

1.0 INTRODUCTION

Termites belonging to the order Isoptera are such insects which generally play contrasting roles of both beneficial as decomposers and harmful as pest in different terrestrial ecosystems. As such, termites have a distinctive status especially in the forest ecosystems in the humid tropics. Even such ecosystem could hardly function long without decomposer like termites and other soil microorganisms.

Termites have polymorphic caste systems (imagoes, soldiers and workers), supra-social organization (division of labour among adults), superb architectural ability (construction of mounds, carton nests, galleries etc.), primitiveness in origin (evolved during cretaceous period), ubiquity in the tropics, symbiotic relationships with microorganisms (flagellates, fungus, bacteria, etc.), supporting guests and inquilines in their nests, unique ecological adjustment in the ecosystem, cryptobiotic and phytophagous nature of life, and lastly, for causing colossal damage to human economy by consuming plant material, disintegrating wood and other cellulose material. Further, they pollute the environment by liberating methane.

Moreover, these insects increase soil fertility by disintegrating leaf litters, wood, animal dung, etc., influence laterisation of soil, increase rate of percolation of rain water and aeration of subsoil, constitute vital food for many animals including man. However, the harmful role of termites has gained much more attention than their beneficial role in the ecosystem (Sen-sarma, 1974).

However, man has changed the status of termites from the role of scavenger to pest due to its continued pursuit of extension of agriculture, industries, urbanization, etc. in natural habitats.

Biologically, these insects enjoy a very complicated and concealed mode of life leading to any control measure unsuccessful against them.

As such, the ecological basis of their suppression is the rewarding venture. But ecologically they are well adjusted in their habitat, especially by cultivating fungus for easy source of food for the youngs in the nest and harbouring flagellates in their guts for digestion of their wood meal to ensure their survival potentiality.

Due to such manifold reason, termites have challenged the curiosity of researchers in various fields of biological research especially in taxonomy, biology, ecology, biodiversity, etc. The recognition based on taxonomic characters of all the castes which is not at all an easy job, is a most vital area of research which remains still to be the prerequisite for any type of research on the group. Present endeavour is made to achieve such an objective of preparation of taxonomic treatise on the Himalayan termites.

The foregoing account has no doubt, highlighted the reasons of selecting termites, as study material with regard to their taxonomic criteria, distribution and concentration, faunal affinities.

Equally, manifold reasons and importance have been attributed to the Himalaya for selecting as the study area.

The Himalayan ecosystem is unique, as it has rich repository of natural resources and biological wealth, which has great impact on the social, cultural and economical life of the people of India.

In the recent past, such mountain system is under severe threat due to advancement of ecotourism, extension of agriculture, industries and urbanization, grazing, clearance of forest, etc. Moreover, the degradation of such ecosystem has been compounded to cater to the daily need of multi-million population inhabiting the area. The fauna and flora of this massive mountain system need inventorization and conservation. Realizing the vastness of fauna, selective group, say for, isoptera in the present context, needs to be studied

before any severe ecodisaster takes place in the area (Khooso, 1986).

However, the Himalayan ranges are about 2500 km long, extending from 73° East to 97° East longitude, and from 27° North to 37° North latitude, and covering an area of approximately 2,36,000 sq. km. There are three ranges, the outer, middle and the inner or great Himalaya, running almost parallel from east to west with altitude ranging from a few hundred to over 8,000 m. There are three factors (longitude, latitude and altitude) which add to the multiplicity of habitats and thus provide varied microclimates and ecological niches not only for plants and animals, but also for human beings also (Table A).

The Himalaya has been divided into four biotic provinces based on the physiography, soil, climate, vegetation etc. These are the North-Western Himalaya (North Kashmir, South Kashmir, hilly tracts of Punjab and Himachal Pradesh), the Western Himalaya (U.P. Himalaya or Kumaon Himalaya), the Central Himalaya (Nepal), and the Eastern Himalaya (hilly tracts of Darjiling, Sikkim, Bhutan and Arunachal Pradesh) [Table A].

However, the review of the existing literature shows that different authors have contributed to the knowledge of the termite fauna of the Himalaya. The first record of termites from the Himalaya dates back to 1904, when Desneux described *Archotermopsis wroughtoni* from Kashmir. Since then, many species was either described or recorded by Holmgren and Holmgren (1917), Gardner (1945), Chatterjee and Thakur (1964, 1967), Weidner (1970), Chhotani (1975a), Thakur (1976), Roonwal and Chhotani (1977), Thakur (1978), Sen-Sarma and Thakur (1980), Maiti (1983), Maiti and Saha (1998), Bose (1999) and others from the Himalaya. Until now, the number of species recorded from the area stands to a total of 107 species and subspecies under 29 genera belonging to six families.

The occurrence of 105 species from the Himalaya, a figure far less than expectation as

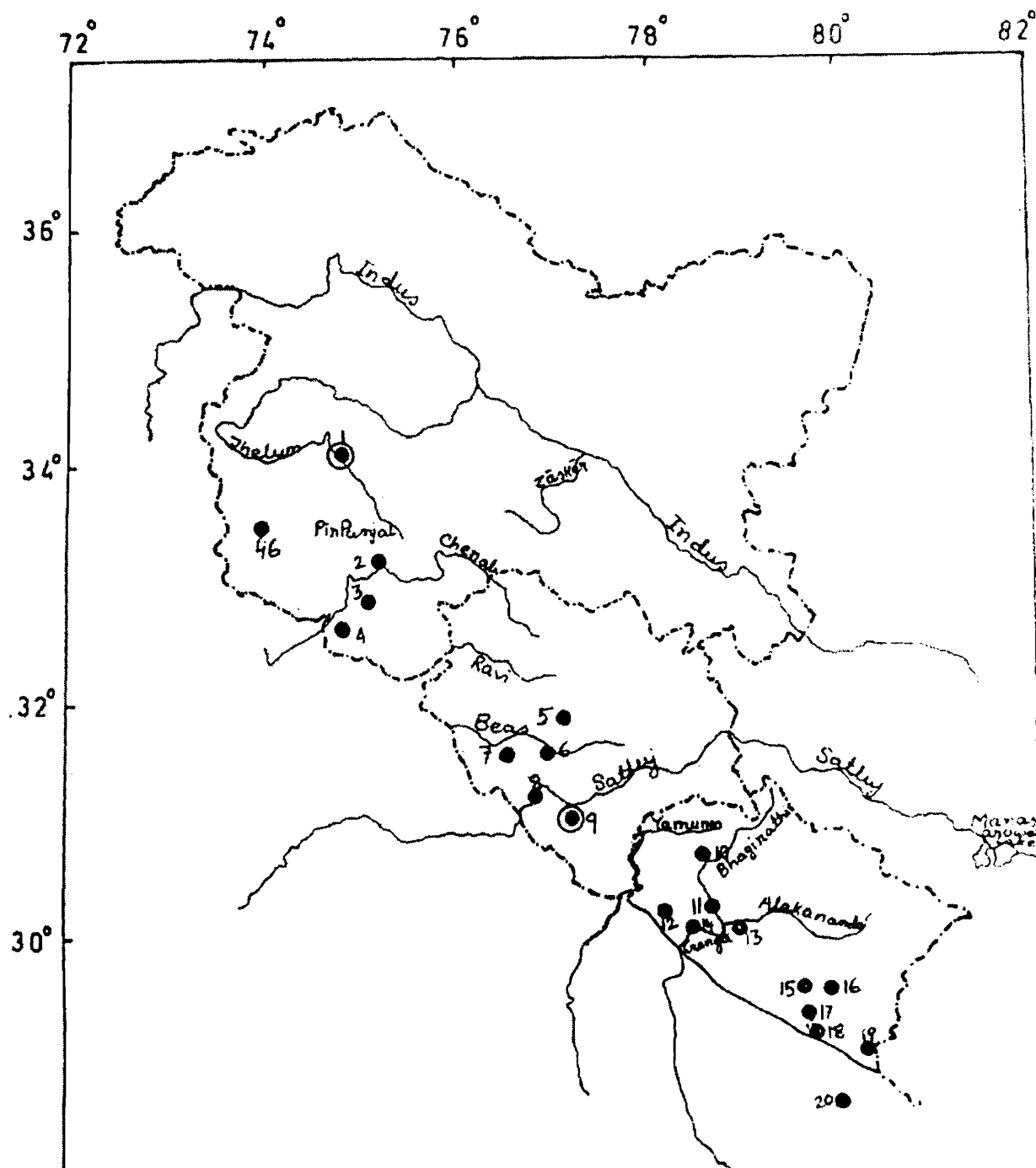
compared to the very wide coverage of area with topographical-cum-climatic variations of the Himalaya has been clearly indicated by the scrutiny of the existing literature. Although region-wise substantial taxonomic contributions on termite fauna have been made in the past, but there remains many a gap.

Attempt has been made here to close up certain gaps. Deficiency of our knowledge on Himalayan fauna may be attributed to certain reasons as follows :

- (i) No serious attempt has so far been made to explore the fauna in a reasonably systematic manner in the entire Himalayan range.
- (ii) Nepal Himalaya remains almost unknown with regard to termite fauna.
- (iii) Knowledge of the fauna till date is based mostly on stray collections except certain areas both in the Western and Eastern Himalaya.
- (iv) No consolidated account of species with their range of distribution and affinities is available, nor the running keys for different taxa of the entire area are provided as ever.

All these aspects have been considered in present contribution with special references to the faunal exploration, taxonomic classification and recognition of species, faunal distribution, affinities and assemblage in different biotic provinces.

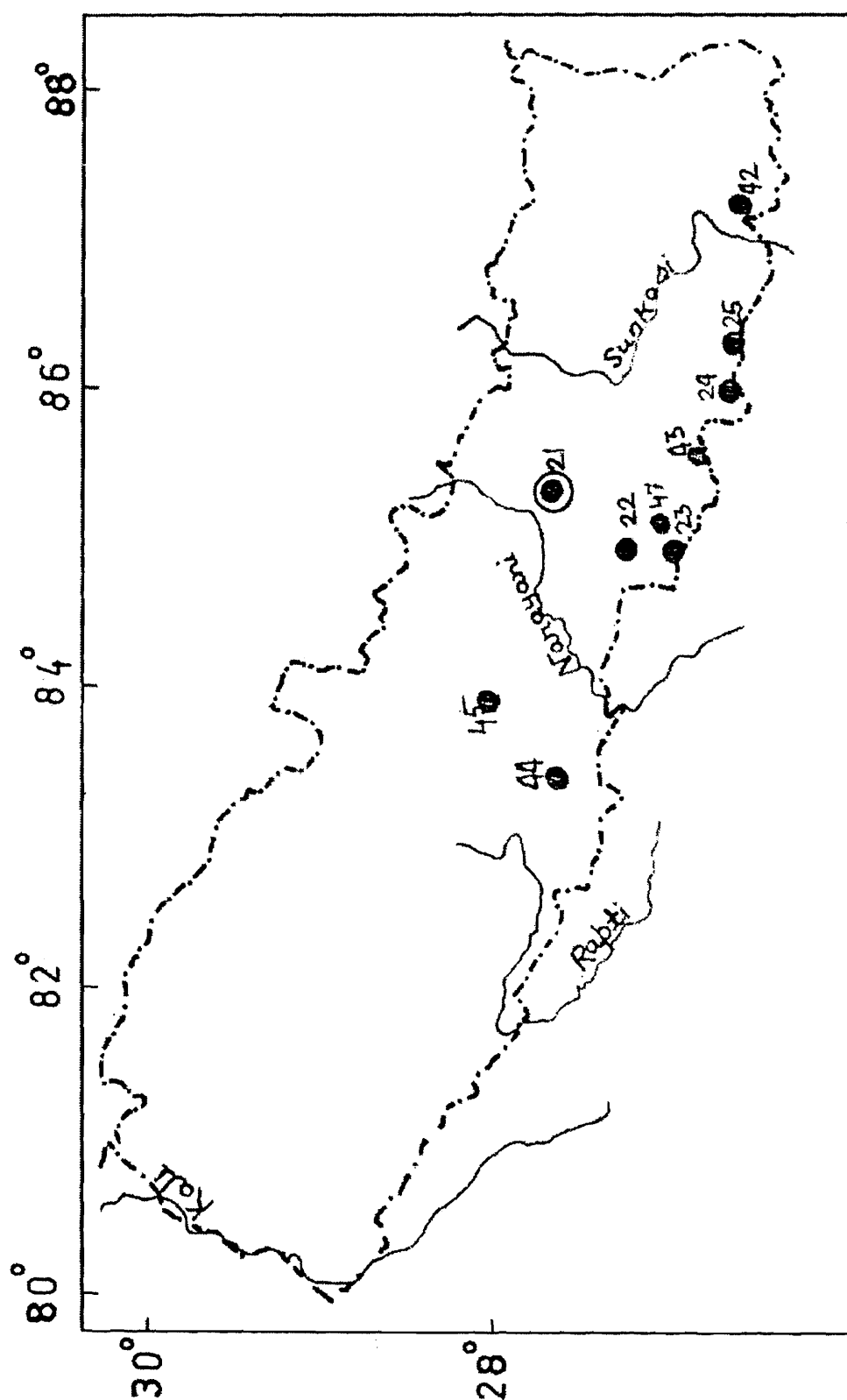
Each species has been dealt with regard to its taxonomic status, chronological synonymies, diagnostic characters, range of variation, distribution, taxonomic and biological remarks, etc. Apart from this, running keys have been prepared for easy identity of the different taxa (vide, Systematic Account). Moreover, historical review, present status and zoogeographical analysis of the fauna, bibliography, illustrations, maps, tables, etc. are the added features to make the present contribution a self-contained one.



Map 1. : Showing collecting localities of Kashmir, Himachal Pradesh and U.P. Himalaya.

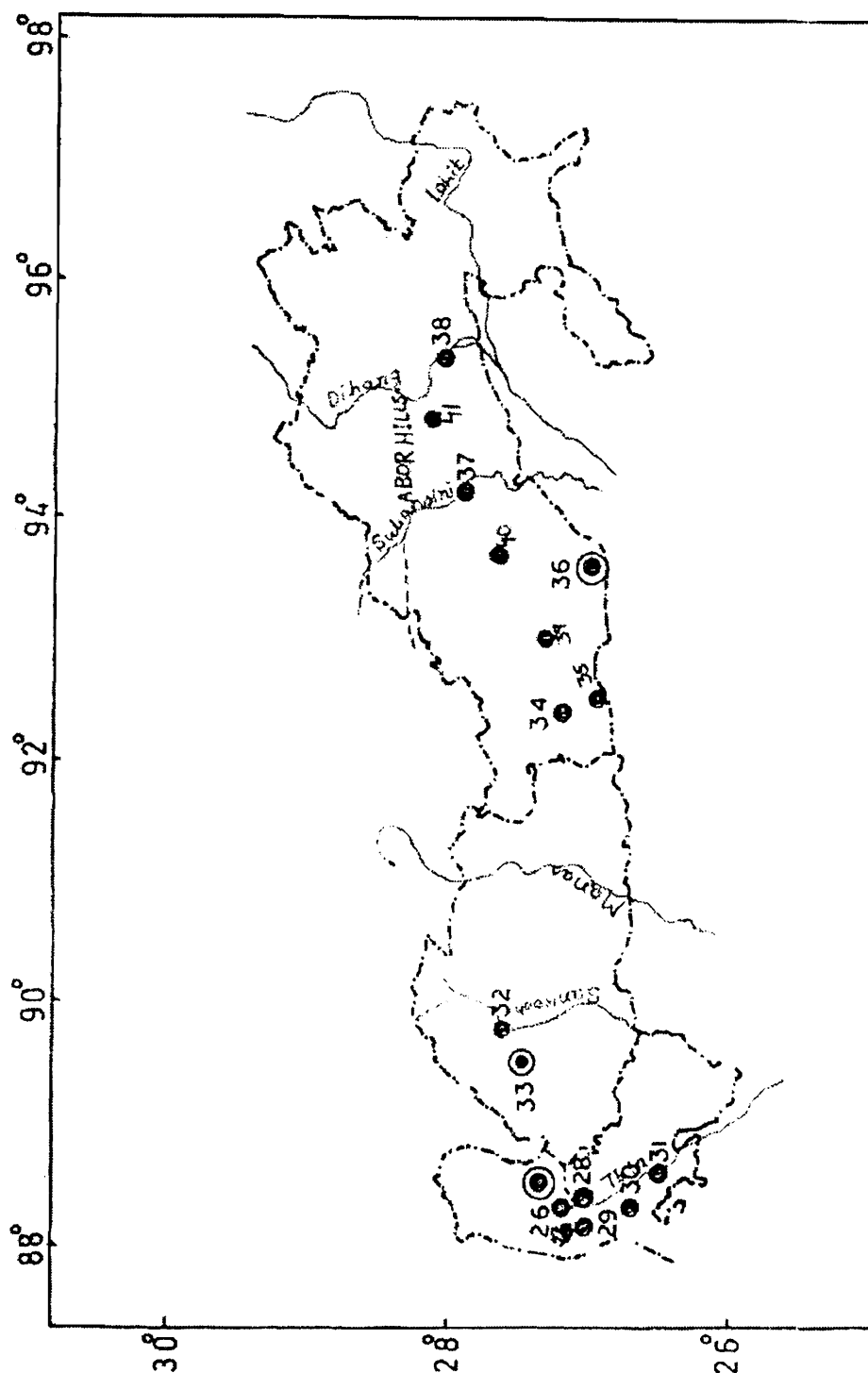
[Number correspond to collecting localities : I, II, III]

I. Jammu & Kashmir	II. Himachal Pradesh	III. Uttaranchal
1. Srinagar	5. Kulu	10. Uttarkashi
2. Ramban	6. Mandi	11. Tehri
3. Udhampur	7. Hamirpur	12. DehraDun
4. Jammu	8. Bilaspur	13. Pauri
46. Kotli	9. Shimla	14. Rishikesh
		15. Ranikhet
		16. Almora
		17. Naini Tal
		18. Haldwani
		19. Tanakpur
		20. Pilibhit



Map 2. : Showing collecting localities of Nepal Himalaya.
[Number correspond to collecting localities : IV]

IV. Nepal	
21. Kathmandu	42. Biratnagar
22. Amlekhganj	43. Malangwa
23. Birganj	44. Butwal
24. Janakpur	45. Pulikhet
25. Sirha	47. Kalaiya



Map 3 : Showing collecting localities of Sikkim, Bhutan, Darjiling and Arunachal Pradesh Himalaya.
[Number correspond to collecting localities : V, VI, VII, VIII]

V. West Bengal (Darjiling Dist.)	VI. Sikkim	VII. Bhutan	VIII. Arunachal Pradesh
28. Kalimpong 29. Darjiling 30. Shiliguri 31. Jalpaiguri	26. Gangtok 27. Samsing	32. Punakha 33. Thimphu	34. Bomdila 35. Bhalukpong 36. Itanagar 37. Daporijo 38. Pasighat 39. Seppa 40. Ziro 41. Along

2.0 PHYSIOGRAPHY, CLIMATE, VEGETATION, ETC., IN BIOTIC PROVINCES OF THE HIMALAYA

6

Table A

	NATURAL UNITS			
	North-Western Himalayan Unit	Western Himalayan Unit	Central Himalayan Unit	Eastern Himalayan Unit
1. Physiography	The Kashmir and Himachal Himalaya (30°–37°N and 72°40'–80°30' E) occupy an area of 2,77,800 sq. km. This region is separated from U.P. Himalaya by Tons river.	The U.P. Himalaya (Kumaon Himalaya) (29°5'–31°25' N and 77°45'–81° E) covers about 46,485 sq. km. This region is separated from Nepal Himalaya by Kali river.	The Nepal Himalaya (26°–30° N and 80°–88° E) covers an area of 13,390 sq. km. It is separated from U.P. Himalaya by Kali river and in the far east lies Kanchenjunga.	The Eastern Himalaya (Sikkim, Bhutan, Arunachal Pradesh and Darjiling district of West Bengal) (26°40'–29°30' N and 88°2'–97° 5' E) covers an area of about 1,22,802 sq. km. In the west it is separated from Nepal by Singalila range and the east and south-east Assam-Burma ranges.
	Four major ranges in Kashmir area are : The Pir Panjal, the main Himalaya or Zaskar, the Ladakh and the Karakoram.	Major physiographic regions are : Siwaliks or sub-Himalayan tract, Himachal or lower Himalaya and Himadri or Greater Himalaya.	Major ranges are : Siwaliks or sub-Himalayan zone, middle Himalaya and inner or Greater Himalaya.	Major ranges are : Siwaliks or sub-Himalaya, lower Himalaya and higher Himalaya-fossiliferous Tethys sediments cover this zone.
	Three physiographic divisions of Himachal area from South to North are : outer Himalaya or Siwaliks, Lesser Himalaya or Central zone and Great Himalaya and Zaskar or Northern zone.		Mount Everest (8,848 m), the highest peak in the world present in this Himalaya.	
2. Drainage	The important rivers of Kashmir are : The Indus, the Jhelum, the Ravi and the Chenab.	Three main systems of this region are : The Ganga system, the Yamuna system and the Kali system.	The important rivers of Nepal are : The Kali, the Rapti, the Gandaki and the Sun Kosi.	The important rivers are : The Torsa, Wongchu, Mochu and Manas in Bhutan. The Teesta in Sikkim and Darjiling. The Dihang, Kamla, Subansiri and Siang in Arunachal Pradesh.
	In Himachal Pradesh, the Beas, the Sutleg and the Yamuna are important rivers.			

Table A : (Cont'd.).

	NATURAL UNITS			
	North-Western Himalayan Unit	Western Himalayan Unit	Central Himalayan Unit	Eastern Himalayan Unit
3. Climate	Jammu region and the lower Himachal region reflect a humid subtropical climate. The northern and eastern high mountains of H.P. face the temperate, cold alpine and glacial climate.	In the summer months, the valleys experience a hot steamy tropical climate, while the great ranges bear some of the highest snow fields of the world. In winter there is heavy fog in wide valleys.	—	The foothills area reflect a hot and humid subtropical climate. Lesser Himalaya faces the cooler climate and the Great Himalaya experiences the Himadri type of climate.
(a) Temperature				
(i) Summer	Jammu 33°C in June. Simla 24.1°C in June	Dehra Dun 35.8°C in May	Average 32°C	Darjiling 19.9°C in August Pasighat 30.7°C in September
(ii) Winter	Jammu 14°C in January Simla 8.9°C in January	Dehra Dun 19.4°C in January	Average -1°C	Darjiling 9.9°C in January Pasighat 22.5°C in January
(b) Rainfall	Srinagar 98.5 mm in March (max.)	Dehra Dun 734 mm in August (max.)	Average 500–3000 mm	Darjiling 774.8 mm in July (max.) Pasighat 1022.4 mm in July (max.)
(c) Relative humidity	Srinagar 82 at 8.30 A.M. 57 at 5.30 P.M. (Annual Total or Mean) Simla 53 at 8.30 A.M. 62 at 5.30 P.M. (Annual Total or Mean)	Dehra Dun 71 at 8.30 A.M. 57 at 5.30 P.M. (Annual Total or Mean)	—	Darjiling 81 at 8.30 A.M. 86 at 5.30 P.M. (Annual Total or Mean) Pasighat 76 at 8.30 A.M. 79 at 5.30 P.M. (Annual Total or Mean)
4. Forest	In the southern slopes of Pir Panjal, vegetation cover is thinner. Except the few patches of Himalayan meadows, Ladakh is almost devoid of vegetal cover.	Sal is the most important species of sub-tropical zone. Other important species of this zone are : Kanju, Semal, Haldu, Khair, Sissu, cane brakes and bamboo brakes. In the temperate zone, Chirpine is dominant.	Sal, Sisso, Savannah are the main species of tropical zone. Oak, Maple, Pine are found in 1220–2590 m height. Spruce, Fir, Cypress are found in 2600 m height.	The foothills comprise the tropical evergreen forest. The middle ranges have temperate evergreen forest. In the higher elevations the coniferous are found.
	In the Kashmir Valley, the well-marked vegetation is Willow and Fir, Deodar and Kail, the Conifers occupy high slopes.			On the western side of this region, the vegetation from 2700 m to 4300m is a growth of shrubby junipers with Pine, Silver Fir, dwarf rhododendrons and wild straw berries, while above 4600 m, Himalayan meadows are seen.

Table A : (Cont'd.).

	NATURAL UNITS			
	North-Western Himalayan Unit	Western Himalayan Unit	Central Himalayan Unit	Eastern Himalayan Unit
	Himachal Pradesh has a diversified and rich flora-Himalayan meadows, birch, rhododendron, bamboo forests etc., are found here. Chilpine and sal are the main species of sub-tropical zone. Moist deodar, pure spruce, pure silver fir are the species of mixed coniferous forest. Horse-chestnut, bird-cherry, walnut, maple, poplar are main species of moist temperate deciduous forests.			
5. Soil	The foot-hill soils are alluvial in nature, varying from loam to sandy loam. In Ladakh region, glacial and mountain meadow soils predominate. In Kashmir valley, the soils vary from clay loam to loam.	Siwaliks and the Dun contain alluvial soils. Lower Bhagirathi-Alakananda zone supports brown forest soils. Upper Bhagirathi-Alakananda zone is provided with brown deciduous and grey coniferous forest soils. Alpine zone contains mountain meadow and glacial soils.	Foothills support brown forest soil.	The soils in the foothills are alluvial in nature being either loams or sandy loams mixed with pebbles.
	In Himachal Pradesh, the soils of low hill are embedded with stones, mid hill soils are loam to clay-loam in texture, and high hill soils are silty-loam to clay-loam. Silty loam to loam soils are found in mountainous soil zone.			Soils in the valleys are clayey alluvium.

Data compiled from : Singh, R.L. (ed.) 1961. *India : A Regional Geography*, I-XX + 1987 pp.

Champion, H.G. and Seth, S.K. 1968. *The Forest Types of India*, I-VIII + 1-464 pp.

3.0 LITERATURE REVIEW AND PRESENT STATUS OF THE FAUNA

The historical record of study of termite fauna of the Himalaya is not too old, which dates back to 1904 and 1906 when Desneux first described a very primitive species *Archotermopsis wroughtoni* from the Kashmir Valley, North-Western Himalaya. Subsequently, Silvestri (1914) studied a collection from Abor Hills, Arunachal Pradesh, collected by S.W. Kemp of Zoological Survey of India during the 'Abor Expedition' and described a new species namely, *Nasutitermes* (= *Eutermes*) *moratus*. He also recorded three more species, namely, *Odontotermes assamensis* Holmgren [synonym of a valid species *O. obesus* (Rambur)], *O. feae* (Wasmann) and *O. microdens* Holmgren (nom. nud.) [synonym of *O. parvidens* Holmgren and Holmgren].

After a long gap, Snyder (1933a, 1933b) in two separate publications described six new species from Dehra Dun and Darjiling as follows : *Neotermes* (= *Kalotermes*) *bosei*, *N. gardneri* (synonym of *N. bosei*), *Euhamitermes lighti*, *Microcerotermes beelsoni*, *M. championi* [synonym of *M. beelsoni* Snyder by Chhotani (1997)], *Odontotermes dehraduni* [synonym of *O. globicola* (Wasmann)], *Microtermes pubescens*, *M. unicolor* and *Nasutitermes gardneri*. The species *Microtermes pubescens* Snyder was synonymised under *M. unicolor* Snyder by the same author in 1949. Later on, Gardner (1944) described *Glyptotermes almorensis* from Almora, Uttaranchal and in 1945 described *Microtermes dehraensis* which was ultimately transferred to *Angulitermes dehraensis* (Gardner) by Ahmad (1955 b) from Dehra Dun, Uttaranchal.

In his world catalogue of Termites, Snyder (1949) recorded 23 species from the Indian subcontinent, of which only five species are from the Himalaya as follows : *Archotermopsis wroughtoni* (Desneux), *Euhamitermes lighti* Snyder, *Odontotermes dehraduni* Snyder [synonym of *O. globicola* (Wasmann)],

Microtermes unicolor Snyder and *Nasutitermes gardneri* Snyder. Rattan Lal and Menon (1953) published a catalogue which hardly add anything new, except the report of only three known species from the area. In the same year, Roonwal and Pant added subsequently 12 species from the entire Himalaya which enrich the faunal account of the Himalaya, namely, *Coptotermes heimi* (Wasmann), *Heterotermes indicola* (Wasmann), *Reticulitermes assamensis* Gardner, *Microcerotermes fletcheri* Holmgren and Holmgren, *Macrotermes estherae* (Desneux) [synonym of *Macrotermes convulsionarius* (König)], *Odontotermes assmuthi* Holmgren, *O. brunneus* (Hagen), *O. obesus* (Rambur), *O. parvidens* Holmgren and Holmgren, *Nasutitermes emersoni* Snyder and *Termes dehraensis* (Gardner).

The taxonomic study of the Indian termites had gained its real momentum since 1953, when Roonwal and his associates actively initiated to explore the Indian fauna. First document has been the description of a new species *Heterotermes gertrudae* from Almora, Uttaranchal. In 1959, Mathur and Chhotani described *Stylotermes bengalensis* from Darjiling, West Bengal. In the same year Mathur and Sen-Sarma recorded four species from Dehra Dun, Uttaranchal which are already mentioned above. Prashad and Sen-Sarma (1959) described three new species as follows : *Nasutitermes jalpaigurensis* from Jalpaiguri and *Nasutitermes suknensis* from Sukna, West Bengal, and *Nasutitermes thanensis* from Thanu, Dehra Dun, Uttaranchal. Roonwal and Sen-Sarma (1960) in their monographic contribution, described seven new species from the Himalayan region, namely, *Neotermes buxensis* from Buxa Forest Division, West Bengal, *Neotermes megaoculatus*, *N. microculatus*, *Speculitermes triangularis*, *Eremotermes dehraduni*, *Pericapritermes dumensis* and *Odontotermes microdentatus*—all from Dehra Dun, Uttaranchal. In the same year, Mathur and Sen-Sarma recorded *Microtermes anandi* Holmgren from Dehra Dun, Uttaranchal which was synonymised under *M. obesi* Holmgren. Mathur

and Thapa (1962b) described *Stylotermes chakratensis* from Chakrata Forest Division, Dehra Dun, Uttaranchal. In 1962a, Roonwal and Chhotani recorded *Reticulitermes assamensis* which was synonymised under *R. chinensis* Snyder by Chhotani and Das (1983) and further its individual status was maintained by Roonwal and Chhotani (1989). Maiti (1983) recorded *Hypotermes obscuriceps* (Wasmann) from Ghumti, Darjiling Dist. West Bengal. Subsequently, Chatterjee and Thakur (1964 c) described *Sarvaritermes faveolus* from Kulu Valley, Himachal Pradesh. However, Emerson (1975) treated it as synonym of *Stylotermes chakratensis* Mathur and Thapa, but in the same year Roonwal transferred the species to *Stylotermes faveolus* (Chatterjee and Thakur). In 1964 d, Chatterjee and Thakur described a new species, namely *Microcerotermes rambanensis* from Ramban, Jammu and Kashmir and in 1964b described *Angulitermes akhorisainensis* from Akhorisain Block, Tehri Garhwal Forest Division, Uttaranchal. In the same year, Chatterjee and Thakur recorded *Odontotermes gurdaspurensis* Holmgren and Holmgren from Tandeh Forest, Udhampur, Jammu and Kashmir. Chatterjee and Thakur (1965) described *Indotermes* (= *Doonitermes*) *capillosus* from Doon Valley, Uttaranchal. In the next year, Chatterjee and Thakur (1966a) recorded *Heterotermes indicola* (Wasmann) from the Himalayan region. In 1967, Chatterjee and Thakur described *Odontotermes lokanandi* which was synonymised under *O. guptai* Roonwal and Bose by Chhotani (1977a). Chatterjee and Thakur (1969) described a new species, *Nasutitermes dunensis* from Dehra Dun, Uttaranchal. In 1971, Roonwal and Chhotani described two new species namely, *Angulitermes kashmirensis* and *Angulitermes tilaki* from Udhampur, Jammu and Kashmir. Thakur and Sen-Sarma (1973) described another species *Doonitermes buxensis* from Jamir Forest, Buxa Forest Division, West Bengal, but Chhotani (1997) synonymised the species under *Indotermes rongrensis* Roonwal and Chhotani. While studying

the termite fauna of West Bengal Maiti (1975) described two new species, namely, *Neotermes kalimpongensis* from Bong Basti, Kalimpong, and *Stylotermes parabengalensis* from Jalpaiguri.

In the same year Thakur described *Stylotermes dunensis* from Dehra Dun, Uttaranchal. Further, Chhotani (1975a) described *Euhamitermes aruna* from Charduar Forest, Kameng division, Arunachal Pradesh and also recorded *Nasutitermes garoensis* Roonwal and Chhotani from Himalayan region. Roonwal and Chhotani (1977) described three new species, namely, *Euhamitermes urbanii*, *Euhamitermes wittmeri* and *Pseudocapritermes bhutanensis* — all are from Bhutan. In 1979, Maiti described *Bulbitermes emersoni* from Tashiding Forest, Darjiling Dist., West Bengal, which was later on transferred to *Ahmaditermes* by Chhotani (1997). Sen-Sarma and Thakur (1980) recorded *Speculitermes cyclops* Wasmann from the Himalayan region. In 1981, Thakur described a new species, namely, *Odontotermes boveni* from Garhwal, Uttaranchal. Chhotani and Das (1983) described *Reticulitermes tirapi* from Tirap Dist., Arunachal Pradesh. In his monographic contribution on West Bengal fauna, Maiti (1983) recorded eight species namely, *Glyptotermes teknafensis* Akhtar, *Glyptotermes ukhiaensis* Akhtar, *Parrhinotermes khasii* Roonwal and Sen-Sarma, *Pericapritermes assamensis* (Mathur and Thapa) as *P. ceylonicus* Holmgren, *P. tetraphilus* (Silvestri), *Macrotermes convulsionarius* (König) as *M. estherae* (Desneux), *M. gilvus* (Hagen) and *Odontotermes redemanni* (Wasmann) from the sub-Himalayan tract. In 1985, Chhotani and Bose described *Glyptotermes tikaderi* from Hornbill, Namdapha, Tirap District, Arunachal Pradesh. One more species, *Odontotermes sikkimensis* has been described by Thakur and Rathore (1986) from Namchi, Sikkim. Verma (1995) made some substantial contribution to the termite fauna of the Western Himalaya and recorded eight species from area, namely, *Bifiditermes beesoni* (Gardner), *Cryptotermes bengalensis* Snyder, *Heterotermes balwanti* Mathur and Chhotani, *Synhamitermes*

quadriceps (Wasmann), *Microcerotermes fletcheri* Holmgren and Holmgren, *M. labioangulatus* Sen-Sarma and Thakur, *Angulitermes acutus* Mathur and Sen-Sarma, *Nasutitermes kali* Roonwal and Chhotani and *Trinervitermes biformis* (Wasmann). In 1997, Chhotani recorded another species, *Nasutitermes matangensiformis* (Holmgren) from Himalayan region. Further addition was made by Bose (1999) and described five new species from Arunachal Pradesh, namely, *Glyptotermes taruni* from Yazali, Lower Subansiri Dist., *Reticulitermes ganga* from Lake Ganga, Itanagar, Lower Subansiri Dist., *Parrhinotermes shamimi* from Itanagar, *Nasutitermes chhotani* from Lake Ganga, Itanagar and *Nasutitermes tandoni* from Tapi, Siang District. In the same year, Bose further recorded thirteen species namely, *Coptotermes gestroi* Wasmann, *Euhamitermes kanhaensis* Roonwal and Chhotani, *Dicuspiditermes laetus* (Silvestri), *Pericapritermes durga* (Roonwal and Chhotani), *Malaysiocapritermes holmgreni* (Akhtar), *Pseudocapritermes tikaderi* Roonwal and Chhotani, *Macrotermes aleemi* Akhtar, *Macrotermes khajuriae* Roonwal and Chhotani, *Odontotermes adampurensis* Akhtar, *O. feae* (Wasmann), *Hypotermes xenotermitis* (Wasmann) and *Microtermes imphalensis* Roonwal and Chhotani from the Eastern Himalaya.

This exhausts our knowledge on the existing termite fauna of the Great Himalayan ranges which comes to a total of 105 species. As a result of present study, two new species have been added to the existing strength to bring an overall total of 107 species as shown below :

The new additions are as follows : The two new species belong to the genera *Angulitermes* and *Ahmaditermes*. The species recorded for the first time from the Nepal Himalaya are : *Heterotermes indicola* (Wasmann), *Speculitermes cyclops* Wasmann, *Odontotermes assmuthi* Holmgren, *O. horni* (Wasmann), *O. microdentatus* Roonwal and Sen-Sarma, *O. redemanni* (Wasmann), *Microtermes obesi* Holmgren and *Trinervitermes biformis* (Wasmann).

LIST OF TERMITES SO FAR KNOWN FROM THE HIMALAYA

(North Western, Western, Central and Eastern Himalayas)

Family I. TERMOPSIDAE

Genus *Archotermopsis* Desneux

1. *Archotermopsis wroughtoni* (Desneux)

Family II. KALOTERMITIDAE

Subfamily KALOTERMITINAE

Genus *Neotermes* Holmgren

2. *Neotermes bosei* Snyder
3. *Neotermes buxensis* Roonwal and Sen-Sarma
4. *Neotermes kalimpongensis* Maiti
5. *Neotermes megaoculatus* Roonwal and Sen-Sarma
6. *Neotermes microculatus* Roonwal and Sen-Sarma

Genus *Glyptotermes* Froggatt

7. *Glyptotermes almorensis* Gardner
8. *Glyptotermes taruni* Bose
9. *Glyptotermes teknaensis* Akhtar
10. *Glyptotermes tikaderi* Chhotani and Bose
11. *Glyptotermes ukhiaensis* Akhtar

Genus *Bifiditermes* Krishna

12. *Bifiditermes beesoni* (Gardner)

Genus *Cryptotermes* Banks

13. *Cryptotermes bengalensis* Snyder

Family III. RHINOTERMITIDAE

Subfamily COPTOTERMITINAE

Genus *Coptotermes* Wasmann

14. *Coptotermes gestroi* (Wasmann)
15. *Coptotermes heimi* (Wasmann)
16. *Coptotermes travians* Haviland

Subfamily HETEROTERMITINAE

Genus *Heterotermes* Froggatt

17. *Heterotermes balwanti* Mathur & Chhotani
18. *Heterotermes gertrudae* Roonwal
19. *Heterotermes indicola* (Wasmann)

- Genus *Reticulitermes* Holmgren
20. *Reticulitermes assamensis* Gardner
 21. *Reticulitermes chinensis* Snyder
 22. *Reticulitermes ganga* Bose
 23. *Reticulitermes tirapi* Chhotani and Das

Subfamily RHINOTERMITINAE

- Genus *Parrhinotermes* Holmgren
24. *Parrhinotermes khasii* Roonwal and Sen-Sarma
 25. *Parrhinotermes shamimi* Bose

Family IV. STYLOTERMITIDAE

- Genus *Stylotermes* Holmgren & Holmgren
26. *Stylotermes bengalensis* Mathur and Chhotani
 27. *Stylotermes chakratensis* Mathur and Thapa
 28. *Stylotermes dunensis* Thakur
 29. *Stylotermes faveolus* (Chatterjee and Thakur)
 30. *Stylotermes parabengalensis* Maiti

Family V. INDOTERMITIDAE

- Genus *Indotermes* Roonwal and Sen-Sarma
31. *Indotermes capillosus* Chatterjee and Thakur
 32. *Indotermes rongrensis* (Roonwal and Chhotani)

Family VI. TERMITIDAE

Subfamily AMITERMITINAE

- Genus *Speculitermes* Wasmann
33. *Speculitermes cyclops* Wasmann
 34. *Speculitermes triangularis* Roonwal and Sen-Sarma

- Genus *Euhamitermes* Holmgren
35. *Euhamitermes aruna* Chhotani
 36. *Euhamitermes kanhaensis* Roonwal and Chhotani
 37. *Euhamitermes lighti* Snyder
 38. *Euhamitermes urbanii* Roonwal and Chhotani

39. *Euhamitermes wittmeri* Roonwal and Chhotani

Genus *Synhamitermes* Holmgren

40. *Synhamitermes quadriceps* (Wasmann)

Genus *Eremotermes* Silvestri

41. *Eremotermes dehraduni* Roonwal and Sen-Sarma

Genus *Microcerotermes* Silvestri

42. *Microcerotermes beelsoni* Snyder
43. *Microcerotermes cameroni* Snyder
44. *Microcerotermes fletcheri* Holmgren and Holmgren
45. *Microcerotermes labioangulatus* Sen Sarma and Thakur
46. *Microcerotermes rambanensis* Chatterjee and Thakur

Subfamily TERMITINAE

Genus *Angulitermes* Sjöstedt

47. *Angulitermes acutus* Mathur & Sen-Sarma [Verma 1995]
48. *Angulitermes akhorisainensis* Chatterjee and Thakur
49. *Angulitermes dehraensis* (Gardner)
50. *Angulitermes kashmirensis* Roonwal and Chhotani
- *51. *Angulitermes nepalensis* sp. nov.
52. *Angulitermes tilaki* Roonwal and Chhotani

Genus *Dicuspiditermes* Krishna

53. *Dicuspiditermes laetus* (Silvestri)

Genus *Pericapritermes* Silvestri

54. *Pericapritermes assamensis* (Mathur and Thapa)
55. *Pericapritermes dunensis* (Roonwal and Sen-Sarma)
56. *Pericapritermes durga* (Roonwal and Chhotani)
57. *Pericapritermes tetraphilus* (Silvestri)

Genus *Malaysiocapritermes* Ahmad and Akhtar

58. *Malaysiocapritermes holmgreni* (Akhtar)

Genus *Pseudocapritermes* Kemner

59. *Pseudocapritermes bhutanensis* Roonwal and Chhotani
 60. *Pseudocapritermes tikadari* Roonwal and Chhotani

Subfamily MACROTERTITINAE

Genus *Macrotermes* Holmgren

61. *Macrotermes aleemi* Akhtar
 62. *Macrotermes convulsionarius* (König)
 63. *Macrotermes gilvus* (Hagen)
 64. *Macrotermes khajuriae* Roonwal and Chhotani

Genus *Odontotermes* Holmgren

65. *Odontotermes adampurensis* Akhtar
 66. *Odontotermes assmuthi* Holmgren
 67. *Odontotermes bellahunisensis* Holmgren and Holmgren
 68. *Odontotermes bhagwatii* Chatterjee and Thakur
 69. *Odontotermes boveni* Thakur
 70. *Odontotermes brunneus* (Hagen)
 71. *Odontotermes feae* (Wasmann)
 72. *Odontotermes giriensis* Roonwal and Chhotani
 73. *Odontotermes globicola* (Wasmann)
 74. *Odontotermes guptai* Roonwal and Bose
 75. *Odontotermes gurdaspurensis* Holmgren and Holmgren
 76. *Odontotermes horai* Roonwal and Chhotani
 77. *Odontotermes horni* (Wasmann)
 78. *Odontotermes kapuri* Roonwal and Chhotani
 79. *Odontotermes microdentatus* Roonwal and Sen-Sarma
 80. *Odontotermes obesus* (Rambur)
 81. *Odontotermes parvidens* Holmgren and Holmgren
 82. *Odontotermes proformosanus* Ahmad
 83. *Odontotermes prolatigula* Bose
 84. *Odontotermes redemanni* (Wasmann)
 85. *Odontotermes sikkimensis* Thakur and Rathore

Genus *Hypotermes* Holmgren

86. *Hypotermes obscuriceps* (Wasmann)
 87. *Hypotermes xenotermitis* (Wasmann)

Genus *Microtermes* Wasmann

88. *Microtermes imphalensis* Roonwal and Chhotani
 89. *Microtermes obesi* Holmgren
 90. *Microtermes unicolor* Snyder

Genus *Ancistrotermes* Silvestri

91. *Ancistrotermes pakistanicus* (Ahmad)

Subfamily NASUTITERMITINAE

Genus *Nasutitermes* Dudley

92. *Nasutitermes cherraensis* Roonwal and Chhotani
 93. *Nasutitermes chhotani* Bose
 94. *Nasutitermes dunensis* Chatterjee and Thakur
 95. *Nasutitermes emersoni* Snyder
 96. *Nasutitermes gardneri* Snyder
 97. *Nasutitermes garoensis* Roonwal and Chhotani
 98. *Nasutitermes jalpaigurensis* Prasad and Sen-Sarma
 99. *Nasutitermes kali* Roonwal and Chhotani
 100. *Nasutitermes matangensiformis* (Holmgren)
 101. *Nasutitermes moratus* (Silvestri)
 102. *Nasutitermes suknensis* Prasad and Sen-Sarma
 103. *Nasutitermes tandoni* Bose
 104. *Nasutitermes thanensis* Prasad and Sen-Sarma
 Genus *Ahmaditermes* Akhtar
 105. *Ahmaditermes emersoni* (Maiti)
 *106. *Ahmaditermes sikkimensis* sp. nov.

Genus *Trinervitermes* Holmgren

107. *Trinervitermes biformis* (Wasmann)

*New species added to the existing species

4.0 MATERIAL METHODS

4.1 Material

The present study is mainly based on a fairly large collection of termites present in the Isoptera Section, Zoological Survey of India, Calcutta. The large majority of the collection was primarily made during the period 1933-1999, made mostly by different survey parties of Zoological Survey of India. Further, a small collection made recently by the authors, has also been incorporated. However, the types and the authentically identified material pertaining to the species, occurring in the Himalayan region, have been studied in details to draw a complete faunal picture of the area.

4.2 Methods

A total number of 107 species based on a large collections made from the Himalayan region preserved in 70% to 80% alcohol, have been studied under a Sterioscopic Binocular Microscope. The different body parts of taxonomic importance (e.g. Imago-worker mandible and Imago-wings) have been processed and mounted on glass slide and studied under a Sterioscopic Microscope. The illustrations have been drawn with the aid of a Camera Lucida. The detailed synonymies have been furnished to the species with restricted distribution, while brief synonymies given for others to avoid repetition.

Classification

The classification of the Order Isoptera as well as the standard measurement schedules of different castes (Imago and Soldier) have been followed from the *Fauna of India Isoptera (Termites)* by Roonwal and Chhotani (1989).

Measurements

In taking measurements of specimens, the following general principles have been followed :

- i. The fully matured individual of each caste is measured.
- ii. Measurements are generally taken in alcohol preserved specimens.

- iii. Hairs, bristles, etc. are excluded from measurements.
- iv. Measurements are taken under a binocular, with the aid of an ocular micrometer.
- v. All the measurements are recorded in millimeter.

5.0 SYSTEMATIC ACCOUNTS

This section deals with detailed taxonomic treatment of the Himalayan termite fauna. It includes the extensive scientific keys of the families (6), genera (29) and species under each genus based on the diagnostic characters of the soldiers and imagoes. The measurements, etc. of different castes of each species have been taken by the authors and those in the parenthesis are from literature. In addition, each of the 107 species so far known from the study area has been dealt with regard to its current scientific name and status, synonymies, diagnosis, measurements, range of measurements and variations, taxonomic and biological remarks, etc.

Key to the families of ISOPTERA (based on Imagoes & Soldiers)

I. IMAGOES :

1. Ocelli indistinct, present only as minute spots; cerci long with 6-8 segments Termopsidae
– Ocelli distinct; cerci short with 1-2 segments 2
2. Fontanelle absent; tarsi always with 4 segments KALOTERMITIDAE
– Fontanelle present; tarsi either with 3 or 4 segments 3
3. Tarsi with 4 segments 4
– Tarsi with 3 segments 5
4. Basal scale of forewing large, covering the hindwing scale at least partly; left mandible always with 3 marginal teeth; pronotum flat; wing membranes generally reticulate; fontanelle without any plate RHINOTERMITIDAE
– Basal scale of forewing small, not covering the hindwing scale; left mandible with 1-2

marginal teeth : pronotum slightly saddle-shaped; wing membranes not reticulate; fontanelle with plate TERMITIDAE

5. Pronotum flat; wings with the median vein usually unbranched and rarely bifurcate
.....STYLOTERMITIDAE
- Pronotum strongly saddle-shaped; wings with the median vein having several branches
.....INDOTERMITIDAE

II. SOLDIERS :

1. Tarsi with 4 segments 2
- Tarsi with 3 segments 5
2. Compound eyes present and pigmented; cerci fairly long, with 4-8 segments
.....TERMOPSIDAE
- Compound eyes usually absent (if present, unpigmented); cerci very short, usually with 2 segments 3
3. Fontanelle absent; antennae with 10-18 segments KALOTERMITIDAE
- Fontanelle present; antennae with 12-20 segments 4
4. Pronotum flat, devoid of any anterior lobe ...
.....RHINOTERMITIDAE
- Pronotum saddle-shaped, with anterior lobe .
.....TERMITIDAE
5. Pronotum flat.....STYLOTERMITIDAE
- Pronotum strongly saddle-shaped
.....INDOTERMITIDAE

Family TERMOPSIDAE

Genus *Archotermopsis* Desneux

1. *Archotermopsis wroughtoni* (Desneux) (Fig. 1, Tables 1 and 2)

1. *Termopsis wroughtoni* Desneux

1904. Desneux, *J. Bombay nat. hist. Soc.*, **15** : 445-446. Im., S. Type-locality : Kashmir Valley (India).

2. *Termopsis radcliffei* Radcliffe

1904. Radcliffe, *Indian Forester*, **30**(9) : 412-414. Type-locality : Kashmir (India).
1949. Snyder, *Smiths misc. Coll.*, **112** : 55 (synonymy)

3. *Termopsis (Archotermopsis) wroughtoni* Desneux

1904. Desneux, *Genera Insectorum (Isoptera, Fam. Termitidae)*, Brussels, Fasc., **25** : 13-14; Fig. 3; and Pl-1, Fig. 3. North India, including Kashmir.

4. *Archotermopsis wroughtoni* (Desneux)

1911. Holmgren, *K. sv. Vet. Akad. Handl.*, **46**(6) : 36, Fig. 3 (wing) Pl.-1, Fig. 6 (S.), Pl.-2, Fig. 1 (Im.). Im., S., W. Kashmir (India).
1974. Akhtar, *Pakistan J. Zool.*, **6** : 90-91.
1980. Sen-Sarma and Thakur, *Indian Forest Rec. (Ent.)*, **14**(1) : 7-8. Kumaon Hills : Barechima Forest Range (Almora Dist., Uttaranchal), 1350 m.
1984. Roonwal, Bose and Verma, *Rec. zool. Surv. India*, **81**(3-4) : 315-338 (Taxonomy and distribution).
1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 126-134 (detailed synonymy)
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

5. *Archotermopsis deodarae* Chatterjee and Thakur

1967. Chatterjee and Thakur, *Indian Forest Rec.*, (N.S.) (Ent.), **11**(1) : 10-13, Pl.-I.S., Psw, Kashmir (India).
1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 126-134 (synonymy)

Material studied : Identified : A. From *North-Western Himalaya* : (i) 3 Im., IS. and 3W., Yusimarg (alt. 2800 m), Kashmir, J & K., coll. Fletcher, 8.viii.1923. (ii) 1 Im., Manali (alt. 2000 m), Kulu valley, H.P., coll. V.K. Gupta, 6.vii.1956.

B. From *Western Himalaya* : (iii) 2S., 4W., Mundali Chakrata, Uttaranchal, coll. J.C.M. Gardner, 16.iv.1933, ex. "*Cedrus deodara*".

Diagnostic Character : (i) Imago (Fig. 1a-d) : Head reddish brown to pale brown; mandibles darker, rest of body golden yellow. Head and pronotum moderately and abdomen fairly densely pilose.

Head subcircular. Fontanelle absent. Ocelli small as minute spots. Antennae with 19-25 segments, 3 shortest. Postclypeus narrow with a few short bristles. Labrum large, subquadrate. Left mandible with three marginal teeth, right mandible with two well developed marginals and a small

subsidiary tooth at the front base of the first marginal. Pronotum flat, narrower than head. Forewing with a large scale, all principle veins arising inside scale. Hindwing, almost like forewing, but scale small and with an anal lobe present.

(ii) Soldier (Fig. 1e-j) : Head deep reddish brown apically; body pale creamish yellow. Head devoid of any distinct hair; pronotal margin with some minute hairs.

Head subsquarish, a little longer than broad, slightly narrowing anteriorly, posterior margin medially outcurved with a shallow depression on

either side. Fontanelle absent. Antennae long and with 22-27 segments, either 3 or 4 shortest. Labrum subsquarish, broader than long with some minute hairs apically, apical margin incurved. Mandibles long and stout with strongly incurved pointed apices, left with an apical and three marginal teeth, right with an apical and two marginal teeth. Postmentum long, narrow, widest width slightly more than the waist. Pronotum broader than long, anterior margin outcurved without a median notch; posterior margin substraight with a feeble median emargination and body with a few hairs.

Distribution INDIA : *North-Western Himalaya :* Jammu and Kashmir : Kashmir valley and Muzaffarabad Dist. *Himachal Pradesh :* Manali in Kulu valley and near Narkanda. *Western Himalaya :* Uttaranchal : Dehra Dun Dist. : Jhajra, Chakrata; Naini Tal Dist. : Bhowali; Almora Dist.; Almora; Garhwal Dist.; Tehri Dist.; Uttar-Kashi Dist.

Elsewhere : West Pakistan (Hazara). Afganistan (north-east of Kabul).

Remarks : The species, being the only living representative of genus, easily be recognized and distinguished by the large and flat head of soldiers with denticulate robust mandibles. It is one of the largest and most primitive termite species in India, occurring only in the cold temperate coniferous forests of the Himalaya upto an elevation of 900-3000 m (from Kashmir to Kumaon Hills). It prefers dead and decaying logs, breeding generally inside the wood, as such no external sign of attack is found in the log. The logs of *Cedrus deodara*, *Abies pindrow*, *Pinus excelsa*, *Pinus longifolia* and *Picea morinda* are known as hosts of the species. Colonies are generally very small (30 or 40 individuals) and live in long, vertical galleries. Swarming occurs during the monsoon (June-August). Biological information is furnished by different authors especially by Roonwal (1970a). Several species of protozoan flagellates have been reported from the intestine of the species.

Two species, namely, *Termopsis radcliffei* Radcliffe and *Archotermopsis deodarae* Chatterjee and Thakur have been synonymised by Snyder (1949), and Roonwal and Chhotani (1989) respectively.

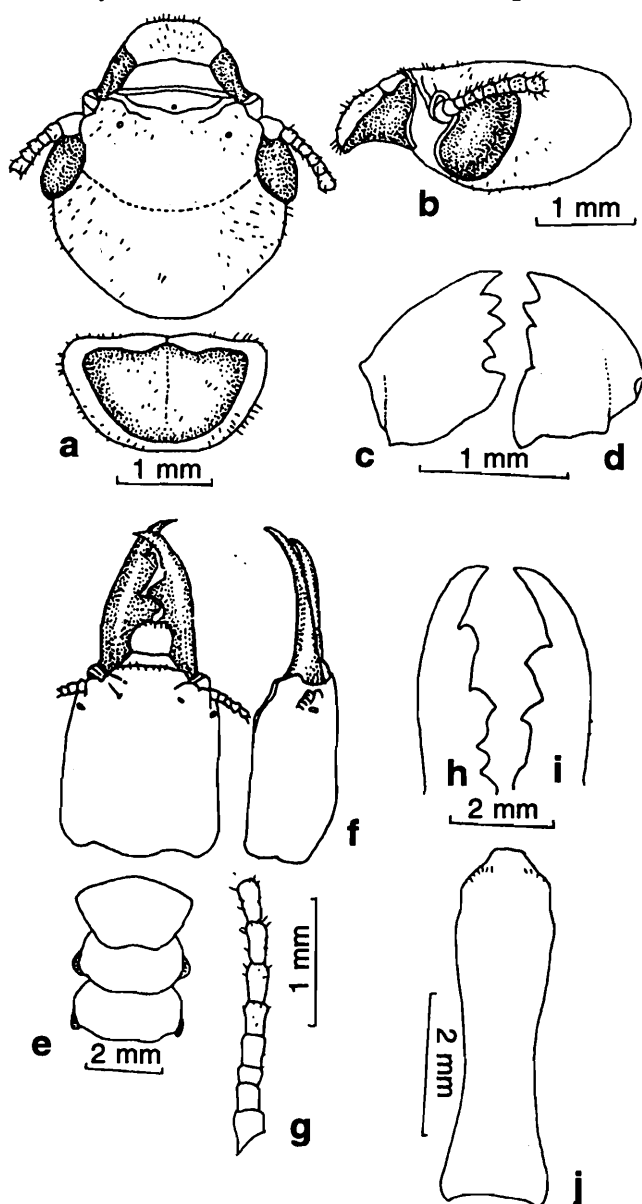


Fig. 1. : *Archotermopsis wroughtoni* (Desneux); a-d, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible; e-j, Soldier. e. Head, pronotum, mesonotum and metanotum, dorsal view; f. Head, side view; g. Basal part of antenna; h. Left mandible; i. Right mandible; j. Postmentum.

Table 1 : Measurements (in mm) etc. of Caste-Imago.

	<i>Archotermopsis wroughtoni</i>	
	3Im.	Known Range
Total body-length without wings	11.0–14.0	10.7–14.0
Total body-length with wings	24.0–26.0	23.6–26.0
Length of head to lateral base of mandibles	2.12–2.30	1.88–2.40
Maximum width of head with eyes	2.30–2.62	2.25–2.70
Height of head	–	–
Length of labrum	0.50–0.70	0.50–0.75
Maximum width of labrum	0.84–1.05	0.83–1.06
Maximum diameter of compound eye (with	0.87–1.05	0.85–1.10
ocular sclerite)	0.60–0.75	0.57–0.77
Maximum diameter of lateral ocellus	–	–
Minimum eye-ocellus distance	–	–
Maximum length of pronotum	1.00–1.22	0.97–1.22
Maximum width of pronotum	1.90–2.12	1.80–2.22
Length of forewing with scale	22.6	22.5
Length of hindwing with scale	20.5	20.5
No. of antennal segments	19–24	19–25

Table 2 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Archotermopsis wroughtoni</i>	
	2S.	Known Range
Length of head to lateral base of mandibles	3.00–4.50	2.80–5.20
Maximum width of head	2.60–4.00	2.55–4.55
Head index (width/length)	0.86–0.88	–
Maximum length of labrum	0.40–0.85	0.33–0.80
Maximum width of labrum	0.65–1.00	0.63–1.10
Length of left mandible (Upper base of condyle to tip)	2.50–4.50	2.10–4.80
Head-mandibular length Index (left mandibles length/ head-length)	0.83–1.00	–
Minimum median length of postmentum	2.50–4.45	2.23–4.43
Maximum width of postmentum	0.75–1.25	0.70–1.20
Width of postmentum at waist	1.06	–
Maximum length of pronotum	0.98–1.95	0.95–1.95
Maximum width of pronotum	1.60–3.00	1.53–3.03
Pronotum index (length/width)	0.61–0.65	–
No. of antennal segments	22–26	22–27

Family KALOTERMITIDAE

Key to genera of family KALOTERMITIDAE

I. IMAGOS :

1. Anterior margin of forewing scale strongly convex, radial sector with several branches to costal margin of wing; median vein not as strongly sclerotized as radial sector and radius *Neotermes* Holmgren
- Anterior margin of forewing scale almost straight; radial sector without any branches to costal margin of wing; median vein as strongly sclerotized as radial sector and radius *Glyptotermes* Froggatt

II. SOLDIERS :

1. Head truncate in front and phragmotic; mandibles comparatively very short *Cryptotermes* Banks
- Head not truncate in front, long and gradually sloping in front; mandibles comparatively long 2
2. Frons bilobed and with a pair of antero-lateral prominences at base of mandibles *Glyptotermes* Froggatt
- Frons not bilobed and without any antero-lateral prominences at base of mandibles 3
3. Pronotum with anterior margin deeply incurved; head comparatively thick and sloping anteriorly from in front of middle *Bifiditermes* Krishna
- Pronotum with anterior margin not deeply incurved; head comparatively flat and sloping anteriorly on anterior third *Neotermes* Holmgren

Genus *Neotermes* HolmgrenKey to the species of genus *Neotermes* Holmgren

I. IMAGOS :

1. Head-capsule as long as broad; ocelli weakly touching the ocular sclerite; pronotum with anterior margin weakly concave *N. buxensis* Roonwal and Sen-Sarma
- Head-capsule slightly broader than long; ocelli broadly touching the ocular sclerite; pronotum with anterior margin deeply concave 2

2. Eyes with anterior margin rounded; ocelli large (0.25–0.30 mm); anterior margin of pronotum deeply incurved *N. megaoculatus* Roonwal and Sen-Sarma

- Eyes with anterior margin truncated; ocelli smaller (0.20 mm); anterior margin of pronotum less so incurved *N. bosei* Snyder

II. SOLDIERS :

1. Eye smaller, max. diameter of eyes 0.10–0.30 mm 2
- Eye larger, max. diameter of eyes 0.30–0.42 mm 3
2. Antennal segment 3 more chitinated and darker; lateral sides of head weakly outward; pronotum with anterior margin deeply incurved and posterior margin feebly outcurved; larger species; head length to base of mandibles 3.90 mm (2.90–4.00 mm) *N. bosei* Snyder
- Antennal segment 3 not so chitinated and paler; lateral sides of head almost straight; pronotum with both anterior and posterior margins feebly incurved; smaller species; head length to base of mandibles 3.30 mm (3.20–3.30 mm) *N. microculatus* Roonwal and Sen-Sarma
3. Head elongate, lateral sides of head gradually diverging anteriorly with feeble-emargination on posterior third; mandibles shorter in relation to head, mandible-head index 0.47 (0.48–0.53); posterior margin of pronotum substraight *N. buxensis* Roonwal and Sen-Sarma
- Head not so elongate, lateral sides of head substraight; mandibles longer in relation to head, mandible-head index 0.50–0.65; posterior margin of pronotum somewhat outcurved 4
4. Mandibles stouter and thicker; margin between 2nd and 3rd marginal teeth of left mandible shorter; epicranial suture indistinct; postmentum with shorter anterior lobe; 3rd antennal segment not strongly chitinated *N. megaoculatus* Roonwal and Sen-Sarma
- Mandibles weak and thinner; margin between 2nd and 3rd marginal teeth of left mandible longer; epicranial suture distinct; postmentum with longer anterior lobe; 3rd antennal segment strongly chitinated *N. kalimpongensis* Maiti

2. *Neotermes bosei* Snyder

(Fig. 2, Tables 3 and 4)

1. *Kalotermes (Neotermes)bosei* Snyder

- 1933a. Snyder, *Proc. U.S. natn. Mus.*, **82** (16) : 2-3. S., Ny.
Holotype : S., in BM, London. Type-locality :
Matharanwala, about 12 km south of Dehra Dun,
Uttaranchal, India.

2. *Neotermes bosei* Snyder

1949. Snyder, *Smiths. misc. Coll.*, **112** : 22 (Part, specimens
from Matharanwala only are *N. bosei*).
1989. Roonwal and Chhotani, *Fauna of India : Isoptera*
(*Termites*), **1** : 214-220 (detailed synonymy).
1995. Verma, *Himalayan Ecosystem Series : Fauna of*
Western Himalaya, Part I, Uttar Pradesh : 47-50.
Uttaranchal.

**3. *Kalotermes/Calotermes (Neotermes) gardneri*
Snyder**

- 1933a. Snyder, *Proc. U.S. natn. Mus.*, **82** (16) : 3-4. Im.
Holotype not designated. Syntypes in FRI, Dehra Dun;
BM, London; USNM, Washington and AMNH, New
York. Type-locality : Dehra Dun, Uttaranchal, India.

4. *Neotermes gardneri* Snyder

1949. Snyder, *Smiths. misc. Colls.*, **112** : 25.
1975b. Chhotani, *Zool. Anz.*, **194** (1-2) : 113, 117.
1989. Roonwal & Chhotani, *Fauna of India : Isoptera*
(*Termites*), **1** : 214-220 (synonymy).

Material studied : Unidentified : From *Eastern Himalaya* : 1 Im. (deal.) and 1 S., Samsing, Darjiling Dist., W.B., coll. P.K. Maiti, 11.xi. 1966, ex. "*Mangifera indica*"

Diagnostic Character : (i) Imago (Fig. 2a) : Head castaneous brown, antennae and legs yellowish. Head sparsely and body densely hairy.

Head subround, sides without eyes outcurved, substraight; posterior margin uniformly rounded, Y-suture distinct. Ocelli broadly oval, almost touching eyes. Antennae with 17-18 segments, 2-generally longer, sometimes as long as 3; 3 slightly longer than 4. Postclypeus flat, with 2 pairs of longish hairs anteriorly. Labrum subrectangular with outcurved apical margin broader than long. Mandibles of *Neotermes* type. Pronotum flat, subrectangular, as wide as head, anterior margin

strongly concave; posterior margin feebly incurved. Wings transparent not tuberculate. Venation as of *Neotermes* type.

(ii) Soldier (Fig. 2b-c) Head castaneous brown with some reddish tinge. Head and body sparsely hairy.

Head subrectangular. Antennae with 14-16 segments (mostly 14-15); 3 either longer or subequal to 2. Labrum subsquarish or dome-shaped with a few hairs anteriorly and on body. Mandibles stout and strong; length subequal to half to about 2/3rd of head length. Left mandible generally with 5 marginals and right mandible with 2 large marginals. Postmentum long, club shaped, club either feebly bilobed or not. Pronotum flat, subrectangular, anterior margin broadly concave, devoid of any notch; posterior margin substraight.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Dehra Dun, Mathranwala; Almora Dist. : Begeswar; Naini Tal Dist. : Sultan forest. *Eastern Himalaya* : West Bengal : Darjiling Dist. : Samsing, Bagdogra; Jalpaiguri Dist. : Chalsa Forest Range. West Bengal (other than Darjiling and Jalpaiguri Dist.) : Coch Bihar Dist. : Coch Bihar Forest Range. BHUTAN (*Eastern Himalaya*) : Phuntsholing; Samchi.

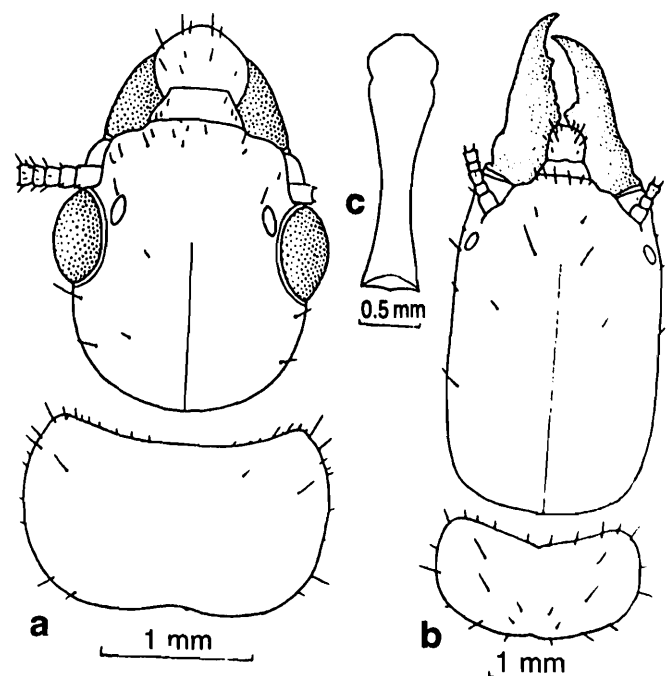


Fig. 2. : *Neotermes bosei* Snyder; a, Imago. a. Head and pronotum, dorsal view; b-c, Soldier, b. Head and pronotum, dorsal view; c. Postmentum.

Table 3 : Measurements (in mm) etc. of Caste-Imago.

	<i>Neotermes bosei</i>		<i>N. buxensis</i>		<i>N. megaoculatus</i>	
	1 Im.	Known Range	1 Im.	Known Range	1 Im.	Known Range
Total body-length with wings (excluding antennae), ca.	—	—	—	—	—	—
Total body length without wings (excluding antennae), ca.	9.00–10.2	8.50–10.4	9.00	7.00–9.00	11.0	10.0–11.9
Length of head to lateral base of mandibles	1.65	1.50–1.60	1.85	1.90	1.70	1.75–1.90
Maximum width of head (with eyes)	1.95	1.90–2.00	1.88	1.90	1.92	1.95–2.15
Maximum length of postclypeus	—	—	—	—	—	—
Maximum width of postclypeus	—	—	—	—	—	—
Maximum length of labrum	0.51	0.30–0.50	0.50	0.50	—	—
Maximum width of labrum	0.67	0.50–0.65	0.60	0.60	—	—
Maximum diameter of compound eye (with ocular sclerite)	0.65	0.65	0.64	0.60–0.65	—	0.65–0.73
Maximum diameter of lateral ocellus	—	—	—	—	—	—
Minimum diameter of lateral ocellus	—	—	—	—	—	—
Minimum eye-ocellus distance	Nil	Nil	0.01	0.0125	—	—
Maximum length of pronotum	1.20	1.10–1.20	1.10	1.10	1.20	1.05–1.20
Maximum width of pronotum	2.10	1.90–2.10	2.20	2.20	1.94	2.00–2.20
Length of forewing with scale	—	—	—	—	—	—
Length of hindwing with scale	—	—	—	—	—	—
Number of antennal segments	18	17–18	—	16+	18	18–19

Table 4 : Measurements (in mm) etc. of Caste-Soldier.

	<i>N. bosei</i>		<i>N. buxensis</i>	
	1S.	Known Range	3S.	Known Range
Length of head to lateral base of mandibles	3.90	2.90–4.00	4.30–4.33	3.69–4.30
Maximum width of head	2.50	2.22–2.50	2.48–2.51	2.40–2.52
Maximum diameter of eye	0.25	0.20–0.30	—	—
Head index (width/length)	0.64	0.59–0.83	0.57	—
Maximum length of labrum	0.40	0.24–0.50	0.52–0.54	0.54
Maximum width of labrum	0.45	0.42–0.66	0.74–0.76	0.66–0.78
Length of left mandible (Upper base of condyle to tip)	1.90	1.70–2.10	2.04–2.07	1.90–2.07
Head-mandibular length Index (left mandible-length/head-length)	0.48	0.46–0.62	0.47	—
Minimum median length of postmentum	2.10	2.20–3.00	2.92–2.94	2.90–3.06
Maximum width of postmentum	0.71	0.75–0.84	0.85	0.90
Width of postmentum at waist	0.26	0.25–0.36	0.28–0.30	0.30–0.42
Maximum length of pronotum	1.25	0.90–1.26	—	1.30–1.53
Maximum width of pronotum	2.40	2.04–2.50	—	2.50–2.79
Pronotum index (length/width)	0.52	—	0.52	—
Number of antennal segments	14	14–16	14–15	14–15

Remarks : The species is characterised with having mandibular tooth pattern of mandibles, strongly chitinised 3rd antennal segments, deeply incurved anterior margin of pronotum, etc. It occurs in the semi-wild condition both in the hilly tracts of Eastern and Western Himalaya infesting quite a number of host-plants including planted trees like *Magnifera indica* and *Ficus* sp. Very little information is known except the longitudinal gallery pattern in its hosts and swarming period from February to July (Roonwal and Sen-Sarma, 1955; Mathur and Sen-Sarma, 1959; Sen-Sarma *et al.*, 1975).

3. *Neotermes buxensis* Roonwal and Sen-Sarma (Fig. 3, Tables 3 and 4)

1. *Neotermes buxensis* Roonwal and Sen-Sarma

1960. Roonwal and Sen-Sarma, *Contrib. Syst. Oriental Termites* (ICAR Ent. Monogr. 1) : 139, 140, 143, 161-166, 263, 264, 344-347 (Pls. 34, 35). Im., S., Psw. Holotype : S., in FRI, Dehra Dun. Type-locality : Buxa Forest Division, West Bengal, India.
1975. Sen-Sarma *et al.*, *Wood Destroying Termites* (Final Tech. Rep. PL 480 Project) : 35, 64.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 4, 16, 21, 30-31, 132, 141.
1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 220-224 (detailed synonymy).

2. *Neotermes bosei* Snyder (Wrong determination)

1934. Snyder, *Indian For. Rec.*, 20(11) : 2-3. Im., S. Specimens from Buxa Forest Division, West Bengal are *buxensis*.

Material studied : Identified : From *Eastern Himalaya* : 3S., Buxa Forest Division, Jalpaiguri Dist., North Bengal, W.B., 6.i. 1915, ex. "*Macaranga denticulata*" det. T.E. Snyder as *N. bosei*.

Diagnostic Character : (i) Imago (Fig. 3a) : Head pale brown; antennae, labrum, legs and abdominal sternites pale yellow. Head moderately hairy.

Head subsquarish, sides slightly narrowing posteriorly and terminating rounded behind, Y-suture distinct. Ocelli oval, slightly separated from eyes. Antennae with 16 segments, 2 longer than 3; 3 and 4 subequal. Postclypeus subrectangular and with a pair of hairs anteriorly on either side of middle. Labrum subsquarish, somewhat rounded laterally and almost straight anteriorly; anteriorly hairy. Pronotum subrectangular, a little wider than head; anterior margin weakly incurved; posterior margin substraight; fairly hairy with long and short hairs on margins and on body. Wings transparent, non-tuberculate, without hairs. Venation in general as of *Neotermes* type.

(ii) Soldier (Fig. 3b-c) : Head pale brown to deep brown. Head and pronotum sparsely and abdomen somewhat densely hairy.

Head subrectangular, widest at base of antennae and slightly narrowing behind. Antennae with 14-15 segments; 3 subequal to 2, 4 shorter. Labrum small, subrectangular, hairy near anterior margin. Mandibles short and robust, almost half of head length to base of mandibles. Left mandible with 5 marginal teeth, right with 2 large ones in basal half. Postmentum long and club-shaped, club strongly bilobed. Pronotum subrectangular, anterior margin strongly incurved, devoid of any notch; posterior margin substraight.

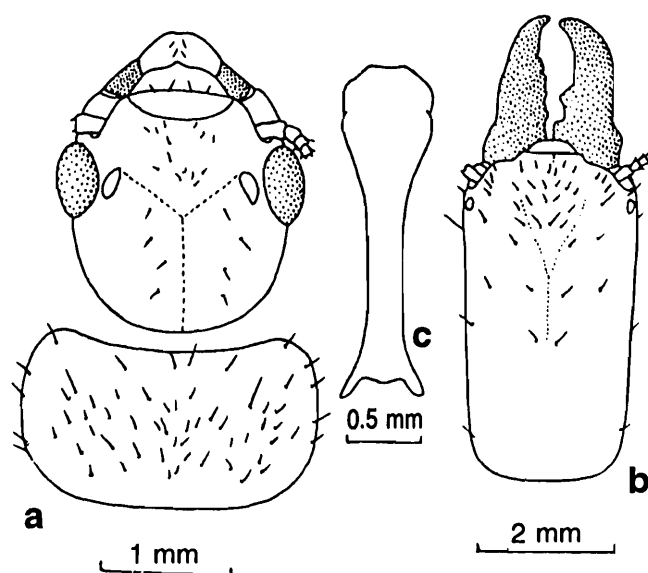


Fig. 3. : *Neotermes buxensis* Roonwal and Sen-Sarma; a, Imago. a. Head and Pronotum, dorsal view; b-c, Soldier. b. Head, dorsal view; c. Postmentum.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Bagdogra; Jalpaiguri Dist. : Buxa Forest Division.

Remarks : The species is distinctive in having head with anteriorly divergent lateral margins of soldier. This species so far is sparsely known from the sub-Himalayan West Bengal only. Nothing is known about its biology.

4. *Neotermes kalimpongensis* Maiti (Fig. 4, Table 5)

1. *Neotermes kalimpongensis* Maiti

1975. Maiti, *Oriental Insects*, 9 (2) : 139-143. S., Psw. Holotype : S., in ZSI, Calcutta. Type-locality : Bong Basti, Kalimpong, West Bengal, India.

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 11, 31-32.

1989. Roonwal & Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 242-244 (detailed synonymy).

Material studied : Identified : From *Eastern Himalaya* : Holotype S., Bong Basti (alt. 1209 m), Kalimpong, Darjiling Dist., West Bengal, coll. P.K. Maiti, 3.xi.1966, det. P.K. Maiti (Type examined).

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 4a-c) : Head brownish yellow; body yellowish white. Head and pronotum sparsely and body more densely hairy.

Head subrectangular, labrum broader than long, anteriorly rounded, Y-suture distinct. Antennae with 15-16 segments; 3 strongly chitinished, shorter than 2 and about twice as long as 4 (15 segmented antennae). Mandibles short and stout; a little longer than half of head length to base of mandibles. Left with 5 marginals, 1st and 2nd marginals fairly prominent, 3rd and 4th weak, 5 larger than 3rd or 4th, right with 2 marginals. Postmentum long, club-shaped, broadest at anterior lobe of bilobed club. Pronotum flat, a little broader than head, anterior margin somewhat strongly incurved and with a median notch; posterior margin convex.

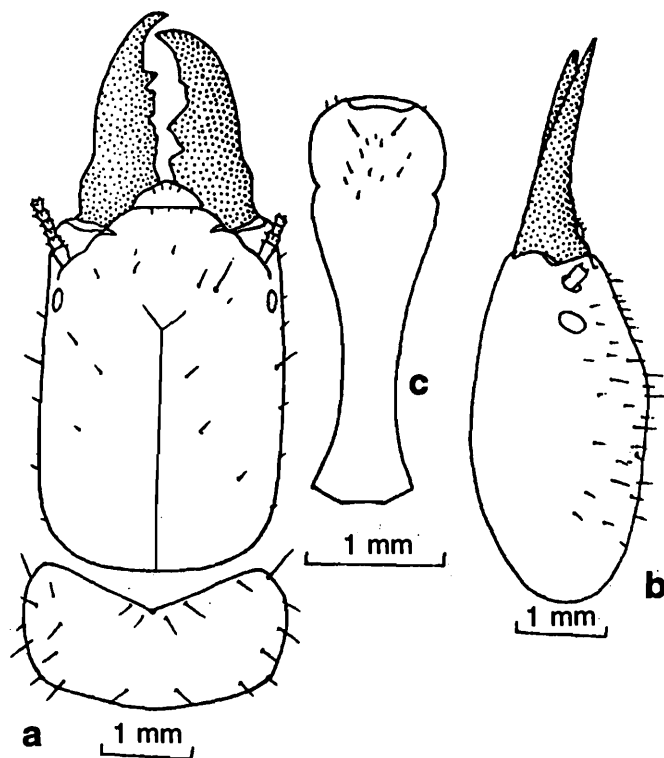


Fig. 4. : *Neotermes kalimpongensis* Maiti; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Kalimpong : Bong Basti.

Remarks : The species is so far known from a single colony at its type-locality at Kalimpong. It's biological information is limited to the report of gallery and damage patterns (Maiti, 1983).

5. *Neotermes megaoculatus* Roonwal and Sen-Sarma (Fig. 5, Tables 3 and 5)

1. *Neotermes megaoculatus megaoculatus* Roonwal and Sen-Sarma

1960. Roonwal and Sen-Sarma, *Contrib. Syst. Oriental Termites* (ICAR Ent. Monogr. 1) : 139, 143, 214-217, 271, 380-381. S., Psw. Holotype : S., in FRI, Dehra Dun. Type-locality : Dehra Dun, Uttaranchal, India.

