PART IX

SOME INTERESTING DISCOVERIES IN TERMITES

OF THE INDIAN REGION

(a) Discovery of termite genus Prototermes
(Isoptera, Kalotermitidae) from Indo-Malayan Region, with a new species from India

(b) A new neotropical element (Anoplopetrum) in the Indian termite fauna, with fuller description of A. shillongensis from Assam

(c) Soldier caste found in the termite genus Speculitermes

(d) Soldier and other castes in termite genus Speculitermes, and the phylogeny of Anoplopetrum-Speculitermes complex


(b) Reg. Indian Mus., Delhi, 89(3 & 4), pp. 159-168, 1 pl., 1963.


Discovery of termite genus *Procryptotermes* (Isoptera, Kalotermitidae) from Indo-Malayan Region, with a new species from India

By M. L. Roonwal and O. B. Chhotani
Discovery of termite genus *Procryptotermes* (Isoptera, Kalotermitidae) from Indo-Malayan Region, with a new species from India

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

*With 4 Tables, 1 Text-figure and 1 Plate*

I. Introduction

*Procryptotermes* Holmgren (1910) (Isoptera, Family Kalotermitidae) is a widely distributed genus, but has hitherto not been found in the Palaearctic and Indo-Malayan (Oriental) Regions (vide Snyder, 1949; Emerson, 1955). Emerson predicted that it is likely to be found in the Indo-Malayan Region, and wrote as follows (p.498):

"*Procryptotermes*: This genus is cosmopolitan except for the absence of any record from the Palaearctic and Indo-Malayan regions. Only one species occurs in Nearctic, so the genus may have been absent from the Palaearctic throughout its history. However, it should have been present in the Indo-Malayan region during Mesozoic and Tertiary times. Possibly it will be found there ultimately."

In this paper we report its discovery from India, and describe a new species from that region. The present composition of the genus is also briefly discussed.

II. Composition and Distribution of *Procryptotermes*

*(Tables 1 and 2)*

*Procryptotermes* Holmgren


17 Biologisches Zentralblatt Band 82, 1963

a) Composition (Table 1)

Holmgren (1910) created Procryptotermes, as a subgenus of genus “Calotermes” Hagen, for his new species P. fryeri. Afterwards (1911) he added to it Allotermes paradoxus Wasmann and, with some uncertainty, “Calotermes” taurocephalus Silvestri. Snyder (1949) assigned 12 species to it, including the three mentioned above.

Table 1. Species of genus Procryptotermes as recognised by various authorities

<table>
<thead>
<tr>
<th>Holmgren (1911)</th>
<th>Snyder (1949)</th>
<th>Krishna (1961)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. fryeri Holmgren</td>
<td>1. canalensis Holmgren &amp; Holmgren</td>
<td>1. fryeri Holmgren</td>
</tr>
<tr>
<td>2. paradoxus Wasmann</td>
<td>2. corniceps Snyder</td>
<td>2. corniceps Snyder</td>
</tr>
<tr>
<td>3. (?) taurocephalus Silvestri</td>
<td>3. fryeri Holmgren</td>
<td>3. dicrocerus Harris</td>
</tr>
<tr>
<td></td>
<td>4. hubbardi</td>
<td>4. krishnii Hill (new name for soldier of canalensis Hill, 1942)</td>
</tr>
<tr>
<td></td>
<td>Banks &amp; Snyder</td>
<td>5. rapae</td>
</tr>
<tr>
<td></td>
<td>Jeanneleanus Sjostedt</td>
<td>Light &amp; Zimmermann</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. speiseri Holmgren &amp; Holmgren</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.1 Two new undescribed species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. queenlandis Hill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. rapae</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light &amp; Zimmermann</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10. speiseri Holmgren &amp; Holmgren</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11. taurocephalus Silvestri</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12. triceromegas Silvestri</td>
</tr>
</tbody>
</table>

Emerson raised this number to 21, including 9 undescribed species present in his collection. Krishna (1961), however, has made a drastic reduction, to 8 species including 2 undescribed ones. The manner of this reduction may briefly be stated: Of the 12 species of Snyder, Krishna retains only 6 (Table 1), the remaining ones having been relegated to other genera as follows: He has reinstated the genera Allotermes Wasmann and Proneotermes Holmgren which were sunk by Holmgren (1911) and Snyder (1949) in Procryptotermes – Allotermes in full and Proneotermes in part. The species taurocephalus and triceromegas have been assigned to a new genus Tauritermes, and hubbardi to another new genus Macintotermes. The two species queenlandis Hill, which was originally described as Calotermes (Cryptotermes) queenlandis and later incorporated in Procryptotermes by Snyder (1949), and canalis have been
assigned to genus *Cryptotermes*. The species *jeannelanus*, originally described as *Calotermes jeannelanus* and later assigned to *Procryptotermes* by Snyder (1949), has been assigned, with many others, to a new genus *Bifiditermes*.

To Krishna's list we may add the new species from India described below.

b) Geographical distribution

According to Snyder's (1949) composition of the genus, the species occurs in all the zoogeographical regions except the Palaearctic and the Indo-Malayan, while with Krishna's restricted composition the genus would occur only in the Papuan, Ethiopian, Malagasy and Neotropical regions as given below. To this distribution may now be added the Indo-Malayan region on the basis of the new species from India described here.

Table 2. Geographical distribution of the genus *Procryptotermes*

<table>
<thead>
<tr>
<th>Region</th>
<th>Snyder (1949)</th>
<th>Krishna (1961)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Australian</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>2. Papuan</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3. Indo-Malayan</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. Palaearctic</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. Ethiopian</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6. Malagasy</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7. Nearctic</td>
<td>(1 common with one Neotropical)</td>
<td>-</td>
</tr>
<tr>
<td>8. Neotropical</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Total:</td>
<td>12</td>
<td>8</td>
</tr>
</tbody>
</table>

(including 2 undescribed species)

III. Description of a new species

*Procryptotermes dhari* (sp. nov.) Roonwal & Chhotani

a) Material

In spirit, in a vial with several soldiers and pseudoworkers, from the grounds of the Agricultural College, Coimbatore (Madras State, India), altitude ca. 435 m, P. C. Dhar coll. (Field Colln. No. D 9/27.9.60), 27. IX. 1960, ex "a live tree of unknown species".

b) Description

1. Imago. – Unknown.

2. Soldier (Table 3; and Text-fig. 1; and Pl. 1).

General: Head-capsule brown, paler posteriorly and darker anteriorly; antennae golden yellow, 3rd segment somewhat darker; labrum translucent, yellowish; mandibles dark brown, paler posteriorly; pronotum brownish yellow; abdomen and legs yellow. Head-capsule and body moderately hairy.
Head: Head-capsule subrectangular (length to base of mandibles 1.68-1.77 mm.; maximum width 1.23–1.30 mm.); sides substraight to slightly convex; slightly incurved in front of antennae and then forming a horn-like projection on either side which is a prolongation of the ventral genae; frons sloping in front at an angle of ca. 40° and separated from vertex by a prominent ridge; the ridge depressed medially to form a short shallow, groove; posterior margin convex.

Eyes: Small, longish-oval (maximum diameter 0.13–0.14 mm.; minimum diameter 0.05–0.07 mm.) and transluscent; one on either side, situated just below the base of antennae and separated from the latter by about 0.1 mm. Ocelli: Absent.

Antennae: Short, not extending beyond head-capsule behind; with 11 segments; segments 1 and 2 sparsely, and the remainder fairly, pilose; segment 1 short, subcylindrical, broader at anterior end; 2 narrower and shorter than 1, and cylindrical; 3 longest (length 0.20 to 0.23 mm.), club-shaped, about twice the length of 2 and longer than the 4 and 5 together; 4 to the penultimate one subequal in length but narrowing gradually; the last one ovate, and narrower and shorter than the penultimate one. Clypeus: Divided into an ante- and a postclypeus. Anteclypeus a thin, narrow strip. Postclypeus trapezoidal, of same colour as frons and hardly separable from the latter. Labrum: Broader than long; subrectangular, with anterior margin weakly subconical; with two pairs of longish setae on anterior margin and a few shorter ones on body. Mandibles: Long (only slightly shorter than head-length), stoutish and with pointed incurved apex; length 1.17–1.23 mm.; outer margin weakly humped near base. Left mandible:
*Procryptotermes dhari* (sp. nov.) Roonwal & Chhotani. Body-parts of soldier (paratype) and pseudoworker (paramorphotype)

**Soldier** (Figs. a-g). A Head and thorax, in dorsal view; b Head and pronotum, in side view; c Labrum, in dorsal view; d Left mandible, in dorsal view; e Right mandible, in dorsal view; f Basal portion of left antenna, showing segments 1-5; g Postmentum, in ventral view. **Pseudoworker** (Figs. h-i).  

h Head and thorax, in dorsal view; i Head and pronotum, in side view; j Left mandible, in dorsal view; k Right mandible, in dorsal view; l Basal portion of left antenna, showing segments 1-7.

*acl.* = anteclypeus; *ant.* = antenna; *e.* = eye; *lr.* = labrum; *m1, n1.* = 1st and 2nd marginal teeth of mandibles; *md.* = mandible; *mst.* = mesonotum; *mtt.* = metanotum; *pel.* = postclypeus; *prt.* = pronotum.
Inner margin with two large, prominent, triangular, marginal teeth in the distal one-third; proximal two-thirds with, or without, 1–2 weak crenulations. Right mandible: Inner margin with two weak crenulations in the distal half and a sharp tooth near the base.

Postmentum: About 2/3rd the length of head-capsule (head-postmentum length index [Median length of postmentum/Length of head to base of mandibles] 0.65–0.67); wine-glass shaped; divided into two parts – a wide distal part and a narrower proximal one –, the two separated by a narrow waist; anterior half weakly hairy; anterior margin convex, with a pair of longish hairs; posterior margin concave with a thick median bulge.

Table 3. Body-measurements (in mm.) and indices of the soldier caste of *Procryptotermes dhari* (sp. nov.) ROONWAL & CHHOTANI (10 specimens measured)

<table>
<thead>
<tr>
<th>Body-part</th>
<th>Range</th>
<th>Holotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total body-length (ca.)</td>
<td>6.15–6.65</td>
<td>6.60</td>
</tr>
<tr>
<td>2. Length of head with mandibles</td>
<td>2.77–2.93</td>
<td>2.93</td>
</tr>
<tr>
<td>3. Length of head to lateral base of mandibles</td>
<td>1.68–1.77</td>
<td>1.77</td>
</tr>
<tr>
<td>4. Maximum width of head</td>
<td>1.23–1.30</td>
<td>1.30</td>
</tr>
<tr>
<td>5. Maximum height of head</td>
<td>0.97–1.00</td>
<td>0.97</td>
</tr>
<tr>
<td>6. Head index I (width/length to base of mandibles)</td>
<td>0.72–0.74</td>
<td>0.73</td>
</tr>
<tr>
<td>7. Head index II (height/length)</td>
<td>0.55–0.58</td>
<td>0.55</td>
</tr>
<tr>
<td>8. Head index III (height/width)</td>
<td>0.75–0.79</td>
<td>0.75</td>
</tr>
<tr>
<td>9. Median length of labrum</td>
<td>0.10–0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>10. Maximum width of labrum</td>
<td>0.30–0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>11. Maximum length of 3rd segment (of antenna)</td>
<td>0.20–0.23</td>
<td>0.20</td>
</tr>
<tr>
<td>12. Length of mandibles (distance between upper base of condyle to tip: i) Left mandible 1.17–1.23</td>
<td>1.23</td>
<td>1.20</td>
</tr>
<tr>
<td>13. Head-mandibular length index (mandible-length/head-length to base of mandibles)</td>
<td>0.68–0.73</td>
<td>0.69</td>
</tr>
<tr>
<td>14. Maximum diameter of eye</td>
<td>0.13–0.14</td>
<td>0.14</td>
</tr>
<tr>
<td>15. Minimum diameter of eye</td>
<td>0.05–0.07</td>
<td>0.05</td>
</tr>
<tr>
<td>16. Minimum eye-antennal distance</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>17. Median length of postmentum</td>
<td>1.13–1.18</td>
<td>1.17</td>
</tr>
<tr>
<td>18. Maximum width of postmentum</td>
<td>0.46–0.47</td>
<td>0.47</td>
</tr>
<tr>
<td>19. Minimum width of postmentum</td>
<td>0.15–0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>20. Head-postmentum-length index (postmentum-length/head-length to base of mandibles)</td>
<td>0.65–0.67</td>
<td>0.66</td>
</tr>
<tr>
<td>21. Maximum length of pronotum</td>
<td>0.66–0.71</td>
<td>0.71</td>
</tr>
<tr>
<td>22. Maximum width of pronotum</td>
<td>1.13–1.27</td>
<td>1.27</td>
</tr>
<tr>
<td>23. Maximum width of mesonotum</td>
<td>1.00–1.06</td>
<td>1.03</td>
</tr>
<tr>
<td>24. Maximum width of metanotum</td>
<td>1.06–1.10</td>
<td>1.10</td>
</tr>
<tr>
<td>25. Head-pronotum width index (pronotum-width/head-width)</td>
<td>0.92–0.99</td>
<td>0.98</td>
</tr>
<tr>
<td>26. Pronotum index (length/width)</td>
<td>0.56–0.59</td>
<td>0.56</td>
</tr>
<tr>
<td>27. Length of hind-femur</td>
<td>0.70–0.77</td>
<td>0.70</td>
</tr>
<tr>
<td>28. Maximum width of hind-femur</td>
<td>0.23–0.25</td>
<td>0.25</td>
</tr>
</tbody>
</table>
**Thorax:** Pronotum: Subreniform; flat; slightly narrower than head-capsule (head-pronotum width index [Pronotum-width/Head-width] 0.92-0.98); sides strongly convex; weakly hairy; anterior margin moderately concave and smooth; posterior margin substraight. Mesonotum: Narrower than pronotum; weakly hairy; sides rounded; posterior margin straight. Metanotum: Slightly broader than mesonotum, but narrower than pronotum; weakly hairy; sides weakly rounded; posterior margin weakly concave. Legs: Rather short. Femora thick, somewhat swollen, and darker than rest of leg; tibia relatively thin; apical tibial spur formula 3:3:3; tarsi 4-jointed.

**Abdomen:** Elongate, moderately hairy. A pair of cerci present on 10th sternum; 2-jointed, ca. 0.10-0.15 mm. long. Styli generally absent; when present short, 1-jointed and ca. 0.10 mm. long.

**Measurements:** See Table 3.

3. **Pseudoworker** (Table 4; Text-fig. 1; and Pl. 1).

**General:** Head-capsule, antennae, labrum and clypeus pale yellow; mandibles pale yellow, with dark brown toothed margins; thorax and body yellowish white to dirty white. Head and body moderately hairy.

Table 4. Measurements (in mm.) of pseudoworkers of *Procryptotermes dhari* (sp. nov.) RooNwal & Chhotani (5 specimens measured)

<table>
<thead>
<tr>
<th>Body-part</th>
<th>Range (mm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total body-length (ca.)</td>
<td>4.50-5.00</td>
</tr>
<tr>
<td>2. Length of head to lateral base of mandibles</td>
<td>1.07-1.10</td>
</tr>
<tr>
<td>3. Maximum width of head</td>
<td>1.13-1.27</td>
</tr>
<tr>
<td>4. Maximum height of head</td>
<td>0.66-0.70</td>
</tr>
<tr>
<td>5. Median length of labrum</td>
<td>0.28-0.33</td>
</tr>
<tr>
<td>6. Maximum width of labrum</td>
<td>0.40-0.47</td>
</tr>
<tr>
<td>7. Maximum length of pronotum</td>
<td>0.60</td>
</tr>
<tr>
<td>8. Maximum width of pronotum</td>
<td>0.90-1.00</td>
</tr>
</tbody>
</table>

**Head:** Subcircular; slightly broader than its length to base of mandibles. **Eyes:** Rudimentary, small and oval (maximum diameter ca. 0.13 mm.; minimum diameter ca. 0.10 mm.); either transluscent whitish or pale brownish; one on either side. **Ocelli:** Absent. **Antennae:** Very short, much shorter than head-length; moderately pilose, pilosity increasing distally; with 11-12 segments; segment 1 longest, subcylindrical; 2 about half the length of 1; 3 onwards broader than long; 3-7 (or 8) ring-shaped; the last oval and narrower than the penultimate one. **Clypeus:** Divided into ante- and a postclypeus. Anteclypeus subtriangular, apilose. Postclypeus subrectangular, flat; with a few hairs on anterior margin and on sides. **Mandibles:** Of typical *Procryptotermes*-type. Left mandible with an apical and two marginal teeth on inner margin: apical finger-like; 1st marginal short, smaller than apical; 2nd sub-
equal to 1st and separated from the latter by a wide margin. Right mandible also with an apical and two marginal teeth on inner margin; apical finger-like; 1st marginal short; 2nd much smaller and lying close to 1st.

