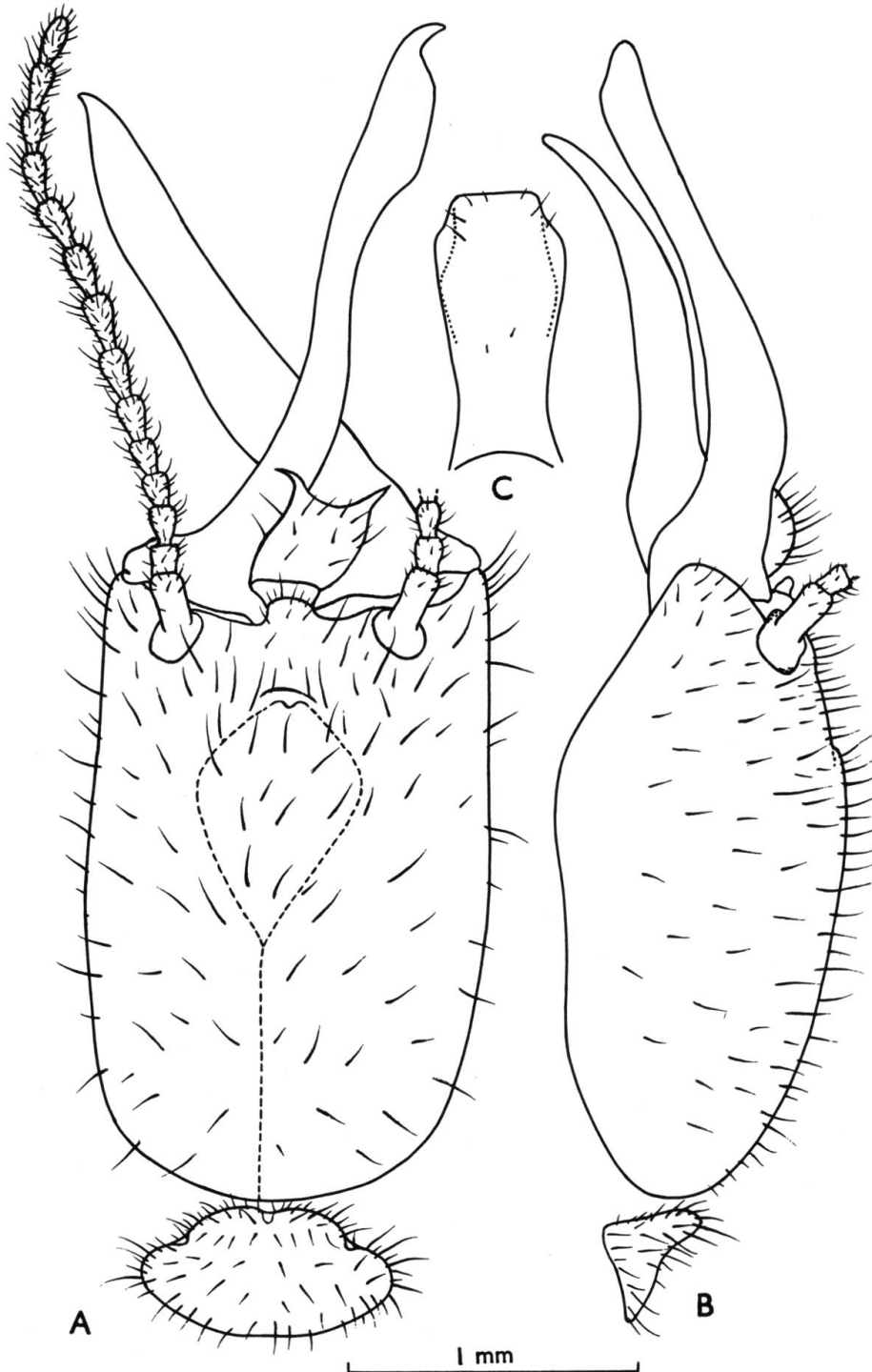


Fig. 9. Soldier of *Procapritermes bhutanensis* sp. n. A. Head and pronotum, in dorsal view. B. Same, in side view. C. Postmentum, in situ.

Table 4. Measurements (mm), etc. of soldier of *Procapritermes bhutanensis* sp. n.

| Items  | Holotype    |
|--|-------------|
| 1. Total length with mandibles . . . . .   | 7.8         |
| 2. Head-length with mandibles . . . . .  | 3.80        |
| 3. Head-length to mandible-base . . . . .  | 2.18        |
| 4. Max. head-width . . . . .   | 1.40        |
| 5. Max. head-height . . . . .  | 1.03        |
| 6. Labrum (median L × max. W) . . . . .  | 0.33 × 0.30 |
| 7. Length of mandibles: left, right . . . . .  | 2.10, 2.03  |
| 8. Occipito-fontanelle distance . . . . .  | 1.67        |
| 9. Postmentum (median L × max. W) . . . . .  | 0.83 × 0.43 |
| 10. Pronotum (L × W) . . . . .   | 0.43 × 0.83 |
| <i>Indices</i>   |             |
| 1. Head Index I (W/L to mandible-base) . . . . .                                     | 0.64        |
| 2. Head Index II (H/W) . . . . .   | 0.74        |
| 3. Head Index III (H/L to mandible-base) . . . . .                                   | 0.47        |
| 4. Mandible-Head Index (Left mandible-length/Head-length to mandible-base) . . . . . | 0.96        |

incurved waist proximally. Pronotum saddle-shaped, much narrower than head; anterior margin with a median notch; posterior margin faintly incurved medially. Mesonotum narrower and, metanotum as wide as pronotum; both with the posterior margin having a median notch. Apical tibial spurs 3:2:2; dorsal spur of foretibia weak; tarsi 4-segmented. Abdomen oblong, hairy. Cerci small, 2-jointed, 0.17 mm long.

Measurements (mm): See Table 4.

Types: Holotype soldier, from Thimphu, in N.H.M., Basel.

Distribution: BHUTAN: Thimphu, 2300–2500 m (the type-locality). Affinities: The soldier of *P. bhutanensis* is closest to *P. tikadari* from which it is separable as in the key above.

## 9. *Procapritermes tikadari* (Roonwal and Chhotani 1962) (Fig. 10)

*Pseudocapritermes tikadari* ROONWAL and CHHOTANI 1962a, p.319.

*Procapritermes tikadari* (R. and C.); KRISHNA, 1968, pp.218, 300–304.

Material: One soldier, Thimphu, 29. iv. 72. (Mixed with a soldier of *P. bhutanensis*, see above; also a dealate king, queen and workers of *Procapritermes* sp.)

Measurements (mm):

|  |             |
|--|-------------|
| Total length with mandibles . . . . .  | 7.2         |
| Head-length to mandible-base . . . . . | 2.33        |
| Max. head-width . . . . .              | 1.37        |
| Mandible-length: left, right . . . . . | 2.07, 2.00  |
| Pronotum (L × W) . . . . .             | 0.30 × 0.80 |

Distribution: BHUTAN: Thimphu, 2300–2500 m. INDIA: Meghalaya (Cherrapunji, 1330 m).

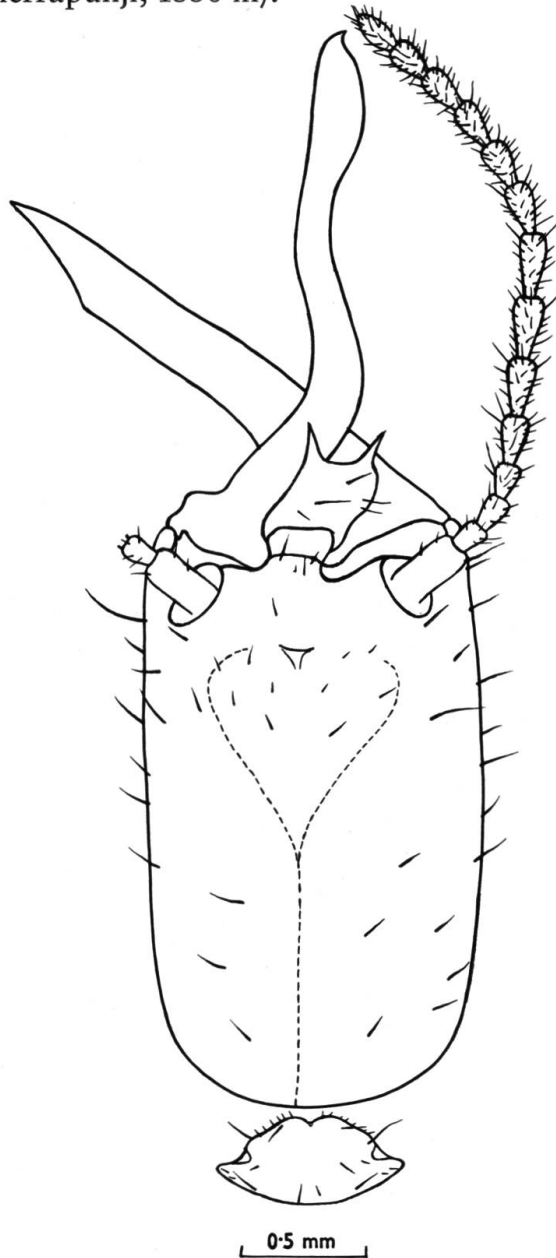


Fig. 10. *Procapritermes tikadari* (Roonwal and Chhotani). Head and pronotum of soldier, in dorsal view.