1980. Sen-Sarma and Thakur, *Indian For. Rec. (N.S.) Ent.*, 14(1) : 3-5.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

2. *Neotermes megaoculatus* Roonwal and Sen-Sarma

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 253-256 (detailed synonymy).

Material studied : Identified : From *Western Himalaya* : (i) 1 Paratype S., New Forest, (alt. ca. 2000 m), Dehra Dun, Uttaranchal, *det.* M.L. Roonwal and P.K. Sen-Sarma.

Diagnostic Character : (i) Imago (Fig. 5a-b) : Head and postclypeus pale to deep brown; labrum and pronotum brown. Head and pronotum sparsely pilose.

Head suboval, slightly broader than long, sides gradually converging posteriorly, Y-suture distinct. Ocelli translucent, large, oval, almost touching the ocular sclerites. Antennae with 18-19 segments, 2 much longer than 3; 3 longer than 4. Clypeus trapezoidal. Labrum tongue-shaped and pilose. Mandibles of *Neotermes*-type. Pronotum subrectangular, broader than head-width with eyes; anterior margin broadly concave; posterior margin substraight. Wing Venation broadly as in genus.

(ii) Soldier (Fig. 5c-d) : Head brown to dark brown, body whitish. Head subrectangular, with

rounded posterior margin. Antennae with 14-16 segments, 3 subequal to 2; 4 shortest. Labrum much wider than long; anterior margin slightly outcurved with a few hairs on tip as well as on

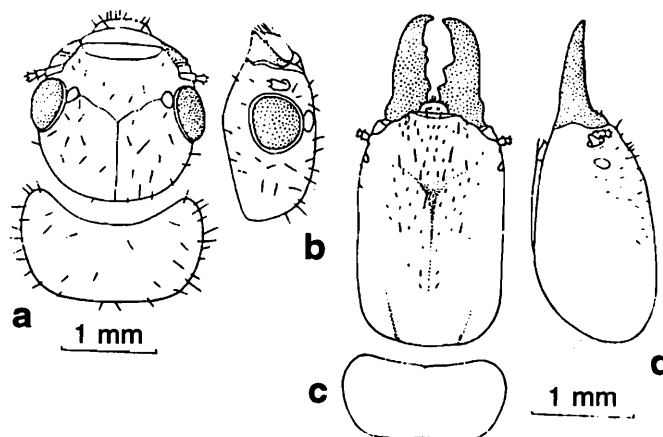


Fig. 5. : *Neotermes megaoculatus* Roonwal and Sen-Sarma; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-d, Soldier. c. Head and pronotum, dorsal view; d. Head, side view.

body. Mandibles stout, length more than half of head-length to base of mandibles. Left with 3-5 small to large marginal teeth, right with 2 large,

Table 5 : Measurements (in mm) etc. of Caste-Soldier.

	<i>N. kalimpongensis</i>		<i>N. megaoculatus</i>	
	Holotype	Known Range	Paratype	Known Range
Length of head to lateral base of mandibles	4.00	3.80–4.20	3.60	3.60–4.50
Maximum width of head	2.80	2.70–2.80	2.55	2.60–2.88
Maximum diameter of eye	–	–	0.30	0.30–0.42
Head index (width/length)	0.70	–	0.71	–
Maximum length of labrum	0.50	0.48–0.55	0.35	0.36–0.42
Maximum width of labrum	0.80	0.72–0.81	0.58	0.60–0.78
Length of left mandible (Upper base of condyle to tip)	2.30	2.24–2.30	1.96	2.00–2.76
Head-mandibular length Index (left mandible-length/head-length)	0.57	0.53–0.58	0.54	0.50–0.65
Minimum median length of postmentum	2.87	2.80–3.00	–	2.76–3.36
Maximum width of postmentum	0.92	0.90–0.92	–	0.90–1.02
Width of postmentum at waist	0.37	0.33–0.37	–	0.30–0.43
Maximum length of pronotum	1.50	1.37–1.50	1.48	1.10–1.62
Maximum width of pronotum	2.90	2.85–2.90	–	2.46–3.00
Pronotum index (length/width)	0.50	0.48–0.51	–	–
Number of antennal segments	16	15–16	16	14–16

triangular marginal teeth. Postmentum club shaped bilobed anteriorly. Pronotum subrectangular, sparsely pilose, anterior margin broadly concave, without any distinct median notch and posterior margin almost substraight.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Dehra Dun, Kanda, New Forest; Pauri Dist. : Pauri.

Remarks : This species has been recorded as a wood-destroying species in Askot, attacking both dead and living standing trees of *Mangifera indica*, *Myrica esculenta* and *Pieris ovalitolia* (Sen-Sarma *et al.*, 1975).

6. *Neotermes microculatus* Roonwal and Sen-Sarma

(Fig. 6, Table 6)

1. *Neotermes microculatus* Roonwal and Sen-Sarma

1960. Roonwal and Sen-Sarma, *Contrib. Syst. Oriental Termites* (ICAR Ent. Monogr. 1) : 139, 142, 220-223, 270, 382-383. S., Psw. Holotype : S., in FR1, Dehra Dun. Type-locality : Dehra Dun, Uttaranchal, India.

1975b. Chhotani, *Zool. Anz.*, **194**(1-2) : 118.

1989. Roonwal and Chhotani, *Fauna of India : Isoptera, (Termites)*, **1** : 258, 259 (detailed synonymy).

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50, Uttaranchal.

Material studied : Identified : From *Western Himalaya* : Holotype : S., Dehra Dun, Uttaranchal; coll. G. D. Ghasin, 24.i. 1933, ex. '*Salix alba*', det. T.E. Snyder as *N. bosei*, redet. M.L. Roonwal and P.K. Sen-Sarma as *N. microculatus*.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 6a-b) : Head reddish brown; body yellowish white. Head and pronotum sparsely pilose and body more densely hairy.

Head rectangular, one-and-a-half times as long as wide, sides subparallel. Antennae with 14 segments, 3 longer or subequal to 2; 4 shortest.

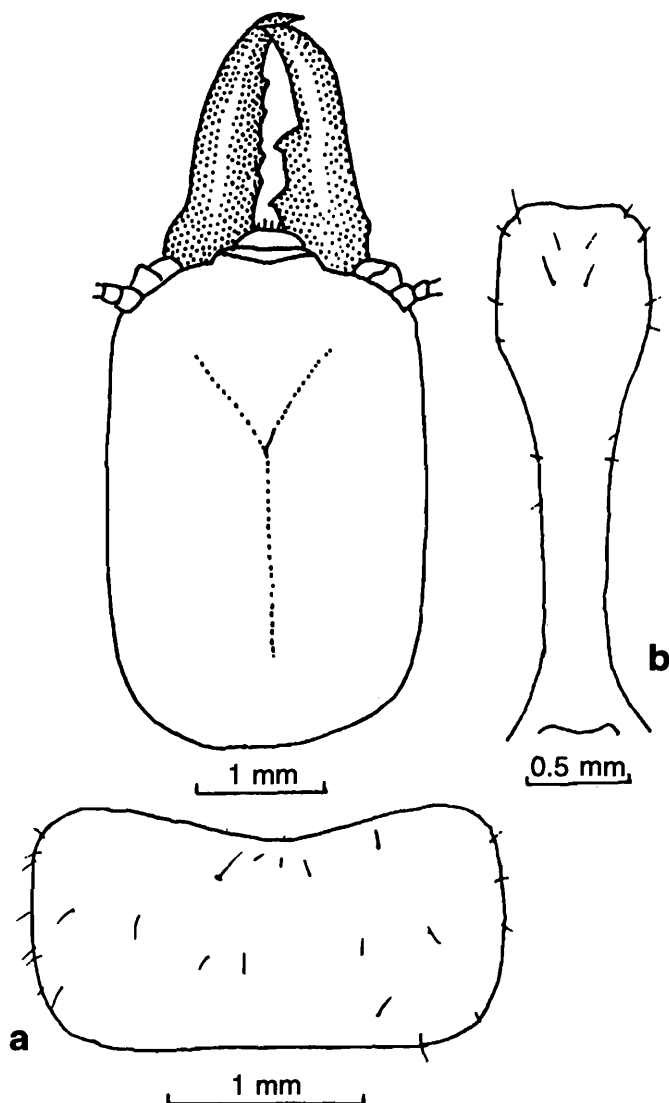


Fig. 6. : *Neotermes microculatus* Roonwal and Sen-Sarma; a-b, Soldier. a Head and pronotum, dorsal view; b. Postmentum.

Labrum squarish with a few short and long hairs at tip. Mandibles long and stout, almost straight with weakly incurved apices. Left mandible with 5 prominent, marginal teeth, right with 2 large, almost subequal marginals. Postmentum long, club-shaped, club indistinctly bilobed. Pronotum subrectangular, sparsely pilose, anterior margin broadly and shallowly concave, margin without a median notch; posterior margin almost straight with a feeble median emargination.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Dehra Dun.

Remarks : The species is only known from its type-locality infesting dead wood of the willow *Salix alba*.

Table 6 : Measurements (in mm) etc. of Caste-Soldier.

	<i>N. microculatus</i>	
	1 S.	Known Range
Length of head to lateral base of mandibles	3.30	3.20–3.30
Maximum width of head	2.20	2.10–2.20
Head index (width/length)	0.66	–
Maximum length of labrum	0.30	0.30–0.40
Maximum width of labrum	0.50	0.50–0.55
Length of left mandible (Upper base of condyle to tip)	1.80	1.70–1.80
Head-mandibular length Index (left mandible-length/head-length)	0.55	0.53–0.55
Minimum median length of postmentum	2.60	2.60–2.80
Maximum width of postmentum	0.80	0.75–0.80
Width of postmentum at waist	0.35	0.30–0.35
Maximum length of pronotum	1.10	0.90–1.10
Maximum width of pronotum	2.10	2.10
Pronotum index (length/width)	0.52	–
Number of antennal segments	14	14

Genus *Glyptotermes* FroggattKey to the species of genus *Glyptotermes* Froggatt

I. IMAGOS :

1. Head wider, head width 0.94–1.03 mm (0.90–0.97 mm); Y-suture somewhat distinct; antennae with 12 segments *G. almorensis* Gardner
- Head narrower, head width 0.75–0.86 mm; Y-suture indistinct; antennae with 11–12 segments *G. ukhiaensis* Akhtar

II. SOLDIERS :

1. Larger species, head length to base of mandible, 3.30–3.50 mm, head width 1.90–2.05 mm; antennae with 14–15 segments; angle of inclination at anterior portion of frons nearly 70° *G. tikaderi* Chhotani and Bose
- Smaller species, head length to base of mandible 1.30–2.25 mm, head width 0.90–1.48 mm; antennae with 10–14 segments; angle of inclination at anterior portion of frons below 60° 2
2. Larger species, length of head of base of mandible 1.93–2.25 mm, head width 1.30–1.48 mm, head index 0.62–0.67 3

- Smaller species, length of head to base of mandible 1.30–1.73 mm; head width 0.90–1.13 mm, head index 0.68–0.74 4
3. Mandible-head index, 0.44; antero-lateral protuberance at base of mandible absent; head length to base of mandible 2.25 mm, width 1.48 mm; head index 0.65 *G. taruni* Bose
- Mandible-head index 0.38–0.42 (0.47–0.48), antero-lateral protuberance at base of mandible present; head length to base of mandible 1.95–2.13 mm (1.93–2.23 mm), width 1.30–1.37 mm (1.30–1.40 mm), head index 0.64–0.66 (0.62–0.67) *G. teknafensis* Akhtar
4. Mandible-head index 0.42–0.46 (0.44–0.46), antennae with 11–12 segments; head length to base of mandible, 1.45–1.80 mm (1.43–1.65 mm), width, 1.08–1.18 mm (1.07–1.13 mm); head less thick, head index, 0.65–0.74 (0.68–0.74) *G. almorensis* Gardner
- Mandible-head index, 0.38–0.42 (0.38–0.39); antennae with 10 segments; head length to base of mandible 1.35–1.45 mm (1.30–1.45 mm), width 0.96–0.99 mm (0.90–0.99 mm); head very thick; head index 0.68–0.71 (0.68–0.69) *G. ukhiaensis* Akhtar

7. *Glyptotermes almorensis* Gardner
(Fig. 7, Tables 7 and 8)

1. *Kalotermes (Glyptotermes) almorensis*
Gardner

1944. Gardner, *Indian J. Ent.*, 6: 104-105. Im., S., Lectotype : S., in FRI, Dehra Dun (Type examined). Type-locality : Bajwar, Almora Dist., Uttaranchal, India.

2. *Glyptotermes almorensis* Gardner

1949. Snyder, *Smiths. misc. Colls.*, 112 : 45.

1981. Maiti and Chakraborty, *Bull. zool. Surv. India*, 4 (1) : 83.

1989. Roonwal & Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 286-291 (detailed synonymy).

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1*, Uttar Pradesh : 47-50. Uttaranchal.

Material studied : Identified : From *Western Himalaya* : 2Im., 2S., 2Ny., Garhwal Jakh Kandar Syun, Paithani, Uttaranchal, coll. B. Singh, 19.vi.1941, ex. "dead and hard stump of *Rhododendron arboreum*" det. J.C.M. Gardner.

Diagnostic Character : (i) Imago (Fig. 7a) : Head, pronotum and abdominal tergites deep brown; labrum, antennae, tibiae and tarsi pale brown, wings dark brown. Head and pronotum sparsely hairy.

Head generally as long as or sometimes shorter than its width with eyes, sides without eyes weakly outcurved. Ocelli small, oval, translucent, almost touching the eyes. Antennae with 2-segments, 2 longer than half of 1 and slightly longer than 3. Clypeus sub-trapezoidal. Labrum broadly tongue-shaped, hairy near anterior margin. Mandibles typically *Glyptotermes*-type. Pronotum subrectangular, narrower than head with eyes, anterior margin weakly incurved, sides weakly outcurved; posterior margin substraight. Wings covered with tubercles, venation as of *Glyptotermes* type.

(ii) Soldier (Fig. 7b-e) : Head brown, darker anteriorly, abdomen pale yellowish brown, last abdominal tergite dark testaceous. Head and pronotum sparsely hairy and body more hairy.

Head somewhat flat, subrectangular, lateral sides parallel. Antennae with 11-12 segments, 2 about half of 1; 3 shorter than 2, subequal to or slightly longer than 4, sometimes subdivided. Labrum broadly tongue-shaped, slightly longer than broad. Mandibles short, shorter than half of the head-length. Left mandible with 3 marginal teeth, 1 and 2 short, situated in distal third, 3 larger, situated in middle third, right mandible with 2 marginal teeth. Postmentum long, club-shaped. Pronotum subrectangular, anterior margin weakly concave, antero-lateral corners narrowly rounded; posterior margin nearly straight.

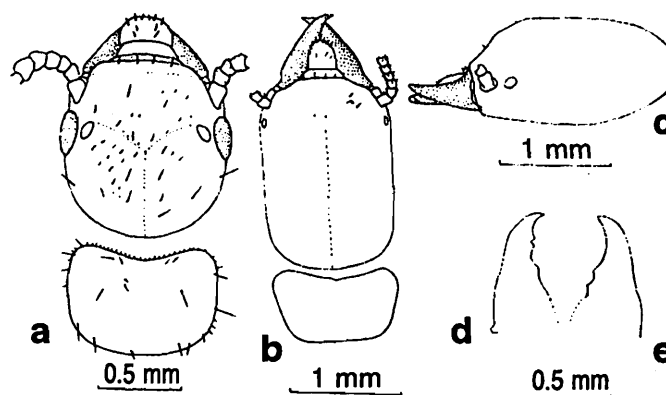


Fig. 7. : *Glyptotermes almorensis* Gardner; a, Imago. a. Head and pronotum, dorsal view; b-e, Soldier. b. Head and pronotum, dorsal view; c. Head, side view; d. Left mandible; e. Right mandible.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Almora Dist. : Almora, Bajwar, Barechina Range, Bageshwar; Garhwal Dist. : Paithani.

Remarks : This is a well established species in the Kumaon Hills since its first description by Gardner (1944) under *Kalotermes*. Snyder (1949) transferred it under the genus *Glyptotermes*. In morphological features of the soldiers, it comes close to *G. ukhiaensis*, but differs in having less thick head. The species has been reported as an important wood destroying termite species in the Kumaon Hills and has been recorded attacking dead, partially dead or even living portions of standing trees of *Cellis australis*, *Mangifera indica*, *Rhododendron arboreum* and *Shorea robusta*. It severely riddles the wood of the trees in the process of gallery making (Sen-Sarma et. al., 1975; Roonwal and Chhotani, 1989).

Table 7 : Measurements (in mm) etc. of Caste-Imago.

	<i>Glyptotermes almorensis</i>		<i>G. ukhiaensis</i>	
	2Im.	Known Range	Sev. Im.	Known Range
Total body-length with wings (excluding antennae), ca.	7.40–8.00	7.20–8.10	5.70–6.00	5.50–6.00
Total body-length without wings (excluding antennae), ca.	4.25–5.20	4.20–5.40	4.00–4.20	4.00–4.30
Length of head to lateral base of mandibles	0.95–1.03	0.90–0.97	0.75–0.86	0.75–0.86
Maximum width of head (with eyes)	0.94–1.03	0.90–0.97	0.78–0.86	0.78–0.86
Maximum length of postclypeus	–	–	–	–
Maximum width of postclypeus	–	–	–	–
Maximum length of labrum	0.18–0.26	0.17–0.25	–	–
Maximum width of labrum	0.30–0.35	0.30–0.33	–	–
Maximum diameter of compound eye (with ocular sclerite)	0.23–0.25	0.23–0.25	0.25–0.26	0.25–0.27
Maximum diameter of lateral ocellus	–	–	–	–
Minimum diameter of lateral ocellus	–	–	–	–
Minimum eye-ocellus distance	–	–	–	–
Maximum length of pronotum	0.55–0.63	0.53–0.60	0.46–0.50	0.45–0.50
Maximum width of pronotum	0.78–0.85	0.77–0.83	0.65–0.68	0.65–0.73
Length of forewing with scale	–	–	–	–
Length of hindwing with scale	–	–	–	–
Number of antennal segments	12	12	11–12	11–12

Table 8 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Glyptotermes almorensis</i>		<i>G. taruni</i>
	2S.	Known Range	Holotype
Length of head to lateral base of mandibles	1.45–1.80	1.43–1.73	2.25
Maximum width of head	1.08–1.18	1.07–1.13	1.48
Head index (width/length)	0.65–0.74	–	0.657
Maximum length of labrum	0.15–0.26	0.10–0.25	0.33
Maximum width of labrum	0.25–0.26	0.27–0.30	0.38
Length of left mandible (Upper base of condyle to tip)	0.68–0.76	0.67–0.77	1.00
Head-mandibular length Index (left mandible-length/ head-length)	0.42–0.46	–	0.44
Minimum median length of postmentum	–	0.90–1.10	1.78
Maximum width of postmentum	–	0.40–0.43	0.55
Width of postmentum at waist	–	0.20–0.21	0.23
Maximum length of pronotum	0.62–0.74	0.60–0.63	0.83
Maximum width of pronotum	1.05–1.12	1.03–1.07	1.40
Pronotum index (length/width)	0.59–0.66	–	0.59
Number of antennal segments	12	11–12	14

8. *Glyptotermes taruni* Bose
(Fig. 8, Table 8)

1. *Glyptotermes taruni* Bose

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 40-44, S., Psw. Holotype : S. and Psw., in ZSI, Calcutta. Type-locality : Lichi, 23 km from Yazali, Lower Subansiri Dist., Arunachal Pradesh, India.

Material studied : Identified : From *Eastern Himalaya* : Holotype S. and Paratypes Pws., near Lichi, Lower Subansiri Dist., Arunachal Pradesh, coll. T.K. Pal and Party, 16.ix.1988, det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 8a) : Head yellowish brown, darker anteriorly. Head and body sparsely hairy, last few abdominal tergites and sternites more hairy.

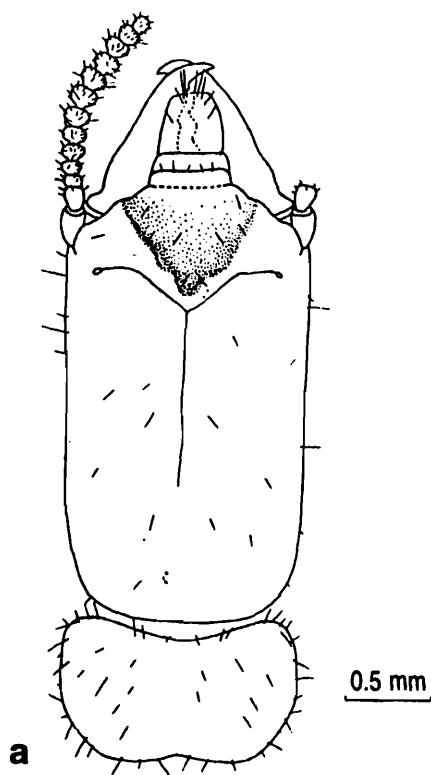


Fig. 8. : *Glyptotermes taruni* Bose; a, Soldier. a. Head and pronotum, dorsal view.

Head subrectangular, longer than broad, sides substraight. Antennae with 14 segments; 3 ring-like and shortest. Labrum subsquarish with long hairs near tip and a few short ones on body. Mandibles short, thick, stout, weakly incurved at the apices with a few minute hairs on basal portion. Left mandible with 3 and right with 2 marginal teeth. Postmentum long, club-shaped.

Pronotum subrectangular, anterior margin broadly incurved, devoid of any median notch; posterior margin weakly incurved medially.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : near Lichi.

Remarks : Nothing is known about its biology, since the species has so far been known only from its type-locality.

9. *Glyptotermes teknafensis* Akhtar
(Fig. 9, Table 9)

1. *Glyptotermes teknafensis* Akhtar

1972. Chaudhry and Ahmad, *Termites of Pakistan* (Final Tech. Rept. PL. 480 Proj.) : vii + 4 pp (nom. nud.).

1975. Akhtar, *Bull. Dept. Zool. Univ. Panjab* (N.S.), Art. 7 : 15, 19-23, 190. Im. and S. : Holotype : S., in Ahmad's Coll., Dept. of Zoology, Panjab Univ., Lahore. Type-locality : Teknaf, Bangladesh.

1989. Roonwal and Chhotani, *Fauna of India : Isoptera*, (Termites), 1 : 315-318 (detailed synonymy).

2. *Glyptotermes chinpingensis* Tsai and Chen
(wrong determination)

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 21, 35-36.

Material studied : Identified : From *Eastern Himalaya* : 4S., 21 Psw., Gailikhola Forest, four km South-West of Teesta Bridge, Darjiling Dist., W.B., coll. P.K. Maiti, 4.xi.1966, det. P.K. Maiti as *G. chinpingensis*, redet. O.B. Chhotani as *G. teknafensis*.

Diagnostic Character : (i) Imago : Known from Bangladesh, not dealt since not represented from the Himalaya.

(ii) Soldier (Fig.9a-c) : Head reddish brown; abdomen pale brownish. Head and pronotum sparsely and abdomen somewhat densely hairy.

Head subrectangular, much longer than broad; sides substraight. Antennae with 12-14 segments; 3 and 4 shortest. Anteclypeus thin, hyaline, strip-like, postclypeus hairy. Labrum subrectangular, broader than long. Mandibles short, thick, less than

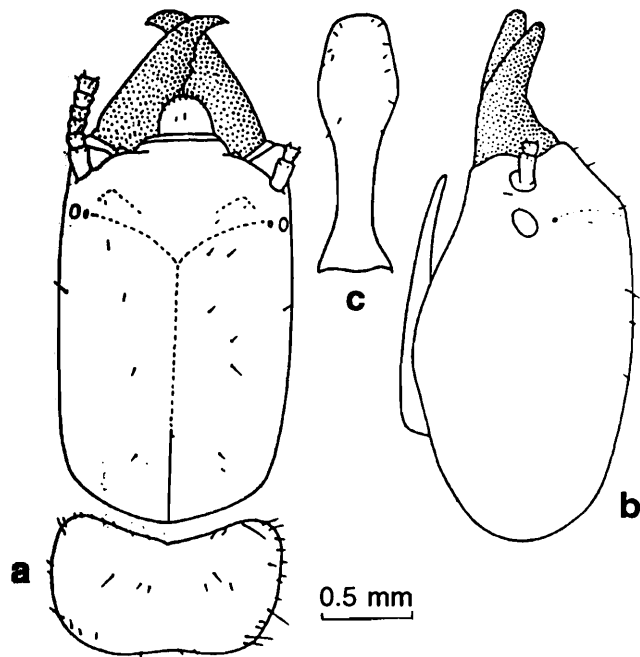


Fig. 9. : *Glyptotermes teknaensis* Akhtar; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

half to about half to head without mandibles. Left with 3 marginals, right with 2 marginals. Postmentum long, club-shaped. Pronotum flat,

rectangular, anterior margin fairly deeply incurved; posterior margin substraight, with a weak incurving at middle.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Gailikhola Forest, four km South-West of Teesta Bridge.

Elsewhere : Bangladesh : Teknaf and Ukhia.

Remarks : The species is characterized by two protuberances on either sides of frontal slope of soldiers by which it may be separated from its close species *G. taruni* recently described from Arunachal Pradesh. In Bangladesh, this species is reported from dead portions of *Eugenia* sp., making longitudinal galleries, interconnected with each other by small holes (Chaudhury and Ahmad, 1972). It is also reported from *Syzigium* sp., (Akhtar, 1975). From Gailikhola Forest, West Bengal, it is collected from a nest around a firescar on the trunk of an unknown tree (Maiti, 1983).

Table 9 : Measurements (in mm) etc. of Caste-Soldier.

	<i>G. teknaensis</i>		<i>G. tikaderi</i>		<i>G. ukhiaensis</i>	
	4S.	Known Range	4S.	Known Range	Holotype	Known Range
Length of head to lateral base of mandibles	1.95–2.13	1.93–2.23	3.30–3.50	3.20–3.50	1.45	1.35–1.45 (3)
Maximum width of head	1.30–1.37	1.30–1.40	1.98–2.00	1.90–2.05	0.99	0.96–0.99 (3)
Head index (width/length)	0.64–0.66	–	0.57–0.60	–	–	–
Maximum length of labrum	0.18–0.22	0.18	0.27–0.29	0.28–0.35	–	–
Maximum width of labrum	0.28–0.38	0.38	0.45–0.50	0.45–0.50	–	–
Length of left mandible (Upper base of condyle to tip)	0.75	0.93–1.06	1.49–1.57	1.48–1.58	0.57	0.50–0.57 (3)
Head-mandibular length Index (left mand.-length/head-length)	0.38–0.42	–	–	–	–	–
Minimum median length of postmentum	1.30–1.44	1.27–1.53	2.15–2.55	2.15–2.60	0.92	0.89–0.93 (3)
Maximum width of postmentum	0.45–0.50	0.50–0.53	0.53–0.63	0.60–0.65	0.41	0.40–0.41 (3)
Width of postmentum at waist	0.24–0.19	0.20–0.26	0.25–0.30	0.28–0.33	0.21	0.21–0.22 (3)
Maximum length of pronotum	0.56–0.75	0.56–0.75	1.05–1.06	1.05–1.08	0.48	0.44–0.48 (2)
Maximum width of pronotum	1.20–1.25	1.19–1.44	1.94–2.01	1.93–2.03	0.92	0.88–0.92 (3)
Pronotum index (length/width)	0.46–0.60	–	2.01	–	–	–
Number of antennal segments	12–14	12–14	14–15	14–15	10	10

10. *Glyptotermes tikaderi* Chhotani and Bose
(Fig. 10, Table 9)

1. *Glyptotermes tikaderi* Chhotani and Bose

1985. Chhotani and Bose, *Rec. zool. Surv. India.*, **82** (1-4) : 53-56. S. and Psw. Holotype : S., in ZSI. Type-locality : Hornbill, Namdapha, Tirap Dist., Arunachal Pradesh, India.

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 318-320.

1999. Bose, *Occ. Paper Rec. zool. Surv. India*, No. 171 : 44.

Material studied : Unidentified : From *Eastern Himalaya* : (i) 4S., sev. W., Miao, Tirap Dist., Arunachal Pradesh, coll. S. Biswas, 10.xi.1982.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 10a-d) : Head pale brown, somewhat darker anteriorly; abdominal tergites pale brown. Head and pronotum sparsely and abdomen somewhat densely hairy.

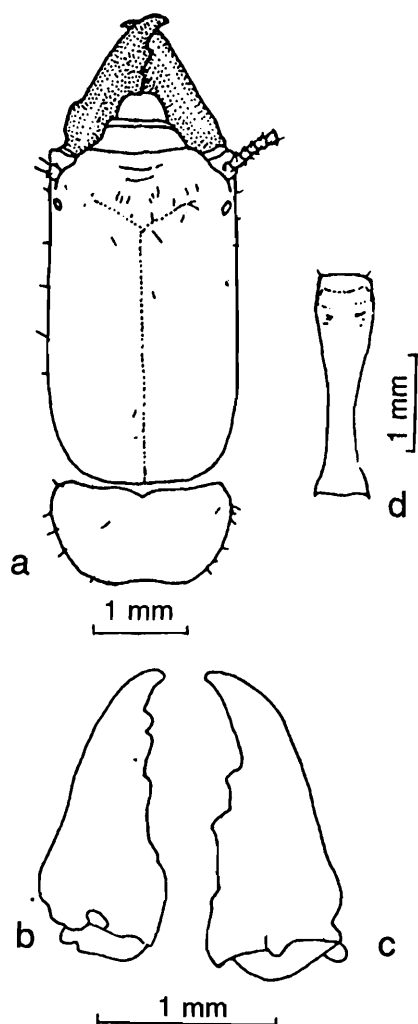


Fig. 10. : *Glyptotermes tikaderi* Chhotani and Bose; a-d, Soldier. a. Head and pronotum, dorsal view; b. Left mandible; c. Right mandible; d. Postmentum.

Head subrectangular, much longer than broad. Antennae with 14-15 segments, 2 cylindrical and strongly sclerotised; 3 or 4 shortest. Labrum short, broader than long with substraight anterior margin. Mandibles thick, short and stout, length less than half of head-length to base of mandibles, weakly incurved apically, outer margin near base swollen and with a few short hairs. Left mandibles with 4 marginal teeth and right with 2 marginal teeth. Postmentum long, club-shaped, anterior broader portion with weakly roughen and with a few bristles, sometimes faintly bilobed. Pronotum flat, much wider than long, anterior margin weakly incurved with a median notch; posterior margin faintly incurved.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Tirap Dist. : Hornbill, Miao.

Remarks : Biology of the species is not known, since it is so far known only from its type-locality. The species can easily be distinguished from all other species of the genus *Glyptotermes*, known from the Himalaya by the excessive large size of the soldiers' head.

11. *Glyptotermes ukhiaensis* Akhtar
(Fig. 11, Tables 7 and 9)

1. *Glyptotermes ukhiaensis* Chaudhry and Ahmad

1972. Chaudhry and Ahmad, *Termites of Pakistan* (Final Tech. Rept. PL. 480 Proj.) : vii + 4 pp (nom. nud.).

1975. Akhtar, *Bull. Dept. Zool. Univ. Panjab* (N.S.), Art. 7 : 15, 23-27. Im. and S. Holotype : S., in Dept. of Zoology, Panjab University, Lahore. Type-locality : Ukhia (Bangladesh).

1989. Roonwal and Chhotani, *Fauna of India : Isoptera, (Termites)*, **1** : 322-326 (detailed synonymy).

2. *Glyptotermes caudomunitus* Kemner

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 21, 32-35 (wrong determination).

Material studied : Identified : From *Eastern Himalaya* : Sev. Ims., 2S. and Psw., Gailikhola Forest (305 m), four km South-West of Teesta

Bridge, Darjiling Dist., coll. P.K. Maiti, 4. xi. 1966, ex, "scar at the base of an unidentified tree", det. P.K. Maiti.

Diagnostic Character : (i) Imago (Fig. 11a-b) : Head reddish brown to blackish brown; labrum and antennae somewhat brownish; wings pale brownish; abdomen above darker than pronotum. Head sparsely hairy; labrum with a few short hairs on margins and body.

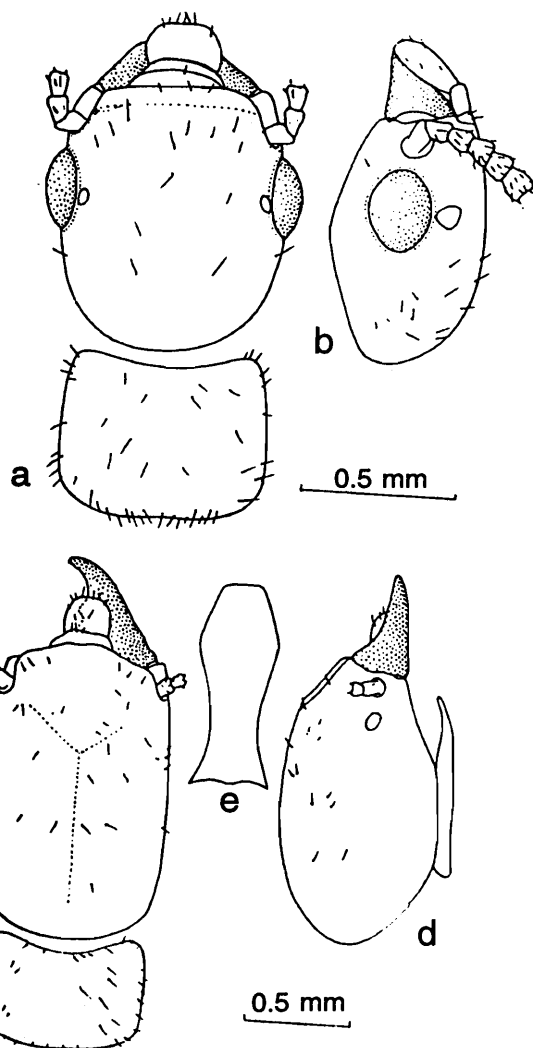


Fig. 11. : *Glyptotermes ukhiaensis* Akhtar; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-e, Soldier. c. Head and pronotum, dorsal view; d. Head, side view; e. Postmentum.

Head as wide as long, sides subparallel, Y-suture indistinct. Ocelli small, broadly oval, not or slightly touching the eyes. Labrum wider than long, anterior margin nearly straight. Mandibles typically *Glyptotermes*-type. Antennae with 11-12 segments, 3 slightly shorter than 2 (in 11-segmented antenna), short ring-like (12-segmented antenna). Pronotum a little narrower than head,

anterior margin weakly incurved; posterior margin concave, not emarginated.

(ii) Soldier (Fig. 11c-e) : Head pale brown; pronotum and abdomen yellowish brown, tenth abdominal tergite sclerotised, reddish brown. Head sparsely hairy; labrum with long bristles near anterior margin and a few in middle; thorax and abdomen fairly-hairy.

Head subrectangular, sides subparallel. Antennae with 10-11 segments, segment 2 longer than 3 or 4; 3 shorter than 4. Labrum as long as wide, anterior margin slightly rounded. Mandibles short, basal humps weakly developed, length less than half of head length. Left mandible with 3 marginal teeth and right with 2 marginal teeth. Postmentum club-shaped. Pronotum subrectangular, flat, anterior margin weakly incurved; posterior margin nearly straight with or without median emargination.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Gailikhola Forest.

Elsewhere : Bangladesh : Ukhia.

Remarks : This species has been recorded only in two occasions in the Eastern Himalaya making irregular galleries in *Syzigium* sp. in humid areas of Ukhia in Cox Bazar, Bangladesh. It has also been reported from dead and fallen branch and galleries, filled with brownish excreta (Chaudhry and Ahmad, 1972). In Gailikhola Forest, West Bengal, its nest is reported to be formed of irregular, flattened tunnels interconnected through small holes. Imagoes have been collected from nest during April in Ukhia and November in Gailikhola Forest (Maiti, 1983) in North Bengal.

Genus *Biffiditermes* Krishna

12. *Bifiditermes beelsoni* (Gardner)

(Fig. 12, Table 10)

1. *Kalotermes beelsoni* Gardner

1945. Gardner, *Indian J. Ent.*, 6(1944) : 103. S., Ny. Lectotype (selected Roonwal and Sen-Sarma, 1960) : S., in FRI, Dehra Dun, Uttaranchal, India. Type-locality : Haldwani, Uttaranchal, India.

1949. Snyder, *Smiths. misc. Coll.*, **112** : 13.
 1955b. Ahmad, *Biologia*, Lahore, **1**(2) : 204-206.
 1960. Roonwal and Sen-Sarma, *Contrib. Syst. Orient. Termites* (ICAR Ent.Monogr. 1) : 101, 102, 103-110.
 1962b. Chhotani, *Termites in Humid Tropics* (Proc. New Delhi, Symp. 1960) : 73-75.

2. *Bifiditermes beesoni* (Gardner)

1961. Krishna, *Bull. Am. Mus. nat. Hist.*, **122** (Article 4) : 369.
 1972. Chaudhry and Ahmad, *Termites of Pakistan* (Final Tech. Report PL. 480 Proj.) : ix, 5, fig. 4.
 1975. Sen-Sarma *et al.*, *Wood Destroying Termites of India* (Final Tech. Rept. PL. 480 Proj.) 32, 34, 52.
 1980. Chhotani, *Tech. Monogr. zool. Surv. India*, No. 4 : 3, 22-23.
 1986. Roonwal, Verma and Bisen, *Proc. Indian natn. Sci. Acad.*, (B) **52**(2) : 241, 242.
 1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 339-343 (detailed synonymy).
 1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.

Material studied : Identified : From *Western Himalaya* : S. and Psw. from Naini Tal, coll. S.C. Verma, 26. vi.1976, ex. "wood", det. S.C. Verma.

Diagnostic Character : (i) Imago : Known but not from the study area.

(ii) Soldier (Fig. 12a-e) : Head reddish brown; abdomen pale straw coloured. Head and body fairly densely pilose with short hairs.

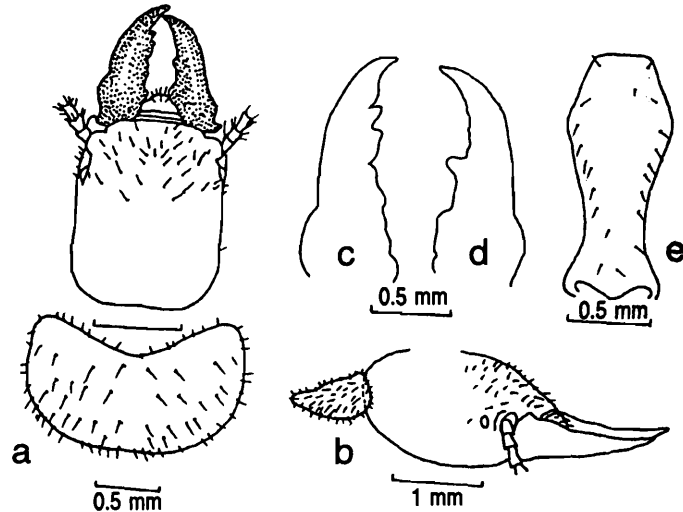


Fig. 12. : *Bifiditermes beesoni* (Gardner); a-e, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible; e. Postmentum.

Head rectangular, much longer than broad, slightly weakly diverging posteriorly. Eyes small, oval. Ocelli absent. Antenna 11-14 segmented, segment 4 shortest. Postclypeus subrectangular with 2 pairs of hairs on anterior margin. Labrum tongue-shaped to pear-shaped, anterior margin

Table 10 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Bifiditermes beesoni</i>	
	Sev. S.	Known Range
Length of head to lateral base of mandibles	2.13-2.40	2.02-2.47
Maximum width of head	1.63-1.90	1.57-1.95
Head index (width/length)	0.76-0.79	—
Maximum length of labrum	0.25-0.32	0.25-0.35
Maximum width of labrum	0.45-0.51	0.45-0.55
Length of left mandible (Upper base of condyle to tip)	1.40-1.48	1.40-1.50
Head-mandibular length Index (left mandible-length/head-length)	0.61-0.65	—
Minimum median length of postmentum	1.44-1.58	1.40-1.60
Maximum width of postmentum	0.60-0.70	0.55-0.70
Width of postmentum at waist	0.32-0.35	0.30-0.35
Maximum length of pronotum	1.06-1.07	—
Maximum width of pronotum	1.65-1.66	—
Pronotum index (length/width)	0.64	—
Number of antennal segments	11-13	11-14

either pointed or rounded. Mandibles fairly long, robust, basally humped. Left mandible with 4-5 marginal teeth. Postmentum club-shaped. Pronotum subrectangular, anterior margin deeply concave, devoid of any median notch; posterior margin substraight.

Distribution : INDIA : Western Himalaya : Uttaranchal : Naini Tal Dist. : Naini Tal; Haldwani Dist. : Haldwani. Uttar Pradesh : Gorakhpur; Ramnagar, Haryana : Karnal.

Elsewhere : Pakistan : Lahore; Mianwali; Bhakkar; Muzaffargarh; Bahawalpur; Multan.

Remarks : This is the only species of the genus known from the Western Himalaya and can be isolated from the lone other species, *B. pinto* known from India having postmentum devoid of anterior lobe and angular anterior margin of pronotum of soldiers. The species has been reported from a number of trees including ber (*Zizyphus jujuba*) and apple trees in the Western Himalaya including Pakistan, but nowhere is a serious pest. The nest of this species is in the longitudinal galleries filled with dry, compressed, loose faecal pellets similar to those found in *Cryptotermes* species. In a laboratory colony, emergence of alates was recorded during the months of June to August (Chhotani, 1962a, b). The alates, soldiers and pseudoworkers are in the ratio of 1 : 5 : 94 and reproduction by constant parthenogenesis is reported.

Genus *Cryptotermes* Banks

13. *Cryptotermes bengalensis* Snyder (Fig. 13, Table 11)

1. *Kalotermes* (*Cryptotermes*) *bengalensis* Snyder

1934. Snyder, *Indian For. Rec.*, 20(11) : 4-6. Im., S. Syntypes : In BM, London and FRI, Dehra Dun, India. Type-locality : Sundarbans, West Bengal, India.

2. *Cryptotermes havilandi* (Sjöstedt) (Part)

1955. Moszkowski, *Mem. Inst. Sci. Madagascar*, (E) 6 : 15-29 (indian records only).

1970a. Roonwal, In *Biology of Termites*, 2 (Eds. Krishna and Weesner) : 328.

1975. Akhtar, *Bull. Dept. Zool. Univ. Panjab* (N.S.), Art. 7 : 28, 31-35.

1979. Roonwal, *Termite Life and Termite Control in Tropical South Asia* : 51, 78, 116, 121.

1984. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 49 : 62, 66-69.

3. *Cryptotermes bengalensis* Snyder

1975. Sen-Sarma *et al.*, *Wood destroying Termites of India*. (Final Tech. Rep. PL-480 Proj.) : 10, 19-21.

1982. Thakur and Rathore, *J. Bombay nat. Hist. Soc.*, 79 : 699-700

1987. Bacchus, *Trop. Pest. Bull.*, No. 7 : 1, 2, 3, 5, 8, 9, 10, 25, 30, 38-40, 57, 77, 78, 85, 86.

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 373-377 (detailed synonymy).

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

Material studied : Identified : From Western Himalaya : Sev. S. and Psw, Naini Tal, coll. S.C. Verma, ex. "tree trunk", det. S.C. Verma.

Diagnostic Character : (i) Imago : Known but not from the Himalaya, hence not dealt. (ii) Soldier (Fig. 13a) : Head reddish dark brown; body pale brown. Head sparsely and body moderately hairy.

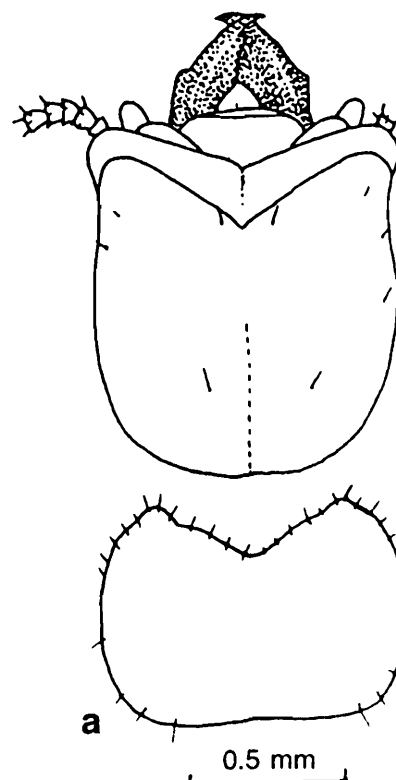


Fig. 13. : *Cryptotermes bengalensis* Snyder; a. Soldier. a. Head and pronotum, dorsal view.

Table 11 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Cryptotermes bengalensis</i>	
	Sev. S.	Known Range
Length of head to lateral base of mandibles	1.13–1.45	1.13–1.47
Maximum width of head	0.94–1.20	1.08–1.35
Head index (width/length)	0.82–0.83	–
Maximum length of labrum	0.11–0.18	0.10–0.19
Maximum width of labrum	0.13–0.21	0.20–0.27
Length of left mandible (Upper base of condyle to tip)	–	0.44–0.60
Head-mandibular length Index (left mandible-length/ head-length)	–	–
Minimum median length of postmentum	–	–
Maximum width of postmentum	–	–
Width of postmentum at waist	–	–
Maximum length of pronotum	0.68–0.90	0.70–0.90
Maximum width of pronotum	1.00–1.25	1.00–1.30
Pronotum index (length/width)	0.68–0.72	–
Number of antennal segments	11–15	11–15

Head short, thick, subsquarish to subrectangularly truncate. Eyes marked as pale spot. Antennae with 11-15 segments, 3 either shortest or subequal to 2, sometimes subdivided. Postclypeus subtrapezoidal, weakly pilose. Labrum subtriangular with a pair of hairs at the tip. Mandibles short, stout, triangular and prominently humped, each mandible with 2 weak marginal teeth. Postmentum short, anterior margin substraight to weakly incurved. Pronotum weakly narrower to somewhat broader than head, anterior margin deeply incurved; posterior margin substraight.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Naini Tal Dist. : Naini Tal. Assam. Tripura, West Bengal, Orissa, Madhya Pradesh, Gujarat, Karnataka, Andaman and Nicobar Islands. ELSEWHERE : Sri Lanka, Bangladesh

Remarks : This is the lone species of the genus known from the Western Himalaya and foot-hills of the Eastern Himalaya. The truncate head with very short mandibles of the soldiers in fact keeps the species separate from all other termites from the study area. This dry wood species is commonly

found in the structural timber in buildings as well as in most planted trees around human habitations in India including Bangladesh and Sri Lanka. In a single occasion, it has been reported recently (Verma, 1995) from a considerable height at Naini Tal, Western Himalaya. Biology of the Himalayan population are unknown so far.

Family RHINOTERMITIDAE

Key to the subfamilies of family RHINOTERMITIDAE

I. IMAGOS :

1. Postclypeus strongly swollen, generally projected medially in front, fontanelle groove running from fontanelle opening either to tip of labrum or slightly shorter Rhinotermitinae
- Postclypeus not strongly swollen, either weakly swollen or flat, not projected medially in front, fontanelle groove absent 2
2. Head oval with substraight lateral margins ... Heterotermitinae
- Head round with strongly outcurved lateral margins Coptotermitinae

II. SOLDIERS :

1. Soldiers either monomorphic or dimorphic; mandibles each with 1-2 sharply pointed teeth; fontanelle situated forwardly in between antennal carinae with a groove running from it upon base of clypeus Rhinotermitinae
- Soldiers generally monomorphic, sometimes dimorphic; mandibles with any distinct tooth; but with some basal crenulations; fontanelle either small or large; situated at the base of clypeus, but without any groove running forwards 2
2. Soldiers generally monomorphic, sometimes dimorphic; Head subrectangular; tip of labrum with hyaline needle-like projections; fontanelle opening small Heterotermitinae
- Soldiers always monomorphic; head oval or roundly oval; tip of labrum not needle-like, but somewhat tapering and hyaline; fontanelle opening large Coptotermitinae

Key to the genera of family
RHINOTERMITIDAE

I. IMAGOS :

1. Head round with distinctly outcurved sides ..
..... *Coptotermes* Wasmann
- Head oval with substraight sides 3
2. Generally paler species; second marginal tooth on left mandible distinctly longer than first..
..... *Heterotermes* Froggatt
- Generally darker species; second marginal tooth on left mandible nearly as long as first
..... *Reticulitermes* Holmgren

II. SOLDIERS :

1. Head subrectangular; mandibles without teeth, labrum triangular, sometimes with a needle-like projection at apex 2
- Head oval or roundly oval; labrum either tongue-shaped or dome shaped 3
2. Labrum tongue-shaped with somewhat blunt hyaline tip *Reticulitermes* Holmgren
- Labrum with a hyaline needle-like projection at apex *Heterotermes* Froggatt
3. Mandibles each with 1-2 sharply pointed teeth; fontanelle situated forwardly in between antennal carinae, with a groove running from

it usually upto tip of labrum or upto base of clypeus; labrum tongue-shaped
..... *Parrhinotermes* Holmgren

– Mandibles with only a few crenulations in basal half; fontanelle large, situated at base of clypeus, without any groove running onwards; labrum dome-shaped ... *Coptotermes* Wasmann

Subfamily COPTOTERMITINAE

Genus *Coptotermes* Wasmann**Key to the species of genus *Coptotermes* Wasmann****I. IMAGOS :**

1. Head-width 1.18–1.30 mm; pronotum smaller (length 0.61–0.83 mm; width 1.06–1.38 mm)
..... *C. travians* (Haviland)
- Head-width 1.30 mm (1.30–1.40 mm); pronotum larger, length 0.81 mm (0.72–0.81 mm); width 1.25 mm (1.21–1.33 mm)
..... *C. heimi* (Wasmann)

II. SOLDIERS :

1. Larger species, head-length to base of mandibles 1.41–1.53 mm (1.40–1.50 mm); head dorsum behind the fontanelle not swollen or wavy *C. gestroi* Wasmann
- Smaller species, head length to base of mandibles 1.20–1.40 mm; head dorsum behind the fontanelle swollen and wavy 2
2. Head elongately oval, waist of postmentum less 0.25–0.30 mm (0.22–0.24 mm), postmentum contraction index 0.57–0.69
..... *C. travians* (Haviland)
- Head broadly oval, waist of postmentum wide 0.28–0.64 mm (0.26–0.32 mm), postmentum contraction index 0.63–0.76
..... *C. heimi* (Wasmann)

14. *Coptotermes gestroi* Wasmann
(Fig. 14, Table 13)

1. *Termes (Coptotermes) gestroi* Wasmann

1896. Wasmann, *Ann. Mus. civ. Stor. Nat. Genova*, (2) 16 : 628-629. S. Holotype : Not designated by Wasmann. Syntypes not traceable in Wasmann Coll. in *Nat. Hist. Mus.*, Maastricht. Type-locality : Bhamo, Myanmar.
1904. Desneux, *Genera Insect.*, 25 : 34 (Part, specimens from Myanmar only identified as *gestroi*).

2. *Coptotermes gestroi* Wasmann

- 1913b. Holmgren, K. sv. Vet. Akad. Handl., 50(2) : 78, 266-267.
 1934. Margabandhu, J. Bombay nat. Hist. Soc., 37(3) : 704.
 1949. Snyder, Smiths. misc. Colls., 112 : 78 (Records from Malaysia are *curvignathus*).
 1962a. Roonwal and Chhotani, Proc. natn. Inst. Sci. India, (B) 28(4) : 306, 307, 393.
 1973. Morimoto, Bull. Govt. For. Exp. Sta., No. 257 : 61.
 1986. Gressé, Termitologia, 3 : 523.
 1989. Roonwal and Chhotani, Fauna of India : Isoptera (Termites), 1 : 445-449 (detailed synonymy).
 1999. Bose, Occ. Paper Rec. zool. Surv. India, No. 171 : 44-46.

Material studied : Identified : From *Eastern Himalaya* : (i) Sev. S. and W. near Chakma village, Arunachal Pradesh, coll. J.M. Julka, 25.xi.1969, det. G. Bose (ii) Sev. S. and W., Sille, East Siang Dist., Arunachal Pradesh, coll. P.T. Bhutia, 22.xi.1988 (2 vials), det. G. Bose, (iii) Sev. S. and W., Nambung, seven km from Bolang, East Siang Dist., Arunachal Pradesh, coll. T.K. Pal, 23.ii.1989, det. G. Bose. (iv) Sev. S. and W., Dibru, 15 km off Seijusa, East Siang Dist., Arunachal Pradesh, coll. D.P. Sanyal, 12.x.1987, det. G. Bose. (v) Sev. S. and W., Zoological Garden, Itanagar, Lower Subansiri Dist., Arunachal Pradesh, coll. O.B. Chhotani, 12.v.1989, ex. "a stump of wood", det. G. Bose. (vi) Sev. S. and W., Bhalukpong, Tipi, West Kameng Dist., Arunachal Pradesh, coll. A.N.T. Joseph, 3.v.1966, det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 14a-b) : Head yellowish to yellowish brown. Head with a few erect bristles including one on either side of fontanelle. Pronotum with short setae on anterior margin and longer ones on margins. Body and abdominal tergites with a row of setae on posterior margin and a few on body.

Head oval, longer than broad; sides weakly outcurved, converging anteriorly. Fontanelle large, opening with a brown chitinous border. Antennae with 14-15 segments, 3 shortest. Labrum subtriangular, longer than broad, sides narrowing

distally to a hyaline apex, distal tip with one long bristle on either side. Mandibles sabre-shaped. Postmentum club-shaped, long, a few bristle like hairs present in anterior part. Pronotum, subreniform, much broader than long, anterior margin broadly convex with a median notch; posterior margin substraight, with a weak median depression.

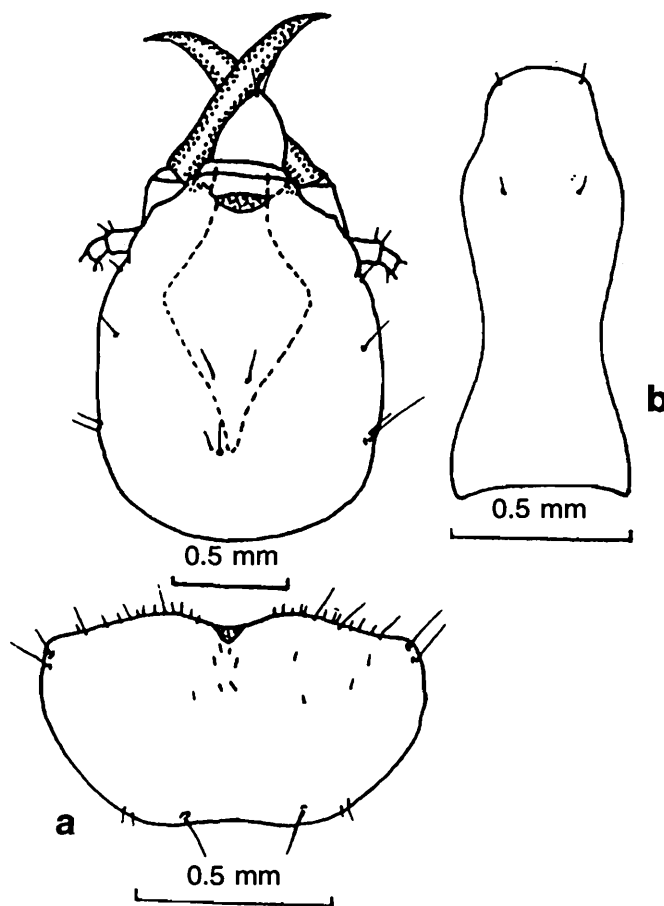


Fig. 14. : *Coptotermes gestroi* Wasmann; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Kameng Dist. : Bhalukpong, Tipi; Lower Subansiri Dist. : Itanagar : Zoological Garden; East Siang Dist. : Nambung, Dibru, 15 km off Seijusa, Sille. Assam : Kaziranga; Dibrugarh; Jaipur Range.

Elsewhere : Myanmar : Bhamo.

Remarks : The species is known to occur from Arunachal Pradesh eastward upto Myanmar. It is not so familiar in India like *C. heimi* and *C. travians* although very similar in habitats. However, it is quite a larger species than those two other species.

15. *Coptotermes heimi* (Wasmann)

(Fig. 15, Tables 12 and 13)

1. *Arrhinotermes heimi* Wasmann

1902. Wasmann, *Zool. Jb. (Syst.)*, **17**(1) : 104; Pl. 4, figs. a-f, Im.; 160 (Syn.). Im. Type Im., in Wasmann's Coll., NHM, Maastricht (Holland). Type-locality : India : Wallon, Ahmadnagar Dist., Maharashtra.

2. *Coptotermes heimi* (Wasmann)

1911. Holmgren, *K. sv. Vet. Akad. Handl.*, **46**(6) : 73, India.
 1949. Snyder, *Smiths. misc. Colls.*, **112** : 79.
 1958a. Ahmad, *Biologia*, **4** (1) : 63, 64.
 1967. Roonwal and Chhotani, *J. Bombay nat. Hist. Soc.*, **63**(2) : 355, 358; Pl. 2.
 1974. Akhtar, *Pakistan J. Zool.*, **6**(1-2) : 90, 101.
 1983. Maiti, *Occ. pap. Rec. zool. Surv. India*, No. 42 : 17, 23, 48-51, 144, Map. 1.
 1987. Bose and Das, *Fauna of Orissa : State Fauna Series*, No. 1 : 103, 108.
 1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 449-457 (detailed synonymy).
 1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1*, Uttar Pradesh : 47-50, Uttaranchal.
 1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 46-47.

3. *Coptotermes parvullus* Holmgren

- 1913a. Holmgren, *J. Bombay nat. Hist. Soc.*, **22**(1) : 102, 104. S., W. Holotype : Not selected; Syntypes : S. and W. in AMNH, New York and Holmgren Coll., National Mus., Stockholm. Type-localities : Anand and Vadtal (Gujarat, India).
 1949. Snyder, *Smiths. misc. Colls.*, **112** : 82.
 1953. Rattan Lal and Menon, *Catal. Indian Insects, Part 27, Isoptera* : 26.

4. *Coptotermes travians* (Haviland)

(Wrong determination)

1910. Bugnion, *Ann. Soc. Ent. Fr.*, **79** : 137.

Material studied : Unidentified : From *Eastern Himalaya* : Two vials from Darjiling Dist., W.B. as (i) with 10S. and 5W., one km South-West of Reyang F.R.H., on the way to Rambhi, coll. *H.S. Sharma & party*, 31.iii.1973, ex. 'rotten log, making longitudinal gallery lying deep in the wood'; (ii) with 9S. and 10W., Koang, coll. *D.N. Tiwari*, 8.iv.1979. Three vials from Sikkim, coll.

D.N. Tiwari as follows : (iii) with 5S. and 8W., Mansong, Rongpo, 2.iv.1979; (iv) with 7S. and 10W., Mansong, Rongpo, 6.iv.1979; (v) with 3S. and 5W., Melli, Rongpo, 4.iv.1979. Identified : A. From *Western Himalaya* : (i) 2S. and 10W Bijrani, Naini Tal, Uttaranchal, coll. *S.C. Verma*, 7.vi.1976, det. *S.C. Verma* (ii) 1S. and sev. W. Dhikola, Dhangarhi Road, Pauri Dist., Uttaranchal, coll. *S.C. Verma*, 1.vii.1976, det. *S.C. Verma*. B. From *Eastern Himalaya* : (iii) 1Im., Sukna, Darjiling Dist., W.B., coll. *A.R. Bhowmik*, 11.iv.1978. ex. 'at light', det. *S.C. Verma*.

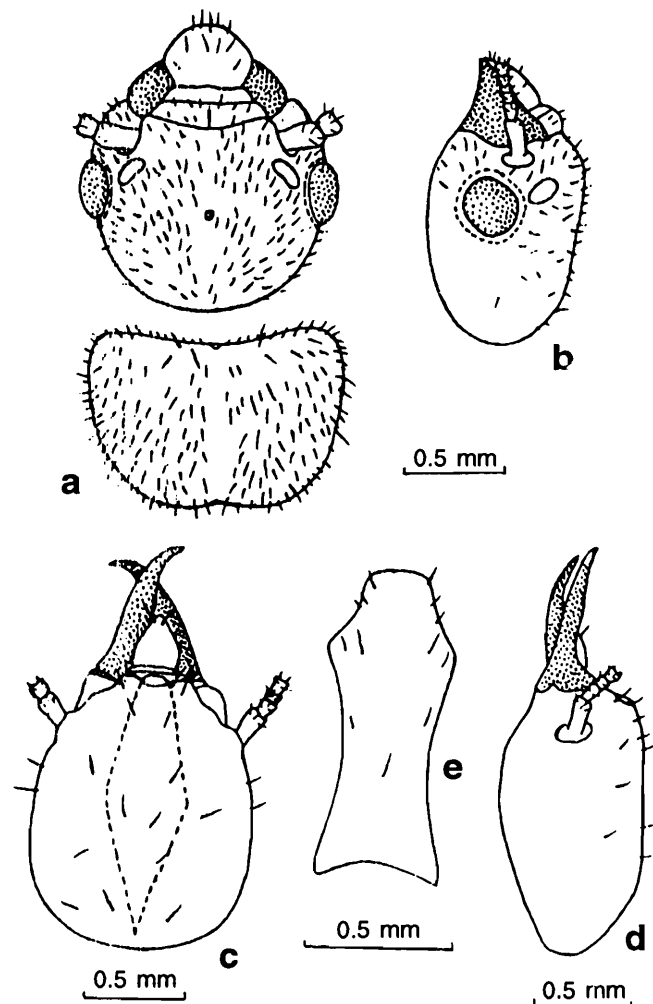


Fig. 15. : *Coptotermes heimi* (Wasmann); a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-e, Soldier. c. dorsal view; d. Head, side view; e. Postmentum.

Diagnostic Character : (i) Imago (Fig. 15a-b) : Head pale brown to dark brown; labrum, antennae, postclypeus and legs yellowish brown; pronotum paler than head; wings transparent. Head fairly pilose; pronotum and abdomen densely pilose; wings with a dense covering of small hairs on membrane, wing scales with longer hairs.

Table 12 : Measurements (in mm) etc. of Caste-Imago.

	<i>Coptotermes heimi</i>	
	1 Im.	Known Range
Total body-length with wings (excluding antennae), ca.	12.0	10.6–12.3
Total body-length without wings (excluding antennae), ca.	6.80	5.60–7.00
Length of head to lateral base of mandibles	1.04	1.04–1.16
Maximum width of head (with eyes)	1.30	1.30–1.40
Maximum length of postclypeus	–	–
Maximum width of postclypeus	–	–
Maximum length of labrum	0.38	0.39–0.41
Maximum width of labrum	0.46	0.46–0.47
Maximum diameter of compound eye (with ocular sclerite)	0.38	0.37–0.41
Maximum diameter of lateral ocellus	0.18	0.16–0.19
Minimum diameter of lateral ocellus	–	–
Minimum eye-ocellus distance	0.03	0.012–0.037
Maximum length of pronotum	0.81	0.72–0.81
Maximum width of pronotum	1.25	1.21–1.33
Length of forewing with scale	9.70	8.60–9.75
Length of hindwing with scale	8.20	8.10–9.60
Number of antennal segments	22	20–22

Table 13 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Coptotermes gestroi</i>		<i>C. heimi</i>		<i>C. travians</i>	
	Sev. S.	Known Range	Sev. S.	Known Range	7S.	Known Range
Length of head to lateral base of mandibles	1.41–1.53	1.40–1.53	1.31–1.40	1.20–1.45	1.23–1.38	1.23–1.40
Maximum width of head	1.14–1.25	1.14–1.25	1.09–1.30	1.05–1.35	1.00–1.18	1.00–1.18
Head index (width/length)	0.80–0.81	–	0.83–0.92	1.04	0.81–0.85	–
Maximum length of labrum	0.33–0.35	0.33–0.35	0.28–0.35	0.28–0.35	0.27–0.31	0.25–0.34
Maximum width of labrum	0.28–0.30	0.30	0.23–0.30	0.23–0.30	0.23–0.30	0.25–0.30
Length of left mandible (Upper base of condyle to tip)	0.81–0.90	0.82–0.93	0.74–0.98	0.70–1.00	0.75–0.86	0.75–0.88
Head-mandibular length Index (left mand.-length/head-length)	0.57–0.58	–	–	–	–	–
Minimum median length of postmentum	0.95–1.10	0.93–1.08	1.03	–	0.81–1.00	0.78–1.00
Maximum width of postmentum	0.40–0.45	0.40–0.45	0.38–0.44	0.38–0.45	0.35–0.44	0.34–0.44
Width of postmentum at waist	0.25–0.30	0.23–0.28	0.28–0.34	0.25–0.34	0.23–0.28	0.23–0.29
Maximum length of pronotum	0.40–0.53	0.38–0.50	–	0.40–0.50	0.38–0.44	0.35–0.44
Maximum width of pronotum	0.70–0.95	0.65–0.95	–	0.75–0.95	0.72–0.87	0.68–0.88
Pronotum index (length/width)	0.56–0.57	–	–	–	–	–
Number of antennal segments	14–15	14–15	14–16	14–16	14–15	14–15

Head rounded; sides and posterior margin rounded. Fontanelle minute, indistinctly visible. Ocelli whitish, translucent, oval; almost touching the eyes or slightly separated. Antennae with 20-22 segments; 3 shortest. Postclypeus pilose, median line incomplete. Labrum broadly dome-shaped with a few hairs on body and on anterior margin. Mandibles of *Coptotermes*-type. Pronotum narrower than head-width with eyes, anterior margin weakly concave; posterior margin convex with median emargination, a pale T-shaped mark on middorsum. Wings transparent; venation as of *Coptotermes*-type.

(ii) Soldier (Fig. 15c-e) : Head straw yellow to yellowish white; abdomen yellowish white. Head with a few erect bristles and one on each side of fontanelle; pronotum with small setae-like hairs on anterior margin and longer ones all over; each abdominal tergum with a row of hairs at posterior margin and some scattered ones on body.

Head variable in shape, pyriform to subcircular, generally longer than broad. Fontanelle large, circular, with a highly sclerotized border. Antennae with 14-16 segments, 3 either smallest or subequal to 2 or 4. Labrum subrectangular, longer than broad, apex hyaline, pointed out and with a pair of bristles, a few short setae on body. Left mandible with 4 small crenulations and a basal projection in proximal half and right with 4 small crenulations in proximal one-third. Postmentum generally club-shaped with a few hair on anterior part and body. Postmentum subreniform, much broader than long, anterior margin slightly wavy with a medial depression; posterior margin medially invaginated.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun; Tehri; Pauri; Naini Tal and Haldwani. *Eastern Himalaya* : Sikkim : East Sikkim Dist. : Rongpo. West Bengal : Darjiling Dist. : Samsing; Jalpaiguri Dist. : Chalsa Forest Range. Arunachal Pradesh : East Kameng Dist. : Bhairavkonda; Lower Subansiri Dist. : Nirjuli;

West Siang Dist. : Likhabali; Tirap Dist. : Deban, 27 km from Miao. Assam. Nagaland. Tripura. West Bengal (except Darjiling and Jalpaiguri Dist.) : Kolkata. Gujarat. Punjab. Madhya Pradesh. Uttar Pradesh. Orissa. Tamil Nadu and Delhi. NEPAL (*Central Himalaya*). BHUTAN (*Eastern Himalaya*).

Elsewhere : Pakistan. Bangladesh. Indonesia and Oman.

Remarks : The species is represented by highly variable population at least in its shape, size and measurements of head, pronotum, postmentum, etc. Hence, identification deserves much caution. In its external features, measurements, etc., the species is almost inseparable from *C. travians* – a species is more prevalent in the south-east Asia including the eastern India. This has however, broadly oval head and slightly wider waist of postmentum in soldier caste, while *C. travians* has elongately oval head and narrower waist of postmentum. It is quite a common species found inhabiting in wood, logs, under bark etc. This is one of the most common and most destructive, economically important polyphagous species in India and Pakistan. Reports are there of its introduction in south-east Asia (Gay, 1967).

It nests in soil as well as in dead portions of trees, in concealed nests having diffuse chambers containing semi-carton sponge-like fillings. In the Himalaya the species is known to infest felled logs in different altitudes. It occurs at highest altitude between 2600 m and 3400 m on Kathoka-Gagona route in Bhutan.

The species generally swarms at sunset from January to August depending upon the seasonal condition of the locality. In Dehra Dun, its swarming occurs in June and July after a heavy shower and in Sukna in the month of April. Biology of the species is limited to the information of Assmuth, 1913; Annandale, 1923; Mathur and Sen-Sarma, 1959; Roonwal, 1970a; Maiti, 1983 and others.

16. *Coptotermes travians* Haviland
(Fig. 16, Table 13)

1. *Termes* (*Coptotermes*) *travians* Haviland

1898. Haviland, *J. Linn. Soc. Lond. (Zool)*, **26**(164) : 391-392; Pl. 23 (Figs. 19-22). Im., S., W. Holotype : Not selected. Syntypes in BM, London; AMNH, New York; FRI, Dehra Dun; IARI, New Delhi. Also probably in Zoology Mus., Cambridge (U.K.) and Holmgren Coll., National Mus., Stockholm. Type-localities : Singapore and Sarawak (Malaysia).
1904. Desneux, *Genera Insectorum, Fasc.*, **25** : 34.

2. *Coptotermes travians* Haviland

1911. Holmgren, *Zool. Anz.*, **37** : 551-552.
1917. Holmgren and Holmgren, *Mem. Dept. Agric. India (Ent.)*, **5**(3) : 145.
1934. Kemner, K. *sv.Vet. Akad. Handl.*, (3) **13**(4) : 62-64. Im., S. and W.
1949. Snyder, *Smiths. misc. Colls.*, **112** : 83.
- 1958a. Ahmad, *Biologia*, Lahore, **4**(1) : 62, 67.
1965. Roonwal and Chhotani *J. Bombay nat. Hist. Soc.*, **62**(1) : 22, 23.
1975. Sen-Sarma *et al.*, *Wood destroying Termites of India (Final Tech. Rept. PL. 480 Proj)* : 11, 48, 64.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 17, 23, 53-54.
1987. Bose and Das, *Fauna of Orissa : State Fauna Series*, No. 1 : 104, 108.
1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 461-467 (detailed synonymy)
1995. Maiti *et al.*, *Rec. zool. Surv. India : State Fauna Series*. **4** : *Fauna of Meghalaya*, Part 3 : 437.

Material studied : Unidentified : From *Eastern Himalaya* : (i) 2S. and 10W., Suchnagar, Itanagar, Lower Subansiri Dist., Arunachal Pradesh, coll. B. Nandi and party, 20.vi.1985. (ii) 1Im., 10S., sev. W., Rongpo, East Sikkim, coll. B.N. Nandi and party, 12.iv.1980, ex, "decaying stump"; (iii) 7S. and 12W., Rongpo, East Sikkim, coll. P.H. Roy and party, 14.iv.1994, ex. "under log"; (iv) 3S. and 8W., Rumtek, East Sikkim, coll. P.H. Roy and party, 6.iv. 1994, ex "soil under bamboo"; (v) 5S. and 10W., Mamring, South Sikkim, coll. P.H. Roy, 20.v.1995, ex, 'under log'; (vi) 5S. and 20W., Melli, South Sikkim, coll P.H. Roy and party, 13.iv.1994, ex. 'fense post.

Diagnostic Character : (i) Imago : Head reddish brown; pronotum and abdominal tergites

pale brown; wings transparent, pale brownish. Head and body fairly densely hairy, wings densely pilose with small hairs.

Head subcircular. Fontanelle minute. Eyes black, subcircular. Ocelli oval, situated very close to eyes or touching eyes. Antennae with 19-23 segments, 3 or 4 shortest. Postclypeus with a median line. Labrum dome-shaped. Mandibles of typically *Coptotermes* type. Pronotum subreniform, anterior margin weakly incurved and faintly or not notched in middle; posterior margin weakly invaginated medially. Wing venation as in genus in general, cubitus with 10-12 branches in forewing; 10 in hindwing.

(ii) Soldier (Fig. 16a-b) : Head yellow, abdomen paler than head. Head with a few, erect, scattered bristles and a long one on either side of fontanelle. Pronotum with short hairs on anterior margin and longer hairs on margins and body. Abdominal tergites each with a row of setae on posterior margin and irregular ones on body.

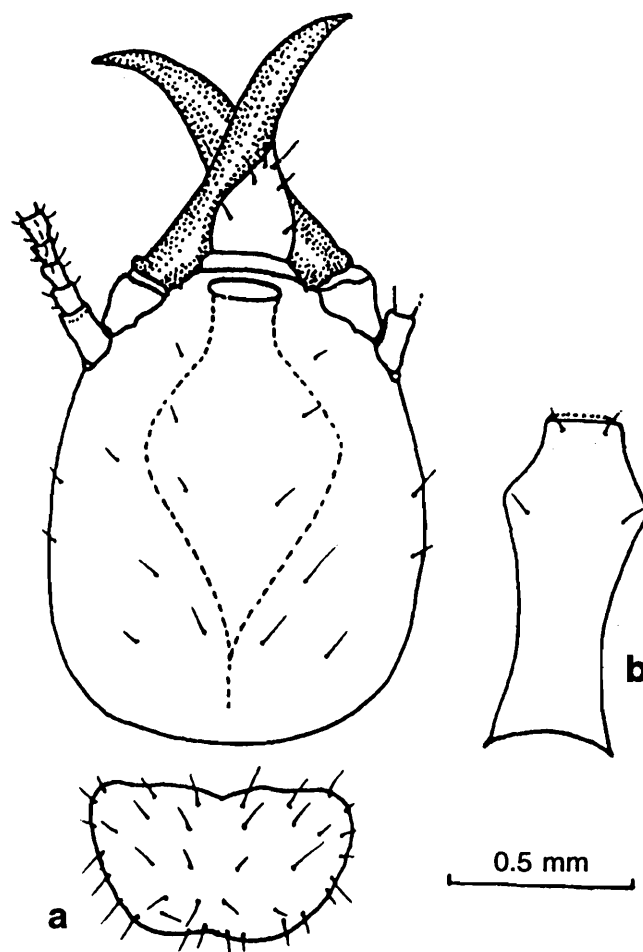


Fig. 16. : *Coptotermes travians* Haviland; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Head oval, longer than broad. Fontanelle opening large, circular, with chitinous border. Eyes and Ocelli absent. Antennae with 14-15 segments, 3 either shortest or subequal to or longer than 2 or 4. Labrum subtriangular, strongly converging to a pointed, hyaline tip, with one long bristle on either side of tip. Mandibles sabre-shaped with sharply pointed, incurved apices. Postmentum club-shaped with a concave posterior margin. Pronotum subreniform, narrower than head, anterior margin convex with a median notch; posterior margin weakly incurved medially.

Distribution : INDIA : *Eastern Himalaya* : Sikkim : East Sikkim Dist. : Rongpo, Rumtek; South Sikkim Dist. : Mamring, Melli. Arunachal Pradesh : Lower Subansiri Dist. : Itanagar, Suchnagar. Assam, Andaman and Nicobar Islands. Meghalaya. Orissa. Tripura and West Bengal (Kolkata).

Elsewhere : Bangladesh, Myanmar, Malaysia, Singapore and Indonesia.

Remarks : A very variable species (as its closest one *C. heimi*) in its head shape and other morphological characters. Their identity sometimes remains doubtful. However, this species predominantly found from Orissa and West Bengal eastward to Indonesia, while *C. heimi* spread from Assam westward to Oman. As such, both the species are sympatric only in some parts of eastern India. The identity of the population found to the Arunachal Pradesh has been done with caution considering the migre collection as studied here.

The species generally nests underground and extends their galleries above ground in wooden material of economic importance.

Subfamily HETEROTERMITINAE

Genus *Heterotermes* Froggatt

Key to the species of genus *Heterotermes* Froggatt

I. IMAGOS :

1. Ocelli absent; larger species; eyes broadly oval; antennae with 19 segments
..... *H. gertrudae* Roonwal

- Ocelli present; smaller species; eyes elongately oval; antennae with 16-17 segments
..... *H. indicola* (Wasmann)

II. SOLDIERS :

1. Smaller species; head length to base of mandibles 1.00 mm (1.00–1.10 mm), head width, 0.70 mm (0.70–0.75 mm); mandibles slender and weakly incurved apically; mandibles longer in relation to head, mandible-head index, 0.73 (0.68–0.78)
..... *H. balwanti* Mathur and Chhotani
- Larger species; head length to base of mandibles, 1.25–1.78 mm, head width 0.77–1.05 mm; mandibles thick and more strongly incurved apically; mandibles comparatively shorter in relation to head, mandible-head index, 0.50–0.65 2
2. Head-capsule subrectangular, sides strongly narrowing posteriorly; pronotum width 0.97 mm (0.83–1.00 mm); head length to base of mandibles 1.53 mm (1.50–1.78 mm), head width 1.18 mm (0.97–1.05 mm)
..... *H. gertrudae* Roonwal
- Head-capsule rectangular, sides subparallel or weakly converging posteriorly; pronotum width 0.67–0.83 mm; head length to base of mandibles 1.38–1.75 mm, head width 0.82–1.00 mm *H. indicola* (Wasmann)

17. *Heterotermes balwanti* Mathur and Chhotani (Fig. 17, Table 15)

1. *Heterotermes balwanti* Mathur and Chhotani

1969. Mthur and Chhotani, *J. Timber Dev. Assoc. India*, **15**(4) : 4-8, 10. S., W. Holotype : S., in FRI, Dehra Dun. Type-locality : Balukhand For. Range, near Puri, Orissa, India.
1979. Roonwal, *Termite Life and Termite Contr. Trop. South Asia* : 117.
1983. Bose and Das, *Rec. zool. Surv. India*, **80** : 198, 199, 202, 210.
1987. Bose and Das, *Fauna of Orissa, State Fauna Ser.*, No. 1 : 104, 108.
1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 476-479 (detailed synonymy).
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50, Uttaranchal.

Material studied : Since no material is available, description, measurement, etc. are based on Mathur and Chhotani (1969).

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 17a-c) : Head yellowish white to yellowish brown; mandibles dark brown. Head and pronotum moderately and body fairly densely hairy.