Thorax: Pronotum: Flat, subrectangular, and broader than long; narrower than head-capusle; somewhat sloping downwards laterally; weakly hairy; sides substraight; anterior margin concave; posterior margin substraight, with a weak median depression. Mesonotum: Slightly broader than pronotum; postero-lateral corners rounded; posterior margin substraight, with a faint median depression. Metanotum: Slightly broader than mesonotum; postero-lateral corners rounded; posterior margin substraight. Legs: As in soldier.

Abdomen: Oblong; weakly hairy. A pair of short (ca. 0.10-0.13 mm. long), hairy, 2-jointed cerci present. Styli either present or absent; when present, ca. 0.10 mm. long and one-jointed.

c) Type-specimens


d) Type-Locality

Grounds of the Agricultural College, Coimbatore (Madras State, India), ca. 11°0’ N. latitude, and 77°0’ E. longitude; altitude ca. 435 m.

e) Type-Host

A live plant of unknown species.

f) Geographical Distribution

India: Known only from the type-locality.

g) Comparisons

The soldier of Procryptotermes dhari sp. nov., closely resembles that of P. corniceps Snyder, from Puerto Rico (both having a single horn-like projection on either side of the head-capusle), but is separable as follows: (i) Is much larger (total body-length 6.15-6.65 vs. 3.7-3.8 mm.; head-length with mandibles 2.77-2.93 vs. 2.20-2.45 mm., without mandibles 1.68-1.77 vs. 1.45-1.50 mm.; maximum head-width 1.23-1.30 vs.
Roonwal and Chhotani: Discovery of termite genus Procryptotermes from Indo-Malayan Region

1.05-1.15 mm.), (ii) Anterior margin of labrum subconical medially (vs. rounded). (iii) Mandibles longer (length 1.17-1.23 vs. 1.00 mm.); right mandible with a prominent tooth in basal half (absent in corniceps). (iv) 3rd segment of antenna much longer, more than the next 2 segments together (vs. only slightly longer than the next one). (v) Anterior margin of pronotum moderately concave (vs. deeply concave).

IV. Summary

1. Procryptotermes is a widely distributed genus but has hitherto been unrecorded from the Indo-Malayan and the Palaearctic Regions.

2. A new species, P. dharai, based on soldiers and pseudoworkers, from Coimbatore (Madras State, India) is described here. This constitutes the first record of the genus from the Indo-Malayan Region.

3. The composition of the genus and its geographical distribution are briefly discussed.

V. Zusammenfassung


References


Anschrift der Verfasser: Dr. M. L. Roonwal and Dr. O. B. Chhotani, Zoological Survey of India, 34, Chittaranjan Avenue, Calcutta – 12 (Indien).
A new Neotropical element (*Anoptotermes*) in the Indian termite fauna, with fuller description of *A. shillongensis* from Assam.

*By*

M. L. Roonwal

&

O. B. Chhotani

*PUBLISHED: 28th December, 1962*

DELHI
A NEW NEOTROPICAL ELEMENT (ANOPLOTERMES) IN THE INDIAN TERMITE FAUNA, WITH FULLER DESCRIPTION OF A. SHILLONGENSIS FROM ASSAM*

By
M. L. ROONWAL
Director
and
O. B. CHHOTANI
Junior Research Officer
Zoological Survey of India, Calcutta
(With 3 Tables, 2 Text-figures and 1 Plate)

CONTENTS

I—Introduction 159
II—New find of Anoplotermes in India, and a fuller description of A. shillongensis Roonwal & Chhotani 161
III—Discussion 165
IV—Summary 166
V—References 167

I—INTRODUCTION

There is a group of termites in the Anoplotermes-complex (Isoptera, Family Termitidae, Subfamily Amitermitinae) in which the soldier caste is absent, and only the worker caste and the reproductives (alates: male and female) are known to occur. The complex consists of two closely allied genera, Anoplotermes Müller and Speculitermes Wasmann.

The genus Anoplotermes was erected by Müller (1873) to accommodate a new Neotropical species, A. pacificus Müller, from Peru. Later on, Wasmann (1902) erected the genus Speculitermes to accommodate a new species, S. cyclops Wasm., from India. Holmgren (1912), however, reduced Speculitermes to the status of a subgenus of the parent genus Anoplotermes which thus had two subgenera, Anoplotermes and Speculitermes. Some authorities (e.g., Grassé, 1949, p. 537) have accepted this new status, while others continue to hold the two groups as of generic rank (Snyder, 1949). There is no doubt that the two genera are very closely allied, but as there are marked and clear differences, it is perhaps best to regard them as two full genera which are separable...
as in the following key, while a more detailed comparison is given in Table 1.

**Key to workers of the genera of the Anoploptermes-complex.**

1 (2). Body pale. Smaller (head and body ca. 2.7-6.3 mm. long; head-width 0.4-1.2 mm.). Mid-dorsal spot on head either absent or very weak and reduced to a point. Antennae shorter, ca. 1/2-1/6 times the head-width; with 14 segments; 3rd segment generally smaller than 2nd. Fore-tibia markedly swollen. Tibial spur formula variable; generally either 3 : 4 : 2 (Ethiopian species) or 2 : 2 : 2 (Neotropical and Oriental species). Left mandible with an apical and either 2 or 3 marginal teeth; the 3rd marginal, when present, very small.

*Anoploptermes* Müller

2 (1). Body dark. Larger (head and body ca. 4.0-7.0 mm. long; head-width 1.0-1.4 mm.). Mid-dorsal spot on head ("Stirnocellus" of Wasmann) large and prominent. Antennae longer, ca. 1.5-2.0 times the head-width; with 14 (rarely 15) segments; 3rd segment longer than 2nd (rarely subequal). Fore-tibia not swollen. Tibial spur formula 2 : 2 : 2. Left mandible with an apical and 2 marginal teeth.

*Speculitermes* Wasmann.

**Table 1.—Comparison of worker characters of the genera *Anoploptermes* and *Speculitermes*.**

<table>
<thead>
<tr>
<th>Anoploptermes</th>
<th>Speculitermes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Smaller species:</td>
<td>2. Larger species:</td>
</tr>
<tr>
<td>Total length ca. 2.7-6.3 mm.</td>
<td>Total length ca. 4.0-7.0 mm.</td>
</tr>
<tr>
<td>Max. head-width 0.4-1.2 mm.</td>
<td>Max. head-width 1.0-1.4 mm.</td>
</tr>
<tr>
<td>3. Head weakly chitinized</td>
<td>3. Head usually strongly chitinized.</td>
</tr>
<tr>
<td>4. Mid-dorsal spot on head either absent or very weak and reduced to a point.</td>
<td>4. Mid-dorsal spot on head (&quot;Stirnocellus&quot; of Wasmann) large and prominent and of varying shape — round or triangular.</td>
</tr>
<tr>
<td>5. Antennae shorter, length 1/2-1/6 times the head-width; 14 segmented; 3rd segment generally shorter than 2nd.</td>
<td>5. Antennae longer, length 1.5-2.0 times the head-width, generally 14-segmented (15-segmented in <em>S. proratus</em> Emerson); 3rd segment generally longer than 2nd (subequal in <em>S. proratus</em>).</td>
</tr>
<tr>
<td>8. Left mandible with an apical and either 2 or 3 marginal teeth; 3rd marginal, when present, very small and lying a little above the molar plate.</td>
<td>8. Left mandible with an apical and 2 marginal teeth.</td>
</tr>
</tbody>
</table>
Table 2.—Zoogeographical distribution of the species of Anoplotermes and Speculitermes.

<table>
<thead>
<tr>
<th>Zoogeographical Regions</th>
<th>Continents, etc.</th>
<th>Number</th>
<th>Species</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I—Anoplotermes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Neotropical</td>
<td>South &amp; Central America; West Indies.</td>
<td>32</td>
<td></td>
<td>72.7</td>
</tr>
<tr>
<td>2. Ethiopian</td>
<td>Africa</td>
<td>11</td>
<td></td>
<td>25.0</td>
</tr>
<tr>
<td>3. Nearctic</td>
<td>Southern U.S.A.</td>
<td>1</td>
<td>Common with Neotropical</td>
<td>2.3</td>
</tr>
<tr>
<td>4. Oriental</td>
<td>India (Assam)</td>
<td>1</td>
<td></td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>44</td>
<td>(excluding 1 Nearctic which is common with Neotropical)</td>
<td>100</td>
</tr>
</tbody>
</table>

II—Speculitermes

<table>
<thead>
<tr>
<th>Species</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Neotropical</td>
<td>South America</td>
<td>4</td>
</tr>
<tr>
<td>2. Oriental</td>
<td>India, Burma, Ceylon</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>

II—New Find of Anoplo"termes in India, and Fuller Description of A. SHILLONGENSIS ROONWAL & CHHOTANI

The genus Anoplo"termes has hitherto been known to have representatives from the Neotropical (S. America), the southern Nearctic (southern United States) and the Ethiopian (Africa) Regions, and none from the Oriental. Recently (Roonwal & Chhotani, 1959, 1960), we discovered the existence of the genus in India (Assam), where it is represented by a single new species, *Anoplo"termes shillongensis* Roonwal & Chhotani,
which was briefly described by us (1960) some time ago, and a fuller, illustrated description is given below:

Anoplotermes shillongensis Roonwal and Chhotani

(Table 3; and Plate 14)


(a) Material

(i) Several workers, in a vial, in spirit, Shillong (Bishop Falls), Assam (91° 56' E. long.; 25° 34' N. lat.), India, coll. A. P. Kapur, 22nd December, 1958.

(ii) Four workers, in a vial, in spirit, Rongrengiri, District Tura, Assam (approx. 90° 45' E. long.; 25° 45' lat.), coll. A. N. Fernandez, 13th January, 1957. ex 'earth in the forest around Rongrengiri'. (Found mixed with a new species of Speculitermes to be described elsewhere; now separated and kept in another vial.)

Also, two slides, Nos. 6 and 7, from lots (i) and (ii) above.

(b) Fuller Description

1. Imago.—

Unknown.

2. Soldier.—

Unknown in the genus.

3. Worker (Table 3; and Pl. 14).—

General.—Head-capule pale yellow; postclypeus of same colour as head-capule; anteclypeus whitish hyaline; labrum pale yellow, whitish hyaline anteriorly; antennae, thorax and legs pale yellow, paler than head-capule; mandibles pale yellow, with dark brown toothed margins; abdomen dirty grey because of food matter in the intestines visible through sclerites. Head and body rather densely hairy. Total-length of head and body (excluding antennae) ca. 3.6-4.2 mm.

Head.—Head-capule subcircular; broader than its length to base of mandibles (width 0.85-0.90 mm.; length 0.70-0.75 mm.); broadest a little behind the level of antennae; sides rounded and narrowing posteriorly; posterior margin round; a faint, circular, tiny, whitish mid-dorsal spot usually present (sometimes absent); Y-suture absent. Eyes: Two lateral, rudimentary, brown eye-spots, one on either side, usually present (sometimes absent). Ocelli: Absent. Antennae: With 14 segments; moderately pilose; pilosity gradually increasing distally; segment 1 longest, cylindrical; 2 about half the length of 1, and cylindrical; 3 somewhat shorter than 2; 4 shorter than 3; 5-8 club-shaped, and gradually increasing in length; 9-13 club-shaped, and gradually decreas-
Anoplotermes from Assam

ing in length; last (14th) ovate, longer than the penultimate one.

Clypeus: Divided into an ante- and a postclypeus. Postclypeus weakly swollen, pilose; a little shorter than half its width; divided into right and left halves by a median suture; posterior margin convex, medially incurved, forming a notch. Anteclypeus whitish, hyaline, apilose; subtriangular; shorter in length than postclypeus. Labrum: Slightly broader than long; broadest in middle; in front somewhat narrowing; anterior margin rounded. Mandibles: Somewhat longish; outer margins incurved. Left mandible with an apical and 3 marginal teeth; apical finger-like; 1st marginal slightly smaller than apical; second smaller than 1st and widely separated from it; 3rd very minute, located just above the molar-plate. Right mandible with an apical and 2 marginal teeth; apical finger-like; 1st marginal somewhat shorter than apical and broader; 2nd shorter than 1st and finger-like.

Thorax.—Pronotum: Saddle-shaped; narrower than head-capsule; much broader than long (width 0.53-0.55 mm.; length 0.25-0.28 mm.); anterior lobe rounded and greatly upturned; anterior margin not notched; sides strongly narrowing posteriorly; posterior margin substraight. Mesonotum: Narrower than pronotum; posterior margin substraight. Metanotum: Broader than pronotum; posterior margin straight. Legs: Long and thin; fore-tibia swollen, middle-tibia a little less swollen, and hind-tibia slender and not swollen. Tibial spur formula variable, either 3 : 2 or 2 : 2 : 2, thus: Tibia generally with 2 apical spurs in the forelegs, sometimes (approximately 16 per cent) with a third minute rudimentary spur on outer side; middle and hind-tibiae with 2 apical spurs each. Tarsi 4-jointed.

Table 3.—Body measurements (in mm.) and indices of Anoplotermes shillongensis Roonwal and Chhotani. (10 specimens measured.)

<table>
<thead>
<tr>
<th>Caste</th>
<th>Worker</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Body-part</th>
<th>Range</th>
<th>Holotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>I—Measurements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Total body-length (approx.)</td>
<td>3.6—4.2 mm.</td>
<td>3.8 mm.</td>
</tr>
<tr>
<td>2 Head-length to lateral base of mandibles</td>
<td>0.70—0.75 mm.</td>
<td>0.70 mm.</td>
</tr>
<tr>
<td>3 Max. width of head</td>
<td>0.85—0.90 mm.</td>
<td>0.90 mm.</td>
</tr>
<tr>
<td>4 Max. height of head</td>
<td>0.33—0.38 mm.</td>
<td>0.33 mm.</td>
</tr>
<tr>
<td>5 Diameter of mid-dorsal spot (when present).</td>
<td>0.05—0.07 mm.</td>
<td>0.05 mm.</td>
</tr>
<tr>
<td>6 Length of antennae</td>
<td>1.33—1.35 mm.</td>
<td>1.35 mm.</td>
</tr>
<tr>
<td>7 Max. length of pronotum</td>
<td>0.25—0.28 mm.</td>
<td>0.25 mm.</td>
</tr>
<tr>
<td>8 Max. width of pronotum</td>
<td>0.53—0.55 mm.</td>
<td>0.55 mm.</td>
</tr>
<tr>
<td>9 Length of hind-tibiae</td>
<td>0.75—0.78 mm.</td>
<td>0.78 mm.</td>
</tr>
<tr>
<td>II—Indices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Antennal-length/head length</td>
<td>1.77—1.93</td>
<td>1.93</td>
</tr>
<tr>
<td>2 Antennal-length/head width</td>
<td>1.50—1.56</td>
<td>1.50</td>
</tr>
</tbody>
</table>
Abdomen.—Elongated, hairy. Cerci 2-jointed, short about 0.05 mm. long. Styli absent.

Measurements.—See Table 3 above.

(c) Type-specimens

Holotype.—From "Material" (i) above; one worker, Z.S.I. Reg. No. 2445/H8, in spirit, in a vial; Shillong (Bishop Falls) Assam, India, coll. A. P. Kapur, 22. xii. 1958. Deposited in the National Zoological Collections in the Zoological Survey of India, Calcutta.

Paratypes.—Deposited as follows: (i) Five workers, Z.S.I. Reg. No. 2446/H8, in Zoological Survey of India, Calcutta. (ii) Two workers in Entomological Collection, Forest Research Institute, Dehra Dun. (iii) Two workers with Professor A.E. Emerson, Department of Zoology, University of Chicago, Chicago (U.S.A.).

(d) Type-locality

India: Bishop Falls, Shillong (Assam), 25° 34' N. lat. and 91° 56' E. long.

(e) Geographical Distribution

India: Assam: Rongrengiri (District Tura); and Shillong (type-locality).