Genus (8) **Pericapritermes** Silvestri

The soldiers of the two species found in Bhutan can be separated as follows:

Smaller species, Head-length to mandible-base 2.30–2.50, head-width 1.30–1.40 mm. Labrum with antero-lateral points longish.

*dunensis* (Roonwal and Sen-Sarma)

Larger species. Head-length to mandible-base 2.66–3.00, head-width 1.47–1.60 mm. Labrum with antero-lateral points very minute.

*durga* (Roonwal and Chhotani)

10. **Pericapritermes dunensis** (Roonwal and Sen-Sarma 1960)  
(Figs. 11, 12A; Table 2)

*Capritermes dunensis* ROONWAL and SEN-SARMA, 1960, p. 28.

*Pericapritermes dunensis* (R. and S.); KRISHNA, 1968, p. 294.

Material: 3 vials: imagoes, soldiers and workers. Changra, 1900 m, 22. vi. 72; Samchi, 300 m, 7.–11. v. 72; Thimphu, 2300–2500 m, 29. iv. 72.

Description:

IMAGO (Fig. 11; Table 2): The hitherto unknown imago is described below.

Head dark brown; postclypeus, labrum, antennae and legs golden yellow; pronotum yellowish brown, darker posteriorly; wings brownish; abdominal terga dark brown, sterna yellowish. Head and body thickly pilose, with a thick coat of short hairs and several long hairs; abdominal pleura show sexual dimorphism, in males sparsely and in females densely hairy. Wing membranes with a few short hairs on distal part. Total length with wings 14.1–15.1, without wings 7.4–8.0 mm.

Head-capsule subcircular, faintly depressed around fontanelle plate; frons weakly inclined; epicranial suture faint, lateral arms sometimes not visible; with a white linear spot in front of fontanelle plate and a few paler spots in between ocelli. Fontanelle plate large. Eyes rounded, strongly projecting out; nearly equidistant from ocelli, antennae and lower margin of head. Ocelli oval, separated from eyes by half their short diameter or less. Postclypeus swollen, densely pilose; length about one-third the width; anterior margin weakly concave.

Anteclypeus hyaline, apilose; anterior margin weakly projected in middle. Labrum tongue-shaped, wider than long, with short and long hairs. Antennae with 15 segments; segment 2 about half of 1; 3 shortest; 4 and 5 subequal. Mandibles with an apical and two well developed marginal teeth. Left mandible with a long, sinuate posterior edge to 1st marginal tooth. Right mandible with a weakly concave posterior edge to 2nd marginal tooth. Pronotum flat, only slightly raised anteriorly; narrower than head; anterior margin with a weak, and posterior margin with a well marked, median notch. Meso- and metanota with posterior margin having a deep, angular, median notch. Wing-mem-

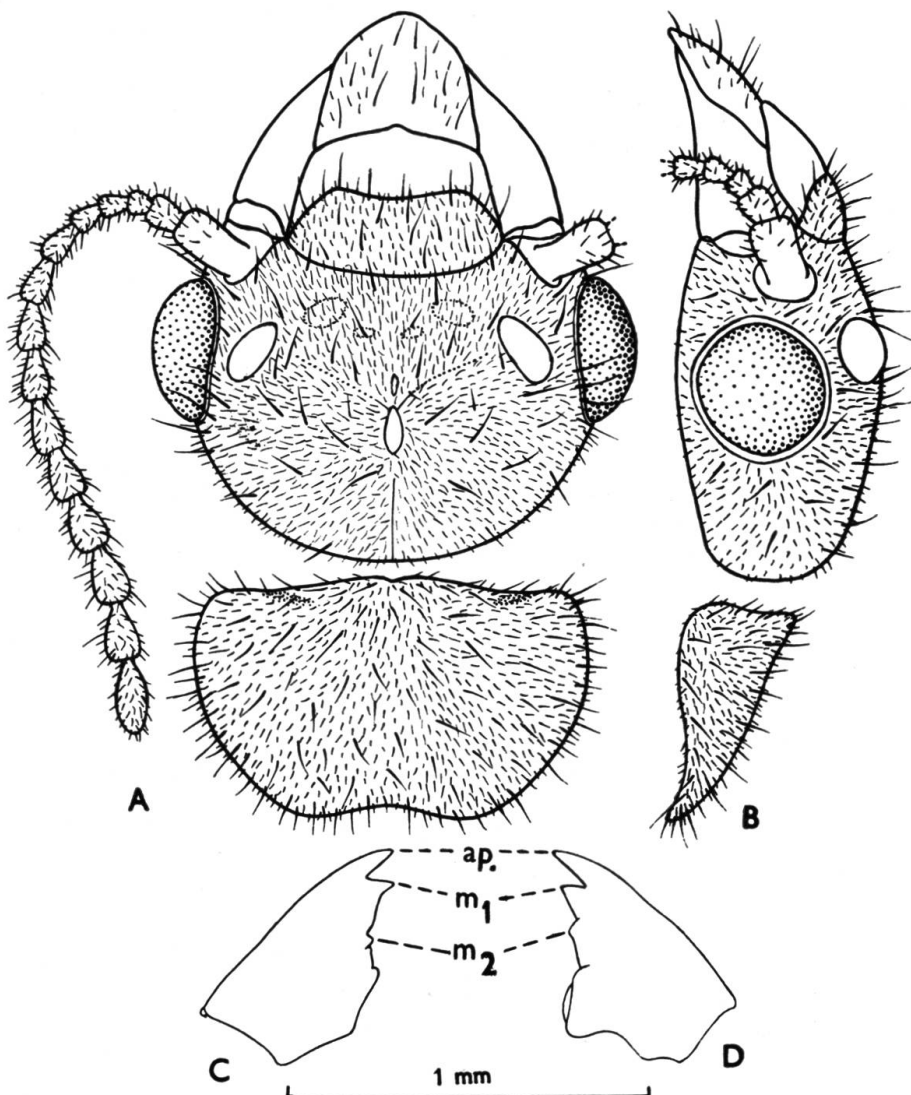


Fig. 11. *Pericapritermes dunensis* (Roonwal and Sen Sarma). Imago. A. Head and pronotum, in dorsal view. B. Same, in side view. C. Left mandible. D. Right mandible. ap., apical tooth; m<sub>1</sub>, m<sub>2</sub>, first and second marginal teeth.