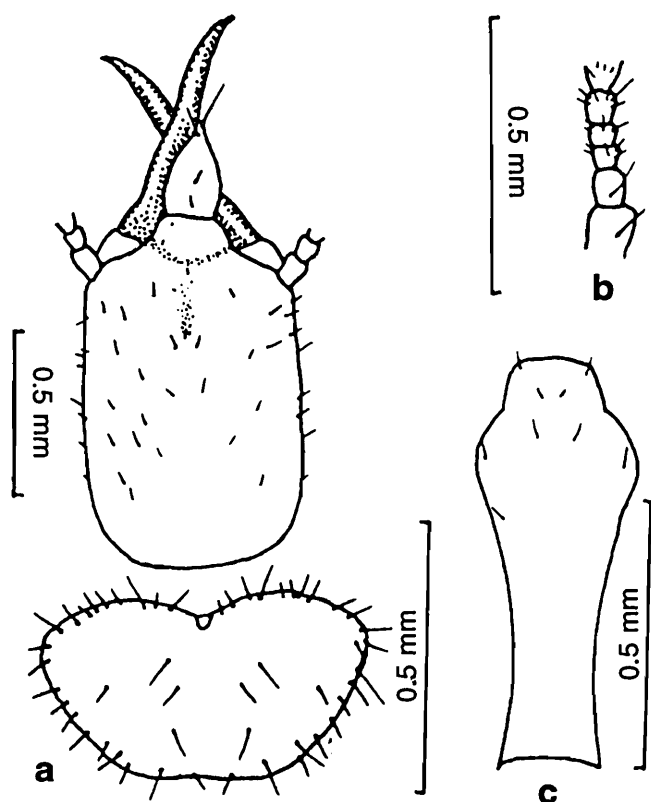


Fig. 17. : *Heterotermes balwanti* Mathur and Chhotani; a-c, Soldier. a. Head and pronotum, dorsal view; b. Basal part of antenna; c. Postmentum.

Head subrectangular, in lateral view anteriorly swollen and with a median groove, frons sloping sharply in front. Fontanelle minute, leading into a small brownish tube. Eyes and Ocelli absent. Antennae with 12-14 segments (mostly 14), 3 normally subequal to or sometimes a little longer than 4. Labrum triangular, with a long, acuminate, hyaline tip, a pair of long hairs at base of apex. Mandibles thin, sabre-shaped. Postmentum club-shaped. Pronotum subreniform, anterior margin weakly to fairly deeply and broadly incurved medially; posterior margin with a feeble invagination.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Uttarkashi Dist. Orissa : Balukhand

Forest Range, near Puri (type-locality); Barkuda Island; Puri and Rambha. Karnataka : Dharwar. Goa : Valpoi Forest Range, North Goa Forest Division.

Remarks : The species is predominantly found in the Indian plains except its single record in the hilly tracks of the Himalaya (Verma, 1995). It is close to *H. malabaricus*, but differs in having smaller size, and longer mandibles.

18. *Heterotermes gertrudae* Roonwal

(Fig. 18, Tables 14 and 15)

1. *Heterotermes gertrudae* Roonwal

1953. Roonwal, *Indian J. Ent.*, **15**(2) : 115-118. S., W. Holotype : S., in AMNH. Type-locality : Almora, Uttaranchal, India.

1976. Roonwal and Verma, *Rec. zool. Surv. India*, **69** : 241-247.

1979. Roonwal, *Termite Life & Termite Contr. Trop. South Asia* : 7, 51, 79, 117.

1983. Chhotani, *Orient. Insects*, **17** : 118.

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 483-487 (detailed synonymy).

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50, Uttaranchal.

2. *Heterotermes indicola* (Wasmann).

Part. Wrong determination

1979. Thakur and Sen-Sarma, *Indian For. Rec. (N.S.), Ent.*, **13**(2) : 10-11.

Material studied : Identified : From *Western Himalaya* : 1S., Dhikola, Pauri Dist., Uttaranchal, coll. S.C. Verma, 30.v.1977, det. M.L. Roonwal.

Diagnostic Character : (i) Imago (Fig. 18a-c) : Head and pronotum yellowish brown; body paler ventrally; antennae and legs paler than head. Both head and body fairly densely hairy.

Head subcircular, almost as wide as length to base of mandibles; sides weakly narrowing behind. Fontanelle minute. Ocelli absent. Antennae with 17 segments, 3 a little smaller than 2; 4 shortest. Postclypeus weakly swollen, pilose with a median line. Labrum broad, tongue-shaped with a few short

Table 14 : Measurements (in mm) etc. of Caste-Imago.

	<i>H. gertrudae</i>		<i>H. indicola</i>	
	1 Im.	Known Range	1 Im.	Known Range
Total body-length with wings (excluding antennae), ca.	10.50	10.0–11.5	11.0	10.0–11.70
Total body-length without wings (excluding antennae), ca.	5.60	5.50–5.80	6.00	5.40–6.50
Length of head to lateral base of mandibles	0.83	0.89–0.95	1.00	0.80–1.00
Maximum width of head (with eyes)	1.00	0.89–0.95	0.86	0.85–1.00
Maximum length of postclypeus	–	–	–	–
Maximum width of postclypeus	–	–	0.37	–
Maximum length of labrum	–	–	0.22	–
Maximum width of labrum	–	–	0.31	–
Maximum diameter of compound eye (with ocular sclerite)	0.23	0.23	0.25	0.20–0.25
Maximum diameter of lateral ocellus	–	–	–	(long diameter)
Minimum diameter of lateral ocellus	–	–	–	–
Minimum eye-ocellus distance	–	–	–	–
Maximum length of pronotum	0.53	0.47–0.53	0.50	0.43–0.65
Maximum width of pronotum	0.84	0.84–0.89	0.70	0.70–0.80
Length of forewing with scale	–	–	–	–
Length of hindwing with scale	–	–	–	–
Number of antennal segments	17	17	16	16–18

Table 15 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Heterotermes balwanti</i>		<i>H. gertrudae</i>		<i>H. indicola</i>	
	1 S.	Known Range	1S.	Known Range	Sev. S.	Known Range
Length of head to lateral base of mandibles	1.00	1.00–1.10	1.53	1.50–1.78	1.38–1.75	1.25–1.77
Maximum width of head	0.70	0.70–0.75	1.18	0.97–1.05	0.82–1.00	0.83–1.00
Head index (width/length)	0.70	–	0.77	–	0.59	–
Maximum length of labrum	0.31	0.30–0.38	0.40	–	–	0.08–0.10
Maximum width of labrum	0.19	0.20–0.25	0.31	–	–	–
Length of left mandible (Upper base of condyle to tip)	0.73	0.73–0.78	1.05	0.90–1.05	0.69–0.90	0.73–0.93
Head-mandibular length Index (left mand.-length/head-length)	0.73	0.68–0.78	0.68	–	0.50–0.51	–
Minimum median length of postmentum	0.75	0.70–0.88	1.25	1.13–1.50	0.85–1.19	0.83–1.23
Maximum width of postmentum	0.29	0.30–0.35	0.38	0.30–0.38	0.37	0.35–0.37
Width of postmentum at waist	0.13	0.15–0.18	0.21	0.13–0.19	0.17–0.19	0.17–0.20
Maximum length of pronotum	0.31	0.30–0.35	0.56	–	0.37–0.47	0.35–0.50
Maximum width of pronotum	0.59	0.50–0.55	0.97	–	0.66–0.80	0.60–0.83
Pronotum index (length/width)	0.52	–	0.59	–	0.82	–
Number of antennal segments	12	12–14 (mostly 14)	15	12–17 (mostly 14–15)	15	14–16 (generally 15)

hairs distally. Mandibles typically *Heterotermes*-type. Pronotum slightly narrower than head, anterior margin round. Wings slender, colourless, translucent, with a few short hairs, anterior veins more so hairy. Venation as of *Heterotermes*-type.

(ii) Soldier (Fig. 18d-f) : Head yellowish brown; body pale yellow. Head and pronotum sparsely and body fairly hairy, last 3 segments of abdomen moderately densely hairy.

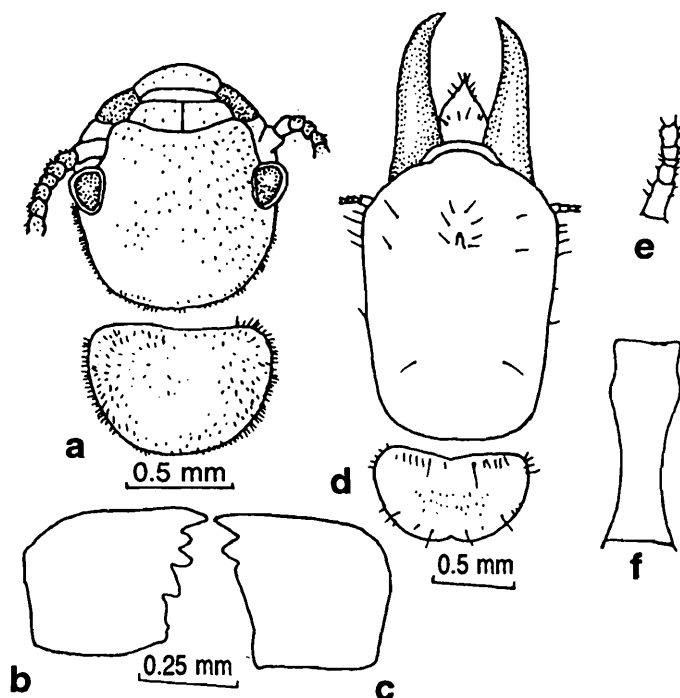


Fig. 18. : *Heterotermes gertrudae* Roonwal; a-c, Imago. a. Head and pronotum, dorsal view; b. Left mandible; c. Right mandible; d-f, Soldier. d. Head and pronotum, dorsal view; e. Basal part of antenna; f. Postmentum.

Head subrectangular, sides weakly diverging anteriorly. Frontanella minute, circular. Postclypeus pilose. Labrum subtriangular with a fine, sharply acuminate distal tip, with a pair of long bristles and a few short hairs at base of distal tip and a few short hairs on body. Mandibles long, incurved at distal tip and of typical *Heterotermes*-type. Antennae with 12-17 (mostly 14-15) segments, 2-subequal to 3 and 4; 3 shortest. Postmentum long, club-shaped. Pronotum subreniform, anterior margin slightly incurved and with a weak median notch; posterior margin also with a weak median invagination.

Distribution : INDIA : North-Western Himalaya : Himachal Pradesh : Malha. Western Himalaya : Uttaranchal : Dehra Dun Dist.;

Naini Tal Dist.; Almora Dist.; Tehri Dist. Pauri Dist.; Dhikola; Pithoragarh Dist.; Rishikesh; Chamoli.

Remarks : The species was a valid one since its first description made by Roonwal (1953) until 1979 when Thakur and Sen-Sarma synonymised it under *H. indicola*. But Roonwal and Chhotani (1989) had maintained its species status valid. However, it is known so far from the Western part of the Himalaya. The species attacks the wood works in the building in the sub-Himalayan tract (Roonwal, 1970a).

19. *Heterotermes indicola* (Wasmann) (Fig. 19, Tables 14 and 15)

1. *Leucotermes indicola* Wasmann

1902. Wasmann, *Zool. Jb.(Syst.)*, 17(1) : 118-119. S., W. Lectotype : S. (designated O.B. Chhotani), in *Nat.Hist. Mus.*, Maastricht. Type-locality : Bombay, India.

2. *Heterotermes indicola* (Wasmann)

- 1933a. Snyder, *Proc. U.S. natl. Mus.*, 82 (Art. 16) : 5
1949. Snyder, *Smiths. misc. Colls.*, 112 : 68.
1961. Harris, *Termites : Their Recognition & Contr.* : 152, 156 (2nd Ed. 1971).
1977. Roonwal and Rathore, *Zool. Anz.*, 198 : 299, 300-301.
1979. Thakur and Sen-Sarma, *Indian For. Rec. (N.S.) Ent.*, 13(2) : 4, 10-15.
1980. Chhotani, *Tech. Manogr. zool. Surv. India*, No. 4 : 26-27.
1985. Chhotani, *Z. and. Ent.*, 100 : 93.
1989. Roonwal & Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 487-491 (detailed synonymy).
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

Material studied : Unidentified : From *Central Himalaya* : (i) 1 Im., sev. S. and W., Ramananda Chak, Janakpurdham, Dhansa Dist., Nepal, coll. P. Mukherjee, 28.iv.2000, ex. "from a sal wood of a hut." (ii) Sev. S. and W., Library of Birendra bahumukhi campus, Narayangarh, Chitwan Dist., Nepal, coll. P. Mukherjee, 27.ix.2000, ex. "inside a book" Identified : From *Western Himalaya* : 2S. and 4W., Dhikola, Dhangarhi Road, Pauri Dist., Uttaranchal, coll. S.C. Verma, 23.vi.1976, det. S.C. Verma.

Diagnostic Character : (i) Imago (Fig. 19a-b) : Head and thorax straw yellow to light brown; antennae, labrum, abdominal tergites paler. Head and pronotum sparsely and abdomen moderately pilose.

Head subsquarish with sides weakly and posterior margin fairly strongly rounded. Fontanelle small, minute and circular. Ocelli very small, dot-like, separated from eyes by double its long diameter. Antennae with 16-18 segments, 3 and 4 almost subequal. Postclypeus weakly swollen with a distinct median line. Labrum and mandibles are of *Heterotermes* type. Pronotum trapezoidal, narrower than head-width with eyes, anterior and posterior margins almost straight with feeble invagination. Wings weakly hairy. Venation of *Heterotermes*-type.

(ii) Soldier (Fig. 19c-e) : Head pale yellow to brownish yellow. Head and pronotum with a few large and several small hairs, abdomen fairly pilose.

Head rectangular, distinctly longer than broad; sides subparallel, converging posteriorly and terminating into a rounded posterior margin. Fontanelle indistinct with a brownish tube; fontanelle gland area pale yellowish. Antennae with 14-16 (generally 15) segments, 3 variable—either shorter or longer than 2 and either subequal to or longer than 4. Labrum lanceolate shape with a hyaline spine-like tip. Mandibles long, sabre-shaped, outer margin fairly straight with weakly incurved apices. Postmentum club-shaped, fairly long, widest at club. Pronotum subtrapezoidal, anterior margin medially weakly notched; posterior margin also weakly to deeply notched, broader than long.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir : Ramban; Udhampur and vicinities. *Himachal Pradesh* : Bialspur; Kulu. *Western Himalaya* : Uttaranchal : Dehra Dun Dist.; Naini Tal Dist. : Bhowali; Almora Dist.; Pithoragarh Dist.; Pauri Dist. : Dhikola, Dhangarhi Road; Rishikesh; Chamoli; Haldwani; Chaubattia. NEPAL (*Central Himalaya*) : Dhansa Dist. : Ramananda Chak, Janakpurdham; Chitwan

Dist. : Birendra bahumukhi campus, Narayangarh. Uttar Pradesh : Kanpur; Makteswar; Baharaich. Gujarat. Khandala. Rajasthan : Ajmer; Sirdhi State. Punjab : Dharamsala; Shri Hargovindpur; Harmirpur; Palampur.

Elsewhere : Pakistan. Afghanistan.

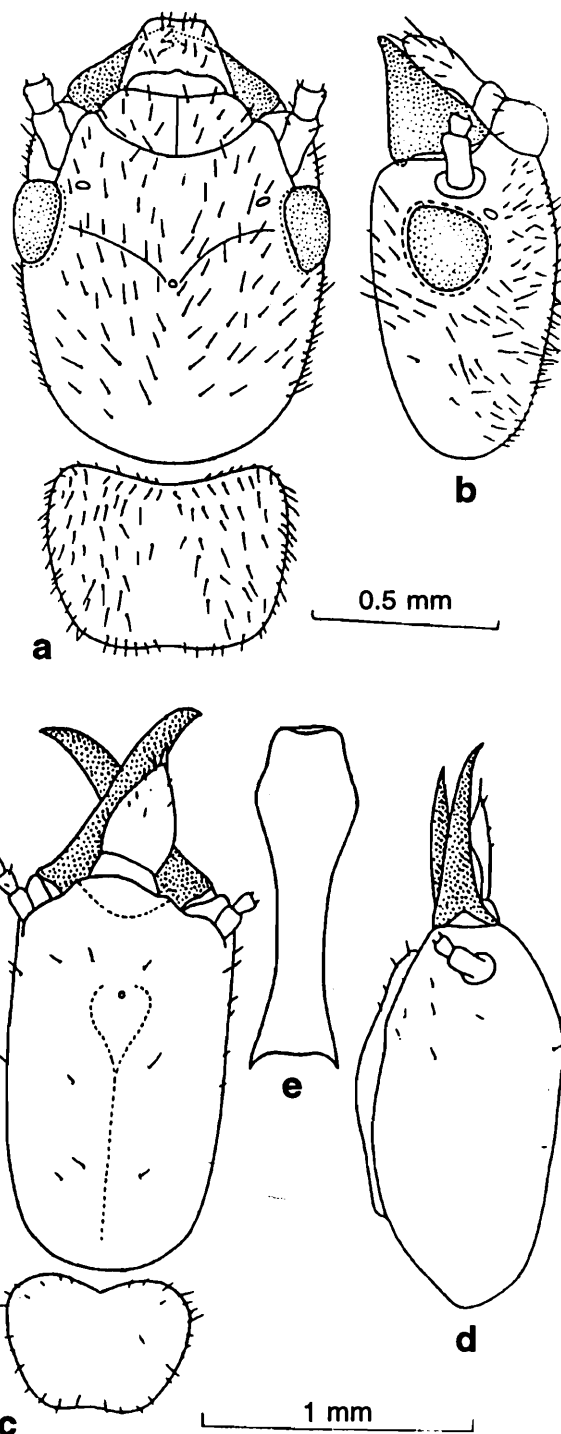


Fig. 19. : *Heterotermes indicola* (Wasmann); a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-e, Soldier. c. Head and pronotum, dorsal view; d. Head, side view; e. Postmentum.

Remarks : *H. indicola* (Wasmann) is one of the most notorious wood destroying termites occurring

throughout Northern India (both in plains and high altitudes upto 2200 m), West Pakistan and Afghanistan. It is quite a variable species belonging to the subterranean group of termites. Although living and breeding in ground, it usually attacks and causes severe damage to structured timber in houses, books, cloths, etc. including anything of cellulosic origin.

It is a very familiar household insect, making earthen cover runways on walls, timbers etc. in houses. The species is highly variable in eye-ocelli distance; antennal segments, etc. in the imago castes. Likewise, head-capsule, antennal segments and shape of the labrum vary within the species range in soldier castes. Head-capsules sometimes varies with divergent lateral margins.

This species has been recorded as the principal wood destroying termite in Kumaon Hills, where it has been found attacking stumps, logs and standing trees (both dead and living) of *Aesculus indica*; *Alnus nitida*; *Artocarpus takoocha*; *Toona ciliata*; *Mangifera indica*; *Pieris ovalifolia*; *Pinus roxburghii*; *Quercus leucotrichophora*; *Shorea robusta* and *Syzygium cumini* (Sen-Sarma *et al.*, 1975).

The habits and biology of the species have been dealt by Roonwal (1955; 1970a), Mathur and Sen-Sarma (1959), Maiti (1983) and others.

In Dehra Dun, it swarms in the middle of July particularly when it is raining, between 9 and 12 P.M. nights. Swarming continues for an hour or so (Mathur and Sen-Sarma, 1959).

Genus *Reticulitermes* Holmgren

Key to the species of genus

Reticulitermes Holmgren

I. IMAGOS : Known from the Himalaya only for *R. assamensis* Gardner

II. SOLDIERS :

1. Species smaller, head length to base of mandible 1.55 mm, head width 1.18 mm [lateral sides outcurved, postmentum width (max.) almost thrice the waist] *R. ganga* Bose

- Species larger, head length to base of mandible 1.75–2.82 mm, head width 1.05–1.25 mm ... 2
- 2. Labrum with a sharply pointed tip; frontal protuberances either ill developed or absent ..
..... *R. chinensis* Snyder
- Labrum with a blunt tip; frontal protuberances well developed 3
- 3. Head narrower and flat; head width 1.06–1.09 mm (1.08–1.12 mm) (mean 1.07 mm), head height 0.90–0.95 mm (mean 0.93 mm); mandibles more pointed at the apices; pronotum narrower, width 0.84–0.87 mm (0.80–0.87 mm), mean 0.82 mm
..... *R. tirapi* Chhotani and Das
- Head wider and swollen; head width 1.15–1.27 mm (1.08–1.30 mm) (mean 1.18 mm), head height 0.87–1.10 mm (mean 1.01 mm); mandibles less pointed at the apices; pronotum wider, width 0.78–0.86 mm (0.77–0.92 mm), mean 0.84 mm *R. assamensis* Gardner

20. *Reticulitermes assamensis* Gardner

(Fig. 20, Tables 16 and 17)

1. *Reticulitermes assamensis* Gardner

- 1944. Gardner, *Indian J. Ent.*, 6 : 105-106. Lectotype : S., in FRI, Dehra Dun. Type-locality Sadiya, Assam, India.
- 1953. Rattan Lal and Menon, *Cat. Indian Insects, Part 27, Isoptera* : 27, 31.
- 1977. Roonwal and Chhotani, *Ent. Basil.*, 2 : 46-48 (Im. described).
- 1981. Roonwal, *Proc. Indian natnl. Sci. Acad.*, (B) 47(4) : 471.
- 1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42, 47-48.
- 1986. Gao and Lam, *Mem. Hongkong nat. Hist. Soc.*, 17 : 82.
- 1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 498-501 (detailed synonymy).
- 1995. Maiti *et al.*, *Rec. zool. Surv. India : State Fauna Series*, 4 : *Fauna of Meghalaya*, Part 3 : 435-436.
- 1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 47-48.

2. *Reticulitermes chinensis* Snyder

(Wrong determinations, Indian records are *assamensis*)

- 1949. Snyder, *Smiths. misc. Colls.*, 112 : 71.
- 1962a. Mathur and Thapa, *Indian For. Leaflet. (Ent.)*, No. 167 : 27.

Material studied : Unidentified : From *Eastern Himalaya*, following two vials from Ganoputu, ten km North of Hapoli, Lower Subansiri Dist., Arunachal Pradesh, coll. *B. Nandi & party*, 29.vi.1985 as (i) with 8S. and 5 W., ex. "decaying pine stump"; (ii) with 10S. and 5W., ex. "decaying unknown stump" Following five vials, coll. *D.N. Tiwari*, 1992-1994 as (iii) with 1S. and 6W., Rangoli, East Sikkim, 24.iv.1992; (iv) with 1S. and 4W., Rumtek, Gangtok, East Sikkim 22.iv.1994; (v) with 1S. and 5W., Geyzing, West Sikkim, 7.v.1992; (vi) 1S. and 3W., Chungthang, North Sikkim, 27.iv.1992; (vii) 1S. and 7W., Kabi, North Sikkim, 30.iv.1992; Following four vials, coll. *P.H. Roy and party*, as (viii) with 10Im., 5S., 10W. Tumin Wild Life Sanctuary, East Sikkim, 8.vi.1997. ex. "pine log"; (ix) with 5Im., 3S., 6W., Tumin Wild Life Sanctuary, East Sikkim, 7.vi.1997, ex. "gallery on pine log laying in the soil"; (x) with 12Im. and 4S., Sonmary forest, West Sikkim, 8.vi.1995, ex. "stump", (xi) with 4S. and 8W., Phensong, North Sikkim, 3.iv.1994, ex. "stump"

Diagnostic Character : (i) Imago (Fig. 20a-b) : Head chestnut brown and shining; postclypeus, antennae, wing scales, abdominal tergites and sternites blackish brown; pronotum paler. Wings transparent, colourless. Head and body fairly densely hairy.

Head elongately oval, feebly diverging anteriorly. Fontanelle minute. Ocelli small, subcircular, separated from eyes by their long diameter (0.07–0.10 mm). Antennae with 17-segments, 3 short and broad; 4 shortest. Postclypeus weakly swollen, pilose and devoid of any distinct median line. Labrum tongue-shaped, wider than long. Mandibles of *Reticulitermes*-type. Pronotum a little narrower than head-width with eyes, anterior margin faintly wavy and prominently notched medially; posterior margin convex with a deep median notch. Wings almost devoid of hairs, front veins brown, remaining ones almost colourless. Venation of *Reticulitermes*-type.

(ii) Soldier (Fig. 20c-e) : Head pale yellow to yellowish brown, a little darker in front; body paler

than head. Head and pronotum fairly, and body densely hairy.

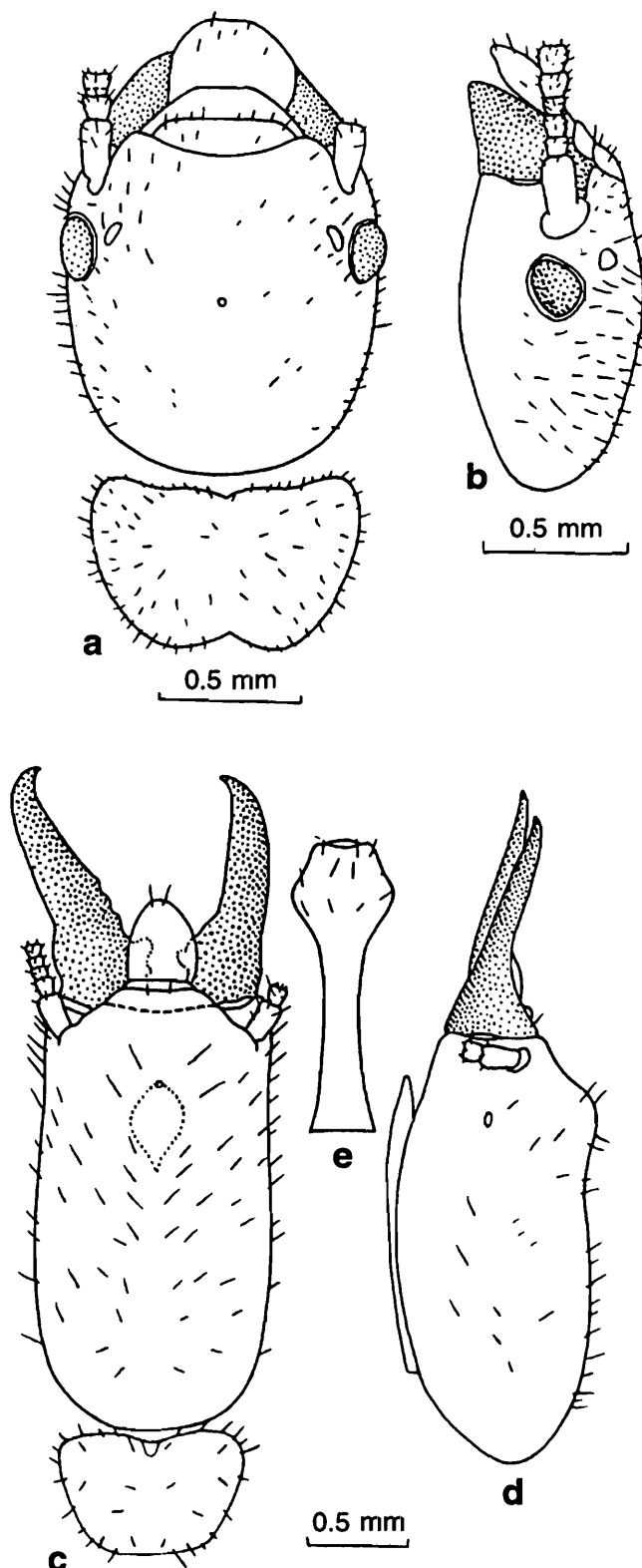


Fig. 20. : *Reticulitermes assamensis* Gardner; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-e, Soldier. c. Head and pronotum, dorsal view; d. Head, side view; e. Postmentum.

Head elongately rectangular, length slightly less than the double the width, sides subparallel, somewhat narrowed anteriorly, frontal

Table 16 : Measurements (in mm) etc. of Caste-Imago.

	<i>Reticulitermes assamensis</i>	
	5 Im.	Known Range
Total body-length with wings (excluding antennae), ca.	—	—
Total body-length without wings (excluding antennae), ca.	6.38	6.40
Length of head to lateral base of mandibles	1.12–1.16	1.10–1.17
Maximum width of head (with eyes)	1.10–1.12	1.10
Maximum length of postclypeus	—	—
Maximum width of postclypeus	—	—
Maximum length of labrum	0.31	—
Maximum width of labrum	0.44	—
Maximum diameter of compound eye (with ocular sclerite)	0.23–0.26	0.23–0.27 (long diameter)
Maximum diameter of lateral ocellus	0.07–0.09	0.07–0.10
Minimum diameter of lateral ocellus	—	—
Minimum eye-ocellus distance	—	—
Maximum length of pronotum	0.63–0.68	0.60–0.70
Maximum width of pronotum	0.92	0.90
Length of forewing with scale	—	9.00–9.95
Length of hindwing with scale	—	—
Number of antennal segments	17	17

Table 17 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Reticulitermes assamensis</i>		<i>R. chinensis</i>	
	10S.	Known Range	2S.	Known Range
Length of head to lateral base of mandibles	1.97–2.20	1.75–2.32	1.79–2.25	1.83–2.27
Maximum width of head	1.15–1.27	1.08–1.30	1.08–1.30	1.08–1.32
Head index (width/length)	0.57–0.58	—	0.61	—
Maximum length of labrum	0.37	—	0.34	—
Maximum width of labrum	0.31	—	0.31	—
Length of left mandible (Upper base of condyle to tip)	0.97–1.12	0.95–1.15	1.00–1.22	0.95–1.22
Head-mandibular length Index (left mandible-length/head-length)	0.49–0.51	—	0.51–0.54	—
Minimum median length of postmentum	1.05–1.36	1.00–1.52	1.38–1.50	1.30–1.50
Maximum width of postmentum	0.44–0.50	0.42–0.52	0.44–0.50	0.43–0.52
Width of postmentum at waist	0.13–0.15	0.12–0.17	0.12–0.15	0.12–0.15
Maximum length of pronotum	0.56–0.60	0.42–0.62	0.52–0.58	0.50–0.55
Maximum width of pronotum	0.78–0.86	0.77–0.97	0.84–0.97	0.82–0.95
Pronotum index (length/width)	0.70–0.71	—	0.59–0.62	—
Number of antennal segments	15	15–16	16	16–18

protuberances prominently swollen. Fontanelle minute. Antennae with 15-16 segments, 3 or 4 shortest. Postclypeus pilose. Labrum triangularly tongue-shaped with a blunt-tip and a pair of long bristles at tip. Mandibles thick, stout, sabre-shaped, about half of head without mandibles, weakly incurved at outer margin in basal third, tip weakly incurved. Postmentum club-shaped with a long, narrow stalk. Pronotum narrower than head-width, anterior margin with a prominent notch at the middle; posterior margin also with a weak, median incurving.

Distribution : INDIA : *Eastern Himalaya* : Sikkim : East Sikkim Dist. : Rangoli, Rumtek, Tumin Wild Life sanctuary; West Sikkim Dist. : Geyzing, Sonmary forest; North Sikkim Dist. : Chungthang, Kabi, Phensong. West Bengal : Darjiling Dist. : Samsing, Kalimpong. Arunachal Pradesh : East Kameng Dist. : Lower Siggon village (6600 ft), Rupa, Bhairvonda, Shaitan Bridge; West Kameng Dist. : Chug village; Lower Subansiri Dist. : Itanagar, Lake Ganga, Ganoputu, ten km North of Hapoli; East Siang Dist. : Dulla Tapi; West Siang Dist. : Dofe; Tirap Dist. : Namdapha. Assam : Sadiya (type-locality). Meghalaya : Khasi and Jaintia Hills Dist. : Mawphlong, Cherrapunji; Shillong; Pynursula. BHUTAN (*Eastern Himalaya*) : Sampa Kothoka.

Elsewhere : China.

Remarks : The species is characterized by its elongated head with low frontal hump which keeps it distinct from its close species, *R. chinensis*. Both the species occur closely in the Eastern Himalaya. Thus sub-terranean termite infesting the dead and decaying felled logs. So far been reported to cause no pronounced damage to the wood works. It is mostly associated with pine logs and tree trunk in addition to other minor logs in Meghalaya and Sikkim.

21. *Reticulitermes chinensis* Snyder (Fig. 21, Table 17)

1. *Reticulitermes chinensis* Snyder

1923. Snyder, *J. Wash. Acad. Sci.*, **13**(6) : 107-109. Im., S. Holotype : Im., in USNM, Washington. Type-locality : Suifu, Szechuan Prov., China.

1931. Light, *Lignan Sci. J.*, **7** : 583-584, 589, 590.

1949. Snyder, *Smiths. misc. Colls.*, **112** : 71 (Chinese records only).

1962a. Roonwal and Chhotani, *Proc. natnl. Inst. Sci. India*, (B) **28**(4) : 301-303 (Records from China only).

1977. Thakur, *J. Bombay nat. Hist. Soc.*, **74** : 194.

1986. Gao and Lam, *Mem. Hongkong nat. Hist. Soc.*, **17** : 82.

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 501-505 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*. No. 171 : 49.

2. *Reticulitermes chinensis chinensis* Snyder

1968. Hsai and Fan, *Acta ent. Sinica*, **14**(4) : 2.

1983. Chhotani, *Orient. Insects*, **17** : 118.

Material studied : Unidentified : From *Eastern Himalaya* : (i) 2S. and 8W., Kameng Frontliner Division, Arunachal Pradesh, coll. K.C. Jayramkrishnan, 17.iii.1961, ex. 'below stones' Two vials from Bomdilla Road, Arunachal Pradesh, coll. S.K. Tandon & party as follows. (ii) 1S. and 5W., 13.iii.1973; (iii) 1S. and 5W., 24.iii.1973.

Diagnostic Character : (i) Imago : Known but not from the study area. (ii) Soldier (Fig. 21a-c) : Head somewhat straw yellow; abdomen paler. Head sparsely, thorax and abdomen moderately hairy.

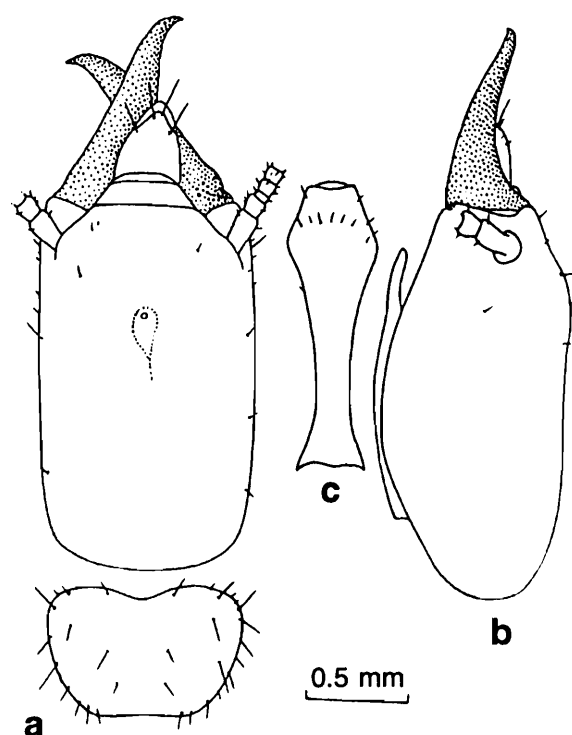


Fig. 21. : *Reticulitermes chinensis* Snyder; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Head broadly rectangular, sides sub-parallel, frontal protuberances weakly marked or absent. Fontanelle minute and circular. Antennae with 16 to 18 segments, 3 smallest. Postclypeus wider and pilose. Labrum broadly lanceolate shape, sides with hyaline margin and converging with blunt apex with 2 long bristles. Mandibles short and stout with weakly incurved apices. Postmentum club-shaped, more than three times as wide as at waist. Pronotum flat, anterior margin with a deep median and posterior margin with a shallow invagination.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : East Kameng Dist. : Rupa, Siggon village; West Kameng Dist. : Kalaktung, Charduar Forest, Bomdilla Road. Assam : Shantipur. Meghalaya : Khasi, Jaintia Hills Dist. : Shillong. ELSEWHERE : China : Szechuan province and from other provinces. Vietnam.

Remarks : The species is found in warm temperate regions of the north-east India, including China. It is known to infest the roots of pine, *Pinus longifolia* in Shillong (Kapur, 1962). Although, the swarming period is unknown, its imagoes were collected from Kalimpong in November (Maiti, 1983). The species damages wood-works in buildings in China. The extensive galleries with infested logs are at times filled with earth and excreted wood (Roonwal, 1970a).

22. *Reticulitermes ganga* Bose (Fig. 22, Table 18)

1. *Reticulitermes ganga* Bose

1999. *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 49-53. S., W. Holotype : S. and W. in ZSI., Calcutta. Type-locality : Lake Ganga, Itanagar, Arunachal Pradesh.

Material studied : Identified : From *Eastern Himalaya* : Holotype S. and Paratype W., Lake Ganga, Itanagar, Lower Subansiri Dist., Arunachal Pradesh, coll. O.B. Chhotani, 15.v.1989, ex. "a log of wood", det. G. Bose.

Diagnostic character : (i) Imago : Unknown.

(ii) Soldier (Fig. 22a-b) : Head pale-yellowish; body creamy white. Head fairly and body densely hairy.

Head rectangularly oval, maximum width in middle whence weakly converging anteriorly and posteriorly. Fontanelle minute. Antennae with 16-segments, segment 3 shortest. Anteclypeus translucent, apilose, strip-like. Postclypeus flat with a small hair on either side. Labrum somewhat triangular, as long as wide, tip broadly rounded with some hairs on body. Mandibles sabre-shaped, weakly incurved at tips. Left mandible with very faint crenulations in basal half of inner margin. Postmentum club-shaped. Pronotum with weak medial notch at anterior margin; posterior margin weakly emarginated.

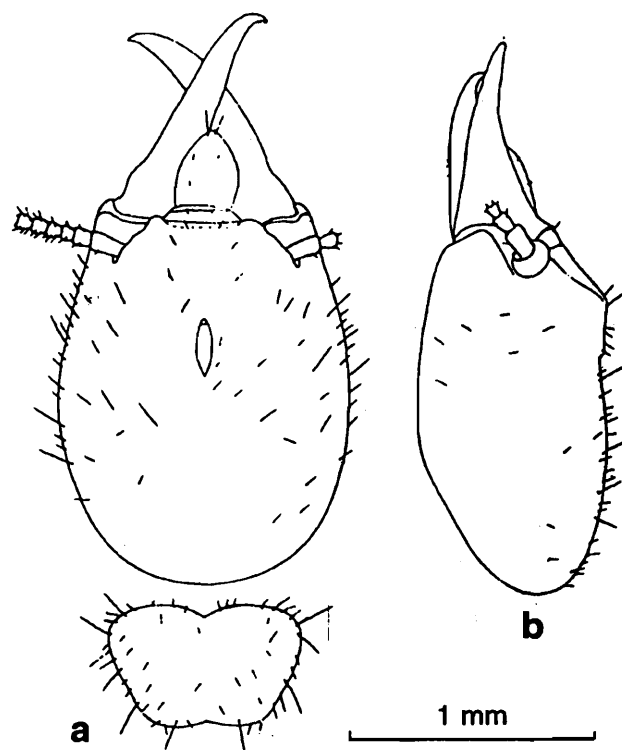


Fig. 22. : *Reticulitermes ganga* Bose; a-b, Soldier. a. Head and pronotum, dorsal view; b. Head, side view.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : Itanagar : Lake Ganga.

Remarks : The species has recently been described by Bose (1999) and is known only from its type-locality. Characteristic oval head and broad anterior portion of postmentum keep the species separate from all other species of the genus from the Himalaya.

Table 18 : Measurements (in mm) etc. of Caste–Soldier.

	<i>Reticulitermes ganga</i>		<i>R. tirapi</i>
	Holotype	Sev. S.	Known Range
Length of head to lateral base of mandibles	1.55	1.85–2.00	1.87–2.03
Maximum width of head	1.18	1.06–1.09	1.05–1.10
Head index (width/length)	0.76	0.54–0.57	0.54–0.58
Maximum length of labrum	0.28	–	–
Maximum width of labrum	0.25	0.37	–
Length of left mandible (Upper base of condyle to tip)	0.95	1.00–1.05	1.00–1.05
Head-mandibular length Index (left mandible-length/head-length)	0.613	0.52–0.54	–
Minimum median length of postmentum	1.00	1.32–1.43	1.30–1.43
Maximum width of postmentum	0.43	0.45–0.50	0.45–0.50
Width of postmentum at waist	0.15	0.13–0.15	0.12–0.15
Maximum length of pronotum	0.50	0.46–0.53	0.45–0.55
Maximum width of pronotum	0.80	0.84–0.87	0.80–0.87
Pronotum index (length/width)	0.63	0.54–0.61	–
Number of antennal segments	16	15–16	15–16

23. *Reticulitermes tirapi* Chhotani and Das (Fig. 23, Table 18)

1. *Reticulitermes tirapi* Chhotani and Das

1983. Chhotani and Das, *Rec. zool. Surv. India*, **80** : 316, 324–327, 328, 329. S., W. Holotype : S., in ZSI, Calcutta. Type-locality : Nampong, Tirap District, Arunachal Pradesh.

1983. Chhotani, *Orient. Insects*, **17** : 119.

1989. Roonwal & Chhotani, *Fauna of India : Isoptera (Termites)*, **I** : 508–510 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 53.

Material studied : Unidentified : From *Eastern Himalaya* : Sev. S. and W. near Deban, ten km from Miao, Arunachal Pradesh, coll. P.K. Maiti, 20.viii.1983, ex. "under bark of a fallen log"
Identified : From *Eastern Himalaya* : Sev. S. and W. from Arunachal Pradesh as follows : (i) Deban, 27 km from Miao, coll. S. Biswas, 8.xii.1982; (ii) Gibbons Land, 16 km East of Miao, coll. S. Biswas, 18.xii.1982, det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.
(ii) Soldier (Fig. 23a–d) : Head pale yellow, more

paler in front, abdomen yellowish white. Head sparsely and thorax, abdomen rather densely hairy.

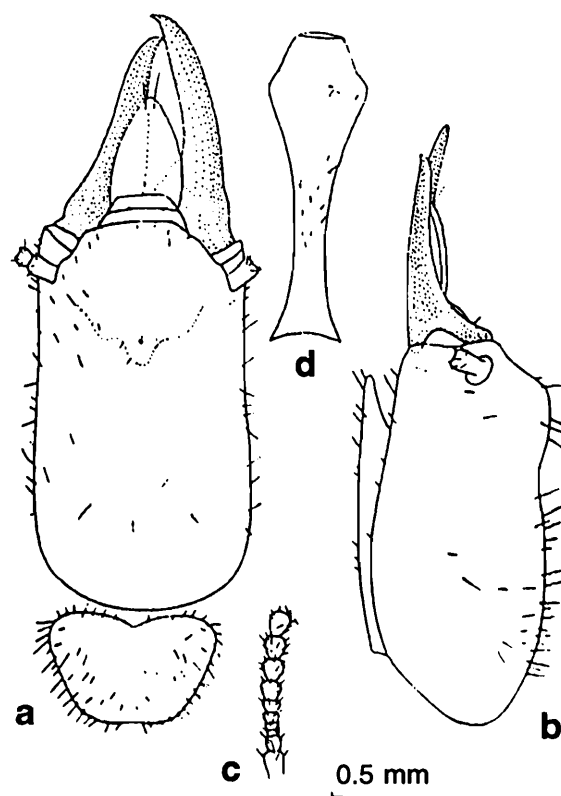


Fig. 23. : *Reticulitermes tirapi* Chhotani and Das; a–d, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Basal part of antenna; d. Postmentum.

Head subrectangular, much longer than broad. Antennae with 15-16 segments, in 15-segmented antenna, 3 longer than 4; in 16-segmented one 3-shortest. Postclypeus pale yellow, pilose. Labrum oval, tip blunt and with two long hairs. Mandibles weakly incurved at the apices, length half to slightly more than half of head-length, widest point more than 3 times as wide as at waist. Pronotum with anterior margin with a distinct median notch; posterior margin faintly incurved medially.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Changlang Dist. : Nampong; Tirap Dist. : Deban, Gibbons Land.

Remarks : This is a rare species and endemic to the hilly tracts of Arunachal Pradesh. In broad characters, the species is very similar to *R. assamensis*—another Himalayan species; but differs in having more pointed apices of mandibles. However, it is a very smaller species from all other Indian species. Bose (1999) had placed it near to *R. saraswati* Roonwal and Chhotani from which it is distinguished in having oval head and very short and narrow waist of postmentum (vs. long waist and parallel sided head in *R. saraswati*).

Subfamily RHINOTERMITINAE

Genus *Parrhinotermes* Holmgren

Key to the species of genus

Parrhinotermes Holmgren

I. IMAGOES : Unknown.

II. SOLDIERS :

1. Larger species, head-length to base of mandibles, 1.24–1.30 mm (1.26 mm), maximum head-width 0.72 mm; pronotum width 0.62–0.70 mm (0.72 mm)
..... *P. khasii khasii* Roonwal and Sen-Sarma
- Smaller species, head-length to base of mandibles, 0.98 mm (0.95–0.98 mm), maximum head-width, 0.85 mm; pronotum width 0.53 mm (0.50–0.53 mm)
..... *P. shamimi* Bose

24. *Parrhinotermes khasii khasii* Roonwal and Sen-Sarma (Fig. 24, Table 19)

1. *Parrhinotermes khasii khasii* Roonwal and Sen-Sarma

1956. Roonwal and Sen-Sarma, *Indian J. Agric. Sci.*, **26**(1) : 5, 6-11. S. and W. Holotype : S., in ZSI. Type-locality : Collecting Station No. 14, Bank of Nong-Priang Stream, Khasi Hills, Meghalaya, India.
- 1962a. Roonwal and Chhotani, *Proc. natnl. Inst. Sci. India*, (B) **28**(4) : 288, 310-312.
1977. Lahiri, Ghosh and Biswas, *Bull. Meghalaya Sci. Soc.*, **2** : 36.
1983. Chhotani, *Orient. Insects*, **17** : 119.
1995. Maiti *et al.*, *Rec. zool. Surv. India : State Fauna Series* **4** : Fauna of Meghalaya : Part 3 : 438.
1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 529-532.
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 53-54.

2. *Parrhinotermes khasii khasii* Roonwal and Sen-Sarma

1982. Tsai and Huang, *Acta ent. Sinica*, **25** : 306-310.

Material studied : Identified : From *Eastern Himalaya* : (i) 15S. and 7W., Kameng Frontlines Division, Arunachal Pradesh, coll. K.C. Jayramkrishna, 2.v.1961, det. G. Bose. (ii) 2S. and 17W., Damin (1100 m), Upper Subansiri Dist., Arunachal Pradesh, coll. J.M. Julka & party, 22.i.1975, det. G. Bose. (iii) 1S. and sev. W., Naba, ca. 24 km from Nacho, Upper Subansiri Dist., Arunachal Pradesh, coll. J.M. Julka & party, 30.xi.1979, det. G. Bose. (iv) 7S. and sev. W., Rahung village, on the bank of Digien river, Arunachal Pradesh. coll. K.C. Jayramkrishna, 25.iv.1961, det. G. Bose.

Diagnostic Character : (i) Imago : Unknown. (ii) Soldier (Fig. 24a-b) : Head yellowish brown; body pale yellow. Head and pronotum fairly and abdomen pilose. Head with a few bristles and very short hairs all over, abdomen more hairy.

Head somewhat oval, narrowing anteriorly, broadest in middle. Fontanelle small. Fontanelle gland distinct. Antennae with 13 segments, 2

shortest, each with tuft of hairs anteriorly. Labrum elongate, much longer than broad with

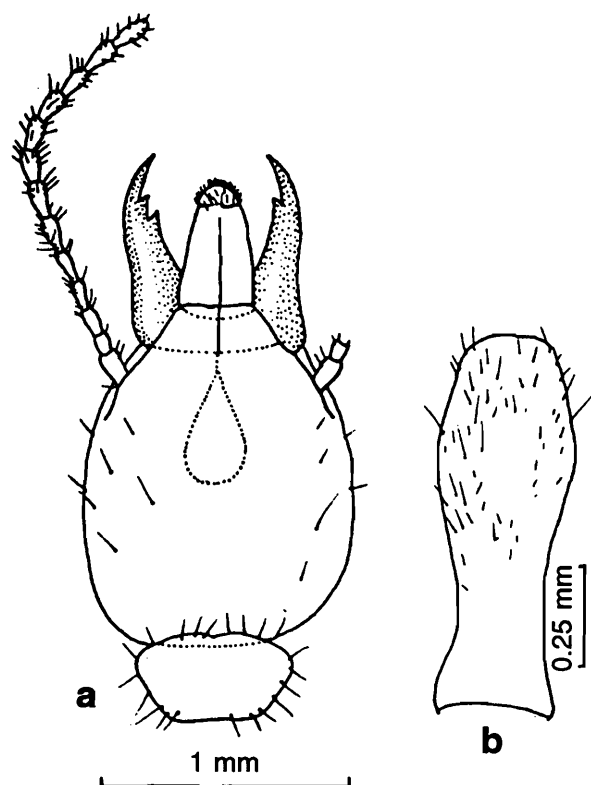


Fig. 24. : *Parrhinotermes khasii* Roonwal and Sen-Sarma; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

a blunt broadly rounded hyaline tip, a few long bristles at base of hyaline part and a dense row

of hairs forming a 'daubing brush' along the anterior margin of tip. Mandibles thin and long, sabre-shaped, with sharply pointed incurved apices with fine serrations in basal half of inner margin, left mandible with two marginal teeth in distal half and right with one sharp marginal tooth in distal one-third. Postmentum fairly densely pilose, long, club-shaped with a bulge at widest width. Pronotum broader than long, anterior margin outcurved with a median notch; posterior margin substraight with weak median emargination.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Kalimpong. Arunachal Pradesh : Kameng Dist. : Rahung village, Bank of Digien River (1800 m); East Kameng Dist. : Rupa; Upper Subansiri Dist. : Naba, *ca.* 24 km from nacho (1060 m), Damin. Meghalaya : Bank of Nong Priang Stream, *ca.* 366 m. Khasi Hills (type-locality).

Remarks : The species is close to *P. khasii ruiliensis* Tsai and Huang occurring in China generally inhabiting bark of dead tree lying in the soil (Roonwal and Sen-Sarma, 1956).

Table 19 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Parrhinotermes khasii</i>		<i>P. shamimi</i>	
	10 S.	Known Range	Holotype	Known Range
Length of head to lateral base of mandibles	1.24–1.30	1.20–1.32	0.98	0.95–0.98
Maximum width of head	1.04–1.13	1.02–1.14	0.85	0.85–0.90
Head index (width/length)	0.84–0.86	–	0.814	–
Maximum length of labrum	0.48	0.48	0.40	0.38–0.40
Maximum width of labrum	0.32–0.35	0.30–0.36	0.28	0.25–0.28
Length of left mandible (Upper base of condyle to tip)	0.67–0.75	0.66–0.78	0.63	0.63
Head-mandibular length Index (left mandible-length/head-length)	0.54–0.57	–	0.642	0.642–0.663
Minimum median length of postmentum	0.88–1.06	0.90–1.08	0.65	0.63–0.65
Maximum width of postmentum	0.30–0.34	0.30–0.36	0.28	0.50–0.53
Width of postmentum at waist	0.19	–	0.18	–
Maximum length of pronotum	0.31–0.45	0.36–0.48	0.28	–
Maximum width of pronotum	0.62–0.70	0.66–0.72	0.53	–
Pronotum index (length/width)	0.50–0.64	–	0.53	–
Number of antennal segments	13	13	12	12

25. *Parrhinotermes shamimi* Bose
(Fig. 25, Table 19)

1. *Parrhinotermes shamimi* Bose

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 56-58. S., W. Holotype : S. and W. in ZSI, Calcutta. Type-locality : Itanagar (natural forest ca.1 km from Lake Ganga), Arunachal Pradesh, India.

Material studied : Identified : From *Eastern Himalaya* : Holotype S. and Paratypes 1S. and sev. W., Lake Ganga, Itanagar, Lower Subansiri Dist., Arunachal Pradesh, coll. O.B. chhotani, 13.v.1989, ex. "stump of wood", det. G. Bose.

Diagnostic Character : (i) Imago : Unknown. (ii) Soldier (Fig. 25a-e) : Head pale yellow, whitish in frontal; abdomen pale creamy white. Head and body sparsely pilose.

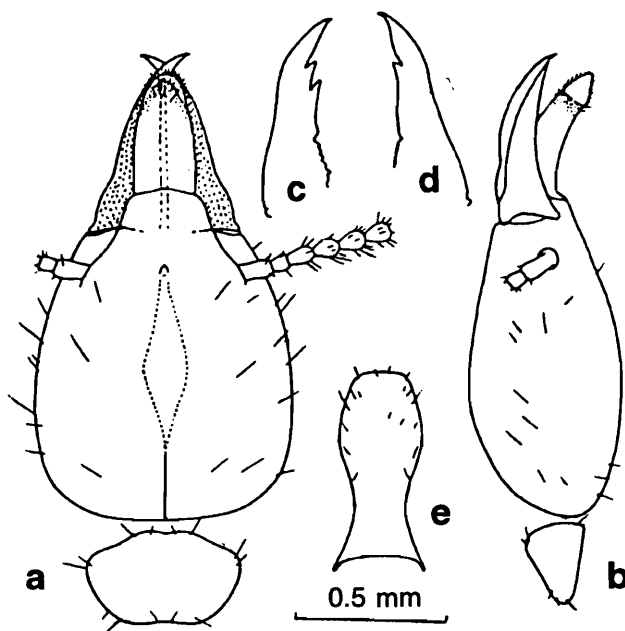


Fig. 25. : *Parrhinotermes shamimi* Bose; a-e, Soldier. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Left mandible; d. Right mandible; e. Postmentum.

Head subrectangularly oval, longer than broad; sides weakly converging in front. Fontanelle small. Antennae with 12 segments, segments 4 and 5 shortest. Postclypeus small, flat. Mandibles somewhat sabre-shaped, sharply pointed at apices. Left mandible with 2 marginal teeth and right with one marginal tooth. Labrum tongue-shaped, longer than broad, with a hyaline tip fringed with hairs and a few longer hairs present at anterior end. Postmentum vase-shaped, broadest at anterior one-third, profusely hairy. Pronotum sparsely pilose,

trapezoidal, anterior margin convex, with a median notch; posterior margin substraight with a very weak median emargination.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : Itanagar : Lake Ganga (type-locality). Known only from type-locality.

Remarks : The species is so far known only from its type-locality and is separable from the other Indian subspecies *P. khasii khasii* by the smaller size of head, mandibles and pronotum of the soldier caste.

Family STYLOTERMITIDAE

Genus *Stylotermes* Holmgren
and Holmgren

Key to the species of genus
Stylotermes Holmgren and Holmgren

I. IMAGOS :

1. Larger species, head-length 1.33–1.60 mm, head-width 1.65–1.80 mm 2
- Smaller species, head-length 1.00–1.24 mm, head-width 1.25–1.55 mm 3
2. Y-suture distinctly marked, wing-scale shorter (forewing scale 1.00–1.13, hindwing scale 0.75–0.85 mm)
..... *S. faveolus* (Chatterjee and Thakur)
- Y-suture indistinctly marked, only posterior arm visible, wing-scale longer (forewing scale 1.30–1.50 mm, hindwing scale 0.73–0.85 mm)
..... *S. bengalensis* Mathur and Chhotani
3. Antennae with 16 segments (smaller in size, head-length 1.13 mm, head-width 1.37 mm, pronotum-width 1.28 mm) *S. dunensis* Thakur

II. SOLDIERS :

1. Larger species, head-length to base of mandible 3.10–3.70 mm and head-width 2.25–2.60 mm 2
- Smaller species, head-length to base of mandible 1.92–2.60 mm and head-width 1.19–1.78 mm 3

2. Head subrectangular, sides subparallel; antennal faveolae not prominent and deep; fontanelle subcircular; mandibles larger in comparison to head, mandibular head index 0.70–0.72 (0.73–0.76)
..... *S. chakratensis* Mathur and Thapa
- Head rectangularly oval, sides slightly outcurved and narrowing anteriorly; antennal faveolae prominent, deep; fontanelle oval; mandibles shorter in comparison to head, mandibular head index 0.63–0.65 (0.60–0.67)
..... *S. faveolus* (Chatterjee and Thakur)
3. Larger species, head-length to base of mandible, 2.60 mm (2.60–2.70 mm) and head-width 1.78 mm (1.75–1.80 mm); mandibles longer in relation to head-length, mandibular head index 0.68 (0.65–0.69)
..... *S. bengalensis* Mathur and Chhotani
- Smaller species, head-length to base of mandible 1.92–2.45 mm and head-width 1.19–1.55 mm; mandibles shorter in relation to head-length, mandibular head index 0.53–0.63 4
4. Anterior margin of pronotum convex with a deep median notch, antero-lateral angles broadly rounded; postmentum with lateral margins above the maximum width weakly incurved *S. parabengalensis* Maiti
- Anterior margin of pronotum broadly incurved, antero-lateral corners narrowly rounded; postmentum with lateral margins above the maximum width strongly incurved
..... *S. dunensis* Thakur

The species are very close to each other. The characters on which these are separated will be proved to be variations when large collection will be studied. This is also the opinion of Roonwal and Chhotani (1989).

26. *Stylotermes bengalensis* Mathur and Chhotani
(Fig. 26, Tables 20 and 21)

1. *Stylotermes bengalensis* Roonwal and Chhotani

1959. Mathur and Chhotani, *Zool. Anz.*, **163**(1&2) : 42-53.
S. and W. Holotype : S., in FRI, Dehra Dun. Type-locality : "Darjiling Division", West Bengal, India.
1975. Sen-Sarma *et al.*, *Wood Destroying Termites of India* (Final Tech. Rept. PL. 480 Project) : 11, 37, 52, 64.

1983. Chhotani, *Oriental Insects*, **17** : 120.

1989. Roonwal & Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 578-582 (detailed synonymy).

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.

Material studied : Since material is not available, description, measurement etc. are based on Mathur and Chhotani (1959).

Diagnostic Character : (i) Imago (Fig. 26a-d) : Head, pronotum, wing scales and labrum bright yellowish brown; antennae, mesonotum and legs yellowish to pale brown; abdomen castaneous brown. Head moderately and body densely hairy with long hairs.

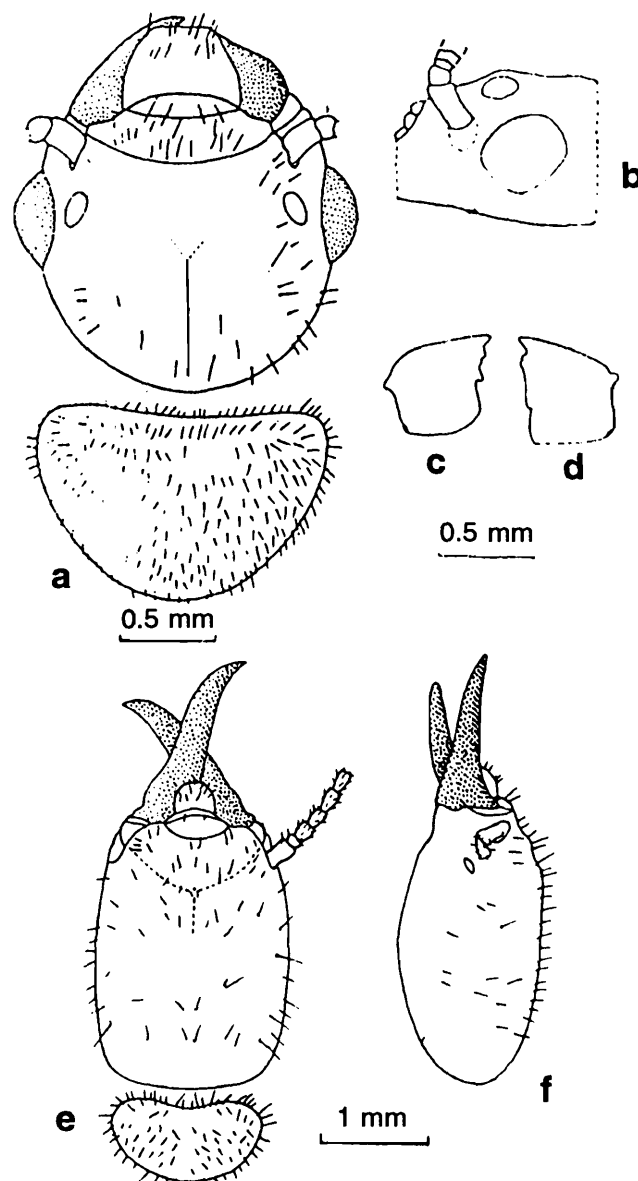


Fig. 26. : *Stylotermes bengalensis* Mathur and Chhotani; a-d, Imago. a. Head and pronotum, dorsal view; b. Part of head, side view showing eye and ocellus; c. Left mandible; d. Right mandible; e-f, Soldier. e. Head and pronotum, dorsal view; f. Head, side view.

Table 20 : Measurements (in mm) etc. of Caste-Imago.

	<i>Stylotermes bengalensis</i>		<i>S. dunensis</i>		<i>S. faveolus</i>	
	1 Im.	Known Range	1 Im.	Known Range	2 Im.	Known Range
Total body-length with wings (excluding antennae), ca.	—	—	10.5	9.40–10.7	16.00	15.80–16.40
Total body length without wings (excluding antennae), ca.	7.50	6.25–9.35	—	—	8.70–9.00	8.60–9.10
Length of head to lateral base of mandibles	1.47	1.33–1.60	1.13	1.00–1.13	1.44–1.53	1.40–1.55
Maximum width of head (with eyes)	1.81	1.68–1.80	1.37	1.25–1.30	1.68–1.78	1.65–1.80
Maximum length of postclypeus	—	—	—	—	—	—
Maximum width of postclypeus	—	—	—	—	—	—
Maximum length of labrum	0.50	0.45–0.50	0.31	—	0.37	—
Maximum width of labrum	0.58	0.50–0.58	0.34	—	0.47	—
Maximum diameter of compound eye (with ocular sclerite)	0.47	0.45–0.50	0.44	0.33–0.45	0.40–0.44	0.40–0.45
Maximum diameter of lateral ocellus	0.18–0.23	0.18–0.23	0.15	0.13–0.15	—	0.18–0.20
Minimum diameter of lateral ocellus	—	0.13–0.15	0.90	0.08–0.10	—	—
Minimum eye-ocellus distance	—	—	0.05	0.04–0.05	0.08	0.08
Maximum length of pronotum	0.86–1.06	0.85–0.90	0.69	0.50–0.60	0.81–0.85	0.80–0.85
Maximum width of pronotum	1.38–1.56	1.35–1.50	1.28	0.95–1.00	1.40–1.44	1.40–1.48
Length of forewing with scale	—	—	—	—	—	13.00–13.70
Length of hindwing with scale	—	—	—	—	—	11.75–12.40
Number of antennal segments	16	16	16	16-17	20	20–22

Table 21 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Stylotermes bengalensis</i>		<i>S. chakratensis</i>		<i>S. dunensis</i>	
	1 S.	Known Range	Sev. S.	Known Range	2 S.	Known Range
Length of head to lateral base of mandibles	2.60	2.60–2.70	3.12–3.25	3.10–3.30	2.20–2.63	2.15–2.45
Maximum width of head	1.78	1.75–1.80	2.25–2.30	2.25–2.32	1.49–1.53	1.48–1.55
Head index (width/length)	0.68	—	0.70–0.72	0.68–0.73	0.58–0.67	—
Maximum length of labrum	0.26	0.25–0.30	0.50–0.53	0.50–0.54	—	—
Maximum width of labrum	0.45	0.45	0.52–0.55	0.55–0.56	—	—
Length of left mandible (Upper base of condyle to tip)	1.44	1.75–1.80	2.25–2.38	2.35–2.40	1.50	1.25–1.38
Head-mandibular length Index (Left mand.-length/head-length)	—	—	0.72–0.73	0.73–0.76	0.57	0.53–0.63
Minimum median length of postmentum	—	1.80–2.00	—	2.37–2.50	—	1.45–1.70
Maximum width of postmentum	—	0.70–0.75	—	0.80–0.87	—	0.48–0.60
Width of postmentum at waist	—	0.25	—	0.30–0.35	—	0.25–0.33
Maximum length of pronotum	0.81	0.80–0.90	1.26–1.31	1.25–1.30	—	0.70–0.80
Maximum width of pronotum	1.45	1.45–1.55	1.95–2.06	1.92–2.06	—	1.10–1.18
Pronotum index (length/width)	—	—	—	0.61–0.63	—	—
Number of antennal segments	14	13–14	—	broken	12–14	12–15

Head subrectangular, wider than long; sides (excluding eyes) subparallel upto posterior one-third, epicranial suture visible only in posterior part of head, lateral arms indistinct. Fontanelle not distinct. Antennae with 16-segments, 2 variable, subequal to 3 and 4 or longer than 3. Ocelli small, separated from eyes by half their long diameter. Postclypeus subtrapezoidal. Mandibles of *Stylotermes*-type. Labrum dome-shaped, wider than long, anterior margin substraight. Pronotum subreniform, densely pilose with long and short hairs, narrower than head with eyes, anterior margin weakly concave and devoid of notch, antero-lateral corners broadly rounded.

(ii) Soldier (Fig. 26e-f) : Head yellowish brown; other body parts paler. Head and thorax sparsely, and abdomen densely hairy.

Head subrectangular with weakly convex sides, longer than broad. Fontanelle minute, circular; small fontanelle gland indistinctly visible. Labrum dome-shaped, with several long hairs in distal half. Postclypeus transversely prominent. Mandibles stout with slightly pointed apices, inner margins of both the mandibles with a weak tooth at proximal one-third and a larger one a little below in each. Antennae with 13-14 segments, 2 smallest. Postmentum long with anterior bilobed club, posterior lobes broader. Pronotal anterior margin with a strong and posterior one without any median notch.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist.; Nainital Dist. : Bhowali; Ranikhet; Askot (Kanda Dhar Forest). *Eastern Himalaya* : West Bengal : Darjiling Forest Division. ELSEWHERE : None.

Remarks : The species occurs sparsely in the Western and Eastern Himalaya infesting dead and living portions of both felled logs and standing trees. The trees of *Alnus nitida*, *Quercus incana*, *Rhododendron* sp. and *Morus laevigata* are known among hosts in the Himalaya (Sen-Sarma *et al.*, 1975).

27. *Stylotermes chakratensis* Mathur and Thapa (Fig. 27, Table 21)

1. *Stylotermes chakratensis* Roonwal and Thapa

1962b. Mathur and Thapa, *J. Timber Dryers & Preserv. Assoc. India*, 8(4) : 4-8. S. and W. Holotype : S., in FRI. Type-locality : Koawa Block (ca. 1830 m), Chakrata Forest Division, Dehra Dun Dist., Uttaranchal, India.

1975. Emerson, *Am. Mus. Novit.*, No. 2570 : 13.

1983. Chhotani, *Oriental Insects*, 17 : 120.

1989. Roonwal & Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 582-584 (detailed synonymy).

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

Material studied : Identified : From *Western Himalaya* : 2S., 4W., Koawa Block, Chakrata Forest Division, Dehra Dun Dist., Uttaranchal, coll. R.N. Chopra, 2.xii.1949, ex. '*Quercus incana*', det. O.B. Chhotani.

Diagnostic Character : (i) Imago : Unknown.
(ii) Soldier (Fig. 27a) : Head reddish brown; rest of the body parts paler. Head and body moderately hairy with short and stiff hairs.

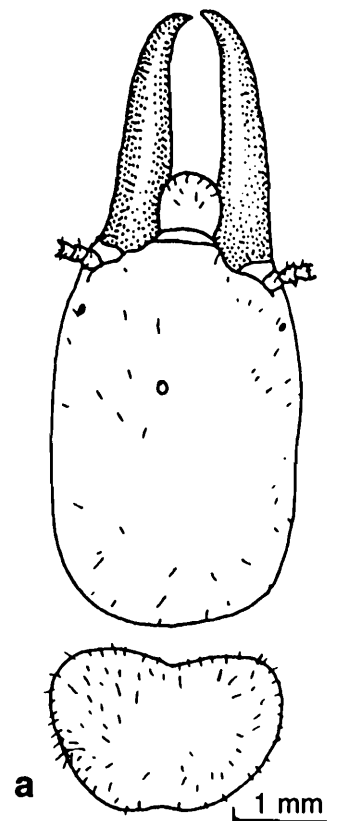


Fig. 27. : *Stylotermes chakratensis* Mathur and Thapa; a, Soldier. a. Head and pronotum, dorsal view.

Head longish, subrectangular; feebly outcurved sides narrowing anteriorly, longer than broad. Fontanelle minute, circular, placed above the middle. Labrum subsquarish with a few hairs in distal half. Postclypeus indistinctly demarcated from frons. Mandibles long and stout, slightly shorter than head, with pointed weakly incurved apices, inner margin with a minute tooth in proximal one-third and a stronger one near base in each mandible. Antennae broken, segment 2 smaller than 3. Postmentum long, club-shaped. Pronotum trapezoidal, anterior and posterior margins with a median emargination.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Koawa Block, Chakrata Forest Division.

Remarks : The species is so far known from its type-locality only.

28. *Stylotermes dunensis* Thakur
(Fig. 28, Tables 20 and 21)

1. *Stylotermes dunensis* Thakur

1975a. Thakur, *J. Indian Acad. Wood. Sci.*, 6(2) : 98-105. Im., S., W. Holotype : S., in FRI, Dehra Dun. Type-locality : Dehra Dun (Uttaranchal, India).

1983. Chhotani, *Oriental Insects*, 17 : 120.

1985. Roonwal, *Proc. Indian natn. Sci. Acad.*, (B) 51(2) : 154.

1989. Roonwal & Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 584-587 (detailed synonymy).

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

Material studied : Identified : From *Western Himalaya* : 2S., New Forest, Dehra Dun, Uttaranchal, coll. B.K. Gupta, 27.vii.1971, det. O.B. Chhotani.

Diagnostic Character : (i) Imago (Fig. 28a-b) : Head; pronotum; abdominal tergites and anterior margins of wings dark brown; antennae; postclypeus; labrum and mandibles basally, yellow brown. Head fairly and body densely pilose.

Head subsquarish; sides rounded, posterior margin broadly rounded. Y-suture not distinct. Fontanelle minute, rounded. Ocelli small, oval, separated from eyes by a distance of 0.04-0.05 mm

(half their short diameter). Antennae 16-17 segmented, segment 2 longer than 3; either 4 (16-segmented antennae) or 3 (17 segmented antennae) shortest. Postclypeus narrowly subrectangular and with a few hairs. Mandibles of *Stylotermes* type. Pronotum flat, trapezoidal, narrower than head-width with eyes; anterior margin substraight, with a median notch; posterior margin substraight with or without a median depression. Forewings a little longer than hind wing.

(ii) Soldier (Fig. 28c-d) : Head reddish brown; other body parts paler. Head and pronotum sparsely and body moderately pilose.

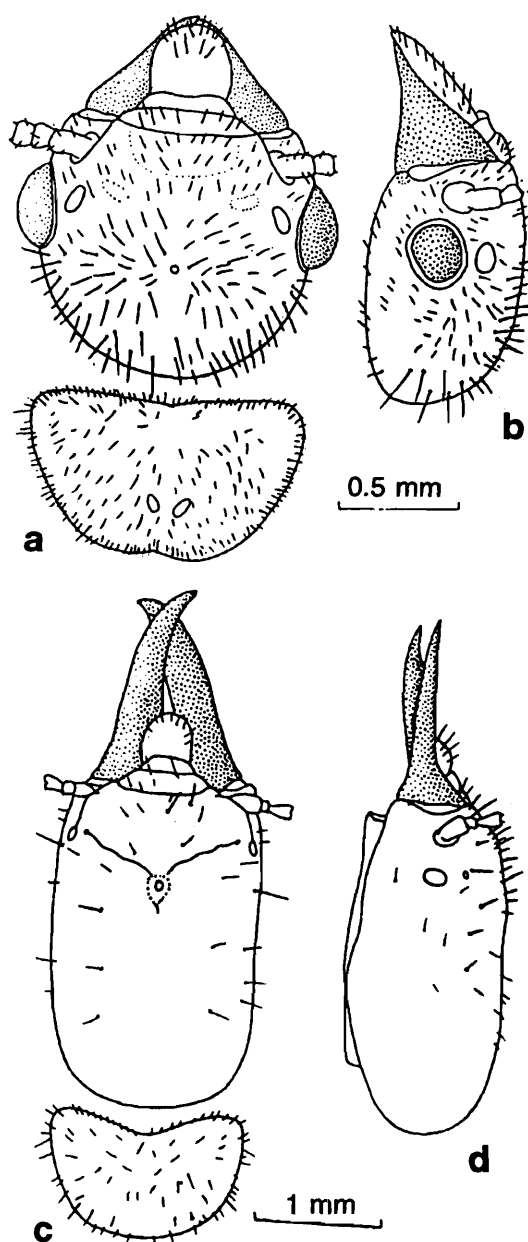


Fig. 28. : *Stylotermes dunensis* Thakur; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-d, Soldier. c. Head and pronotum, dorsal view; d. Head, side view.

Head rectangular, much longer than broad; sides weakly diverging anteriorly, anterior arms of Y-suture distinct. Fontanelle minute, placed anteriorly. Antennae with 12-15 segments, 2 shortest; 3 double the 2. Postclypeus with a few hairs, transversely sub-rectangular. Labrum dome-shaped, broader than long, with a few long hairs on body and on rounded anterior margin. Mandibles thick and broad, sabre-shaped with weakly incurved apices. Left mandibles with a crenulation at base and right with a basal, large, knob-like projection. Postmentum club-shaped, club bilobed, posterior lobe broader. Pronotum subreniform, a little narrower than head-width; anterior margin deeply concave; posterior margin almost substraight.

Distribution : INDIA : Western Himalaya : Uttaranchal : Dehra Dun Dist. : New Forest.

Remarks : The species is so far known only from a single locality in the Western Himalaya.

29. *Stylotermes faveolus* (Chatterjee and Thakur)
(Fig. 29, Tables 20 and 22)

1. *Sarvaritermes faveolus* Chatterjee and Thakur

1963a. Chatterjee and Thakur, *Indian Forester*, **89**(9) : 635-637. nomen nudum.

1964c. Chatterjee and Thakur, *Zool. Anz.*, **173**(2) : 149-162. Im., S. and W. Holotype : S., in FRI. Type-locality : Sarvari Village, Notified Cremation Ground Area, near Kulu Saw Mill, Kulu Valley, Himachal Pradesh, India.

2. *Stylotermes faveolus* (Chatterjee and Thakur)

1975. Roonwal, *Biol. Zentrabl.*, **94** : 28, 29.

1986. Roonwal, Verma and Bisen, *Proc. Indian natn. Sci. Acad.*, (B) **52**(2) : 242-244, 253.

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, **1** : 588-591 (detailed synonymy).

Material studied : Identified : From North-Western Himalaya : 2Im., 2S. (Paratype), and 2W. (Paramorphotype), Sarvari village, Cremation ground area, near Kulu Saw Mill, Kulu, Himachal Pradesh, coll. M.L. Thakur, 5.vi.1962, ex. '*Alnus nitida*', det. Chatterjee and Thakur.

Diagnostic Character : (i) Imago (Fig. 29a-b) : Head and body brown; antennae, legs and lower part of thorax brownish yellow; postclypeus and labrum yellowish brown; wings transparent, almost colourless. Head; body and legs densely pilose.

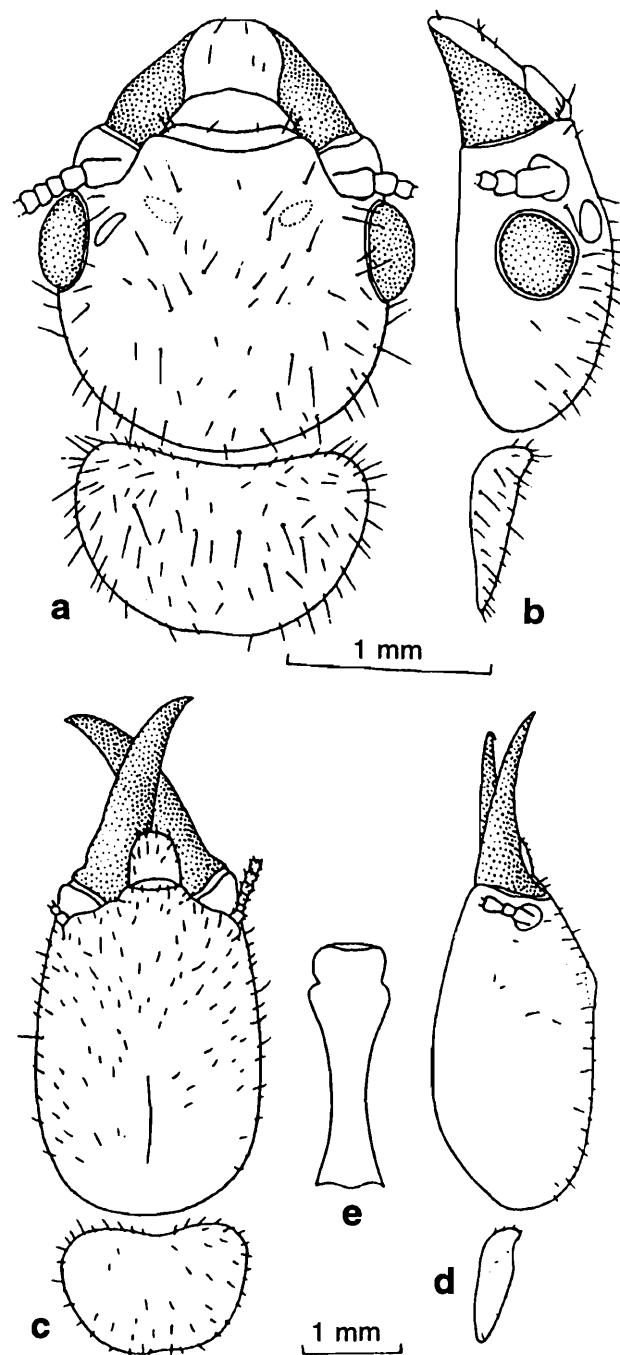


Fig. 29. : *Stylotermes faveolus* (Chatterjee and Thakur); a-b, Imago. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c-e, Soldier. c. Head and pronotum, dorsal view; d. Head and pronotum, side view; e. Postmentum.

Head subrounded, a little broader than long, Y-suture present, lateral arms not so distinct. Fontanelle minute. Antennae 20-22 segmented, segment 2 variable, subequal to or longer than 3 or equal to 3 and 4 combined. Ocelli hyaline,

Table 22 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Stylotermes faveolus</i>		<i>S. parabengalensis</i>	
	2S.	Known Range	Holotype	Known Range (7S.)
Length of head to lateral base of mandibles	3.25–3.60	3.20–3.70	1.92	1.92–2.23
Maximum width of head index (width/length)	2.37–2.55	2.30–2.60	1.19	1.19–1.34
Maximum length of labrum	0.38–0.56	0.35–0.48	–	–
Maximum width of labrum	0.54–0.62	0.55–0.63	–	–
Length of left mandible (Upper base of condyle to tip)	2.13–2.29	2.00–2.30	1.14	1.14–1.26
Head-mandibular length Index (left mandible-length/head-length)	0.63–0.65	–	0.59~	–
Minimum median length of postmentum	2.50–2.67	2.45–2.70	1.50	1.34–1.61
Maximum width of postmentum	0.75–0.95	0.85–1.00	0.50	0.46–0.57
Width of postmentum at waist	0.30–0.40	0.30–0.40	0.12	–
Maximum length of pronotum	1.15–1.30	1.15–1.35	0.61	0.61–0.76
Maximum width of pronotum	1.80–1.94	1.75–2.10	1.00	1.00–1.13
Pronotum index (length/width)	0.63–0.67	–	0.61	–
Number of antennal segments	16–17	16–19	12	12–13

whitish; minimum eye-ocellus distance less than half of maximum diameter of ocellus, 0.08 mm. Postclypeus with no median line present, trapezoidal; with a few setal-like hairs, anterior margin slightly concave. Mandibles of *Stylotermes* type. Pronotum flat, narrower than head-width with eyes, anterior margin concave, with a weak median emargination. Wings strongly reticulate. Venation of *Stylotermes* type.