(f) Comparison

The worker of Anoplotermes shillongensis Roonwal & Chhotani is close to that of the two Ethiopian species, namely, A. pacatus Silvestri and A. quietus Silvestri, but differs from them as follows:—

1. From A. pacatus: (i) Head broader (0.85-0.90 vs. 0.83 mm.), (ii) Antennae longer both absolutely and comparative to head-length and head-width (length 1.33-1.35 vs. 1.20 mm.); index antennal length/head-length 1.77-1.95 vs. 1.66; and index antennal length/head-width 1.50-1.56 vs. 1.44. (iii) Hind-tibia longer (0.75-0.80 vs. 0.72 mm.).

2. From A. quietus: (i) Head broader (0.85-0.90 vs. 0.84 mm.), (ii) Antennae longer both absolutely and comparative to head-length and head-width (length 1.33-1.35 vs. 1.20 mm.); index antennal-length/head-length 1.77-1.93 vs. 1.54; index antennal-length/head-width 1.50-1.56 vs. 1.43. (iii) Hind-tibia shorter (0.75-0.80 vs. 0.85 mm.).
Out of about 44 known species of *Anoplotermes* (Silvestri, 1901-1914; Holmgren, 1912; Emerson, 1925; Sjostedt, 1925; Snyder, 1949) the majority are Neotropical (72.7 per cent), one Nearctic, a few Ethiopian (25 per cent) and one Oriental (present paper), vide Table 2 and Text-fig. 1.

The closely allied but smaller genus, *Speculitermes* (regarded by some authorities as a subgenus of *Anoplotermes*), where only 7 species are known (vide Snyder, 1949; Roonwal & Sen-Sarma, 1959; and Roonwal & Chhotani, present paper), is also largely Neotropical (57.1 per cent) but is also well represented in the Oriental Region (42.9 per cent), vide Table 2; and Text-fig. 2. It has so far not been recorded from the Ethiopian Region. The Oriental forms of *Speculitermes* comprise three species, one of which has two subspecies, as follows:

1. *S. cyclops* Wasmann.
   - *S. cyclops, cyclops*, Wasmann.—All India (except extreme south of the Peninsula, and the eastern region, e.g., Bihar, Bengal and Assam); and Burma.
   - *S. cyclops sinhalensis* Roonwal & Sen-Sarma.—Peninsular India; and Ceylon.

2. *S. triangularis* Roonwal & Sen-Sarma.—India (Uttar Pradesh).

3. A new species of *Speculitermes* to be described elsewhere.—India (Assam).
From the abundance and variety of the species of both the genera of the *Anoplotermes-Speculitermes* complex, which comprises a total of about 51 species, it will be evident that the complex was most probably evolved in the Neotropical Region (South America) and thence spread to Africa and the Indo-Malayan Region while these land-masses were still contiguous and before they had started to drift apart according to Wegener's Hypothesis (Wegener, 1922; van der Gracht, 1928). Alternatively, one can regard the group to have evolved independently in S. America, Africa and India, a contingency which appears to be unlikely to have happened. Accepting the former view, we may suppose that the *Anoplotermes*-element, which is the stronger one (44 out of 51 species) spread to Africa, and one species, *A. shillongensis* R. & C., reached as far east as Assam (India).

The *Speculitermes*-element of this complex, which is relatively weak (7 out of 51 species), also appears to have been evolved in South America, but whether it initially occurred and evolved in the Indo-Malayan Region as well, or spread there later, is not clear, and its total absence in the intervening land-mass of Africa is puzzling.

**IV—SUMMARY**

1. The termite genus *Anoplotermes* Müller (Isoptera, Termitidae, Amitermitinae) is, along with the closely allied genus *Speculitermes* Wasmann, characterised by the absence of the soldier caste*—only workers and the reproductive (male and female alates) being present.

2. *Anoplotermes* was hitherto known mainly from the Neotropical (32 species) and the Ethiopian (11 species) Regions, with one of the Neotropical species extending north to the Nearctic Region (southern U.S.A.).

---

*Since the above was written, the soldier caste has been found in the genus *Speculitermes* by Roonwal & Chhotani, vide foot-note on p. 159.
3. Recently (Roonwal & Chhotani, 1959, 1960a), the genus has been found to occur in India (Assam) where it is represented by a single species, *A. shillongensis* Roonwal & Chhotani, which is described in detail; a brief, preliminary description was given earlier (Roonwal & Chhotani, 1960a).

4. The discovery of a mainly Neotropical element in the Oriental Region is of considerable zoogeographical significance.

5. The allied genus *Speculitermes* (with 7 known species), which some authors regard as a subgenus of *Anoplotermes*, has been recorded from the Neotropical Region (S. America) and the Oriental Region (India), but is, curiously enough, totally absent in the intervening landmass of Africa (Ethiopian Region).

6. The *Anoplotermes-Speculitermes* complex was presumably evolved in the Neotropical Region where it still dominates. The *Anoplotermes*-section thence spread to the Ethiopian Region, and also sent an offshoot to the Indian Region (a single species). The *Speculitermes*-section is well represented in both the Neotropical and the Oriental Regions, and its absence from the intervening Ethiopian Region is quite puzzling.

V—REFERENCES


PLATE 14

Anoplotermes shillongensis Roonwal and Chhotani. Worker Caste.
All figures from the paratype workers from Shillong (Assam, India),

FIG. a.—Whole body, in dorsal view.
FIG. b.—Head and thorax, in dorsal view.
FIG. c.—Head and thorax, in side view.
FIG. d.—Labrum, in dorsal view. (Slide No. 6.)
FIG. e.—Left mandible, in dorsal view. (Slide No. 6.)
FIG. f.—Ditto, right mandible.
FIG. g.—Right antenna, in dorsal view. First and last (14th)
    segments numbered.
FIG. h.—Pronotum, in dorsal view (in situ).
FIG. i.—Pronotum, in side view (in situ).
FIG. j.—Fore-tibia, with three apical tibial spurs.
FIG. k.—Fore-tibia, with two apical tibial spurs.
FIG. l.—Hind-tibia, with two apical tibial spurs.

aecl., anteclypeus; ant., antenna; ap. t., apical teeth of mandibles;
at., anterior; cer., cercus; c., rudiments of eyespots; lr., labrum; l.t.,
left; m.1-m.3, first to third marginal teeth of mandible; m4, mandible;
m. s., mid-dorsal spot of head; mst., mesonotum; mtt., metanotum;
pcl., postclypeus; prl., pronotum; pr. r., posterior; rt., right;
tb. sr., tibial spurs.
Worker: Anoplotermes shillongensis Roonwal & Chhotani.
SOLDIER CASTE FOUND IN
THE TERMITE GENUS
*SPECULITERMES*

M. L. ROONWAL
AND
O. B. CHHOTANI

Reprinted from
Science & Culture, Calcutta,
Vol. 26 (No. 3), Sept. 1960,
pp. 143-144.

1960
Soldier Caste found in the Termite
Genus Speculitermes

In only two closely allied genera, Anoplotermes Muller and Speculitermes Wasmann (some authorities regard the latter as a subgenus of the former), out of about 170 known genera of living termites, has a soldier caste not been hitherto found, although nearly 50 species and sub-species (43 of Anoplotermes and 7 of Speculitermes) have so far been described from various parts of the world. It has thus come to be widely accepted among zoologists that the soldier caste in these two genera is absent, having been lost secondarily. Recently, in two collections of Speculitermes cyclops sinhalensis Roonwal & Sen-Sarma received from two widely separated localities in southern India, and by two independent collectors, we found a single soldier in each of the collections which also contained several imagos (alates) and workers. Each collection was made from a single location and we have no reason to doubt that the soldiers are conspecifically associated with the imagos and workers. The newly-discovered soldier is described below briefly. A fuller description will be published elsewhere.

Material

(i) One vial, with one soldier and several imagos and workers, Saptapur area, Dharwar (Mysore State), coll. J. C. Uttangi, 12.iv.1959, winged forms, soldiers and workers coming out of holes in ground about 5 cm. below the surface.

(ii) One vial with one soldier and several imagos and workers, Coimbatore (Madras
State), coll. P. Susai Nathan, 11.IV.1960, ex "black cotton soil, on ground".

Fig. 1.—Speculitermes cyclops sinhalensis Roonwal & Sen-Sarma (1960). Specimens from Saptapur area, Dharwar (Mysore State): (a) Soldier. (b) Worker.

Description of Soldier

Head dark brown with a pair of pale longitudinal streaks dorsally; mandibles dark brown distally, paler proximally; thorax and body yellowish white. Head and thorax sparsely, and abdomen fairly, pilose.

Head subrectangular, and rather flat; longer than broad (length to base of mandibles, 2.33-2.40; width 1.83-1.93 mm.); fontanelle indistinct; antennae 14-segmented. Mandibles long, thick and symmetrical, strongly incurved distally; each with a large triangular tooth lying at the beginning of distal third of inner
margin and directed slightly forwards. Post-
mentum club-shaped. Prontum saddle-shaped; 
mesonotum narrower, and metanotum broader 
than pronotum. Legs long and thin; apical 
tibial spur formula 2:2:2 (with sometimes a 
rudimentary third spur lying dorsally on the 
foretibia). Abdomen elongate; cerci present; 
styli absent.

1. Total body-length (with mandibles 
but without antennae) in. 7.73 mm.
2. Length of head (to lateral base of 
mandibles) 2.33-2.4 mm.
3. Maximum width of head 1.93-1.99 mm.
4. Maximum length of pronotum 0.69 mm.
5. Maximum width of pronotum 0.93-1.03 mm.

Affinities.—The present discovery of the 
soldier in Speculitermes has now made it possible 
to establish its phylogenetic affinities. This 
genus, together with the closely allied genus 
Ikepitermes, has been placed by various autho-
rities either in the subfamily Nasutitermitinae 
or in the Amitermintae, of the family Termi-
tidae. The characters of the soldier caste, 
particularly the structure of the head and 
mandibles (both the right and left mandibles 
have a prominent tooth on the inner margin), 
leave no doubt that the two genera should be 
placed in the Amitermintae.

M. L. Roonwal
O. B. Chhotani

Zoological Survey of India,
34, Chittaranjan Avenue,
Calcutta-12.
16-6-1960

Soldier and other castes in termite genus *Speculitermes*
and the phylogeny of *Anoploderma-Speculitermes* Complex

By


and

O.B. CHHOTANI, M.Sc. (Hons.)

Zoological Survey of India, Calcutta - 12

(With 4 Tables, 5 Text-figures and 4 Plates)

CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I - Introduction</td>
<td>670</td>
</tr>
<tr>
<td>II - Material</td>
<td>673</td>
</tr>
<tr>
<td>III - The Castes in Genus <em>Speculitermes</em></td>
<td>675</td>
</tr>
<tr>
<td>IV - Biology and Habits of <em>Speculitermes</em></td>
<td></td>
</tr>
<tr>
<td><em>sinhalensis</em></td>
<td>685</td>
</tr>
<tr>
<td>V - The Castes in Genus <em>Anoploderma</em></td>
<td>689</td>
</tr>
<tr>
<td>VI - Phylogeny and Zoogeography of</td>
<td></td>
</tr>
<tr>
<td><em>Anoploderma-Speculitermes</em> Complex</td>
<td>690</td>
</tr>
<tr>
<td>VII - Summary</td>
<td>702</td>
</tr>
<tr>
<td>VIII - References</td>
<td>703</td>
</tr>
</tbody>
</table>
ABSTRACT

The absence of a soldier caste has hitherto made the phylogenetic placement of the closely allied termite genera *Anoplotermes* and *Speculitermes* difficult and controversial. Authorities have been almost equally divided in assigning them to the subfamilies Amitermitinae and the Nasutitermitinae (of the family Termitidae).

The soldier caste in *Speculitermes* (*S. sinhalensis* R. & S.), reported by us sometime ago (Roonwal and Chhotani, 1960b, preliminary communication) is now confirmed on much more abundant material, and that caste is described more fully. The imago of that species is reported for the first time.

Some field data on the biology of this species in Peninsular India are discussed. The soldiers occur rarely, apparently only in certain seasons, and form only about 0.02 to 0.44% of the soldier-worker population. Nesting occurs in subterranean galleries.

The phylogeny and zoogeography of the *Anoplotermes—Speculitermes* complex are discussed. The evidence from morphology, especially from the recently found soldier caste in *Speculitermes*, is generally in favour of assigning the genus to Amitermitinae. The indirect evidence from the termiophiles (Coleoptera: Staphylinidae), however, is less clear and partly supports the assignment of *Anoplotermes* to the Nasutitermitinae,
but assignment to the Amitermitinae has been suggested by Seevers. On the whole, the assignment of both the genera to the Amitermitinae is favoured.

Zoogeographically the two genera are believed to have arisen in South America in mesozoic times (when the southern land-mass was united) and thence spread to Africa and South Asia.
I - INTRODUCTION

Out of nearly 180 known genera of living termites, the soldier caste has, until recently, not been found in only two rather closely allied genera, namely, Anoplotermes F. Müller (1873) and Speculitermes Wasmann (1902), even though they are represented by many species, are widespread and have been collected extensively for more than 60 years. In the allied genus Protohamitermes Holmgren also the soldier caste has not yet been found, but the genus is very rare and is represented by a single species; it is likely that with further collection the soldier caste may be found in it. Some authorities (e.g., Holmgren, 1912; Hare, 1937; Grassé, 1949; etc.) regard Speculitermes as a subgenus of Anoplotermes.

The genus Anoplotermes is widely distributed in the Neotropical region (South and Central America), the southern portion of the United States of America and in Africa, and recently, a single species, A. shillongensis R. & C., was found in Assam, Eastern India (Roonwal and Chhotani, 1969, 1964). Out of 44 known species of this genus, 32 are Neotropical (one of them is also Nearctic), 11 Ethiopian and one Indo-Malayan.

In the genus Speculitermes, out of the 13 known species and subspecies (vide Snyder, 1949; Roonwal and San-Garma, 1960; Roonwal and Chhotani, 1962, 2, 1964; and Chatterjee and Thapa, 1964), 4 are Neotropical (South America), and 9 Indo-Malayan
(India, East Pakistan / East Bengal, / Burma and Ceylon); the
genus has not been found in Africa but may well occur there.
The following are the 9 Indo-Malayan species of *Speculitermes*:

1. *S. chadaensis* Chatterjee & Thapa 1964. - Madhya Pradesh, India.


8. *S. sinhalensis* Roonwal & Sen-Sarma 1960. - Peninsular India and N. Ceylon. (Originally described as *S. cyclopa sinhalensis*. Soldier caste found in this species only.)


In only one of the 56 known species, namely *Speculitermes sinhalensis* R. & S., of these two genera has a soldier caste been found recently by Roonwal and Chhotani, 1960b. It is believed that the soldier caste in these genera has been lost secondarily.
Goetsch (1939) reported that in artificial colonies of *Anoplotermes cingulatus* (Burmeister) from the Argentine a single soldier was produced, and it was intermediate in characters between the nasute and the mandibulate types, as in *Armigermes*. There has been no confirmation so far of this finding. Later on, Goetsch (1946, 1947) claimed having shown the occurrence in the body of certain insects, especially termites, of substances called by him the "vitamin T complex", which accelerate the vital processes and induce the formation of soldiers in termite species which do not ordinarily produce that caste. This work also remains uncorroborated.

The phylogeny of the *Anoplotermes-Speculitermes* group is highly controversial, and the opinions of various authorities are at present almost equally divided between the placement of the group either in the subfamily Nasutitermitinae or the Amitermitinae of the family Termitidae.

In the present account, the soldier caste in *Speculitermes sinhalensis*, a preliminary announcement of which was made by us some time ago (Rooewal and Chhotani, 1960b) is described fully and with more abundant material obtained as a result of intensive field surveys carried out for that purpose in Peninsular India. The imago caste of this species is described here for the first time. The phylogeny of the *Anoplotermes-Speculitermes* Complex is discussed on the basis
of the morphology of the various castes, particularly of the recently discovered soldier, and on other evidence. It is concluded that, on the whole, it is desirable to place these two genera in the subfamily Amitermitinae rather than in the Nasutiterminae. The zoogeographical origins and dispersions of the two genera are also discussed, and it is concluded that they probably arose in the Neotropical region in early mesozoic times before the continents had drifted apart in Wegener's sense (Wegener, 1922) and thence spread further east to Eastern India.