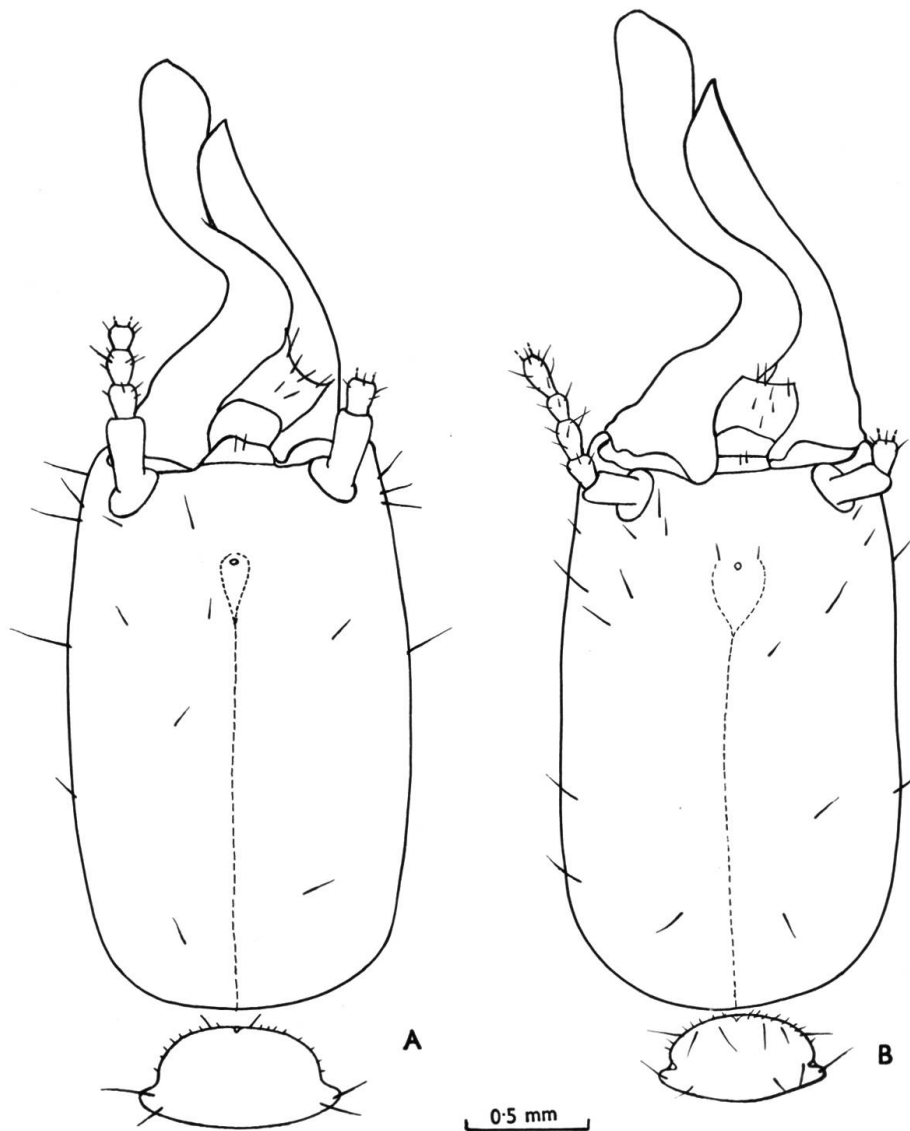


Fig. 12. Head and pronotum of soldiers of *Pericapritermes*, in dorsal view. A. *P. dunensis* (Roonwal and Sen-Sarma). B. *P. durga* (Roonwal and Chhotani).

brane brownish, fairly densely covered with numerous 5- to 7-armed micrasters; hairy along margins and in distal portion. Forewing: Costa-subcosta fused, thick; radius not discernible; radial sector thick, running all along parallel with and close to costa-subcosta; media prominent, generally with 4 main branches in distal half; cubitus with 7-9 main branches to posterior margin. Hindwing: Media arising from radial sector inside wing-membrane; cubitus with 8-10 main branches; rest as in forewing. Legs long; apical tibial spurs 3:2:2. Tarsi 4-segmented. Abdomen oblong, densely hairy. Cerci short, 2 segmented, 0.2 mm long. Styli absent.

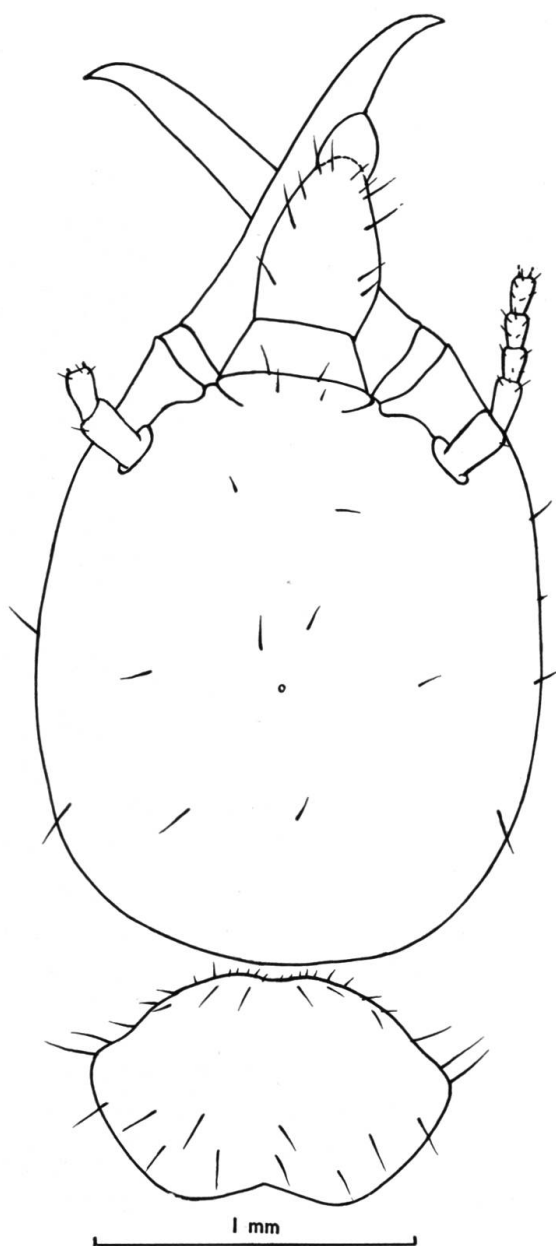


Fig.13. Head and pronotum of soldier of *Macrotermes khajuriae* Roonwal and Chhotani, in dorsal view.

Measurements: See Table 2.

SOLDIER (Fig. 12 A): Measurements (mm), 5 exs.

|  |                       |
|--|-----------------------|
| Total length . . . . .                 | 6.7 -7.2              |
| Head-length to mandible-base . . . . . | 2.30-2.40             |
| Max. head-width . . . . .              | 1.33-1.40             |
| Mandible-length: left, right . . . . . | 1.43-1.53, 1.37-1.47  |
| Pronotum (L × W) . . . . .             | 0.37-0.40 × 0.80-0.83 |

Distribution: BHUTAN: As above, 300–2500 m. INDIA: The Himalayan foothills: Uttar Pradesh (Dehra Dun) and Meghalaya (Shillong).

### 11. *Pericapritermes durga* (Roonwal and Chhotani 1962) (Fig. 12B)

*Capritermes latignathus durga* ROONWAL and CHHOTANI, 1962 a, p. 325.

*Pericapritermes latignathus durga* (R. and C.); KRISHNA, 1968, p. 294.

Material: 6 vials, soldiers and workers. Changra, 1900 m, 22. vi. 72; Samchi 300 m, 7.–11. v. 72; Thimphu, 2300–2500 m, 29. iv. 72.

Measurements (mm), 7 soldiers:

|  |                       |
|--|-----------------------|
| Total length . . . . .                 | 7.6 –8.5              |
| Head-length to mandible-base . . . . . | 2.67–2.73             |
| Head-width . . . . .                   | 1.47–1.53             |
| Mandible-length: left, right . . . . . | 1.73–1.81, 1.67–1.73  |
| Pronotum (L × W) . . . . .             | 0.37–0.40 × 0.80–0.84 |

Distribution: BHUTAN: As above, 300–2500 m. INDIA: Eastern Himalayas (Meghalaya: Cherrapunji, 1330 m).

Affinities: This was originally described as a subspecies of “*Capritermes latignathus* Holmgren” but is in our opinion sufficiently separable to deserve independent specific rank, on the basis of characters already given by ROONWAL and CHHOTANI, 1962 a, p. 329).

## Subfamily (c) MACROTERMITINAE

### Genus (9) *Macrotermes* Holmgren

### 12. *Macrotermes khajuriai* Roonwal and Chhotani 1962 (Fig. 13)

ROONWAL and CHHOTANI, 1962 a, p. 329.

Material: One soldier (minor), Thimphu, 2300–2500 m, 29. vi. 72.