(ii) Soldier (Fig. 29c-e) : Head reddish brown; pronotum yellowish brown; abdomen paler. Head and pronotum moderately and body fairly densely pilose.

Head subrectangular, much longer than broad; sides slightly outcurved and converging in front. Fontanelle indistinct. Antennae with 16-19 segments, 2 shortest, 3 fairly long. Postclypeus broad, sparsely pilose, length about half of width. Labrum dome-shaped with a few hairs on anterior margin and on body, rounded apically. Mandibles long, sabre-shaped, bluntly incurved apically. Left mandibles with a crenulation below the middle and right with some minute crenulations at upper part of proximal one-third and a larger tooth like

projection at base of mandible. Postmentum long, club-shaped, club divided into an anterior and posterior lobes. Pronotum pilose, trapezoidal, anterior margin with a sharp deep median notch; posterior margin medially feebly emarginated.

Distribution : INDIA : North-Western Himalaya : Himachal Pradesh : Kulu Valley : Sarvari village, cremation ground area, near Kulu Saw Mill.

Remarks : The species was first described under a new genus *Sarvaritermes* (Chatterjee and Thakur, 1963a and 1964c) which was latter on transferred to *Stylotermes*. Subsequently, Emerson (1975) had treated it as synonym of *S. chakratensis* Mathur and Thapa. However, it has been kept here as a valid one until further detailed study is undertaken. It occurs in living and partly dead trees of Kash (*Alnus nitida*) making longitudinal galleries. Small colonies are found scattered in irregular chambers in wood which contain eggs, nymphs and other castes. Swarming takes place (in the laboratory) in July (Chatterjee and Thakur, 1963a; Roonwal, 1970a).

30. *Stylotermes parabengalensis* Maiti

(Fig. 30, Table 22)

1. *Stylotermes parabengalensis* Maiti

1974. Maiti, *Oriental Insects*, 9(2) : 143-148. S. Holotype : S., in ZSI., Calcutta. Type-locality : Near Nagrakata Rly. Station, Jalpaiguri Dist., West Bengal, India.

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 22, 56.

1983. Chhotani, *Oriental Insects*, 17 : 120.

1989. Roonwal & Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 596-598 (detailed synonymy).

Material studied : Identified : From *Eastern Himalaya* : 1S. (Holotype), near Nagrakata Rly. Station, 85 km North-East of Jalpaiguri, Jalpaiguri Dist., W.B., coll. P.K. Maiti, 6.xi.1966, det. P.K. Maiti.

Diagnostic Character : (i) Imago : Unknown.

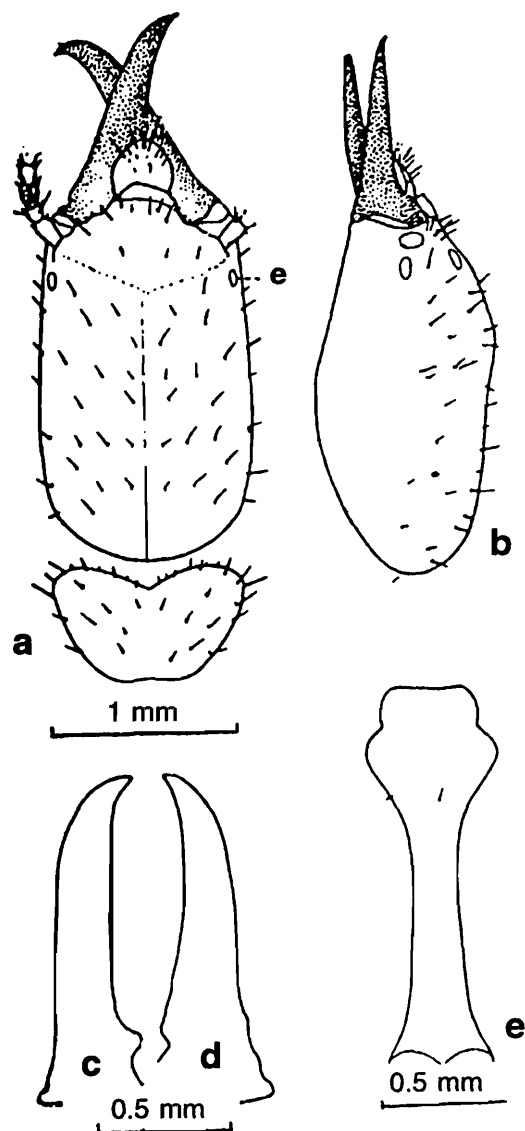


Fig. 30. : *Stylotermes parabengalensis* Maiti; a-e, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible; e. Postmentum.

(ii) Soldier (Fig. 30a-e) : Head brownish yellow, paler posteriorly; abdomen whitish yellow. Head and pronotum fairly and body densely hairy.

Head subrectangular, longer than wide; sides substraight, weakly narrowed in front. Fontanelle minute. Antennae with 12-13 segments, 2 small, 3 large and sclerotic; more than double the length of 2. Postclypeus chitinised and pilose. Labrum slightly broader than long, rounded anteriorly. Mandibles sabre-shaped, weakly incurved apically, less than two-thirds of head-length. Left mandibles with a few weak crenulations basally. Postmentum club-shaped with a long narrow waist. Pronotum flat, narrower than head and subtrapezoidal, anterior margin convex and deeply notched medially; posterior margin weakly emarginate medially.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Jalpaiguri Dist. : near Nagrakata Railway Station, 85 km North-East of Jalpaiguri.

Remarks : The species is only from the sub-Himalayan, West Bengal infesting dead wood of standing *Ficus bengalensis*, *Mangifera indica*. The biology of the species is limited, gallery patterns only (Maiti, 1983).

Family INDOTERMITIDAE

Genus *Indotermes* Roonwal and Sen-Sarma

**Key to the species of genus *Indotermes*
Roonwal and Sen-Sarma**

I. IMAGOS :

1. Y-suture not visible, mid-dorsal spot of head crescentic in shape; postclypeus with distinct median line; head-dorsum mostly with dense small hairs; larger species, head-length 1.30-1.45 mm, head-width (with eyes) 1.80-1.90 mm *I. capillosus* Chatterjee and Thakur
- Y-suture visible, mid-dorsal spot of head triangular; postmentum devoid of any distinct median line; head-dorsum with admixture of both short and long hairs; smaller species, head-length 1.16 mm (1.16-1.27 mm), head-width (with eyes) 1.72 mm (1.67-1.80 mm) *I. rongrensis* (Roonwal and Chhotani)

II. SOLDIERS :

1. Head with lateral margins almost parallel; mandibles with fairly strongly hooked and with fine apices; mandibles large in comparison to head, mandible-head index 0.61–0.63 (0.60–0.63); postmentum less bulging on the anterior-third, postmentum maximum width 0.45–0.50 mm *I. capillosus* Chatterjee and Thakur
- Head with lateral margins feebly diverging anteriorly; mandibles with less strongly hooked and with blunt apices; mandibles small in comparison to head, mandible-head index 0.55–0.56; postmentum maximum width 0.50–0.54 mm (0.50–0.56 mm) *I. rongrensis* (Roonwal and Chhotani)

31. *Indotermes capillosus* Chatterjee and Thakur (Fig. 31, Table 24)

1. *Doonitermes capillosus* Chatterjee and Thakur

1966. Chatterjee and Thakur, *Zool. Anz.*, **176**(5) : 349-357, S. and W. Holotype : S. and W., in FRI, Dehra Dun. Type-locality : Sal forest, Chandervani block, Asarori Range, Dehra Dun Forest Division, Dehra Dun Dist., Uttaranchal, India.
1970. Thakur and Chatterjee, *Orient. Ins.*, **4**(2) : 159-164.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

2. *Indotermes capillosus* (Chatterjee and Thakur)

1997. Chhotai, *Fauna of India : Isoptera (Termites)*, **2** : 14.

Material studied : Identified : From *Western Himalaya* : 2 Paratypes S. and sev. Paramorphotypes W., Sal forest, Chandervani Block, Asarori Range, Dehra Dun Forest Division, Dehra Dun, Uttaranchal, coll. M.L. Thakur, 23.6.1964, ex. "mound", det. P.K. Sen-Sarma as *Doonitermes capillosus*, redet. O.B. Chhotani as *Indotermes capillosus*.

Diagnostic Character : (i) Imago : Head deep fuscous, slightly paler near the occiput; postclypeus and pronotum dark castaneous brown; labrum; antennae and legs deep straw coloured. Head and body densely pilose.

Head sub-circular, a large sub-triangular mid-dorsal spot lying almost at the middle of head-capsule, Y-suture not visible. Ocelli large, oval. Antennae with 15 segments, 3 shortest. Postclypeus moderately swollen, densely pilose with many short hairs, interspersed with a few long hairs. Labrum sub-round. Left mandible with one apical and two marginal teeth, right mandible with an apical, two marginals and a molar plate. Pronotum flat, sub-trapezoid. Forewing with large scale, radius short, arising independently from wing scale. Hindwing, almost like forewing.

(ii) Soldier (Fig. 31a-e) : Head light castaneous brown, with pale longitudinal streaks dorsally; abdominal tergites slightly paler than head. Head covered with dense microscopic hairs interspersed with several long hairs, body fairly covered with long hairs.

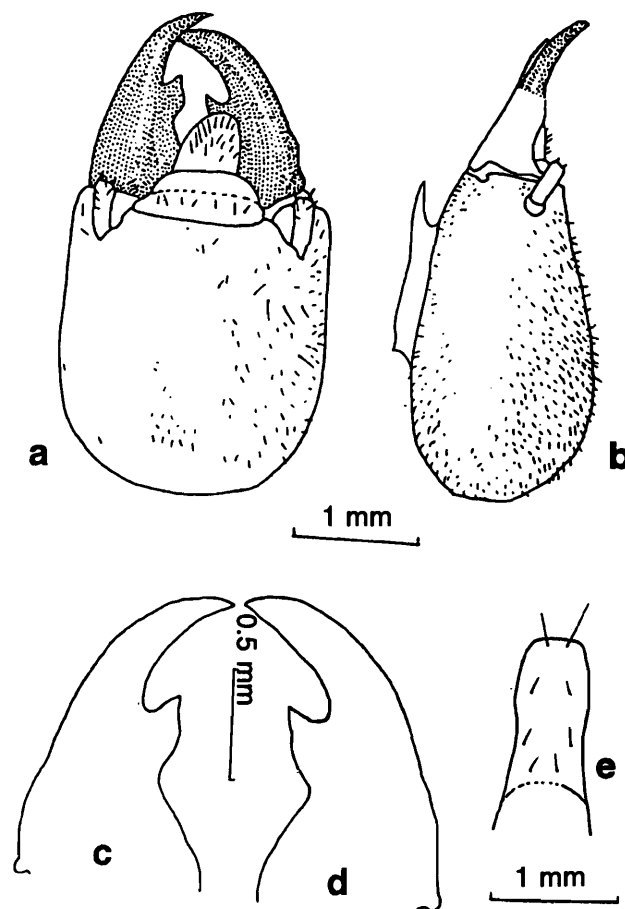


Fig. 31. : *Indotermes capillosus* Chatterjee and Thakur; a-e, Soldier. a. Head, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible; e. Postmentum.

Head subrectangular, lateral sides weakly arched, posterior margin broadly rounded, Y-

Table 23 : Measurements (in mm) etc. of Caste-Imago.

	<i>Indotermes rongrensis</i>	
	1Im.	Known Range
Total body-length with wings (excluding antennae), ca.	18.0	18.0–18.6
Total body-length without wings (excluding antennae), ca.	8.82	8.80–10.6
Length of head to lateral base of mandibles	1.16	1.16–1.27
Maximum width of head (with eyes)	1.72	1.67–1.80
Maximum length of postclypeus	0.27	0.27–0.30
Maximum width of postclypeus	0.74	0.67–0.80
Maximum length of labrum	0.50	0.43–0.50
Maximum width of labrum	0.57	0.57–0.60
Maximum diameter of compound eye (with ocular sclerite)	0.45	0.43–0.51
Maximum diameter of lateral ocellus	–	–
Minimum diameter of lateral ocellus	–	–
Minimum eye-ocellus distance	0.09	0.07–0.10
Maximum length of pronotum	0.75	–
Maximum width of pronotum	1.31	–
Length of forewing with scale	–	13.0–16.0
Length of hindwing with scale	–	12.0–14.5
Number of antennal segments	15	15

Table 24 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Indotermes capillosus</i>		<i>I. rongrensis</i>	
	2S.	Known Range	5S.	Known Range
Length of head to lateral base of mandibles	2.40–2.48	2.40–2.50	2.28–2.48	2.24–2.50
Maximum width of head	2.02–2.20	2.00–2.20	1.91–2.15	1.91–2.18
Head index (width/length)	0.84–0.88	0.80–0.91	0.83–0.86	0.82–0.87
Maximum length of labrum	0.36–0.47	0.35–0.40	0.44–0.47	0.44–0.47
Maximum width of labrum	0.42–0.50	0.40–0.45	0.44	0.44
Length of left mandible (Upper base of condyle to tip)	1.50–1.52	1.50–1.55	1.13–1.40	1.37–1.40
Head-mandibular length Index (left mandible-length/head-length)	0.61–0.63	–	0.50–0.56	0.55–0.56
Left mandibular tooth distance (base of tooth to tip of mandible)	0.66–0.75	0.65–0.75	–	–
Left mandibular tooth index (tooth distance/left mandible length)	0.44–0.49	0.43–0.48	–	–
Minimum median length of postmentum	1.12–1.15	1.00–1.15	1.06–1.22	0.93–1.25
Maximum width of postmentum	0.45–0.50	0.45–0.50	0.50–0.54	0.50–0.56
Width of postmentum at waist	0.40–0.47	0.40–0.48	0.31	–
Maximum length of pronotum	–	0.65–0.80	0.73–0.80	0.72–0.82
Maximum width of pronotum	–	1.03–1.10	0.99–1.04	0.99–1.06
Pronotum index (length/width)	–	0.60–0.74	0.74–0.77	–
Number of antennal segments	14	14	14	14

suture absent. Fontanelle small, circular. Antennae with 14-segments, 2 cylindrical, slightly shorter than 3 but subequal to 4. Postclypeus semicircular in shape, hairy. Labrum tongue shaped, pilose. Mandibles large, robust and symmetrical. Both mandibles with forwardly directed subtriangular teeth at the junction of the broad basal and the distal attenuated portions. Postmentum club-shaped. Pronotum strongly saddle shaped, anterior margin convex, without any median notch; posterior margin weakly convex.

Distribution : Western Himalaya : Uttaranchal : Dehra Dun Forest Division : Sal forest, Chandervani Block, Asarori Range; Pauri Dist.; Naini Tal Dist. : Almora Dist; Chamoli.

Remarks : Chatterjee and Thakur (1966a) described *I. capillosus* as a type-species of the new genus *Doonitermes* from Dehra Dun Forest Division, Uttaranchal, India, based on the soldier and worker. Subsequently Thakur and Chatterjee (1970) described the imago. Since the genus *Doonitermes* has been synonymised under the rare genus *Indoterme*s by Chhotani (1997), so the species is included in the genus *Indoterme*s. However, this soil inhabiting species, though collected from the mound, was already known from study area.

32. *Indoterme*s *rongrensis* (Roonwal and Chhotani)
(Fig. 32, Tables 23 and 24)

1. *Speculiterme*s *cyclops rongrensis*
Roonwal and Chhotani

1962a. Roonwal and Chhotani, *Proc. natnl. Inst. Sci. India*, (B) 28(4) : 314. Type-locality : Rongrengiri (Garo Hills, Meghalaya, India). Holotype W., in ZSI., Calcutta.

2. *Speculiterme*s *rongrensis* Roonwal and Chhotani

1973. Morimoto, *Bull. Govt. Forest Exper. Sta.*, No. 257 : 62-63. Thailand. Im.

3. *Indoterme*s *rongrensis* (Roonwal and Chhotani)

1986. Roonwal and Chhotani, *Rec. zool. Surv. India*, 83(3 & 4) : 155-162. Im., S., W. N.E. India (Meghalaya).

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 609-616 (detailed synonymy).

4. *Indoterme*s *pakistanicus* Chaudhry and Ahmad

1972. Chaudhry and Ahmad, *Termites of Pakistan* (Final Tech. Rept., PL. 480 Program) : 42. S., W. (nom. nud.).

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 609-616 (synonymy).

5. *Indoterme*s *bangladeshiensis* Akhtar

1975. Akhtar, *Bull. Dept. Zool. Univ. Panjab* (Lahore) (N.S.), Art. 7 : 113, 114, 115-120. Im., S. Holotype S., in Zool. Dept. Panjab Univ., Lahore. Type-locality : Bangladesh (South-East part, Ukhia).

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 609-616 (synonymy).

Material studied : Unidentified : From Eastern Himalaya : 1Im., 5S. and 10W., Itanagar, Lower Subansiri Dist., Arunachal Pradesh, coll. B.N. Nandi and S.K. Chakraborty, 18.vi.1985.

Diagnostic Character : (i) Imago (Fig. 32a-b) : Head and body blackish brown; labrum paler. Head and body with a thick mat of short hairs and a few longer bristles.

Head hypognathus, subcircular, Y-suture faintly marked and mid-dorsal spot large, suboval to subtriangular. Ocelli oval, separated from eyes by less than its short diameter. Postclypeus subtrapezoidal. Labrum broad, tongue-shaped, with narrowly rounded apical margin. Antennae 15-segments, 3 shorter than 2. Mandibles with an apical and two marginal teeth. Pronotum trapezoidal, weakly saddle-shaped, anterior margin substraight, with or without median emargination; posterior margin with a prominent median notch. Wings transparent, colourless, scales and base brown, thinly hairy.

(ii) Soldier (Fig. 32c-e) : Head brown with reddish tinge; pronotum darker with a white median streak extending to 9th abdominal tergum. Head and pronotum densely pilose with small hairs and a few longer bristles.

Head subrectangular, sides weakly diverging anteriorly with broadly rounded posterior margin strongly hypognathus. Antennae with 14-segments,

2 shortest; 3 and 4 subequal. Postclypeus with a few hairs, very broad. Labrum very small, tongue-

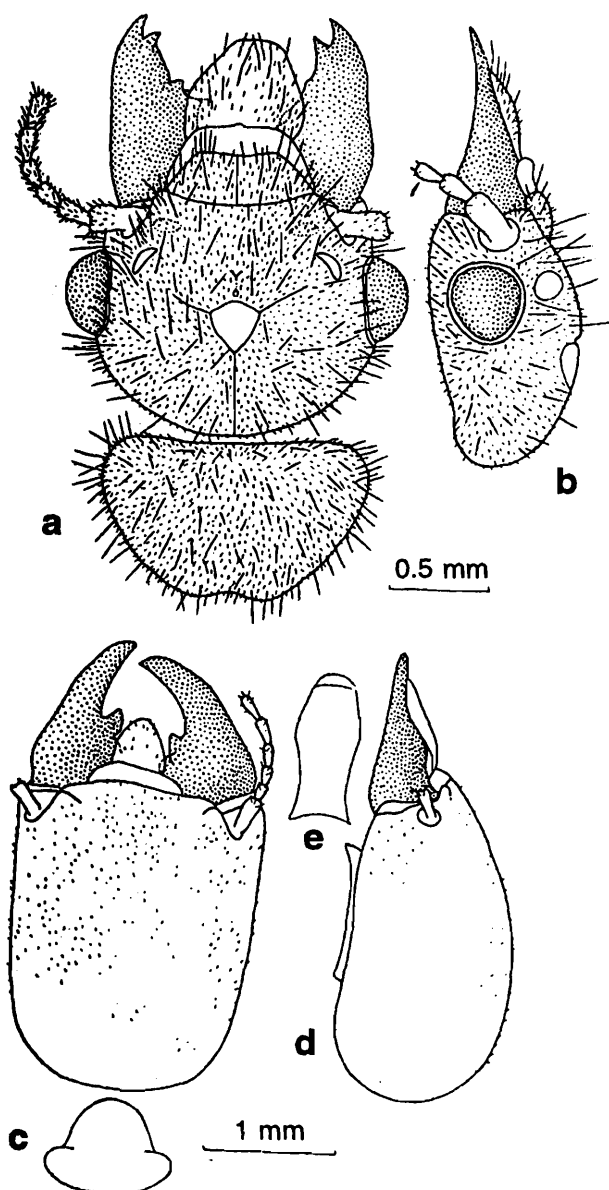


Fig. 32. : *Indotermes rongrensis* (Roonwal and Chhotani); a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-e, Soldier. c. Head and pronotum, dorsal view; d. Head, side view; e. Postmentum.

shaped, slightly longer than wide, with minute hairs. Mandibles slightly longer than half the head-length, massive, with a large basal plate and a slender, attenuated, pointed, incurved apical part with a large, pointed tooth at the junction of the two parts on the inner margin, the left tooth larger than the right. Postmentum club-shaped with a bulge in the middle, very short. Pronotum much narrower than head, strongly saddle-shaped, anterior lobe much longer than posterior, anterior margin convex, strongly outcurved; posterior margin weakly outcurved.

Distribution : INDIA : Meghalaya : Garo, Khasi and Jaintia Hills BHUTAN (*Eastern Himalaya*) : Phuntsholing; Samchi and Thimpu River bank.

Elsewhere : Bangladesh : Chittagong Dist. : Ukhia. Thailand : Fang; Chieng Dao and Mae Klang Water fall.

Remarks : The species was originally described as *Speculitermes cyclops rongrensis* by Roonwal and Chhotani (1962a) based on workers from Meghalaya. Soon after the imago was described from Thailand by Morimoto (1973) and from Bhutan by Roonwal and Chhotani (1977). Subsequently, Roonwal and Chhotani (1986) further substantiate its species status based on the associated collection of imago, soldier and worker castes from Meghalaya. The same authors (1989) had synonymised two species, namely, *I. pakistanicus* Chaudhry and Ahmad, and *I. bangladeshiensis* Akhtar under this species. The species restricts itself in the eastern India, occurring mostly in the humus soil. In Tripura, it has been collected from the outer pocket of a termite mound (*Odontotermes* sp.).

Family TERMITIDAE

Key to the subfamilies of family TERMITIDAE

I. IMAGOS :

1. Labrum wider than long or as long as broad 2
 - Labrum longer than wide 3
2. Apical tooth of mandibles larger than first marginal tooth and widely separated with a wide angle of more than 45° TERMITINAE
 - Apical tooth of mandibles slightly smaller than first marginal tooth and not widely separated, angle between two teeth nearly 45° AMITERMITINAE
3. Labrum with distinctly sclerotised band; apical tibial spurs formula generally 3 : 2 : 2 MACROTERMITINAE
 - Labrum without a sclerotised band; apical tibial spurs formula generally 2 : 2 : 2 NASUTITERMITINAE

II. SOLDIERS :

1. Head produced into a rostrum; mandibles generally degenerate with or without spine-like apical processes, not functional
..... **NASUTITERMITINAE**
- Head not produced into rostrum, rather rectangular, squarish or oval; mandibles not degenerate, but well developed with or without teeth in the inner margins 2
2. Mandibles sabre-shaped or hooked; mostly shorter than head-length; fontanelle distinct or indistinct. 3
- Mandibles rod-like or twisted; as long as or a little longer than head-length and shorter in some genera; fontanelle generally placed below frontal projection **TERMITINAE**
3. Mandible each with a prominent tooth or serration (*Microcerotermes*)
..... **AMITERMITINAE**
- Mandible either with or without tooth, left with a prominent and right with a smaller or minute tooth (*Odontotermes*) or with crenulations (*Hypotermes*, *Macrotermes*)
..... **MACROTERMITINAE**

Key to the genera of family TERMITIDAE**I. IMAGOES :**

1. First and second marginal teeth of left mandible close to each other; posterior margin of first marginal shorter **Angulitermes** Sjöstedt
- First and second marginal teeth of left mandible far apart; posterior margin of first marginal longer 2
2. Fontanelle large and oval (coupled with strongly twisted left mandible of soldier)
..... **Pericapritermes** Silvestri
- Fontanelle long and narrow (posterior margin of first right marginal longer and second right marginal tooth comparatively small)
..... **Dicuspiditermes** Krishna
3. Posterior margin of second marginal tooth of right mandible straight
..... **Microcerotermes** Silvestri
- Posterior margin of second marginal tooth of right mandible weakly to strongly incurved 4

4. Apical teeth of mandibles longer than first marginal and those two widely separated from each other; second marginal of left mandible not separated from first by a cut or notch 8
- Apical teeth of mandibles as long as or smaller than first marginal and those two not as widely separated; second marginal of left mandible separated from first by a cut or notch 9
5. Posterior margin of second marginal tooth of right mandible strongly incurved
..... **Eremotermes** Silvestri
- Posterior margin of second marginal tooth of right mandible weakly incurved
..... **Synhamitermes** Holmgren
6. Fontanelle plate large, round or irregular in shape; apical tooth of mandibles as long as first marginal and angle between the two acute
..... **Speculitermes** Wasmann
- Fontanelle small, point-like or somewhat larger and oval, apical tooth of mandibles smaller than first marginal and angle between the two wide **Euhamitermes** Holmgren
7. Very large species; right mandible with a small subsidiary tooth at base of first marginal tooth
..... **Macrotermes** Holmgren
- Medium to large species; right mandible without any subsidiary tooth at base of first marginal tooth 8
8. Antennae with 15-18 segments; postclypeus swollen, about half or slightly more than half the width and projecting more strongly into frons
..... **Microtermes** Wasmann
..... **Ancistrotermes** Silvestri
- Antennae with 19-20 segments; postclypeus swollen, length less than half the width and weakly convex posteriorly 9
9. Fontanelle raised **Odontotermes** Holmgren
- Fontanelle not raised **Hypotermes** Holmgren
10. Postclypeus slightly shorter than half its width and strongly swollen (arched); left mandible with apical tooth subequal to first marginal and both closely placed; fontanelle triangular or Y-shaped **Trinervitermes** Holmgren

- Postclypeus much shorter than half its width and less so swollen; left mandible with apical tooth slightly shorter than first marginal; fontanelle narrow and elongate
..... *Nasutitermes* Dudley

II. SOLDIERS :

1. Head distinctly constricted behind the antennae, soldier monomorphic; head not broadly rounded behind rather substraight or weakly emarginate; antennae with 13 segments; mandibles without any spine like process; smaller species *Ahmaditermes* Akhtar
- Head not constricted behind the antennae, soldiers either dimorphic or monomorphic; head broadly rounded behind; antennae with 13-14 segments; mandibles with or without spine like processes; larger species 2
2. Soldier dimorphic, mandibles without any spine like process; head very broadly rounded; antennae with 13 segments
..... *Trinervitermes* Holmgren
- Soldier monomorphic, mandibles generally without any spine like process, but rarely with spine; head not so rounded; antennae mostly with 13-14 segments *Nasutitermes* Dudley
3. Mandible sickle-shaped, mandibles serrated (finely or coarsely) throughout the inner margin *Microcerotermes* Silvestri
- Mandibles not serrated on inner margin, with a weak to prominent tooth on each mandible 4
4. Head with frontal protuberance; mandibles long, thin, slender, slightly incurved at apices *Eremotermes* Silvestri
- Head without frontal protuberance; mandibles short, strong and strongly curved at apices ...
..... 5
5. Mandibles exceptionally broad at base, each with an anteriorly directed tooth; clypeus entire, not bilobed; large species
..... *Euhamitermes* Holmgren
- Mandibles of normal shape, not very broad at base; each with a less strong tooth directed at right angle, small species
..... *Synhamitermes* Holmgren

6. Mandibles rod-like; frons weakly to appreciably produced conically in front
..... *Angulitermes* Sjöstedt
- Mandibles asymmetrical, generally left mandible weakly to strongly twisted; frons not produced in front; generally sloping in front gradually, sometimes abruptly sloping 7
7. Labrum sinuate, not incurved at anterior margin; mandibles much shorter than head; left mandible strongly twisted
..... *Pericapritermes* Silvestri
- Labrum strongly incurved at anterior margin; mandibles as long as or a little shorter than head; left mandible less so twisted 8
8. Apical tibial spurs formula 2 : 2 : 2
..... *Malaysiocapritermes* Ahmad and Akhtar
- Apical tibial spurs formula 3 : 2 : 2 9
9. Antero-lateral corners on both the sides of head produced into tubercle-like projections in front *Dicuspidermes* Krishna
- Antero-lateral corners of head not produced into tubercle-like projections in front
..... *Pseudocapritermes* Kemner
10. Soldier dimorphic; labrum with a hyaline tip; meso-and meta-notum laterally expanded
..... *Macrotermes* Holmgren
- Soldier monomorphic; labrum without hyaline tip; meso-and meta-notum not laterally expanded 11
11. Small and delicate species; right mandible without any tooth or crenulations; left sometimes with a minute tooth 12
- Larger species; right mandible either with a tooth on inner margin or crenulations in basal half; left mandible without any tooth 13
12. Head broadly round or squarish; head not so densely hairy, mandibles strongly incurved anteriorly, well incurved on outer margins; larger species *Ancistrotermes* Silvestri
- Head oval, converging in front; head generally densely hairy; mandibles weakly incurved anteriorly, not so incurved on outer margin; smaller species *Microtermes* Wasmann

13. Left mandible without any tooth, but with 3-5 crenulations at basal half *Hypotermes* Holmgren
- Left mandible with a tooth placed at different positions on its inner margin, but without any crenulation *Odontotermes* Holmgren

Subfamily AMITERMITINAE

Genus *Speculitermes* Wasmann

Key to the species of genus *Speculitermes* Wasmann based on workers only

I. WORKERS :

1. Mid-dorsal spot of medium size and rounded (diameter 0.12–0.16 mm), raised, very weakly swollen; length of head to base of mandible, 1.06–1.18 mm (0.90–1.20 mm), head-width 1.10–1.35 mm (1.20–1.40 mm) *S. cyclops* Wasmann
- Mid-dorsal spot large and triangular in shape (0.20–0.31 mm), not so raised from the head-surface; length of head to base of mandible, 1.05–1.09 mm (1.05–1.10 mm), head-width 1.30–1.35 mm *S. triangularis* Roonwal and Sen-Sarma

33. *Speculitermes cyclops* Wasmann

(Fig. 33, Table 25)

1. *Speculitermes cyclops* Wasmann

1902. Wasmann, *Zool. Jb. Syst.*, **17**(1) : 160-162. Im. W. Lectotype (designated Roonwal and Sen-Sarma, 1960) W., in FRI. Type-locality : Khandala near Bombay, Maharashtra, India.
1949. Snyder, *Smiths. misc. Colls.*, **112** : 110.
1960. Roonwal and Sen-Sarma, *Contrib. Syst. Oriental Termites* (ICAR Ent Monogr. 1) : 16.
1977. Roonwal and Chhottani, *Ent. Basil.*, **2** : 53.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42, 62-63.
1989. Thakur, *Indian Forest Rec. (N.S.) Ent.*, **15**(1) : 18-19.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 44-48 (detailed synonymy).

2. *Speculitermes cyclops cyclops* Roonwal

1958. Roonwal, *Trans. Bose Res. Inst.*, **22** : Pl. 1.
- 1984b. Verma, *Indian J. For.*, **7**(4) : 305.

Material studied : Unidentified : A. From *Western Himalaya* : (i) 12W., Turlong, North-East

of Mala, Pilibhit Dist., Uttaranchal, coll. K. Krishna, 26.i.1953, ex. 'galleries in soil' (ii) 3W., Gwain Block, two miles North of Kotdwara, Garhwal Dist., Uttaranchal, coll. K. Krishna, 4.ii.1953, ex. 'under stone in soil' (iii) 10W., Totgodhera Block, five miles East of Kotdwara, Garhwal Dist., Uttaranchal, coll. K. Krishna, 3.ii.1953, ex. 'under stone in soil' B. From *Central Himalaya* : (iv) 10W., ten miles North of Tanakpur, Nepal Forest, Nepal, coll. K. Krishna, 31.i.1953, ex. 'under stone in rocky soil. C. From *Eastern Himalaya* : (v) 9W., Mal Forest, two km South-West of Garubathan, Darjiling Dist., W.B., coll. G.K. Srivastava & P.K. Maiti, 18.ii.1973 (F.C. No. 19/18.12.73). (vi) 12W., Samsing, Darjiling Dist., W.B., coll. P.K. Maiti & G.K. Srivastava, 24.xii.1973 (F.C. No. 9/24.12.73). Identified : From *Western Himalaya* : (i) 5W. Dhikola, Sarapduli Road, Pauri Dist., Uttaranchal, coll. R.N. Chopra, 10.viii.1975. (ii) 3W., Bijrani, NainTal, Uttaranchal, coll. Asket Singh, 24.ii.1973.

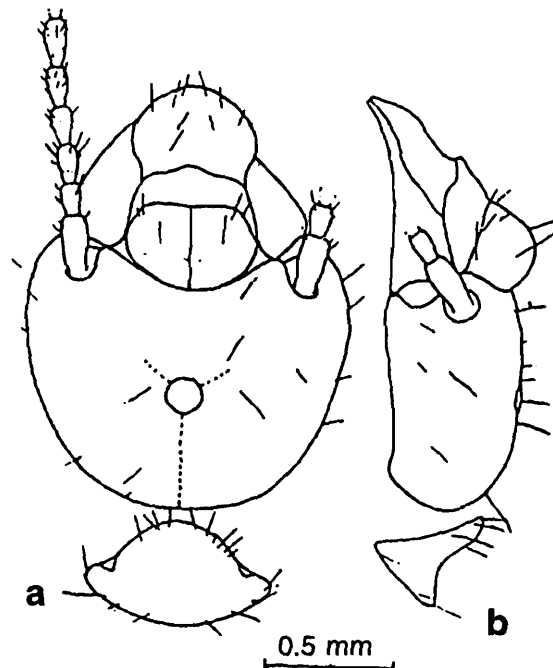


Fig. 33. : *Speculitermes cyclops* Wasmann; a-b, Worker. a. Head and pronotum, dorsal view; b. Head and pronotum, side view.

Diagnostic Character : (i) Imago : Known from Maharashtra, but not represented from the Himalaya, hence not dealt with. (ii) Soldier : Unknown. (iii) Worker (Fig. 33a-b) : Head light to deep brown; other body parts paler than head. Head and pronotum very sparsely and abdomen more hairy.

Table 25 : Measurements (in mm) etc. of Caste-Worker.

	<i>Speculitermes cyclops</i>		<i>S. triangularis</i>	
	10W.	Known Range	Sev. W.	Known Range
Length of head to lateral base of mandibles	1.06–1.18	0.90–1.20	1.05–1.09	1.05–1.10
Maximum width of head Head index (width/length)	1.10–1.35	1.20–1.40	1.30–1.35	1.30–1.35
Maximum diameter of mid-dorsal spot	0.12–0.16	0.12–0.16	0.22–0.31	0.20–0.31
Maximum length of labrum	–	–	–	–
Maximum width of labrum	–	–	–	–
Length of left mandible (Upper base of condyle to tip)	–	–	–	–
Head-mandibular length Index (left mandible-length/head-length)	–	–	–	–
Minimum median length of postmentum	–	–	–	–
Maximum width of postmentum	–	–	–	–
Width of postmentum at waist	–	–	–	–
Maximum length of pronotum	0.40–0.50	0.40–0.50	0.40–0.45	0.40–0.45
Maximum width of pronotum	0.70–0.80	0.65–0.80	0.75–0.80	0.75–0.80
Pronotum index (length/width)	0.57–0.62	–	0.53–0.56	–
Number of antennal segments	14	14	14	14

Head subcircular, Y-suture indistinct. Dorsal spot fairly large, almost round, whitish and feebly swollen. Antennae with 14 segments, 2 shortest. Labrum dome-shaped, hairy near distal end. Pronotum strongly saddle-shaped with convex anterior margin being devoid of any median suture; posterior margin weakly outcurved but devoid of any median emargination.

Distribution : India : *North-Western Himalaya* : Jammu and Kashmir. *Western Himalaya* : Uttaranchal : Pilibhit Dist. : Turlong, North-East Mala; Garhwal Dist. : Togodhera Block, five miles East of Kotdwara, Gwain Block, two miles North of Kotdwara; Pauri Dist. : Dhikola, Sarapduli Road; Naini Tal Dist. : Bijrani, *Eastern Himalaya* : West Bengal : Darjiling Dist. : Mal Forest, two km South-West of Garubathan, Samsing. Maharashtra. Karnataka. Orissa. Madhya Pradesh. Rajasthan. Uttar Pradesh. NEPAL (*Central Himalaya*) : ten miles North-East of Tanakpur, Nepal Forest.

Elsewhere : Bangladesh. Pakistan and Myanmar.

Remarks : This soldierless species is known from the entire range of the Himalaya, although it is quite common in the plains of Indian subcontinent, mostly inhabiting in humus soil.

34. *Speculitermes triangularis* Roonwal and Sen-Sarma (Fig. 34, Table 25)

1. *Speculitermes triangularis* Roonwal and Sen-Sarma

1960. Roonwal and Sen-Sarma, *Contrib. Syst. Orient. Termites* (ICAR Ent. Monogr. No. 1) : 15, 26-28. W. only. Holotype : W., in FRI. Type-locality : Dehra Dun, Uttaranchal, India.
1966. Roonwal and Chhotani, *Biol. Zbl.*, **85**(2) : 183.
1975. Sen-Sarma *et al.*, *Wood Destroying Termites of India* (Final Tech. Rept. PL. 480 Proj. No. A7-FS-58) : 12, 62.
- 1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 32.
1989. Thakur, *Indian Forest Rec. (N.S.) Ent.*, **15**(1) : 20.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 67-69.

Material studied : Unidentified : From *Western Himalaya* : Sev. W., Kahalquira (1700 m), Bhowali, Naini Tal, Uttaranchal, coll. P.K. Maiti & party. 11.x.1974, ex. 'under cowdung' (F.C. No. 1/11.10.74). Identified : From *Western Himalaya* : (i) Sev. W., Nabapani forest, Dehra Dun Dist., Uttaranchal, coll. S.C. Verma, 6.ix.1985, det. S.C. Verma. (ii) Sev. W., Kempty fall, Tehri Dist., Uttaranchal, coll. Raj Tilak, 12.vii.1973. (iii) Sev. W., Lachhiwala forest, Dehra Dun, Uttaranchal, coll. A.E. Emerson, 10.x.1960, ex. 'unknown'.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier : Unknown.

(iii) Worker (Fig. 34a-b) : Head light yellow to pale straw coloured; postclypeus and labrum slightly paler than head; abdomen transparent white. Head and body moderately hairy.

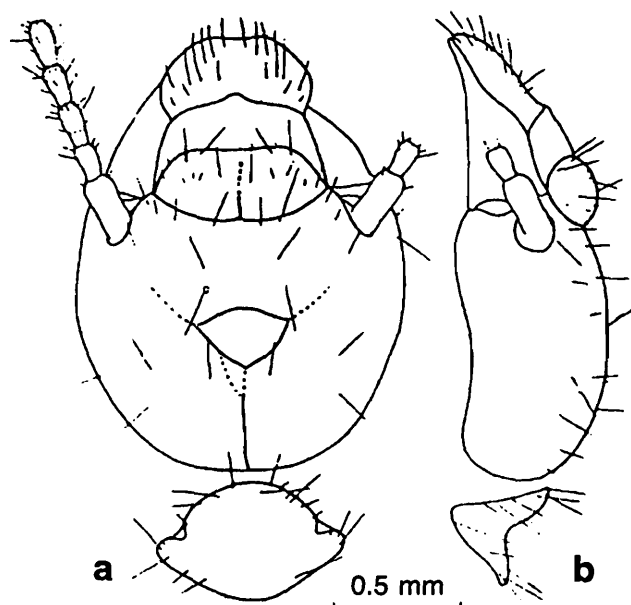


Fig. 34. : *Speculitermes triangularis* Roonwal and Sen-Sarma; a-b, Worker. a. Head and pronotum, dorsal view; b. Head and pronotum, side view.

Head subcircular, Y-suture indistinct. Dorsal spot triangular. Antennae with 14 segments, 2 shortest. Labrum dome-shaped, pilose. Pronotum strongly saddle-shaped, anterior and posterior margins rounded, without any notch.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Lachhiwala forest, Nabapani forest; Naini Tal Dist. : Kahalquira, Bhowali; Tehri Dist. : Kempty fall; Kumaon Hills : Bageshwar.

Remarks : The species differs from other species of the genus by its distinct triangular mid-dorsal spot. It is so far known only from the Western Himalaya, inhabiting in soil.

Genus *Euhamitermes* Holmgren

Key to the species of genus *Euhamitermes*

I. IMAGOS :

1. Head wider, head-width with eyes 1.20 mm (1.15–1.30 mm); pronotum width 1.12 mm (1.00–1.17 mm); Y-suture absent; fontanelle plate fairly large (length 0.13 mm, width 0.9–0.10 mm); Ocellus from eye separated by about half its short diameter 0.11 mm *E. urbanii* Roonwal and Chhotani*
- Head narrower, head-width with eyes 1.03–1.12 mm (1.03–1.13 mm); pronotum width 0.93–1.00 mm (0.93–1.03 mm); Y-suture present, but faint; fontanelle plate small (length 0.04–0.06 mm, width 0.03–0.04 mm); Ocellus from eye separated by about its short diameter 0.10–0.11 mm *E. wittmeri* Roonwal and Chhotani*

*Only represented by imagoes

II. SOLDIERS :

1. Smaller species, head-length to base of mandibles 1.27 mm, head-width 0.99 mm; third segment of antenna shortest *E. aruna* Chhotani
- Larger species, head-length to base of mandibles 1.43–1.70 mm, head-width 1.18–1.28 mm; fourth segment of antenna shortest 2
2. Head with lateral margins uneven; tooth on each mandible small and indistinct; head-length to base of mandible 1.43–1.70 mm; maximum head-width 1.18–1.28 mm; pronotal anterior and posterior margins with feeble median emarginations *E. lighti* Snyder
- Head with lateral margins not uneven, rather straight; tooth on each mandible comparatively large and prominent; head-length to base of mandibles 1.45–1.50 mm, head-width 1.10–1.18 mm; pronotal anterior and posterior margins devoid of any median emargination *E. kanhaensis* Roonwal and Chhotani

35. *Euhamitermes aruna* Chhotani

(Fig. 35, Table 26)

1. *Euhamitermes aruna* Chhotani

1975a. Chhotani, *Orient. Insects*, 9(2) : 149-153 : S. and W. Holotype S., in ZSI. Type-locality : Charduar Forest (towards Bhalukpong), Kameng Div., Arunachal Pradesh, India.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 73-75 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 10.

Material studied : Identified : From *Eastern Himalaya* : 1S. (Holotype). Charduar Forest (towards Bhalukpong), Arunachal Pradesh, coll. S.K. Bhattacharya, 27.xii.1965, det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 35a-c) : Head straw yellow, deeper at base of mandibles; body paler than head. Head and body fairly pilose.

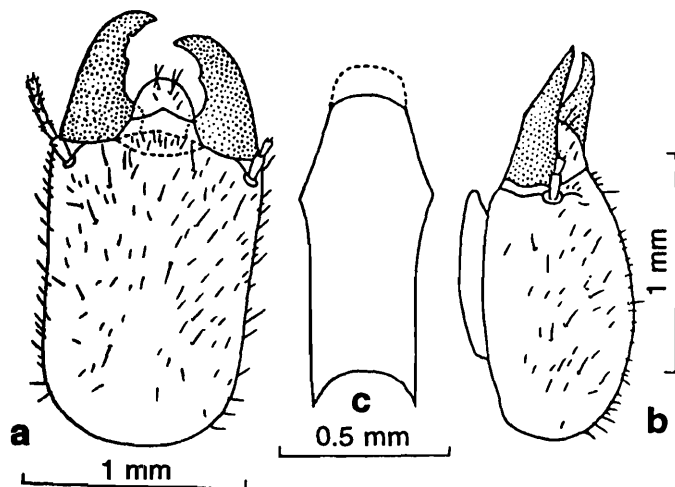


Fig. 35. : *Euhamitermes aruna* Chhotani; a-c, Soldier. a. Head, dorsal view; b. Head, side view; c. Postmentum.

Head subrectangular, longer than wide. Antennae broken, segment 3 shortest. Labrum broadly tongue-shaped, wider than long. Mandible thick, short and sickle-shaped; each mandible with a small tooth at distal third. Postmentum club-shaped, widest at anterior one-third and posteriorly narrowing weakly to a thin waist, anterior margin convex and posterior margin fairly deeply incurved. Pronotum saddle-shaped, anterior margin convex and devoid of any notch; posterior margin weakly outcurved.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : West Kameng Dist. : Charduar Forest.

Remarks : The species is known so far only from its type-locality in the *Eastern Himalaya*.

36. *Euhamitermes kanhaensis* Roonwal and Chhotani
(Fig. 36, Table 26)

1. *Euhamitermes kanhaensis* Roonwal and Chhotani

1965. Roonwal and Chhotani, *Proc. zool. Soc., Calcutta*, 18 : 11-16, 19 S. and W. Holotype : S., in ZSI. Type-locality : Kanha National Park, Mandla Dist., Madhya Pradesh, India.

1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 31.

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 67, 68.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 83-85 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 10 and 61.

Material studied : Identified : From *Eastern Himalaya* : 2S. and 7W., about four km from Kimin on road to Ziro, Lower Subansiri Dist., Arunachal Pradesh. coll. O.B. Chhotani, 17.v.1989, ex. "soil", det. G. Bose.

Diagnostic Character : (i) Imago : Not Known from the Himalaya.

(ii) Soldier (Fig. 36a-d) : Head straw yellow to yellowish with brownish tinge; thorax paler than head. Head and pronotum sparsely and body fairly densely hairy.

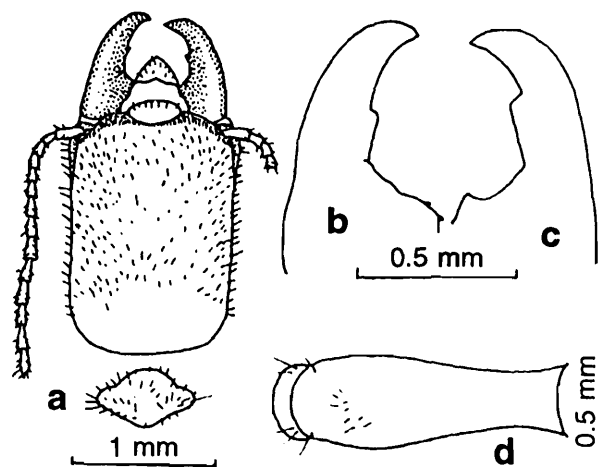


Fig. 36. : *Euhamitermes kanhaensis* Roonwal and Chhotani; a-d, Soldier. a. Head and pronotum, dorsal view; b. Left mandible; c. Right mandible; d. Postmentum.

Head subrectangular, longer than wide. Fontanelle indistinct. Labrum broadly tongue-shaped with short and long hairs on body and anterior margin weakly incurved medially. Antennae with 14 segments, 4 shortest. Mandibles short and broad basally. Left mandible with a prominent tooth at distal third and 2 weak denticles at base, right with tooth as in left and one small denticle near base. Postmentum long, club-shaped. Pronotum saddle-shaped, anterior margin convex without having any notch; posterior margin outcurved without any emargination.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : about four km from Kimin on road to Ziro. Madhya Pradesh : Kanha National Park (type-locality).

Elsewhere : Bangladesh.

Remarks : The species is very similar to *E. karnatakensis*, but differs by its thin mandibles with comparatively small teeth. It is known so far from the hilly tracts of central and eastern India (Himalaya).

37. *Euhamitermes lighti* Snyder (Fig. 37, Table 26)

1. *Amitermes (Euhamitermes) lighti* Snyder

1933b. Snyder, *Proc. biol. Soc.*, **46** : 93. S. only. Holotype : S., in USNM. Type-locality : Dehra Dun, Uttaranchal, India.

2. *Euhamitermes lighti* Snyder

1949. Snyder, *Smiths. misc. Colls.*, **112** : 112.

1977. Roonwal and Chhotani, *Ent. Basil.*, **2** : 56, 58.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya. Part I, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 88-91 (detailed synonymy).

Material studied : Identified : From *Western Himalaya* : (i) 1S., Ranibagh, Gairal, Naini Tal Dist., Uttaranchal, coll. S.C. Verma, 17.v.1977, det. S.C. Verma. (ii) 2S., Sultan Forest, Naini Tal Dist., Uttaranchal, coll. S.C. Verma, 20.v.1977, det. S.C. Verma.

Diagnostic Character : (i) Imago : Known but not available for study.

(ii) Soldier (Fig. 37a-f) : Head yellowish to yellowish brown, body whitish. Head and pronotum moderately and abdomen fairly densely hairy.

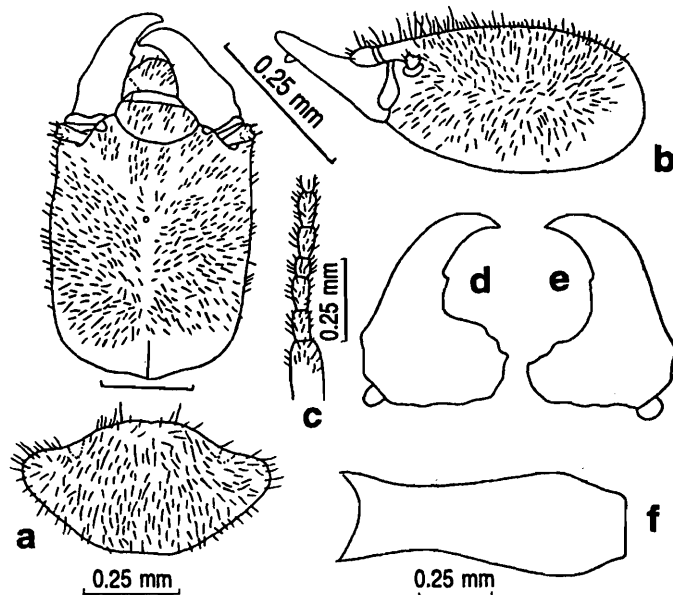


Fig. 37. : *Euhamitermes lighti* Snyder; a-f, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Basal part of antenna; d. Left mandible; e. Right mandible; f. Postmentum.

Head subrectangular, width nearly $\frac{3}{4}$ of length; sides uneven, subparallel, posterior margin outcurved. Fontanelle indistinct, placed above the middle. Antennae with 14 segments, 4 shortest. Labrum broad, tongue shaped with moderate hairs anteriorly. Mandibles thick, short, very broad basally, each mandible with a small tooth lying almost at the middle third. Postmentum club-shaped. Pronotum strongly saddle-shaped with outcurved anterior margin with very indistinct median emargination; posterior margin substraight.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Lachhiwala Forest, Asarori Range; Naini Tal Dist. : Ranibagh, Gairal, Sultan Forest; Kumaon Hills : Bageshwar.

Remarks : The species was first described as *Amitermes lighti* by Snyder from Dehra Dun and subsequently transferred to *Euhamitermes*. This is a medium size species very close to *E. kanhaensis* but differs in having uneven lateral margins of head and with minute tooth on left mandible of soldier.

Table 26 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Euhamitermes aruna</i>		<i>E. kanhaensis</i>		<i>E. lighti</i>	
	Holo-type	Known Range	2S.	Known Range	2S.	Known Range
Length of head to lateral base of mandibles	1.27	1.27	1.45–1.5	1.44–1.50	1.43–1.70	1.50–1.75
Maximum width of head	0.99	0.99	1.10–1.18	1.10–1.18	1.18–1.28	1.18–1.30
Head index (width/length)	0.76	0.76	–	–	–	0.71–0.81
Maximum length of labrum	0.20	0.20	0.18	–	0.19–0.24	0.20–0.25
Maximum width of labrum	0.30	0.30	0.30	–	0.31–0.40	0.31–0.40
Length of left mandible (Upper base of condyle to tip)	0.60	0.60–0.63	0.70–0.73	0.70–0.73	0.75–0.80	0.75–0.80
Head-mandibular length Index (Left mand.-length/head-length)	0.47	–	0.48	0.23	0.47–0.52	–
Minimum median length of postmentum	0.875	0.87	0.80–1.00	0.78–1.00	0.88–1.15	0.90–1.15
Maximum width of postmentum	0.37	0.37	0.37–0.40	0.33–0.41	0.34–0.47	0.35–0.48
Width of postmentum at waist	0.30	0.30	0.23–0.26	0.20–0.26	0.23–0.30	0.25–0.30
Maximum length of pronotum	–	0.27	0.32–0.35	0.33–0.35	0.32–0.40	0.30–0.40
Maximum width of pronotum	–	0.43	0.57–0.60	0.57–0.62	0.63–0.70	0.63–0.70
Pronotum index (length/width)	–	–	–	–	–	–
Number of antennal segments	Broker	Broken	14	14	14	14

Table 27 : Measurements (in mm) etc. of Caste-Imago.

	<i>Euhamitermes urbanii</i>		<i>E. wittmeri</i>	
	1 Im.	Known Range	2 Im.	Known Range
Total body-length with wings (excluding antennae), ca.	14.6	14.6–14.7	12.3–13.0	12.3–13.2
Length of head to lateral base of mandibles	0.90	0.90–0.97	0.74–0.80	0.77–0.83
Maximum width of head with eyes	1.20	1.20	1.03–1.12	1.03–1.13
Height of head	–	–	–	–
Maximum length of labrum	–	–	0.28–0.35	0.33–0.37
Maximum width of labrum	–	–	0.37–0.43	0.35–0.43
Maximum diameter of compound eye (with ocular sclerite)	0.32	0.31–0.33	0.30–0.32	0.29–0.33
Long diameter of lateral ocellus	0.13	0.13–0.15	0.13–0.14	0.13–0.15
Short diameter of lateral ocellus	–	0.11	–	0.10–0.11
Minimum eye-ocellus distance	0.05	0.05	0.05	0.03–0.05
Maximum length of pronotum	0.66	0.67	0.53–0.65	0.66–0.67
Maximum width of pronotum	1.12	1.10–1.17	0.93–1.00	0.93–1.03
Length of forewing with scale	12.2	12.2–12.3	10.2–11.0	10.20–11.20
Length of hindwing with scale	11.6	11.6	9.90–10.0	9.80–10.2
Number of antennal segments	15	15	15	15

The species inhabits in soil making small chambers with interconnecting narrow galleries. It swarms sometimes in the rainy months in Dehra Dun. Nothing is known about its destructive activities (Chatterjee and Thakur, 1966a).

38. *Euhamitermes urbanii* Roonwal & Chhotani
(Fig. 38, Table 27)

1. *Euhamitermes urbanii* Roonwal & Chhotani

1977. Roonwal and Chhotani, *Ent. Basil.*, 2 : 53-56. Im. only. Holotype : Im., in NHM, Basel; Paratype : Im., in ZSI. Type-locality : Changra (1900 m), Bhutan.

1980. Roonwal and Verma, *Proc. Indian. natnl. Sci. Acad.*, (B) 46(3) : 255.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 91-92 (detailed synonymy).

Material studied : Identified : From *Eastern Himalaya* : 1 Im. (Paratype). Changra (alt. 900 m), Bhutan, coll. Zool. Expd. N.H. Museum, Basel (Switzerland), 22.vi.1972, det. M.L. Roonwal and O.B. Chhotani.

Diagnostic Character : (i) Imago (Fig. 38a-b) : Head blackish brown, darker anteriorly; Ocelli, postclypeus and pronotum yellowish brown; antennae paler; wings faintly brownish and transparent; abdominal tergites yellowish brown.

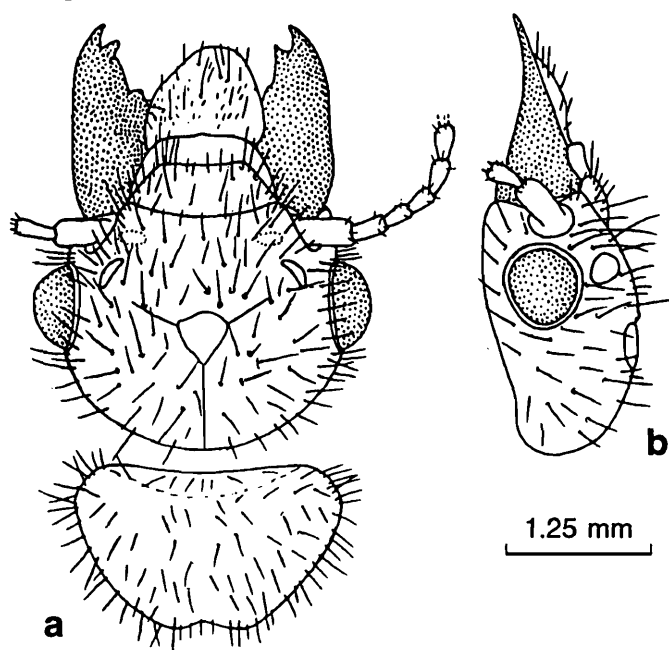


Fig. 38. : *Euhamitermes urbanii* Roonwal and Chhotani; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view.

Head and pronotum thickly pilose with short and long hairs, and abdomen more so hairy.

Head subcircular with uniformly rounded posterior margin, epicranial suture not visible. Fontanelle oval and fairly large. Ocelli elongately oval, translucent, separated from eyes by about half their short diameter (0.05 mm). Postclypeus weakly swollen, pilose, without any median line. Antennae with 15-segments, 3,4 and 5 subequal. Pronotum slightly narrower than head, anterior margin substraight or feebly concave; posterior margin weak with median emargination. Wing venation of *Euhamitermes* type.

(ii) Soldier : Unknown.

Distribution : BHUTAN : *Eastern Himalaya* : Changra (type-locality).

Remarks : The species is known by imago caste only. It swarms in the month of May in the higher altitude of Changra in Bhutan (Roonwal and Chhotani, 1977).

39. *Euhamitermes wittmeri* Roonwal
and Chhotani
(Fig. 39, Table 27)

1. *Euhamitermes wittmeri* Roonwal
and Chhotani

1977. Roonwal and Chhotani, *Ent. Basil.*, 2 : 53, 53-58. Im. and W. Holotype : Im., in NHM, Basel; Paratype : Im. and Paramorphotype W., in NHM, Basel, ZSI, Calcutta and AMNH, New York. Type-locality : Samchi, Bhutan.

1980. Roonwal and Verma, *Proc. Indian. Natnl. Sci. Acad.*, (B) 46(3) : 255.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 93-95 (detailed synonymy).

Material studied : Identified : From *Eastern Himalaya* : (i) 2 Im. (Paratype). Samchi (alt. 300 m), Bhutan, coll. Zool. Expd. N.H., Museum, Basel (Switzerland). 7-11.v.1972, det. M.L. Roonwal and O.B. Chhotani. (ii) 1 Im. and 1 W. (Paratype & Paramorphotype), Thimphu river bank, Bhutan, coll. Zool. expd. N.H. Museum, Basel (Switzerland), 29.iv.1972, det. M.L. Roonwal and O.B. Chhotani.

Diagnostic Character : (i) Imago (Fig. 39a-b) : Very similar to *E. urbanii* Roonwal and Chhotani except the following characters.

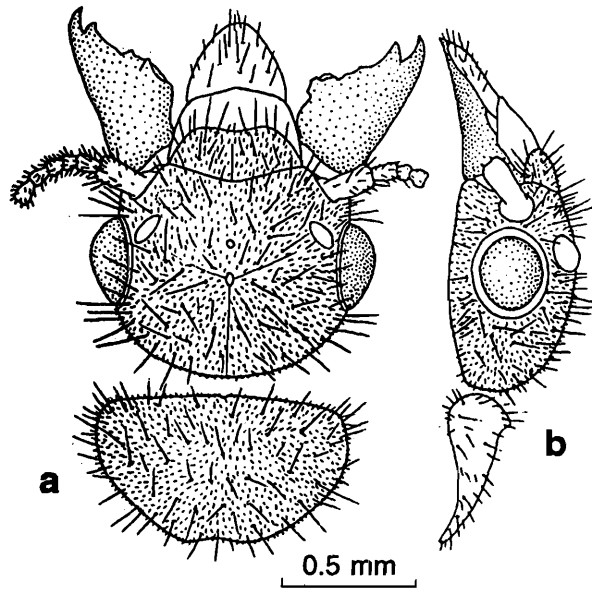


Fig. 39. : *Euhamitermes wittmeri* Roonwal and Chhotani; a-b, Imago. a. Head and pronotum, dorsal view; b. Head and pronotum, side view.

Fontanelle small, translucent, round to oval spot. Ocelli oval and larger, situated at a distance of about half their short diameter from eyes. Postclypeus with distinct emarginated anterior margin and incomplete median line. Labrum broad, tongue-shaped, with a few short hairs. Pronotum slightly narrower than head, anterior margin substraight or slightly convex with a faint median notch; posterior margin slightly incurved medially. Wing venation of *Euhamitermes* type.

(ii) Soldier : Unknown.

Distribution : BHUTAN (*Eastern Himalaya*) : Samchi; Thimphu River Bank.

Remarks : The species is so far known only from Bhutan represented by imago caste only.

Genus *Synhamitermes* Holmgren

40. *Synhamitermes quadriceps* (Wasmann)
(Fig. 40, Table 28)

1. *Amitermes quadriceps* Wasmann

1902. Wasmann, *Zool. Jb. Syst.*, 17(1) : 123, Pl. 4, fig. 5. S., W. and Ny. Holotype : S., in Wasmann Coll., NHM, Maastricht. Type-locality : Khandala near Bombay, Maharashtra, India.

2. *Termes (Eutermes) quadriceps* Wasmann

1904. Desneux, *Gen. Insectorum*, Fasc. 25 : 41.

3. *Hamitermes (Synhamitermes) quadriceps*
(Wasmann)

1912. Holmgren, K. sv. *Vet. Akad. Handl.*, 48 : 91, Pl. 4, fig. 25.

4. *Synhamitermes quadriceps* (Wasmann)

1949. Snyder, *Smiths. misc. Colls.*, 112 : 129.

1968. Chatterjee and Thakur, *Indian Forester*, 94(7) : 564-565.

1976. Roonwal, *Zool. Jb. Syst.*, 103 : 464, 465, 466, 468, 469, 484.

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 18, 24, 68-70.

1989. Roonwal and Chhotani, *Fauna of India : Isoptera (Termites)*, 1 : 18.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 100-104 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 10.

Material studied : Identified : From *Western Himalaya* : 2S., High bank forest area near Sarapduli Road, Pauri Dist., Uttaranchal, coll. S.C. Verma, 25.v.1977, det. S.C. Verma.

Diagnostic Character : (i) Imago : Known, but not from the Himalaya.

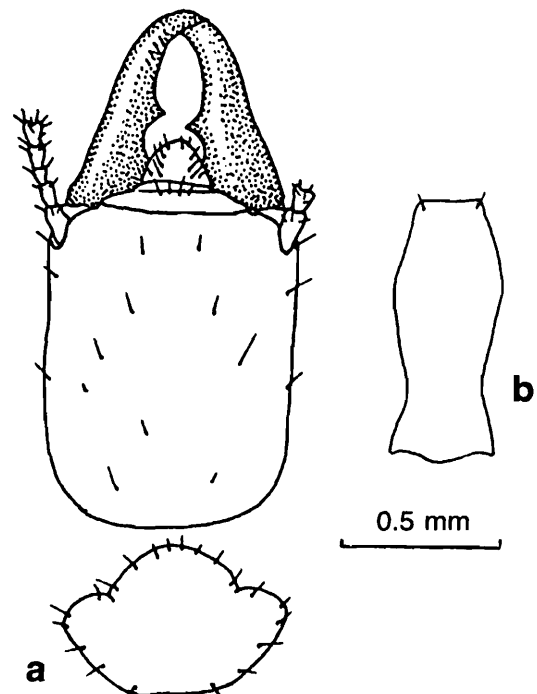


Fig. 40. : *Synhamitermes quadriceps* (Wasmann); a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Table 28 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Synhamitermes quadriceps</i>	
	2 S.	Known Range
Length of head to lateral base of mandibles	0.85–1.00	0.84–1.00
Maximum width of head	0.70–0.81	0.69–0.85
Head index (width/length)	0.81–0.82	–
Maximum length of labrum	0.20	–
Maximum width of labrum	0.45	–
Length of left mandible (Upper base of condyle to tip)	0.57–0.62	0.57–0.67
Head-mandibular length Index (left mandible-length/head-length)	0.62–0.67	–
Minimum median length of postmentum	0.60–0.77	0.52–0.62
Maximum width of postmentum	0.26–0.35	0.23–0.29
Width of postmentum at waist	0.23	0.16–0.20
Maximum length of pronotum	0.28–0.44	0.24–0.35
Maximum width of pronotum	0.50–0.73	0.48–0.55
Pronotum index (length/width)	0.56–0.60	–
Number of antennal segments	13	13

(ii) Soldier (Fig. 40a-b) : Head light yellow to brownish yellow. Head and pronotum scantily and body moderately densely hairy.

Head subsquarish, a little longer than broad, Y-suture absent. Antennae with 13 segments, 3 shortest. Labrum broadly tongue-shaped. Mandibles with a triangular tooth on inner margin almost at the middle. Postmentum short, club-shaped. Pronotum saddle-shaped, anterior margin outcurved and without notch; posterior margin substraight with an indistinct emargination.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Pauri Dist. : High bank forest area near Sarapduli Road. Tripura : Ambasa. Assam : Kamrup Dist. : Gotanagar. West Bengal. Madhya Pradesh. Kerala : Trichur. Goa. Daman. Rajasthan : Chitenpura near Kotah. Maharashtra : Mumbai; Khandala; Kusgam forest, Lonavla; Vardhangad forest, Koregam.

Elsewhere : Bangladesh.

Remarks : The species had undergone many nomenclatural changes since its first description in 1902 by Wasmann (1902) from Khandala (near Bombay). It is a very common soil-dwelling

species in India, equally common in the Himalayan tract. Swarming takes place in mid-June and early November (Roonwal and Sen-Sarma, 1960).

Genus *Eremotermes* Silvestri

41. *Eremotermes dehraduni* Roonwal and Sen-Sarma (Fig. 41, Tables 29 and 30)

1. *Eremotermes dehraduni* Roonwal and Sen-Sarma

1960. Roonwal and Sen-Sarma, *Contrib. Syst. Orient. Termites* (ICAR Ent. Monogr. No.1) : 49, 50, 51, 53-63, Pls. 9, 10, Im., S. and W. Holotype : S., in FRI. Type-locality : Malhan Forest Range, 12 miles North-West of Dehra Dun, Uttaranchal, India.

1970a. Roonwal, In : *Biology of Termites* (Eds. Krishna and Weesner). 2 : 347.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

1997. *Eremotermes dehraduni* Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 123-126 (detailed synonymy).

Material studied : Identified : From *Western Himalaya* : 5S. and 10W. Jamnagar, Pauri Dist. : Uttaranchal, coll. S.C. Verma, 8.vi.1976, det. S.C. Verma.

Diagnostic Character : (i) Imago (Fig. 41a-d) : Head and pronotum dark smoky brown, postclypeus straw-coloured; abdominal terga a little paler than head. Head and pronotum moderately and body fairly densely hairy.

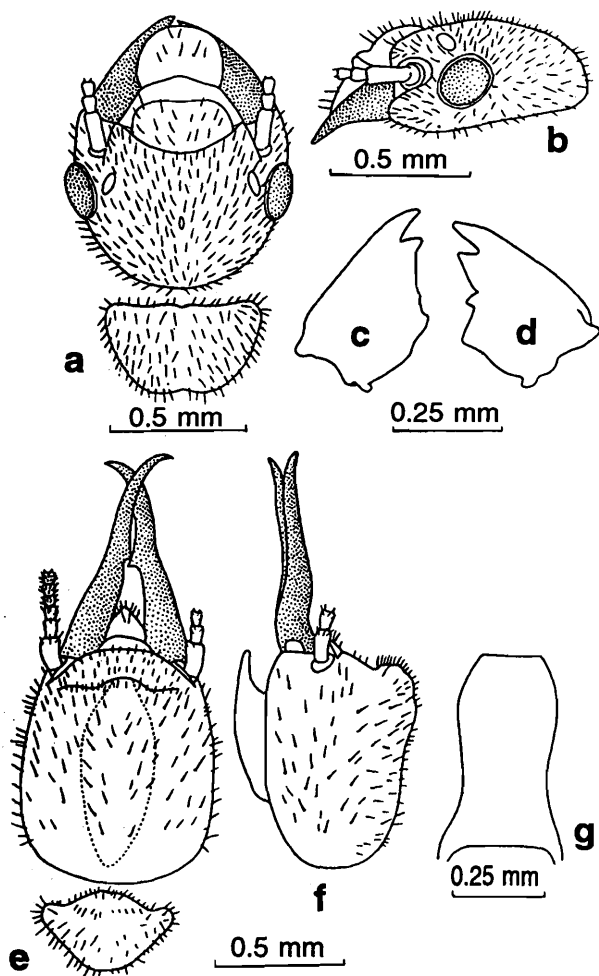


Fig. 41. : *Eremotermes dehraduni* Roonwal and Sen-Sarma; a-d, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible; e-g, Soldier. e. Head and pronotum, dorsal view; f. Head, side view; g. Postmentum.

Head subcircular. Fontanelle prominent, small, elongate and placed below the middle. Ocelli oval, separated from eyes by a distance little less than its long diameter (0.50–0.063 mm). Antennae broken. Postclypeus hairy with almost indistinct median line. Labrum subsquarish with uniformly outcurved apical margin. Mandibles of *Eremotermes*-type. Pronotum with anterior margin substraight with a faint median notch and posterior margin with a prominent median emargination.

(ii) Soldier (Fig. 41e-g) : Head deep straw coloured, smoky around frontal protuberance; body creamish white. Head and pronotum fairly and body densely hairy.

Head somewhat ovoid, thick with prominent frontal hump, only slightly longer than broad. Fontanelle indistinctly marked, situated below frontal protuberance with chitinous ring; fontanelle gland large. Antennae with 14 segments, 3 shorter than 2, subequal to or little longer than 4. Labrum tongue-shaped, narrowed in front, wider than long. Mandibles long, sabre-shaped, strongly hooked apices and outer margin incurved medially, each mandible with a sharp well marked tooth directed downwards and situated almost at the middle. Postmentum with a weakly incurved waist posteriorly. Pronotum saddle-shaped, without any notch at anterior margin; posterior margin devoid of any emargination.

Distribution : INDIA : Western Himalaya : Uttaranchal : Dehra Dun Dist. : Malhan Forest Range (near Dehra Dun), Rajpur, Kalsi; Pauri Dist. : Jamnagar.

Remarks : The species stands as a distinct one in having very prominent frontal protuberance appearing knob-like and frons steeply inclining in front. With this features, it comes close to *E. paradoxalis* having more wide distribution in India and Pakistan and less prominent protuberance of soldiers. This is the only representative of genus *Eremotermes* from the entire Himalayan tracts. It attacks the root of *Ocimum kilimandscharicum* in nurseries and swarms in June at Dehra Dun (Roonwal, 1970a)

Genus *Microcerotermes* Silvestri

Key to the species of genus *Microcerotermes* Silvestri

I. IMAGOES :

1. Fontanelle indistinctly marked; pronotum with feeble median notch on anterior margin; head dark castaneous brown *M. cameroni* Snyder
- Fontanelle distinctly marked; pronotum without any median notch on anterior margin; head dark castaneous brown to blackish brown *M. beelsoni* Snyder

Table 29 : Measurements (in mm) etc. of Caste—Imago.

	<i>Eremotermes dehraduni</i>	
	1 Im.	Known Range
Total body-length with wings (excluding antennae), ca.	—	—
Length of head to lateral base of mandibles	0.65	0.65
Maximum width of head with eyes	0.84	0.75
Maximum length of labrum	0.20	0.20
Maximum width of labrum	0.30	0.20–0.25
Maximum diameter of compound eye (with ocular sclerite)	0.20	0.20
Maximum diameter of lateral ocellus	0.075	0.075 long
Minimum eye-ocellus distance	0.05	0.05–0.063
Maximum length of pronotum	0.35	0.35
Maximum width of pronotum	0.56	0.55–0.60
Length of forewing with scale	—	—
Length of hindwing with scale	—	—
Number of antennal segments	—	broken

Table 30 : Measurements (in mm) etc. of Caste—Soldier.

	<i>Eremotermes dehraduni</i>	
	5 S.	Known Range
Length of head to lateral base of mandibles	0.87–0.90	0.85–0.90
Maximum width of head	0.76–0.80	0.75–0.80
Head index (width/length)	0.87–0.88	0.83–0.89
Maximum length of labrum	0.10–0.12	0.10–0.13
Maximum width of labrum	0.15–0.16	0.15–0.175
Length of left mandible (Upper base of condyle to tip)	0.80–0.84	0.80–0.85
Head-mandibular length Index (left mandible-length/head-length)	0.91–0.93	0.89–0.98
Minimum median length of postmentum	0.45–0.47	0.45
Maximum width of postmentum	0.25–0.27	0.25
Width of postmentum at waist	0.18–0.20	0.15–0.20
Maximum length of pronotum	0.23–0.25	0.20–0.25
Maximum width of pronotum	0.42–0.47	0.40–0.45
Pronotum index (length/width)	0.53–0.54	—
Number of antennal segments	14	14

II. SOLDIERS :

1. Mandibles finely serrated : (Pronotum with deep median notch on anterior margin. Mandibles with sharp pointed apices)
..... *M. rambanensis* Chatterjee and Thakur
- Mandibles coarsely serrated 2
2. Labrum pentagonal 3
3. Mandibles strongly sickle-shaped, lateral margins of head subparallel
.... *M. labioangulatus* Sen-Sarma and Thakur
- Mandibles not sickle shaped, rather somewhat feebly incurved apically; lateral margins of head diverging anteriorly
..... *M. fletcheri* Holmgren and Holmgren
4. Mandibles gradually incurved and strongly hooked apically; head less hairy; mandibles shorter 0.87 mm (0.86–0.97 mm)
..... *M. cameroni* Snyder
- Mandibles somewhat straight and less hooked apically, head more hairy; mandibles somewhat shorter 0.76–0.90 mm (0.75–0.92 mm) *M. beelsoni* Snyder

42. *Microcerotermes beelsoni* Snyder

(Fig. 42, Tables 31 and 32)

1. *Microcerotermes beelsoni* Snyder

- 1933a. Snyder, *Proc. U.S. natn. Mus.*, **82**(16) : 12-14. Im. only. Lectotype : Im., in FRI, Dehra Dun. Type-locality : Chakata Range, Haldwani, Uttaranchal, India.
1949. Snyder, *Smiths. misc. Colls.*, **112** : 133.
- 1958b. Ahmad, *Biologia, Lahore*, **4**(2) : 167, 171.
1967. Bains Prasad, Thapa and Sen-Sarma, *Indian For. Bull.* No. 246 (N.S.) : 14-18.
1974. Roonwal *et al.*, *Z. zool. Syst. Evolut-forsch.*, **12** : 57, 58, 59, 60, 64, 69, 74.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 18, 24, 70-74.
1987. Bose and Das, *Fauna of Orissa : State Fauna Ser. 1* : 105, 109.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 155-159 (detailed synonymy).

2. *Microcerotermes championi* Snyder

- 1933a. Snyder, *Proc. U.S. natn. Mus.*, **82** (Art. 16) : 14-15.
- 1977b. Chhotani, *Rec. zool. Surv. India*, **72** : 370-371 (synonymy).
1949. Snyder, *Smiths. misc. Colls.*, **112** : 136.

3. *Microcerotermes heimi* Wasmann

(Wrong determination)

1902. Wasmann, *Zool. Jahrb. Syst.*, **17**(1) : 120-121.
- 1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci., India*, (B) **28**(4) : 318, 319. Is actually *M. beelsoni* Snyder.

4. *Microcerotermes lanceolatus* Mathur and Thapa

1965. Mathur and Thapa, *Bull. Ent.*, **6** : 4-5, 11.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 155-159 (synonymy).

Material studied : Identified : A. From *Western Himalaya* : (i) 3S., 4W., Gairal, Naini Tal Dist., Uttaranchal, coll. S.C. Verma, 25.iii.1976, det. S.C. Verma (ii) 2S., Sultan forest, Naini Tal Dist., Uttaranchal, coll. S.C. Verma, 18.v.1977, det. S.C. Verma. B. From *Eastern Himalaya* : (iii) 5S. and 10W., Punakha, Bhutan, coll. M.L. Roonwal & O.B. Chhotani, 8.vi.1983, det. Roonwal and

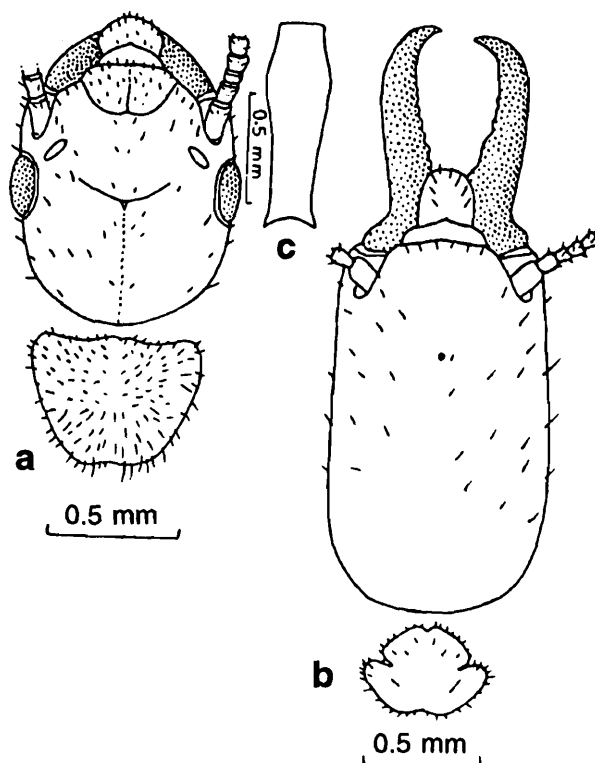


Fig. 42. : *Microcerotermes beelsoni* Snyder; a, Imago. a. Head and pronotum, dorsal view; b-c, Soldier. b. Head and pronotum, dorsal view; c. Postmentum.

Chhotani. (iv) 1 Im., 5S. and 10W., Rongpo, three km North-East of SPWD Bunglow, East Sikkim, coll. B.N. Nandi and party, 14.iv.1980, ex. "gallery inside fallen branch", det. P.K. Maiti.

Diagnostic Character : (i) Imago (Fig. 42a) : Head light brown to dark brown; postclypeus as dark as head; labrum and legs yellowish brown; pronotum and abdominal tergites and sternites paler than head; wings pale smoky brown. Head sparsely hairy; pronotum moderately and body densely hairy.