II - MATERIAL

A considerable collection (79 vials) of *Speculitermes sinhalensis* Rooval & Sen-Sarma from Peninsular India and Ceylon was examined. It is listed below in some detail in order mainly to illustrate the occurrence, and rarity, of the soldier caste; the lots where only workers were found are lumped together for the sake of brevity.

(a) Present in Zoological Survey of India, Calcutta

LOTS (A) - (D). - Containing soldiers, imagoes and workers, as follows:

LOT (A). - 2 vials, Saptapur area, Dharwar (Dharwar District, Mysore State, India), c. 15°27' N. lat. and 75°05' E. long., J.C. Uttamch coll., 1959-60, thus: - (1) A vial with one soldier and several workers and imagoes, 12.iv.59, "winged
forms, soldier and workers coming out of hole in ground and
from earth about 5 cm. below ground level". (ii) A vial with
several imagos and workers, 18.iii.60.

LOT (B). - 7 vials, Saptapur area, Dharwar, E.G. Dhar
coll. (the denominator in Field Coll. No. indicates the date
of collection), thus i- (iii) No. DB/10.9.60, one soldier
(incompletely chitinised) and several workers and nymphs, ex
"earth". (iv) No. D1/11.9.60, 2 soldiers and several workers
and nymphs, ex "galleries in soil under dry cowdung lying on
ground; galleries running about 30 cm. below ground level".
(v) No. D12/11.9.60, 3 soldiers and several workers, ex
"galleries under dry cowdung lying on ground". (vi) No. D2/
14.9.60, one soldier and several workers, ex "earth at the
base of bamboo". (Found mixed with Odontotermes sp.) (vii)
No. D17/14.9.60, 3 soldiers and several workers, ex "galleries
in soil under dry cowdung lying on ground". (viii) No. D1/20.9.60, 3 soldiers and several
workers and nymphs, ex "galleries in soil under dry cowdung
lying on ground; galleries running upto 50 cm. below ground-
level". (ix) No. D1/21.9.60, 5 soldiers and several workers,
ex "galleries in soil under cowdung". (Found mixed with
Capritermes sp. and Odontotermes sp.)

LOT (C). 4 (x) A vial, No. 012/9.11.62, a queen, a dealte
imagi male and several workers and nymphs, Dharwar, O.B. Chhotani
coll., 9.x1.62, ex "nest in soil".

LOT (D). - 2 vials, Coimbatore (Coimbatore District,
Madras State, India), 9.1100' N. lat., 7700' E. long.,
altitude 427 m. (ca. 1400 ft.) above mean sea-level, thus:—

(xii) A vial with one soldier and several workers and imagos, P. Susai Nathan coll., 11.iv.60, ex "black cotton soil".

(xii) No. 03/26.11.62, one soldier and several workers, C.R. Chhotani coll., 26.xi.62, ex "galleries in earth".

LOTS (E)-(I). - 58 vials, workers only, Madras and Mysore State (India) and Ceylon, coll. H.S. Pruthi (1929), P.C. Dhar (1960) and C.R. Chhotani (1962).

(b) Present in the Indian Agricultural Research Institute, New Delhi

LOT (J). - 6 vials, workers only, Madras and Mysore States (India), T.B. Fletcher coll., 1912.

(c) Present in the Forest Research Institute, Dehra Dun

LOT (K). - (i) One vial, workers only, Vavuniya (North Province, Ceylon), Sandrasagara coll., 13.xii.61; (ii) 2 vials, several workers, Madras State (S. India) thus; Chitteri, Salem District, 3000 ft., Pruthi coll.; and Shevaroy Hills.

III - THE CASTES IN GENUS SPECULITERMES

(Tables 1-3; Text-figs. 1-3; and Plates 1-3)

The soldier caste in genus Speculitermes was, until recently, believed to be entirely absent, only workers and reproductives (alates) being reported. Roomwal & Chhotani (1960b, preliminary account) found it in the Indian species
S. sinhalensis* Roonwal & Sen-Sarma. As no comprehensive account of the castes of this species exists, they are described below. Of special interest are the soldier caste (now confirmed and fully described on more abundant material than was available to us earlier) and the imago (described here for the first time).

Speculitermes sinhalensis* R. & S.

(a) Description

1. IMAGO (Table 1, Text-fig. 1; and Plates 1 and 3). -

   General: Head-capsule blackish, with a pair of small, pale, subcrescentic, spots on frons between postclypeus and lateral ocelli; postclypeus and pronotum blackish brown; antennae and labrum brown; mandibles brown, with dark brown toothed margins; eyes black; ocelli translucent white; wing-

* This was originally described as a subspecies of S. cyclops Wasmann, but we now regard it as a full species for reasons given in the present paper (vide infra, 'Comparison'). The original particulars are:
membranes brown; wing-scales dark brown; legs yellowish brown
to brown; abdominal tergites dark brown; abdominal sternites
brownish, paler medially. Head-capsule fairly densely pilose,
with many small and some long hairs; body fairly densely pilose,
with longish hairs. Total length (without antennae): with
wings 15.0 - 16.9 mm., without wings 7.2 - 9.4 mm.

Head: Subcircular; broader than long (width with eyes
1.43 - 1.63 mm.; length to lateral base of mandibles 1.1 - 1.2
mm.); weakly depressed in middle in region of fontanelle;
mid-dorsal spot minute and circular; lying in middle of head-
dorsum. Eyes: Two, one on either side, subround; black; maximum
diameter with ocular sclerite 0.37 - 0.40 mm. Ocelli: Two
lateral, suboval, translucent ocelli, one on either side;
maximum diameter 0.17 - 0.18; minimum diameter 0.11 - 0.13 mm.;
separated from the eye of its side by about one-half its (45% of ocellus) long diameter or a little more (eye-ocellus distance
0.085 - 0.110 mm.). Antennae: With 15 (rarely 16) segments;
pilose; segment 1 longest, cylindrical, weakly tapering proxim-
ally; 2 shorter than 1 and longer than 3, cylindrical; 3
shortest (and in 16-segmented antennae subdividing into two
halves -- a small proximal half and a longer distal one); 4
longer than 3; 5-9 (or 10) club-shaped and increasing in length
in that order 10 (or 11) - 14 gradually decreasing in length in
that order; last (15 or 16) ovate and slightly longer than the
penultimate one. Labrum: Broad and tongue-shaped, the distal
end narrowing to form a more or less truncate apex; with long
and short hairs on body. Clypeus: Divided into an ante- and a postclypeus. Anteclypeus subtrapezoidal, hyaline, apilose. Postclypeus with many short and a few long hairs; divided into right and left halves by a median suture; slightly longer than one-half its width (maximum length 0.38 - 0.40 mm.; maximum width 0.66 - 0.73 mm.); posterior margin round. Mandibles: Longish; anterior margin weakly incurved. Left mandible with an apical and 2 marginal teeth; apical finger-like; 1st marginal either subequal to, or slightly shorter than, the apical; 2nd short, widely separated from 1st. Right mandible also with an apical and two marginal teeth; apical finger-like; 1st marginal either subequal to, or slightly shorter than, the apical; 2nd short.

Thorax: Pronotum: Blackish brown, with a curved dark brown strip a little below anterior margin and a pale median vertical line; anterior margin in profile slightly raised, weakly concave and without a median notch; sides broadly rounded at postero-lateral margins, straight and weakly narrowing infront; posterior margin round, with a deep median notch. Mesonotum and metanotum: Somewhat darker than pronotum; sides in posterior lobe hyaline; posterior margin with a deep median notch. Legs: Long, thin and pilose; apical tibial spurs: 3 in fore-legs (with 3rd or dorsal spur quite prominent) and 2 each in middle- and hind-legs; tibial spur formula 3 : 2 : 2). Tarsi 4-jointed.
Wings (Text-fig. 1): Transparent, brown; wing-membranes covered with minute, variously-shaped scales; with numerous minute hairs all over membrane in forewing, but with only a few hairs, present distally, on hindwing; forewing 13.1 - 14.7 mm., hindwings 12.2 - 13.2 mm. long. Forewing: Longer than hindwing; scale also longer than in hindwing. Costa-subcosta greatly thickened and chitinised and forming the anterior margin of wing; fringed with a row of minute hairs. Radius short, arising independently from wing-scale and fusing with costa-subcosta just outside the scale. Radial sector as thick and chitinised as the costa-subcosta; running parallel to and near the latter, and fusing with it as distal end. Median moderately chitinised and arising independently inside the wing-scale; running all along the length of wing and giving 2-3 branches in distal third. Cubitus prominent and giving 11-13 moderately chitinised branches to posterior margin of wing; branches generally not further subdivided. Hindwing: Shorter than forewing. Costa-subcosta, radius and radial sector as in forewing. Median arising from radial sector just outside the scale; moderately chitinised and giving 2-4 branches in distal third of wing. Cubitus well marked, giving 11-12 branches to posterior margin of wing; otherwise as in forewing.


Measurements: - See Table 1.
2. SOLDIER (Table 2 and Plates 2 and 3). -

The soldier caste in *Speculitermes sinhalensis* was recently reported by us (Roonwal & Chhotani, 1960b) in a brief, preliminary account based on two soldiers (the first ever to be described in the genus) — one each from two separate collections, which also contained workers and alates, from southern India. A complete description, based on more abundant material (*vide* above), is given below.

**General:** Head-capsule dark brown, with a pale yellow streak running backwards on either side of mid-dorsal line along the frons and converging posteriorly (in Coimbatore specimens, the streak brownish and not prominent); frons either deep brown or paler; labrum pale yellow; antennae brownish, with distal tip of each segment hyaline; mandibles dark brown distally, paler proximally; thorax, legs and abdomen yellowish white. Head and thorax sparsely, and abdomen moderately, pilose. Total body-length (with mandibles but without antennae) 6.5 - 8.2 mm.

**Head:** Head-capsule subrectangular, rather flat; longer than broad (length to lateral base of mandibles 2.3 - 2.6 mm.; maximum width 1.80 - 1.93 mm.; index Width/Length 0.74 - 0.83); frons weakly sloping in front. Fontanelle indistinct. **Eyes and ocelli:** Absent. **Antennae:** With 14 segments; pilose, pilosity gradually increasing distally; segment 1 longest, cylindrical; 2 slightly longer than one-half of 1, also cylindrical; 3 club-shaped, slightly longer than 2 and incompletely divided into a
distal and a proximal half; 4–8 club-shaped, increasing in length in that order; 9–13 also club-shaped but decreasing in length in that order; the last (14) ovate and shorter than the penultimate one. Labrum: Dome-shaped in outline; with a few hairs near anterior margin and on body; broadest near base, sides weakly converging in front. Clypeus: Divided into an ante- and a postclypeus. Anteclypeus a subtrapezoidal, hyaline, apilose strip. Postclypeus pale yellow, pilose; divided incompletely by a thin, longitudinal suture into right and left halves. Mandibles: Long and thick, distally strongly incurved and pointed; right and left mandibles almost symmetrical; slightly longer than one-half the length of head to lateral base of mandibles (index Mandible-length/Head-length 0.58 - 0.65); each mandible with a large, slightly forwardly directed triangular tooth at the beginning of distal third of inner margin.

Postmentum: Club-shaped; length shorter than that of head-capsule; with 2 bristles on antero-lateral corners on either side and a few on anterior one-third of body; broadest at about anterior one-fourth; in front of this weakly narrowed, and behind somewhat concave; anterior margin substraight; posterior margin concave.

TheTax: Pronotum: Saddle-shaped; much narrower than head-capsule (a little more than half as wide as the latter; index Pronotum-width/Head-width 0.51 - 0.53); much broader than long (length 0.57 - 0.63 mm.; width 0.93 - 1.03 mm.; index Length/Width 0.57 - 0.64); anterior lobe triangular and strongly
raised; anterior margin convex, without a median notch; sides narrowing posteriorly; posterior margin weakly rounded, without a median notch. **Mesonotum**: Slightly narrower than pronotum; sides rounded; posterior margin weakly rounded, medially not notched. **Metanotum**: Slightly broader than pronotum; sides rounded; posterior margin weakly rounded. **Legs**: Long and thin; hind-legs longest, middle-legs shortest. Fore-legs generally with 3 apical tibial spurs (the two ventral spurs, strong, the dorsal spur rudimentary; in 2 out of 12 specimens the left fore-leg with only the 2 ventral spurs, Pl. 2, Fig. K); middle- and hind-legs with only the 2 ventral apical tibial spurs; tibial spur formula generally 3 : 2 : 2, rarely 2 : 2 : 2. **Tarsi**: 4-segmented.

**Abdomen**: Elongate; tergites and sternites very weakly chitinized; moderately pilose. Cerci 2-jointed; 0.1 mm. long. Styli absent.

**Measurements**: See Table 2.

3. **WORKER** (Table 3, Text-fig. 2 and Plate 3)

**General**: Head-capsule brown to greyish brown; postclypeus, antennae and labrum paler; body and legs translucent white. Head sparsely, and body moderately, pilose; hairs rather long. Total body-length without antennae a. 4.5 - 6.3 mm.

**Head**: Subcircular; broader than long (length to base of mandibles 1.06 - 1.17 mm.; maximum width 1.25 - 1.40 mm.) Y-sutures present; a rounded, small (diameter 0.07 - 0.11 mm.),
pale, mid-dorsal spot present at junction of Y-suture. Eyes and ocelli: Absent. Antennae: With 14 segments; segment 1 longest, cylindrical; 2 half of 1 and cylindrical; 3 longer than 2, club-shaped and incompletely subdivided into two by a weak horizontal suture; 4-13 club-shaped; last (14) ovate and subequal to 13. Clypeus: Anteclypeus apilose and subtrapezoidal, with anterior margin medially projected. Postclypeus hairy and greatly swollen; length equal to about half its width. Labrum: Broadly tongue-shaped; broader than long. Mandibles: Of typically Speculitermes-type.

Thorax: Pronotum: Strongly saddle-shaped; broader than long (maximum length 0.37 - 0.46 mm.; maximum width 0.70 - 0.83 mm.). Mesonotum narrower, and metanotum broader, than pronotum. Legs: Moderately long, slender and hairy; apical tibial spurs mostly 2 on each leg, the dorsal spur on fore-leg mostly absent, rarely present (rudimentary when present); tibial spur formula 2 : 2 : 2.

Abdomen: Elongate and hairy; colour greyish because of intestinal contents showing through the transparent tergites and sternites. Cerci 2-segmented, 2x 0.1 mm. long. Styli absent.

Measurements: See Table 3.

(b) Comparisons

As Speculitermes sinhalensis is the only species in which the soldier caste has so far been found, it is not possible to
compare it, in that respect, with other species of its genus.
Regarding the other two castes, the species is distinguishable
from the allied ones as follows:

**IMAGO**: Is easily distinguishable from *S. cyclops* Wasmann,
dharwensis R. & C. and *koesswaldi* R. & C. (*vide* Roomwal &
Chhotani, 1964) by having the mid-dorsal spot on head very
minute vs. larger (maximum diameter 0.25, 0.17 and 0.09 - 0.13
mm. respectively in the other 3 species).

From *S. cyclops*, to which *sinalensis* is closest, the
latter is distinguishable thus: (1) Head-capsule wider (width
with eyes 1.56 - 1.63 vs. 1.40 mm.). (ii) Mid-dorsal spot of
head very minute (vs. large, maximum diameter 0.25 mm. in
*cyclops*). (iii) Lateral ocelli larger (maximum diameter 0.17 -
0.18 vs. 0.13 mm.). (iv) Wings with practically no cross-veins
(vs. with an irregular reticulation of fine cross-veins). (v)
Forewing scale larger (length 0.83 - 0.93 vs. 0.75 mm.).

**WORKER**: Close to *S. cyclops* Wasmann, but differing as
follows: (i) Mid-dorsal spot of head smaller (maximum diameter
0.07 - 0.11 vs. 0.12 - 0.15 mm.). (ii) Abdominal tergites
transparent and weakly chitinised (vs. semi-opaque and relatively
strongly chitinised).

Due to these considerable differences we now consider
*sinalensis* R. & S. as a distinct species rather than as a
subspecies of *S. cyclops* Wasmann.
S. ainhaiangi is known from Ceylon and Peninsular India, as follows:

**CEYLON** : Vavuniya (North Province), the type-locality.

**INDIA**:
- **Madras State** : Districts of Salem (Chitteri, 915 m altitude; Shevaroy Hills and Yercaud) and Coimbatore (Coimbatore).
- **Mysore State** : Districts of Bangalore (Tallagatpura), Bellary (Bellahunisi, Kamalapuram), Chickmagalur (Chickmagalur), Coorg (Anakad Forest Range, 15 miles from Mercara on road to Mysore) and Dharwar (Dandeli and Dharwar).