Measurements (mm), 1 soldier:

|  |             |
|--|-------------|
| Total length . . . . .                 | 6.0         |
| Head-length to mandible-base . . . . . | 1.97        |
| Head-width . . . . .                   | 1.57        |
| Mandible-length (left) . . . . .       | 1.27        |
| Pronotum (L × W) . . . . .             | 0.63 × 1.10 |

Distribution: BHUTAN: As above. INDIA: Eastern Himalayas (Meghalaya: Khasi – Jaintia Hills District).

Genus (10) *Odontotermes* Holmgren

The four species found in Bhutan can be separated as follows:

IMAGOEES (3 species only):

- 1(2). Postclypeus shorter than half its width. Ocelli small (length 0.20–0.27 mm), separated from eyes by about their length.
  1. *parvidens* Holmgren and Holmgren
- 2(1). Postclypeus half as long as wide. Ocelli large (0.30–0.37 mm), separated from eyes by less than their length.
- 3(4). Eye-ocellus distance less than half the length of ocellus.
  2. *obesus* (Rambur)
- 4(3). Eye-ocellus distance subequal to half the length of ocellus.
  3. *feae* (Wasmann)

## SOLDIERS

- 1(4). Smaller species. Head-length to base of mandibles 1.30–1.67, head-width 1.00–1.40 mm; head oval; left mandible with a tooth in distal one-third.
- 2(3). Head larger (head-length to base of mandibles 1.43–1.67, head-width 1.23–1.40 mm). Tooth of left mandible closer to distal tip (index Tooth distance from tip of mandible/Mandible-length 0.22–0.24).
  1. *kapuri* Roonwal and Chhotani
- 3(2). Head smaller (head-length to base of mandibles 1.38–1.50; head-width 1.15–1.20 mm). Tooth of left mandible almost at distal third (index Tooth distance from tip of mandible/Mandible-length 0.29–0.31).
  2. *obesus* (Rambur)
- 4(1). Larger species. Head-length to base of mandibles 1.88–2.70, head-width 1.50–2.17 mm; head rectangularly oval; left mandible with a tooth in middle or proximal third.
- 5(6). Tooth of left mandible prominent, situated in middle third.
  3. *feae* (Wasmann)
- 6(5). Tooth of left mandible small, situated at proximal third.
  4. *parvidens* Holmgren and Holmgren

13. *Odontotermes feae* (Wasmann 1896) (Fig. 14)

SNYDER, 1949, p. 226.

Material: 4 vials, soldiers and workers. Samchi, 300 m, 7.–11. v. 72; Thimphu, 2300–2500 m, 29. iv. 72 (mixed with *O. parvidens*).

## Measurements (mm), 4 soldiers:

|  |                       |
|--|-----------------------|
| Total length . . . . .                 | 6.5 -7.0              |
| Head-length to mandible-base . . . . . | 2.50-2.66             |
| Head-width . . . . .                   | 2.00-2.17             |
| Left mandible, length . . . . .        | 1.33-1.43             |
| Do. Tooth from tip . . . . .           | 0.65-0.70             |
| Pronotum (L × W) . . . . .             | 0.80-0.83 × 1.43-1.53 |

Distribution: BHUTAN: As above, 300-2500 m. Elsewhere:  
Widespread in South Asia (India, Bangladesh, Burma).

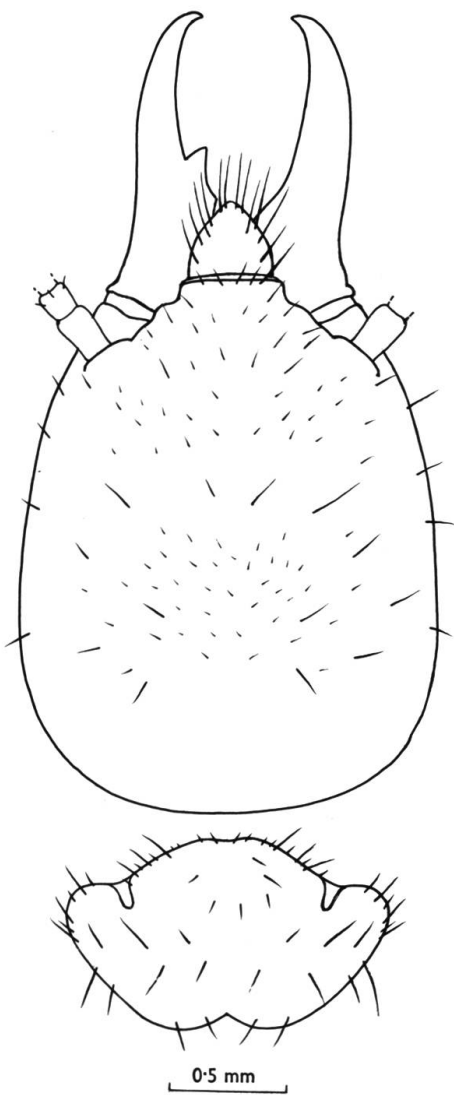


Fig. 14. Head and pronotum of soldier of *Odontotermes feae* (Wasmann), in dorsal view.

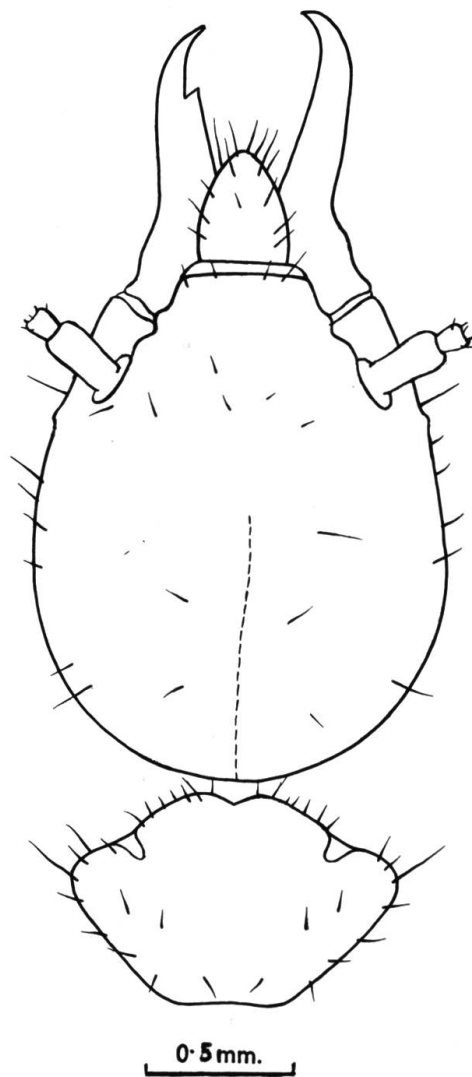


Fig. 15. Head and pronotum of soldier of *Odontotermes kapuri* Roonwal and Chhotani, in dorsal view.

14. *Odontotermes kapuri* Roonwal and Chhotani 1962 (Fig. 15)

ROONWAL and CHHOTANI, 1962 a, p.352.

Material: One vial, soldiers and workers. Sampa-Kothoka, 1600–2600 m, 9.vi.72 (mixed with *Reticulitermes assamensis*).

Measurements (mm), 5 soldiers:

|  |                       |
|--|-----------------------|
| Total length . . . . .                 | 6.4 –7.0              |
| Head-length to mandible-base . . . . . | 1.60–1.67             |
| Head-width . . . . .                   | 1.37–1.40             |
| Left mandible, length . . . . .        | 0.93–1.00             |
| Do. Tooth from tip . . . . .           | 0.21–0.23             |
| Pronotum (L × W) . . . . .             | 0.63–0.67 × 1.00–1.07 |

Distribution: BHUTAN: As above, 1600–2600 m. INDIA: Eastern Himalayas (Meghalaya: Cherrapunji, 1330 m).

Remarks: In some soldiers there is a weak knob-like swelling a little below the antennae, and the mandibles are slightly longer.