Head ovoidal; sides and posterior margin feebly outcurved, Y-suture incompletely present. Fontanelle subcircular. Ocelli oval, separated from eyes by about their short diameter. Antennae with 14 segments, 2 longer than 3 or subequal to 3+4 combined, 3 smallest. Postclypeus swollen, hairy with median line. Pronotum subtrapezoidal, anterior margin substraight; posterior margin incurved. Wings thin, transparent. Wing venation of genus-type.

(ii) Soldier (Fig. 42b-c) : Head yellow, slightly darker anteriorly; body pale yellow. Head sparsely and body densely hairy.

Head subrectangular, and elongate with parallel sides. Fontanelle minute, situated at anterior one-third. Antennae with 13 segments, 3 smallest. Labrum subpentagonal, anterior margin somewhat rounded. Mandibles coarsely serrated, with a larger tooth-like serration a little behind middle, appreciably incurved with thick apices. Postmentum club-shaped with waist lying posteriorly. Pronotum saddle-shaped, anterior margin weakly and posterior margin somewhat emarginated.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : New Forest, Jhajra; Haldwani Dist. : Chakata Range (type-locality); Tehri; Pauri; Nainital Dist. : Sultan Forest; Chamoli; Pithoragarh. *Eastern Himalaya* : East Sikkim Dist. : Rongpo. Delhi. Haryana. Punjab. Madhya Pradesh. Orissa. West Bengal. Assam. BHUTAN (*Eastern Himalaya*) : Punakha.

Elsewhere : Pakistan. Bangladesh.

Remarks : A very common species both in the plains as well as in the Himalaya. The imago caste of this species closely resembles that of *M. cameroni* but can be separated from the latter by fontanelle distinctly marked and pronotum devoid of any median notch on anterior margin (fontanelle indistinct and pronotum with distinct median notch in *M. cameroni*).

The species occurs in and under logs and bark and in carton-nest buried in soil or adpest to tree trunk. The nest is honey-combed with numerous flat cells (Roonwal, 1970a; Maiti, 1983). The species swarms in late May to middle July at Dehra Dun (Mathur and Sen-Sarma, 1960).

Sickle-shaped mandibles of soldiers with strongly hooked apices of *M. cameroni* keeps this species separate from *M. beesoni*.

43. *Microcerotermes cameroni* Snyder (Fig. 43, Tables 31 and 32)

1. *Microcerotermes cameroni* Snyder

1934. Snyder, *Indian For. Rec.*, **20**(11) : 21-22. Im. and S. Holotype : Im., in BM. Type-locality : North Vellore Dist., Tamil Nadu.
1962. Baini Prasad, Thapa and Sen-Sarma, *Indian For. Bull.* No. 246 (N.S.) : 27-31.
1962. Becker, *Z. ang. Ent.*, **50**(4) : 360-361.
1974. Ronwal *et al.*, *Z. zool. Syst. Evolut-forsch.*, **12** : 57, 58, 59, 60, 64, 69, 74.
1980. Roonwal and Verma, *Proc. Indian natn. Sci. Acad.*, (B) **46**(3) : 257, 258.
1984. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 49 : 92, 126-128.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 155-159 (detailed synonymy).

Material studied : Unidentified : From *Eastern Himalaya* : (i) Sev. S. and sev. W., Gailikhola Forest, Darjiling Dist., West Bengal, coll. G.K. Srivastava and P.K. Kaiti, 21.xii.1973; (ii) 5S. and sev. W., Jorethang, forest area at valley, South Sikkim, coll. P.H. Roy and party, 11.iv.1994; (iii) 1Im., 1S. and 9W., Topakhani, East Sikkim Dist., coll. P.H. Roy and party, 2.v.1995, ex. "log"

Diagnostic Character : (i) Imago (Fig. 43a-c) : Head, pronotum and abdominal tergites castaneous

Table 31 : Measurements (in mm) etc. of Caste–Imago.

	<i>Microcerotermes beesonii</i>		<i>M. cameroni</i>	
	1 Im.	Known Range	1 Im.	Known Range
Total body-length with wings (excluding antennae), ca.	9.00	8.50–9.90	9.00	8.50–9.20
Total body-length without wings (excluding antennae), ca.	6.00	4.00–6.20	5.65	4.70–5.70
Length of head to lateral base of mandibles	0.85	0.75–0.90	0.92	0.83–0.90
Maximum width of head (with eyes)	0.85	0.77–0.90	0.92	0.83–0.90
Maximum length of postclypeus	–	–	–	–
Maximum width of postclypeus	–	–	–	–
Maximum length of labrum	–	–	–	–
Maximum width of labrum	–	–	–	–
Maximum diameter of compound eye (with ocular sclerite)	0.23	0.18–0.24	–	0.20–0.25
Maximum diameter of lateral ocellus	–	–	–	–
Minimum diameter of lateral ocellus	–	–	–	–
Minimum eye-ocellus distance	0.06	0.05–0.07	–	0.04–0.07 (long diameter)
Maximum length of pronotum	0.44	0.37–0.45	0.53	0.40–0.51
Maximum width of pronotum	0.63	0.56–0.72	0.74	0.65–0.72
Length of forewing with scale	–	–	–	–
Length of hindwing with scale	–	–	–	–
Number of antennal segments	14	14	14	14

Table 32 : Measurements (in mm) etc. of Caste–Soldier.

	<i>Microcerotermes beesonii</i>		<i>M. cameroni</i>	
	5 S.	Known Range	Sev. S.	Known Range
Length of head to lateral base of mandibles	1.30–1.50	1.28–1.67	1.56–1.65	1.40–1.67
Maximum width of head	0.78–0.90	0.77–1.00	0.90–1.00	0.90–1.00
Head index (width/length)	0.60	0.58–0.60	0.57–0.60	0.56–0.64
Maximum length of labrum	0.18–0.20	0.17–0.20	0.24	–
Maximum width of labrum	0.25–0.27	0.20–0.27	0.23	–
Length of left mandible (Upper base of condyle to tip)	0.76–0.90	0.75–0.92	0.87	0.86–0.97
Head-mandibular length Index (left mandible-length/head-length)	0.58–0.60	0.58–0.66	0.55	0.59–0.63
Minimum median length of postmentum	0.72–0.90	0.72–0.90	0.90–1.00	0.85–1.02
Maximum width of postmentum	0.29–0.30	0.29–0.31	0.32–0.35	0.29–0.35
Width of postmentum at waist	0.16–0.17	0.16–0.17	0.15–0.21	0.19–0.22
Maximum length of pronotum	0.29–0.32	0.22–0.33	0.27–0.35	0.27–0.35
Maximum width of pronotum	0.50–0.60	0.47–0.60	0.50–0.65	0.53–0.66
Pronotum index (length/width)	0.53–0.58	–	0.54	–
Number of antennal segments	13	13 (in general) rarely 12	13	13

brown; wings light smoky brown. Head and body densely hairy.

Head elongately oval, Y-suture distinct. Fontanelle plate small. Ocelli oval, separated from the eyes by its long diameter. Antenna with 14 segments, 3 smallest. Postclypeus weakly swollen with indistinct median line. Pronotum

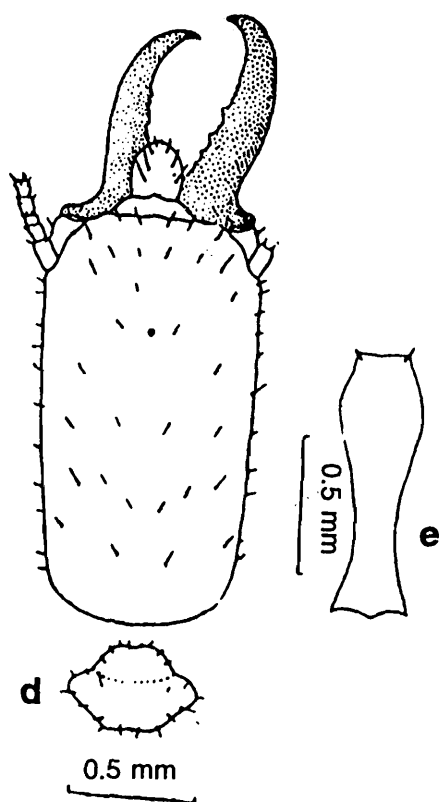
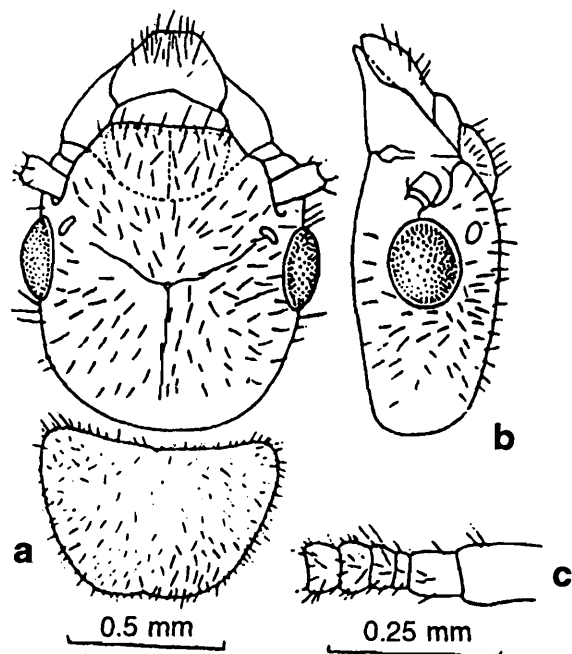


Fig. 43. : *Microcerotermes cameroni* Snyder; a-c, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c. Basal part of antenna; d-e, Soldier. d. Head and pronotum, dorsal view; e. Postmentum.

trapezoidal, anterior margin without a median notch; posterior margin shallowly emarginated. Wing microsculpture consists of 1-2 rows of spiny, pointed papillae on anterior and posterior margins and both nonasteroid (4-6 arms) and asteroid (5-6 arms) micrasters on membrane.

(ii) Soldier (Fig. 43d-e) : Head yellowish brown; body pale yellow. Head and pronotum sparsely and body fairly hairy.

Head subrectangular, with parallel sides and rounded posterior margin. Fontanelle minute, placed above the middle. Antenna with 13 segments, 3 smallest. Labrum subrectangular with anterior margin bluntly rounded. Mandibles coarsely serrated with one larger tooth-like, serration behind the middle and markedly incurved in anterior half. Postmentum club-shaped. Pronotum saddle-shaped, anterior margin distinctly notched; posterior margin weakly emarginate.

Distribution : INDIA : *Eastern Himalaya* : Sikkim : South Sikkim Dist. : Jorhang forest area and Garden complex; East Sikkim Dist. : Topakhani. West Bengal. Tamil Nadu. Kerala. Andhra Pradesh.

Remarks : This is very common species in India including eastern India making carton-nests found in soil and at times adpest with tree trunk. But such nest are very uncommon in the Himalayan tracts where it is only found in log. The habits and habitats of the species are very much alike to those of *M. beelsoni*.

44. *Microcerotermes fletcheri* Holmgren and Holmgren (Fig. 44, Table 33)

1. *Microcerotermes fletcheri* Holmgren and Holmgren

1917. Holmgren and Holmgren, *Mem. Dep. Agric. India (Ent.)*, 5(2) : 170-171. S. and W. Syntypes : In Riksmus., Stockholm. Type-locality: Bababudin Hills, Karnataka, India.

1958b. Ahmad, *Biologia*, Lahore, 4(2) : 168.

1967. Prasad *et al.*, *Indian For. Bull.*, No. 246 : 6, 40-42, figs. 24-25.

- 1970a. Roonwal, In : *Biology of Termites* (Eds. Krishna and Weesner). 2 : 349.
1975. Sen-Sarma et al., *Wood Destroying Termites of India* (Final Tech. Rep. PL. 480 Proj. No. A7-FS-58) : 12, 38-39, 54-65.
1978. Roonwal, *Z. ang. Ent.*, **85** : 17-18.
1984. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 49 : 92, 126, 128-132. Im. described.
1992. Ferry, *Pedobiologia*, **36** : 201, 202, 203-204, 207.
1995. Verma, *Himalayan Ecosystem Series Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 174-176.

Material studied : Identified : From *Western Himalaya* : 6S. and sev. W., Almora, Uttaranchal, coll. S.C. Verma, 26.iii.1976, det. S.C. Verma.

Diagnostic Character : (i) Imago : Known but not from the Himalaya.

(ii) Soldier (Fig. 44a) : Head yellowish brown to deep brown. Head sparsely and body densely hairy.

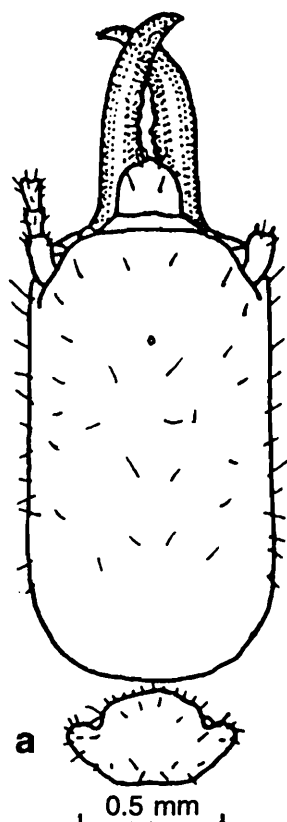


Fig. 44. : *Microcerotermes fletcheri* Holmgren and Holmgren; a. Soldier. a. Head and pronotum, dorsal view.

Head subrectangular with strictly parallel sides. Fontanelle minute, placed more anteriorly. Antenna with 13 segments, 3 smallest. Labrum pentagonal, anterior margin projected medially

with hairs. Mandibles stout and coarsely serrated with one slightly larger serration behind middle. Postmentum club-shaped. Pronotum saddle-shaped, anterior margin convex and posterior margin with weak median emargination.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Almora Dist. : Almora. Karnataka. Tamil Nadu. Kerala.

Remarks : The species can easily be distinguished from all other indian species by its distinctly diverging lateral margins of the head anteriorly of soldiers.

45. *Microcerotermes labioangulatus*

Sen-Sarma and Thakur

(Fig. 45, Table 33)

1. *Microcerotermes labioangulatus*

Sen-Sarma and Thakur

1975. Sen-Sarma and Thakur, In : Sen-Sarma et al., *Wood Destroying Termites of India* (Final Tech. Rep. PL 480 Proj. No. A7-FS-58) : 13, 54, 65.
1979. Sen-Sarma and Thakur, *Indian For. Rec. (N.S.) Ent.*, **13**(1) : 5, 16-18. S. and W. Holotype : S., in FR1. Type-locality : Zoelchara, Ambasa, Tripura, India.
- 1984a. Verma, *Indian J. Forestry*, **7**(1) : 82.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50, Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 184-186.

Material studied : Since no material is available, description, measurement etc. are based on Sen-Sarma and Thakur (1975).

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 45a-c) : Head yellowish brown to deep brown; body straw yellow. Head sparsely and body moderately hairy.

Head long, broadly rectangular, sides subparallel, frons hairy. Antenna with 13 segments, 3 shortest. Labrum pentagonal, antero-lateral corners angular and anterior margin somewhat outcurved at the middle. Mandibles strongly outcurved like a scythe with pointed apices, inner margin coarsely serrated in basal half. Postmentum club-shaped, broadest on anterior fifth and waist

at posterior fifth. Pronotum saddle-shaped, anterior lobe reduced and broad with indistinct median notch; posterior margin with feeble median emargination.

Distribution : INDIA : Western Himalaya : Uttaranchal : Naini Tal Dist. : Naini Tal. Tripura :

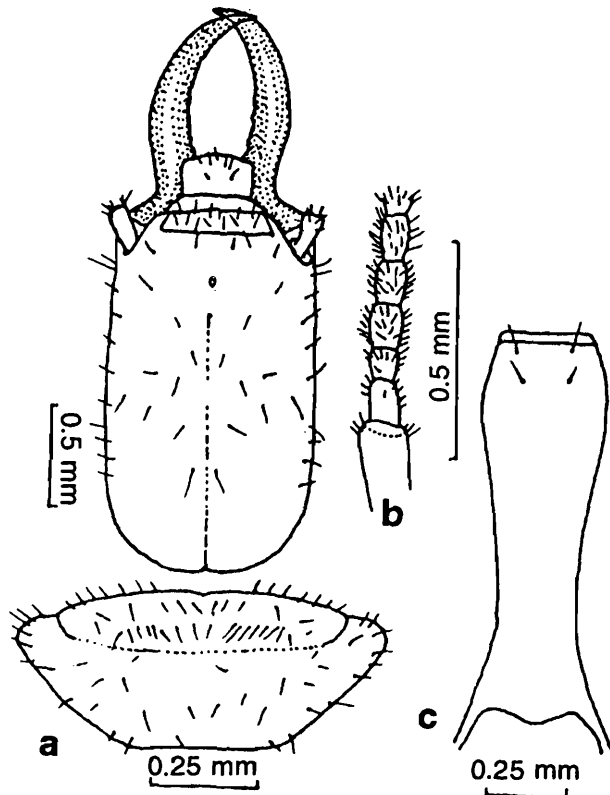


Fig. 45. : *Microcerotermes labioangulatus* Sen-Sarma and Thakur; a-c, Soldier. a. Head and pronotum, dorsal view; b. Basal part of antenna; c. Postmentum.

Zoelchara, Ambasa (type-locality); Chandrapur block, Paratia and Merakhera block, Manu Range. Nagaland.

Remarks : The species is somewhat close to *M. fletcheri*, but remains separate by strongly sickle-shaped mandibles and head with parallel sides of soldiers (vs. not sickle-shaped mandibles and divergent sides of head in *M. labioangulatus*).

46. *Microcerotermes rambanensis*

Chatterjee and Thakur

(Fig. 46, Table 33)

1. *Microcerotermes rambanensis*

Chatterjee and Thakur

1964d. Chatterjee and Thakur, *Bull. Ent.*, No. 5, 1-6. S. and W. Holotype : S., in FRI. Type-locality : Maitra Forest, Ramban, Jammu and Kashmir, India.

1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 31.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 209-211 (detailed synonymy).

Material studied : Identified : From North-Western Himalaya : Holotype S., Maitra Forest, Ramban, Jammu and Kashmir, India.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 46a-b) : Head yellowish brown, darker anteriorly; body pale brown. Head sparsely and body moderately hairy.

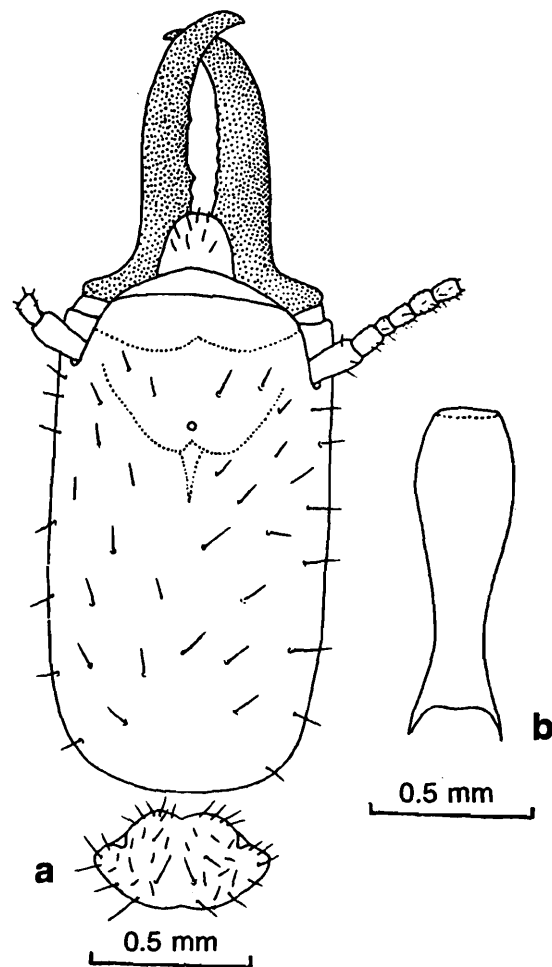


Fig. 46. : *Microcerotermes rambanensis* Chatterjee and Thakur; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Head elongately rectangular, width a little more than half of the head-length. Fontanelle minute, situated at about anterior third. Antennae with 13 segments, 3 smallest. Labrum broader than long, broadly rounded anteriorly. Mandibles short and strong, finely serrated; a little longer than half of head-length. Postmentum club-shaped. Pronotum saddle-shaped, anterior margin indistinctly notched; posterior margin weakly convex.

Table 33 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Microcerotermes fletcheri</i>		<i>M. labioangulatus</i>		<i>M. rambanensis</i>	
	6 S.	Known Range	Literature	Known Range	Holotype	Known Range
Length of head to lateral base of mandibles	1.50–1.65	1.37–1.68	1.75	1.60–1.90	1.52	1.58–1.60
Maximum width of head	0.85–0.96	0.85–0.98	1.03	1.00–1.13	0.88	0.88–0.90
Head index (width/length)	0.56–0.58	–	0.58	–	0.57	0.56
Maximum length of labrum	0.22	–	0.18	0.15–0.25	0.18	0.18–0.20
Maximum width of labrum	0.22	–	0.36	0.30–0.40	0.25	0.28
Length of left mandible (Upper base of condyle to tip)	0.75–0.87	0.87	1.03	0.95–1.15	0.88	0.88–0.90
Head-mandibular length Index (Left mand.-length/head-length)	0.50–0.53	0.53–0.67	0.58	0.55–0.65	0.57	0.56
Minimum median length of postmentum	–	0.77–1.05	1.30	1.00–1.15	0.94	0.88–0.98
Maximum width of postmentum	–	0.30–0.32	0.37	0.30–0.35	0.32	0.34–0.35
Width of postmentum at waist	–	0.17–0.20	0.23	0.18–0.20	0.16	0.18–0.20
Maximum length of pronotum	0.27–0.31	0.27–0.32	0.37	0.33–0.43	0.28	0.28–0.30
Maximum width of pronotum	0.56–0.60	0.55–0.60	0.94	0.65–0.73	0.54	0.55–0.58
Pronotum index (length/width)	0.48–0.52	–	0.39	–	0.51	–
Number of antennal segments	13	13	13	13	13	13

Distribution : INDIA : North-Western Himalaya : Jammu and Kashmir : Ramban (type-locality).

Remarks : The species is closely distinguished from all other members of genus occurring in the Himalaya by its mandibles with finely serrated inner margins and strongly hooked apices of soldier castes.

Subfamily TERMITINAE

Genus *Angulitermes* Sjöstedt

Key to the species of genus *Angulitermes* Sjöstedt

I. IMAGOES :

1. Fontanelle prominent and elongate; postclypeus without any median line; head and pronotum covered with dense short hairs *A. dehraensis* (Gardner)
- Fontanelle less so prominent and shorter; postclypeus with a complete median line; head and pronotum covered with more dense and

comparatively long hairs
.... *A. akhorisainensis* Chatterjee and Thakur

II. SOLDIERS :

1. Head wider, head index (head-width/head-length) 0.80–0.89 2
- Head narrower, head index, 0.70–0.78 3
2. Mandibles only slightly longer than head, mandible-head index, 1.08 (1.06–1.12), smaller species, length of head to base of mandible, 1.15–1.25 mm (1.13–1.20 mm)
..... *A. tilaki* Roonwal and Chhotani
- Mandibles comparatively much longer than head, mandible-head index, 1.14–1.18 (1.14–1.23); larger species, length of head to base of mandible, 1.22–1.28 mm (1.20–1.25 mm)
..... *A. kashmirensis* Roonwal and Chhotani
3. Head with lateral margins irregular and wavy; head-length 1.38–1.40 mm (1.35–1.40 mm); head-width 1.01–1.05 mm (1.00–1.05 mm); frontal projection with blunt apex and with dense hair
.... *A. akhorisainensis* Chatterjee and Thakur

- Head with lateral margins not wavy, rather somewhat straight 4
- 4. Head with frontal projection somewhat acute [projection with a pointed apex directed forward and twined upwards; antero-lateral processes of labrum with pointed apices, head-length 1.21-1.31 mm (1.20-1.35 mm)]
..... *A. acutus* Mathur and Sen-Sarma
- Head with frontal projection not acute, rather blunt 5
- 5. Frontal projection with weak emargination in front; antero-lateral processes of labrum pointed *A. dehraensis* (Gardner)
- Frontal projection with somewhat rounded margin in front; antero-lateral processes of labrum not so pointed *A. nepalensis* sp. nov.

47. *Angulitermes acutus* Mathur and Sen-Sarma
(Fig. 47, Table 34)

1. *Angulitermes acutus* Mathur and Sen-Sarma

1961. Mathur and Sen-Sarma, *Ann. Mag. nat. Hist.*, (13) 3 (31) : 401-406. S. and W. Holotype : S., in FRI. Type-locality : Palayamcottah, Tinnevely Dist., Tamil Nadu, India.
1965. Krishna, *Am. Mus. Novit.*, No. 2210 : 13.
1971. Roonwal and Chhotani, *Rec. zool. Surv. India*, 63 : 210, 218.
1975. Akhtar, *Bull. Dept. Zool. Univ. Panjab. (N.S.)*, Art. 7 : 166.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 81.
1989. Verma, *Indian J. For.*, 12(4) : 297. Uttaranchal
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50, Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 231-233 (detailed synonymy).

Material studied : Identified : From *Western Himalaya* : 2S., sev. W., Sultan forest, Naini Tal, Uttaranchal, coll. S.C. Verma, 20.v.1977, det. S.C. Verma.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 47a-c) : Head and pronotum straw coloured; abdomen slightly paler than head. Head and thorax sparsely and abdomen densely pilose.

Head subrectangular, longer than wide, sides feebly diverging anteriorly and irregularly straight, frontal projection very prominent and fringed with hairs on anterior margin. Fontanelle gland large and prominent. Antenna with 14 segments, 3 longer than 2. Mandibles long, slender, rod-like with weakly incurved tips. Labrum with lateral margins diverging anteriorly, antero-lateral corners finely pointed, anteriorly broadly incurved. Pronotum strongly saddle-shaped, anterior lobe larger and margin with a weak median notch; posterior margin substraight. Postmentum stump-like.

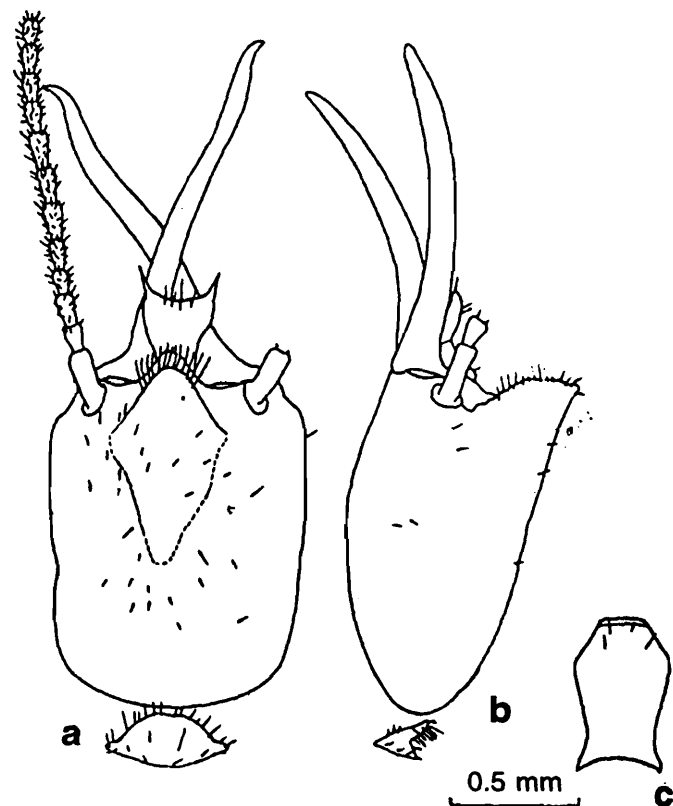


Fig. 47. : *Angulitermes acutus* Mathur and Sen-Sarma; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Postmentum.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Naini Tal Dist. : Naini Tal. Tamil Nadu : Palayamcottah (type-locality).

Remarks : This is a very uncommon species and so far unknown from elsewhere except its type-locality at Tamil Nadu. The prominent, pointed frontal projection of head of soldiers keep the species distinct from all other *Angulitermes* of the Himalaya. It was first reported from Naini Tal by Verma (1989).

48. *Angulitermes akhorisainensis* Chatterjee and Thakur
(Fig. 48, Table 34)

1. *Angulitermes akhorisainensis* Chatterjee and Thakur

- 1964b. Chatterjee and Thakur, *J. Bombay nat. Hist. Soc.*, **61**(2) : 348-353, 3 pls. Im., S. and W. Holotype : S., in FRI. Type-locality : Akhorisain Block, Tehri Range, Tehri Garhwal Forest Div., Uttaranchal, India.
1975. Sen-Sarma *et al.*, Wood Destroying Termites of India (Final Tech. Rep. PL. 480 Proj. No. A7-FS-58) : 13, 63, Kumaon Hills, Uttaranchal.
- 1984c. Verma, *Rec. zool. Surv. India*, **81**(3&4) : 243, 244, 248. Uttaranchal.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 233-236 (detailed synonymy).

Material studied : Identified : From *Western Himalaya* : (i) 2 Im., 2S., Khinanauli, four km from Dhikola, Uttaranchal, coll. S.C. Verma, 4.iii.1977, det. S.C. Verma. (iii) 3S., sev. W., Sultan Forest, Naini Tal, Uttaranchal, coll. S.C. Verma, 18.v.1977, det. S.C. Verma.

Diagnostic Character : (i) Imago : Head brown, postclypeus pale castaneous brown; pronotum slightly paler than head and with a pale yellow T-marking; abdominal tergites and sternites pale castaneous brown. Head and body densely hairy.

Head subcircular. Fontanelle small, longitudinal, slit-like, situated slightly above the middle. Antennae with 15 segments, segment 3 shorter than 2, subequal to 4. Ocelli oval, separated from eyes by their width. Postclypeus swollen, hairy, with distinct median line. Pronotum a little narrower than head, anterior margin slightly concave with a very weak median notch; posterior margin prominently notched. Wings dark grayish, hairy along margin and weakly so on membrane.

(ii) Soldier (Fig. 48a-b) : Head whitish yellow to straw yellow; body whitish. Head and pronotum sparsely and body fairly densely hairy.

Head subrectangular, frontal projection bluntly rounded and straight and more hairy on anterior

margin when viewed laterally. Antennae with 14 segments, 4 shortest. Labrum with anterior margin deeply incurved and having pointed, horn-like projections laterally. Mandibles long, slender, rod-like, subequal to or slightly longer than head, with pointed and incurved apices. Pronotum strongly saddle-shaped with large prominent anterior lobe. Postmentum stump-like.

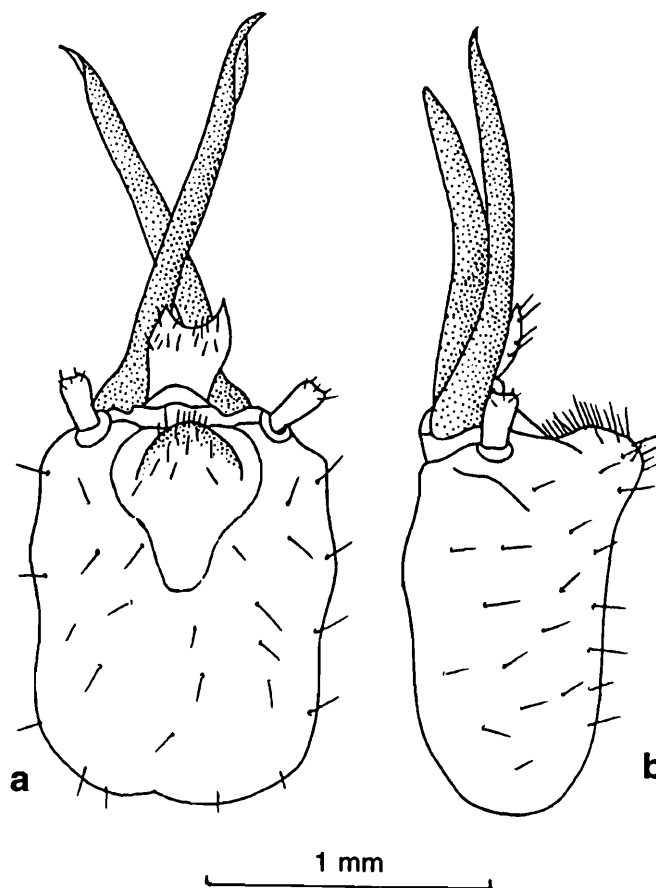


Fig. 48. : *Angulitermes akhorisainensis* Chatterjee and Thakur; a-b, Soldier. a. Head, dorsal view; b. Head, side view.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Tehri Garhwal Forest Division : Tehri Range : Akhorisain Block (type-locality); Naini Tal Dist. : Bhowali, Sultan Forest; Almora Dist. : Bageshwar; Pauri Dist. : Khinanauli, four km from Dhikola.

Remarks : The distributional records show that the species is confined to the hilly track of Western Himalaya. It is essentially a subterranean species. Its distribution range has been extended upto Kumaon Hills by Sen-Sarma *et al.* (1975) and Verma (1984c) from its type-locality in Tehri Garhwal.

49. *Angulitermes dehraensis* (Gardner)
(Fig. 49, Table 34)

1. *Mirotermes dehraensis* Gardner

1945. Gardner, *Indian J. Ent.*, 6 : 108-110. Im. and S. Syntypes : Im., S. and W., in FRI, BM, ZSI. Type-locality : Dehra Dun, Uttaranchal, India.

2. *Termes dehraensis* (Gardner)

1949. Snyder, *Smiths, misc. Colls.*, 112 : 179.

3. *Angulitermes dehraensis* (Gardner)

1955b. Ahmad, *Biologia*, Lahore., 1 : 259-260.

1964b. Chatterjee and Thakur, *J. Bombay nat. Hist. Soc.*, 61(2) : 353.

1974. Roonwal, Verma and Rathore, *Z. zool. Syst. Evolut. Forsch.*, 12 : 55, 61, 64, 68, 69, 73, 74, 75.

1984c. Verma, *Rec. zool. Surv. India*, 81(3&4) : 244-245, 247.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 237-241 (detailed synonymy).

Material studied : Unidentified : From *Central Himalaya* : 1 Im., 2S. and 8W., ten miles North of Tanakpur, Nepal Forests, Nepal, coll. K. Krishna, 31.i.1953, ex. 'understone in soil.

Diagnostic Character : (i) Imago : Head brown; postclypeus paler; antennae still pale; pronotum and abdominal tergites a little paler than head. Head and body densely hairy with a coat of short, minute hairs and several longer bristles; wings hairy along margins and sparsely so on membrane.

Head transversely subcircular. Fontanelle long, linear, slit-like, situated at the level of eyes. Antennae with 15 segments, 3 shortest or subequal to 4. Postclypeus swollen, straight anteriorly. Ocelli oval, situated from eye at a distance of their short diameter or slightly more. Pronotum almost subequal to head-width without eyes, both anterior and posterior margins with feeble emargination. Wings of *Angulitermes* type.

(ii) Soldier (Fig. 49a-b) : Head yellowish white, body pale yellow. Head fairly and body densely hairy.

Head subrectangular; sides unevenly straight, slightly incurved medially and feebly widest

anteriorly. Frontal projection blunt, anteriorly medially notched and hairy. Antennae with 14 segments, 4 shortest. Labrum deeply notched at anterior margin, with very prominent antero-lateral angles. Mandibles long, slender, rod-like, longer than head, not incurved distinctly at apices. Pronotum strongly saddle-shaped. Postmentum short and stump-shaped.

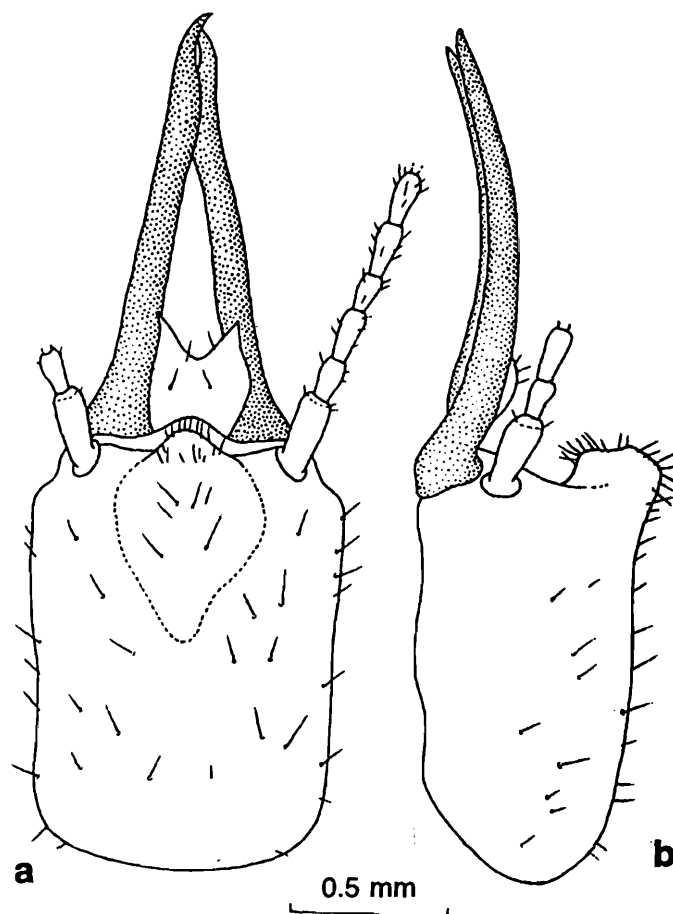


Fig. 49. : *Angulitermes dehraensis* (Gardner); a-b, Soldier. a. Head, dorsal view; b. Head, side view.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Malhan and near the banks of the river Tons. NEPAL (*Central Himalaya*) : Nepal Forest : ten miles North-East of Tanakpur.

Elsewhere : Pakistan, Afganistan.

Remarks : The species was first described (Gardner, 1945) as *Mirotermes dehraensis*, subsequently transferred (Snyder, 1949) to *Termes* and finally placed (Ahmad, 1955b) under *Angulitermes*. Since then, it stands as a well established species known from hilly tracts of Uttaranchal. The species is of rare occurrence and

Table 34 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Angulitermes acutus</i>		<i>A. akhorisainensis</i>		<i>A. dehraensis</i>	
	1S.	Known Range	1S.	Known Range	Sev. S.	Known Range
Length of head to lateral base of mandibles	1.21–1.31	1.20–1.35	1.38–1.40	1.35–1.40	1.15–1.38	1.12–1.40
Maximum width of head	0.96–1.00	0.95	1.01–1.05	1.00–1.05	0.90–1.00	0.89–1.06
Head index (width/length)	0.76–0.79	–	0.73–0.75	0.72–0.75	0.72–0.78	–
Maximum length of labrum	0.35–0.43	0.30	0.35	0.35	0.34–0.37	0.33
Maximum width of labrum	0.31	0.30	0.28–0.30	0.25–0.30	0.31	0.30
Length of left mandible (Upper base of condyle to tip)	1.31–1.40	1.40	1.35–1.45	1.35–1.45	1.34–1.42	1.34–1.45
Head-mandibular length Index (Left mand.-length/head-length)	1.06–1.08	1.05–1.17	0.98–1.03	1.00–1.04	1.16	1.16–1.25
Minimum median length of postmentum	0.48–0.56	0.45	–	0.45–0.48	–	0.43–0.45
Maximum width of postmentum	0.31–0.36	0.30–0.35	–	0.28–0.33	–	0.30
Width of postmentum at waist	0.25	–	–	–	–	0.25
Maximum length of pronotum	0.21	0.20	–	–	–	0.23
Maximum width of pronotum	0.50	0.50	–	–	–	0.50
Pronotum index (length/width)	0.42	–	–	–	–	–
Number of antennal segments	14	14	14	14	14	14

may be found under stones, soil and galleries underground. It makes small earthen cells about 2 inches wide, here and there in soil. This species swarms sometimes in the last week of June, when mature sexual forms are met within small numbers. The soldiers are capable of jumping to short distances with the help of their mandibles and when put into alcohol they produce 'tick-tick' sound by striking their mandibles against one another (Mathur and Sen-Sarma, 1959; Roonwal, 1970a).

Economic Importance : Its feeding propensities are not known, but Ahmad (1955b) recorded this species, feeding on the woodwork of a building at Lyallpur (W. Punjab, Pakistan).

50. *Angulitermes kashmirensis* Roonwal and Chhotani
(Fig. 50, Table 35)

1. *Angulitermes kashmirensis* Roonwal and Chhotani

1971. Roonwal and Chhotani, *Rec. zool. Surv. India*, **63** : 210-213, 219, 220-222. S. and W. Holotype : S., in

ZSI. Type-locality : about 10 km East of Chineni near confluence of River Tawi and Binisangh Nallah, Dist. Udhampur, Jammu and Kashmir, India.

1984c. Verma, *Rec. zool. Surv. India.*, **81**(3&4) : 243, 247-248.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 251-253 (detailed synonymy).

Material studied : Identified : From North-Western Himalaya : 4S., sev. W., Udhampur, ten km East of Chineni, near confluence of River Tawi and Binisangh Nallah (1122 m), J.K., coll. Raj Tilak, 28.ix.1964, det. Roonwal and Chhotani.

Diagnostic Character : (i) Imago : Unknown.
(ii) Soldier (Fig. 50a-c) : Head yellowish white to light orange yellow; body paler. Head and pronotum moderately and body fairly densely hairy.

Head sub-rectangular, only slightly longer than wide; sides wavy. Frontal projection blunt, projected a little and indented. Antennae with 14 segments, 3 club-shaped and longer than 2.

Labrum with anterior margin deeply and broadly incurved, antero-lateral corners projected in front like horn and faintly serrated on outer side. Mandibles long, slender, rod-like, much longer than head with pointed incurved apices. Postmentum short, vase-shaped. Pronotum strongly saddle-shaped, anterior lobe distinctly raised with antero-median notch; posterior also with feeble median emargination.

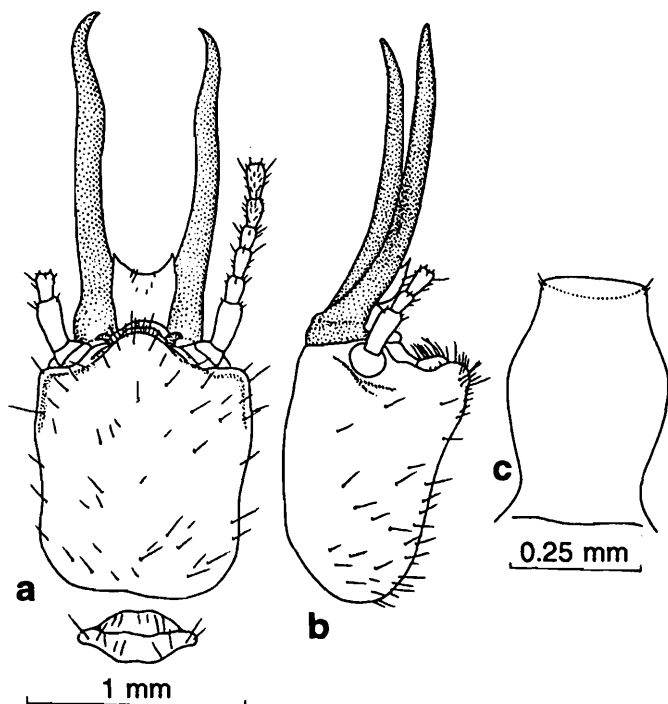


Fig. 50. : *Angulitermes kashmirensis* Roonwal and Chhotani; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Distribution : INDIA : North-Western Himalaya : Jammu and Kashmir : Udhampur Dist. : ten km East of Chineni, near confluence of river Tawi and Binisangh Nallah (type-locality).

Remarks : The species is known so far only from its type-locality in the North-Western Himalaya. It is a distinctive species in having quite wavy lateral margins of soldier's head.

51. *Angulitermes nepalensis* sp. nov.
(Fig. 51, Table 35)

2008. Mukherjee and Maiti, *Rec. zool. Surv. India*, 108(1) : 1-8.

Material studied : From : Central Himalaya : 2S., ten miles NE of Tanakpur, Nepal forest,

Nepal, coll. K. Krishna, 31.01.1953, ex. "under stone in soil"

Description : (i) Imago - unknown.

(ii) Soldier (Fig. 51a-b) : Head-capsule straw yellow; antennae and labrum as same as head-capsule; mandibles dark reddish brown; body and legs whitish yellow. Head-capsule moderately and body fairly densely pilose. Body length : 4.00-4.10 mm.

Head-capsule subrectangular; broadest just behind antero-lateral corners, whence gradually converging behind and somewhat incurved a little above posterior margin; posterior margin convex; antero-lateral corners somewhat prominent and comparatively chitinised; frontal projection fairly large, prominent with rounded anterior margin,

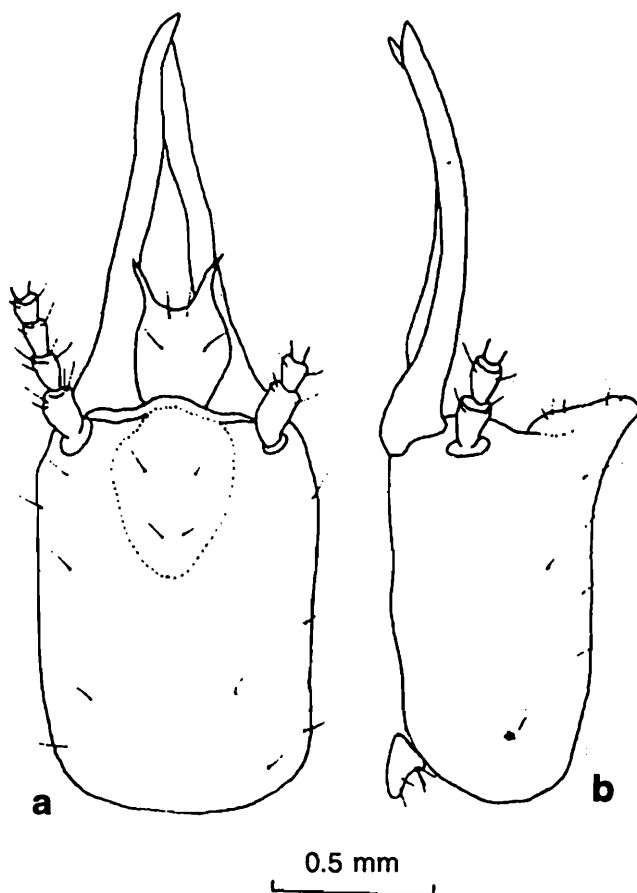


Fig. 51. : *Angulitermes nepalensis* sp. nov.; a-b, Soldier. a. Head, dorsal view; b. Head and pronotum, side view.

apex pilose, somewhat rounded and turned upwards, reaching upto or sometimes beyond the median depression of labrum. Fontanelle lying below the frontal projection, prominent and less hairy than head; fontanelle gland large and

prominent. Eyes and ocelli absent. Antennae broken (last segment); segment 1 and 2 sparsely and remainder fairly densely pilose; 2 slightly and 4 much smaller than 3, 5-8 club-shaped and increasing gradually in length, 9 to the penultimate one subequal or shorter than 8. Postclypeus weakly swollen and pilose. Anteclypeus whitish and apilose. Labrum a little longer than broad; antero-lateral corners with horn-like projections; anterior margin deeply and angularly concave and with hairs; lateral margins narrowing posteriorly. Mandibles of snapping-type, long and slender, pointed out weakly and incurved at distal end, slightly longer than head-length. Postmentum

short, club-shaped, widest a little below the anterior margin, with transverse weak striations and apilose, lateral margin weakly incurved basally, anterior margin substraight and posterior margin weakly incurved.

Pronotum strongly saddle-shaped, anterior margin considerably raised; broader than long and much narrower than head capsule, anterior margin without any median notch, fairly pilose. Legs thin, short and pilose. Tibial spur formula 3:2:2, tarsi 4-segmented, claws weak. Abdomen oblong, short, fairly densely pilose. Cerci short with 2-segments and hairy. Styli absent.

Measurements (in mm)

		Holotype soldier
1.	Body-length	3.50
2.	Length of head to lateral base of mandibles	1.12
3.	Length of head to tip of frontal projection	1.20
4.	Maximum width of head	1.00
5.	Maximum height of head	0.60
6.	Maximum height of frontal projection	0.27
7.	Head Index I (width/length)	0.72
8.	Head Index II (height/width)	0.69
9.	Head Index III (height/length)	0.55
10.	Maximum length of labrum	0.22
11.	Maximum length of labrum (without tip)	0.19
12.	Maximum width of labrum	0.20
13.	Maximum length of mandibles-left	1.30
14.	Head mandibular Index (left mandible-length/head-length)	1.08
15.	Min (median) length of postmentum	0.38
16.	Maximum width of postmentum	0.27
17.	Minimum width of postmentum	0.20
18.	Postmentum contraction Index	0.68
19.	Maximum length of pronotum	0.12
20.	Maximum width of pronotum	0.35
21.	Pronotum index (length/width)	0.34
22.	Head-pronotum width Index (Pronotum-width/head-width)	0.35
23.	No. of antennal segments	Broken

Type-specimens : All specimens, in spirit and from a single source (vide, Material) in separate vials, deposited as follows :

Holotype Soldier, deposited in ZSI., Kolkata, and PARATYPE SOLDIER preserved as above.

Type-locality and distribution : Type-locality : *Central Himalaya* : ten miles NE of Tanakpur, Nepal Forest, Nepal, coll. K. Krishna. Distribution : Known only from the type-locality.

Comparison : The species, *Angulitermes nepalensis* n. sp. can easily be separated by its shape, size and characters of rostrum and labrum from all other species from India. However, the species is very close to *A. dehraensis* from Dehra Dun, but it can be separated from this species by the following characters :

From *A. dehraensis* : Soldier – (i) Antero-lateral corners of head below antennal socket very much prominent and angular (vs., not so prominent in *A. dehraensis*); (ii) Frontal projection very much prominent, tip raised and directed slightly backward (vs., frontal projection not so prominent, tip not so raised and directed not backward rather forward); (iii) Anterior margin of labrum with deep, angular median notch (vs., anterior margin deeply incurved with rounded median emagination); (iv) Tip of labrum very sharply pointed (vs., anterior tip not so pointed); (v) Mandible slightly longer than head-length, head-mandible index (mandible length/head-length) 1.08 (vs., mandible distinctly longer than head-length, head-mandibular index : 1.12-1.26).

52. *Angulitermes tilaki* Roonwal and Chhotani (Fig. 52, Table 35)

1. *Angulitermes tilaki* Roonwal and Chhotani

1971. Roonwal and Chhotani, *Rec. zool. Surv. India*, **63** : 210-213, 219, 220-222. S. and W. Holotype : S., in ZSI. Type-locality : Approx. 1 km West of Chineni near confluence of River Tawi and Motorshed Nallah, Dist. Udhampur, J&K State, India.

1984c. Verma, *Rec. zool. Surv. India*, **81**(3&4) : 243. 247.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 266-269 (detailed synonymy).

Material studied : Identified : From *North-Western Himalaya* : 3S, sev. W., Udhampur, one km West of Chineni, near confluence of River Tawi and Motor Shed Nallah (1090 m), J.K., coll. Raj Tilak, 27.ix.1964, det. M.L. Roonwal and O.B. Chhotani.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 52a-c) : Head pale yellow; body whitish. Head and pronotum sparsely and body fairly pilose.

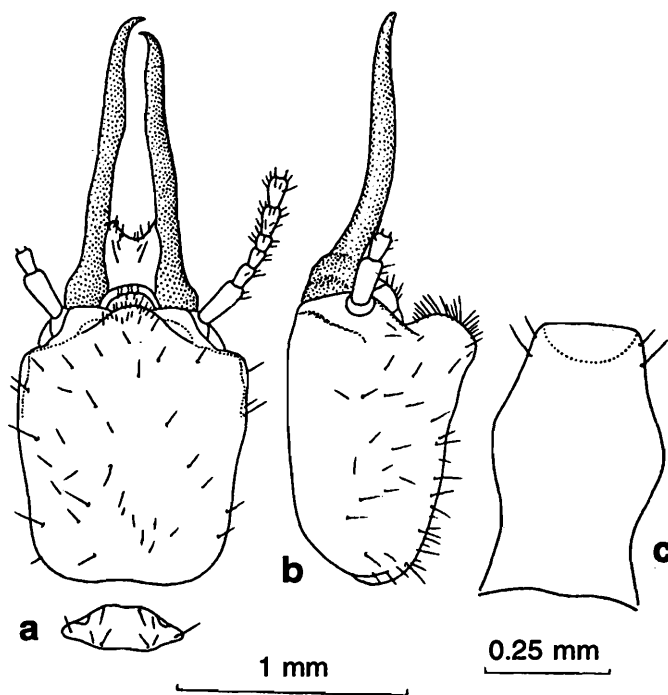


Fig. 52. : *Angulitermes tilaki* Roonwal and Chhotani; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head side view; c. Postmentum.

Head sub-rectangular, broader anteriorly, with feebly incurved lateral and posterior margins, frontal projection broadly rounded, not indented anteriorly. Antennae with 14 segments, 4 shortest. Labrum deeply incurved at anterior margin, without serrations on side margins, antero-lateral corners not so much pointed. Mandibles rod-like, weakly incurved distally with hooked apices, slightly longer than head-length. Pronotum strongly saddle shaped; both anterior and posterior margins feebly incurved medially. Postmentum vase-shaped.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir : Udhampur Dist. : One km West of Chineni, near confluence

Table 35 : Measurements (in mm) etc. of Caste–Soldier.

	<i>Angulitermes kashmirensis</i>		<i>A. nepalensis sp. nov</i>	<i>A. tilaki</i>	
	4S.	Known Range	Holotype	3S.	Known Range
Length of head to lateral base of mandibles	1.22–1.28	1.20–1.30	1.12	1.15–1.25	1.13–1.20
Maximum width of head	1.00	1.00	1.00	0.97–1.00	0.97–1.00
Maximum height of head	–	–	0.60	–	–
Head index (width/length)	0.82	–	0.72	0.80–0.84	–
Maximum length of labrum	0.31–0.33	0.30–0.33	0.22	0.28–0.31	0.28–0.31
Maximum width of labrum	0.27–0.28	0.27–0.28	0.20	0.25	0.25
Length of left mandible (upper base of condyle to tip)	1.44–1.47	1.43–1.47	1.30	1.25	1.27
Head-mandibular length Index (left mand.-length/head-length)	1.14–1.18	1.14–1.23	1.08	1.08	1.06–1.12
Minimum median length of postmentum	0.47	0.47	0.38	0.52	0.47–0.50
Maximum width of postmentum	0.31	0.31–0.33	0.27	0.33	0.33
Width of postmentum at waist	0.22	0.23–0.27	0.20	0.27	0.27
Maximum length of pronotum	0.20–0.25	0.20	–	0.17	0.17
Maximum width of pronotum	0.48–0.52	0.47–0.50	–	0.51	0.50
Pronotum index (length/width)	–	–	–	–	–
Number of antennal segments	14	14	–	14	14

of river Tawi and Motor shed Nallah (type-locality).

Remarks : The characteristic anteriorly divergent head capsule and frontal projection with rounded anterior face of the soldier caste serve as the identify of the species. It is so far known only from its type-locality.

Genus *Dicuspiditermes* Krishna

53. *Dicuspiditermes laetus* (Silvestri) (Fig. 53, Tables 36 and 37)

1. *Capritermes laetus* Silvestri

1914. Silvestri, *Rec. Indian Mus.*, 8 : 434–435. S. only.
Syntype : Silv. Coll. Type-locality : Sukli, Eastside of Dawna Hills, Lower Burma, Myanmar.

2. *Dicuspiditermes laetus* (Silvestri)

1965. Krishna, *Am. Mus. Novit.*, No. 2210 : 18.

1980. Roonwal and Verma, *Proc. Indian natnl. Sci., Acad.*, (B) 46 : 465, 466.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 303–308.

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 64–65. Arunachal Pradesh.

3. *Capritermes garthwaitei* Gardner

1945. Gardner, *Indian J. Ent.*, 6 : 106–108.

1962a. Mathur and Thapa, *Indian For. Leaflet*, No. 167 : 108.

4. *Dicuspiditermes garthwaitei* (Gardner)

1965. Krishna, *Am. Mus. Novit.*, No. 2210 : 18–19.

1968. Krishna, *Bull. Am. Mus. nat. Hist.*, 138(5) : 290 (synonymy).

1975. Akhtar, *Bull. Dep. Zool. Univ. Panjab (N.S.)*, Art. 7 : 175–179, 194.

5. *Dicuspiditermes tripurensis* Sen-Sarma and Thakur

1979. Sen-Sarma and Thakur, *Indian For. Rec. (N.S.) Ent.*, 13(1) : 21–23, 47, 48, 66, 67.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 304 (detailed synonymy).

Material studied : Identified : From *Eastern Himalaya* : Sev. Im., S., W., Itanagar, Arunachal Pradesh. coll. C.B. Prasad, 24.iv.1987, det. G. Bose.

Diagnostic Character : (i) Imago (Fig. 53a-b) : Head blackish brown; postclypeus; antennae and pronotum dark brown, slightly paler than head; labrum brownish yellow; wings pale brown. Head and body with a dense coat of short, fine hairs

and several longer bristles interspersed; wings hairy along margin and scantily hairy on membrane.

Head subcircular, Y-suture present, lateral arms not distinct. Fontanelle slit-like. Postclypeus hairy as head with incomplete median line. Ocelli oval, large translucent, separated from eyes by its short diameter. Antennae with 14-15 segments. Labrum dome-shaped, with short and long hairs. Mandibles of *Dicuspiditermes*-type. Pronotum with a faint T-mark, anterior margin substraight or weakly incurved with faint median notch; posterior margin outcurved with distinct median notch, narrower than head with eyes.

(ii) Soldier (Fig. 53c-e) : Head yellow to yellowish red; body creamish. Head and pronotum sparsely and body densely hairy.

Head subrectangular, sides weakly outcurved, very slightly converging near anteriorly, distinctly longer than wide. Fontanelle transverse, lying in front and below frontal protuberance; fontanelle gland large. Antennae with 14 segments, segments 2, 3 and 4 subequal. Labrum asymmetrical, with long, needle-like antero-lateral processes, anterior margin deeply incurved. Mandibles asymmetrical, almost as long as head-capsule, left mandible twisted at middle and with a weak, beak-like tip; right blade-like, tip sharp and pointed. Postmentum club-like. Pronotum strongly saddle-shaped, anterior margin weakly notched; posterior margin not emarginate.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : Itanagar. Tripura.

Elsewhere : Bangladesh. Myanmar. Thailand.

Remarks : The species has been recorded for the first time from India in the *Eastern Himalaya* (Bose, 1999), although it was already known from Bangladesh, Myanmar and Thailand. The species seems to be a variable species, since two species, namely, *Dicuspiditermes garthwaitei* (Gardner) and *D. tripurensis* Sen-Sarma and Thakur have been synonymised under it.

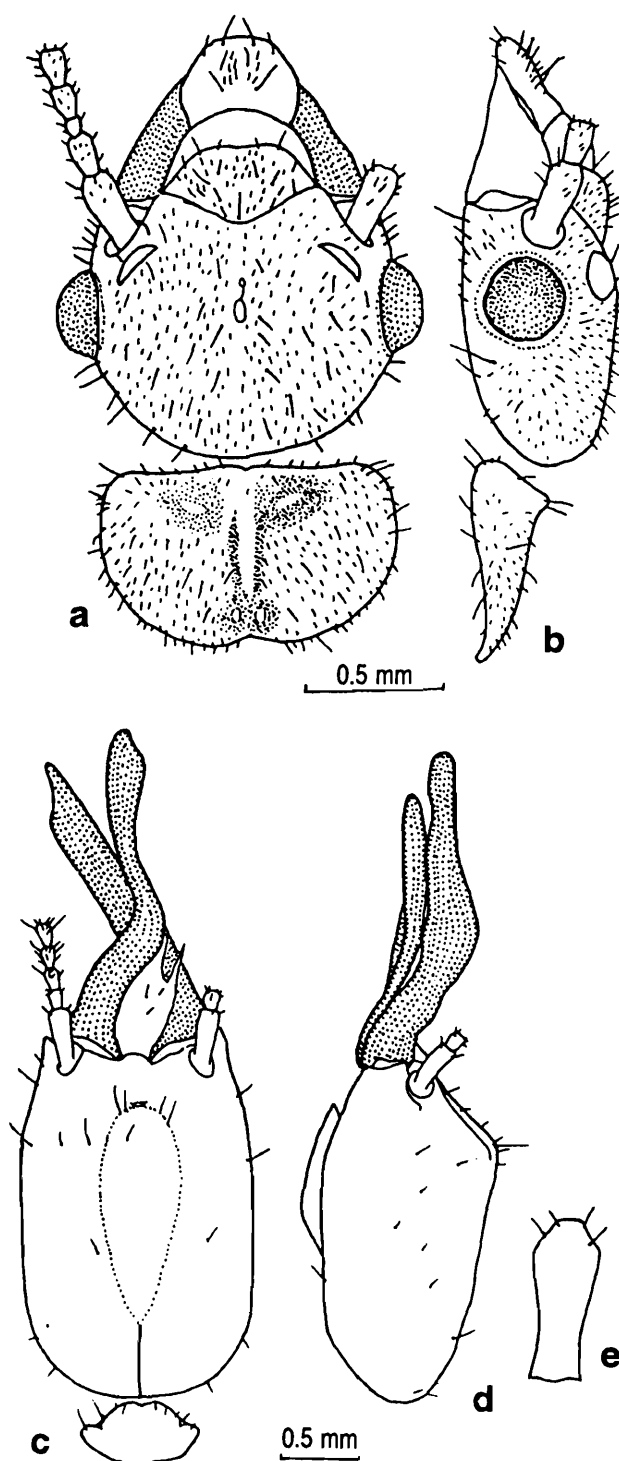


Fig. 53. : *Dicuspiditermes laetus* (Silvestri); a-b, Imago. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c-e, Soldier. c. Head and pronotum, dorsal view; d. Head, side view; e. Postmentum.

Table 36 : Measurements (in mm) etc. of Caste-Imago.

	<i>Discuspiditermes laetus</i>	
	Sev. Im.	Known Range
Total body-length with wings (excluding antennae), ca.	14.00–15.00	14.00–15.20
Length of head to lateral base of mandibles	0.88–1.00	0.90–1.05
Maximum width of head with eyes	1.32–1.38	1.35–1.40
Maximum Length of labrum	0.31	–
Maximum width of labrum	0.44	–
Maximum diameter of compound eye (with ocular sclerite)	0.30–0.35	0.28–0.37
Maximum diameter of lateral ocellus	0.13–0.19	0.11–0.20
Minimum diameter of lateral ocellus	0.10–0.13	0.09–0.14
Minimum eye-ocellus distance	0.08–0.12	0.08–0.16
Maximum length of pronotum	0.62–0.73	0.59–0.75
Maximum width of pronotum	1.05–1.15	0.96–1.15
Length of forewing with scale	–	12.2–12.8
Length of hindwing with scale	–	12.0–12.5
Number of antennal segments	14–15	14–15

Table 37 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Discuspiditermes laetus</i>	
	5S.	Known Range
Length of head to lateral base of mandibles	2.06–2.12	2.02–2.23
Maximum width of head	1.29–1.49	1.28–1.52
Head index (width/length)	0.62–0.70	–
Maximum length of labrum	0.74–0.75	–
Maximum width of labrum	0.37–0.38	–
Length of left mandible (Upper base of condyle to tip)	1.80–2.13	1.77–2.15
Head-mandibular length Index (left mandible-length/head-length)	0.87	0.923–0.930
Minimum median length of postmentum	0.74–1.00	0.70–1.04
Maximum width of postmentum	0.35–0.44	0.36–0.45
Width of postmentum at waist	0.18–0.23	0.17–0.23
Maximum length of pronotum	0.25–0.38	0.23–0.40
Maximum width of pronotum	0.56–0.75	0.54–0.83
Pronotum index (length/width)	0.44–0.51	–
Number of antennal segments	14	14

Genus *Pericapritermes* Silvestri

Key to the species of genus

Pericapritermes Silvestri

I. **IMAGOES** : Of *P. dunensis* are only known from the Himalaya.

II. **SOLDIERS** :

1. Smaller species, length of head to lateral base of mandibles 2.05-2.15 mm (2.05-2.20 mm), maximum width of head 1.20-1.25 mm (1.19-1.27 mm); median suture not reaching upto fontanelle
..... *P. assamensis* (Mathur and Thapa)
- Large species, length of head to lateral base of mandibles (2.30-3.05 mm), maximum width of head (1.30-1.76 mm); median suture reaching almost upto fontanelle 2
2. Abdominal tergites each with 4 long bristles; tip of right mandible blunt (large species, head-length, 2.75 mm (2.45-3.05 mm); width, 1.50 mm (1.48-1.70 mm)
..... *P. tetraphilus* (Silvestri)
- Abdominal tergites each with several long bristles; tip of right mandible pointed 3
3. Smaller species, length of head to base of mandibles 2.35-2.56 mm (2.30-2.50 mm), maximum width of head 1.32-1.49 mm (1.30-1.45 mm); tip of left mandible thick and knob-like; labrum incurved at anterior margin
..... *P. dunensis* (Roonwal and Sen-Sarma)
- Larger species, length of head to base of mandibles 2.66-3.00 mm, maximum width of head 1.60 mm (1.47-1.60 mm); tip of left mandible not so thick and devoid of any nob; labrum somewhat convex at anterior margin *P. durga* (Roonwal and Chhotani)

54. *Pericapritermes assamensis* (Mathur and Thapa)

(Fig. 54, Table 98)

1. *Capritermes assamensis* Mathur and Thapa

1965. Mathur and Thapa, *Bull. Ent.*, No. 6 : 10-12. Holotype : S., in FRI. Type-locality : Polo Block, Central Range, Goalpara Divn., Assam.

2. *Pericapritermes assamensis* (Mathur and Thapa)

1968. Krishna, *Bull. Am. Mus. nat. Hist.*, 138 (Art 5) : 293.
1977. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 33.
1983. Verma, *Indian J. Forestry*, 6(4) : 298, 300.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 322-324.

3. *Pericapritermes ceylonicus*
(wrong determination)

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 24, 87-89. Sub-Himalayan West Bengal.

Material studied : Unidentified : From *Eastern Himalaya* : 1S. and sev. W., Onlakh ca six km East of Geyzing beyond Sakyong, West Sikkim, coll. Y. Chaturvadi and K.C. Kansal, 3.viii.1989, ex. 'trunk of Orange tree'. Identified : From *Eastern Himalaya* : 2S. and sev. W., Gailikhola Forest, Darjiling Dist., West Bengal, coll. P.K. Maiti, 4.xi.1966, ex. "soil", det. P.K. Maiti.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 54a-c) : Head yellowish brown; mandibles reddish brown to blackish. Head and pronotum sparsely and body fairly densely hairy.

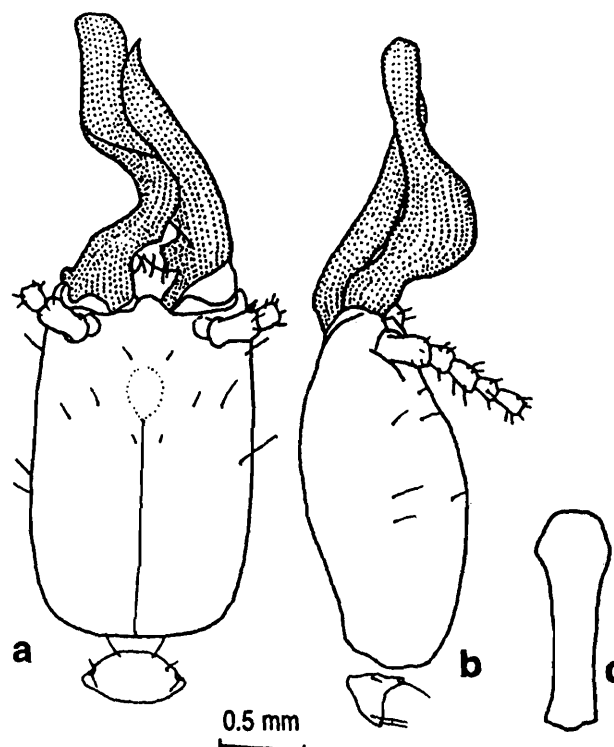


Fig. 54. : *Pericapritermes assamensis* (Mathur and Thapa); a-c, Soldier. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Postmentum.

Head subrectangular, sides slightly convex. Fontanelle minute, circular, situated at anterior fourth. Antenna with 14-segments, 4 smallest. Labrum asymmetrically subsquarish, anterior margin almost straight or incurved, anterolateral corners produced into small, pointed tips. Mandibles strongly asymmetrical, left mandible strongly twisted at middle, without a pointed tip, right blade-like, tip pointed and weakly outcurved apically. Postmentum club-shaped. Pronotum saddle-shaped, anterior margin devoid of any notch.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Nazeok. Sikkim : West Sikkim Dist. : Onlakh. Assam : Goalpara Division : Polo Block, Central Range (type-locality).

Remarks : This is a soil inhabiting species reported only from the eastern India, including foot hills of the Eastern Himalaya. The material from Onlakh, mentioned above having comparatively long narrow head with some indication of variation in its population, but seems to be intercolonial differences. This soil-inhabiting species is comparatively smaller one among the known Himalayan species of the genus.

55. *Pericapritermes dunensis* (Roonwal and Sen-Sarma)
(Fig. 55, Table 38)

1. *Capritermes dunensis* Roonwal and Sen-Sarma

1960. Roonwal and Sen-Sarma, *Contr. Syst. Orient. Termites* (ICAR Ent. Monogr., 1) : 28-33, Pl.4, Holotype : S., in FRI. Type-locality : Dehra Dun (New Forest), Uttaranchal, India.

2. *Pericapritermes dunensis* (Roonwal and Sen-Sarma)

1968. Krishna, *Bull. Am. Mus. nat. Hist.*, 138 (Art 5) : 294.
1983. Verma, *Indian J. Forestry*, 6(4) : 298, 299, 300.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 324-328 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 65-68.

Material studied : Unidentified : A. From *Western Himalaya* : (i) 5S. and 10W., Sukhidhang, 16 miles North of Tanakpur, Haldwani Dist., Uttaranchal, coll. K. Krishna, 30.i.1953, ex. 'understone in rocky soil. (ii) 1S. and 2W., Lalpani Block, four miles East of Kotdwara, Garhwal Dist., Uttaranchal, coll. K. Krishna, 3.ii.1953, ex. 'understone in rocky soil. B. From *Eastern Himalaya* : Following 2 vials from Nazeok, Darjiling Dist., West Bengal, coll. G.K. Srivastava & P.K. Maiti, 7.1.1974, ex. 'soil' as (iii) with 6S. and 5W. (F.C. No. 39/7.1.74); (iv) with 5S. and 5W. (F.C. No. 31/7.1.74). Identified : From *Western Himalaya* : (i) 1 Im., Kaunda, Pauri Dist. Uttaranchal. coll. Asket Singh, 13.xii.1970 and 30.vii.1991, det. S.C. Varma.

Diagnostic Character : (i) Imago : Head dark brown; postclypeus; labrum; antennae and legs bright yellow; pronotum brownish yellow; wings brownish. Head and pronotum fairly and body densely pilose with mixture of fine short hairs and several long hairs. Wing membrane with a few short hairs on distal part.

Head subcircular, epicranial suture faint. Fontanelle large and oval. Ocelli oval, separated from eyes by about half their short diameter (0.05-0.07 mm). Postclypeus swollen, hairy, without any median line. Antennae with 15 segments, 3 shortest; 4 and 5 subequal. Pronotum anteriorly weakly outcurved with a faint notched medially and posterior margin with strong emargination.

(ii) Soldier (Fig. 55a-b) : Head yellowish brown to deep brown, paler posteriorly; abdomen whitish yellow. Head and pronotum very sparsely and abdomen fairly densely hairy.

Head subrectangular with parallel sides, almost twice as long as wide; sides slightly narrowing in front of antennae. Fontanelle gland small, sometimes not distinct. Antennae with 14 segments, 4 shortest. Labrum asymmetrical,

subsquarish, anterior margin slightly incurved with short antero-lateral corners. Mandibles asymmetrical, left mandibles strongly twisted and much shorter than head, with blunt tips, right blade-like, outcurved near tip. Postmentum long club-shaped. Pronotum saddle-shaped, anterior margin with a very weak median notch; posterior margin convex without any emargination.

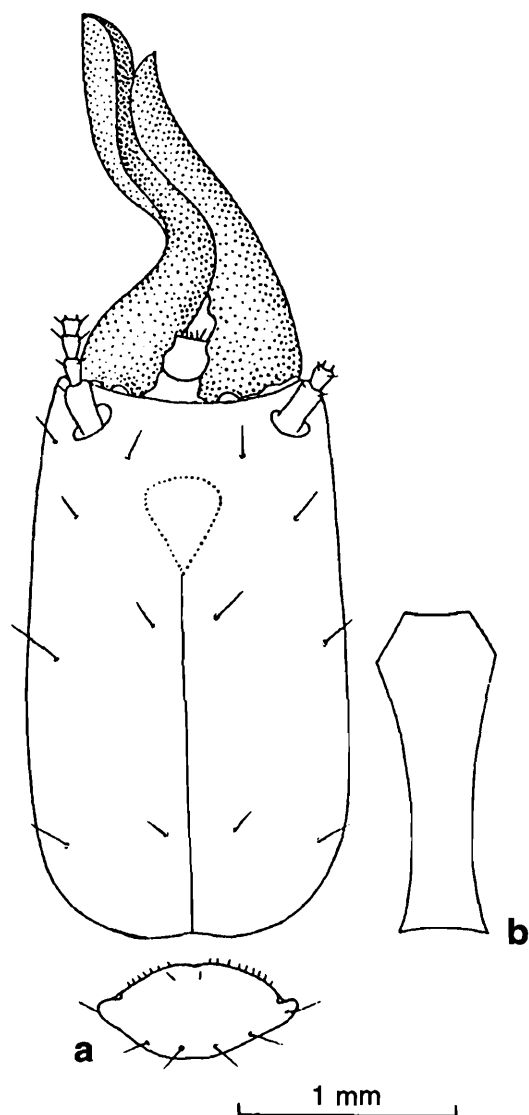


Fig. 55. : *Pericapritermes dunensis* (Roonwal and Sen-Sarma); a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Dehra Dun (type-locality); Garhwal Dist. : Lalpani Block, four miles East of Kotdwara; Pauri Dist. : Kaunda; Haldwani Dist. *Eastern Himalaya* : West Bengal : Darjiling Dist. : Gailikhol Forest (near Teesta Bridge), Nazeok. Arunachal Pradesh : Tirap Dist. : Deban, 27 km from Miao. Meghalaya : Shillong;

Mawphlong; Umtham. BHUTAN (*Eastern Himalaya*).

Remarks : The distributional records show that the species is confined to the hilly tracts of *Eastern and Western Himalaya* including eastern India. It is essentially a subterranean species as evidenced from the collection data and soldiers can spring a little distance with the help of their mandibles. The species comes close to *P. durga*, but differs in having nob-like tip of left mandible and overall smaller size.

56. *Pericapritermes durga* (Roonwal and Chhotani)

(Fig. 56, Table 39)

1. *Capritermes latignathus durga* Roonwal and Chhotani

1962a. Roonwal and Chhotani, *Proc. natnl. Inst., Sci., India*, (B) 28(4) : 325-329, Pls. 22, 23. S. and W. Holotype : S., in ZSI. Type locality : Cherrapunji, Meghalaya, India.

2. *Pericapritermes latignathus durga* (Roonwal and Chhotani)

1968. Krishna, *Am. Mus. nat. Hist.*, 138 (Art. 5) : 294.

3. *Pericapritermes durga* (Roonwal and Chhotani)

1977. Roonwal and Chhotani, *Ent. Basil*, 2 : 64, 66, 68.

1983. Verma, *Indian J. For.*, 6(4) : 298, 300.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 328-330.

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 68-69. Arunachal Pradesh.

Material studied : Identified : From *Eastern Himalaya* : (i) 1S. and 2W., Samchi (alt. 300 m), Bhutan, coll. Zool. Expt. N.H. Museum, Basel (Switzerland), 7-11.v.1972, det. Roonwal and Chhotani. (ii) 1S. and 8W., Changra (alt. 1900 m), 18 km South of Tongsa, Bhutan, coll. Zool Expt. N.H. Museum, Basel (Switzerland), 22.vi.1972, det. Roonwal and Chhotani. (iii) Sev. S. and W., Lake Ganga, Itanagar, Arunachal Pradesh, coll. O.B. Chhotani, 13.v.1989, ex. "stump", det. G. Bose.

Table 38 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Pericapritermes assamensis</i>		<i>P. dunensis</i>	
	2S.	Known Range	5S.	Known Range
Length of head to lateral base of mandibles	2.05–2.15	2.05–2.20	2.35–2.56	2.30–2.50
Maximum width of head	1.20–1.25	1.19–1.27	1.32–1.49	1.30–1.45
Head index (width/length)	0.58	–	0.56–0.58	0.56–0.59
Maximum length of labrum	0.25	–	–	0.20–0.25
Maximum width of labrum	0.25	–	–	0.25–0.30
Length of left mandible (Upper base of condyle to tip)	1.35–1.50	1.32–1.37	1.45–1.68	1.43–1.70
Head-mandibular length Index (left mandible-length/head-length)	0.66	0.63	0.61–0.65	0.56–0.63
Minimum median length of postmentum	1.19	–	1.40–1.50	1.40–1.50
Maximum width of postmentum	0.44	–	0.40–0.51	0.40–0.50
Width of postmentum at waist	0.22	–	0.25	0.25
Maximum length of pronotum	0.30	–	0.35–0.37	0.33–0.40
Maximum width of pronotum	0.62	–	0.80–0.87	0.80–0.88
Pronotum index (length/width)	0.48	–	0.42–0.43	–
Number of antennal segments	14	14	14	14

Table 39 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Pericapritermes durga</i>		<i>P. tetraphilus</i>	
	1S.	Known Range	1S.	Known Range
Length of head to lateral base of mandibles	2.45	2.45–3.00	2.75	2.45–3.05
Maximum width of head	1.60	1.45–1.60	1.50	1.48–1.70
Head index (width/length)	0.65	–	0.54	–
Maximum length of labrum	–	0.20–0.25	–	0.20–0.23
Maximum width of labrum	0.30	0.28–0.35	–	0.30–0.33
Length of left mandible (Upper base of condyle to tip)	2.00	1.75–2.00	1.63	1.60–1.84
Head-mandibular length Index (left mandible-length/head-length)	–	0.65–0.68	0.59	0.55–0.61
Minimum median length of postmentum	1.57	1.57–1.83	1.63	–
Maximum width of postmentum	0.50	0.47–0.50	0.50	–
Width of postmentum at waist	0.23	0.20–0.23	0.25	–
Maximum length of pronotum	0.44	–	0.45	0.40–0.45
Maximum width of pronotum	0.88	–	1.13	0.90–1.13
Pronotum index (length/width)	0.50	–	–	–
Number of antennal segments	14	14	14	14

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 56a-c) : Head yellow to pale brown; pronotum paler than head, abdomen yellowish white. Head sparsely and body densely hairy.