**IV - BIOLOGY AND HABITS OF SPECULITERMES SINHALENSIS**

(Table 4; Text-fig. 4; and Plates 3 and 4)

Almost nothing is known of the biology and habits of this peculiar genus Speculitermes. Some field observations, made mainly in Peninsular India (Madras and Mysore States) on the biology of *Speculitermes sinhalensis* are, therefore, of interest, particularly with reference to the occurrence of the soldier caste. Field data are available for the months of March, April, June and August to November. Even with this limited data, certain interesting indications are possible, and it may be hoped that future field work in these areas and in Ceylon would fill in the lacunae. The data from the 79 different collections
were tabulated monthwise, and a summary with reference to the occurrence of the various castes is given in Table 4.

1. Seasonal occurrence of soldiers, imagos and nymphs

**Soldiers:** In Dharwar (Mysore State) soldiers were found in April and again in September, being more numerous in the latter month. Further south, in Coimbatore (Madras State), they were found in April and November.

**Imagos:** Winged imagos (reproductives) were noted to form, and emerge from subterranean nests, in March and April. In Dharwar the earliest date is 15th March and the last 12th April. In November, a queen and a dealate male were obtained, the latter suggesting that if imagos are at all formed in autumn their swarming is over before November.

**Workers:** They are met with in large number in all collections and form the bulk (often exclusively) of the colony.

**Nymphs:** Nymphs were met with in Dharwar in September and early November.

2. Frequency of occurrence and proportion of soldier caste

In the considerable material that we have examined, soldiers were found only in 10 out of the 79 different collections, and in single collection the maximum number obtained was 5 soldiers. In the remaining collections no soldiers were found although the number of workers examined was several thousand. In three cases, where all the available individuals were collected from the site, the soldiers formed only 0.02 - 0.44 per cent of the soldier-worker population, as follows :-
This extremely low proportion of soldiers is in striking contrast to other species of termites where the soldiers form roughly 2-10 per cent of the soldier-worker population. Altogether, in several collections over a number of years (1969-62), only 21 soldiers were obtained. Though small, this number is large enough to establish the genuineness of the occurrence of that caste in *Speculitermes*.

3. Subterranean galleries and nest

(Text-fig. 4)

The workers are sluggish creatures and spend most of their time in narrow, subcylindrical, subterranean galleries which are about 2-5 mm. in diameter, run zig-zag, and open on the ground surface either singly or in groups of four or five, usually under a stone or dry cowdung. They attain a maximum depth of approximately 50 cm. below the ground surface. From the mouth, the galleries generally run more or less horizontally for a short distance before going down. They often branch and cross each other before terminating in rounded, hollow, empty pouches which are about 10-15 mm. in diameter; such pouches also occur along the course of the galleries.
The species apparently does not build a discrete nest as, inspite of intensive digging both in Dharwar and in Coimbatore, we found no regular nests. However, since the alates emerge from ground holes which lead to galleries, breeding must occur underground. In one case (9th November, 1962), a dealate queen (Pl. 3, Fig. 4) was obtained from an underground group of galleries at Dharwar, but here again no discrete nest was found. Nymphs of various stages (Pl. 3, Fig. 5) were found in the subterranean galleries in a few cases.

4. Ecological distribution

(Plate 4)

Ecologically, the species seems to be confined to semi-open forests (Pl. 4) in the tropical and subtropical portions of Peninsular India and Ceylon. But the fact that it has been found at moderate altitudes in Salem District, Madras State (Salem District: Chitteri, 6. 915 m. altitude; and Shevaroy Hills) would suggest that it may occur in cooler regions as well, its subterranean mode of life apparently protecting it from the cold.

5. Other aspects of biology

Association with other species: In the subterranean galleries, the workers of R. sinhalensis are occasionally found to be associated with those of two other species of subterranean termites, namely, Odontotermes sp. and Capritermes sp.
Protosoa from the gut: We did not make any observations. Uttangi and Desai (1962) found the following three species of gregarine Protosoa from the foresgut of workers from Dharwar:

- **Hirmocystis speculitermes** U. & D. - Nearly all workers were found infected with 6 - 10 sporonts of this species.
- **Hirmocystis dharwarensis** U. & D.
- **Steinina termitis** U. & D.

V - THE CASTES IN GENUS **ANOPLOTERMES**

(Text-fig. 5)

Little need be said about the castes in the widely spread and highly successful genus **Anoplotermes**. Only two castes have been found, viz., the worker and the imago (reproductives). The soldier caste has never been found in nature.

However, Goetsch (1939, 1946, 1947) stated that in the South American species, **A. cingulatus** (Burm.), under certain conditions all the young nymphs in a nest were transformed into 'pre-soldiers' ("Vorsoldaten") and one of them became a true soldier. Goetsch attributed this to a substance, called by him 'Vitamin T', which according to him, occurs in several insects, especially termites, and the lower fungi. This unusual, soldier as illustrated by Goetsch (1947, p. 268, Fig. 11f), is reproduced by us in Text-fig. 5. According to Goetsch, it has developed a nasute defense organ on the head and the mandibles and their
musculature are also enlarged. These interesting claims of Goetsch have never been confirmed.

VI - PHYLOGENY AND ZOOOGEOGRAPHY OF ANOPLOTEREMES - SPECULITEREMES COMPLEX

(a) General

Anoplotermes and Speculitermes are regarded by some authorities (Holmgren, 1912; Grassé, 1949) as constituting a single genus, the latter forming a subgenus of the former, while others (Snyder, 1949; Roonwal and Chhotani, 1959) consider them as two distinct genera, and Roonwal and Chhotani have given a key for their separation. We may conveniently regard the two genera, which constitute a closely knit group of species, as the "Anoplotermes - Speculitermes Complex".

Owing mainly to the "absence" of the soldier caste (which, in the Isoptera, provides excellent differentiating characters for both genera and species) the phylogenetic position of the Anoplotermes-Speculitermes Complex has remained controversial. While the assignment of this Complex to the family Termitidae is universally and correctly accepted by all authorities, two different views have been held on the subfamily assignment (vidae also Weesner, 1960, p. 154). The first view assigns the Complex to the subfamily Nasutitermitinae and the second to the Amitermiteinae. These views are discussed below.
and, finally, our own view, based among other considerations, on the characters of the recently discovered soldier caste in a species of *Speculitermes*, is presented here.

**b) First view: Assignment to Subfamily Nasutitermitinae**

The assignment of the *Anoplotermes-Speculitermes* Complex to the Nasutitermitinae has been advocated by Silvestri (1903), Holmgren (1906, 1912, 1913) and Grassé, 1949).

Both Silvestri (1903) and Holmgren (1906) implied the affinity of *Anoplotermes sens. lat.* with Nasutitermitinae group of termites since they placed that genus immediately contiguous with *Rutermes* Müller sens. str. In a later paper, Holmgren (1912, pp. 74-75) gave a more specific and clear-cut opinion in favour of regarding *Anoplotermes* as belonging to the Nasutitermitine group, and affirmed that the determination of the position of *Anoplotermes* does not present any difficulties. He pointed out that if we compare the imagos of *Anoplotermes atrer* with those of *Subulitermes microsoma* and *Convexitermes convexifrons*, a very close relationship is apparent, so much so that *A. atrer* and *C. convexifrons* might be regarded as subgenera of a common genus.

The close affinity of the three genera is strengthened by the structure of the brain which in all the three genera is well developed and fills the entire width of the head. A small difference is noticeable in the workers where the number of antennal segments is 14 in *Anoplotermes* and 12-13 in the other two genera. Holmgren concluded that *Anoplotermes* arose from the
"Eutermes"-group of species where the soldier caste is "completely reduced", and the genus lies on the Subulitermes-branch of the Eutermes-tree. He, however, did not take into consideration the evidence from the imago and worker mandibles.

Later on, Holmgren (1913, p. 267) assigned the same phylogenetic position also to Speculitermes (which he regarded as a subgenus of Anoplotermes), and reaffirmed that this subgenus should follow Eutermes Müller in the Eutermes-series.

More recently, Grasse (1949, p. 537), also placed the genus Anoplotermes (including its subgenus Speculitermes) in the subfamily Kasutitermitinae, in his "group (a)" which contains the genera without or with nasutiform soldiers having well-developed mandibles, such as Syntermes Holmg., Lablotermes Holmg., Cronitermes Wasm., Armitermes Wasm., Curvitermes Holmg. and Rhynchoter mes Holmg. His "group (b)" contains the genera with nasutiform soldiers with reduced mandibles, such as the old composite genus Eutermes Müller (sens. lat.), and several of its derivates, e.g., Anularitermes Womers., Subulitermes Holmg., Convexitermes Holmg., Constrictotermes Holmg., Velocitermes Holmg. (synonym Uniformitermes Snyd.), Ceylonitermes Holmg., Trinervitermes Holmg., Diversitermes Holmg. and "Nasulitermes Banks" (= Dudley J.

(c) Second view: Assignment to subfamily Amitermitinae

The assignment of Anoplotermes-Speculitermes Complex to the Amitermitinae has been advocated by Light (1933), Hare (1937),
Snyder (1949) and Ahmad (1950). Light (1933, p. 135), on the basis of worker mandibles, drew attention to the affinities between the genera *Anoplotermes* and Light's new genus *Hoplotermes*, from Mexico, which is allied to *Amitermes* (subfamily *Amitermitinae*). He stated (p. 135) that there is a close resemblance between workers of *Hoplotermes* and *Anoplotermes*, especially in the mandibles, although *Hoplotermes* has a soldier with strongly armoured mandibles and *Anoplotermes* is devoid of that caste.

Hare (1937, p. 463) accepted the similarity in the worker mandibles between *Anoplotermes* and the two *Amitermitine* genera *Hoplotermes* (as shown by Light, 1933), and *Eurytermes* Wasmann. She stated that because of these similarities *Anoplotermes* should be placed with the *Amitermitinae*. Snyder (1949), in his world "Catalog", also included *Anoplotermes* and *Speculitermes* in the *Amitermitinae*, and placed them adjacent to the genera *Hoplotermes* Light, *Eurytermes* Wasm. and *Prohamitermes* Holmg. on the one hand, and *Cephalotermes* Silv., *Labritermes* Holmg., *Cylindrotermes* Holmg. and *Epamitermes* Holmg. on the other.

Based on the imago–worker mandibles, Ahmad (1950, pp. 65-66) accepted Hare's view of placing *Anoplotermes* (sens. lat.) in the *Amitermitinae*. He divided that subfamily into three series, *Visa*, the *Protohamitermes*-series, the *Microrotermes*-series and the *Pseudomicrotermes*-series, and placed *Anoplotermes* (sens. lat.) in the *Protohamitermes*-series which included the genera *Protohamitermes*,...
Eurytermes, Anoplotermes (including Speculitermes), Ruhamitermes, Hoplotermes and Ahamitermes. He placed Ruhamitermes next to Anoplotermes on the basis of the worker mandibles alone, but added that since the imago of Ruhamitermes is as yet unknown and no soldier caste is found in Anoplotermes, the exact relationship between the two genera are difficult to understand. He further remarked that the relationship between the genus Anoplotermes and its subgenus Speculitermes would also be difficult to study until more information on the former is available. From the existing evidence, according to him, Speculitermes is more primitive, and the short third antennal segment and the less conspicuous second marginal tooth of the right mandible of Anoplotermes (sensu str.) indicate its higher evolutionary status.

(d) Discussion on phyloseny

We may now consider the evidence, particularly the recent one, available from various sources.

(i) The evidence from soldiers

The recent discovery by Roomwal and Chhotani (1960) of the soldier caste in a species of Speculitermes (S. sinhalensis R. & S.) furnishes perhaps the clearest evidence to decide the phylogenetic placement of the genus, since soldiers provide excellent and reliable characters in this respect. The soldier has a large, rectangular head, stout, sabre-shaped incurved mandibles, each with a large tooth a little above the middle of
the inner margin, indistinct fontanellae, 4-jointed tarsi and a 3 : 2 : 2 apical tibial spur formula. All these are typical Amitermitine characters and strongly support the inclusion of the genus in that subfamily; no Nasutitermitine character is to be found in the soldier of *Speculitermes*. Our recent work (Roonwal and Chhotani, 1966a, b – in press) has shown that, taking the genus *Protohamitermes* Holmgren as the most primitive *Amitermitinae* genus (the soldier caste here too is not yet known), the remaining genera which are close to *Speculitermes* may, on the basis mainly of soldier characters (e.g., head, mandibles and antennae), be pooled into two groups, *viz.*, first the *Speculitermes*-group (containing *Speculitermes* and probably *Anoploterms*), and secondly the *Ruhamitermes*-group (containing, in the ascending order, the genera *Ruhamitermes*, *Eurytermes* and *Hoploterms*).

For *Anoploterms* the evidence from soldiers is not available since that caste has never been found in nature in any of the numerous species. The production by Goetsch (1939, 1946, 1947) of a single nasutiform soldier in *A. cingulatus* under artificial conditions (*vide supra*) needs confirmation, and we cannot as yet seriously accept that evidence.

(ii) The evidence from imagos and workers

In the following characters *Speculitermes* resembles more the Amitermitinae than the primitive Nasutitermitinae (e.g., *Syntermes*, etc.): - Labrum broader than long (*vs.* generally long and narrow in the Nasutitermitinae); fewer antennal segments
(15 in imagos, 14 in workers, 19-21 in Synterme$); the 
apical tooth of mandibles subequal to the 1st marginal (vs, 
smaller in the primitive Nasutitermitinae); the posterior 
margin of the 2nd marginal tooth of the right mandible concave 
(vs, straight in the primitive Nasutitermitinae); and the apical 
tibial spurs on the fore-, middle- and hind-legs being 3 : 2 : 2 
in Speculitermes and most of the Anoploterme$, but 2 : 2 : 2 
in a few species of the latter (vs, 2 : 2 : 2 in most of the 
Nasutitermitinae, but 3 : 2 : 2 in the primitive species, Synterme$ and some Procornitermes).

The above differentiations also generally apply to 
Anoploterme$, but further information on that genus is desired 
before a more definite opinion can be given.

A word here is necessary about the occurrence of a mid­
dorsal spot ('Stirrupcellus' of Wasmann, 1902) in the middle of 
head-dorsum in imagos and workers of Speculiterme$ and Anoploterme$. 
The mid-dorsal spot is prominent in imagos and workers of all 
species of Speculiterme$, but in Anoploterme$ it is either greatly 
reduced or absent. The spot in Speculiterme$ is variable in shape, 
size, etc. in the different species. Thus, it may be either flat 
(flush with the head-surface) or swollen; in shape may be rounded, 
triangular or irregular; the size may vary from minute to fairly 
large; and the spot is generally translucent or a little paler 
than the rest of the head-capsule. It is quite characteristic 
and distinguishes Speculiterme$ (and Anoploterme$ when the spot 
is present) from the allied genera.
The evidence from termitophiles

Seevers (1957, pp. 28-32) has brought forth interesting secondary evidence for determining the position of Anoplotermes, which he assigns to the Amitermitinae, based on the existence of termitophilous insects of the family Staphylinidae (order Coleoptera). He pointed out that the two main branches of the subfamily Nasutitermitinae, via the relatively primitive branch (with the normal sabre-shaped mandibles) and the more specialised nasutiform-branch (with nasute soldiers having the head prolonged into a 'nose' and with reduced mandibles) — see also Grasse, 1949, pp. 536-537 in this connection, vide supra — has associated with them two different subtribes (of the tribe Corotocini) of the termitophilous Staphylinidae. With the former branch the subtribe Timeparthenina, and with the latter the subtribe Termipterastrina, are associated. The subtribe Timeparthenina is, according to Seevers, the more generalised of the two. What is important here from our point of view is that Seevers found that the subtribe Timeparthenina is also associated with Anoplotermes, which genus Seevers regards as belonging to a different subfamily, the Amitermitinae, and not to the Nasutitermitinae.