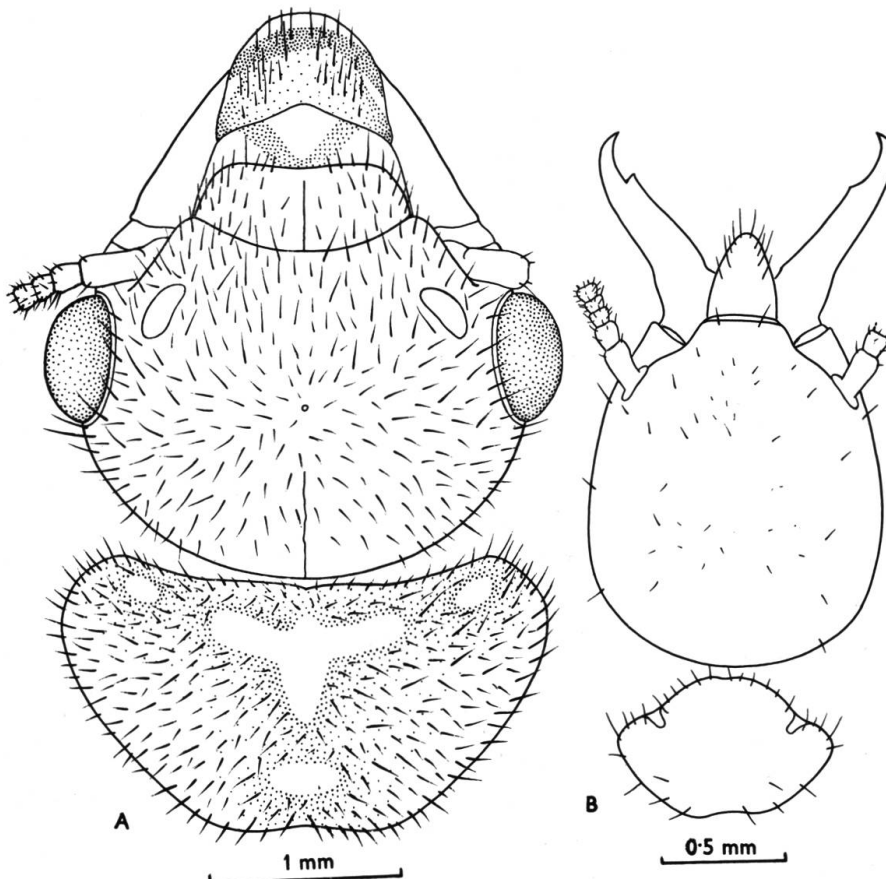


Fig.16. Head and pronotum of *Odontotermes obesus* (Rambur), in dorsal view. A. Imago. B. Soldier.

15. *Odontotermes obesus* (Rambur 1842) (Fig. 16; Table 5)

SNYDER 1949, p.235.

Material: 4 vials, soldiers, workers, and imagoes. Kothoka-Gogona, 2600–3400 m (imagoes), 10.vi.72. Phuntsholing, 200–400 m, 12.v.72; Samchi, 300 m, 7.–11.v.72.

Measurements (mm):

Imagoes (Fig. 16 A): See Table 5.

Soldiers (Fig. 16 B) (8 exs.):

|  |                       |
|--|-----------------------|
| Total length . . . . .                 | 4.7 –5.8              |
| Head-length to mandible-base . . . . . | 1.38–1.50             |
| Head-width . . . . .                   | 1.15–1.20             |
| Left mandible, length . . . . .        | 0.80–0.87             |
| Do. Tooth from tip . . . . .           | 0.23–0.27             |
| Pronotum (L × W) . . . . .             | 0.53–0.56 × 0.83–0.93 |

Distribution: BHUTAN: As above, 300–3400 m. Elsewhere: Widespread in South Asia (Pakistan, India, Bangladesh and Burma).

Table 5. Measurements (mm) of Bhutan imagoes of *Odontotermes obesus*, *Hypotermes xenotermitis*, *Microtermes obesi* and *Nasutitermes garoensis*.

| Items   | <i>Odontotermes obesus</i><br>(4 exs.) | <i>Hypotermes xenotermitis</i><br>(5 exs.) | <i>Microtermes obesi</i><br>(5 exs.) | <i>Nasutitermes garoensis</i><br>(2 exs.) |
|---|--|--|--------------------------------------|---|
| 1. Total length with wings . . . . .              | 27.0–28.5                              | 23.9–25.5                                  | 15.0–16.4                            | 13.5–14.7                                 |
| 2. Total length without wings . . . . .           | 12.1–13.5                              | 11.0–12.2                                  | 8.4– 9.5                             | 6.8                                       |
| 3. Head-length to mandible-base . . . . .         | 1.70–1.85                              | 1.70–1.83                                  | 1.07–1.10                            | 1.03                                      |
| 4. Max. head-width with eyes . . . . .            | 2.70–2.78                              | 2.13–2.23                                  | 1.43–1.50                            | 1.23–1.30                                 |
| 5. Eyes (L) . . . . .                             | 0.73–0.80                              | 0.57–0.63                                  | 0.40–0.43                            | 0.47                                      |
| 6. Ocelli (L) . . . . .                           | 0.33–0.37                              | 0.27–0.32                                  | 0.20–0.23                            | 0.17                                      |
| 7. Min. eye-ocellus distance . . . . .            | 0.12–0.15                              | 0.13–0.17                                  | 0.03                                 | 0.03                                      |
| 8. Pronotum (L × W)                               | 1.30–1.40 ×<br>2.33–2.50               | 1.00–1.17 ×<br>1.93–2.07                   | 0.80–0.90 ×<br>1.20–1.37             | 0.63–0.70 ×<br>1.00–1.07                  |
| 9. Length of forewing (including scale) . . . . . | 25.0–26.0                              | 20.6–22.0                                  | 12.6–14.0                            | 11.3–12.0                                 |
| 10. Ditto, hindwing . . . . .                     | 24.0–24.5                              | 19.4–20.5                                  | 12.0–13.3                            | 10.60–11.40                               |

16. *Odontotermes parvidens* Holmgren and Holmgren 1917 (Fig. 17)

SNYDER 1949, p. 236.

Material: 12 vials, soldiers and workers. Phuntsholing, 200–400 m, 15.iv.72; Thimphu river bank, 29.iv.72; Samchi, 300 m, 7.–11.v.72.

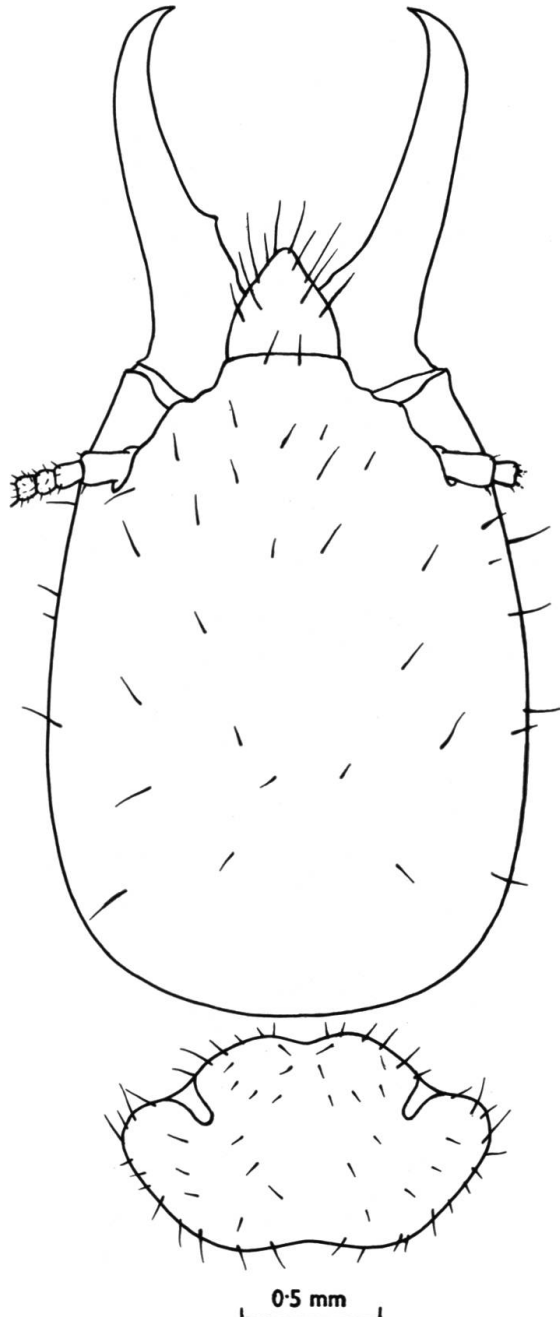


Fig. 17. Head and pronotum of soldier of *Odontotermes parvidens* Holmgren and Holmgren, in dorsal view.