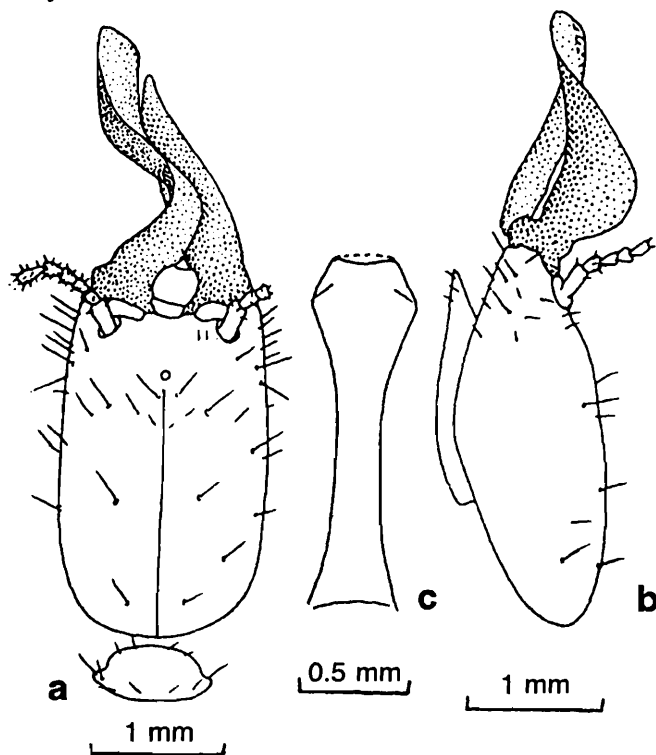


Fig. 56. : *Pericapritermes durga* (Roonwal and Chhotani); a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Head subrectangular, length a little less than double its width, sides subparallel, slightly narrowing in front of antennae. Fontanelle minute, round, median suture distinct. Antennae with 14 segments, 4 shortest. Labrum subsquarish, with lateral sides outcurved somewhat asymmetrical, anterior margin substraight, antero-lateral corners with minute points. Mandibles strongly asymmetrical. Left mandibles strongly twisted, tip broad and spatulate, right mandibles blade-like, bending a little outwards of the tip. Postmentum long, club-shaped. Pronotum strongly saddle-shaped, anterior lobe strongly upturned, rounded at anterior margin with notch; posterior margin convex and devoid of any notch.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : East Kameng Dist. : Bhairavkonda; Lower Subansiri Dist. : Lake Ganga, Itanagar; Siang Dist. : Meghalaya :

Cherrapunji (type-locality). Manipur : Morch Res. Forest. BHUTAN (*Eastern Himalaya*) : Changra, 19 km South of Tongsa; Samchi; Thimpu.

Remarks : The species was described (Roonwal and Chhotani, 1962a) from Meghalaya, India as a subspecies of *Capritermes latignathus* Holmgren which was subsequently transferred to *Pericapritermes* by Krishna (1968). However, Roonwal and Chhotani (1977) gave the species under *Pericapritermes*. The species is so far known from the eastern India inhabiting in soil. This is one of the largest known Himalayan *Pericapritermes* species and comes close to *P. tetraphilus* —a species with sympatric distribution.

57. *Pericapritermes tetraphilus* (Silverstri) (Fig. 57, Table 39)

1. *Capritermes tetraphilus* Silvestri

1922. Silvestri, *Rec. Indian Mus.*, **24**(4) : 543-545. S. and W. Syntypes : Probably in Silv. Coll. Type-locality : Rangamati, Chittagong Hill Tracts, Bangladesh.

2. *Pericapritermes tetraphilus* (Silvestri)

1965. Krishna, *Am. Mus. Novit.*, No. 2210 : 15-16.

1977b. Chhotani, *Rec. zool. Surv. India*, **72** : 372.

1986. Gao and Lam, *Mem. Hongkong nat. Hist., Soc.*, **17** : 83.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 338-341 (detailed synonymy).

3. *Capritermes orientalis* Mathur and Sen-Sarma

1961. Mathur and Sen-Sarma, *Bull Ent.*, No. **2** : 1-4.

1968. Krishna, *Bull. Am. Mus. nat. Hist.*, **138**(5) : 294 (Synonymy)

1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. **9** : 38.

Material studied : Unidentified : From *Eastern Himalaya* : (i) 1S. and 2W. from Rongpo, four km East of SPWD Bungalow, East Sikkim, coll. B. Nandi and party, 18.iv.1980, ex. 'decaying stump' (ii) 2S. and 2W., Damthang Basti near Namchi, South Sikkim, coll. P.H. Roy and party, 15.v.1995, ex. 'under log' Identified : From *Eastern Himalaya* : S. and W., Tashiding forest,

Darjiling Dist., W.B., coll. P.K. Maiti, 2.xi.1966, ex. "under a log", det. P.K. Maiti.

Diagnostic Character : (i) Imago : Known but not from the study area.

(ii) Soldier (Fig. 57a-c) : Head yellow to reddish yellow; abdomen creamish. Head and pronotum sparsely hairy; abdomen with short and a few (2 pairs) long hairs on each tergite.

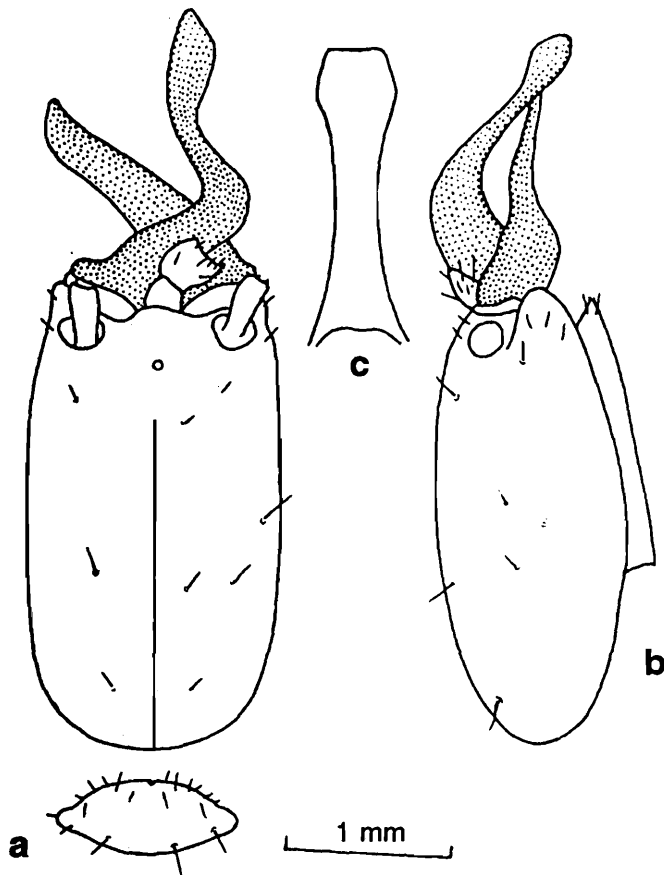


Fig. 57 : *Pericapritermes tetraphilus* (Silvestri); a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Head subrectangular with weak outcurved lateral sides. Fontanelle dot-like; fontanelle gland small, sutural line distinct. Antennae with 14 segments, 4 subequal 2. Labrum slightly asymmetrical, anterior margin substraight, antero-lateral corners with short, pointed processes. Mandibles strongly asymmetrical. Left mandibles strongly twisted at middles, tip without any beak or point, right somewhat straight and blade-like, feebly outcurved at apex. Postmentum club-shaped. Pronotum weakly saddle-shaped, both anterior and posterior margins outcurved, but devoid of any distinct notch.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Tashiding forest. Sikkim : East Sikkim Dist.: Rongpo; South Sikkim Dist.: Dumthang Basti near Namchi. Assam. Madhya Pradesh.

Elsewhere: Bangladesh : Chittagong Hill : Rangamati. Burma. South China (Yunnan).

Remarks : A species, described (Silvestri, 1922) under *Capritermes* had been transferred (Krishna, 1965) to *Pericapritermes* with which *Capritermes orientalis* Mathur and Sen-Sarma had been synonymised (Krishna, 1968). The species has its distribution in the adjoining countries of the eastern India, inhabiting mostly in decaying stumps and logs. Like *P. durga*, it is also a larger species and keeps its identity separate from all other Himalayan ones in having 4 bristles on each tergite and blunt tips of right mandibles of soldiers.

58. *Malaysiocapritermes holmgreni* (Akhtar) (Fig. 58, Table 40)

1. *Procapritermes holmgreni* Akhtar

1975. Akhtar, *Bull. Dept. Zool. Univ. Punjab*. (N.S.), Art 7 : 179-183, 194. Im. and S. Holotype : S., in PU. Type-locality : Dariadighi Forest, Bangladesh.

2. *Malaysiocapritermes holmgreni* (Akhtar)

1981. Ahmad and Akhtar, *Pakistan J. Zool.*, 13(1-2) : 10.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 368-372 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 75-76. Arunachal Pradesh.

Material studied : Identified : From *Eastern Himalaya* : Sev. S. and W., Lake Ganga, Itanagar, Arunachal Pradesh, coll. O.B. Chhotani, 15.v.1989, det. G. Bose.

Diagnostic Character : (i) Imago : Known from Bangladesh, but not represented from the Himalaya, hence not dealt with.

(ii) Soldier (Fig. 58a-c) : Head bright yellow, paler anteriorly; body creamy white. Head moderately and body densely hairy.

Head rectangular, sides weakly convex; slightly longer than wide. Fontanelle transverse, situated

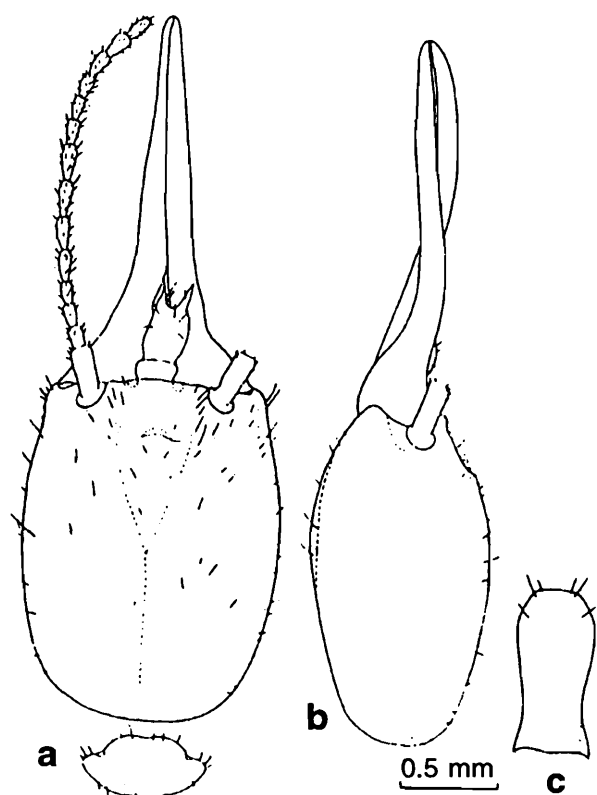


Fig. 58. : *Malysiocapritermes holmgreni* (Akhtar); a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

anteriorly a little below base of slope of frons, frons brownish. Antennae thin, elongate, with 14 segments, segment 2 and 3 subequal; 4 slightly shorter. Labrum subrectangular with deeply incurved anterior margin and with anterior lateral corners produced into long, pointed process and with a few hairs near anterior margin and on body. Mandibles weakly asymmetrical and pointed at tips longer than head-length. Postmentum short, club-like with a few hairs near anterior margin and a few short ones on body. Pronotum saddle-shaped, anterior margin convex with a very weak median notch and posterior margin without any notch.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : Lake Ganga, Itanagar. Meghalaya : Barapani, near Shillong.

Elsewhere : Bangladesh : Dariadighi Forest (type-locality).

Remarks : The species is so far known only from the eastern India and Bangladesh.

Table 40 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Malysiocapritermes holmgreni</i>	
	Sev. S.	Known Range
Length of head to lateral base of mandibles	1.50–1.66	1.49–1.66
Maximum width of head	1.10–1.26	1.08–1.23
Head index (width/length)	0.73–0.75	–
Maximum length of labrum	0.38–0.43	0.38–0.45
Maximum width of labrum	0.20–0.23	0.20–0.23
Length of left mandible (Upper base of condyle to tip)	1.76–1.88	1.75–1.90
Head-mandibular length Index (left mandible-length/head-length)	1.13–1.17	–
Minimum median length of postmentum	0.65–0.78	0.63–0.78
Maximum width of postmentum	0.33–0.39	0.33–0.38
Width of postmentum at waist	0.22–0.30	0.21–0.30
Maximum length of pronotum	0.17–0.19	–
Maximum width of pronotum	0.61–0.63	–
Pronotum index (length/width)	0.27–0.30	–
Number of antennal segments	14	14

Genus *Pseudocapritermes* KemnerKey to the species of genus
Pseudocapritermes Kemner

I. IMAGOS : Unknown in both the species.

II. SOLDIERS :

1. Left mandible with less hooked apex; head larger and narrower in comparison to length, length of head to base of mandibles 2.00-2.31 mm, maximum head-width, 1.23-1.36 mm (head index, 0.53-0.55); lateral sides of head substraight; mandibles shorter in comparison to head, left mandibular head index, 0.85-0.92 (0.82-0.87) *P. tikadari* Roonwal and Chhotani
- Left mandible with strongly hooked apex; head smaller and wider in comparison to length, length of head to base of mandibles 2.18 mm, maximum width of head 1.40 mm (head index, 0.64); lateral sides of head slightly convex; mandibles longer in comparison to head, left mandibular head index, 0.96 *P. bhutanensis* (Roonwal and Chhotani)

59. *Pseudocapritermes bhutanensis* (Roonwal and Chhotani)

(Fig. 59, Table 41)

1. *Procapritermes bhutanensis* Roonwal and Chhotani1977. Roonwal and Chhotani, *Ent. Basil.*, 2 : 60-61, S. Holotype : S., in NHM, Basel. Type-locality : Thimphu, 2300-2500 m altitude, Bhutan.1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 33.1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 377-379.

Material studied : Since material is not available, description, measurement etc. are based on Roonwal and Chhotani (1977).

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 59a-b) : Head golden yellow, somewhat reddish near base of mandibles and on sides; body creamy white. Head and body covered with fairly dense long hairs.

Head subrectangular, sides slightly convex. Fontanelle gland large and prominent. Median suture half marked. Antennae with 14 segments,

4 shortest. Labrum asymmetrical, anterior margin incurved. Mandibles asymmetrical, left mandible weakly bent and incurved in basal half, tip with a prominently incurved beak, portion below beak

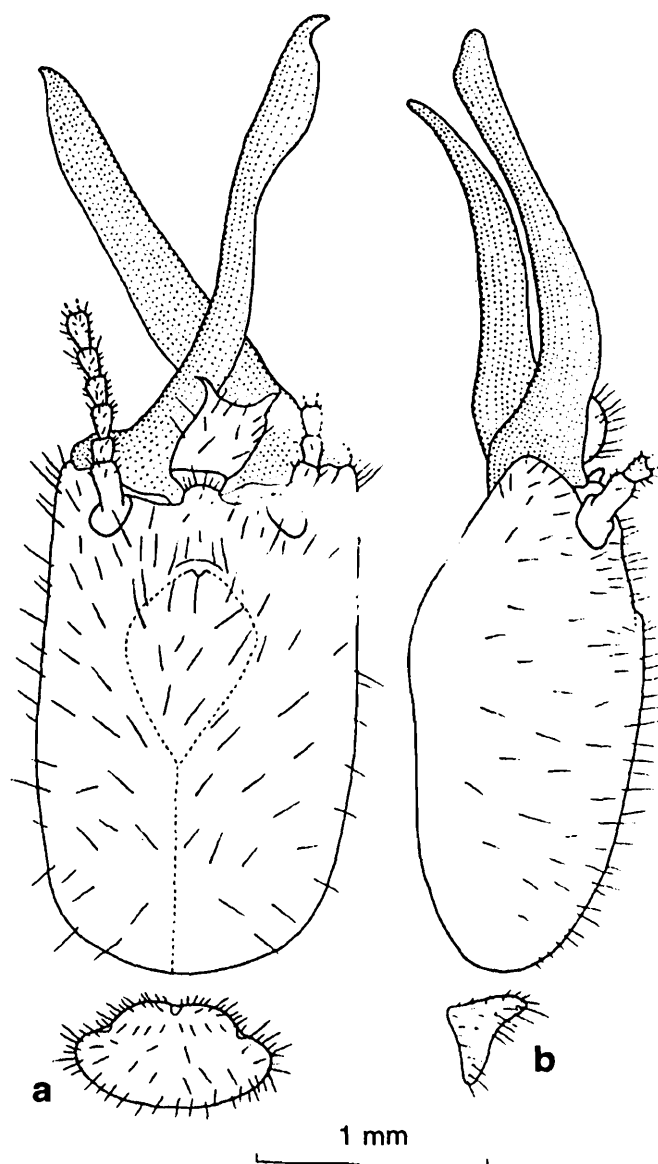


Fig. 59. : *Pseudocapritermes bhutanensis* Roonwal and Chhotani; a-b, Soldier. a. Head and pronotum, dorsal view; b. Head and pronotum, side view.

strongly swollen and substraight on inner margin, right mandibles blade-like, tip pointed and weakly incurved. Postmentum short, club-like. Pronotum saddle-shaped, anterior margin with distinct median notch; posterior margin with weak median emargination.

Distribution : BHUTAN : (Eastern Himalaya) : Thimpu (type-locality).

Remarks : The species is known so far only from its type-locality in the Eastern Himalaya.

60. *Pseudocapritermes tikadari* (Roonwal and Chhotani)
(Fig. 60, Table 41)

1. *Pseudocapritermes tikadari* Roonwal and Chhotani

- 1962a. Roonwal and Chhotani, *Proc. natnl. Inst., Sci., India*, (B) 28(4) : 319-323, pls. 20, 21 S. and W. Holotype : S., in ZSI. Type-locality : Cherrapunji, Meghalaya, India.
1986. Ping and Xu, *Wuyi Sci. J.*, 6 : 14, 20.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 384-387.
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 72-75. Arunachal Pradesh and Meghalaya.

2. *Procapritermes tikadari* Roonwal and Chhotani

1968. Krishna, *Bull. Am. Mus. nat. Hist.*, 138 (Art. 5) : 298, 300, 304.
1977. Roonwal and Chhotani, *Ent. Basil.*, 2 : 60, 62-63.
1995. Maiti *et al.*, *Rec. zool. Surv. India : State Fauna Series 4 : Fauna of Meghalaya*. Part 3 : 441.

3. *Pseudocapritermes planus* Mathur and Thapa

1965. Mathur and Thapa, *Bull. Ent.*, No. 6 : 12-13.
1968. Krishna, *Bull. Am. Mus. nat. Hist.*, 138(5) : 304 (synonymy).
1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 33.

Material studied : Identified : From *Eastern Himalaya* : S. and W., Seijusu, East Siang Dist., Arunachal Pradesh, coll. D.P. Sanyal, 10.x.1987, ex. "under stones", det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 60a) : Head straw yellow to brownish yellow and abdomen yellowish white. Head and pronotum sparsely and body fairly pilose.

Head subrectangular, length almost less than double the width, sides subparallel, posterior margin round, sometimes faintly incurved medially. Fontanelle transversely slit-like, leading into a small tube and a large gland. Antennae with 14 segments, 4 subequal to 2. Labrum asymmetrical, longer than broad, with sharply pointed antero-lateral corners, anterior margin incurved. Mandibles asymmetrical, a little shorter than head-length. Left mandible

twisted and incurved half at outer margin in basal, tip with a weak beak, inner margin with a tooth and a basal projection at basal fourth, right mandible blade-like, with straight pointed tip, inner margin weakly incurved medially. Postmentum long, club-shaped. Pronotum strongly saddle-shaped, anterior margin with a weak median notch and posterior margin weakly convex.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : East siang Dist. : Seijusu. Meghalaya : Cherrapunji (type-locality), Shillong. Assam. BHUTAN (*Eastern Himalaya*).

Remarks : So far the species is known as soil-dwelling form in the eastern hilly tracts of the Himalaya including the east Khasi Hill district. After its discovery in 1962a by Roonwal and Chhotani, Krishna (1968) had transferred the species to *Procapritermes* which had regained its original nomenclature (Chhotani, 1997). Less hooked apices of the left mandibles of soldiers of this species serve as the distinguishing character to that of strongly hooked apices of its allied species *P. bhutanensis* known from the Eastern Himalaya.

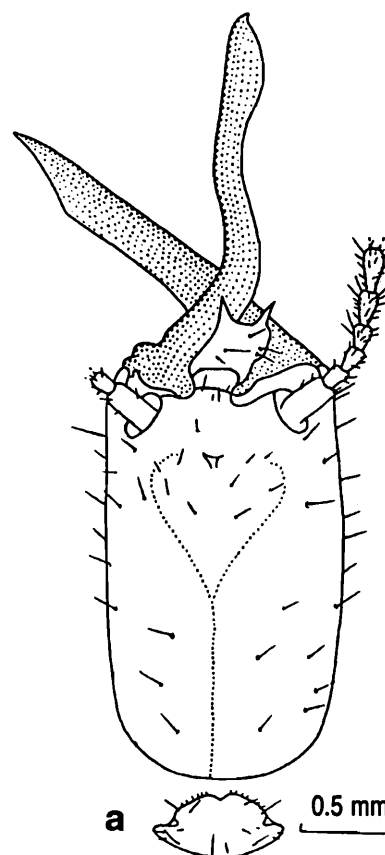


Fig. 60. : *Pseudocapritermes tikadari* Roonwal and Chhotani; a, Soldier. a. Head and pronotum, dorsal view.

Table 41 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Pseudocapritermes bhutanensis</i>		<i>P. tikadari</i>	
	Sev. S.	Known Range	Sev. S.	Known Range
Length of head to lateral base of mandibles	2.18	2.18	2.00–2.31	1.97–2.50
Maximum width of head	1.40	1.40	1.23–1.36	1.17–1.36
Head index (width/length)	0.64	0.64	0.53–0.55	–
Maximum length of labrum	0.33	0.33	0.35–0.47	0.35–0.46
Maximum width of labrum	0.30	0.30	0.24–0.30	0.23–0.30
Length of left mandible (Upper base of condyle to tip)	–	–	1.85–1.97	1.80–2.06
Head-mandibular length Index (left mandible-length/head-length)	0.96	0.96	0.85–0.92	0.82–0.87
Minimum median length of postmentum	0.83	0.83	–	1.07–1.23
Maximum width of postmentum	0.43	0.43	–	0.37–0.40
Width of postmentum at waist	0.35	0.35	–	0.20
Maximum length of pronotum	0.43	0.43	0.25–0.33	0.23–0.33
Maximum width of pronotum	0.83	0.83	0.70–0.74	0.70–0.80
Pronotum index (length/width)	0.52	–	–	–
Number of antennal segments	14	14	14	14

Genus *Macrotermes* HolmgrenKey to the species of genus *Macrotermes*
Holmgren

I. IMAGOS : Unknown from the Himalaya for all the species.

II. SOLDIERS MAJOR :

1. Antero-lateral corners of pronotum very narrowly rounded; head-length 3.60 mm (3.60–3.90 mm), head-width 2.90–3.00 mm
..... *M. khajuriai* Roonwal and Chhotani
- Antero-lateral corners of pronotum broadly rounded 2
2. Pronotum slightly narrower to almost as wide as head; lateral margins of thoracic tergites round; third segment of antennae as long as second or slightly longer; head-length 3.50–4.00 mm *M. gilvus* (Hagen)
- Pronotum much narrower than head; lateral margins of thoracic tergites angular; third segment of antennae much longer than second 3
3. Smaller species, head-length to base mandibles 2.80–3.00 mm (2.75–3.10 mm), head-width 2.32–2.43 mm (3.60–4.15 mm); mandibles

distinctly incurved with weakly incurved apices *M. aleemi* (Akhtar)

- Larger species; head-length to base of mandibles 4.00 mm (4.10–4.85 mm), head-width 3.75 mm (3.60–4.15 mm); mandibles distinctly incurved with pointed apices
..... *M. convulsionarius* (König)

III. SOLDIERS MINOR :

1. Pronotum a little narrower to almost as wide as head; lateral margins of thoracic tergites rounded *M. gilvus* (Hagen)
- Pronotum much narrower than head; lateral margins of thoracic tergites angular 2
2. Larger forms; head-length to base of mandibles 2.23–2.90 mm (2.20–2.90 mm), max. head-width 1.88–2.50 mm (1.88–2.51 mm)
..... *M. convulsionarius* (König)
- Smaller forms; head-length to base of mandibles less than 2.00 mm, max. head-width less than 1.65 mm 3
3. Labrum tip broadly rounded and short; antennae with 17 segments *M. aleemi* Akhtar
- Labrum tip pointed and long; antennae with 16 segments
..... *M. khajuriai* Roonwal and Chhotani

61. *Macrotermes aleemi* Akhtar
(Fig. 61, Table 42)

1. *Macrotermes aleemi* Chaudhry *et al.*
(nom. nud.)

1972. Chaudhry *et al.*, *Termites of Pakistan* (Final Tech. Rep. PL. 480 Proj. No. A17-FS-58) : 21 (nom.nud.)
1975. Akhtar, *Bull. Dept. Zool. Univ. Panjab* (N.S.), Art. 7 : 61-65. S. maj. Holotype : S.maj., in PU. Type-locality : Ukhia, Bangladesh.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 402-404.
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 76-77, Arunachal Pradesh.

Material studied : Unidentified : From *Eastern Himalaya* : 1S. maj., 1S. minor, Itanagar, Arunachal Pradesh, coll. B. Nandi and S.K. Chakraborty, 14.vii.1985, ex. "soil" Identified : From *Eastern Himalaya* : 1S. maj., 7S. minor and sev. W., Lake Ganga, Itanagar, Arunachal Pradesh, coll. O.B. Chhotani, 15.v.1989, det. G. Bose

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier : Dimorphic. (a) Soldier (major) (Fig. 61a-c) : Head pale reddish brown; abdomen yellowish white. Head almost devoid of hairs; thorax with scanty hairs.

Head broadly oval somewhat narrowed in front. Fontanelle dot-like, placed a little behind middle of head. Antennae incomplete in specimens available, segment 3 slightly longer than 2, 4 slightly shorter than 3. Labrum triangular, tip hyaline. Mandibles short and stout, length about half of head-length. Left mandible with crenulations and right without crenulations. Postmentum weakly saddle-shaped, anterior margin distinctly notched; posterior margin weakly emarginate, antero-lateral corners narrowly rounded.

(b) Soldier (minor) (Fig. 61d-f) : Head light reddish brown; pronotum yellowish brown. Head very sparsely and body scantily hairy, but more so than soldier major.

Head oval, narrowed anteriorly. Antennae with 17 segments, segment 2 about one and a half times of 3. Labrum triangular, longer than wide, tip hyaline, narrowly rounded. Mandibles long,

slender, comparative to head-length longer than in soldier major.

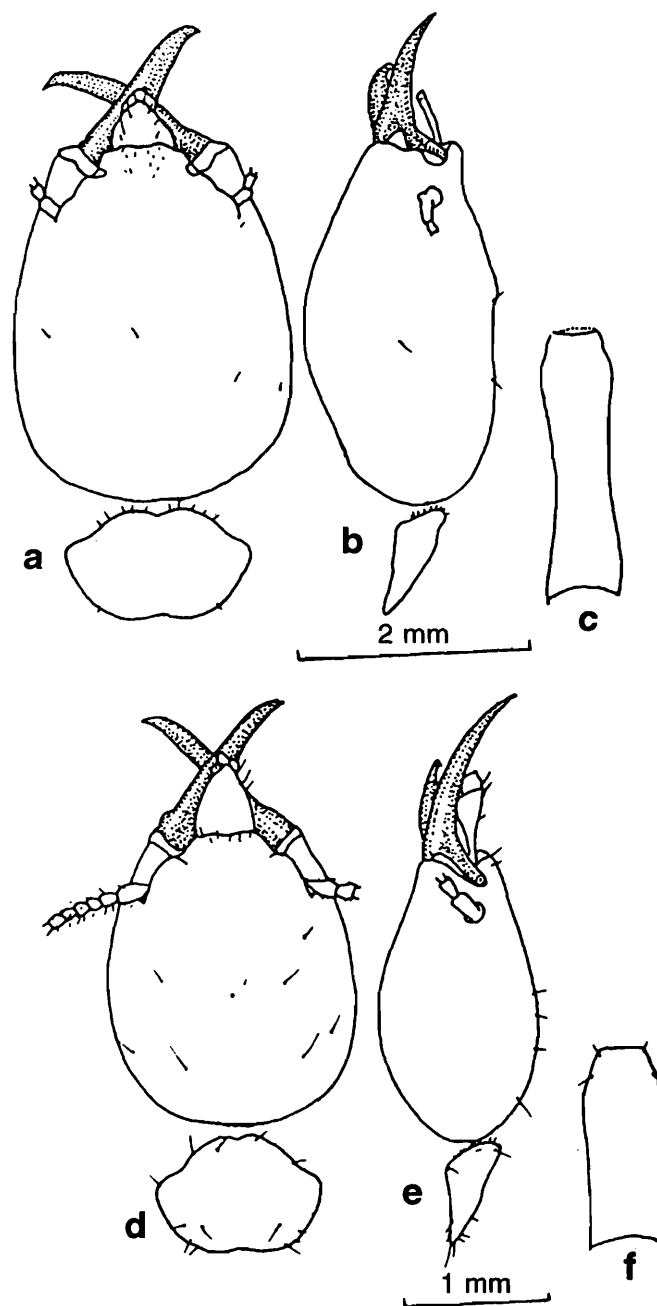


Fig. 61. : *Macrotermes aleemi* Akhtar; a-c, Soldier major. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Postmentum; d-f, Soldier minor. d. Head and pronotum, dorsal view; e. Head and pronotum, side view; f. Postmentum.

Left mandibles with a few crenulations basally. Postmentum sub-rectangular, comparatively wide than in soldier major. Pronotum as in soldier major but somewhat more rounded at lateral margins.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Upper Subansiri Dist. : Lemeking, Nacho; Lower Subansiri Dist.; Lake Ganga, Itanagar; West Siang Dist. : Along; Siang Division : Bame village.

Elsewhere : Bangladesh : Ukhia (type-locality).

Remarks : The species was first reported from Arunachal Pradesh in the Himalaya by Bose (1999), occurring in the soil.

62. *Macrotermes convulsionarius* (König) (Fig. 62, Table 43)

1. *Termes convulsionarli/convulsionarius* (König)

1779. König, *Beschaft.-Berlin Ges. Naturf. Freunde*, 4 : 24.

2. *Hodotermes convulsionarius* (König)

1858. Hagen, *Linn. Ent.*, 12 : 90-91.

3. *Macrotermes convulsionarius* (König)

1925. John, *Treubia*, 6 (3&4) : 385.

1984. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 49 : 160-162.

1987. Bose and Das, *Fauna of Orissa*, Pt. 1, *State Fauna Sr.* 1 : 105, 109.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 408-412 (detailed synonymy).

4. *Termes estherae* Desneux

1908. Desneux, *Ann. Soc. Ent. Belg.*, 51(12) : 390.

1917. Holmgren and Holmgren, *Mem. Dept. agric. Sci.*, 5 : 145-146. Treats *convulsionarius* as a synonym of *estherae*.

5. *Macrotermes estherae* (Desneux)

1949. Snyder, *Smiths. misc. Colls.*, 112 : 211 (synonymy).

1970a. Roonwal, In : *Biology of Termites* (Eds. Krishna and Weesner) Vol. 2 : 357.

1982. Bose and Das, *Rec. zool. Surv. India*, 80 : 200, 205, 211.

Material studied : Identified : From *Eastern Himalaya* : 1S. (maj.), 11S. (min.) and 2W., Tashiding forest, five km North-East of Teesta bridge, Darjiling Dist., W.B., coll. P.K. Maiti, 2.xi.1966, ex. "soil under decaying log", det. P.K. Maiti.

Diagnostic Character : (i) Imago : Unknown from the Himalaya, hence not dealt with.

(ii) Soldier : Dimorphic. (a) Soldier (major) (Fig. 62a-b) : Head pale reddish brown to brownish red; abdomen pale brown to brown. Head and

pronotum sparsely and body very sparsely hairy.

Head large, broadly oval, widest near middle and strongly narrowed in front. Fontanelle small, circular. Antennae with 17 segments, 3 much longer than 2. Labrum oval and tongue-shaped with a triangular hyaline tip. Mandibles short, stout, as long as $\frac{1}{2}$ of head-length. Postmentum subrectangular, a little wider posteriorly. Pronotum saddle-shaped, anteriorly weakly and posteriorly distinctly notched.

(b) Soldier (minor) (Fig. 62c-d) : Colour and hairiness as in soldier major. Head oval, sides strongly converging anteriorly. Antennae with 17 segments, 3 a little longer than 2; 4 equal to 2. Labrum triangularly tongue-shaped, with triangular hyaline tip. Mandibles thin, long, weakly incurved apically. Pronotum saddle-shaped, anteriorly not notched; clearly emarginate posteriorly.

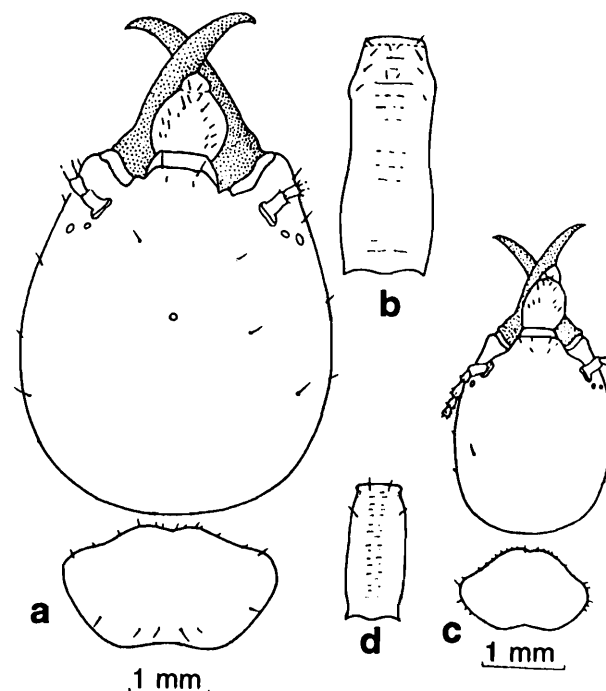


Fig. 62. : *Macrotermes convulsionarius* (König); a-b, Soldier major. a. Head and pronotum, dorsal view; b. Postmentum; c-d, Soldier minor. c. Head and pronotum, dorsal view; d. Postmentum.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Ghoomti, Sonada. Meghalaya. Orissa. Andhra Pradesh. Tamil Nadu. Kerala. Karnataka. Maharashtra.

Elsewhere : Sri Lanka.

Table 42 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Macrotermes aleemi</i>			
	<i>Soldier major</i>		<i>Soldier minor</i>	
	2S.	Known Range	7S.	Known Range
Length of head to lateral base of mandibles	2.80–3.00	2.75–3.10	1.83–2.00	1.84–2.05
Maximum width of head	2.32–2.43	2.30–2.40	1.45–1.63	1.43–1.65
Head index (width/length)	0.81–0.82	–	0.79–0.81	–
Maximum length of labrum	–	–	–	–
Maximum width of labrum	–	–	–	–
Length of left mandible (Upper base of condyle to tip)	1.20–1.42	1.43–1.45	1.01–1.20	1.21–1.25
Head-mandibular length Index (left mandible-length/head-length)	0.47	0.47–0.52	0.60	0.608–0.610
Minimum median length of postmentum	1.90–2.12	1.91–1.95	1.18–1.26	1.17–1.22
Maximum width of postmentum	0.62–0.65	0.61–0.65	0.46–0.50	0.46–0.51
Width of postmentum at waist	0.44	0.43	–	–
Maximum length of pronotum	0.78–0.98	0.76–0.98	0.64–0.76	0.61–0.73
Maximum width of pronotum	1.50–1.63	1.48–1.65	1.06–1.15	1.04–1.15
Pronotum index (length/width)	0.52–0.60	–	0.60	–
Number of antennal segments	–	Incomplete in specimen available	17	17

Table 43 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Macrotermes convulsionarius</i>			
	<i>Soldier major</i>		<i>Soldier minor</i>	
	1S.	Known Range	11S.	Known Range
Length of head to lateral base of mandibles	4.00	4.10–4.85	2.23–2.90	2.20–2.96
Maximum width of head	3.75	3.60–4.15	1.88–2.50	1.88–2.51
Head index (width/length)	0.93	–	0.84–0.86	–
Maximum length of labrum	–	–	–	–
Maximum width of labrum	–	–	–	–
Length of left mandible (Upper base of condyle to tip)	2.00	2.20–2.40	1.50–1.57	1.50–1.60
Head-mandibular length Index (left mandible-length/head-length)	0.50	0.49–0.53	0.67	0.65–0.80
Minimum median length of postmentum	2.18	2.90–3.10	1.56	–
Maximum width of postmentum	1.10	1.10–1.25	–	–
Width of postmentum at waist	–	–	–	–
Maximum length of pronotum	1.50	1.26–1.60	0.90–1.00	0.88–1.05
Maximum width of pronotum	2.57	2.60–2.93	1.50–1.85	1.48–1.86
Pronotum index (length/width)	0.58	–	0.60	–
Number of antennal segments	17	17	17	17

Remarks : This is the largest species of the genus and is predominantly found in Sri Lanka and South India. It is known sparsely in the sub-Himalaya and Meghalaya. The species is easily recognized by the characteristic transverse weak wrinkles on the surface of postmentum (Maiti *et al.*, 1995). Its subterranean nest is indicated by the presence of earthen hillocks of about 2.8 cm height (Roonwal, 1970a).

63. *Macrotermes gilvus* (Hagen)

(Fig. 63, Table 44)

1. *Termes gilvus* Hagen

1858. Hagen, *Linn. Ent.*, 12 : 148-151, Pl. 3 (Fig. 14). Im., Q., S. maj., S. min. Syntypes : In Coll. Selys Longchamps, Brussels, Mus. Vienna, Mus. Berlin. Type-locality : Java, Indonesia.

2. *Macrotermes gilvus* (Hagen)

1949. Snyder, *Smiths. misc. Colls.*, 112 : 111 (detailed synonymy).

1958a. Ahmad, *Biologia*, Lahore, 4(1) : 93, 94-95, 96.

1965. Krishna, *Am. Mus. Novit.*, No. 2210 : 20-21 (detailed synonymy).

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 19, 25, 91-92.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 412-417.

Material studied : Unidentified : From *Eastern Himalaya* : Two vials from Nazeok, Darjiling Dist., W.B., coll. G.K. Srivastava & P.K. Maiti, 22.xii.1973, ex. 'under logs' as follows : (i) 3S. (maj.) and 5S. (min.) and 12W.; (ii) 2S. (maj.) and 10W. Two vials from Samsing, Darjiling Dist., W.B., coll. G.K. Srivastava & P.K. Maiti, 24.xii.1973 as follows : (iii) 5S. and 8W., ex. 'soil under log' (F.C. No. 3/24.12.73); (iv) 2S. (maj.) and 4W. (F.C. No. 4/24.12.73). (v) 2S. (maj.) and 5S. (min), and 10W., around Rambhi, Darjiling Dist. West Bengal, coll. G.K. Srivastava & P.K. Maiti, 6.i.1974, ex. 'log' (F.C. No. 3/6.1.74).

Diagnostic Character : (i) Imago : Unknown from the Himalaya, hence not dealt with.

(ii) Soldier : Dimorphic. (a) Soldier (major) (Fig. 63a) : Head golden brown to reddish brown; thorax yellowish brown; abdomen a little paler

than thorax. Head and pronotum very sparsely hairy; labrum with long hairs on sides and a pair or two just below hyaline tip; pronotum with a few small hairs on anterior margin only.

Head subrectangular, sides converging in front. Fontanelle small, minute and circular. Antennae with 17-18 segments, 3 about 1.5 times longer than 4. Labrum triangular, with triangular hyaline tip. Mandibles short, stout and strong, length less than half of head-length. Postmentum long, with a long stalk or waist. Pronotum weakly saddle-shaped, distinctly emarginate both anteriorly and posteriorly, lateral margins outcurved, posterior margin concave.

(b) Soldier (minor) (Fig. 63b-d) : Head pale yellowish brown; body paler than head. Head very sparsely hairy, with a pair of hairs posteriorly and a pair or two just behind anteclypeus; pronotum with a few short hairs on anterior margin.

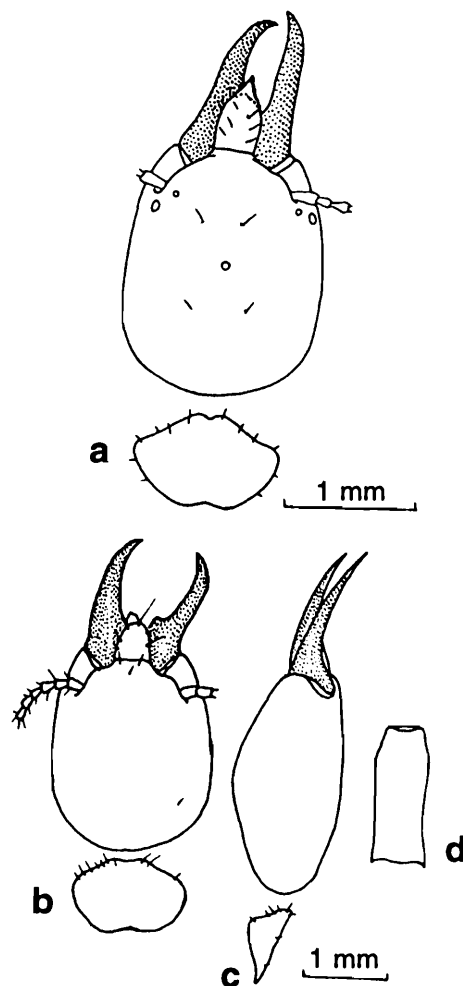


Fig. 63. : *Macrotermes gilvus* (Hagen); a, Soldier major. a. Head and pronotum, dorsal view; b-d, Soldier minor. b. Head and pronotum, dorsal view; c. Head and pronotum, side view; d. Postmentum.

Head subrectangularly oval, sides converging in front. Fontanelle minute and circular. Antennae with 17 segments, 3 a little longer than 2. Labrum triangular, with a hyaline, triangular and dome-shaped tip. Mandible thin, long, slender and straight, slightly longer than half of head-length. Postmentum subrectangular. Pronotum weakly saddle-shaped, emarginate both at anterior and posterior margins, lateral margins rounded.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Nazeok, Samsing, around Rambh.

Elsewhere : Myanmar. Singapore. Indonesia (Java, Sumatra, Borneo). Malaysia. Vietnam. Kampuchea and Thailand.

Remarks : The narrower pronotum with broadly rounded antero-lateral corners of soldiers of the species keeps it separate from all other species known from the Himalaya. The species has a restricted distribution in moist hill forest in the Duars area in Darjiling District, being recorded from a rotten wood in Samsing (alt. 300 m). This is a highly variable species and is a common mound building termite of South-East Asia. However, its biology has been studied by various authors. Roonwal and Chhotani (1961a); Roonwal (1970a) described the mound of this species from Rangoon, Myanmar. Noirot (1959) provided an account of mound architecture in the Mekong River plains of Cambodia.

64. *Macrotermes khajuriae* Roonwal and Chhotani
(Fig. 64, Table 45)

1. *Macrotermes khajuriae* Roonwal and Chhotani

1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) 28(4) : 329-334, 395, Pls. 24-27, Holotype : S. major, in ZSI. Type-locality : Umsa, Nongkharai, Khasi and Jaintia Hills, Meghalaya, India.

1977. Roonwal and Chhotani, *Ent. Basil.*, 2 : 67, 68.

1985. Chhotani and Bose, *Rec. zool. Surv. India*, 82(1-4) : 58.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 421-425 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 77-80.

Material studied : Unidentified : From *Eastern Himalaya* : 1S. (maj.) and 1S. (min.) and 7W., Nazeok, Darjiling Dist., W.B., coll. G.K. Srivastava & P.K. Maiti, 23.xii.1973, ex. "soil under log"

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier : Dimorphic. (a) Soldier (major) (Fig. 64a-b) : Head brownish yellow; pronotum paler. Head and thorax sparsely and abdomen moderately hairy. Each abdominal tergite with a row of hairs on posterior margin and with a few scattered hairs.

Head large, subrectangular, longer than wide with feebly outcurved sides. Fontanelle minute, placed slightly above the middle. Antennae with 17 segments, 3 longer than 2. Labrum subtriangular with a sharp hyaline tip. Mandibles thick, stout, sabre-shaped, almost half the head-length. Postmentum long and weakly narrowed behind the middle. Pronotum weakly saddle-shaped, anterior lobe slightly raised, antero-lateral angles prominently narrowed, both anterior and posterior margins convex and with median emarginations.

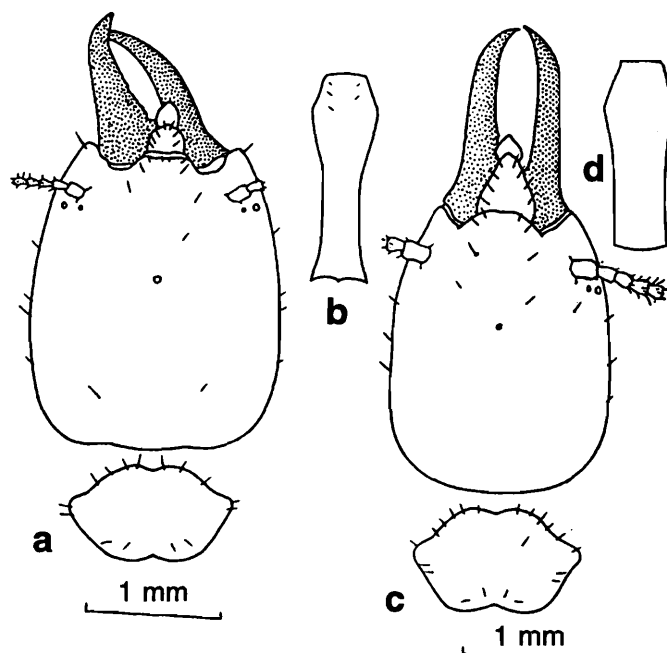


Fig. 64. : *Macrotermes khajuriae* Roonwal and Chhotani; a-b, Soldier major. a. Head and pronotum, dorsal view; b. Postmentum; c-d, Soldier minor. c. Head and pronotum, dorsal view; d. Postmentum.

(b) Soldier (minor) (Fig. 64c-d) : Head as in soldier major in colouration; body paler than head. Head and thorax sparsely and body moderately hairy.

Table 44 : Measurements (in mm) etc. of Caste–Soldier.

	<i>Macrotermes gilvus</i>			
	<i>Soldier major</i>		<i>Soldier minor</i>	
	5S.	Known Range	5S.	Known Range
Length of head to lateral base of mandibles	3.50–4.00	3.24–4.00	1.94–2.40	1.82–2.43
Maximum width of head	2.40–3.00	2.36–3.42	1.45–2.00	1.43–2.00
Head index (width/length)	0.75	0.76–0.88	0.74–0.83	0.76–0.83
Maximum length of labrum	–	–	–	–
Maximum width of labrum	–	–	–	–
Length of left mandible (Upper base of condyle to tip)	1.30–2.00	1.42–2.02	1.20–1.55	1.14–1.50
Head-mandibular length Index (left mandible-length/head-length)	0.50	0.45–0.49	–	0.52–0.55
Minimum median length of postmentum	–	2.04–2.86	1.18–1.56	1.14–1.61
Maximum width of postmentum	–	0.62–0.95	0.50–0.62	0.46–0.60
Width of postmentum at waist	–	0.43–0.64	–	0.41–0.57
Maximum length of pronotum	–	1.05–1.35	0.65–0.94	0.60–0.88
Maximum width of pronotum	1.95–2.50	1.93–2.60	0.98–1.25	0.95–1.13
Pronotum index (length/width)	–	–	0.66–0.75	–
Number of antennal segments	17	17–18	17	17

Table 45 : Measurements (in mm) etc. of Caste–Soldier.

	<i>Macrotermes khajurali</i>			
	<i>Soldier major</i>		<i>Soldier minor</i>	
	1S.	Known Range	1S.	Known Range
Length of head to lateral base of mandibles	3.60	3.50–3.90	1.80	1.80–2.00
Maximum width of head	2.90	2.85–3.00	1.50	1.45–1.57
Head index (width/length)	0.80	0.76–0.80	–	0.79–0.80
Maximum length of labrum	0.70	0.65–0.75	0.45	0.45
Maximum width of labrum	0.63	0.63–0.65	0.38	0.38
Length of left mandible (Upper base of condyle to tip)	1.65	1.60–1.70	1.22	1.20–1.25
Head-mandibular length Index (left mandible-length/head-length)	0.45	0.43–0.47	–	0.63–0.64
Minimum median length of postmentum	2.52	2.50–2.63	–	–
Maximum width of postmentum	0.81	0.80–0.83	–	–
Width of postmentum at waist	0.58	0.55–0.60	–	–
Maximum length of pronotum	1.12	1.00–1.13	0.64	0.63–0.72
Maximum width of pronotum	2.00	1.78–2.03	1.00	1.00–1.10
Pronotum index (length/width)	–	–	–	–
Number of antennal segments	17	17	16	16

Head subrectangular, sides weakly convex, slightly converging in front in anterior fourth. Fontanelle as in soldier major but smaller. Antennae with 16 segments, 3 shorter than 2. Mandibles thin, long, sabre-shaped, weakly incurved at apices, slightly longer than half of the head-length. Postmentum elongate with incurved sides, minimum width at the middle. Pronotum as in soldier major.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Gailikhol Forest, Teesta Valley Forest, Tashiding Forest and Nazeok. Arunachal Pradesh : Kameng Dist. : Denling Forest; Lower Subansiri Dist. : Kimin; West Siang Dist. : Sirum Bridge, Kumbung, New Jinning and road to Along; Tirap Dist. : Miao Reserve Forest. Meghalaya : Barapani; Lower Mawprem; Tura Peak and Umsa, Nongkharai (type-locality). Mizoram : Fwipak. Assam.

Remarks : The species is predominantly found in the north-eastern India including the Himalayan range. It is generally found in the mud-plaster around the log lying on soil in Meghalaya (Maiti *et al.*, 1995) and as well as in the study area. Maiti (1983) recorded the species in close association with *Odontotermes parvidens* in the Darjiling.

Genus *Odontotermes* Holmgren

Key to the species of genus *Odontotermes* Holmgren

I. IMAGOES :

1. Postclypeus much shorter than $\frac{1}{2}$ its width....2
 - Postclypeus almost as long as $\frac{1}{2}$ its width ... 5
2. Head-width more than 2.50 mm-2.80 mm
 - *O. parvidens* Holmgren and Holmgren
 - Head-width upto 2.40 mm 3
3. Eyes larger (max. diameter 0.65-0.70 mm) and strongly projecting out; ocelli also larger (long diameter 0.30-0.38 mm, short diameter 0.23-0.28 mm) and placed closer to eyes, eye-ocellus distance less than half of short diameter *O. globicola* (Wasmann)
 - Eyes smaller (max. diameter 0.53-0.58 mm) and less so projecting out; ocelli smaller (long

diameter 0.21-0.25 mm, short diameter 0.20 mm) and placed farther from eyes, eye-ocellus distance equal to short diameter or more 4

4. Wings darker, dusky, smoky brown and shorter (Forewing-length 20.0-22.5 mm); microsculpture of wings consists of more wavy and thicker cuticular rods. Head a little narrower (width 2.20-2.35 mm).... *O. assmuthi* Holmgren
 - Wings paler, pale brown and longer (forewing-length 23.5-24.0 mm); microsculpture of wings consists of less wavy and thinner cuticular rods; head wider (width 2.30 -2.40 mm)
..... *O. giriensis* Roonwal and Chhotani
5. Head-width with eyes upto 2.4 mm
..... *O. bhagwati* Chatterjee and Thakur/
..... *O. horai* Roonwal and Chhotani
 - Head-width with eyes more than 2.40 mm.....6
6. Ocelli separated from eyes by less than their short diameter 7
 - Ocelli separated from eyes by about their short diameter 8
7. Head-width with eyes 2.63 mm (2.40-2.70 mm), head-length to base of mandible 1.80 mm (1.85-2.55 mm), min. diameter of eyes less (0.53-0.58 mm). Pronotum larger, length 1.38 mm (1.30-1.48 mm), width 2.38 mm (2.30-2.60 mm); radial streak in wing present
..... *O. obesus* (Rambur)
 - Head-width with eyes 2.63 mm (2.30-2.60 mm), head-length to base of mandibles 1.85 mm (1.70-1.85 mm), min. diameter of eye more (0.60-0.75 mm). Pronotum smaller, length 1.25 mm (1.05-1.28 mm), width 2.25 mm (2.00-2.43 mm); radial streak absent
..... *O. redemanni* (Wasmann)
8. Smaller forms; head-width with eyes 2.50-2.70 mm; pronotum width 2.20-2.58 mm and pronotum length 1.13-1.35 mm
... *O. microdentatus* Roonwal and Sen-Sarma
 - Larger forms; head-width with eyes 2.6-2.90 mm; pronotum width 2.3-2.66 mm and pronotum length 1.3-1.53 mm 9
9. Forewing length 21.0-23.0 mm
..... *O. feae* (Wasmann)
 - Forewing length 23.0-24.0
..... *O. horni* (Wasmann)

II. SOLDIERS :

1. Larger species; head-length to lateral base of mandibles more than 2.00 mm 2
- Smaller species, head-length to lateral base of mandibles less than or about 2.00 mm 4
2. Left mandible with a minute tooth and situated at basal third of mandible
..... *O. parvidens* (Holmgren and Holmgren)*
- Left mandibular tooth not minute, rather larger and situated on or near the middle of mandible 3
3. Left mandibular tooth placed near the middle [mandible-tooth index : 0.50-0.56 (0.50-0.54); head-capsule widest near the posterior third, sides weakly but distinctly converging anteriorly; labrum triangular, with a sharp tip; head-length 2.53-3.00 mm (2.25-3.10 mm), max. width 2.12-2.45 mm (1.80-2.50 mm) ...
..... *O. feae* (Wasmann)
- Left mandibular tooth placed near proximal end of middle one-third [mandible-tooth index : 0.57-0.64 (0.56-0.60)]; head capsule widest almost at the middle, sides parallel, indistinctly converging anteriorly; head-length 2.50-3.00 mm (2.47-3.00 mm), max. head-width 1.85-2.20 mm (1.80-2.30 mm)
..... *O. horni* (Wasmann)
4. Distal segments of antennae distinctly darker than proximal segments 5
- Distal segments of antennae not darker than the proximal segments, rather uniformly coloured 14
5. Postmentum extraordinarily wide, sides strongly outcurved; left mandibular tooth situated anterior to distal third (mandible-tooth index 0.21-0.27) 6
- Postmentum not extraordinarily wide, sides subparallel to weakly outcurved; left mandibular tooth situated at about distal third (mandible-tooth index : 0.30-0.40) 9
6. Species smaller, head-length to base of mandibles 0.90-1.03 mm (mandible length 0.60-0.69 mm, tooth distance from tip 0.13-0.15 mm; (mandible-tooth index 0.21-0.25)
..... *O. globicola* (Wasmann)
- Species larger, head-length to base of mandible 1.18-1.58 7
7. Head broadly oval, head-length to base of mandibles 1.40-1.62 mm (1.38-1.58 mm), max. width of head 1.30-1.40 mm (1.33-1.38 mm); mandibles almost half the head-length, mandible-head index (mandible length/head-length) 0.51-0.52
..... *O. kapuri* Roonwal and Chhotani
- Head not broadly oval, head-length to base of mandibles 1.18-1.40 mm, max. width of head 1.00-1.20 mm; mandibles slightly longer than half the head-length, mandible-head index (mandible length/head-length) 0.56-0.60 8
8. Generally smaller species; head-length to base of mandibles 1.15-1.30 mm (1.18-1.35 mm); max. width of head 1.05 -1.13 mm (1.00-1.20 mm); tooth of left mandible more forwardly placed, mandible-tooth index : 0.27 (0.21-0.26); postmentum not very wide, lateral side less outcurved, length 0.70-0.85 mm (0.70-0.83 mm), width 0.50-0.60 mm
..... *O. giriensis* Roonwal and Chhotani
- Generally larger species; head-length to base of mandibles 1.30 mm (1.28-1.40 mm), max. width of head 1.13 mm (1.13-1.15 mm); tooth of left mandible less so forwardly placed, mandible-tooth index : 0.269 (0.25-0.27); postmentum very wide, lateral side prominently outcurved, length 0.75 mm (0.75-0.87 mm), width 0.59 mm (0.55-0.63 mm) ...
..... *O. prolatigula* Bose
9. Left mandibular tooth situated in front of distal third (mandible-tooth index : 0.26-0.33) [mandibles generally shorter and stouter (head and entire body densely pilose); head and body more hairy; antennae with 15-16 segments; labrum broadly rounded at anterior margin; postmentum not so wide, lateral sides convex] *O. guptai* Roonwal and Bose
..... *O. bellahunisensis* Holmgren and Holmgren
- Left mandibular tooth situated at distal third or a little behind distal third, mandibular-tooth index : 0.33-0.46 10

*The species is very similar to *O. distans* Holmgren and Holmgren on the basis of which Thakur (1981) synonymised it with *O. distans*. However, Bose (1984) gave it independent status which had further been substantiated by Chhotani (1997)

10. Left mandibular tooth rudimentary; mandibles substraight, long and slender and with weakly incurved apices; postmentum with sides weakly outcurved *O. microdentatus* Roonwal and Sen-Sarma
- Left mandibular tooth large; mandibles strong, sabre-shaped and with weakly to deeply incurved apices; postmentum with sides almost parallel 11
11. Head-capsule subrectangular; mandibular tooth large and placed near the distal end of the middle one-third portion *O. brunneus* (Hagen)
- Head capsule rectangular-oval to suboval, left mandibular tooth of medium size and placed near the apical third 12
12. Head capsule subrectangular with lateral sides almost parallel upto the base of antennae; mandibles longer, 0.75-1.00 mm (0.98-1.08 mm) *O. gurdaspurensis* Holmgren and Holmgren
- Head-capsule oval, distinctly narrowed anteriorly; mandibles of moderate length 13
13. Mandibles long, outer margin strongly incurved near the basal third, labrum longish; mandible-head index : 0.66-0.69 (0.69-0.79) *O. redemanni* (Wasmann)
- Mandible short, slender and with weakly incurved outer margin near the basal third; labrum short and broadly rounded anteriorly; mandible-head index : 0.60 (0.59-0.67) *O. obesus* (Rambur)
14. Tooth on the left mandible placed near the middle or below (tooth index : 0.50-0.56) ... 15
- Tooth on the left mandible placed near apical third or little below (tooth index : 0.32-0.40) 16
15. Head smaller in size, head-length 1.30-1.63 mm (1.25-1.75 mm), max. width of head 1.12-1.25 mm (1.10-1.38 mm); mandibles shorter, length 0.82-0.97 mm (0.80-1.02 mm); tooth on left mandible very small and rudimentary; antennae longer *O. bhagwatii* Chatterjee and Thakur
- Head larger in size, head-length 1.75-1.95 mm (1.65-2.00 mm), max. width of head 1.31-1.62 mm (1.28-1.65 mm); mandibles longer, length 1.05-1.20 mm (1.05-1.23 mm); tooth on left mandible more prominent; antennae shorter *O. horai* Roonwal and Chhotani
16. Postmentum strongly bulging out and only slightly longer than its width 17
- Postmentum less so bulging out and appreciably longer than its width 19
17. Smaller species, head-length to base of mandible, 1.00 mm (1.00-1.08 mm) and head-width 0.94 mm (0.92-0.95 mm) *O. proformosanus* Ahmad
- Larger species, head-length to base of mandible, 1.30-1.50 mm and head-width 1.10-1.30 mm 18
18. Head somewhat oval, mandibular tooth placed comparatively less towards apex, mandibular tooth index; 0.31-0.37 *O. boveni* Thakur
- Head somewhat round; mandibular tooth placed more towards apex, mandibular tooth index 0.27-0.32 *O. sikkimensis* Thakur and Rathore
19. Inner margin of left mandible anterior to tooth wavy (outcurved), parrot's beak like; head-capsule subrectangular, max. width somewhat posteriorly; head-length 1.45-1.53 mm, head-width 1.12-1.30 mm *O. assmuthi* Holmgren
- Inner margin of left mandible anterior to tooth not wavy; head-capsule subrectangularly oval, max. width more or less at the middle; head-length 1.15-1.30 mm, head-width 0.94-1.00 mm *O. adampurensis* Akhtar
65. *Odontotermes adampurensis* Akhtar
(Fig. 65, Table 48)
- Odontotermes adampurensis* Chaudhry *et al.*,
nom. nud.
1972. Chaudhry *et al.*, *Termites of Pakistan* (Final Tech. Rep. PL-480 Proj. No. A17-FS-12) : 23. nom. nud.
1975. Akhtar, *Bull. Dept. zool. Univ. Panjab* (N.S.), Art. 7 : 70, 71-73. S. only. Holotype : S., in PU. Type-locality : Adampur, Bangladesh.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 445-447.
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 82-83. Arunachal Pradesh.

Material studied : Unidentified : From **Eastern Himalaya** : 2S. and sev. W., Deban, Tirap Dist., Arunachal Pradesh, coll. P.K. Maiti, 18.xii.1983.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 65a-c) : Head yellowish to reddish brown; body yellowish to pale brown. Head sparsely and body fairly pilose.

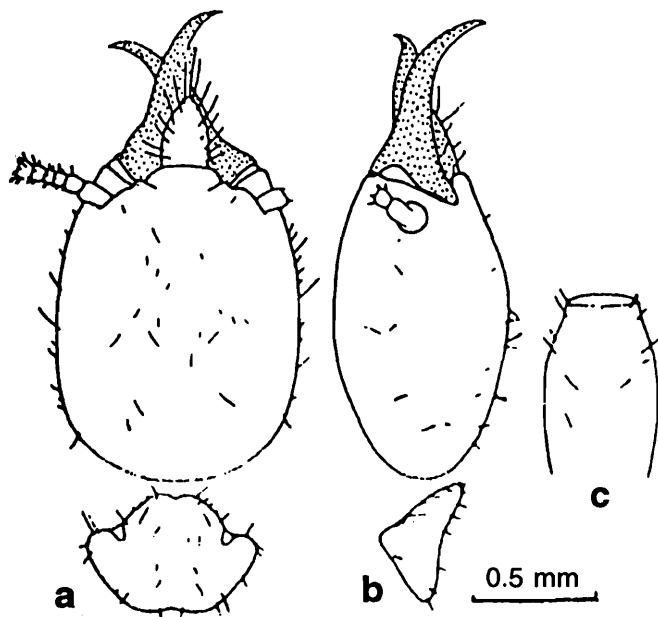


Fig. 65. : *Odontotermes adampurensis* Akhtar; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Postmentum.

Head somewhat ovoid, sides weakly convex, converging anteriorly. Antennae with 15-16 segments, 3 in 15 segmented and 4 in 16-segmented, shortest. Labrum tongue-shaped, sides weakly converging to a rounded tip, with a row of longer bristles on sides and a few minute hairs on body. Mandibles sabre-shaped, weakly incurved distally. Left mandible with a well developed tooth at about apical third. Postmentum a little longer than wide with convex sides. Pronotum strongly saddle-shaped, both anterior and posterior margins weakly notched.

Distribution : INDIA : **Eastern Himalaya** : Arunachal Pradesh : East Siang Dist.: Nambung, seven km from Ziro to Boleng; Tirap Dist. : Deban, Miao and Hornbill. Assam : Goalpara Dist., Bongaigaon. Meghalaya : Mawpahlong. Tripura : Ambasa.

Elsewhere : Bangladesh : Adampur (type-locality); Kaptai and Srimangal.

Remarks : The species is somewhat close to *O. assmuthi*, but differs in having more pointed apices of the mandibles and devoid of outcurved margin of inner margin between apex and tooth of left mandible. It is so far known from the north-east India and Bangladesh including the Himalaya, which was its first record from India (Bose, 1999).

66. *Odontotermes assmuthi* Holmgren (Fig. 66, Table 48)

1. *Odontotermes (Odontotermes) assmuthi/assmuthi* Holmgren

1913a. Holmgren, *J. Bombay nat. Hist. Soc.*, **22** (1) : 112-113. S. and W. Lectotype (selected A.E. Emerson): S., in Riksmus., Stockholm. Type-locality : Borivilli Jungles, Bombay, India.

2. *Odontotermes assmuthi* Holmgren

1967. Roonwal and Chhotani, *Zool. Anz.*, **178**(3/4) : 252-253, tab.

1981. Thakur, *Indian For. Rec. (N.S.) Ent.* **14**(2) : 10, 12, 16-21.

1989. Verma, *Indian J. Forestry*, **12** (4) : 298.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 449-453 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 83-84.

Material studied : Unidentified : From **Central Himalaya** : 3 Im., Amlekhjung, 35 km North of Birjung, Bara Dist., Nepal, coll. P. Mukherjee, 22.ix.2000, in the jungle of Sal and Amlaki. Identified: From **Western Himalaya** : 2S., 4W., Bijrani (Watch Tower), Naini Tal, Uttaranchal, coll. S.C. Verma, 11.vi.1976, det. S.C. Verma.

Diagnostic Character : (i) Imago : Head; pronotum and abdomen dark grayish brown; antennae; postclypeus and legs brown; wings dusky, smoky brown; sternites paler, medially whitish. Head and body densely pilose; wings hairy distally.

Head subround. Fontanelle minute. Ocelli broad, oval or round, separated from eyes by more than their long diameter. Antennae with 19 segments (rarely 20-segmented), 3 generally

shorter than 4, sometimes longer; 5 shortest. Postclypeus swollen with a faint median line. Pronotum trapezoidal, anterior margin with a faint median depression and posterior margin substraight. Radial streak of wing separating from radius almost at the middle, membrane covered with thick and more wavy rods.

(ii) Soldier (Fig. 66a) : Head pale yellow to brownish yellow; body straw yellow to pale yellowish brown. Head and pronotum sparsely and abdomen fairly moderately hairy.

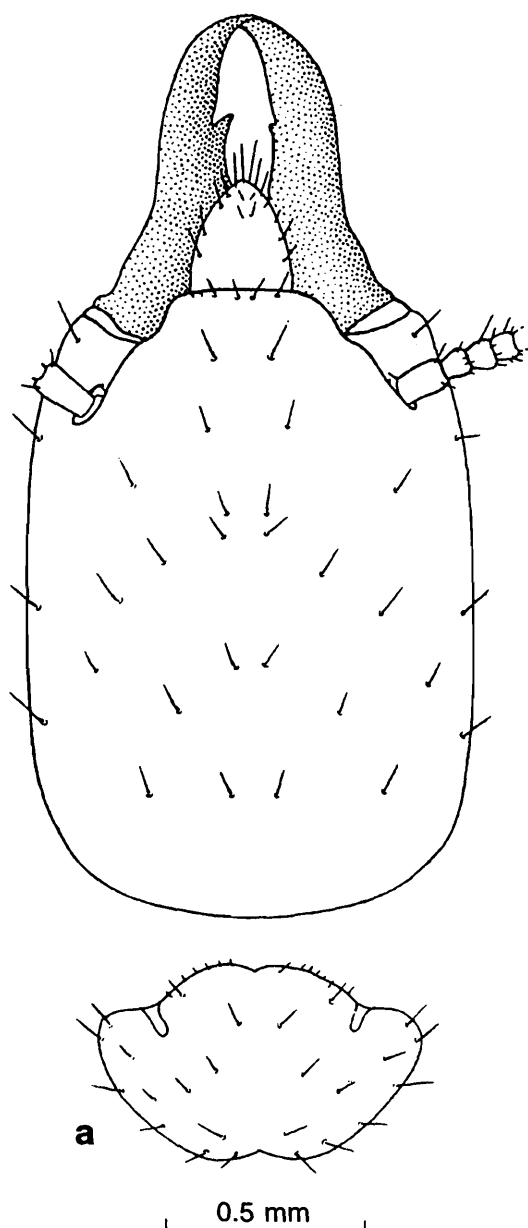


Fig. 66. : *Odontotermes assmuthi* Holmgren; a, Soldier. a. Head and pronotum, dorsal view.

Head subrectangular, sides weakly arched, slightly converging towards the base of mandibles. Antennae with 16 segments (rarely 17 segmented),

4 shortest. Labrum tongue-shaped, with sharp but round tip. Mandibles sabre-shaped, apically weakly incurved, very slightly longer than half of head-length. Left mandible with a distinct anteriorly directed tooth, a little below the apical third, inner margin between apex and tooth weakly outcurved. Postmentum subrectangular, broadest near the distal third. Pronotum saddle-shaped, anterior margin distinctly and posterior margin weakly notched.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Naini Tal Dist. : Bijrani (Watch Tower). Uttar Pradesh. West Bengal. Manipur. Bihar. Tamil Nadu. Karnataka. Maharashtra. Punjab. NEPAL: (*Central Himalaya*) : Bara Dist.: Amlekhjung, 35 km North of Birjung.

Elsewhere : Bangladesh. Pakistan.

Remarks : The species a closely allied species to *O. adampurensis*, is quite common in the Indian subcontinent inhabiting mostly in subterranean nest and extending its galleries to tree trunk, felled logs, wooden structure, poles, bamboo pieces, debris, etc. In Dehra Dun and Bombay, it swarms in June and July (Mathur and Sen-Sarma, 1962; Roonwal, 1970a) and in Dharwar in April-May towards evening time (Basalingappa, 1974). It is also known as serious pest of sugarcane setts (Pruthi and Narayan, 1939), in addition of attacking wood and bark of fallen logs including that of *Dalbergia sissoo* (Sen-Sarma *et al.*, 1975).

67. *Odontotermes bellahunisensis* Holmgren and Holmgren (Fig. 67, Table 48)

1. *Odontotermes (Cyclotermes) bellahunisensis* Holmgren and Holmgren

1917. Holmgren and Holmgren, *Mem. Dept. Agric. India*, 5(3) : 150-151. Im., S. and W. Lectotype : S., in ZSI. Type-locality : Bellahunisi, Bellary Dist., Karnataka, India.

2. *Odontotermes bellahunisensis* Holmgren and Holmgren

1961. Roonwal and Bose, *J. Bombay nat. Hist., Soc.*, 58(3) : 580-588.

1981. Thakur, *Indian For. Rec. (N.S.) Ent.* 14 (2) : 4, 11, 12, 21-25, Synonymy, description, etc.

1989. Verma, *Indian J. Forestry*, **12**(4) : 297.
 1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50, Uttaranchal.
 1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 453-457 (detailed synonymy).

Material studied : Unidentified : From *Western Himalaya* : S. and W., Naini Tal, Uttaranchal, *coll. P.K. Maiti*, 8.x.1974, ex. "soil"

Diagnostic Character : (i) Imago : Known but not from the Himalaya, hence not dealt with.

(ii) Soldier (Fig. 67a-c) : Head pale yellowish brown to deep castaneous brown; thorax and body yellowish white. Head sparsely and body fairly densely hairy.

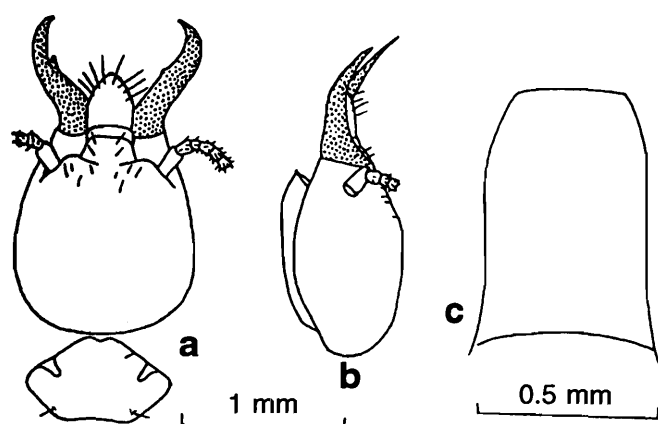


Fig. 67. : *Odontotermes bellahunisensis* Holmgren and Holmgren; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Head broadly oval, broadest posteriorly and narrowest in front. Antennae with 16-17 segments, 4 shortest in 16 segmented and 3 shortest in 17 segmented antennae. Labrum tongue-shaped, apically converging into somewhat blunt tip. Mandibles short, stout, sickle-shaped, with strongly incurved apices, much shorter than head-length. Left mandible with a large pointed tooth at distal third. postmentum subrectangular with weakly convex sides. Pronotum saddle-shaped, weakly notched anteriorly and substraight posteriorly.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Naini Tal Dist.; Almora Dist.; Pauri Dist. and Uttarkashi Dist. Bihar : Silodil. West Bengal. Assam : Silonijan Range, Golaghat.

Orissa. Tamil Nadu. Kerala. Karnataka : Bellary Dist.: Bellahunisi (type-locality). Rajasthan.

Remarks : The species comes very close to *O. obesus* and *O. redemanni* but differs in having very short and stout mandibles with strongly incurved apices of soldiers. Although the species is well known in many localities in the plains of India, it is not at all common in the Himalaya. Only a single population from Naini Tal was available for study. The species attacks logs, dry stumps of *Eucalyptus* and *Tectona grandis* in the Indian plains (Sen-Sarma *et al.*, 1975).

68. *Odontotermes bhagwatii* Chatterjee and Thakur (Fig. 68, Tables 46 and 49)

1. *Odontotermes bhagwatii* Chatterjee and Thakur

1967. Chatterjee and Thakur, *Indian For. Rec. (N.S.) Ent.*, **11**(1) : 6, 33-35, Pls. 3 and 4 S. and W. Holotype: S., in FRI. Type-locality : Pathankot, Panjab, India.
 1977b. Chhotani, *Rec. zool. Surv. India*, **72** : 373-376. Imago described.
 1981. Thakur, *Indian For. Rec. (N.S.) Ent.*, **14**(2) : 4, 11, 13, 25-30 Pls. 7, 50, 51.
 1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
 1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 457-460 (detailed synonymy).

Material studied : Unidentified : From *Western Himalaya* : 1 Im., 2S. and 5W., New Forest, Dehra Dun, Uttaranchal, *coll. Forest Entomologist*, 25.ix.1954, ex. "under log." Identified : From *Western Himalaya* : (i) 3S., 5W., C.N. Park, Sarapduli, Pauri Dist. Uttaranchal, *coll. S.C. Verma*, 25.vi.1976, *det. S.C. Verma* (ii) 2S., Ramgar, Naini Tal, Uttaranchal, *coll. R.N. Chopra*, 25.viii. 1975, *det. S.C. Verma*. (iii) 3S. 2W., Motichur forest, Dehra Dun, Uttaranchal, *coll. Raj Tilak and party*, 13.ix.1987, *det. S.C. Verma*.

Diagnostic Character : (i) Imago (Fig. 68a-b) : Head reddish brown to dark brown; labrum and postclypeus pale brown, paler than head; pronotum and legs a little paler than head; abdominal tergites

brownish, a little paler than postclypeus; sternites yellowish brown; wings pale brown. Head and body densely hairy.

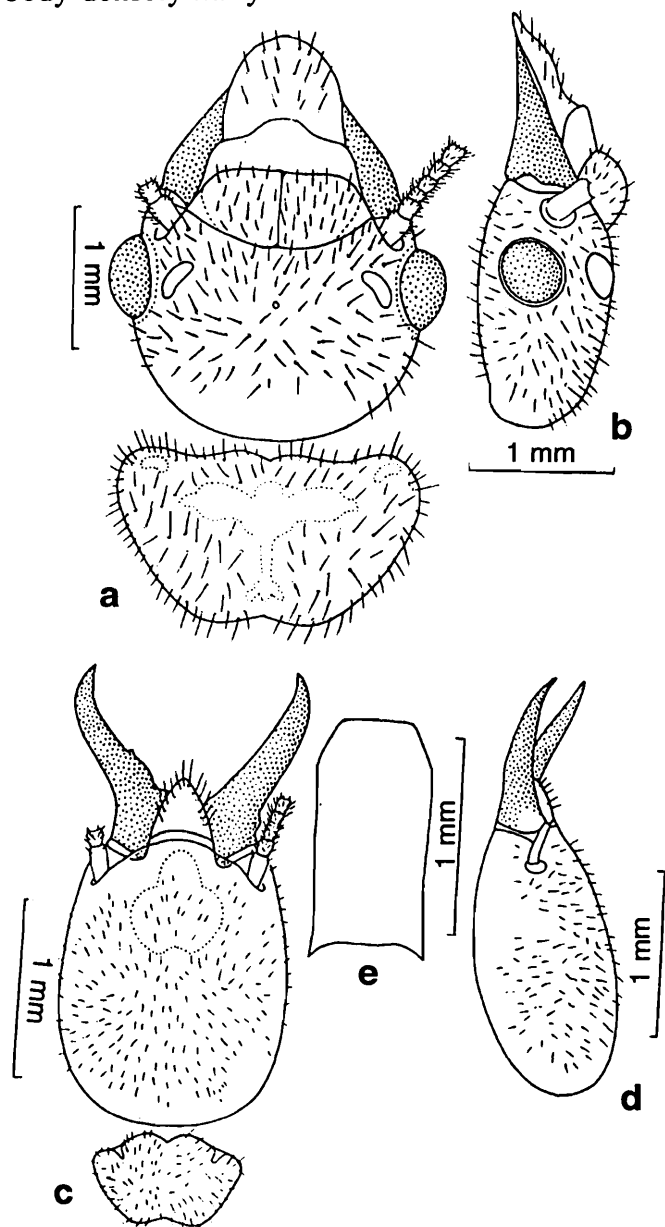


Fig. 68. : *Odontotermes bhagwatii* Chatterjee and Thakur; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-e, Soldier. a. Head and pronotum, dorsal view; d. Head, side view; e. Postmentum.

Head round, epicranial sutures indistinct. Fontanelle minute, point-like. Ocelli oval, moderately large, separated from eyes by about its short diameter. Antennae with 19 segments, 3-5 short and subequal, shorter than 2. Postclypeus swollen, with a faint median line. Pronotum subtrapezoidal, with a T-shaped, paler marking in middle and shoulder spots each on antero-lateral corners, anterior margin slightly incurved and with a distinct median notch; posterior margin weakly

emarginated medially. Radial streak of wing separating from radius from its proximal third to middle of membrane.

(ii) Soldier (Fig. 68c-e) : Head pale yellow to yellowish brown. Head and pronotum sparsely and body fairly densely hairy.

Head subrectangular. Antennae with 15 to 17 segments, 2 equal to 3+4 combined, 4 shortest. Labrum tongue-shaped, narrowed anteriorly to a pointed tip. Mandibles sabre-shaped, a little longer than half of the head-length. Left mandible with a small tooth, situated a little above basal one-third. Postmentum subrectangular, sides behind widest point substraight. Pronotum saddle-shaped, much narrower than head-width, anterior margin distinctly notched medially; posterior margin weakly to distinctly emarginate.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir. *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : New Forest, Motichur Forest (present record); Naini Tal Dist. : Ramgar; Pauri Dist. : C.N. Park, Sarapduli. Madhya Pradesh. Karnataka. Punjab : Pathankot (type-locality).