This strange situation, namely, of the same natural group of termitophilous insects being associated with two different subfamilies of hosts, Seevers tried to explain (pp. 30-32) in the following manner:
He admitted that while the primary association of the Timeparthenina was with the generalised mandibulate genera of the Nasutitermitinae, the fact of the two most specialised genera, *Timeparthenus* and *Ptocholellus*, occurring with *Anoptotermes* (according to him an Amitermes) needs explaining. He suggested three alternatives, thus: (i) A species of an established termitephilous group adapted itself rapidly to a host-species of another subfamily. (ii) The termitephilous group was established with a termite stock ancestral to both the termite subfamilies in question. (iii) The differentiation of the termitephilous tribe Corotocini occurred early enough in the history of the termite family Termitidae (to which both the Nasutitermitinae and the Amitermitinae belong) to permit descendants of the early Corotocines to evolve with the Amitermitinae as well as with the Nasutitermitinae. The objections to this third possibility are first, that among the Amitermitinae only *Anoplotermes* harbours the Corotocini; and secondly that only the most specialised members of the sub-tribe Timeparthenina occur with *Anoplotermes*.

According to Seegers, the evidence from the Timeparthenina supports the first of the three alternatives mentioned above, i.e., the primary evolution of termitephilous subtribe Timeparthenina took place in association with several primitive Nasutitermitinae, followed by a secondary establishment of a termitephilous species with a species of *Anoplotermes*. This led to subsequent differentation of specialised genera such as *Timeparthenus* and *Ptocholellus*. 
A fourth, and in some respects the easiest, alternative, *via*., of simply regarding *Aponotermes* as belonging to the Nasutitermitinae instead of the Amitermitinae, and which would have met all the difficulties mentioned above, was not considered by Seever's. If we take the evidence from the termiophiles alone, it is, on the whole, in favour of regarding *Aponotermes* as a Nasutitermitine but morphological evidence generally favours its inclusion in the Amitermitinae (*vide supra*) and for this reason Seever's first alternative is perhaps more acceptable than the extreme fourth alternative. No evidence from the genus *Speculitermes* is available in regard to the termiophiles.

(iv) Conclusions regarding phylogeny

The morphological evidence available from the imagos, workers and soldiers (where present) is in favour of regarding the *Aponotermes-Speculitermes* Complex as among the relatively primitive (but not the most primitive) genera of the subfamily Amitermitinae, although here and there occur some resemblances with the primitive, mandibulate Nasutitermitinae such as *Syntermes* and *Procornitermes*. Secondary evidence, such as the one brought forth by Seever's (1957) from the Staphylinid termiophiles, poses certain problems which, as discussed above, can best be explained by regarding *Aponotermes* as a Nasutitermitine rather than an Amitermitinae genus, although Seever himself did not consider that view but only those alternatives which assume an Amitermitine affinity. We would, however, give more emphasis to the primary
evidence from morphology rather than to the secondary one from termophiles, and therefore, regard this Complex as belonging to the Amitermitinae.

As shown by us elsewhere, in our revision of the allied genus *Eurytermes* Wasmann (Roomwal & Chhotani, 1965b -- in press), the most primitive Amitermitine genus, *Protohamitermes* (with 3 well developed marginal teeth on the left mandible, as in the Rhinotermitidae) gave rise to a number of primitive genera which can, on the basis of morphological evidence, be pooled into two groups, *viz.*, a *Speculitermes*-group (containing *Speculitermes* and *Anoploterms*) and a *Rhitermes*-group (containing *Rhitermes*, *Eurytermes* and *Hoploterms* in that ascending order).

(e) Zoogeography of Anoploterms-

*Speculitermes Complex*

Regarding the geographical origins and dispersions of the genera *Anoploterms* and *Speculitermes*, Emerson (1955), who assigns them to the subfamily Amitermitinae, stated thus regarding *Anoploterms* (pp. 500-501).

"This genus shares the loss of the soldier caste with the somewhat more primitive *Speculitermes*. The large number of

* The soldier caste in *Speculitermes* has since been found (Roomwal and Chhotani, 1965b; and the present account).
species in the Neotropical and Ethiopian regions and the lack of any record in Indomalaya, where one species of *Speculitermes* is known, present a unique pattern of distribution. These two genera might be expected to have arisen in the Indomalayan region in the late Cretaceous from more primitive Amitermiteae still represented in the tropical orient ...

Emerson further stated that the rarity or possible absence of *Anoplotermes*† in the Indo-Malayan (but see foot-note) and Madagascar regions seems to have no reasonable explanation. It seems to us that Emerson's problem arises from his assumption of the origin of the genera *Anoplotermes* and *Speculitermes* in the Indo-Malayan region and its subsequent dispersion to Africa and South America. On the other hand, if we regard (vide Roonwal and Chhotani, 1959; and Roonwal, Chhotani and Bose, 1962) the *Anoplotermes-Speculitermes* Complex as having originated in the Neotropical region (as would be justified by its present predominance there) in the early mesozoic times, when the three continents (South America, Africa and South Asia) were united

* Several other species have since been discovered (vide supra, under 'Introduction'), and a total of 9 are now known from the Indo-Malayan region.

† One species, *A. shilongensis* R. & C., has since been found in Assam, India (Roonwal and Chhotani, 1959, 1960a, 1962a, b).
into a single land-mass which later gradually drifted apart (Wegener’s Hypothesis; Wegener, 1922), this difficulty can be resolved. At the extreme eastern end which it reached (Assam, India), *Anoplotermes* is represented by a single species. *Speculitermes* is better represented in India (9 species) than in South America (4 species) and could conceivably have originated in Indo-Malaya. But the Complex as a whole is predominant in the Neotropics where it is more likely to have arisen. The absence of *Speculitermes* in the intervening region of Africa is difficult to explain, and is not unlikely that the genus may yet be found there.

While today *Anoplotermes* and *Speculitermes* are easily separable, although they remain closely allied, the common early origin of the *Anoplotermes-Speculitermes* Complex in the neotropics and its subsequent spread to Africa and South Asia seem to fit the known facts better than any alternative view.

**VII - SUMMARY**

1. The soldier caste, hitherto believed to be absent in the genus *Speculitermes* wasp., but recently reported in a preliminary communication by us (Roonwal & Chhotani, 1960b) in an Indian species, *S. sinhalensis* R. & S., is confirmed on more abundant material, and described fully.

2. The imago caste of this species is described here for the first time.
3. Some aspects of the biology of S. sinhalensis, including the possible seasonal occurrence of the various castes, especially the soldier, are discussed. Soldiers occur in Peninsular India in April and September in Dharwar (Mysore State) and in April and November in Coimbatore (Madras State). They are very rare, forming only 0.02 - 0.44 % of the soldier-worker population. Nesting occurs underground.

4. The phylogeny and zoogeography of the Anoplotermes-Speculitermes Complex are discussed. The evidence from morphology, especially from the recently found soldier caste in Speculitermes, is strongly in favour of assigning the genus to the subfamily Amitermitinae. The indirect evidence from termitophiles (Coleoptera : Staphylinidae), however, is less clear, and partly supports the assignment of Anoplotermes to the Nasutitermitinae, but assignment to the Amitermitinae has been suggested by Seevers. On the whole, the assignment of both genera to the Amitermitinae is favoured.

5. Zoogeographically, the two genera are believed to have arisen in South America in the mesozoic times (when the southern land-mass was united) and thence spread to Africa and South Asia.

VIII - REFERENCES


element (Anoplotermes) in the Indian termite fauna,
with fuller description of A. shillongensis from
Assam. - Rec. Indian Mus., Delhi, 58 (3-4) /1960/, pp. 159-168, 1 pl.

ROONWAL, M.L. and CHHOTANI, O.B. 1962b. Termite fauna of
Assam Region, eastern India. - Proc. nation. Inst. Sci.
India, New Delhi, (B) 28 (4), pp. 231-406, 26 pls.

ROONWAL, M.L. and CHHOTANI, O.B. 1962c. A new species and a
new subspecies of the termite Speculitermes (Termitidae,
Amitermitinae) from India. - Zool. Anz., Leipzig, 168
(1-4), pp. 57-63, 2 pls.

ROONWAL, M.L. and CHHOTANI, O.B. 1964. Systematics of oriental
termites. No. 8. Two new species of Speculitermes from
India. - Indian J. agric. Res., Delhi, 34 (2), pp. 120-130.

ROONWAL, M.L. and CHHOTANI, O.B. 1965a. Two new species of
termite genus Euheteritermes from India (Isoptera : Termitidae :

ROONWAL, M.L. and CHHOTANI, O.B. 1965b. Revision of termite
nation. Inst. Sci. India, New Delhi, (B) 31 (3-4), pp. 81-113.

zoogeographical findings in Indian termites. - In: Termites
Paris (UNESCO), pp. 51-64, 1 pl.


### TABLE 1. - *Speculitermes sinhalensis* Roonwal & Sen-Garma.

Body-measurements (in mm.) of imagos.

<table>
<thead>
<tr>
<th>Body-parts</th>
<th>Range (mm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total body-length (without antenna but with wings), $\Omega$</td>
<td>... 15.0 - 16.9</td>
</tr>
<tr>
<td>2. Total-body length (without antenna and wings), $\Omega$</td>
<td>... 7.2 - 9.4</td>
</tr>
<tr>
<td>3. Length of head to lateral base of mandibles</td>
<td>... 1.10 - 1.20</td>
</tr>
<tr>
<td>4. Maximum width of head (with eyes)</td>
<td>... 1.50 - 1.63</td>
</tr>
<tr>
<td>5. Maximum height of head</td>
<td>... 0.63 - 0.70</td>
</tr>
<tr>
<td>6. Maximum length of postclypeus</td>
<td>... 0.38 - 0.40</td>
</tr>
<tr>
<td>7. Maximum width of postclypeus</td>
<td>... 0.66 - 0.73</td>
</tr>
<tr>
<td>8. Median length of labrum</td>
<td>... 0.33 - 0.38</td>
</tr>
<tr>
<td>9. Maximum width of labrum</td>
<td>... 0.57 - 0.66</td>
</tr>
<tr>
<td>10. Maximum diameter of compound eye (with ocellar sclerite)</td>
<td>... 0.37 - 0.40</td>
</tr>
<tr>
<td>11. Maximum diameter of lateral ocellus</td>
<td>... 0.17 - 0.18</td>
</tr>
<tr>
<td>12. Minimum diameter of lateral ocellus</td>
<td>... 0.11 - 0.13</td>
</tr>
<tr>
<td>13. Minimum eye-ocellus distance</td>
<td>... 0.085 - 0.110</td>
</tr>
<tr>
<td>14. Minimum eye-antennal distance</td>
<td>... 0.05 - 0.08</td>
</tr>
<tr>
<td>15. Maximum width of pronotum</td>
<td>... 0.73 - 0.87</td>
</tr>
<tr>
<td>16. Maximum width of pronotum</td>
<td>... 1.30 - 1.43</td>
</tr>
<tr>
<td>17. Length of forewing (with scale)</td>
<td>... 13.13 - 14.68</td>
</tr>
<tr>
<td>18. Length of forewing (scale)</td>
<td>... 0.83 - 0.93</td>
</tr>
<tr>
<td>19. Length of hindwing (with scale)</td>
<td>... 12.16 - 13.16</td>
</tr>
<tr>
<td>20. Length of hindwing scale</td>
<td>... 0.63 - 0.70</td>
</tr>
</tbody>
</table>
TABLE 2. - *Scolitermes sinhalensis* Roonwal & Sen-Garma.
Body-measurements and indices of soldiers.

<table>
<thead>
<tr>
<th>Body-parts</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10 specimens)</td>
<td></td>
</tr>
</tbody>
</table>

1. Total body-length (with mandibles but without antennae), $c.$ ... 6.50 - 8.20 mm.
2. Length of head (to lateral base of mandibles) ... 2.30 - 2.60 mm.
3. Maximum width of head ... 1.80 - 1.93 mm.
4. Maximum height of head ... 1.33 - 1.43 mm.
5. Head index I (Width/Length) ... 0.74 - 0.83
6. Head index II (Height/Length) ... 0.53 - 0.57
7. Head index III (Height/Width) ... 0.69 - 0.74
8. Median length of labrum ... 0.33 - 0.40 mm.
9. Maximum width of labrum ... 0.50 - 0.53 mm.
10. Minimum length of mandibles (distal tip to upper base of outer condyle):
   (a) Left mandible ... 1.47 - 1.50 mm.
   (b) Right mandible ... 1.47 - 1.50 mm.
11. Mandible-head length index (Left mandible length/Head length) ... 0.58 - 0.65
12. Tooth distance (distance between base of tooth and distal tip of mandible):
   (a) Left mandible ... 0.47 - 0.50 mm.
   (b) Right mandible ... 0.47 - 0.50 mm.

contd.
<table>
<thead>
<tr>
<th>Body-parts</th>
<th>Range (10 specimens)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>13. Tooth index (Tooth distance/ Mandible length)</strong> :</td>
<td></td>
</tr>
<tr>
<td>(a) Left mandible</td>
<td>0.31 - 0.33</td>
</tr>
<tr>
<td>(b) Right mandible</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>14. Median length of postmentum</strong></td>
<td>1.47 - 1.60 mm</td>
</tr>
<tr>
<td><strong>15. Maximum width of postmentum</strong></td>
<td>0.50 - 0.60 mm</td>
</tr>
<tr>
<td><strong>16. Width of postmentum at waist</strong></td>
<td>0.33 - 0.43 mm</td>
</tr>
<tr>
<td><strong>17. Width of postmentum at anterior margin</strong></td>
<td>0.37 - 0.40 mm</td>
</tr>
<tr>
<td><strong>18. Maximum length of pronotum</strong></td>
<td>0.57 - 0.63 mm</td>
</tr>
<tr>
<td><strong>19. Maximum width of pronotum</strong></td>
<td>0.93 - 1.03 mm</td>
</tr>
<tr>
<td><strong>20. Pronotum-head width index</strong> (Pronotum width/Head width)</td>
<td>0.51 - 0.53</td>
</tr>
<tr>
<td><strong>21. Pronotum index (Length/Width)</strong></td>
<td>0.57 - 0.64</td>
</tr>
<tr>
<td><strong>22. Maximum width of mesonotum</strong></td>
<td>0.77 - 0.83 mm</td>
</tr>
<tr>
<td><strong>23. Maximum width of metanotum</strong></td>
<td>1.00 - 1.18 mm</td>
</tr>
<tr>
<td><strong>24. Length of tibiae :</strong></td>
<td></td>
</tr>
<tr>
<td>(a) Fore-tibia</td>
<td>1.40 - 1.50 mm</td>
</tr>
<tr>
<td>(b) Middle-tibia</td>
<td>1.30 - 1.37 mm</td>
</tr>
<tr>
<td>(c) Hind-tibia</td>
<td>1.80 - 1.93 mm</td>
</tr>
</tbody>
</table>
TABLE 3. - *Speculitermes sinhalensis* Roomwal & Sen-Garma.

Body-measurements of workers. (Specimens from Dharwar and Coimbatore, *vide* "Material" (i), (iv) and (xi) in text.)

<table>
<thead>
<tr>
<th>Body-parts</th>
<th>Range (mm.)</th>
<th>(5 specimens)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total body-length (ca.)</td>
<td>5.3 - 6.3</td>
<td></td>
</tr>
<tr>
<td>2. Length of head to lateral base of mandibles</td>
<td>1.07 - 1.17</td>
<td></td>
</tr>
<tr>
<td>3. Maximum width of head</td>
<td>1.27 - 1.40</td>
<td></td>
</tr>
<tr>
<td>4. Maximum diameter of mid-dorsal spot of head</td>
<td>0.07 - 0.08</td>
<td></td>
</tr>
<tr>
<td>5. Length of antenna</td>
<td>2.20 - 2.50</td>
<td></td>
</tr>
<tr>
<td>6. Maximum length of postclypeus</td>
<td>0.29 - 0.33</td>
<td></td>
</tr>
<tr>
<td>7. Maximum width of postclypeus</td>
<td>0.60 - 0.66</td>
<td></td>
</tr>
<tr>
<td>8. Maximum length of labrum</td>
<td>0.43 - 0.50</td>
<td></td>
</tr>
<tr>
<td>9. Maximum width of labrum</td>
<td>0.57 - 0.60</td>
<td></td>
</tr>
<tr>
<td>10. Maximum length of pronotum</td>
<td>0.37 - 0.40</td>
<td></td>
</tr>
<tr>
<td>11. Maximum width of pronotum</td>
<td>0.77 - 0.83</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 4. - Summary of data on seasonal occurrence of certain castes in Spoculitermes sinhalensis in Peninsular India.

(Collection where workers only were obtained have been omitted; they form the bulk.)

+ present; - absent.

Note. - The number of specimens is given only for soldiers; in other cases, several specimens were obtained except where otherwise stated.