## Measurements (mm), 6 soldiers:

|  |                       |
|--|-----------------------|
| Total length . . . . .                 | 6.4 -8.3              |
| Head-length to mandible-base . . . . . | 2.03-2.60             |
| Head-width . . . . .                   | 1.57-2.03             |
| Mandible-length, left . . . . .        | 1.03-1.37             |
| Do. Tooth from tip . . . . .           | 0.67-0.89             |
| Pronotum (L × W) . . . . .             | 0.67-0.83 × 1.17-1.47 |

Distribution: BHUTAN: As above. Elsewhere: Widespread in India and Bangladesh.

Genus (11) *Hypotermes* Holmgren17. *Hypotermes xenotermis* (Wasmann 1896) (Fig. 18; Table 5)

SNYDER 1949, p.244; CHATTERJEE and THAKUR 1963, p. 197.

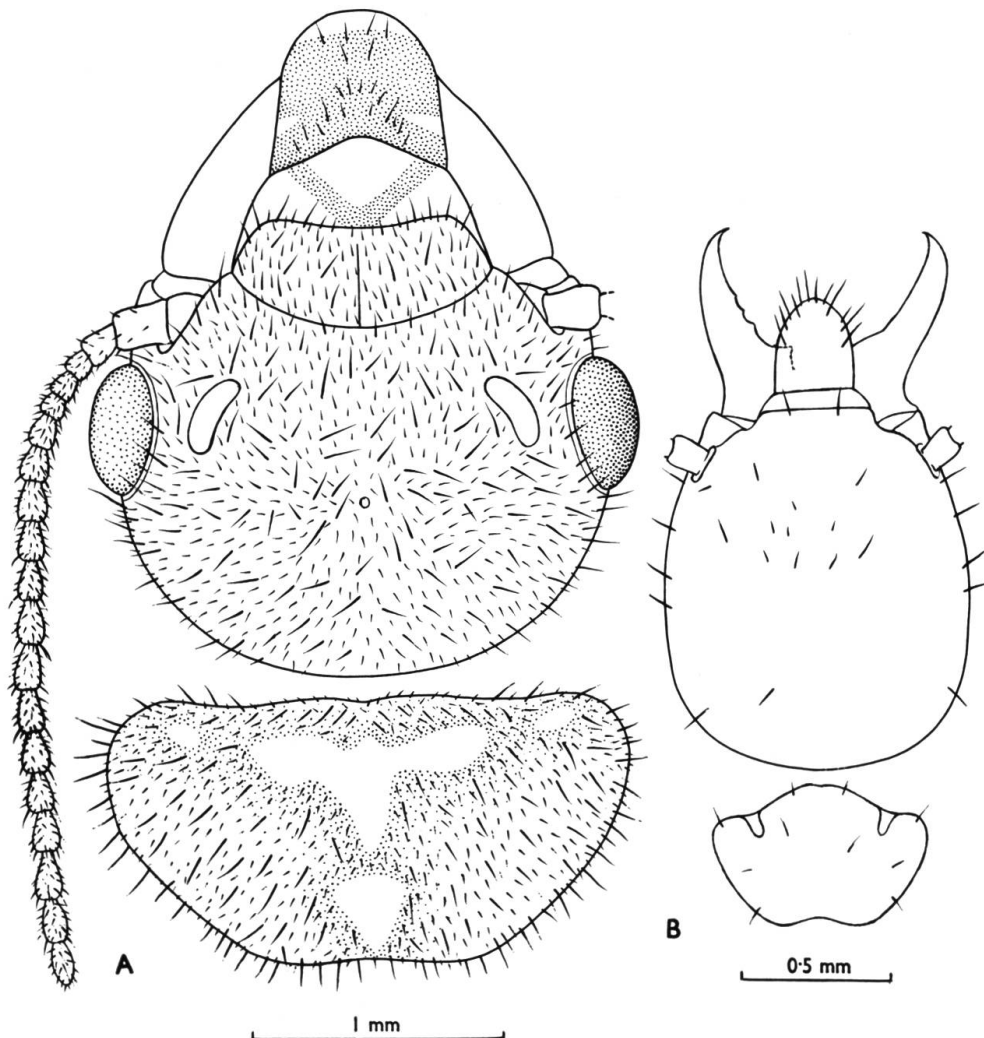


Fig. 18. Head and pronotum of *Hypotermes xenotermis* (Wasmann), in dorsal view. A. Imago. B. Soldier.

Material: 2 vials, imagoes, soldiers and workers. Thimphu river bank, 29.iv.72; Samchi, 300 m, 7.-11.v.72 (imagoes).

Measurements (mm):

Imagoes (Fig. 18 A): See Table 5.

Soldiers (Fig. 18 B) (1 ex.):

|  |             |
|--|-------------|
| Total length . . . . .                 | 4.53        |
| Head-length to mandible-base . . . . . | 1.23        |
| Head-width . . . . .                   | 1.03        |
| Mandible-length, left . . . . .        | 0.63        |
| Pronotum (L × W) . . . . .             | 0.43 × 0.73 |

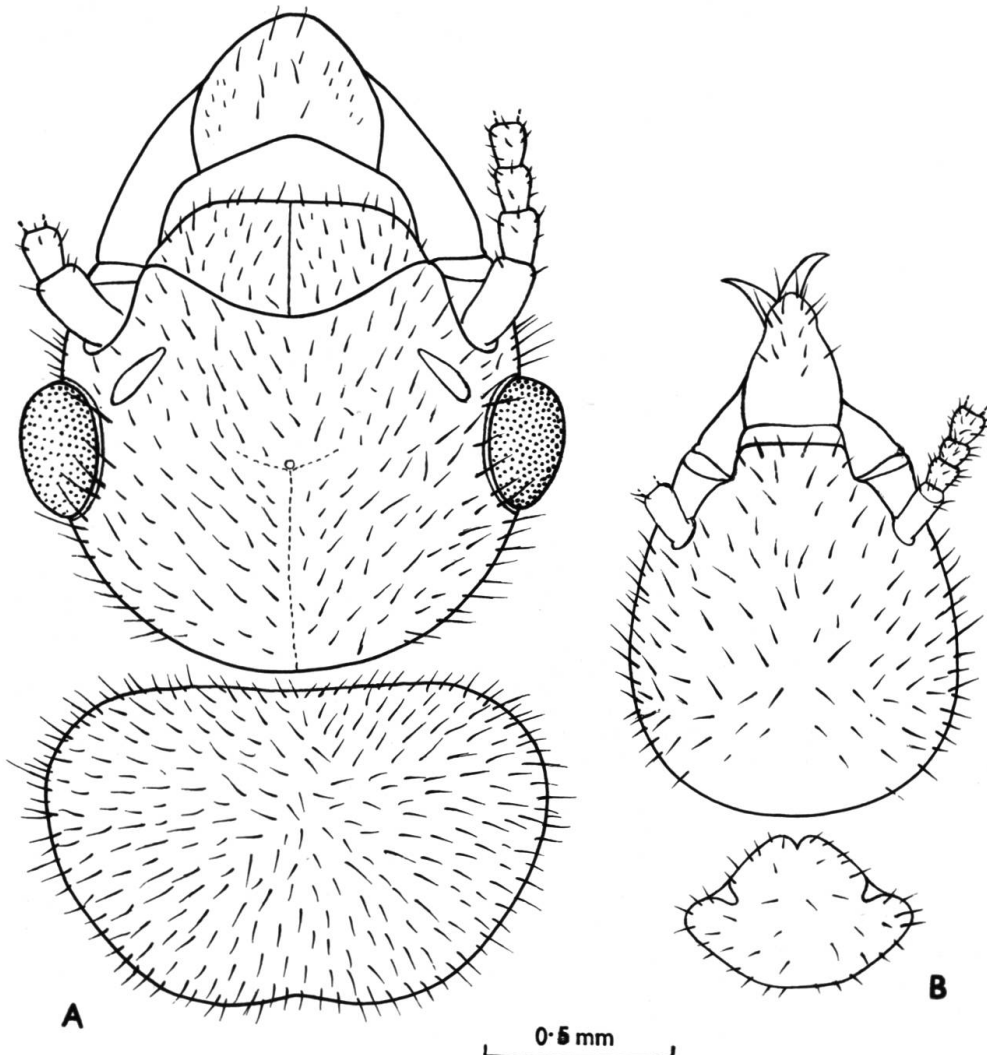


Fig. 19. Head and pronotum of *Microtermes obesi* Holmgren, in dorsal view. A. Imago. B. Soldier.