Remarks : The species is very similar in morphological characters of soldiers to *O. horai*, but differs in having smaller head, and rudimentary tooth on left mandible. It is found widely distributed in the North-Western and Western Himalaya, wherein it was described from material attacking railway sleepers at Pathankot (Punjab). It is a minor wood destroying termite and attacks of *Abies pindrow*, dead stumps and standing trees of *Pinus roxburghii*.

69. *Odontotermes boveni* Thakur (Fig. 69, Table 49)

Odontotermes boveni Thakur

1976. Thakur, *Indian Forester*, **102**(8) : 500, 502 (nom.nud.).

1981. Thakur, *Indian For. Rec. (N.S.) Ent.*, **14**(2) : 4, 12, 30-33, Pls. 8, 9, 50, 51. S. and W. Holotype : S., in FRI. Type-locality : Gwaldam, Garhwal, Uttaranchal, India.

1982. Verma and Thakur (R.K.), *Rec. zool. Surv. India*, **79** : 314.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 460-462.

Material studied : Unidentified : From *Western Himalaya* : Following 2 vials from forest around Niglit locality, Bhowali, Naini Tal Dist., Uttaranchal, coll. P.K. Maiti & party as follows : (i) 2S. and 1W., 8.x.1974, ex. 'soil under log'; (ii) 2S. and 8W., 7.x.1974, ex. 'stump.' B. From *Eastern Himalaya*: (iii) 4S. and 10W., Mal Forest, two km South-West of Garubathan, Darjiling Dist., W.B., coll. G.K. Srivastava & P.K. Maiti, 18.xii.1973, ex. 'stump' (F.C. No. 21/18.12.73). (iv) 2S. and 10W., Pedong, Darjiling Dist., W.B., coll. G.K. Srivastava & P.K. Maiti, 1.i.1974, ex. 'soil' (F.C. No. 4/1.1.74).

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 69a-c) : Head yellowish brown to dark rusty brown; thorax and abdomen creamy yellow. Head and pronotum sparsely and body thickly pilose.

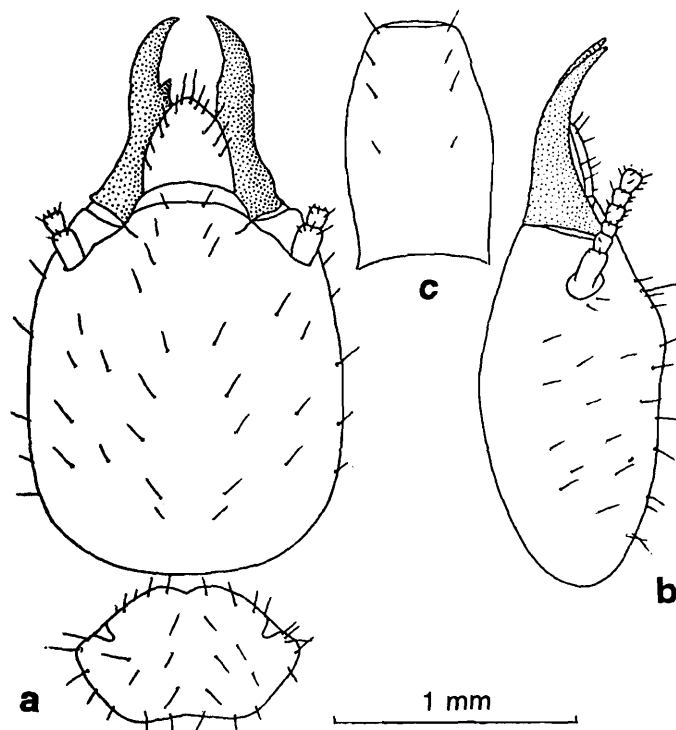


Fig. 69. : *Odontotermes boveni* Thakur; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Head oval, a little longer than wide. Antennae with 15-16 segments, 3 shortest in 15 segmented antennae and 4 a little longer than 3, 4 shortest in

16 segmented antennae and 2 equal to 3+4. Mandibles short, thick and stout, much shorter than head. Left mandible with a sharp, acute tooth at apical third. Postmentum swollen and arched at middle. Pronotum saddle-shaped, anterior lobe triangular with a deep median notch; posterior margin weakly emarginate medially.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Garhwal : Gwaldam (type-locality); Kumaon Hills : Kanda Dhar Forest, Askot; Naini Tal Dist. : Bhowali. *Eastern Himalaya* : West Bengal : Darjiling Dist. : Mal Forest, two km South-West of Garubathan, Pedong. Madhya Pradesh. NEPAL (*Central Himalaya*).

Remarks : The species is characterized by its wide and short postmentum of soldiers which brings *O. proformosanus* to its close similarity. However, the species is so far known from the hilly tracts of the Himalaya except a single record in Madhya Pradesh.

70. *Odontotermes brunneus* (Hagen)

(Fig. 70, Table 49)

1. *Termes brunneus* Hagen

1858. Hagen, *Linn. Ent.*, 12 : 133-135. Im., S. (?). Holotype : Im., in Museum Berlin. Type-locality : Bengal, India.

2. *Odontotermes brunneus* (Hagen)

1981. Thakur, *Indian For. Rec. (N.S.) Ent.*, 14(2) : 10, 12, 33-37.

1984. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 49 : 95, 165, 174-176.

1989. Verma, *Indian J. Forestry*, 12(4) : 298, 299.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 462-465 (detailed synonymy).

3. *Odontotermes mathadi* Roonwal and Chhotani

1964. Roonwal and Chhotani, *Beitr. Ent.*, 14 : 45-48.

1981. Thakur, *Indian For. Rec. (N.S.) Ent.*, 14(2) : 2, 33-37 (synonymy).

Table 46 : Measurements (in mm) etc. of Caste—Imago.

	<i>Odontotermes bhagwatii</i>		<i>O. globicola</i>		<i>O. horni</i>	
	1Im.	Known Range	Sev. Im.	Known Range	5Im.	Known Range
Total body-length with wings (excluding antennae), ca.	22.5	22.5–26.75	24.5–26.5	24.0–26.5	27.0–30.0	27.0–30.0
Total body length without wings (excluding antennae), ca.	10.5	10.0–13.5	12.6–14.0	12.5–14.0	13.0–14.2	13.0–14.2
Length of head to lateral base of mandibles	1.64	1.67–1.83	1.55–2.00	1.50–1.80	1.95–2.05	1.90–2.10
Maximum width of head (with eyes)	2.38	2.15–2.40	2.20–2.50	2.14–2.40	2.65–2.80	2.61–2.85
Maximum length of postclypeus	0.53	0.43–0.53	0.50	0.39–0.40	0.52–0.56	0.52–0.54
Maximum width of postclypeus	–	0.93–1.03	–	0.86–0.90	1.07–1.14	1.05–1.14
Maximum length of labrum	–	–	–	–	–	–
Maximum width of labrum	–	–	–	–	–	–
Maximum diameter of compound eye (with ocular sclerite)	0.57	0.55–0.60	0.65–0.70	0.65–0.70	0.70–0.72	0.70–0.73
Maximum diameter of lateral ocellus	0.23	0.23–0.33	0.30–0.38	0.30–0.38	0.30–0.31	0.29–0.32
Minimum diameter of lateral ocellus	0.17	0.15–0.23	–	0.23–0.28	–	0.25
Minimum eye-ocellus distance	0.18	0.15–0.20	0.10	0.08–0.10	0.21–0.25	0.20–0.25
Maximum length of pronotum	1.22	1.10–1.25	1.20	1.03–1.20	–	1.40–1.53
Maximum width of pronotum	2.06	1.83–2.30	2.20	1.95–2.13	–	2.52–2.66
Length of forewing with scale	21.3–23.0	21.2–23.1	–	20.0–21.3	23.2–24.0	23.0–24.0
Length of hindwing with scale	19.3–22.0	19.2–22.0	–	–	22.0–22.5	22.0–22.50
Number of antennal segments	19	19	19	19	19	19

Table 47 : Measurements (in mm) etc. of Caste—Imago.

	<i>Odontotermes microdentatus</i>		<i>O. obesus</i>		<i>O. redemanni</i>	
	10Im.	Known Range	1Im.	Known Range	1Im.	Known Range
Total body-length with wings (excluding antennae), ca.	28.0–30.0	27.8–30.0	27.0	26.0–31.0	28.5	25.0–29.0
Total body length without wings (excluding antennae), ca.	12.0–14.0	12.0–14.8	11.5	11.0–15.0	14.0	9.20–15.0
Length of head to lateral base of mandibles	1.70–1.98	1.70–2.00	1.80	1.85–2.55	1.85	1.70–1.85
Maximum width of head (with eyes)	2.38–2.65	2.55–2.70	2.63	2.40–2.70	2.63	2.30–2.66
Maximum length of postclypeus	–	–	–	–	–	–
Maximum width of postclypeus	–	–	–	–	–	–
Maximum length of labrum	–	–	–	–	–	–
Maximum width of labrum	–	–	–	–	–	–

Table 47 : (Cont'd.).

	<i>Odontotermes microdentatus</i>		<i>O. obesus</i>		<i>O. redemanni</i>	
	1Im.	Known Range	1Im.	Known Range	1Im.	Known Range
Maximum diameter of compound eye (with ocular sclerite)	0.75–0.79	0.75–0.80	0.76	0.65–0.78	0.75	0.70–0.75
Maximum diameter of lateral ocellus	0.32–0.35	0.30–0.36	0.32	0.30–0.38	0.35	0.25–0.36
Minimum diameter of lateral ocellus	–	0.16–0.20	–	0.23–0.30	0.24	0.18–0.25
Minimum eye-ocellus distance	0.18–0.20	0.18–0.20	0.18	0.15–0.20	0.17	0.12–0.18
Maximum length of pronotum	1.15–1.30	1.13–1.30	1.38	1.14–1.48	1.25	1.05–1.28
Maximum width of pronotum	2.30	2.20–2.30	2.38	2.28–2.60	2.25	2.02–2.43
Length of forewing with scale	25.0–27.0	25–27	22.0	21.4–25.5	25.0	24.0–25.0
Length of hindwing with scale	23.0–25.0	22.5–25.5	20.5	20.5–23.0	24.0	23.0–24.0
Number of antennal segments	19	19	19	19	19	19

Table 48 : Measurements (in mm) etc. of Caste–Soldier.

	<i>Odontotermes adampurensis</i>		<i>O. assmuthi</i>		<i>O. bellahunisensis</i>	
	2S.	Known Range	2S.	Known Range	Sev. S.	Known Range
Length of head to lateral base of mandibles	1.15–1.30	1.05–1.30	1.45–1.53	1.44–1.70	1.12–1.25	1.10–1.35
Maximum width of head	0.94–1.00	0.91–1.10	1.12–1.30	1.07–1.35	0.95–1.06	0.95–1.15
Head index (width/length)	0.82	–	0.84	–	0.84	0.81–0.93
Maximum length of labrum	–	–	0.32–0.35	0.35	0.31–0.35	0.30–0.35
Maximum width of labrum	–	–	0.25–0.28	0.30	0.25–0.28	0.28
Length of left mandible (Upper base of condyle to tip)	0.69–0.73	0.61–0.73	0.77–0.90	0.77–0.95	0.63–0.70	0.60–0.73
Head-mandibular length Index (Left mand.-length/head-length)	0.56–0.60	0.56–0.63	0.53–0.58	0.51–0.57	0.56	0.548–0.583
Left mandibular tooth distance (base of tooth to tip of mandible)	0.14–0.20	0.18–0.23	0.31–0.35	0.28–0.35	0.18–0.25	0.18–0.25
Left mandibular tooth Index (tooth distance/left mandible length)	0.27	0.28–0.30	0.38	0.33–0.37	0.28–0.35	0.27–0.33
Minimum median length of postmentum	0.64–0.75	0.63–0.78	–	0.94–1.25	0.65–0.73	0.60–0.75
Maximum width of postmentum	0.48–0.50	0.48–0.50	–	0.45–0.60	0.47–0.55	0.45–0.55
Width of postmentum at waist	–	–	–	–	–	–
Maximum length of pronotum	0.40–0.47	0.39	0.48–0.56	0.48–0.58	0.42–0.50	0.40–0.55
Maximum width of pronotum	0.68–0.82	0.65–0.82	0.81–0.92	0.75–0.95	0.70–0.87	0.70–0.90
Pronotum index (length/width)	–	–	0.59–0.61	–	0.57–0.60	–
Number of antennal segments	15–16	15–16	16	16 (rarely 17)	16–17	16–17

Table 49 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Odontotermes bhagwatii</i>		<i>O. boveni</i>		<i>O. brunneus</i>	
	3S.	Known Range	4S.	Known Range	1S.	Known Range
Length of head to lateral base of mandibles	1.30–1.63	1.25–1.75	1.35–1.53	1.30–1.53	2.00	1.50–2.00
Maximum width of head	1.12–1.25	1.10–1.38	1.28–1.32	1.15–1.33	1.53	1.28–1.50
Head index (width/length)	0.76–0.86	0.73–0.87	0.83	0.85–0.98	0.76	–
Maximum length of labrum	0.38	–	0.37	–	–	–
Maximum width of labrum	0.38	–	0.37	–	–	–
Length of left mandible (Upper base of condyle to tip)	0.82–0.97	0.80–1.02	0.75–0.80	0.73–0.80	0.97	0.90–1.10
Head-mandibular length Index (Left mand.-length/head-length)	0.59–0.63	0.55–0.66	0.52–0.53	0.52–0.60	–	0.56–0.62
Left mandibular tooth distance (base of tooth to tip of mandible)	0.50–0.80	0.408–0.816	0.23–0.28	0.226–0.280	0.38	0.33–0.45
Left mandibular tooth Index (tooth distance/left mandible length)	0.60	0.50–0.60	–	0.53–0.63	–	0.50–0.60
Minimum median length of postmentum	–	0.80–1.15	–	0.75–0.88	–	0.95–1.20
Maximum width of postmentum	–	–	0.59	–	0.65	–
Width of postmentum at waist	0.48–0.60	0.45–0.60	–	–	–	–
Maximum length of pronotum	0.85–0.96	0.83–0.98	0.56	–	0.62	–
Maximum width of pronotum	–	–	0.94	–	1.15	–
Pronotum index (length/width)	–	0.51–0.58	–	0.31–0.35	–	0.34–0.42
Number of antennal segments	15–16	15–17	15–16	15–16	17	17

Material studied : Identified : From *Western Himalaya* : S., W., Bijrani Sal forest area, Naini Tal Dist., Uttaranchal, coll. J.C. Tripathi, 21.xi.1972, det. S.C. Verma.

Diagnostic Character : (i) Imago : known but not from the Himalaya, hence not dealt with.

(ii) Soldier (Fig. 70a-c) : Head pale brown to reddish brown; thorax and abdomen rusty yellow. Head and pronotum fairly and body densely hairy.

Head subrectangularly oval, weakly narrowed anteriorly. Antennae with 17 segments, 3 shortest. Labrum tongue-shaped with rounded anterior

margin. Mandibles thick, stout and short, strongly incurved anteriorly, shorter than head. Left mandible with a large, prominent tooth below distal third. Postmentum longer than broad, slightly narrowed anteriorly with outcurved lateral margins. Pronotum saddle shaped, anterior margin strongly notched and posterior margin weakly to deeply emarginate medially.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Naini Tal Dist. : Bijrani Sal Forest area. Uttar Pradesh. Orissa. Gujarat. Maharashtra.

Elsewhere : Sri Lanka.

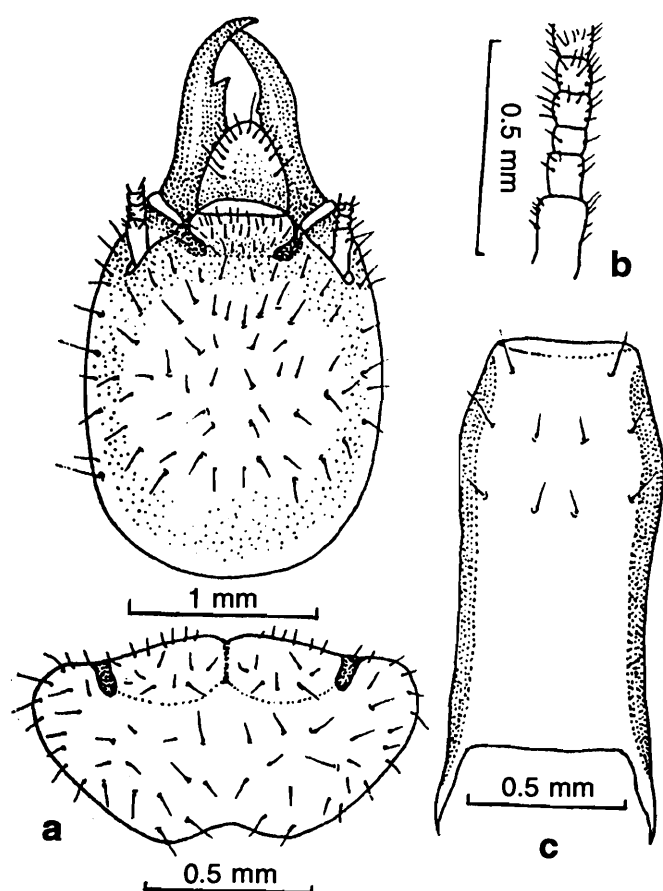


Fig. 70. : *Odontotermes brunneus* (Hagen); a-c, Soldier. a. Head and pronotum, dorsal view; b. Basal part of antenna; c. Postmentum.

Remarks : The species can be distinguished from its allied mound-building termite *O. wallonensis* by convex head at the middle (vs parallel in *O. wallonensis*), mandible tooth more apically placed (vs more basally) of soldier caste. It is one of the oldest described species by Hagen (1858) from India. Since then it has been reported from many localities in India. The species is so far known only from Naini Tal in the Himalaya. It constructs low earthen mound in the plains (Roonwal, 1970a, 1973). In Garhwal Himalaya, the species stages its flight in the month of May in moderate rainfall and humidity (Purkait and Maiti, 1992).

71. *Odontotermes feae* (Wasmann)

(Fig. 71, Table 50)

1. *Termes feae* Wasmann

1896. Wasmann, *Ann. Mus. civ. Stor. Nat. Genova*, (2) 16(36) : 625, 626. S. and W. Holotype : S., in Natural History Museum, Maastricht. Type-locality : Carin Cheba, Myanmar.

2. *Odontotermes feae* (Wasmann)

1912. Holmgren, *J. Bombay nat. Hist. Soc.*, 21(3) : 786, 787.
1991. Roonwal and Verma, *Occ. Pap. Rec. zool. Surv. India*, No. 129 (detailed synonymy, description, etc.)
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 471-475.

3. *Odontotermes indicus* Thakur

1981. Thakur, *Indian For. Rec. (N.S.) Ent.*, 14(2) : 70-75.

Material studied : Unidentified : From *Western Himalaya* : (i) 10S. and 14W., New Forest, Dehra Dun, Uttaranchal, coll. *Forest Entomologist*, 25.ix.1954, ex. 'under log' (ii) 5S. and 8W., Kalsi, Dehra Dun Dist., Uttaranchal. coll. *P.K. Sen-Sarma*, 17.vii.1953, ex. 'rotten bark of *Shorea robusta*'. Identified: From *Western Himalaya* : (i) 1 Im., Dhikola, Pauri Dist., Uttaranchal. coll. *S.C. Verma*, 2.vii.1976, det. S.C. Verma. (ii) 2S., Sultan forest, Naini Tal Dist., Uttaranchal, coll. *Asket Singh*, 7.iii.1973, det. S.C. Verma.

Diagnostic Character : (i) Imago : Head castaneous brown to dark reddish brown; postclypeus and legs rusty yellow, paler than head; antennae pale reddish brown; pronotum brownish, paler than head, with yellowish T-shaped mark and two shoulder spots each on antero-lateral corners; abdominal tergites brown; sternites pale yellow; wings pale brown. Head and Pronotum moderately and abdomen densely hairy; wings hairy all over especially on margins.

Head subround. Fontanelle small, minute. Ocelli oval, moderately large, separated from eyes by about their short diameter. Antennae 19-segmented, 3 shorter than 2 or 4, subequal to 5. Postclypeus greatly swollen, hairy with a faint median line. Labrum subsquarish, hairy, hairs longer near anterior region. Pronotum trapezoidal, narrower than head, anterior margin with a weak, median notch; posterior margin also weakly incurved medially. Wing venation of *Odontotermes* type, media in wings with 6-7 main branches, some of which branching further and cubitus with 8-10

main branches. Microsculpture consists of papillae and rods.

(ii) Soldier (Fig. 71a-b) : Head yellow to yellowish brown; thorax and abdomen rusty yellow. Head and pronotum sparsely, and body moderately hairy.

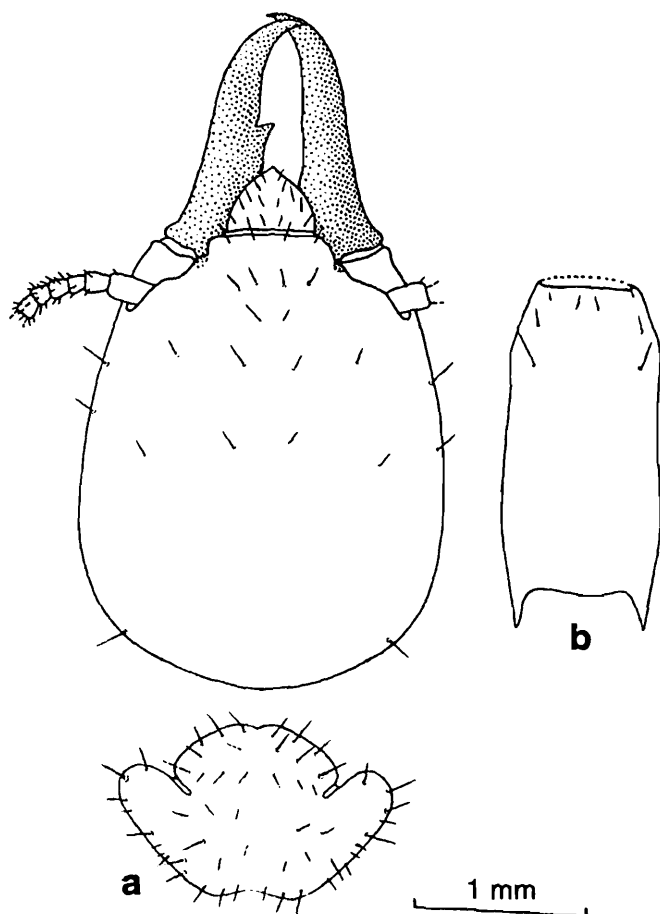


Fig. 71. : *Odontotermes feae* (Wasmann); a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Head subovoid, longer than wide, sides gradually narrowed in front, sometimes almost subparallel. Antennae with 17 segments, 4 longer than 5; 3 shortest. Labrum tongue-shaped with marginal hairs. Mandibles stout, strong, sabre-shaped, a little longer than half the head-length. Left mandible with a medium sized tooth near the middle, angle between the tooth and the inner margin wider, almost 90°. Postmentum elongately subrectangular, somewhat swollen near basal third. Pronotum saddle-shaped, anterior margin with a weak median evagination; posterior margin with a broad median emargination.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Kalsi, New Forest;

Naini Tal Dist. : Sultan Forest; Pauri Dist. : Dhikola. *Eastern Himalaya* : Arunachal Pradesh : Kameng Dist. : Tipi, Bhalukpong; Lower Subansiri Dist. : on road to Yazalli, Zorom, Lake Ganga, Itanagar and Kimin and on road to Kimin to Ziro; East Siang Dist. : Rani; Lohit Dist. : Wakro, Alu Bari, Chowkham, Denbe Tezu; Changlong Dist. : Changlong; Tirap Dist. : Khonsa, Miao, Deban, Gibbons Land. Nagaland. Manipur. Mizoram. Tripura. Assam. West Bengal. Bihar. Orissa. Karnataka. Tamil Nadu. Widely distributed throughout India. NEPAL (*Central Himalaya*). BHUTAN (*Eastern Himalaya*) : Samchi.

Elsewhere : Bangladesh. Sri Lanka. Myanmar. Thailand. Vietnam.

Remarks : The species is a common soil inhabiting termite usually living in underground nest in the south-eastern Asia including India. This variable species is very closely allied to *O. horni* in its morphological characters of soldiers. Although both the species overlap in the measurements, but differ in their morphological characters. The widest width at the posterior third of head and mandibular tooth at the middle of soldiers keep the species separate from *O. horni* with widest head at the middle and mandibular tooth at the proximal end of middle third. The species usually makes galleries or mud plaster on living plants, grasses, decaying woods, fence posts, etc. It also occurs under logs, bricks, cowdung, rubbish and refuse and sometimes found to feed on the bark of several plants. The species is reported to construct low broad base mounds in Manipur (Bose 1992b). It is a recognised pest on structural timber and a number of crops, orchard and forest trees plantation crop like tea (Chhotani, 1997). The species swarms after sunset in the months of June, september and November in different parts of India, usually during or after rain (Roonwal, 1970a). At Dehra Dun, the species attacks all types of timbers in stores, lying on ground, in buildings, etc: Field biology of the species had been dealt by Beeson, 1941; Mathur and Sen-Sarma, 1962; Maiti, 1983.

72. *Odontotermes giriensis* Roonwal and Chhotani
(Fig. 72, Table 50)

***Odontotermes giriensis* Roonwal and Chhotani**

- 1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) **28**(4) : 289, 296, 341-345, Pls. 28, 29, S., W. Holotype : S., in ZSI. Type-locality : Rongrengiri, Garo Hills, Meghalaya, India.
1979. Sen-Sarma and Thakur, *Indian For. Rec. (N.S.) Ent.*, **13**(1) : 6, 25-26, 32, 50.
1981. Thakur, *Indian For. Rec. (N.S.) Ent.*, **14**(2) : 55-59.
- 1984b. Verma, *Indian J. For.*, **7**(4), 307.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 478-482 (detailed synonymy).
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 89-92 (Im, described for the first time from Meghalaya). Arunachal Pradesh.

Material studied : Unidentified : A. From North-Western Himalaya : (i) 6S. and 14W., Jhajerkotli near stream, Jammu, J.K., coll. H.K. Bhowmik, H.L. Paul & party, 15.ix.1976. B. From Western Himalaya : (ii) 2S., Nimi river valley, Dehra Dun Dist., Uttaranchal, coll. *Forest Entomologist*, (A. Kishore), 12.x.1953, ex. 'under stone.' Following three vials from New Forest, DehraDun Dist., Uttaranchal, coll. *Forest Entomologist* (A. Kishore) as (iii) with 4S. and 2W., 21.ix.1953, ex. 'under stone'; (iv) with 2S. and 7W., 28.vi.1963, ex. 'under stone'; (v) with 1S. and 4W., 21.v.1953, ex. 'under dung. Identified : From Western Himalaya : Sev. Im., Sarapduli, Pauri Dist., Uttaranchal, coll. J.C. Tripathi, 6.xi.1972. det. S.C. Verma.

Diagnostic Character : (i) Imago : Head dark reddish brown; antennae; postclypeus and legs brownish yellow; pronotum slightly paler than head, with a pale T-shaped mark and two shoulder spots each on antero-lateral corners; wings pale brown. Head and body densely hairy; wings hairy along margins and weakly so in distal half.

Head subround with distinct outcurved sides. Fontanelle minute. Ocelli broadly oval, separated

from eyes by about their long diameter. Antennae 19-20 segmented, 3 slightly smaller than 2; 4 slightly smaller than 3, 5 shortest. Postclypeus weakly swollen, with a faint median line, hairy. Labrum and mandibles of *Odontotermes* type. Pronotum narrower than head, anterior margin weakly incurved medially; posterior margin weakly invaginated. Wing venation of *Odontotermes* type.

(ii) Soldier (Fig. 72a-e) : Head yellow to dark brown; thorax and abdomen pale yellow to pale brownish. Head and thorax moderately and abdomen fairly densely hairy.

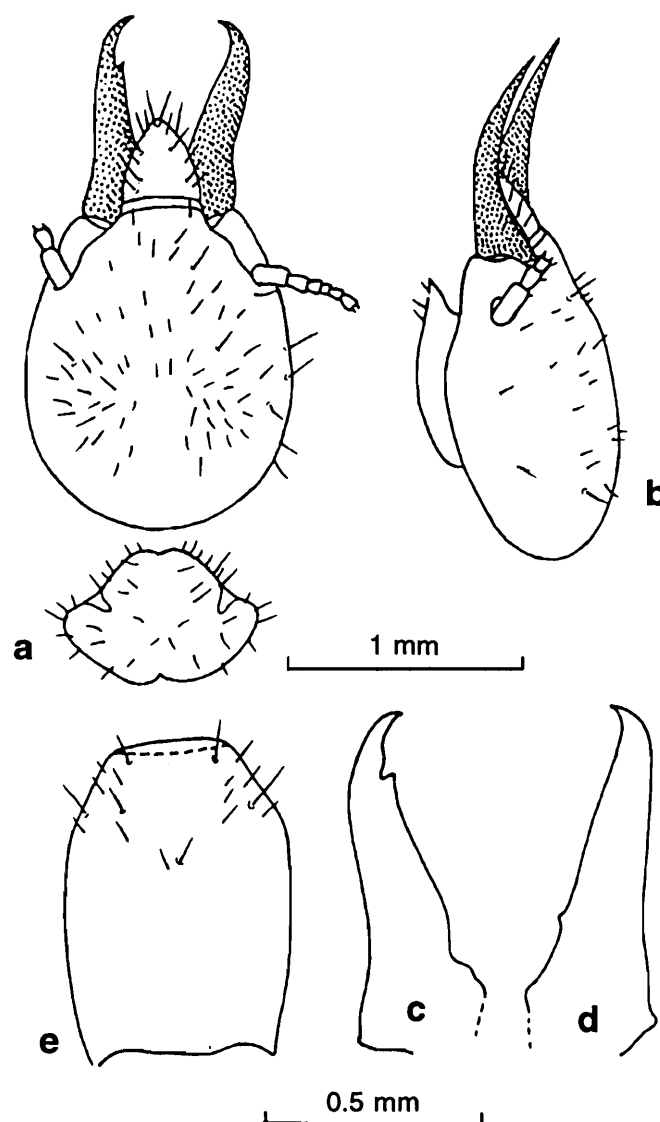


Fig. 72. : *Odontotermes giriensis* Roonwal and Chhotani; a-e, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible; e. Postmentum.

Head oval, longer than broad, sides arched, converging anteriorly. Antennae with 15-16 segments, 3 equal to 2, 4 large. Labrum tongue-

shaped with marginal hairs. Mandibles thin and long, sabre-shaped with weakly incurved sharp apices. Left mandible with a sharp tooth at about distal fourth. Postmentum subrectangular, sides outcurved and abruptly converging in distal fourth. Pronotum saddle-shaped, narrower than head-width, anterior margin with a prominent median sharp notch; posterior margin convex with a weak median emargination.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir : Jammu : Jhajjerkotli near stream. *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : New Forest, Nimi River Valley; Pauri Dist.: Sarapduli. *Eastern Himalaya* : Arunachal Pradesh; West Kameng Dist. : Kalaktang; Upper Subansiri Dist.: on way to Maru, Nacho River Daporijo; Lower Subansiri Dist. : Pamir Bridge, Tamen, Baskham Village, Siki, Lake Ganga, Itanagar, Yazalli; West Siang Dist.: Lohitpur Road; Tirap. Assam. Meghalaya : Garo Hills Dist.: Rongrengiri (type-locality). Manipur. Tripura. Orissa.

Elsewhere : Bangladesh.

Remarks : The species is very close to *O. kapuri* Roonwal and Chhotani but differs by smaller size and head widest at the middle. It is purely an Indian species found scattered all over India. It inhabits the soil like the other members of the genus *Odontotermes*. Biologically, the species is quite unknown. It has been collected for the first time from a fence pole in Sikkim.

73.. *Odontotermes globicola* (Wasmann)
(Fig. 73, Tables 46 and 50)

1. *Microtermes globicola* Wasmann

1902. Wasmann, *Zool. Jb. Syst.* 17(1) : 116-117. S. and W. Holotype : S., in NHM, Maastricht. Type-locality: Anuradhpura, Sri Lanka.

2. *Odontotermes globicola* (Wasmann)

1987. Chhotani and Bose, *Bull. zool. Surv. India*, 8(1-3) : 61, 62, 63, 64. (Transfer to *Odontotermes* based on *O. roonwali* as synonym of *globicola*).

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 482-485 (detailed synonymy).

3. *Odontotermes roonwali* Bose

1975. Bose, *Orient. Insects*, 9(2) : 157-161.

1987. Chhotani and Bose, *Bull. zool. Surv. India*, 8(1-3) : 63, 64 (synonym).

4. *Termes (Termes) dehraduni* Snyder

1933a. Snyder, *Proc. U.S. natn. Mus.*, 82(16) : 6-7.

1949. Snyder, *Smiths. misc. Colls.*, 112 : 224.

5. *Odontotermes dehraduni* (Snyder)

1989. Verma, *Indian J. Forestry*, 11(4) : 310-315.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 482 (synonym).

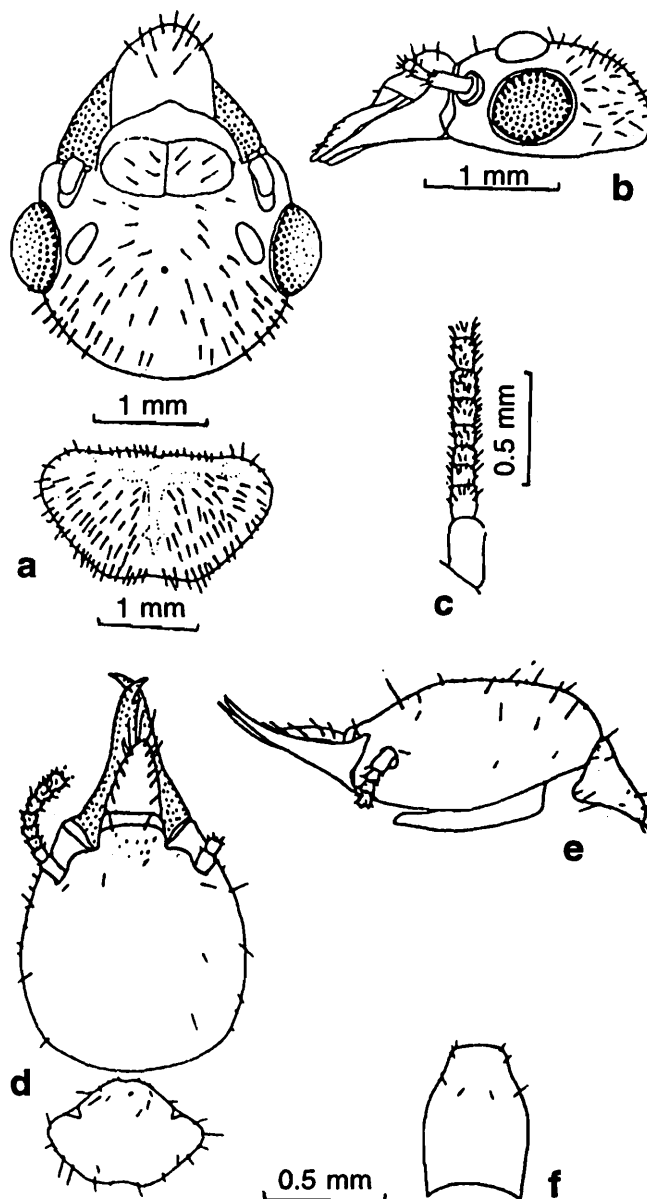


Fig. 73. : *Odontotermes globicola* (Wasmann); a-c, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c. Basal part of antenna; d-f, Soldier. d. Head and pronotum, dorsal view; e. Head and pronotum, side view; f. Postmentum.

Material studied : Unidentified : From *Western Himalaya* : 2S., NainiTal, Uttaranchal, coll. S.C.

Table 50 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Odontotermes feae</i>		<i>O. giriensis</i>		<i>O. globicola</i>	
	10S.	Known Range	6S.	Known Range	2S.	Known Range
Length of head to lateral base of mandibles	2.53–3.00	2.25–3.10	1.15–1.30	1.13–1.30	0.94–1.00	0.90–1.03
Maximum width of head	2.12–2.45	1.80–2.50	1.05–1.13	1.00–1.20	0.86–0.94	0.83–0.95
Head index (width/length)	0.81–0.83	–	0.86	–	0.86–0.92	0.86–0.94
Maximum length of labrum	0.37	–	0.37	–	0.28–0.32	0.25–0.34
Maximum width of labrum	0.50	–	0.31	–	0.25–0.30	0.25–0.34
Length of left mandible (Upper base of condyle to tip)	1.25–1.60	1.20–1.65	0.65–0.80	0.63–0.76	0.63–0.70	0.60–0.69
Head-mandibular length Index (Left mand.-length/head-length)	0.49–0.53	0.51–0.59	0.56–0.61	0.50–0.60	0.67–0.70	0.60–0.73
Left mandibular tooth distance (base of tooth to tip of mandible)	0.63–0.90	0.60–0.90	0.18–0.20	0.15–0.20	0.13–0.14	0.13–0.15
Left mandibular tooth Index (tooth distance/left mandible length)	0.50–0.56	0.50–0.55	0.27	0.21–0.27	0.19–0.20	0.21–0.25
Minimum median length of postmentum	1.35–1.75	1.30–2.00	0.70–0.85	0.70–0.85	0.45–0.56	0.43–0.60
Maximum width of postmentum	0.75–0.93	0.73–0.93	0.50–0.60	0.50–0.60	0.38–0.40	0.38–0.40
Width of postmentum at waist	–	–	–	–	–	–
Maximum length of pronotum	1.00	0.75–1.00	0.53–0.60	0.45–0.60	0.40–0.47	0.38–0.48
Maximum width of pronotum	1.56	1.40–1.83	0.81–0.90	0.73–0.93	0.63–0.74	0.58–0.76
Pronotum index (length/width)	0.64	–	0.65–0.66	–	–	–
Number of antennal segments	17	17	15–16	15–16	15–16	15–16

Verma, 26.v.1977. Identified : From *Western Himalaya* : Sev. Im., New Forest, Dehra Dun, Uttaranchal, coll. M.L. Thakur, 20.vii.1969, det. M.L. Thakur.

Diagnostic Character : (i) Imago (Fig. 73a-c) : Head castaneous brown; antennae; labrum; postclypeus and pronotum yellowish brown, paler than head; wings pale brown. Head sparsely and pronotum and body covered with short and long hairs.

Head subround. Fontanelle small. Ocelli large, oval, lying very close to eyes. Antennae with 19 segments, 3, 4 and 5 subequal. Postclypeus weakly swollen, with a median line. Pronotum subtrapezoidal, anterior margin almost straight

with a weak median notch; posterior margin with a weak median emargination. Wings narrow, radial streak separating from radius at proximal third.

(ii) Soldier (Fig. 73d-f) : Head dark golden brown; body whitish to pale yellow. Head and pronotum sparsely and body moderately hairy.

Head oval, converging anteriorly, widest behind middle. Antennae with 15-16 segments, 2 equal to 3 + 4; the latter shortest. Labrum triangularly sub lanceolate, much longer than broad, pointed at apex. Mandibles thin, long and slender, almost straight and weakly incurved near distal end, shorter than head. Left mandible with a prominent tooth almost near tip. Right mandible with a small tooth at about distal third. Postmentum short, broad

and arched, sides convex, converging anteriorly. Pronotum saddle-shaped, anterior margin weakly to markedly notched and posterior margin weakly incurved medially.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir : Jammu. *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Jhagra range. Rajasthan. Tamil Nadu. Kerala. Karnataka.

Elsewhere : Pakistan. Sri Lanka.

Remarks : The species is a highly variable one as proved now, since number of species has been synonymised under it. It is not yet known from the eastern India including the Eastern Himalaya.

74. *Odontotermes guptai* Roonwal and Bose
(Fig. 74. Table 51)

1. *Odontotermes bellahunisensis guptai*
Roonwal and Bose

1961. Roonwal and Bose, *J. Bombay nat. Hist. Soc.*, **58**(3) : 588-593. S. and W. Holotype : S., in ZSI. Type-locality : Near Gudha Village (Nagaur Dist.), Rajasthan, India.

2. *Odontotermes guptai* Roonwal and Bose

1961. Roonwal, In : *Environment Analysis of Thar Desert* (Eds. Gupta and Prakash) : 409.

1984b. Verma, *Indian J. Forestry*, **7**(4) : 307.

1992. Akhtar, *Proc. 19th int. Congr. Ent.*, (Beijing 1992) : 245.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 487-490 (detailed synonymy).

3. *Odontotermes lokanandi* Chatterjee and Thakur

1967. Chatterjee and Thakur, *Indian For. Rec. (N.S.) Ent.*, **11**(1) : 38-41.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 489 (Synonym).

Material studied : Material not available, so, description, measurement etc., are based on Roonwal and Bose, 1961.

Diagnostic Character : (i) Imago : Not known from the Himalaya, hence not dealt with.

(ii) Soldier (Fig. 74a-c) : Head yellowish brown; body paler.

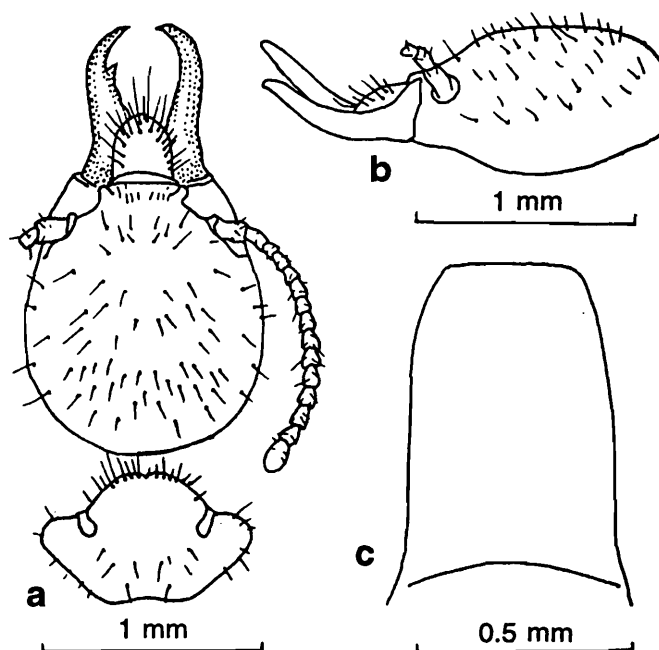


Fig. 74. : *Odontotermes guptai* Roonwal and Bose a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Head broad, oval, a little longer than broad, appreciably converging in front. Antennae with 15-16 segments, 3 generally shortest; sometimes 4 shortest. Labrum tongue-shaped, broadly rounded apically with slightly pointed tip. Mandibles short, stout, strongly incurved with sharply pointed apices, length a little more than half the head-length. Left mandible with a prominent tooth a little in front of distal one-third of mandible. Postmentum a little longer than broad, sides almost straight. Pronotum saddle-shaped, weakly notched anteriorly; appreciably emarginate posteriorly.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir : Tandeh Forest, Udhampur. Himachal Pradesh : Chaniar Forest, Hemirpur. *Western Himalaya* : Uttaranchal : Doon Valley. Bihar. Madhya Pradesh. Assam.

Elsewhere : Pakistan. Bangladesh.

Remarks : Roonwal and Bose (1961) described *O. guptai* as the subspecies of *O. bellahunisensis* which was given the full status of a species *O. guptai* by Roonwal. Later on, Thakur (1981) synonymised it under *O. bellahunisensis*, while Chhotani (1997) maintained its species status and further synonymised *O. lokanandi* under *O. guptai*.

75. *Odontotermes gurdaspurensis* Holmgren and Holmgren
(Fig. 75, Table 51)

1. *Odontotermes (Cyclotermes) obesus f. gurdaspurensis* Holmgren and Holmgren

1917. Holmgren and Holmgren, *Mem. Dept. agric. Sci.*, 5 : 149-150. Lectotype : S., in IARI. Type-locality: Gurdaspur, Panjab, India.
1955b. Ahmad, *Biologia*, Lahore, 1 : 222-224.
1964d. Chatterjee and Thakur, *Bull. Ent.*, No. 5. Udhampur, Jammu and Kashmir.
1967. Roonwal and Chhotani, *Zool. Anz.*, 178 : 245, 246, Tab. 1.
1977. Roonwal and Verma, *Rec. zool. Surv. India*, 72 : 449-450.
1989. Verma, *Indian J. Forestry*, 12(4) : 297, 299.

2. *Odontotermes gurdaspurensis* Holmgren and Holmgren

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 490-493 (detailed synonymy).

Material studied : Identified : From *Western Himalaya* : (i) 2S., sev. W., C.N. Park. Jhirna, Pauri Dist., Uttaranchal, coll. Asket Singh, 15.xi.1971, det. S.C. Verma. (ii) 2S., 2W., C.N. Park, Gairal, Naini Tal Dist., Uttaranchal, coll. S.C. Verma, 28.v.1977, det. S.C. Verma.

Diagnostic Character : (i) Imago : Known from Punjab, but not from the Himalaya, hence not dealt with.

(ii) Soldier (Fig. 75a-b) : Head golden yellow; body yellowish to pale brownish. Head and pronotum sparsely and body fairly densely pilose.

Head subrectangularly oval, sides subparallel and weakly converging in front of antennae. Antennae with 16 segments, 4 shortest. Labrum broadly dome-shaped, anterior margin rounded with marginal hairs. Mandibles long, slender, weakly but abruptly incurved, longer than half of head-length. Left mandible with a prominent, sharp tooth little behind distal third. Postmentum subrectangular, sides weakly convex. Pronotum saddle-shaped, anterior margin with weakly to

deeply median emargination; posterior margin with a distinct median emargination.

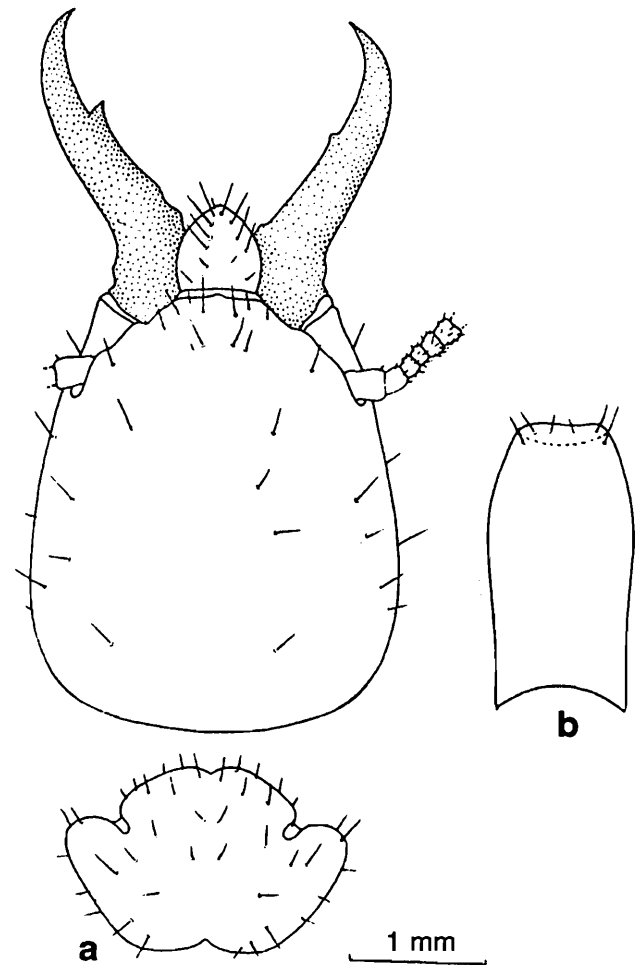


Fig. 75. : *Odontotermes gurdaspurensis* Holmgren and Holmgren; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir; Udhampur Dist. : Tandeh Forest, Sarda Village, Kangra Village. Himachal Pradesh. *Western Himalaya* : Uttaranchal : Naini Tal Dist. : Gairal; Pauri Dist.: Jhirna. Uttar Pradesh. Madhya Pradesh. West Bengal. Punjab : Gurdaspur (type-locality). Rajasthan. Maharashtra.

Elsewhere : Pakistan.

Remarks : The species is very similar to *O. obesus* in morphological characters, but it is certainly a larger species and ocelli of imagoes separated from the eyes by almost their short diameter. It either builds mound or lives in soil in the dry deciduous Sal forest where the climate is dry tropical. No detailed structure of the mound is known.

Swarming takes place after rain at 9 a.m. from holes in ground (Holmgren and Holmgren, 1917). In Rajasthan the species causes damage to fruit plants at Udaipur (Kushwaha, 1960).

76. *Odontotermes horai* Roonwal and Chhotani
(Fig. 76, Tables 46 and 51)

***Odontotermes horai* Roonwal and Chhotani**

1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci., India*, (B) 28(4) : 289, 296, 346-349, pls. 30, 31. S., W. Holotype : S., in ZSI. Type-locality : Bank of Nongpriang Stream, Khasi Hills, Meghalaya, India.

1974. Akhtar, *Pakistan J. Zool.*, 6 : 101.

1984a. Verma, *Indian J. For.*, 7(1) : 82. Uttaranchal.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 495-498 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 92-94.

Material studied : Unidentified : From *Eastern Himalaya* : (i) 1S. and 5W., Pakyong, 14 km South of Rongpo, East Sikkim Dist. (F.C. No. R/6), coll. P.H. Roy and party, 7.v.1997; (ii) Sev. Im., Geyzing, West Sikkim Dist., coll. P.H. Roy and party, 8.viii. 1995, at light. Identified : From *Western Himalaya* : (i) Sev. S., and W., C.N. Park, Gairal, Naini Tal Dist., Uttaranchal, coll. J.C. Tripathi., 15.xi.1972, det. S.C. Verma, (ii) Sev. S. and W., C.N. Park, Dhikola, Pauri Dist., Uttaranchal, coll. S.C. Verma, 2.vii.1976, det. S.C. Verma.

Diagnostic Character : (i) Imago : Head reddish brown; postclypeus yellowish brown with reddish tinge; pronotum slightly paler than head, with a yellow T-shaped marking in middle and a shoulder spot each on antero-lateral corners. Head; pronotum and body densely hairy; labrum sparsely hairy.

Head subround. Fontanelle minute, placed almost at the middle. Eyes subround of medium size. Ocelli oval, separated from eyes by almost their short diameter. Antennae with 19-segments, 3 and 4 subequal; 5 shortest. Postclypeus swollen,

with a faint median line. Labrum length half the maximum width. Pronotum slightly narrower than head, anterior margin indistinctly notched and posterior margin with shallow emargination.

(ii) Soldier (Fig. 76a-c) : Head brownish yellow; pronotum and body yellowish white. Head sparsely; pronotum moderately and abdomen densely hairy.

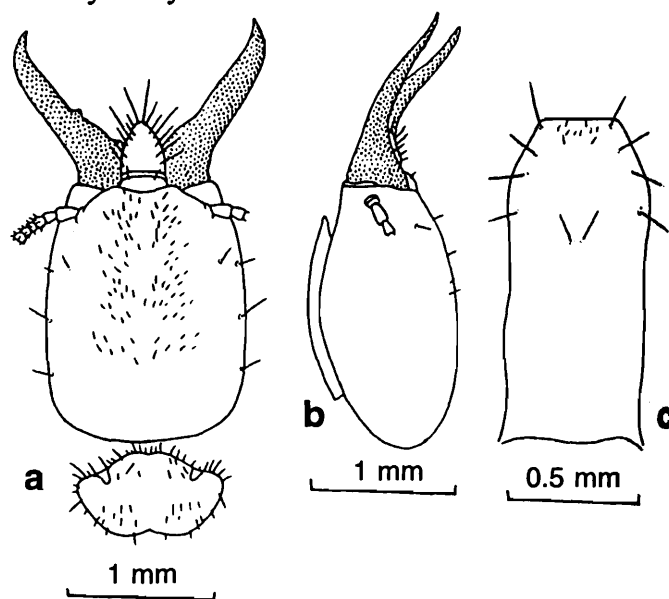


Fig. 76. : *Odontotermes horai* (Wasmann); a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Postmentum.

Head subrectangular, sides subparallel and slightly narrowed in front. Antennae with 15-16 segments, 3 shorter than 2; 4 shortest. Labrum subtriangular with a sharp tip and with long erect hairs. Mandibles sabre-shaped, slightly incurved near tips, about two-third of head-length. Left mandible with a very small tooth in proximal part of middle third. Postmentum subrectangular. Pronotum saddle-shaped, anterior margin with weakly median emargination and posterior margin markedly incurved.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Kumaon Hills : Bageshwar; Naini Tal Dist.: C.N. Park, Gairal; Pauri Dist. : Dhikola. *Eastern Himalaya* : Sikkim : East Sikkim Dist. : Pakyong, 14 km South of Rongpo; West Sikkim Dist. Geyzing. Madhya Pradesh. West Bengal. Nagaland. Meghalaya : Khasi Hills : Bank of Nongpriang Stream (type-locality). NEPAL

Table 51 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Odontotermes guptai</i>		<i>O. gurdaspurensis</i>		<i>O. horai</i>	
	1S.	Known Range	2S.	Known Range	Sev. S.	Known Range
Length of head to lateral base of mandibles	1.25	1.00–1.20	1.45–1.63	1.42–1.63	1.75–1.95	1.65–2.00
Maximum width of head	1.06	0.95–1.08	1.25–1.38	1.20–1.40	1.31–1.62	1.28–1.65
Head index (width/length)	–	0.87–0.98	0.84–0.86	0.80–0.89	0.75–0.83	0.74–0.89
Maximum length of labrum	0.28	0.25–0.28	0.44	–	0.27–0.30	0.26–0.33
Maximum width of labrum	0.25	0.23–0.28	0.31	–	0.26–0.30	Subequal to length
Length of left mandible (Upper base of condyle to tip)	0.66	0.55–0.68	0.75–1.00	0.95–1.08	1.05–1.20	1.05–1.23
Head-mandibular length Index (Left mand.-length/head-length)	0.53	0.54–0.63	0.61	0.63–0.72	0.60–0.61	0.55–0.65
Left mandibular tooth distance (base of tooth to tip of mandible)	0.18	0.15–0.20	0.25–0.40	0.33–0.45	0.63–0.80	0.63–0.81
Left mandibular tooth Index (tooth distance/left mandible length)	–	0.26–0.33	0.33–0.40	0.33–0.40	0.60–0.66	0.60–0.66
Minimum median length of postmentum	0.65	0.45–0.65	0.80–1.00	0.80–1.00	1.15–1.28	1.13–1.38
Maximum width of postmentum	0.49	0.38–0.50	0.45–0.55	0.40–0.55	0.53–0.68	0.53–0.70
Width of postmentum at waist	–	–	0.50	–	–	–
Maximum length of pronotum	0.55	0.45–0.55	0.56–0.68	0.50–0.70	0.56–0.73	0.55–0.75
Maximum width of pronotum	0.93	0.70–0.90	0.90–1.05	0.85–1.00	1.00–1.24	0.90–1.25
Pronotum index (length/width)	–	–	–	–	–	–
Number of antennal segments	15	15–16	16	16	15–16	15–16

(Central Himalaya) : Jirikhala Tal; Sikiri and Kabre.

Elsewhere : Pakistan.

Remarks : In shape, size and position of mandibular tooth of the soldiers, this species is very similar to *O. parvidens*, but the more cylindrical head, smaller size, antennae with 15–16 segments, etc. keep the species separate. This is a soil-inhabiting species frequently found in the northern India and is very close to *O. parvidens* in morphological features of the soldiers.

77. *Odontotermes horni* (Wasmann)
(Fig. 77, Table 52)

1. *Termes horni* Wasmann

1902. Wasmann, *Zool. Jb. Syst.*, 17(1) : 111. S. and W.
Lectotype : S., in NHM, Maastricht. Type-locality:
Nalanda, Sri Lanka.

2. *Termes (Termes) horni* Wasmann

1953. Rattan Lal and Menon, *Cat. Indian Insects, Isoptera-*
Pt. 27 : 79–80.

3. *Odontotermes (Odontotermes) horni*
(Wasmann)

1913. Bugnion, *Rev. Suisse. Zool.*, 21(10) : 299–330, Pls. 3.

4. *Odontotermes horni* (Wasmann)

- 1962a. Roonwal and Chhotani, *Proc. nat. Inst. Sci. India*, (B)
28(4) : 296, 349–352.
1977b. Chhotani, *Rec. zool. Surv. India*, 72 : 372–378.
1984. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 49 : 164,
166, 183–187.
1987. Bose and Das, *Fauna of Orissa* Pt. 1, *State Fauna*
Sr. 1 : 106, 110.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 :
498–502 (detailed synonymy).

5. *Odontotermes horni* var. *hutchinsoni* Kemner

1926. Kemner, *Bull. ent. Res.*, 16(4) : 384-385.

1981. Thakur, *Indian For. Rec. (N.S.) Ent.*, 14(2) : 66 (synonymy).

6. *Odontotermes horni* var. *minor* Kemner

1926. Kemner, *Bull. ent. Res.*, 16(4) : 385-386.

1981. Thakur, *Indian For. Rec. (N.S.) Ent.*, 14(2) : 67 (synonymy).

7. *Termes peradeniyae* Holmgren

1911. Holmgren, In Escherich's *Termitenleben auf Ceylon* : 197.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 494 (synonymy).

Material studied : Unidentified : A. From *Western Himalaya* : Following 2 vials from New Forest, Dehra Dun, Uttaranchal as (i) with 2S. and 5W., coll. *Forest Entomologist (A. Kishore)*, 10.ix.1953, ex. "dry bamboo"; (ii) with 4S. and 8W., coll. *O. B. Chhotani*, 18.ii.1955, ex. 'under log of Sal' B. From *Central Himalaya* : (iii) 5 Im., 8S and 14W., Phulwari, Birjung, near Nepal Custom Office, Parsa Dist., Nepal, coll. *P. Mukherjee*, 25.iv.2000, ex. "from a living mango tree, making tunnel on the tree trunk." C. From *Eastern Himalaya* : (iv) 3S. and 10W., around Khumani F. R. House, Darjiling Dist., W. B., coll. *G. K. Srivastava* and *P. K. Maiti*, 25.xii.1973, ex. "under bark of log" (F. C. No. 3/25.12.73). (v) 5S. and 12W., Mongpong, ten km West of Bagrakote, Darjiling Dist., W. B., coll. *G. K. Srivastava* and *P. K. Maiti*, 29.xii.1973, ex. "under cowdung."

Diagnostic Character : (i) Imago (Fig. 77a) : Head dark brown, anteriorly reddish yellow; labrum; pronotum slightly paler; wings dark rusty yellow. Head; pronotum and abdomen moderately thickly hairy; wings hairy in distal part.

Head subcircular, posterior margin broadly rounded and flat. Fontanelle small, ring-like. Labrum tongue-shaped, anterior margin broadly rounded. Ocelli broadly oval, separated from eyes by about their short diameter. Eyes subround of

medium size. Antennae with 19-segments, 3 slightly shorter than 2; 3, 4 and 5 almost equal. Postclypeus large, swollen, with a faint median line. Pronotum narrower than head with eyes, anterior and posterior margins with weak median invagination.

(ii) Soldier (Fig. 77b-c) : Head yellow to reddish brown; labrum and pronotum pale yellowish brown; abdomen creamish white to yellowish white. Head sparsely and pronotum; abdomen moderately fairly hairy.

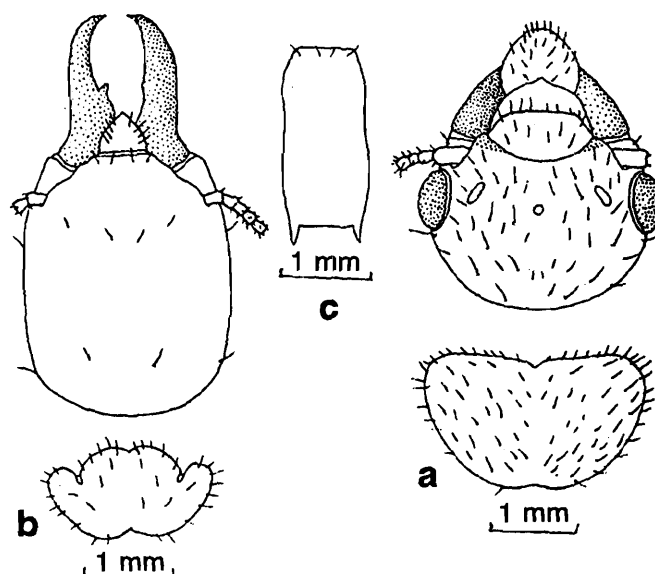


Fig. 77. : *Odontotermes horni* (Wasmann); a, Imago. a. Head and pronotum, dorsal view; b-c, Soldier. b. Head and pronotum, dorsal view; c. Postmentum.

Head subrectangular, sides substraight, very slightly convergent in front of antennae. Fontanelle indistinct. Antennae with 17 segments, 3 ring like, shortest; 2 longer than 3. Labrum tongue-shaped, anteriorly with blunt rounded tip. Mandibles strong, stout, sabre-shaped. Left mandible with a medium size prominent tooth near base of middle third. Postmentum subrectangular, sides bulging out in proximal third. Pronotum saddle-shaped, much narrower than head-width, anterior margin with weak median emargination and posterior margin with fairly distinct emargination.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : New Forest. *Eastern Himalaya* : West Bengal : Darjiling Dist. :

Table 52 : Measurements (in mm) etc. of Caste—Soldier.

	<i>Odontotermes horni</i>		<i>O. kapuri</i>		<i>O. microdentatus</i>	
	8S.	Known Range	5S.	Known Range	5S.	Known Range
Length of head to lateral base of mandibles	2.50–3.00	2.47–3.00	1.40–1.62	1.38–1.60	1.22–1.40	1.00–1.45
Maximum width of head	1.85–2.20	1.82–2.30	1.30–1.40	1.30–1.38	1.03–1.15	0.90–1.15
Head index (width/length)	0.73–0.74	–	0.86	0.873	0.82–0.84	0.73–0.95
Maximum length of labrum	–	–	0.37	0.35–0.38	0.35	0.35
Maximum width of labrum	–	–	0.31–0.33	0.30–0.33	0.28	0.30
Length of left mandible (Upper base of condyle to tip)	1.30–1.55	1.27–1.60	0.80–0.90	0.80–0.84	0.80–0.90	0.78–0.90
Head-mandibular length Index (Left mand.-length/head-length)	0.52	0.53–0.66	–	0.51–0.52	0.64–0.65	0.62–0.78
Left mandibular tooth distance (base of tooth to tip of mandible)	0.75–1.00	0.70–1.00	0.20–0.25	0.20	0.20–0.25	0.20–0.25
Left mandibular tooth Index (tooth distance/left mandible length)	0.57–0.64	0.55–0.63	0.25	0.24–0.25	0.27	0.28–0.31
Minimum median length of postmentum	1.50–1.95	1.50–2.00	–	0.90–0.93	0.65–0.74	0.65–0.80
Maximum width of postmentum	0.75–0.90	0.75–0.93	–	0.60–0.63	0.42–0.50	0.40–0.50
Width of postmentum at waist	–	–	–	–	–	–
Maximum length of pronotum	–	0.80–1.03	0.75	–	0.48–0.55	0.45–0.55
Maximum width of pronotum	–	1.40–1.80	1.25	–	0.75–0.85	0.70–0.85
Pronotum index (length/width)	–	–	0.60	–	0.64	–
Number of antennal segments	17	17	17	17	16–17	16–17

around Khumani F. R. H., Mongpong, ten km West of Bagrakote; Jalpaiguri Dist. : Kamyakhyaguri. Manipur. Orissa. Madhya Pradesh. Southern India. NEPAL (*Central Himalaya*) : Parsa Dist. : Phulwari, Birjung. BHUTAN (*Eastern Himalaya*).

Elsewhere : Sri Lanka : Nalanda (type-locality). Vietnam. Cambodia.

Remarks : *Odontotermes horni*, a closely allied species to *O. feae*, is a very variable one occurring commonly in the south east Asia. It occurs in all Himalayan regions except North-Western Himalaya being collected from live

trees, dry bamboo, under bark, cowdung, etc. However, it is reported to a pest of tea plantation in Sri Lanka (Harris, 1961) and rubber plants in Vietnam (Roonwal, 1970a). The species causes severe damage to dried up bark of numerous plants and to dead wood (Sen-Sarma *et al.*, 1975). The species is yet unknown to construct earthen mounds in the study area unlike its closet species *O. feae*. General field biological accounts are limited to the contributions of Mathur and Sen-Sarma, 1962; Maiti, 1983; and others.

78. *Odontotermes kapuri* Roonwal and Chhotani
(Fig. 78, Table 52)

***Odontotermes kapuri* Roonwal and Chhotani**

- 1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) **28**(4) : 296, 352-356, S. and W. Holotype : S., in ZSI. Type-locality : Cherrapunji, Meghalaya, India.
1977. Lahiri, Ghosh and Biswas, *Bull. Meghalaya Sci. Soc.*, **2** : 38.
1981. Thakur, *Indian For. Rec. (N. S.) Ent.*, **14**(2) : 11, 75-78, 161.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 503-505.
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 94-95.

Material studied : Identified : From *Eastern Himalaya* : S. and W., Sampa-Kothoka (alt. 1600-2600 m), Bhutan, coll. Zool Expt. N. H. Museum, Basel (Switzerland), 9.vi.1972, det. Roonwal and Chhotani.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 78a) : Head yellowish brown; pronotum; abdomen pale yellow. Head and pronotum moderately and abdomen rather densely pilose with a row of hairs at posterior margin of each tergites and few irregularly placed hairs in front.

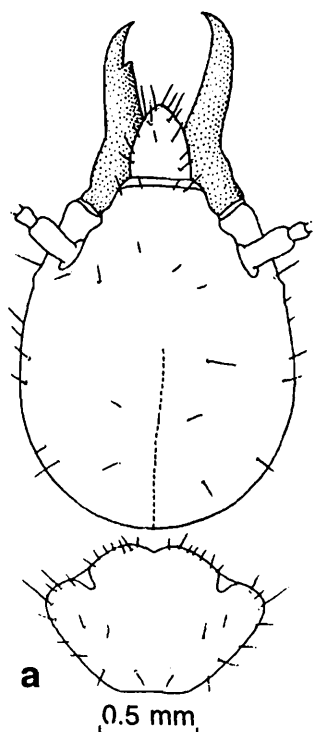


Fig. 78. : *Odontotermes kapuri* Roonwal and Chhotani; a, Soldier. a. Head and pronotum, dorsal view.

Head broadly oval, longer than broad, sides outcurved and converging sharply in front. Antennae with 17 segments, 3 shorter than 2 or 4. Labrum narrowly tongue-shaped, anterior margin rounded. Mandibles short, stout, sabre-shaped with fairly pointed incurved apices and almost half the head-length. Left mandible with a prominent, sharp tooth at distal fourth. Postmentum subrectangular, sides on anterior fourth narrowed. Pronotum saddle-shaped, anterior margin with a sharp notch and posterior margin with a median emargination.

Distribution : INDIA : Meghalaya : Cherrapunji (type-locality) : Mawphlong. Tripura : Ambasa; Tiliamura. BHUTAN (*Eastern Himalaya*) : Sampa Kothoka.

Remarks : The species comes closely to *O. giriensis* but slightly larger head with broadest width on the posterior third. The distribution shows its prevalence in the hilly area. The species less known in India, occurring in Bhutan.

79. *Odontotermes microdentatus* Roonwal and Sen-Sarma
(Fig. 79, Tables 47 and 52)

***Odontotermes microdentatus* Roonwal and Sen-Sarma**

1960. Roonwal and Sen-Sarma, *Contrib. Syst. Orient. Termites* (ICAR Ent. Monogr. 1) : 33-39, 2 pls. Im., S. and W. Holotype : S., in FRI. Type-locality : Dehra Dun, Uttaranchal, India.
1976. Thakur, *Indian Forester*, **102**(8) : 501, 502.
1982. Bose and Das, *Rec. zool. Surv. India*, **80** : 200, 207, 211, tab.
1989. Verma, *Indian J. Forestry*, **12**(4) : 297, 299, 300, 301.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 514-517 (detailed synonymy).

Material studied : Unidentified : From *Central Himalaya* : 10 Im., 5S., Sev. W., Ratomati village, ca. 45 km north of Birjung, Hetauda sub-division, Mokoanpur Dist., Nepal, coll. P. Mukherjee, 26.iv.2000, ex. "at light and soil on a tilla." Identified : From *Western Himalaya* : (i) 2S, 3W.,

Dhikola, Pauri Dist., Uttaranchal, coll. S. C. Verma, 19.iii.1977, det. S. C. Verma. (ii) 2S. Crocodile point, three km North from Gairal, Naini Tal Dist., Uttaranchal, coll. S. C. Verma, 19.vi.1976, det. S. C. Verma. (iii) 1S., Sultan F. R. H., Naini Tal Dist., Uttaranchal, coll. S. C. Verma, 27.vi.1976, det. S. C. Verma. (iv) 3S., Motichur forest, Dehra Dun, Uttaranchal, coll. Raj Tilak & party, 13.ix.1987, det. S. C. Verma. (v) 1S., 2W., Raipur village, Dehra Dun Dist., Uttaranchal, coll. S. C. Verma, 28.viii.1975, det. S. C. Verma.

Diagnostic Character : (i) Imago (Fig. 79a-d) : Head deep brown; antennae brownish; labrum; thorax and abdomen paler than head. Head fairly pilose; pronotum and body densely hairy.

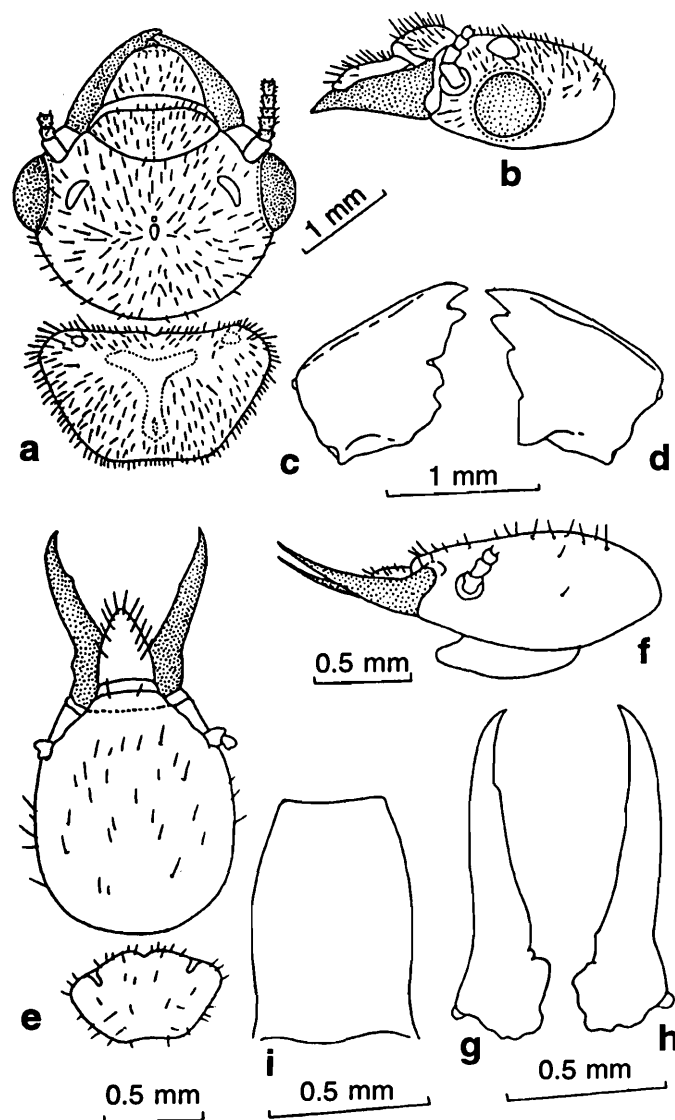


Fig. 79. : *Odontotermes microdentatus* Roonwal and Sen-Sarma; a-d, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible; e-i, Soldier. e. Head and pronotum, dorsal view; f. Head, side view; g. Left mandible; h. Right mandible; i. Postmentum.

Head subcircular, posterior margin broadly rounded. Y-suture absent. Fontanelle minute, point-like. Ocelli suboval, separated from eyes by about their short diameter. Antennae with 19 segments, 3 and 5 subequal. Postclypeus greatly swollen, length almost half its width. Labrum tongue-shaped. Pronotum subtrapezoidal, with a T-shaped pale mark at middle and one shoulder spot on either side, anterior margin sinuate, with a feeble median notch; posterior margin substraight, faintly incurved medially. Wings brown.

(ii) Soldier (Fig. 79e-i) : Head pale brown; abdomen creamish white. Head sparsely and body moderately pilose.

Head oval, converging anteriorly. Antennae with 16 to 17 segments, 4 shortest in 16 and 3 shortest or 5 shortest in 17 segmented one. Labrum tongue-shaped with a narrow rounded apex. Mandibles long, slender and almost straight, with slightly incurved apices. Left mandible with a very minute tooth slightly above distal third. Postmentum subrectangular, sides convex, becoming narrowed on anterior third. Postmentum saddle-shaped, anterior margin deeply notched in the middle and posterior margin with a shallow to deep emargination.

Distribution : INDIA : North-Western Himalaya : Jammu and Kashmir. Himachal Pradesh : Bilaspur. Western Himalaya : Uttaranchal : Dehra Dun Dist. : Dehra Dun, Kalsi, Motichur Forest, Raipur village; Kumaon Hills : Askot, Bageshwar; Naini Tal Dist. : Sultan F. R. H., Crocodile point, three km north from Gairal; Pauri Dist. : Dhikola. Madhya Pradesh. Bihar. NEPAL (*Central Himalaya*) : Mokoanpur Dist. : Hetauda sub-division : Ratomati village, ca. 45 km north of Birjung.

Remarks : This is purely an Indian species and quite common in the Himalayan tract. The species stands quite apart from all other Indian ones having its very minute tooth placed on the base of anterior third of left mandible. The species builds low earthen mounds with about ca. 3 m in diameter at places with intercommunicating

chambers filled with fungus combs. The royal chamber is made up of earth. Two species, namely, *Microtermes obesi* and *Speculitermes triangularis* are sometimes found in close association with its nest vicinity [Roonwal and Sen-Sarma, 1960; Mathur and Sen-Sarma (1962)]. It is one of the wood destroying termites being collected from logs and stumps of many trees in the Kumaon Hills (Sen-Sarma *et al.*, 1975).

80. *Odontotermes obesus* (Rambur)

(Fig. 80, Tables 47 and 53)

1. *Termes obesus* Rambur.

1842. Rambur, *Histoire nat. Insectes, Nevropteres* : 304. Im. only. Syntypes : one Im., in Hope Mus., Oxford (U. K.).

2. *Odontotermes obesus* (Rambur)

1965. Krishna, *Am. Mus. Novit.*, No. 2210 : 24-25.
1974. Akhtar, *Pakistan J. Zool.*, 6(1 & 2) : 201.
1984. Bose and Roy, *Bull. zool. Surv. India*, 5(2-3) : 189.
1989. Verma, *Indian J. Forestry*, 12(4) : 297-298, 300.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 519-524 (detailed synonymy).

3. *Odontotermes assamensis* Holmgren

- 1913b. Holmgren, *K. sv. Vet. Akad. Handl.*, 50(2) : 114-115 (synonymy).
1981. Thakur, *Indian For. Rec. (N. S.) Ent.*, 14(2) : 100.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 519.

4. *Odontotermes bangalorensis* Holmgren

- 1913a. Holmgren, *J. Bombay nat. Hist. Soc.*, 22(1) : 105-109 (synonymy).
1981. Thakur, *Indian For. Rec. (N. S.) Ent.*, 14(2) : 100.

5. *Odontotermes flavomaculatus* Holmgren and Holmgren

1917. Holmgren and Holmgren, *Mem. Dept. Agric. Indian*, 5(3) : 150 (synonymy).
1981. Thakur, *Indian For. Rec. (N. S.) Ent.*, 14(2) : 100.

6. *Odontotermes obesus var. oculatus* Silvestri

1923. Silvestri, *Rec. Indian Mus.*, 25(2) : 224-225.
1981. Thakur, *Indian For. Rec. (N. S.) Ent.*, 14(2) : 100.

7. *Termes obesus (Cyclotermes) orissae* Snyder

1934. Snyder, *Indian For. Rec.*, 20(11) : 10-11.

Material studied : Unidentified : A. From North-Western Himalaya : (i) 11S. and 11W., near river (Tawi) bank, Jammu Tawi, J. & K., coll. H. K. Bhowmik, H. L. Paul and party, 12.ix.1976. (ii) 1S. and 12W., Mandi-Kulu Road and surrounding area, Tah., Mandi Dist., H. P., coll. A. Husain, 10.ii.1965. B. From Western Himalaya : Following three vials from Dehra Dun Dist., Uttaranchal as (iii) with 4S. and 7W., Kalsi, coll. P. K. Sen-Sarma, 16.vii.1953, ex. 'mound'; (iv) with 4S. and 5W., Dhootkot, coll. P. K. Sen-Sarma, 20.viii.1953, ex. 'from the mound of Tulsi experimental plantation'; (v) 2S. and 10W., New Forest, coll. *Forest Entomologist (A. Kishore)*, 21.vii.1953, ex. 'mound.' C. From Eastern Himalaya : Following seven vials from Darjiling Dist., W. B. as (vi) with 1 Im., 11S. and 12W., Samsing, coll. G. K. Srivastava and P. K. Maiti, 24.iii.1973, ex. 'soil' (F. C. No. 10/24.3.73); (vii) with 12S. and 14W., Mongpong, ten km West of Bagrakote, coll. G. K. Srivastava and P. K. Maiti, 29.xii.1973, ex. 'soil' and 'stump'; (viii) with 11S. and 12W., Sambarihat, two km North of Garubathan, coll. G. K. Srivastava and P. K. Maiti, 17.xii.1973, ex. 'mound' (F. C. No. 1/17.12.73); (ix) with 14W., one km East of Goke F. R. H., Singla, coll. H. S. Sharma and party, 17.iv.1973 (F. C. No. 10/17.4.73); (x) with 4S. and 12W., Bhuttabari Forest village, three km South of Garubathan, coll. G. K. Srivastava and P. K. Maiti, 19.xii.1973, ex. 'soil' (F. C. No. 2/19.12.73); (xi) with 6S. and 12W., around Khumani F. R. H., coll. G. K. Srivastava and P. K. Maiti, 25.xii.1973, ex. 'gallery on tree-trunk' (F. C. No. 8/25.12.73); (xii) 14S. and 11W., Nazeok, Kalimpong, coll. P. K. Maiti, 24.xii.1973, ex. 'under log.' Following seven vials from Arunachal Pradesh, coll. S. K. T. and G. S. A., 6-31.x.1966 as (xiii) with 11S. and 12W., Basar village, West Siang Dist.; (xiv) with 5S. and 12W., Pading village, West Siang Dist.; (xv) with 12S. and 14W., Bela village, Upper Subansiri Dist.; (xvi) with 10S. and 12W., Subansiri bridge, Subansiri Dist.; (xvii) with 5S. and 7W., Dulla, Tappi, East Siang Dist., ex. 'from wood';

(xviii) with 7S. and 12W., Tachidoni, Siang Dist.; (xix) with 5S. and 10W., Dali village, West Siang Dist. Following three vials from Arunachal Pradesh as (xx) with 11S. and 14W., on road to Kimin, Lower Subansiri Dist., coll. O. B. Chhotani, 17.v.1989, ex. 'mound'; (xxi) with 1S. and 1W., Monai river bank west side, Kameng Dist., coll. K. C. Jayramkrishnan, 6.iii.1961; (xxii) with 12S. and 1W., Sunpura, coll. S. K. T. and party, 3.iii.1969. Identified : From *Western Himalaya* : Following three vials from Uttaranchal as (i) with 2S., 4W., C. N. Park, Khinanauli, ca. four km from Dhikola, Pauri Dist., coll. S. C. Verma, 4.viii.1977, det. S. C. Verma. (ii) with 3S., Sarapduli forest, Pauri Dist., coll. S. C. Verma, 25.vi.1976, det. S. C. Verma. (iii) with C. N. Park, Gairal Crocodile point, Naini Tal Dist., coll. S. C. Verma, 24.iii.1976, det. S. C. Verma.