<table>
<thead>
<tr>
<th>Sl. No:</th>
<th>Month</th>
<th>Date of collection</th>
<th>Castes found</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1969-62)</td>
<td>Soldiers</td>
<td>Workers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>1</td>
<td>April</td>
<td>11.iv.60</td>
<td>+ (1)</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>November</td>
<td>26.xi.62</td>
<td>+ (1)</td>
<td>-</td>
</tr>
</tbody>
</table>

I - Coimbatore and vicinity (Madras State)

II - Dharwar and vicinity (Mysore State)

<table>
<thead>
<tr>
<th>Sl. No:</th>
<th>Month</th>
<th>Date of collection</th>
<th>Castes found</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1969-62)</td>
<td>Soldiers</td>
<td>Workers</td>
</tr>
<tr>
<td>3</td>
<td>March</td>
<td>18.iii.60</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>April</td>
<td>12.iv.61</td>
<td>+ (1)</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>September</td>
<td>10.ix.60</td>
<td>+ (1)*</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td>&quot;</td>
<td>11.ix.60</td>
<td>+ (2)</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>&quot;</td>
<td>&quot;</td>
<td>+ (3)</td>
<td>+</td>
</tr>
<tr>
<td>8</td>
<td>&quot;</td>
<td>14.ix.60</td>
<td>+ (1)</td>
<td>+</td>
</tr>
<tr>
<td>9</td>
<td>&quot;</td>
<td>&quot;</td>
<td>+ (3)</td>
<td>+</td>
</tr>
<tr>
<td>10</td>
<td>&quot;</td>
<td>20.ix.60</td>
<td>+ (3)</td>
<td>+</td>
</tr>
<tr>
<td>11</td>
<td>&quot;</td>
<td>21.ix.60</td>
<td>+ (5)</td>
<td>+</td>
</tr>
<tr>
<td>12</td>
<td>November</td>
<td>9.xi.62</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TEXT-FIG. 1. - Wings of Speculitermes simhalensis
Roonwal & Sen-Sarma. Dharwar (Mysore State, India).

(a) Left forewing with scale, in dorsal view.
(b) Ditto, proximal part including scale. Enlarged.
(c) Left hindwing with scale, in dorsal view.
(d) Ditto, proximal part including scale. Enlarged.
(e) Portion of forewing, from a place marked by arrow in figure a.

C. ♦ Sc., costa-subcosta vein; Cu₂, cubitus; M₁, median; R₂, radius; Rs₂, radial sector.

(a) Head and thorax, in dorsal view.
(b) Left mandible, in dorsal view.
(c) Ditto, right mandible.

acU., anteclypeus; ant., antenna; ap.t., apical tooth of mandible; \( l h \), labrum; \( lt \), left; \( M_1, M_2 \), first and second mandibular teeth respectively; md., mandible; mid., mid-dorsal spot of head; mnt., mesonotum; mtt., metanotum; pcl., postclypeus; prt., pronotum; rt., right.
TEXT FIG. 3. - Map of Peninsular India and Ceylon, showing geographical distribution of *Speculitermes sinhalensis* Roonwal & Sen-Garma.

(a) Several galleries opening on surface beneath a mass of partially dried cowdung.

(b) A horizontal gallery not far from ground-surface. Note the numerous blind pouches.

*A*: cover of partially dried cowdung; *aG*: external opening of galleries; *aG*: galleries; *Gl*: ground-level; *pB*: blind pouch in galleries.
TEXT-FIG. 5. - Head of nymphs of Anoplotesmus cinclusus (Burm.), "Miscones", South America, showing development of a pre-soldier 'Vorsoldat' (Fig. b) by feeding nymphs with 'Vitamin T'. (After Goetsch, 1947, p. 263, Fig. 11f.)

(a) Without Vitamin T.
(b) With Vitamin T.
Speculitermes sinhalesis Roonwal & Sen-Sarma.

Imago. Dharwar (Mysore State, India).

(a) Head and pronotum, in dorsal view.
(b) Ditto, in side view.
(c) Labrum, in dorsal view.
(d) Left mandible, in dorsal view.
(e) Ditto, right mandible.
(f) Right antennae of two different specimens, showing the proximal segments. Note variations in 3rd and 4th segments.

(h) Fore-, mid- and hind-tibia, showing the apical tibial spurs.

aci., anteclypeus; ant., antenna; apt., apical tooth of mandible; e., compound eye; lr., labrum; lt., left; m1, m2, first and second marginal teeth respectively of mandibles; md., mandible; mds., mid-dorsal spot of head; oo., ocellus; pcr., postclypeus; pr., pronotum; rt., right.
PLATE 2

*Speculitermes sinhalensis* Koomwal & Sen-Sarma.

Soldier. Dharwar (Mysore State, India).

(a) Entire soldier, in dorsal view.

(b) Head and thorax, in dorsal view.

(c) Ditto, in side view.

(d) Labrum, in dorsal view.

(e) Left mandible, in dorsal view.

(f) Ditto. Right mandible.

(g) Left antenna, in dorsal view. Only the proximal six segments shown.

(h) Postmentum, in ventral view.

(i) Pronotum, in dorsal view.

(j) Ditto, in side view.

(k) Fore-tibia, showing two apical tibial spurs (rare occurrence).

(l) Fore-tibia, showing three apical tibial spurs (the general case).

*acly*, anteclypeus; *ant.*, antenna; *at.*, anterior; *cer.*, cercus; *lr.*, labrum; *lt.*, left; *md.*, mandible; *met.*, mesonotum; *ntr.*, metanotum; *pck.*, postclypeus; *pmt.*, postmentum; *prt.*, pronotum; *pt.*, posterior; *rt.*, right; *tb.*sr., apical tibial spur.
PLATE 3

*Speculitermes sinhalensis* Roomwal & Sen-Sarma.

Various castes, all in dorsal view. (Figures 1, 2 and 5, Coimbatore; Figures 3 and 4, Dharwar.)

1. Soldier.
2. Worker.
3. Winged imago.
4. Queen (partly damaged).
5. (i)-(v). Nymphs in various stages of growth.
PLATE 4

Photographs showing the ecological habitat (semi-open ground covered with low bushes) where *Speculitermes sinhalensis* Roomwal & Sen-Sarma is found. Outskirts of Dharwar, Mysore State, S. India.

Photos 2th November, 1962.

1. Radio Colony, Dharwar.
2. and 3. Karnataka College compound, Dharwar.
FULLER DESCRIPTION OF TWO SPECIES OF *ODONTOTERMES* FROM INDIA

M. L. ROONWAL AND O. B. CHHOTANI

Zoological Survey of India, Calcutta

Received : December 29, 1958

Fuller descriptions of two species of the termite genus *Odontotermes* Holmgren (Insecta, Isoptera, Family Termitidae, subfamily Macrotermitinae) from peninsular India recently (1959) briefly described by us are given in this article, and are based on collections sent by Shri B. M. Kulkarni (Department of Zoology, Karnatak College, Dharwar, Mysore State), the Government Entomologist (Mysore State) Bangalore, and a collection already present in the Zoological Survey of India.

This work was financed by the Indian Council of Agricultural Research under the Termite Research Scheme (Taxonomy) which functioned previously at the Forest Research Institute, Dehra Dun, and was later transferred to the Zoological Survey of India, Calcutta, from April 1, 1957.

All type-specimens, except where otherwise stated, are deposited in the Zoological Survey of India, Calcutta.

FULLER DESCRIPTION OF SPECIES

1. *ODONTOTERMES KULKARNII* Roonwal and Chhotani.

MATERIAL

Two soldiers and several workers, in spirit, Bijapur (16°50'N. lat. and 75°47'E. long) Mysore State, India, coll. B. M. Kulkarni, last week December, 1957; found under cowdung mixed with earth.

DESCRIPTION

IMAGO—Unknown.

SOLDIER (Plate I; Table I)

**General:** Head-capside yellowish; antennae yellow, paler than head-capside; labrum rust yellow; postclypeus yellowish like head-capside; anteclypeus whitish; mandibles dark brown, darker distally; pronotum, legs and body pale yellow. Head and pronotum moderately hairy; body and legs thickly pilose. Total body-length ca. 5.03-5.30 mm.

**Head:** Head-capside subrectangular, flat; longer than broad; sides straight, slightly covering in front of antennae; posterior margin weakly convex. **Fontanelle:** Indistinct. **Eyes and ocelli:** Absent. **Antennae:** 16-segmented; segments 1 and 2 sparsely and others moderately pilose; segment 1 long, cylindrical; 2 cylindrical, shorter than 1; 3 subequal to or shorter than 2 and longer than 4; 4 shortest; 5-8 increasing in length and gradually becoming club-shaped in that order; 9 to the penultimate one almost subequal in length and club-shaped; last segment ovate. **Clypeus:** Divided into an anteclypeus and a postclypeus. Anteclypeus a white narrow, semilunar strip along anterior margin of postclypeus. Postclypeus subrectangular, with a few hairs;
not distinctly separated from frons. *Labrum*: Distal part subtriangular with the tip bluntly pointed; body with the sides subparallel; with a few long setae on tip and on body. *Mandibles*: Sabre-shaped, relatively thin and rather sharply curved inwards near the tip; shorter than head (length 0.93 vs. 1.50 mm.). Left mandible with a prominent tooth in the middle third, a little above the middle. Right mandible with a minute, rudimentary tooth in the middle third. *Postmentum*: Subrectangular; broadest in anterior one-fourth, whence the sides weakly narrowing posteriorly, and anteriorly converging sharply; distal margin almost straight; with a few short hairs on body; posterior margin concave with a weak median bulge.


*Abdomen*: Elongated and hairy. Ceri 2-jointed, 0.10 mm. long. Styli single jointed, 0.075 mm. long.

*Measurements*: See Table I.

**Table I. Body Measurements (in mm.) and Indices of Odontotermes kulkarni**

**Roopwal and Chhotani**

**Caste**: Soldier

<table>
<thead>
<tr>
<th>Body-parts</th>
<th>Range (2 specimens)</th>
<th>Holotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. General</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total body-length ca.</td>
<td>5.03-5.30</td>
<td>5.30</td>
</tr>
<tr>
<td>II. Head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of head to base of mandibles</td>
<td>1.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Maximum width of head</td>
<td>1.20</td>
<td>1.20</td>
</tr>
<tr>
<td>Height of head</td>
<td>0.78-0.80</td>
<td>0.78</td>
</tr>
<tr>
<td>Head-index I (Width/Length)</td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>Head-index II (Height/Width)</td>
<td>0.65-0.66</td>
<td>0.65</td>
</tr>
<tr>
<td>Head-index III (Height/Length)</td>
<td>0.52-0.53</td>
<td>0.52</td>
</tr>
<tr>
<td>Median length of labrum</td>
<td>0.50-0.55</td>
<td>0.50</td>
</tr>
<tr>
<td>Maximum width of labrum</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Minimum length of mandibles (Distal tip to upper base of outer condyle)</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>(a) Left mandible</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>(b) Right mandible</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>Basal width of left mandible</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>Left mandibular tooth distance (Distance between distal tip and base of tooth)</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Head-mandibular length index (Left mandible-length)</td>
<td>0.62</td>
<td>0.62</td>
</tr>
<tr>
<td>head-length</td>
<td>0.62</td>
<td>0.62</td>
</tr>
<tr>
<td>Left mandibular tooth index (Tooth distance/Mandible length)</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>Left mandible index (Basal width / Length)</td>
<td>0.43</td>
<td>0.43</td>
</tr>
<tr>
<td>Minimum (median) length of postmentum</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>Maximum width of postmentum</td>
<td>0.53</td>
<td>0.53</td>
</tr>
<tr>
<td>Minimum width of postmentum (waist)</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>Width of postmentum at anterior margin</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>III. Thorax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum length of pronotum</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Maximum width of pronotum</td>
<td>0.68-0.93</td>
<td>0.68</td>
</tr>
<tr>
<td>Pronotum-head index (Pronotum width/Head width)</td>
<td>0.73-0.77</td>
<td>0.73</td>
</tr>
</tbody>
</table>
Plate I. *Odontotermes kulkarnii* Roonwal and Chhotani—Soldier caste
Figs. (a)–(f) from the holotype soldier and others from paratype soldier, coll. Kulkarni, 1957.
(a) Head, in dorsal view; (b) Head, in (left) side view; (c) Labrum, in dorsal view;
(d) Left mandible, in dorsal view; (e) Ditto, right mandible; (f) Left antenna, in dorsal view. First and
last (16th) segments numbered; (g) Postmentum, in ventral view; (h) Pronotum, in dorsal view (in situ);
(i) Pronotum, in side view (in situ).
*ad.*, anteclypeus; *ant.*, antenna; *at.*, anterior; *br.*, labrum; *lr.*, left; *md.*, mandible; *pcl.*, postcly-
peus; *ptm.*, postmentum; *pt.*, posterior; *rt.*, right.
WORKER MAJOR (Plate II)

General: Head-capsule yellow, frons paler; labrum andclypeus yellow; antennae yellow, paler proximally; pronotum, legs and body white to dirty white. Head moderately pilose; body thickly pilose. Total body-length ca. 3·80-5·05 mm.

Head: Subround; flat; depressed in the region of frons; sides somewhat narrowing posteriorly; posterior margin round. Fontanelle: Indistinct. Eyes and ocelli: Absent. Antennae: 17-segmented; pilose, pilosity increasing distally; segment 1 longest; 2 smaller than 1 but longer than 3; 3 shortest, sometimes subequal to 5; 4 longer than either 3 or 5; 6-10 (or 11) increasing in length in that order; 10 (11)-16 subequal; last segment (17) ovate and narrower than the penultimate one. Clypeus: Divided into an ante- and a postclypeus. Anteclypeus narrow, trapezoidal and apilose; with a semilunar, chitinoid, yellow, median band. Postclypeus large, slightly swollen; divided into right and left halves by a median suture. Labrum: Subsquarish, with anterior margin rounded; with a group of setae of varying sizes on body. Mandibles: Subsquarish. Left mandible with an apical and 2 marginal teeth; apical finger-like; 1st marginal similar and subequal to apical; 2nd marginal very small, weak and not pointed. Right mandible also with an apical and 2 marginal teeth; apical finger-like; 1st marginal somewhat larger than apical; 2nd marginal small and not pointed.

Thorax: Pronotum: As in soldier except being a little broader relative to length; median notch in posterior margin gradual and not sharp and deep. Legs, mesonotum and metanotum: As in soldier.

Abdomen: Elongated or subglobular. Cerci 2-jointed, 0·10 mm. long; Styli single jointed 0·10 mm. long.

WORKER MINOR

Resembles the worker major except for its smaller size.

Measurements (in mm.) of major and minor workers of Odontotermes kulkarnii Roonwal and Chhotani are given below.

<table>
<thead>
<tr>
<th>Worker major (5)</th>
<th>Worker minor (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total body-length ca.</td>
<td>3·8 - 5·05</td>
</tr>
<tr>
<td>Head-length to lateral base of mandibles</td>
<td>1·28 - 1·40</td>
</tr>
<tr>
<td>Maximum head-width</td>
<td>1·33 - 1·50</td>
</tr>
<tr>
<td>Maximum length of pronotum</td>
<td>0·35 - 0·40</td>
</tr>
<tr>
<td>Maximum width of pronotum</td>
<td>0·70 - 0·80</td>
</tr>
</tbody>
</table>

(The number measured is given in brackets)

TYPE SPECIMENS: All type-specimens are deposited in National Zoological Collections at the Zoological Survey of India, Calcutta. All from a single source, vide ‘Material’ above.


¹ Z.S.I. is used for Zoological Survey of India throughout this paper.
Plate II. Odontotermes kulkarnii Roonwal and Chhotani—Worker (major) caste

All figures are from the paramorphotype workers major, Kulkarni 1957, coll.

(a) Head, in dorsal view;
(b) Head, in side view (left);
(c) Labrum, in dorsal view (Slide No. 4.);
(d) Left mandible, in dorsal view (Slide No. 4.);
(e) Ditto, right mandible;
(f) Left antenna, in dorsal view. First and last (17th) segments numbered (Slide No. 4.);
(g) Pronotum, in dorsal view (in situ);
(h) Pronotum, in side view (in situ).

acl., anteclypeus; ant., antenna; ap.t., apical tooth of mandible; at., anterior; lr., labrum; it., left; m1 = m2, first and second marginal teeth of mandibles; md., mandible; pcl., postclypeus; pt., posterior; rt., right.
Morphotypes: Two workers (one major and one minor) in spirit (Z.S.I. Reg. No. 2374/H8).