Distribution: BHUTAN: As above. Elsewhere: Widespread in South and Southeast Asia (Eastern India, Bangladesh, Burma and Thailand).

### Genus (12) *Microtermes* Wasmann

#### 18. *Microtermes obesi* Holmgren 1912 (Fig. 19; Table 5)

*M. anandi* Holmgren.

SNYDER 1949, p. 252; CHATTERJEE and THAKUR 1964, p. 234.

Material: 2 vials, imagoes, soldiers and workers. Samchi, 300 m, 7.–11. v. 72.

Measurements (mm):

Imagoes (Fig. 19A): See Table 5.

Soldiers (Fig. 19B) (1 ex.):

|  |             |
|--|-------------|
| Total length . . . . .                 | 4.0         |
| Head-length to mandible-base . . . . . | 0.93        |
| Head-width . . . . .                   | 0.87        |
| Mandible-length, left . . . . .        | 0.57        |
| Pronotum (L × W) . . . . .             | 0.40 × 0.60 |

Distribution: BHUTAN: As above, 300 m. Elsewhere: Widespread in South and Southeast Asia (Pakistan, India, Sri Lanka, Bangladesh, Burma, Thailand).

### Subfamily (d) NASUTITERMITINAE

#### Genus (13) *Nasutitermes* Dudley

Of the two species found in Bhutan, the imago is known only in one (*N. garoensis*). Soldiers of the two species can be separated as follows:

Mandibles with a spiny process.

1. *garoensis* Roonwal and Chhotani

Mandibles without a spiny process.

2. *gardneri* Snyder

#### 19. *Nasutitermes gardneri* Snyder 1933 (Fig. 20 A)

SNYDER 1949, p. 278; PRASHAD and SEN-SARMA 1959, p. 31.

Material: One vial, soldiers and workers. Phuntsholing-Kamjee, 200–400 m, 13. v. 72.

## Measurements (mm), 5 soldiers:

|                                       |                       |
|---------------------------------------|-----------------------|
| Total length . . . . .                | 4.00–4.25             |
| Head-length with rostrum . . . . .    | 1.50–1.63             |
| Head-length without rostrum . . . . . | 0.90–1.00             |
| Length of rostrum . . . . .           | 0.59–0.63             |
| Head-width . . . . .                  | 0.90                  |
| Pronotum (L × W) . . . . .            | 0.17–0.20 × 0.47–0.50 |

The Bhutan soldiers are slightly smaller, but otherwise compare well with the type.

Distribution: BHUTAN: As above. INDIA: Darjeeling District, 1830 m (West Bengal).

20. *Nasutitermes garoensis* Roonwal and Chhotani 1962 (Fig. 20B, C; Table 5)

ROONWAL and CHHOTANI 1962a, p. 379; CHHOTANI 1975, p. 153, imago.

Material: 6 vials, imagoes, soldiers and workers. 14 km from Phuntsholing, 200–400 m, 25.iv.72; (imagoes, etc.); Samchi, 300 m., 7.–11.v.72; Kothoka-Gogona, 2600–3400 m, 10.vi.72.

## Measurements (mm):

Imagoes (Fig. 20B): See Table 5.

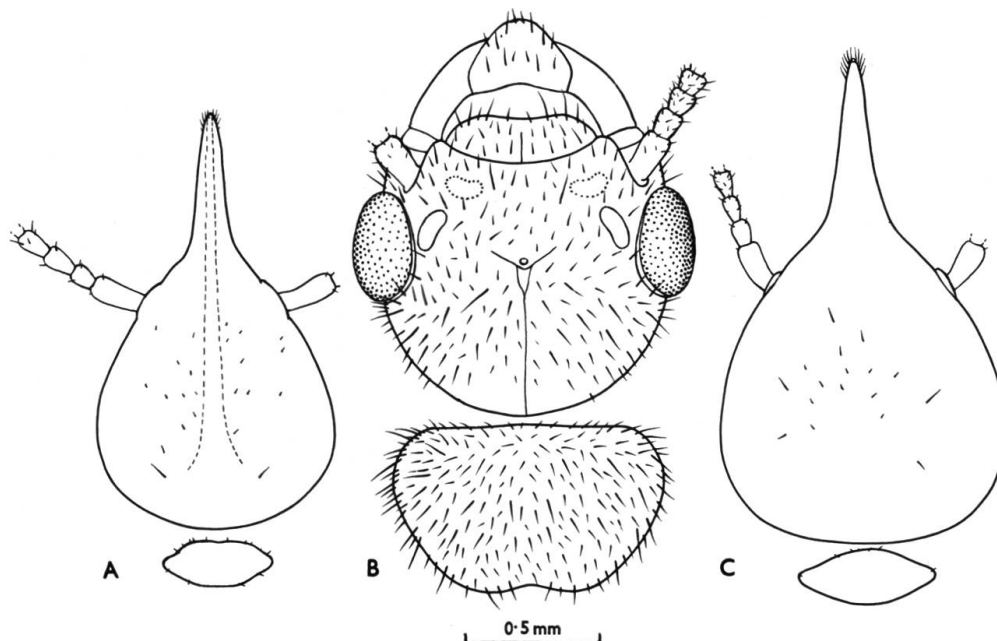


Fig. 20. Head and pronotum of *Nasutitermes*, in dorsal view. A. *N. gardneri* Snyder, soldier. B. *N. garoensis* Roonwal and Chhotani, imago. C. Same, soldier.

## Soldiers (Fig. 20 C) (9 exs.):

|                                       |                       |
|---------------------------------------|-----------------------|
| Total length . . . . .                | 3.5 –4.5              |
| Head-length with rostrum . . . . .    | 1.40–1.70             |
| Head-length without rostrum . . . . . | 0.87–1.10             |
| Length of rostrum . . . . .           | 0.57–0.67             |
| Head-width . . . . .                  | 0.87–1.07             |
| Pronotum (L × W) . . . . .            | 0.15–0.18 × 0.43–0.50 |

Distribution: BHUTAN: As above, 300–3400 m. INDIA: Eastern Himalayas: Assam (Goalpara district), Meghalaya (Garo Hills) and Arunachal Pradesh.

Genus (14) *Bulbitermes* Emerson21. *Bulbitermes emersoni* Maiti. In press (Fig. 21)

Material: 3 vials, soldiers and workers. Phuntsholing-Kamjee, 200–400 m, 15.v.72; Thimphu river bank, 29.iv.72.

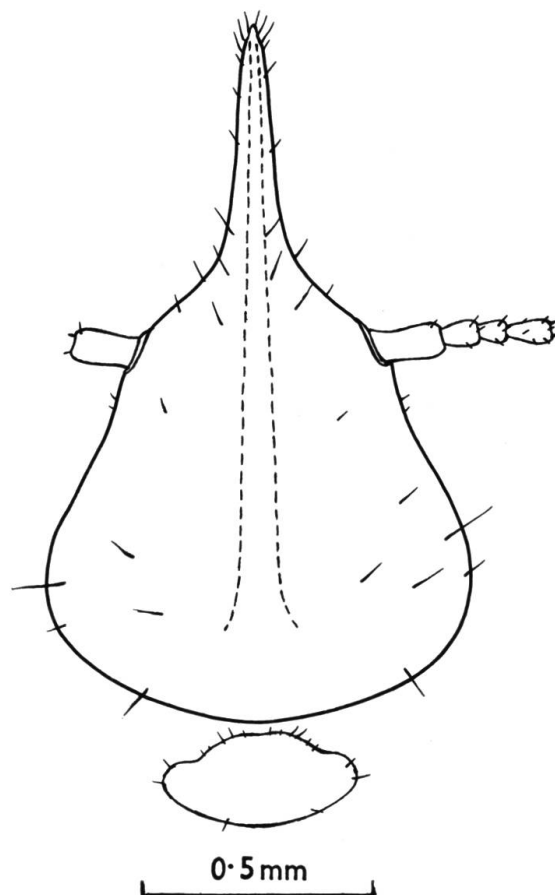


Fig. 21. Head and pronotum of soldier of *Bulbitermes emersoni* Maiti, in dorsal view.

## Measurements (mm), 7 soldiers:

|                                       |                  |
|---------------------------------------|------------------|
| Total length . . . . .                | 3.7 –4.2         |
| Head-length with rostrum . . . . .    | 1.37–1.53        |
| Head-length without rostrum . . . . . | 0.90–1.00        |
| Length of rostrum . . . . .           | 0.47–0.53        |
| Head-width . . . . .                  | 0.83–0.97        |
| Pronotum (L × W) . . . . .            | 0.17 × 0.40–0.43 |

Distribution: BHUTAN: As above. INDIA: West Bengal (Darjeeling district).

**Termites not specifically determined**

The following Bhutan examples could not be satisfactorily determined as to species because of inadequacy of material:

1. *Microcerotermes* sp.

Two vials, workers only; Punakha, 8. vi. 72; Wangdi Phodrang, 6.–9. vi. 72.

2. *Procapritermes* sp.

A dealate male and a dealate female of a *Procapritermes* sp. were obtained mixed with two different soldiers of the species, *P. bhutanensis* sp. n. and *P. tikadari* R. and C. from a collection from Thimphu and imagoes of another *Procapritermes* sp. from Phuntsholing-Kamjee and Samchi. The two apparently differ specifically, but could not be satisfactorily associated with soldiers.

**Zoogeography**

All the 21 species of Bhutan termites are Oriental, and none spreads beyond that Region. Six species are widespread: *Coptotermes heimi*, *Odontotermes feae*, *O. parvidens*, *Hypotermes xenotermitis* and *Microtermes obesi*; all of them attack woodwork in houses and elsewhere, and this probably explains their extensive spread as well as their presence at high altitudes where, inspite of the cold, they get the protection of human dwellings. Three species occur along the Sub-Himalayas, from Uttar Pradesh to the Eastern Himalayas (northeastern India and Bhutan): *Neotermes bosei*, *Reticulitermes assamensis* and *Pericapritermes dunensis*. All the remaining 12 (or 57%) are confined to the Indo-Chinese Sub-Region (of the Oriental Region): three species,

Table 6. Zoogeographical distribution of Bhutan termites.  
+ present; – absent.

| Bhutan species<br>1                        | Sub-Regions of Oriental Region |                |                       |                       | Zoo-<br>geographical<br>status<br>6 | Remarks<br>7                             |
|--|--------------------------------|----------------|-----------------------|-----------------------|-------------------------------------|--|
|  | Indian<br>2                    | Ceylonese<br>3 | Indo-<br>Chinese<br>4 | Indo-<br>Malayan<br>5 |                                     |  |
| Fam.I. KALOTERMITIDAE                      |                                |                |                       |                       |                                     |  |
| 1. <i>Neotermes bosei</i> . . . . .        | +<br>(Sub-Himalayas)           | –              | +                     | –                     | Oriental<br>(Sub-Himalayas)         | –  |
| Fam.II. RHINOTERMITIDAE                    |                                |                |                       |                       |                                     |  |
| 2. <i>Reticulitermes assamensis</i> . . .  | +<br>(NE India)                | –              | +                     | –                     | Oriental (mainly<br>Indo-Chinese)   | –  |
| 3. <i>Coptotermes heimi</i> . . . . .      | +                              | –              | +                     | +                     | Oriental                            | Wide spread<br>(Pakistan, India, Bhutan) |
| Fam.III. TERMITIDAE                        |                                |                |                       |                       |                                     |  |
| 4. <i>Speculitermes rongrensis</i> . . . . | –                              | –              | +                     | –                     | Oriental<br>(Indo-Chinese)          | –  |
| 5. <i>Euhamitermes urbanii</i> . . . . .   | –                              | –              | +                     | –                     | Oriental<br>(Indo-Chinese)          | Endemic                                  |
| 6. <i>E. wittmeri</i> . . . . .            | –                              | –              | +                     | –                     | Oriental<br>(Indo-Chinese)          | Endemic                                  |
| 7. <i>Microcerotermes beelsoni</i> . . . . | + (N. India)                   | –              | +                     | –                     | Oriental                            | –  |
| 8. <i>Procapritermes bhutanensis</i> . .   | –                              | –              | +                     | –                     | Oriental<br>(Indo-Chinese)          | Endemic                                  |
| 9. <i>P. tikadari</i> . . . . .            | +<br>(Meghalaya)               | –              | +                     | –                     | Oriental<br>(Indo-Chinese)          | –  |

Table 6. (Continued)

| Bhutan species                            | Sub-Regions of Oriental Region |           |              |              | Zoo-geographical status        | Remarks  |
|---|--------------------------------|-----------|--------------|--------------|--------------------------------|--|
|   | Indian                         | Ceylonese | Indo-Chinese | Indo-Malayan |                                |  |
| 1   | 2                              | 3         | 4            | 5            | 6                              | 7  |
| 10. <i>Pericapritermes dunensis</i> . . . | +                              | -         | +            | -            | Oriental                       | -  |
|   | (Sub-Himalayas)                |           |              |              | (Sub-Himalayas)                |  |
| 11. <i>P. durga</i> . . . . .             | +                              | -         | +            | -            | Oriental                       | -  |
|   | (Meghalaya)                    |           |              |              | (Indo-Chinese)                 |  |
| 12. <i>Macrotermes khajuriai</i> . . . .  | +                              | -         | +            | -            | Oriental                       | -  |
|   | (Meghalaya)                    |           |              |              | (Indo-Chinese)                 |  |
| 13. <i>Odontotermes feae</i> . . . . .    | +                              | -         | +            | -            | Oriental                       | Wide spread (India, Bhutan, Bangladesh, Burma) |
| 14. <i>O. kapuri</i> . . . . .            | +                              | -         | +            | -            | Oriental                       | -  |
|   | (Meghalaya)                    |           |              |              | (Indo-Chinese)                 |  |
| 15. <i>O. obesus</i> . . . . .            | +                              | -         | +            | +            | Oriental                       | Wide spread (Pakistan via India to Bhutan)     |
| 16. <i>O. parvidens</i> . . . . .         | +                              | -         | +            | -            | Oriental                       | Wide spread (India, Bangladesh)                |
| 17. <i>Hypotermes xenotermitis</i> . . .  | +                              | -         | +            | +            | Oriental                       | Wide spread (S and SE Asia)                    |
| 18. <i>Microtermes obesi</i> . . . . .    | +                              | +         | +            | +            | Oriental                       | Wide spread (S and SE Asia)                    |
| 19. <i>Nasutitermes gardneri</i> . . . .  | +                              | -         | +            | -            | Oriental (mainly Indo-Chinese) | -  |
|   | (N. Bengal)                    |           |              |              |                                |  |
| 20. <i>N. garoensis</i> . . . . .         | +                              | -         | +            | -            | Oriental (mainly Indo-Chinese) | -  |
|   | (Eastern Sub-Himalayas)        |           |              |              |                                |  |
| 21. <i>Bulbitermes emersoni</i> . . . .   | +                              | -         | +            | -            | Oriental (mainly Indo-Chinese) | -  |
|   | (Eastern Sub-Himalayas)        |           |              |              |                                |  |

or 14%, of the Bhutan fauna are endemic (*Euhamitermes urbanii*, *E. wittmeri* and *Procapritermes bhutanensis*), and the remaining nine are confined to Bhutan and the neighbouring elevated portions of northeastern India. Thus, the Bhutan termite fauna is overwhelmingly “Indo-Chinese”.

The termite fauna and zoogeography of the contiguous area of northeastern India (the “Assam Region”) has been studied by Roonwal and Chhotani (1962a, 1965). This area is well-wooded and comprises both plains and hills. Endemicity is much higher, 58.8%, as against 14% in Bhutan. This high endemicity is no doubt explicable as being connected with the subtropical nature of the area where, due to dense, almost impenetrable forests, the possibilities of isolation in small niches and, therefore, of speciation, are much higher (Roonwal and Chhotani, 1965). Again, the Assam fauna has considerable affinities with those of the bulk of the Indian fauna (Indian and Ceylonese Sub-Regions) and less exclusively with the Indo-Chinese Sub-Region than the Bhutan fauna.

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