Paratype and Paramorphotypes: One paratype soldier and 4 paramorphotype workers in spirit (Z.S.I. Reg. No. 2375/H8) and a paramorphotype worker slide (Z.S.I. Reg. No. 2382/H8).

Type-locality: India, Bijapur (Mysore State), 16°50' N. lat.; 75°47' E. long.

Distribution: India: Mysore State: Known only from the type-locality.

Comparison: The soldiers of Odontotermes kulkarnii are very close to those of O. assamthi Holmgren, but differ as follows: (a) Head-capule smaller (head-length to base of mandibles 1.50 mm. vs. 1.60-1.65 mm.); and (b) mandibles relatively thin and long (in assamthi short and stout); head mandibular length index higher (0.51 vs. 0.51-0.53); index basal width of left mandible/mandible length lower (0.43 vs. 0.48-0.50).

The soldiers of O. kulkarnii are also near O. malabaricus Holmg. and Holmg. and O. ceylonicus Holmg. but can be easily differentiated from them as follows: (a) Tooth of left mandible lying above the middle point of mandible (below the middle point in malabaricus and in the middle in ceylonicus); and (b) head-capule shorter and narrower (head-length to base of mandibles 1.50 mm. vs. 1.70 mm. in malabaricus and 1.79 in ceylonicus; head-width 1.20 mm. vs. 1.37 in malabaricus and 1.36 in ceylonicus).

2. ODONTOTERMES METURENSIS Roonwal and Chhotani.

Material

(i) Four soldiers and several workers, in spirit, from Hoganikal Falls, Mettur Dam (ca. 11°52' N. lat.; 77°50' E. long.), coll. T. G. Vazirani, February, 1952; ex. "a log of wood lying on ground."

(ii) One soldier in spirit, from Bangalore (Mysore State), coll. K. S. S. Saiy (his. No. 2), June, 1956; ex. "the root region of Poinciana regia Bojer."

(iii) One soldier and one worker in spirit, from Bangalore (Mysore State), coll. K. S. S. Saiy (his. No. 23), July, 1956.

Description

Imago. Unknown.

Soldier (Plate III; and Table II)

General: Head-capule and labrum yellow to brownish yellow; mandibles dark brown, black distally; antennae, pronotum, legs and body pale yellow. Head sparsely pilose; pronotum and body comparatively densely pilose. Total body-length ca. 6.30-7.35 mm.

Head: Flat, subrectangular; slightly converging in front and behind; posterior margin convex; front sloping in front. Fontanelle: Indistinct. Eyes and ocelli: Absent. Antennae: With 16 segments; pilose; segments 1 and 2 with a few hairs; in others pilosity gradually increasing with the distal segments; segment 1 longest, cylindrical; 2 about half of 1, cylindrical; 3 shorter than 2 and longer than 4; 4 shortest; 5-10 gradually increasing in length in that order and becoming club-shaped; 11-15 club-shaped, subequal and slightly smaller than 10; 16 (terminal) ovate, a little longer than the penultimate one. Clypeus: Divided into an ante- and a postclypeus. Anteclypeus a white, thin,
Plate III: *Odontotermes meturensis* Roonwal and Chhotani—Soldier caste

All figures are from the holotype soldier from Hoganikal Falls, Mettur Dam (Madras) coll.

Vezzani, 1952.

(a) Head, in dorsal view;
(b) Head, in side view (left);
(c) Labrum, in dorsal view;
(d) Left mandible, in dorsal view;
(e) Ditto, right mandible;
(f) Left antenna, in dorsal view. First and last (16th) segments numbered;
(g) Postmentum, in ventral view;
(h) Pronotum, in dorsal view (in situ);
(i) Pronotum, in side view (in situ).

at., anterior; atcl., antennalcl.; at., antenna; ant., antenna; atl., anterior; atcl., anteclypeus; ant., antenna; at., anterior; antcl., anteclypeus; pt., posterior; rt., right; md., mandible; pm., postmentum; mt., metatibia; ltr., left; pr., pronotum; md., mandible.
apilose strip. Postclypeus subrectangular, wider than anteclypeus, and not distinctly separable from frons; anterior margin straight. Labrum: Distal part subtriangular with a bluntly pointed tip; sides in posterior two-thirds straight and subparallel; with several long setae on tip and on body. Mandibles: Thick and stout; broadest basally and narrowing in front into a sharp inwardly bent tip. Left mandible with a large, prominent tooth near the middle of inner margin. Right mandible with a minute corresponding tooth. Postmentum: Subrectangular; broadest at beginning of anterior one-fourth, whence the sides narrowing in front; posteriorly, the sides almost straight; anterior margin straight; posterior margin concave, with a weak median bulge.

Thorax: Pronotum: Saddle-shaped; much broader than long; narrower than head; with a moderate number of short hairs on margins and body; anterior margin round with a deep median notch; antero-lateral corners rounded; posteriorly, the sides converging into broadly rounded postero-lateral corners; posterior border convex with a prominent median notch. Mesonotum: Much narrower than pronotum or metanotum; posterior margin prominently incurved. Metanotum: Slightly narrower than pronotum; posterior margin almost straight. Legs: Long and thin; hairy; tibial spurs 3 in forelegs and 2 each in middle- and hindlegs. Tarsi 4-jointed.

Table II. Body-measurements (in mm.) and indices of *Odontotermes meturensis*

| Body-parts | Range (4-6 specimens) | Holotype
|---|---|---
| I General | | |
| 1. Total body-length ca. | 6.30 - 7.35 | 7.00 |
| II Head | | |
| 2. Length of head to lateral base of mandibles | 2.00 - 2.10 | 2.08 |
| 3. Maximum width of head | 1.45 - 1.55 | 1.53 |
| 4. Maximum height of head | 1.00 - 1.05 | 1.00 |
| 5. Head-index I (Width/Length) | 0.71 - 0.77 | 0.74 |
| 6. Head-index II (Height/Width) | 0.65 - 0.69 | 0.65 |
| 7. Head-index III (Height/Length) | 0.48 - 0.52 | 0.48 |
| 8. Median length of labrum | 0.33 - 0.43 | 0.38 |
| 9. Maximum width of labrum | 0.35 - 0.38 | 0.38 |
| 10. Minimum length of mandibles (distal tip to upper bone of outer condyle) | | |
| (a) Left mandible | 1.29 - 1.23 | 1.20 |
| (b) Right mandible | 1.29 - 1.23 | 1.20 |

(The number measured is given in brackets)
December, 1959] SYSTEMATICS OF ORIENTAL TERMITES

Table II. (Contd.)

<table>
<thead>
<tr>
<th>Body-parts</th>
<th>Range</th>
<th>Holotype</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(4-6 specimens)</td>
<td></td>
</tr>
<tr>
<td>11. Basal width of left mandible</td>
<td>0.45 - 0.48</td>
<td>0.45</td>
</tr>
<tr>
<td>12. Left mandibular tooth distance (Distal tip of mandible to base of tooth)</td>
<td>0.55 - 0.58</td>
<td>0.58</td>
</tr>
<tr>
<td>13. Head-mandibular length index (Left mandible length/Head-length)</td>
<td>0.56 - 0.59</td>
<td>0.56</td>
</tr>
<tr>
<td>14. Left mandibular tooth index (Tooth distance/Mandible length)</td>
<td>0.45 - 0.48</td>
<td>0.47</td>
</tr>
<tr>
<td>15. Left mandible index (Basal width/Length)</td>
<td>0.38 - 0.40</td>
<td>0.38</td>
</tr>
<tr>
<td>16. Minimum (median) length of postmentum</td>
<td>1.33 - 1.43</td>
<td>1.43</td>
</tr>
<tr>
<td>17. Maximum width of postmentum</td>
<td>0.55 - 0.60</td>
<td>0.69</td>
</tr>
<tr>
<td>18. Minimum width of postmentum (waist)</td>
<td>0.50 - 0.55</td>
<td>0.55</td>
</tr>
<tr>
<td>19. Width of postmentum at anterior margin</td>
<td>0.40 - 0.43</td>
<td>0.43</td>
</tr>
<tr>
<td>III. Thorax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Maximum length of pronotum</td>
<td>0.63 - 0.70</td>
<td>0.70</td>
</tr>
<tr>
<td>21. Maximum width of pronotum</td>
<td>1.05 - 1.20</td>
<td>1.18</td>
</tr>
<tr>
<td>22. Pronotum-head index (Pronotum width/Head-width)</td>
<td>0.72 - 0.77</td>
<td>0.77</td>
</tr>
</tbody>
</table>

(The number measured is given in brackets)

Abdomen: Elongate, hairy. Cerci 2-jointed; 0.13-0.15 mm. long. Styli single-jointed, 0.075-0.10 mm. long.

Measurements: See Table II.

Worker Major (Plate IV)

General: Head-capscule yellow; antennae and labrum paler; mandibles yellowish, tooth margins dark brown; pronotum, legs and body pale yellow. Head-capscule moderately hairy; pronotum and body thickly hairy.

Head: Subcircular; broader than long, broadest a little posterior to base of mandibles; frons slightly sloping in front; sides weakly converging posteriorly into a round posterior border. Fontanelle: Indistinct. Eyes and ocelli: Absent. Antennae: With 17 segments; pilosity as in soldier; segments 1 and 2 as in soldier; segment 3 shortest; 4 longer than either 3 or 5; 5 subequal to 3; 6-16 (penultimate) gradually becoming club-shaped; 17 (terminal) ovate. Clypeus: Divided into an ante- and a postclypeus. Anteclypeus an apilose, flat, white strip with a semilunar, chitinoid yellow band in middle; anterior margin projected infront in middle. Postclypeus yellowish, pilose, swollen and divided incompletely into right and left halves by a median line. Labrum:
All figures are from the paramorphotype workers major from Hogenakkal Falls, Metur Dam (Madras), coll. Vazirani, 1952.

(a) Head, in dorsal view; (b) Head, inside view (left); (c) Labrum, in dorsal view (Slide No. 2); (d) Left mandible, in dorsal view (Slide No. 2); (e) Ditto, right mandible; (f) Right antenna, in dorsal view. First and last (17th) segments numbered (in situ); (g) Pronotum, in dorsal view (in situ).
Squarish, broadest at anterior one-third; anterior margin prominently convex; posteriorly sides narrowing weakly; with a few long and short hairs near anterior margin and on body. **Mandibles**: Squarish. Teeth in both mandibles large, but rather blunt, and not sharp and pointed as in the related species. Left mandible with an apical and two marginal teeth; apical finger-like; 1st marginal longer than apical, and separated from the 2nd by a wide margin with a prominent notch in the middle; 2nd much smaller than 1st. Right mandible also with an apical and two marginals; apical broad and blunt; 1st marginal subtriangular and longer than apical; 2nd marginal smaller than 1st.

**Thorax**: **Pronotum**: As in soldier, except that anterior lobe more upturned and projected in front. **Mesonotum**: Narrower than pronotum; posterior margin slightly incurved. **Metanotum**: Broader than pronotum; posterior margin straight. **Legs**: As in soldier.

**Abdomen**: Elongate. Cerci 2-jointed, 0·10-0·13 mm. long. Styli single-jointed 0·08-0·10 mm. long.

**WORKER MINOR**

Similar to worker major, but differs as follows: Body smaller and paler; head in profile swollen in middle; antennae with 16 segments (vs. 17) and with the 4th segment shortest (3rd shortest in worker major).

**Measurements** (in mm.) of major and minor workers of *Odontotermes meturensis* Roonwal and Chhotani are given below:

<table>
<thead>
<tr>
<th></th>
<th>Workers major</th>
<th>Workers minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total body-length ca.</td>
<td>4·88 - 5·40</td>
<td>3·45 - 4·00</td>
</tr>
<tr>
<td>2. Length of head to lateral base of mandibles</td>
<td>1·33 - 1·38</td>
<td>0·80 - 0·83</td>
</tr>
<tr>
<td>3. Maximum width of head</td>
<td>1·48 - 1·53</td>
<td>0·95 - 0·98</td>
</tr>
<tr>
<td>4. Height of head</td>
<td>0·63 - 0·68</td>
<td>0·40 - 0·43</td>
</tr>
<tr>
<td>5. Maximum length of pronotum</td>
<td>0·40 - 0·45</td>
<td>0·33 - 0·35</td>
</tr>
<tr>
<td>6. Maximum width of pronotum</td>
<td>0·80</td>
<td>0·63</td>
</tr>
</tbody>
</table>

(The number measured is given within brackets)

**Type-specimens**: **Holotype**: A holotype soldier (with left foreleg broken), Z.S.I. Reg. No. 2376/H8, in spirit, collection data given as in Materials (i) above. Deposited in Z.S.I.

**Morphotypes**: Two morphotype workers (one major and one minor) from holotype lot, Z.S.I. Reg. No. 2377/H8, in spirit. Deposited in Z.S.I.

**Paratype and paramorphotypes**: (1) One paratype soldier and 5 paramorphotype workers (4 major and 1 minor) from the holotype lot, in spirit, Z.S.I. Reg. No. 2378/H8; two vials, Z.S.I. Reg. Nos. 2379/H8 and 2380/H8, side Material (ii) and (iii) above; and a paramorphotype worker slide, Z.S.I. Reg. No. 2381/H8. All these deposited in
the Zoological Survey of India, Calcutta. (2) Two paratype soldiers and 5 paramorphotype workers (4 major and 1 minor) from the holotype lot, deposited with Professor A. E. Emerson, Department of Zoology, University of Chicago, Chicago (U.S.A.).

**Type-locality:** India: Hoganikal Falls, Mettur Dam (11° 52' N. lat.; 77° 50' E. long), Madras State.

**Type-host:** A log of wood of unknown species.

**Distribution:** India: Southern India, as follows: Bangalore (Mysore State); and Mettur Dam (Madras State).

**Comparison:** *Odontotermes meturensis* Roonwal and Chhotani is very close to *O. anamallensis* Holmg. and Holmg. and fairly closed to *O. oblongatus* Holmg., but differs from them as follows:

1. From *O. anamallensis*
   - **Soldier:** (a) Head-capulse narrower and more slender (maximum head-width 1:45-1:50 vs. about 1:70-1:79 mm.).
   - (b) Mandibles slightly longer (1:20-1:23 vs. 1:18 mm.; index mandible-length/head-length 0:58-0:59 vs. 0:55). (c) Mandibular tooth on left mandible somewhat more posteriorly placed (index tooth-distance/mandible-length 0:45-0:48 vs. 0:41). (d) Postmentum narrower (index maximum width/length 0:40-0:44 vs. 0:49). (e) Pronotum narrower (maximum width 1:05-1:18 vs. 1:23-1:29 mm.). (f) Antennae 16-segmented, with segment 4 shorter than 3 (in *anamallensis* 17-segmented, with segment 4 longer than 3).

   No "smaller soldier" known in *O. meturensis*. From the "smaller soldier" of *O. anamallensis* (vide Holmgren and Holmgren, 1917, p. 158) the soldiers of *O. meturensis* are easily distinguished by their longer and narrower head (head-length 2:0-2:10 vs. 1:79 mm.; the width does not differ).

   **Worker:** (a) Antennae 17-segmented (19-segmented in *O. anamallensis*). (b) Head narrower (head-width 1:48-1:53 vs. 1:70-1:79 mm.). (c) Mandibles with blunt and shallowly indented teeth (in *anamallensis* teeth sharp and deeply indented).

2. From *O. oblongatus*
   - **Soldier:** (i) Larger as a whole (head-length 2:00-2:10 vs. 1:90 mm.; head-width 1:45-1:50 vs. 1:30-1:33 mm.; pronotum-width 1:05-1:18 vs. 0:95 mm.). (ii) Mandibles thinner and longer both absolutely and relative to head-length (length 1:20-1:23 vs. 0:95 mm.; head-mandibular length index 0:56-0:59 vs. 0:50); basal width of left mandible subequal in two species; but index basal width/mandible-length 0:36-0:40 vs. 0:47 (iii) Left mandibular tooth lying in the middle third of mandible-length in both species, but placed more posteriorly (almost near the middle of length) in *O. meturensis* than in *O. oblongatus*; index tooth distance/mandible-length 0:45-0:48 vs. 0:40.

   **Worker:** Somewhat larger than that of *O. oblongatus* (head-width 1:48-1:53 vs. 1:30 mm.); pronotum-width 0:80 vs. 0:70-0:73 mm.).

**REFERENCES**