Diagnostic Character : (i) Imago (Fig. 80a-d) : Head, pronotum and postclypeus reddish brown; wings yellowish brown. Head and pronotum moderately and body rather densely covered with long and short hairs.

Head subround. Fontanelle small, placed almost at the middle of head. Ocelli broad, elongately oval, separated from eyes by almost half their long diameter. Antennae with 19 segments, 2 as long as or almost twice of 3; 3, 4 and 5 variable in size. Postclypeus greatly swollen, hairy, with an incomplete median line. Labrum tongue-shaped with broadly rounded anterior margin. Pronotum roughly subtrapezoidal, with a central, pale, T-shaped mark and two shoulder spots, a little narrower than head, anterior margin almost straight with a weak median notch; posterior margin with a weak median depression. Wings narrow, radial streak separating from middle of wing membrane, membrane with slightly wavy, thin.

(ii) Soldier (Fig. 80e-g) : Head pale yellowish brown; thorax and abdomen straw yellow to deep rusty brown. Head sparsely and body moderately pilose.

Head oval, weakly converging in front. Antennae with 16-17 segments, 2 subequal to 3

and 4 combined. Labrum tongue-shaped, with broadly rounded anterior margin containing marginal hairs. Mandibles long, slender, sabre-shaped with fairly incurved apices. Left mandible with a sharp, prominent tooth at apical third. Postmentum subrectangular with narrowed anterior portion. Pronotum saddle-shaped, anterior margin feebly notched; posterior margin also weakly emarginate.

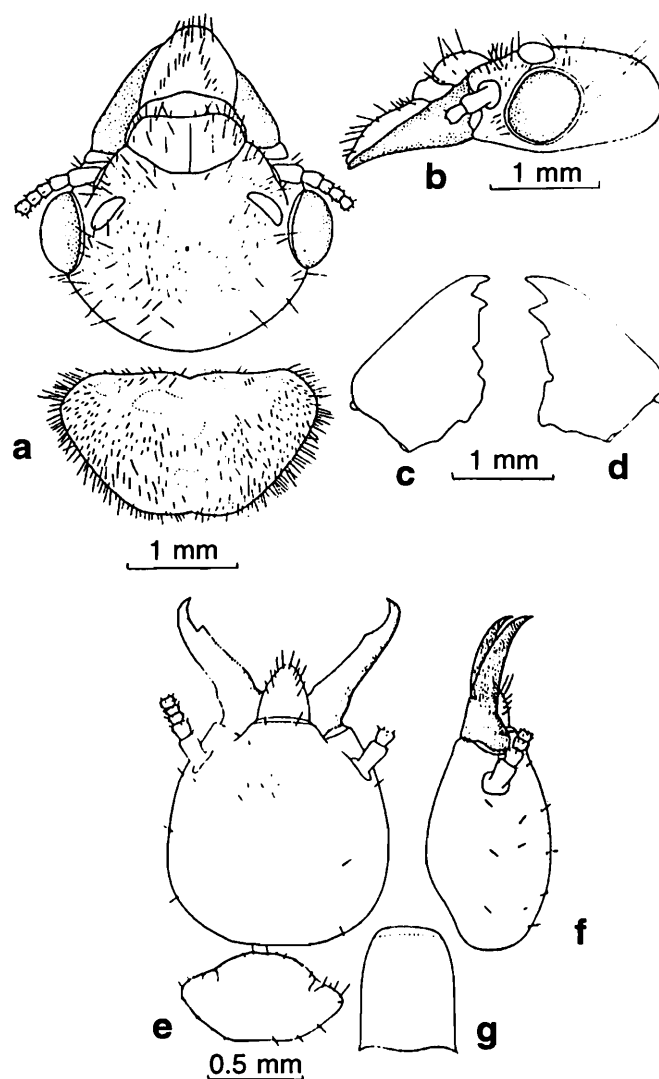


Fig. 80. : *Odontotermes obsesus* (Rambur); a-d, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible; e-g, Soldier. e. Head and pronotum, dorsal view; f. Head, side view; g. Postmentum.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir : Udhampur Dist. : Gangara; Jammu Tawi, near river Tawi bank. Himachal Pradesh : Bilaspur; Mandi Dist. : Mandikulu road and surrounding area, Tah. *Western Himalaya* : Uttaranchal : Kumaon Hills :

Askot (Dholakot), Bageshwar; Almora Dist. : Barechina Range; Pauri Dist. : Dhikola, Sarapduli Forest : Nainital Dist. : C. N. Park Gairal Crocodile point. *Eastern Himalaya* : West Bengal : Darjiling Dist. : Samsing, Mongpong, ten km West of Bagrakote, Sambarihat, two km North of Garubathan, one km East of Goke F. R. H., Singla, Bhuttabari Forest Village, three km South of Garubathan, Nazeok, Kalimpong, around Khumani F. R. H. Arunachal Pradesh : East Kameng Dist. : West Bank of River Monai near Bhairavkond; West Kameng Dist. : Charduar Forest, Bhalukpong; Upper Subansiri Dist. : Dark; Lower Subansiri Dist. : Subansiri bridge, Lake Ganga, Itanagar, Abdul Nalla, five km from Yazalli, on road connecting Kimin; East Siang Dist. : Dulla Tapi; West Siang Dist. : Likhabali Jeep Camp, Dali Village, Pading Village. Assam. Meghalaya. Nagaland. Tripura. Manipur. It is found more or less all over India. BHUTAN (*Eastern Himalaya*).

Elsewhere : Bangladesh, Pakistan and Myanmar.

Remarks : It is one of the most common mound building species in India including its adjacent countries like Bangladesh, Myanmar and Pakistan occurring from the plains upto 2000 m altitude except in very cold territories. It is a very variable species in its morphological features of the soldiers as well as in its mound structure being built in rainy but well drained areas. The species is very close to *O. redemanni*—a species predominantly found in the southern India, but differs in having radial streak which is absent in *O. redemanni* of the imago caste. Soldiers of this species have shorter mandibles (vs. longer in *O. redemanni*) and labrum almost as long as broad (vs. longer than broad). It is quite a common species in the study area. It feeds mainly on woody surface, debris, dry leaves, grasses, cowdung, mounts, etc. in the Himalayan belt. It also attacks various agricultural crops proving its pest status to a great extent. The species is well studied with regard to its biology (Roonwal, 1970a; Maiti, 1983).

81. *Odontotermes parvidens* Holmgren and Holmgren (Fig. 81, Table 53)

1. *Odontotermes/O. (Odontotermes) parvidens* Holmgren and Holmgren

1917. Holmgren and Holmgren, *Mem. Dept. agric. Sci.*, 5(3): 195. S. and W. Syntypes : S. and W., in IARI, ZSI, and Riksums., Stockholm. Types-localities : Mysore to Mercara Road, Karnataka, India; Dhar, Gurdaspur Dist., Panjab, India; Khamakhya Hill, Gauhati, Assam and Chaumahani, Noakhali Dist., Bangladesh.
- 1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) 28(4) : 296, 356-359.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 19, 26, 106-109, map 1.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 526-530 (detailed synonymy).
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 100-103.

2. *Termes (Cyclotermes)/Odontotermes almorensis* Snyder

- 1933a. Snyder, *Proc. U. S. natn. Mus.*, 82 : 8-9.

3. *Odontotermes distans* Holmgren and Holmgren (Part)

1981. Thakur, *Indian For. Rec. (N. S.) Ent.*, 14(2) : 45, Synonymy.

4. *Odontotermes microdens* Holmgren (In Silvestri) *nom. nud.*

1914. Silvestri, *Rec. Indian Mus.*, 8(5) : 428.

Material studied : Unidentified : A. From North-Western Himalaya : (i) 10S. and 12W., Katra, Udhampur, J. & K., coll. S. K. Gupta and party, 12.xi.1976. B. From Western Himalaya : Following five vials from DehraDun Dist., Uttaranchal as (ii) with 4S. and 8W., Jaijra, coll. P. N. Chatterjee, 8.iii.1953, ex. "in soil"; (iii) with 2S. and 5W., New Forest, coll. Forest Entomologist (A. kishore), 9.ix.1953, ex. "in soil"; (iv) with 2S. and 5W., New Forest, coll. O. B. Chhotani, 17.ii.1955, ex. "under stone"; (v) with 2S. and 4W., New Forest, coll. A. Kishore, 20.x.1953, ex. "under dry log" of '*Bombax malabaricum*'; (vi) with 1S. and 4W., New Forest, coll. Forest Entomologist (A. kishore), 10.ix.1953,

ex. "old wooden basket" C. From *Eastern Himalaya* : (vii) 5S. and 10W., Kumbre, Rongpo, East Sikkim Dist., Sikkim, coll. A. C. Mishra and party, 1.ix.1978, ex. "paddy straw litter" Following four vials from Darjiling Dist., W. B. as (viii) with 4S. and 5W., Pedong, coll. G. K. Srivastava and P. K. Maiti, 1.i.1974, ex. "log" (F. C. No. 5/1.1.74); (ix) with 2S. and 12W., Nazeok, coll. G. K. Srivastava and P. K. Maiti, 7.i.1974, ex. "soil" (F. C. No. 39/7.1.74); (ix) with 9S. and 12W., Tarkhole, coll. Z. S. I. Party, 12.viii.1958, ex. "from timber of a house"; (xi) with 3S. and 10W., Ghoomti forest, five kms North of Reyang, coll. G. K. Srivastava and P. K. Maiti, 5.i.1974, ex. "log" (F. C. No. 2/5.1.74). (xii) 2S. and 8W., Chapramari Sanctuary, forest near F. R. H., three km North of Khunia junc., Jalpaiguri Dist., W. B., coll. G. K. Srivastava and P. K. Maiti, 24.xii.1973, ex. "under bark of a log lying on ground" (F. C. No. 7/24.12.73). Following vials from Arunachal Pradesh as (xiii) with 4S. and 8W., Gogari village, Likhhabali, West Siang Dist., coll. T. K. Pal and party, 13.iii.1989; (xiv) with 9S. and 6W., Guru, West Siang Dist., coll. P. T. Bhutia and party, 9.xii.1988; (xv) with 6S. and 12W., Charduar forest, West Kameng Dist., coll. S. K. Tandon and party, 24.iii.1973; (xvi) 3S. and 3W., Kimin, L. Subansiri, coll. S. K. Gupta and M. Prasad, 4.ix.1981; (xvii) 7S. and 8W., Sille, E. Siang, coll. P. T. Bhutia and party, 22.xi.1988 (F. C. No. 43/22.11.88); (xviii) 4S. and 1W., Yabung, coll. P. T. Bhutia and party, 28.xi.1988 (F. C. No. 83/28.11.1988); (xix) 1S. and 10W. Silley, 28 km O. Pasighat, coll. T. K. Pal and party, 17.ii.1989; (xx) 2S. and 5W., Mikir hills coll. S. K. Gupta, 3.xi.1974; (xxi) 5S. and 10W., on way to Boligg, Siang Dist., coll. S. K. Gupta and M. Prasad, 21.x.1981; (xxii) 8S. and 12W., Pasighat, coll. P. T. Bhutia and party, 18.xi.1988 (F. C. No. 11/18.11.88); (xxiii) 3S., Siji, Siang Dist. coll. S. K. Gupta and M. Prasad, 15.x.1981, ex. 'leaf litter'; (xxiv) 1S. and 10W., Basar, coll. P. T. Bhutia and party, 18.xii.1988 (F. C. No. 134/5.12.88); (xxv) 2S. and 12W., Wakto, Lohit Dist., coll. J. M. Julka and party, 1.xii.1969; (xxvi) 3S. and 4W., Kandu

(Roing), coll. S. K. Tandon and party, 7.ii.1969. Following 3 materials from Lower Likhhabali, W. Siang Dist. by B. Nandi and party; (xxvii) 8S. and 12W., 5.vii.1985, ex. 'unknown log' (xxviii) 3S. and 10W., 15.vii.1985, ex. 'fallen banana leaf stalk', and (xxix) 2S. and 10W., 11.vii.1985, ex. 'mud plaster on post' Identified : From *Western Himalaya* : (i) 5S. 3W., C. N. Park, Sultan forest, Naini Tal Dist., Uttaranchal, coll. S. C. Verma, 27.vi.1976, det. S. C. Verma. (ii) 2S., C. N. Park, Sangli, Gairal, Pauri Dist., Uttaranchal, coll. S. C. Verma, 18.xi.1976, det. S. C. Verma. (iii) Uttarkashi, Uttarkashi Dist., Uttaranchal, coll. R. N. Bhargawa, 29.iii.1975, det. S. C. Verma. (iv) Narendranagar, Tehri Dist., Uttaranchal, coll. R. N. Chopra, 9.x.1975, det. S. C. Verma.

Diagnostic Character : (i) Imago : Head and pronotum reddish brown; pronotum with a T-shaped pale marking in middle and one shoulder spot on either side; wings yellowish brown. Head and pronotum fairly and body densely hairy.

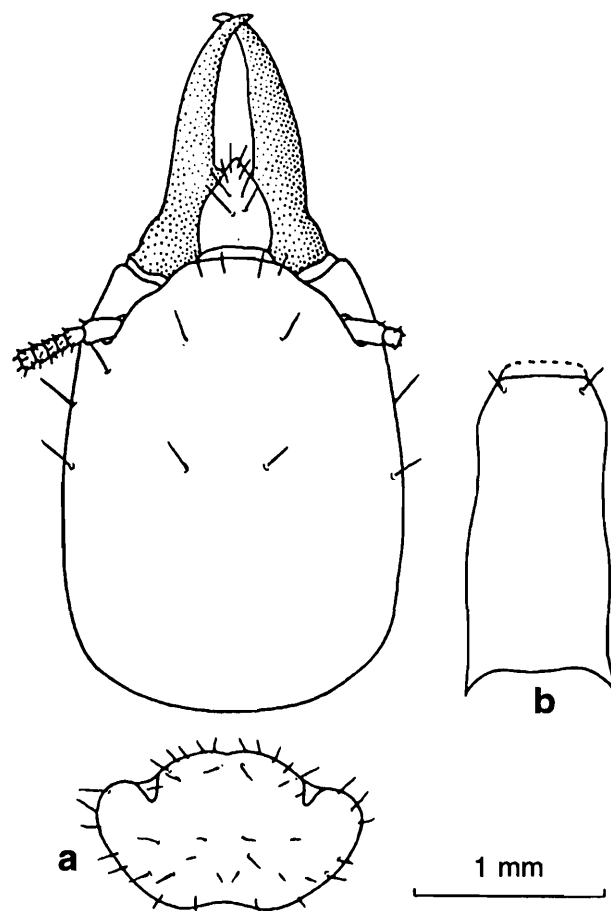


Fig. 81. : *Odontotermes parvidens* Holmgren and Holmgren; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Head subround. Fontanelle small, placed slightly below the middle. Ocelli suboval, separated from eyes by their long diameter to a little more. Antenna with 18-19 segments, 3, 4, 5 either subequal or slightly variable in size. Postclypeus swollen, with a prominent median line. Pronotum roughly trapezoidal, narrower than head with eyes, anterior margin with a shallow, median invagination with one more emarginations on either side; posterior margin substraight. Wings with radial streak separating from radius at proximal third.

(ii) Soldier (Fig. 81a-b) : Head yellowish to deep yellowish brown; body creamy to straw yellow. Head and pronotum sparsely and body rather densely hairy.

Head large, subrectangularly oval, converging anteriorly. Antenna with 16-17 segments (in 16-segmented ones), 3 either subequal to 2 or slightly longer and subdivided. Labrum triangularly tongue-shaped, with pointed tip. Mandibles strong, slightly incurved at tips. Left mandible with a very minute, laterally directed tooth at base of middle-third. Postmentum subrectangular with a few scattered hairs. Pronotum saddle-shaped, anterior margin weakly notched; posterior margin strongly emarginate.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir : Udhampur : Katra. *Western Himalaya* : Uttaranchal : DehraDun Dist. : Jhajra, New Forest; Naini Tal Dist. : Sultan forest; Pauri Dist. : Sangli, Gairal; Uttarkashi Dist. : Uttarkashi; Tehri Dist. : Narendranagar. *Eastern Himalaya* : Sikkim : Rongpo. West Bengal : Darjiling Dist. : Pedong, Ghoomti, Nazeok, Tarkhole; Jalpaiguri Dist. : Chapramari Sanctuary, forest near F. R. H., three km North of Khunia junc. Arunachal Pradesh : West Kameng Dist. : Charduar forest; Lower Subansiri Dist. : Kimin; East Siang Dist. : Pasighat, Yabung, Yingking, Sille; West Siang Dist. : Likhabali, Guru, Basar; Lohit Dist. : Wakro. BHUTAN (*Eastern Himalaya*). Assam. Nagaland. Manipur.

Elsewhere : Bangladesh.

Remarks : The species is highly variable one and is very common in the hilly area than on plains. The shape and size of head and mandible of the species vary appreciably in different populations. The species occurs in numerous habitats such as in hollows and scars of forest trees, in galleries and mud plaster on tree trunks, railway sleepers, fence posts, bamboo poles; in subterranean nests in soil and under cowdung, stones, logs, etc. In some cases, the species was found in association with other termites of the species *Macrotermes khajuriae*, *Microtermes obesi* and *Nasutitermes fletcheri*. In Gailikhola forest, *O. parvidens* and *M. khajuriae* were collected from the large hollowed portion inside the trunk of a half dead tree. The hollowed part generally remains packed up with soil brought by the workers.

Elsewhere in India, the species had been found in association with other species of termites, *Neotermes* sp., *Coptotermes* sp., *Odontotermes obesus*, *O. feae*, *Microtermes* sp., *Nasutitermes* sp. etc. (Beeson, 1941; Roonwal, 1954a, 1970a; Roonwal and Chhotani, 1962a; Mathur and Sen-Sarma, 1958, 1962).

The species usually causes considerable damage to bark of both young and old trees in North Bengal.

82. *Odontotermes proformosanus* Ahmad (Fig. 82, Table 53)

Odontotermes proformosanus Ahmad

1965. Ahmad, *Bull. Am. Mus. nat. Hist.*, **131** (Art. 1) : 43, 46-48. Im. and S. Holotype : S., in PU. Type-locality : Kachong, Thailand.
1975. Akhtar, *Bull. Dept. Zool. Univ. Panjab* (N. S.) Art. 7 : 70, 93-97.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 534-537 (detailed synonymy).
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 103-104.

Material studied : Identified : From *Eastern Himalaya* : S. and W., Likhabali, West Siang Dist., Arunachal Pradesh, coll. S. K. Gupta, 17.x.1981, det. G. Bose.

Diagnostic Character : (i) Imago : Known but not from the Himalaya, hence not dealt with.

(ii) Soldier (Fig. 82a-b) : Head yellowish brown. Head and pronotum sparsely and body fairly densely hairy.

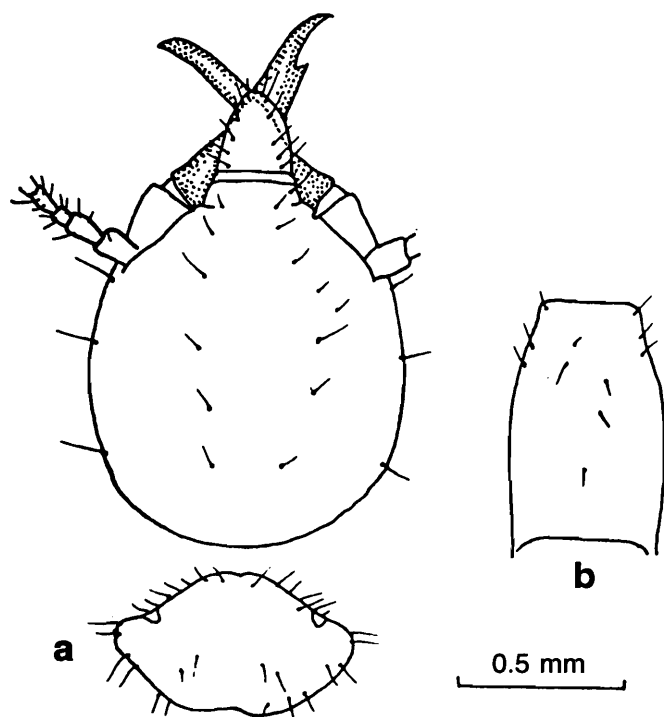


Fig. 82. : *Odontotermes proformosanus* Ahmad; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Head elongately oval, narrowed anteriorly. Antenna with 15-16 segments, 3 or 4 shortest. Labrum tongue-shaped, anteriorly broadly rounded with erect hairs. Mandibles sabre-shaped, weakly but pointed incurved apices. Left mandible with a sharply pointed, and anteriorly directed tooth on apical third. Postmentum arched, sides convex and narrowed at anterior third. Pronotum saddle-shaped, indistinctly notched anteriorly and distinctly emarginate at posterior margin.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : West Siang Dist. : Likhabali.

Elsewhere : Bangladesh. Thailand.

Remarks : The name of the species itself indicates its close similarity with *O. formosanus* (Shiraki) known from the south-east Asia including east India which seems to be smaller in size of soldiers.

83. *Odontotermes prolatigula* Bose (Fig. 83, Table 54)

Odontotermes prolatigula Bose

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 537-539.

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 104-107. Holotype : S., in ZSI. Type-locality : Nambung, East Siang District, Arunachal Pradesh.

Material studied : Identified : From *Eastern Himalaya* : Holotype S. and 3 paratype S. and 2 paratype W., Nambung, East Siang, Dist. : Arunachal Pradesh (seven km from Ziro to Boleng), coll. T. K. Pal, 23.ii.1989, det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 83a-c) : Head yellow to dark brown; pronotum yellow to pale brownish; abdomen creamish yellow. Head and body fairly densely hairy.

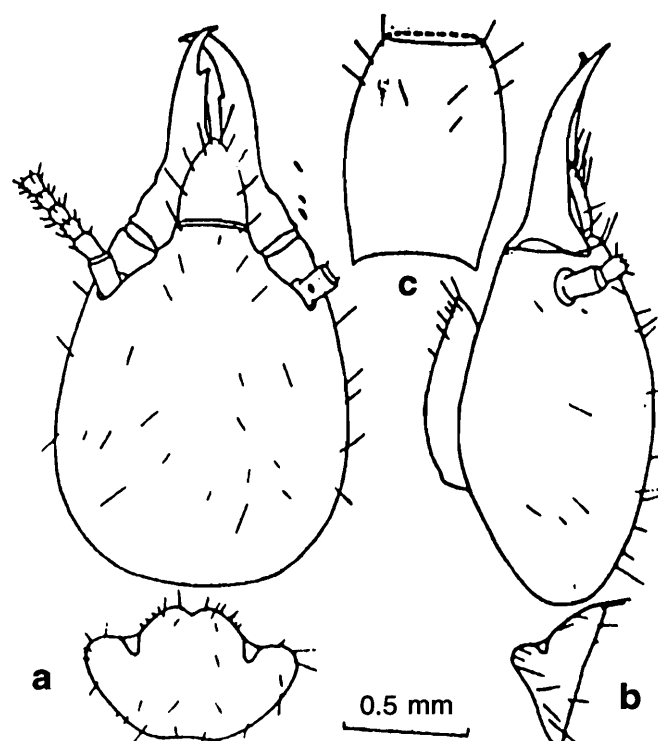


Fig. 83. : *Odontotermes prolatigula* Bose; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Postmentum.

Head oval, longer than wide, appreciably narrowed in front to base of mandibles. Antennae 16-segmented, 3 a little shorter than 2; 4 shortest.

Labrum triangularly tongue-shaped, with 4 pairs of long hairs. Mandibles sabre-shaped, moderately robust. Left mandible with a prominent tooth situated a little in front of distal 1/3, right mandible with a minute tooth a little below distal third. Postmentum broad cask-like. Pronotum saddle-shaped, anterior margin fairly to prominently notched medially; posterior margin weakly incurved.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : East Siang Dist. : Nambung (Type-locality). Known only from type-locality.

Remarks : This species can be easily differentiated from all other species of the genus by its much broader postmentum of soldiers which is the most diagnostic character of its allied species *O. latigula*, known only from the Andamans and Nicobars.

Table 53 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Odontotermes obesus</i>		<i>O. parvidens</i>		<i>O. proformosanus</i>	
	Sev. S.	Known Range	Sev. S.	Known Range	1S.	Known Range
Length of head to lateral base of mandibles	1.40–1.65	1.03–1.67	2.38–2.68	1.89–2.70	1.00	1.00–1.31
Maximum width of head	1.18–1.35	0.95–1.37	1.88–2.10	1.45–2.15	0.94	0.90–1.22
Head index (width/length)	0.81–0.84	0.82–0.95	0.78–0.79	–	0.94	–
Maximum length of labrum	0.33	–	0.47	–	0.25	–
Maximum width of labrum	0.26	–	0.38	–	0.22	–
Length of left mandible (Upper base of condyle to tip)	0.79–1.00	0.75–1.03	1.31	1.19–1.38	0.62	0.62–0.74
Head-mandibular length Index (Left mand.-length/head-length)	0.60	0.59–0.68	0.50	0.50–0.60	–	0.533
Left mandibular tooth distance (base of tooth to tip of mandible)	0.20–0.35	0.25–0.38	0.80	0.70–0.80	0.16	0.16–0.25
Left mandibular tooth Index (tooth distance/left mandible length)	0.35	0.31–0.40	0.61–0.62	0.58–0.65	0.26	0.292
Minimum median length of postmentum	0.75–0.90	0.70–0.93	1.18–1.62	1.15–1.70	0.68	0.49–0.72
Maximum width of postmentum	0.50–0.56	0.50–0.58	0.75–0.90	0.62–0.90	0.44	0.39–0.59
Width of postmentum at waist	–	–	–	–	–	–
Maximum length of pronotum	0.55–0.63	0.50–0.65	0.85	0.60–0.93	0.40	0.33–0.49
Maximum width of pronotum	0.88–1.00	0.80–1.07	1.47	1.05–1.65	0.68	0.65–0.88
Pronotum index (length/width)	0.62–0.63	–	0.58	–	–	–
Number of antennal segments	16–17	16–17	16–17	16–17	15	15–16

84. *Odontotermes redemanni* (Wasmann)

(Fig. 84, Tables 47 and 54)

1. *Termes redemanni* Wasmann

1893. Wasmann, *Wein. Ent. Zeig.*, **12**(7) : 239. Im., S. and W.
Lectotype : S., in NHM, Maastricht. Type-locality :
Sri Lanka.

2. *Odontotermes redemanni* (Wasmann)

1967. Roonwal and Chhotani, *Zool. Anz.*, **178**(3/4) : 251-252.
1976. Thakur, *Indian Forester*, **102**(8) : 498, 501, 502.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 19,
25, 110-114.
1985. Verma, *Indian J. Forestry*, **8**(3) : 182.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western
Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** :
539-542 (detailed synonymy).

Material studied : Unidentified : A. From *Western Himalaya* : (i) 7S. and 8W., New Forest, Dehra Dun Dist., Uttaranchal, coll. *Forest Entomologist (A. Kishore)*, 4.viii.1953, ex. "manure", B. From *Central Himalaya* : (ii) 6S., sev W., Ratomati village, ca. 45 km North of Birjung, Hetauda subdivision, Mokoanpur Dist., Nepal, coll. *P. Mukherjee*, 26.iv.2000, ex. "mound beneath a Sal tree of a tilla." (iii) 3S., 8W., Nijgarh jungle, ca. 35 km South-East of Birjung, adjacent to Tamaguri Beat Office, Bara Dist., Nepal, coll. *P. Mukherjee*, 28.iv.2000, ex. "from a mound beneath the Sal tree" (iv) Sev. S., sev. W., Ganesh sthan, behind Birendra bahumukhi campus, seven km West of Narayangarh, Chitwan Dist., Nepal, coll. *P. Mukherjee*, 25.ix.2000, ex. "from mound of Sal jungle." (v) Sev. S., sev. W., Gadauli, 30 km East of Narayangarh, Chitwan Dist., Nepal, coll. *P. Mukherjee*, 26.ix.2000, ex. "under soil." (vi) Sev. S., sev. W., Ramnagar jungle, beside Medical College Hostel Campus, seven km West of Narayangarh, Chitwan Dist., Nepal, coll. *P. Mukherjee*, 24.ix.2000, ex. "from mound of Sal tree." Identified : From *Western Himalaya* : (i) 1 Im., 2S., 4W., C. N. Park, Bijrani, Naini Tal Dist., Uttaranchal, coll. *S. C. Verma*, 6.vi.1976, det. *S. C. Verma*. (ii) 3S., 3W., Dhikola, Sarapduli Road, Pauri Dist., Uttaranchal, coll. *S. C. Verma*, 17.i.1979, det. *S. C. Verma*.

Diagnostic Character : (i) Imago (Fig. 84a-c) : Head pale brown to dark brown; antennae and postclypeus yellowish brown, paler than head; pronotum either paler than or as dark as head, with paler T-shaped mark and shoulder spots; wings yellowish brown. Head and body thickly pilose.

Head subcircular. Fontanelle minute, round, placed slightly below the middle of head. Ocelli broadly oval, separated from eyes half of their short diameter. Antennae with 18-19 segments, 2 longer than 3; the latter shortest or subequal to 5. Postclypeus swollen, with a faint median line and hairy. Pronotum trapezoidal, anterior margin with a weak median notch; posterior margin weakly invaginated medially. Radial streak of wing absent.

(ii) Soldier (Fig. 84d-e) : Head pale yellow to deep yellowish brown. Head and pronotum sparsely and abdomen fairly densely pilose.

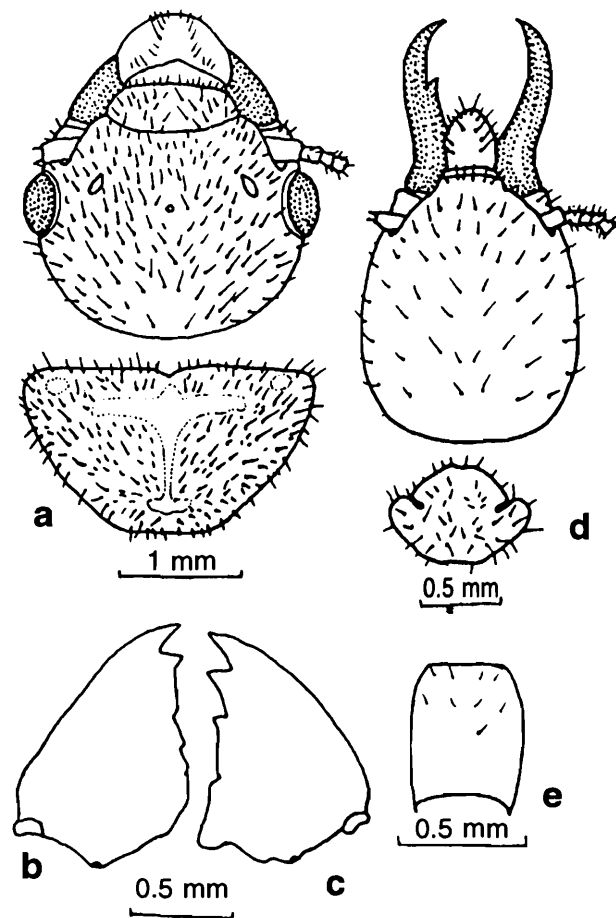


Fig. 84. : *Odontotermes redemanni* (Wasmann); a-c, Imago. a. Head and pronotum, dorsal view; b. Left mandible; c. Right mandible; d-e, Soldier. d. Head and pronotum, dorsal view; e. Postmentum.

Head oval, closely similar to *O. obesus*. Antennae with 16 to 17 segments, 4 shortest in 16-segmented antennae and 3 in 17-segmented ones. Labrum tongue-shaped, anterior margin broadly rounded. Mandibles long, slender, sabre-shaped, apices incurved distally, longer than half of head-length. Left mandible with a medium sized tooth near the apical third. Postmentum moderately swollen, subrectangular. Pronotum saddle-shaped, weakly to deeply notched medially at anterior margin and weakly emarginated on posterior margin.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : New Forest, Motichur Forest; Naini Tal Dist. : Bijrani, Sultan Forest; Pauri Dist. : Dhikola, Sarapduli Road, C. N. Park, Sangli, Gairal; Uttarakashi Dist. : Uttarkashi; Tehri Dist. : Narendranagar; Almora Dist. : Pithoragarh Dist. West Bengal. Bihar. Maharashtra. NEPAL (*Central Himalaya*) : Mokoanpur Dist. : Hetauda sub-division : Ratomati village, ca. 45 km North of Birjung; Bara Dist. : Nijgarh jungle, ca. 35 km South-East of Birjung, adjacent to Tamaguri Beat office; Chitwan Dist. : Ganesh sthan, behind Birendra bahumukhi campus, seven km West of Narayangarh, Gadauli, 30 km East of Narayangarh, Rām-nagar jungle, beside Medical College Hostel Campus, seven km West of Narayangarh.

Elsewhere : Sri Lanka (widely distributed). Bangladesh.

Remarks : It is a very variable and common mound building termite in India. It is very much closely allied to *O. obesus* from which it cannot be easily isolated vide under *O. obesus*. It has got a minor pest status in the country.

Odontotermes redemanni (Wasmann) is a common mound building termite in Ceylon and India. The internal structure of the mounds and its ecology are studied in details by Mukherjee and Mitra (1949). Apart from galleries and mud palster on tree trunks, logs, fence post, transmission poles, grasses etc., it inhabits also under stone, refuse and rubbish, manured soil, etc., in the Himalaya. From

the nest the galleries or covered runways extend to a quite long distance through which the workers go out to collect food.

The species usually swarms in the month of June to August in the sub-Himalayan of West Bengal.

The species is of great importance in the country. It causes damage to growing trees, bark of many plants, timbers in human use, fence posts and several other articles. The species has also been recorded from tea plantations in North Bengal. However, the species is known to damage tea and coconut in Ceylon. Biology of the species is fairly well known (Roonwal, 1970a; Sen-Sarma *et al.*, 1975; Chhotani, 1980; Maiti, 1983).

85. *Odontotermes sikkimensis* Thakur and Rathore

(Fig. 85, Table 54)

Odontotermes sikkimensis Thakur and Rathore

1986. Thakur and Rathore, *J. Ind. Acad. Wood. Sci.*, 17(1) : 53-56, figs. 1 and 2. S. and W. Type-locality : Namchi, Sikkim, India.

Material studied : Identified : From *Eastern Himalaya* : Holotype : S., 2 Morphotypes W., 5 Paratypes S. and sev. Paramorphotypes W., Namchi, Sikkim, coll. T. G. Vazirani, 19.x.1977, det. R. K. Thakur and N. S. Rathore.

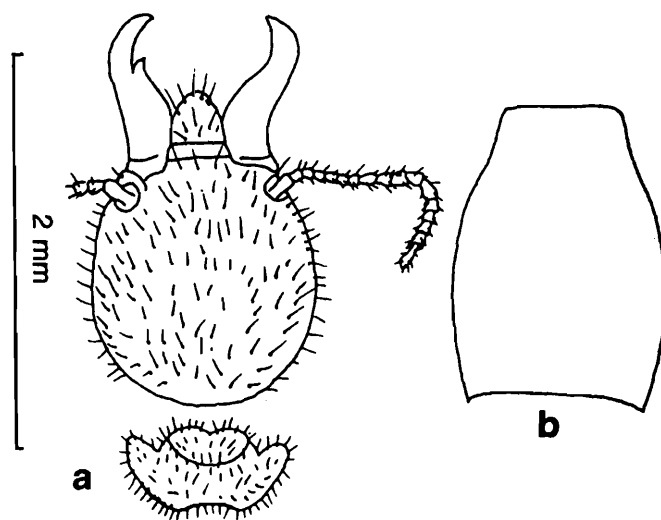


Fig. 85. : *Odontotermes sikkimensis* Thakur and Rathore; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 85a-b) : Head; antennae yellowish to yellowish brown, uniformly coloured; pronotum and body straw yellow, much paler than head.

Head broadly oval, broadest near the posterior third. Fontanelle indistinct. Antennae with 15-16 segments, 2 about one and a half times of 3; 3 shortest. Labrum tongue-shaped, with hairs. Mandibles sickle-shaped, short and slightly more than half of head-length, apices weakly incurved. Left mandible with a prominent acute tooth, placed near the upper edge of apical third. Postmentum subrectangular, sides well arched,

abruptly narrowing near the anterior one-fourth, anterior margin sub-straight, posterior margin weakly concave. Pronotum saddle-shaped, distinctly narrower than head-width, anterior margin weakly but distinctly notched in the middle; posterior margin broadly concave medially.

Distribution : INDIA : *Eastern Himalaya* : Sikkim : Namchi.

Remarks : Nothing is known about its biology, since it is not recorded after its discovery from Sikkim. However, it is a very close species to *O. boveni*, from which it can be isolated by its narrower head of soldiers.

Table 54 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Odontotermes prolatigula</i>		<i>O. redemanni</i>		<i>O. sikkimensis</i>	
	Holo-type	Known Range	7S.	Known Range	Holo-type	Known Range
Length of head to lateral base of mandibles	1.30	1.28–1.40	1.20–1.62	1.15–1.35	1.30	1.30–1.40
Maximum width of head	1.13	1.13–1.15	1.05–1.31	1.00–1.20	1.10	1.10–1.25
Head index (width/length)	0.869	0.821–0.883	0.81–0.87	–	0.85	–
Maximum length of labrum	0.33	0.33–0.35	0.37	–	–	–
Maximum width of labrum	0.275	0.27–0.30	0.25	–	–	–
Length of left mandible (Upper base of condyle to tip)	0.78	0.78–0.83	0.80–1.12	0.75–0.95	0.65	0.65–0.73
Head-mandibular length Index (Left mand.-length/head-length)	0.60	0.593–0.625	0.66–0.69	0.60–0.63	0.50	–
Left mandibular tooth distance (base of tooth to tip of mandible)	0.21	0.21–0.23	0.44	–	–	–
Left mandibular tooth Index (tooth distance/left mandible length)	0.269	0.253–0.287	–	–	–	–
Minimum median length of postmentum	0.75	0.75–0.87	0.50–0.80	0.65–0.85	–	–
Maximum width of postmentum	0.59	0.58–0.63	0.49–0.58	0.45–0.58	–	–
Width of postmentum at waist	–	–	–	–	–	–
Maximum length of pronotum	0.50	0.50–0.53	0.48–0.60	0.45–0.60	0.40	0.40–0.50
Maximum width of pronotum	0.80	0.80–0.87	0.88–1.00	0.70–1.00	0.75	0.75–0.80
Pronotum index (length/width)	0.63	–	–	–	0.53	–
Number of antennal segments	16	16	16–17	16–17	–	15–16

Genus *Hypotermes* HolmgrenKey to the species of genus *Hypotermes* Holmgren

I. IMAGOES :

1. Head wider, head-width with eyes 2.23-2.35 mm; eyes larger (max. diameter 0.62-0.70 mm, min. diameter 0.54-0.59 mm); Ocelli large, separated from eyes by less than or about their short diameter 0.20-0.25 mm; pronotum width 2.10-2.26 mm *H. obscuriceps* (Wasmann)
- Head narrower, head-width with eyes 1.90-2.20 mm (1.89-2.10 mm); eyes smaller, max. diameter 0.53-0.60 mm (0.52-0.63 mm), min. diameter (0.45-0.58 mm); Ocelli small, separated from eyes by about their short diameter or slightly more (0.5-0.19 mm); pronotum width, 1.75-2.03 mm (1.71-2.00 mm) *H. xenotermitis* (Wasmann)

II. SOLDIERS :

1. Smaller species, head-length 1.15-1.20 mm, head-width 0.91-1.23 mm (0.95-1.05 mm), maximum width of head at middle; labrum oval; pronotum indistinctly emarginated anteriorly *H. obscuriceps* (Wasmann)
- Larger species, head-length 0.98-1.44 mm (1.38-1.42 mm), head-width 0.90-1.30 mm (1.20-1.23 mm), maximum width of head somewhat posteriorly; labrum broadly rounded apically; pronotum distinctly emarginated anteriorly *H. xenotermitis* (Wasmann)

86. *Hypotermes obscuriceps* (Wasmann)

(Fig. 86, Tables 55 and 56)

1. *Termes obscuriceps* Wasmann

1902. Wasmann, *Zool. Jb. Syst.*, **17** : 113-114. S. and W. Lectotype : S., in NHM. Type-locality : Trincomalee, Sri Lanka.

2. *Odontotermes (Hypotermes) obscuriceps* (Wasmann)

1969. Van Boven, *Publ. natuurh. Genoot. Limburg*, **19** : 49.

3. *Hypotermes obscuriceps* (Wasmann)

1956. Roonwal and Sen-Sarma, *Indian J. agric. Sci.*, **26**(1) : 25.

- 1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) **28**(4) : 360-362. Darjiling Himalaya.

- 1970a. Roonwal, In : *Biology of Termites* (Eds. Krishna and Weesner) Vol. **2** : 370-371.

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 19, 114-115.

1984. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 49 : 200-202.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 557-561.

Material studied : Unidentified : From *Eastern Himalaya* : (i) 3S. and sev. W., Namchi, South Sikkim, coll. P. H. Roy and party. 13.v.1995. (ii) 2S. and 6W., Namthang, South Sikkim, coll. P. H. Roy and party. 14.v.1995, ex. 'under stone'; (iii) 2 Im., 3S. and 5W. Namchi, South Sikkim, coll. P. H. Roy and party, ex. 'gallery on felled log'

Identified : From *Eastern Himalaya* : 3S., and 5W. Ghumti (alt. 3,300 ft.), Darjiling Dist., W. B., coll. F. H. Gravely, 27.iii.1910, det. F. Silvestri.

Diagnostic Character : (i) Imago : Head dark brown; postclypeus; antennae; pronotum pale brown. Wings yellowish brown with cuticular rods on membrane, radial streak present, densely hairy. Head and pronotum densely and abdomen more densely hairy.

Head almost circular. Fontanelle small, circular, whitish and placed at the middle of head. Ocelli large, oval, translucent, separated from eyes by a distance of about their short diameter (distance 0.20-0.25 mm). Antennae with 19 segments, segment 3 shorter than 2; 4 longer than 3 but shorter than 2. Postclypeus large, outcurved and devoid of any median line. Pronotum subtrapezoidal, anterior margin with indistinct emargination at middle; posterior margin faintly incurved medially. Wings yellowish brown; hairy near distal end. Media bifurcating near about middle.

(ii) Soldier (Fig. 86a) : Head pale brown to dark brown; body whitish yellow to dirty yellow. Head and pronotum sparsely and body fairly densely hairy.

Head subrectangular, sides weakly convex and slightly narrowing in front, widest at middle.

Antennae with 16-17 segments, segment 3 shortest in 16-segmented and 4 shortest in 17-segmented, 4 sometimes in process of division. Labrum broadly tongue-shaped, with a row of hairs on either side, anterior margin rounded with a small tip. Mandibles short, stout, sabre-shaped, incurved distally, shorter to a little longer than half of head-length. Postmentum subrectangular, sides subparallel or very feebly incurved. Pronotum saddle-shaped, anterior margin with sharp and posterior margin also with broad emarginations.

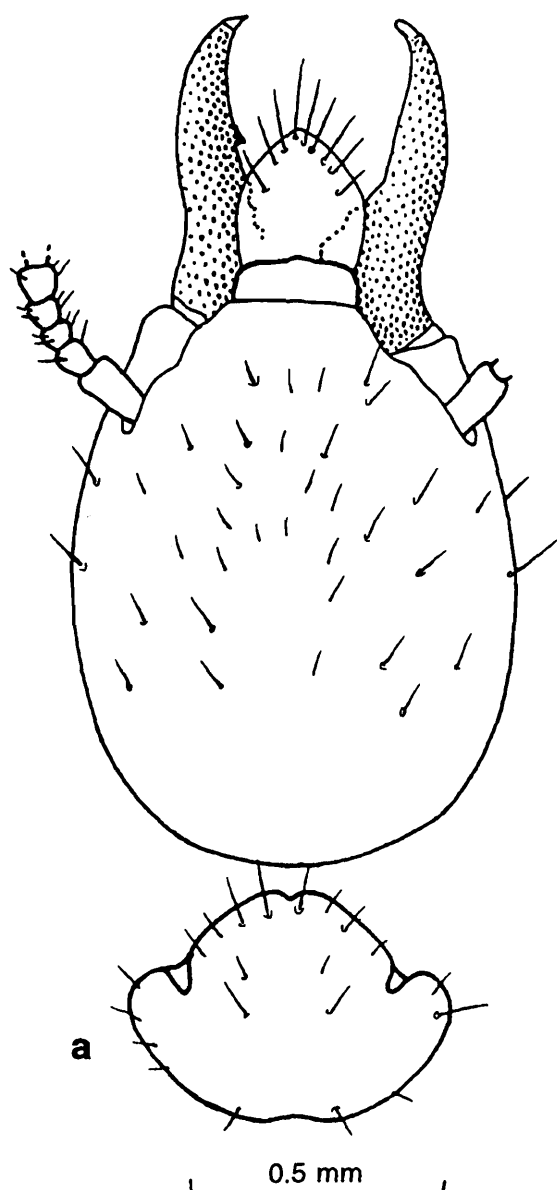


Fig. 86. : *Hypotermes obscuriceps* (Wasmann); a, Soldier.
a. Head and pronotum, dorsal view.

Distribution : INDIA : *Eastern Himalaya* : Sikkim; South Sikkim Dist. : Namchi and Namthang. West Bengal : Darjiling Dist. : Ghumti. Southern India.

Elsewhere : Sri Lanka. Indochina (South Vietnam).

Remarks : Among three species of the genus *Hypotermes* known from India, two occur in the Eastern Himalaya of which *H. obscuriceps* is more common. The species differs morphologically in having max. head-width of the soldiers at the middle from its allied one, *Xenotermitis scenot* with max. head-width more posteriorly. Biology of the species is not known in India which had been studied to some extent in Sri Lanka (Escherich, 1911) and Indo-China (Bathellier, 1927). In these areas, the species is known to construct low earthen mound of about 1.5-7.5 m. The species attacks timber in houses in Sri Lanka, and living palms and rubber trees in Viena (Roonwal, 1970a).

87. *Hypotermes xenotermitis* (Wasmann) (Fig. 87, Table 56)

1. *Termes xenotermitis* (Wasmann)

1896. Wasmann, *Ann. Mus. Civ. Stor. Nat.*, (2) 16 (36) : 628.
S. and W. Lectotype : S., in NHM. Type-locality : Palon (Pegu), Myanmar.

2. *Hypotermes xenotermitis* (Wasmann)

1956. Roonwal and Sen-Sarma, *Indian J. agric. Sci.*, 26(1) : 25.
1965. Ahmad, *Bull. Am. Mus. nat. Hist.*, 131 (Art. 1) : 53, 54-55.
1977. Roonwal and Chhotani, *Ent. Basil.*, 2 : 74-76.
1985. Chhotani and Bose, *Rec. zool. Surv. India*, 82(1-4) : 59.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 563-567 (detailed synonymy).
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 110-112. Eastern Himalaya.

3. *Hypotermes nongpriangi* Roonwal & Sen-Sarma

1956. Roonwal and Sen-Sarma, *Indian J. agric. Sci.*, 26 : 21-26.
1965. Krishna, *Am. Mus. Novit.*, No. 2210. 25. (Treats it as synonym of *H. xenotermitis*).

Material studied : Identified : From *Eastern Himalaya* : (i) 2S. and 12W., Teesta Valley,

Darjiling Dist. W. B., coll. P. K. Maiti, 20.x.1966, det. P. K. Maiti. (ii) 6 Im., Samchi (alt. 300 m.), Bhutan, coll. Zool. Exptd. N. H. Museum, Basel (Switzerland), 7-11.v.1972, det. M. L. Roonwal and O. B. Chhotani.

Diagnostic Character : (i) Imago (Fig. 87a) : Head and pronotum brown, paler anteriorly; postclypeus yellowish to yellowish brown. Head and pronotum fairly and abdomen more densely hairy.

Head subcircular. Fontanelle minute, circular and situated below middle. Ocelli oval, separated from eyes by about short diameter or a little more (0.15-0.19 mm). Antennae with 19-segments, 3 and 4 subequal; 5 shortest. Postclypeus hairy and devoid of any median line. Pronotum semicircular, anterior margin almost straight, indistinctly emarginate; posterior margin slightly emarginated. Wings long.

(ii) Soldier (Fig. 87b-c) : Head yellowish brown, somewhat paler anteriorly; body pale yellow. Head and pronotum sparsely and body fairly hairy.

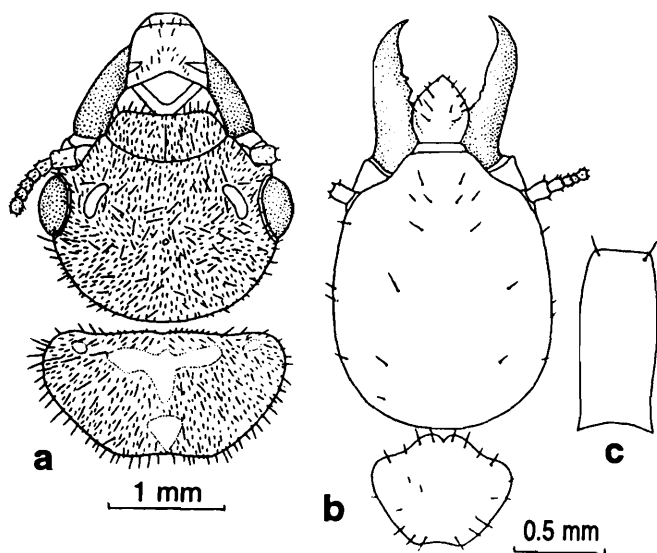


Fig. 87. : *Hypotermes xenotermitis* (Wasmann); a, Imago. a. Head and pronotum, dorsal view; b-c, Soldier. b. Head and pronotum, dorsal view; c. Postmentum.

Head oval, broadest posteriorly; sides appreciably converging in front. Antennae with 15-16 segments, 3 shorter than 2, 4 shortest. Labrum broad, tongue-shaped with 6-7 longer bristles on either side, tip slightly pointed. Mandibles short and thick, almost half the head-length. Left

mandibles with 3 prominent crenulations in basal half, right without crenulations but sometimes with a few serrations near base. Postmentum subrectangular, broadest in anterior third. Pronotum strongly saddle-shaped, sparsely hairy, anterior margin weakly to fairly distinctly notched, posterior margin weakly to fairly emarginate.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Jalpaiguri Dist. : Pangar Airport. Arunachal Pradesh : Kameng Dist. : Bank of River Belsiri, Ankling, Panjali; Tirap Dist. : Khonsa, Changhi, Gibbons Land, 16 km of Miao, Miao Res. Forest. Assam. Meghalaya. Nagaland. Tripura. BHUTAN (*Eastern Himalaya*) : Samchi.

Elsewhere : Bangladesh, Myonmar, Thailand. Malaysia.

Remarks : The species occurs mostly in the north-eastern India including the Eastern Himalaya, although it well spreads in the south-east Asia.

Genus *Microtermes* Wasmann

Key to the species of genus *Microtermes* Wasmann

I. IMAGOS :

1. Eye-ocellus distance less 0.02 mm (0.03-0.035 mm), ocellus generally touching the eye; fontanelle fairly large *M. imphalensis* Roonwal and Chhotani
- Eye-ocellus distance more (0.05-0.07 mm), ocellus distinctly separated from eye; fontanelle small 2
2. Postclypeus about $\frac{1}{2}$ as long as its width; ocellus separated from eye by $\frac{1}{3}$ of short diameter *M. unicolor* Snyder
- Postclypeus $\frac{1}{2}$ or slightly more than $\frac{1}{2}$ of its width; ocellus separated from eye by $\frac{1}{2}$ of its width *M. obesi* Holmgren

II. SOLDIERS :

1. Head strongly convergent anteriorly, max. width of head near posterior end; labrum elongately tongue shaped, tip of labrum very faintly lanceolate *M. imphalensis* Roonwal and Chhotani

Table 55 : Measurements (in mm) etc. of Caste–Imago.

	<i>Hypotermes xenotermitis</i>	
	6Im.	Known Range
Total body-length with wings (excluding antennae), ca.	23.5–25.0	23.0–25.0
Total body-length without wings (excluding antennae), ca.	11.0–12.0	11.0–12.0
Length of head to lateral base of mandibles	1.56–1.78	1.44–1.80
Maximum width of head (with eyes)	1.90–2.20	1.89–2.20
Maximum length of postclypeus	–	–
Maximum width of postclypeus	–	–
Maximum length of labrum	–	–
Maximum width of labrum	–	–
Maximum diameter of compound eye (with ocular sclerite)	0.53–0.60	0.52–0.63
Minimum diameter of compound eye (with ocular sclerite)	–	0.45–0.58
Long diameter of lateral ocellus	0.19–0.20	0.19–0.20
Short diameter of lateral ocellus	–	0.13–0.16
Minimum eye-ocellus distance	0.15–0.18	0.15–0.19
Maximum length of pronotum	0.90–1.05	0.87–1.05
Maximum width of pronotum	1.75–2.03	1.71–2.00
Length of forewing with scale	21.0–22.0	20.5–22.0
Length of hindwing with scale	19.0–20.0	19.1–20.0
Number of antennal segments	19	19

Table 56 : Measurements (in mm) etc. of Caste–Soldier.

	<i>Hypotermes obscuriceps</i>		<i>H. xenotermitis</i>	
	6S.	Known Range	2S.	Known Range
Length of head to lateral base of mandibles	1.13–1.55	1.13–1.60	0.98–1.44	0.98–1.50
Maximum width of head	0.91–1.23	0.90–1.25	0.90–1.30	0.85–1.32
Head index (width/length)	0.79–0.80	0.76–0.89	0.90–0.92	0.83–0.90
Maximum length of labrum	0.26–0.30	0.18–0.30	0.20–0.34	0.20–0.30
Maximum width of labrum	0.25–0.30	0.25–0.35	0.28–0.35	0.28–0.38
Length of left mandible (Upper base of condyle to tip)	0.60–0.72	0.60–0.75	0.55–0.75	0.54–0.72
Head-mandibular length Index (left mandible-length/head-length)	0.46–0.53	0.47–0.58	–	0.45–0.60
Minimum median length of postmentum	–	0.60–0.90	0.65–0.90	0.64–0.88
Maximum width of postmentum	–	0.35–0.50	0.44–0.50	0.41–0.53
Width of postmentum at waist	–	–	–	–
Maximum length of pronotum	0.44–0.56	0.40–0.58	0.40–0.56	0.38–0.55
Maximum width of pronotum	0.75–0.90	0.70–0.90	0.75	0.62–0.90
Pronotum index (length/width)	–	–	–	–
Number of antennal segments	16	16–17	15	15–16

- Head comparatively oval, less so convergent in front, max. width of head more or less at middle; labrum strongly lanceolate 2
- 2. Antennae with 2nd segment shorter than 3rd and 4th combined together; head and body comparatively densely hairy
..... *M. unicolor* Snyder
- Antennae with 2nd segment equal to 3rd and 4th combined together; head and body less so hairy *M. obesi* Holmgren

88. *Microtermes imphalensis* Roonwal and Chhotani
(Fig. 88, Tables 57 and 58)

***Microtermes imphalensis* Roonwal and Chhotani**

1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) 28(4) : 364-374, 391, 396, Pl. 34. Holotype : Im., in ZSI. Type-locality : Imphal Valley, Manipur, India.

1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 34.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 576-578 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 113-116. Arunachal Pradesh.

Material studied : Unidentified : From *Eastern Himalaya* : 1 Im., sev. S. and sev. W., Lake Ganga, Itanagar, Arunachal Pradesh, coll. *B. Nandi and S. K. Chakraborty*, 12.vii.1985, ex. "soil" (ii) Im., S. and W., Deban, Tirap Dist., Arunachal Pradesh, coll. *P. K. Maiti*, 20.viii.83, ex. "under stone."

Diagnostic Character : (i) Imago (Fig. 88a-d) : Head brown; antennae; postclypeus; pronotum brownish yellow. Head and pronotum moderately and abdomen densely hairy.

Head subcircular, Y-suture weakly marked. Fontanelle minute, circular, white, dot-like and placed below the middle. Ocelli moderately large, either touching the eyes or very slightly separated (by 0.01-0.02 mm). Antennae with 15 segments, segment 3 shortest (longer than 4 in 16-segmented antennae). Postclypeus strongly swollen, anterior margin almost straight; posterior margin strongly convex. Pronotum almost semicircular, anterior margin weakly concave with a feeble median notch; posterior margin slightly convex and weakly incurved medially. Wings hairy.

(ii) Soldier (Fig. 88e-g) : Head pale brownish yellow, paler medially; abdomen creamy white. Head and body fairly hairy.

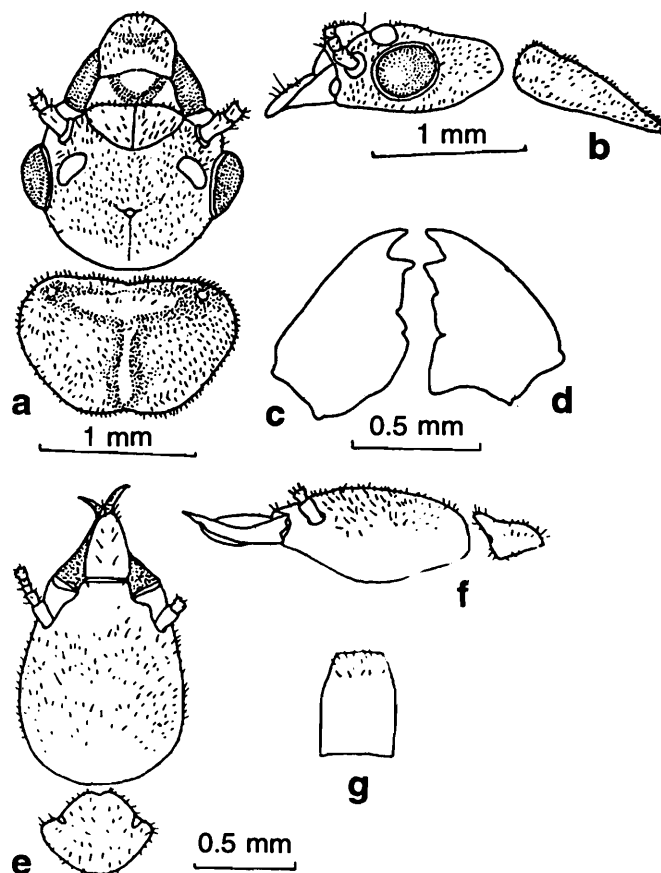


Fig. 88. : *Microtermes imphalensis* Roonwal and Chhotani; a-d, Imago. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Left mandible; d. Right mandible; e-g, Soldier. e. Head and pronotum, dorsal view; f. Head and pronotum, side view; g. Postmentum.

Head oval; sides strongly converging in front. Antennae with 14 segments, 3 shortest. Labrum elongately tongue-shaped, with weak, lanceolately pointed tip. Mandibles delicate, slightly concave in outer margin in basal half, tips weakly incurved. Postmentum somewhat rectangular with outcurved sides. Pronotum strongly saddle-shaped, anterior margin deeply notched; posterior margin distinctly emarginate.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : Kimin, Lake Ganga (Itanagar), Nirjuli, near Itanagar. Manipur : Imphal valley (type-locality); Southern Dist. : Morch.

Remarks : The name of the species was derived from its type-locality in Imphal valley, wherein

the species remains confined so far, until Bose (1999) reported it from Arunachal Pradesh. In the present study it has been recorded from two more localities in *Eastern Himalaya*, occurring in soil.

However, the characteristic lanceolate shape of the labrum of the soldiers of the species keeps it distinct from all other species of the genus known from the Himalaya, although it is closely allied to *M. incertoides* Holmgren with wide but allopatric distribution in India.

• 89. *Microtermes obesi* Holmgren
(Fig. 89, Tables 57 and 58)

1. *Microtermes obesi* Holmgren

1911. Holmgren, *J. Bombay nat. Hist. Soc.*, **21**(1) : 787-788. Im. only. Holotype : Probably in Riksmus., Stockholm. Syntypes, present in FRI and IARI. Type-locality : Khandala, Maharashtra, India.
- 1964a. Chatterjee and Thakur, *Indian For. Rec.* (N. S.) *Ent.*, **10**(11) : 222, 223, 234-239, 265, 266.
1974. Akhtar, *Pakistan J. Zool.*, **6**(1 & 2) : 102.
- 1984b. Verma, *Indian-J. Forestry*, **7**(4) : 309, 310, 313.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 583-587 (detailed synonymy).
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 116-117.

2. *Microtermes anandi* Holmgren

- 1913a. Holmgren, *J. Bombay nat. Hist. Soc.*, **22**(1) : 114.
1960. Mathur and Sen-Sarma, *J. Timber Dryers & Preserv. Assoc. India*, **6**(2) : 23-27. Uttaranchal.
- 1962a. Roonwal and Chhotani, *Proc. nat. Inst. Sci. India*, (B) **28**(4) : 362 (synonymy)

3. *Microtermes anandi f. curvignathus*
Holmgren

1911. Holmgren, *J. Bombay nat. Hist. Soc.*, **22**(1) : 114.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 584.

Material studied : Unidentified : A. From *Western Himalaya* : Following two vials from Dehra Dun, Uttaranchal, coll. *Forest Entomologists* as (i) with 4S. and 5W., Arcadia Tea Estate, 3.x.1953, ex. 'under log in soil';

(ii) with 2S. and 7W., Mathibehri Tea Estate, 14.X.1953, ex. 'under stone in soil. B. From *Central Himalaya* : Following two vials from ten miles North-East of Tanakpur, Nepal Forests, Nepal, coll. K. Krishna, 31.i.1953 with (iii) 5S. and 12W., ex. 'under stone in soil'; (iv) 2S. and 11W., ex. 'rotten sal log. (v) 2 Im., 3S., 5W., Nijgarh jungle, ca. 35 km South-East of Birjung, adjacent to Tamaguri Beat Office, Bara Dist., Nepal, coll. P. Mukherjee, 29.iv.2000, ex. "from a mound beneath a 'amlaki' tree" C. From *Eastern Himalaya* : Following four vials from Darjiling Dist., W.B., coll. G.K. Srivastava & P.K. Maiti as (vi) with 10S. and 10W., Samsing, 24.xii.1973, ex. 'under bark' (F.C. No. 8/24.12.73). (vii) with 1S. and 11W., Bhuttabari Forest village, three km South of Garubathan, 19.xii.1973, ex. 'under bark' (F.C. No. 4/19.12.73); (viii) with 3S. and 11W., around Rambhi, 6.i.1974, ex. 'log'; (ix) with 5S. and 10W., Nazeok, 22.xii.1973, ex. 'log under soil. (x) 12S. and 12W., Lower Likhali, West Siang Dist., Arunachal Pradesh, coll. B. Nandi & party, 15.vii.1985, ex. 'decaying fallen bamboo. Identified : From *Western Himalaya* : (i) 2S., 4W., Dhikola, Paterpani Road, Pauri Dist., Uttaranchal, coll. S.C. Verma, 3.viii.1977, det. S.C. Verma. (ii) Sev. S., sev. W., Bijrani, Nainital Dist., Uttaranchal, coll. S.C. Verma, 28.iii.1976, det. S.C. Verma. (iii) 1S., 2W., Motichur Forest, Dehra Dun Dist. coll. Raj Tilak, 13.ix.1987, det. S.C. Verma.

Diagnostic Character : (i) Imago (Fig. 89a) : Head yellowish brown; antennae; labrum; postclypeus and pronotum yellowish; wings brownish. Head and body fairly densely hairy.

Head subcircular, epicranial suture faint. Fontanelle small, circular, white spot placed almost at the middle. Ocelli oval, large, separated from eyes by about half of short diameter (0.05-0.08 mm). Antennae with 15-16 segments, 2, 3 and 4 subequal. Postclypeus strongly swollen with median line. Pronotum semicircular, a little narrower than head, anterior margin substraight and devoid of any notch; posterior margin distinctly emarginate. Wings sparsely hairy.

(ii) Soldier (Fig. 89b) : Head brownish yellow; body creamish white. Head and pronotum fairly; body densely hairy.

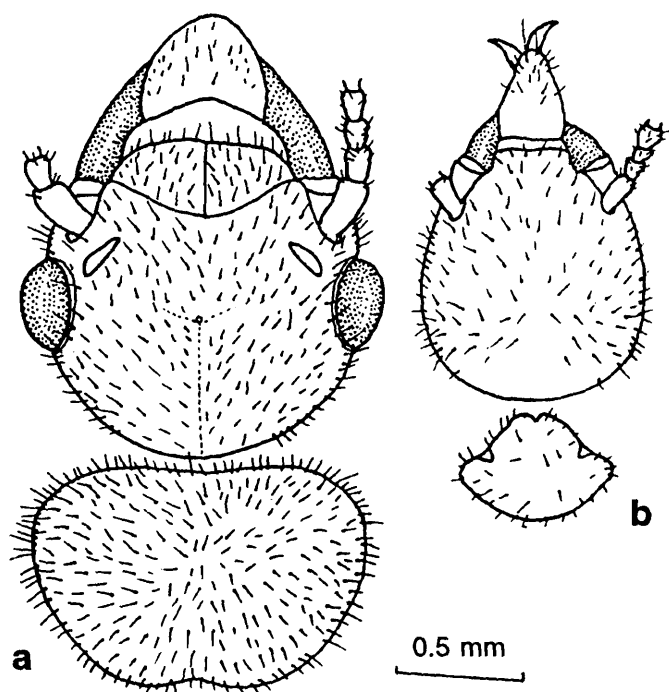


Fig. 89. : *Microtermes obesi* Holmgren; a, Imago. a. Head and pronotum, dorsal view; b, Soldier. b. Head and pronotum, dorsal view.

Head oval a little longer than wide, widest at middle of head. Antennae with 14 segments, 2 subequal to 3 and 4 combined; 4 shortest. Labrum long, lanceolate, reaching upto about two-third of mandibles, tip comparatively wider than in other species. Mandibles thin, delicate and weakly incurved apically, a little longer than half the head-length. Postmentum a little longer than wide and slightly arched, sides distinctly convex. Pronotum strongly saddle-shaped, anterior margin deeply notched; posterior margin weakly emarginate.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Arcadia Tea Estate, Mathibehri Tea Estate, Motichur Forest; Nainital Dist. : Bijrani; Pauri Dist. : Dhikola, Paterpani Road. *Eastern Himalaya* : West Bengal : Darjiling Dist. : Samsing, Bhuttabari Forest Village, three km South of Garubathan, around Rambhi, Nazeok. Arunachal Pradesh : Lower Subansiri Dist. : Kimin, on road to Ziro, four miles from Kimin, Itanagar. Mizoram. Nagaland.

Tripura. NEPAL (*Central Himalaya*) : ten miles North-East of Tanakpur, Nepal Forest; Bara Dist. : Nigarh jungle, ca. 35 km South-East of Birjung, adjacent to Tamaguri Beat office; Chitwan Dist. : Gadauli, 30 km East of Narayangarh. BHUTAN (*Eastern Himalaya*).

Elsewhere : Pakistan, Bangladesh. Sri Lanka. Thailand. Vietnam. Kampuchea.

Remarks : The species is one of the most common subterranean termites occurring in different countries of the south-east Asia including India. It is one of the serious pests of sugarcane, wheat, vegetables, etc. in addition to its attack to logs, poles, bamboos, fence posts, dead portion of both young and old plantations, roots of agricultural crops, vegetable and flowering plants, etc.

It is a highly variable species and closely allied to *M. unicolor* from which it differs by its dense coat of hairs on head. It occurs in the entire range of the Himalaya upto a quite high altitude.

The nest consists of a number of small chambers which are interconnected by narrow channels. The species cultivates fungi on small, rounded fungus combs which are found in the nest chambers. Some of the chambers are also packed with egg masses. To reach the source of food, it constructs thin, delicate earthen galleries or sheathing on the exposed surface and thereby feeding activities take place under cover. Sometimes it has been found nesting in the outer wall of mounds of *Odontotermes redemanni* (Wasmann). In numerous occasions the species occurs in close association with other species of termites viz., *Odontotermes redemanni* (Wasm.), *Pericapritermes ceylonicus* (Holmg.), *Angulitermes longifrons* (Maiti), *Nasutitermes* sp. The species swarms in the months of May and June in Calcutta, immediately after rain. The biological information goes to the credit of different authors, namely, Assmuth, 1915; Annandale, 1923; Beeson, 1941; Roonwal, 1958 and 1970a; Maiti, 1983 and others.

Table 57 : Measurements (in mm) etc. of Caste-Imago.

	<i>Microtermes imphalensis</i>		<i>M. obesi</i>	
	1Im.	Known Range	2Im.	Known Range
Total body-length with wings (excluding antennae), ca.	18.0	15.0–18.0	14.5–15.5	14.0–16.0
Total body-length without wings (excluding antennae), ca.	11.0	8.50–11.1	8.50–12.0	8.00–12.0
Length of head to lateral base of mandibles	1.00	1.05–1.13	0.94–1.06	0.92–1.15
Maximum width of head (with eyes)	1.44	1.43–1.65	1.44–1.60	1.31–1.60
Maximum length of postclypeus	–	–	–	–
Maximum width of postclypeus	–	–	–	–
Maximum length of labrum	–	–	–	–
Maximum width of labrum	–	–	–	–
Maximum diameter of compound eye (with ocular sclerite)	0.50	0.43–0.50	0.38–0.45	0.35–0.48
Minimum diameter of compound eye (with ocular sclerite)	–	–	–	0.30–0.36
Long diameter of lateral ocellus	0.26	0.23–0.27	0.18–0.25	0.15–0.28
Short diameter of lateral ocellus	0.18	0.16–0.18	–	0.10–0.16
Minimum eye-ocellus distance	0.02	0.01–0.02	0.06–0.08	0.05–0.08
Maximum length of pronotum	0.93	0.85–0.93	0.84–0.96	0.68–0.98
Maximum width of pronotum	1.44	1.25–1.45	1.31–1.44	1.19–1.45
Length of forewing with scale	13.0–13.5	12.75–13.60	12.1–12.5	12.0–12.5
Length of hindwing with scale	12.2–13.2	12.0–13.2	10.8–11.0	10.7–11.0
Number of antennal segments	15	15 (rarely 16)	15	15–16

Table 58 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Microtermes imphalensis</i>		<i>M. obesi</i>		<i>M. unicolor</i>	
	Sev. S.	Known Range	Sev. S.	Known Range	6S.	Known Range
Length of head to lateral base of mandibles	0.88–0.93	0.88–0.93	0.88–1.00	0.80–1.00	0.83–0.95	0.82–0.96
Maximum width of head	0.81–0.85	0.80–0.85	0.75–0.88	0.74–0.90	0.81–0.85	0.75–0.86
Head index (width/length)	0.91–0.92	–	–	0.85–0.88	–	0.89
Maximum length of labrum	0.26–0.28	0.25–0.28	0.37	–	0.31–0.37	0.30–0.37
Maximum width of labrum	0.18–0.21	0.18–0.23	0.25	–	0.23–0.25	0.23–0.25
Length of left mandible (Upper base of condyle to tip)	0.50–0.52	0.50–0.53	0.52–0.55	0.49–0.55	0.50–0.55	0.49–0.55
Head-mandibular length Index (Left mand.-length/head-length)	0.56	0.569	0.55–0.59	0.55–0.62	0.51–0.60	0.58–0.61
Minimum median length of postmentum	0.50	–	–	0.40–0.59	0.40–0.45	0.38–0.45
Maximum width of postmentum	0.35	–	–	0.35–0.52	0.35–0.42	0.35–0.43
Width of postmentum at waist	–	–	–	–	–	–
Maximum length of pronotum	0.33–0.35	0.33–0.35	0.41–0.50	0.33–0.50	0.30–0.37	0.27–0.37
Maximum width of pronotum	0.54–0.55	0.54–0.55	0.62	0.50–0.76	0.50–0.56	0.48–0.58
Pronotum index (length/width)	0.61–0.63	–	0.66	–	0.60–0.66	–
Number of antennal segments	14	14	14	14	14	14

90. *Microtermes unicolor* Snyder
(Fig. 90, Table 58)

1. *Microtermes unicolor* Snyder

- 1933b. Snyder, *Proc. biol. Soc. Washington*, **46** : 92-93. Im. only. Syntypes, in BM and USNM. Type-locality : Dehra Dun, Uttaranchal, India.
- 1964a. Chatterjee and Thakur, *Indian For. Rec. (N.S.) Ent.*, **10**(11) : 222, 223, 244-247, 259, 260.
1977. Roonwal and Verma, *Rec. zool. Surv. India*, **72** : 457-458, 462, 469, 474.
- 1984b. Verma, *Indian J. Forestry*, **7**(4) : 310, 313.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part I, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 589-592 (detailed synonymy).

2. *Microtermes pubescens* Snyder

- 1933a. Snyder, *Proc. U.S. natn. Mus.*, **82** (Art. 16) : 9-10.
1949. Snyder, *Smiths. misc. Colls.*, **112** : 254 (synonymy).

Material studied : Identified : From *Western Himalaya* : (i) 6 Im., 4S., 5W., Dhikola, Pauri Dist., Uttaranchal, coll. S.C. Verma, 30.vii.1977 det. S.C. Verma. (ii) 2S., Lachiwala forest, Dehra Dun Dist., Uttaranchal, coll. S.C. Verma, 26.xi.1975, det. S.C. Verma.

Diagnostic Character : (i) Imago : Head yellowish brown to brown with smoky tinge; antennae; postclypeus; labrum and pronotum light yellowish brown; pronotum with yellowish T-marking and shoulder spots. Head and body fairly densely hairy. Wings with minute hairs on membrane.

Head subcircular, epicranial suture weakly marked or absent. Fontanelle small, circular, whitish spot. Ocelli large, oval, separated from eyes by one-third their short diameter, (0.04-0.06 mm). Antennae with 15 segments, 2 slightly longer than 3; 3 shortest or subequal to 5. Postclypeus strongly arched without median notch. Pronotum slightly wider than head, anterior margin indistinctly emarginate; posterior margin somewhat distinctly emarginate. Membrane of wings covered with small, thin, cuticular rods.

(ii) Soldier (Fig. 90a-b) : Head yellowish white to brownish yellow; body paler than head. Head and pronotum fairly and abdomen densely hairy.

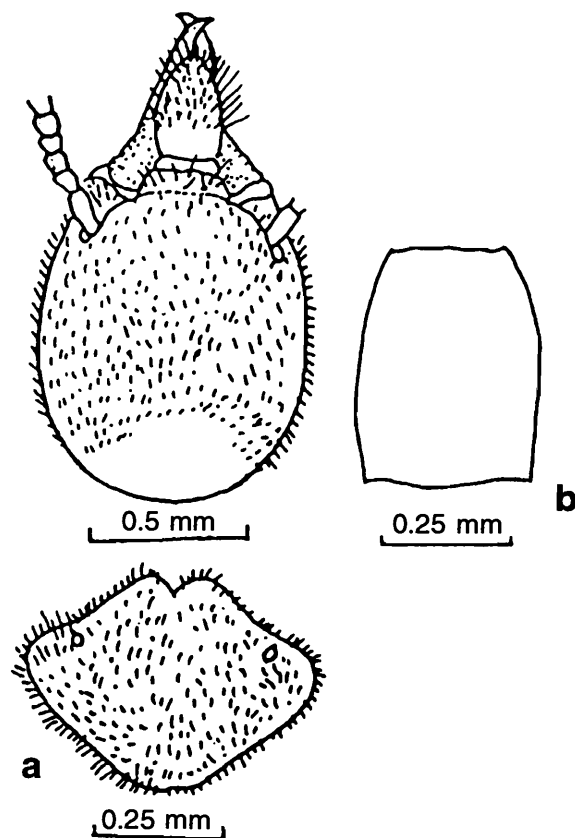


Fig. 90. : *Microtermes unicolor* Snyder; a-b, Soldier. a. Head and pronotum, dorsal view; b. Postmentum.

Head oval, converging anteriorly. Antennae with 14 segments, 2 slightly smaller than 3 and 4 combined, the latter two subequal. Labrum long, lanceolate, reaching upto two-third of mandibles, sides convex, tip comparatively broad. Mandibles thin, delicate, weakly incurved apically and without any tooth, a little longer than half of the head-length. Postmentum well arched with outcurved sides. Pronotum saddle-shaped, anterior margin deeply notched; posterior margin weakly incurved.

Distribution : INDIA : *North-Western Himalaya* : Jammu and Kashmir : Ramban : Bathiali village, Maitra Forest, Pront Forest; Udampur : Gangara village, Samroli forest, Tandeh forest. Himachal Pradesh : Bilaspur. *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Lachiwala forest; Pauri Dist.: Dhikola. Punjab.

Elsewhere : Pakistan. Bangladesh.

Remarks : The species is very close to *M. obesi* in morphology and biological habits; but have more restricted distribution in northern India including the Western Himalaya.

Genus : *Ancistrotermes* Silvestri

91. *Ancistrotermes pakistanicus* (Ahmad)
(Fig. 91, Table 59)

1. *Microtermes pakistanicus* Ahmad

1955a. Ahmad, *Biologia*, Lahore, **1** : 25-27. Holotype : S., in PU. Type-locality : Mainimukh, Chittagong Hills, Bangladesh.

1979. Sen-Sarma and Thakur, *Indian For. Rec. (N.S.) Ent.*, **13**(1) : 6, 29-30.

2. *Ancistrotermes pakistanicus* (Ahmad)

1980. Akhtar and Hussain, *Socio-biology*, **5** : 261-271.

1985. Chhotani and Bose, *Rec. zool. Surv. India* **82**(1-4) : 59.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, **2** : 593-597 (detailed synonymy).

3. *Termes pallidus* Haviland

1898. Haviland, *J. Linn. Soc. Lond.*, **26** : 389.

4. *Microtermes umsae* Roonwal and Chhotani

1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) **28**(4) : 297, 370-374, 396, pls. 35, 36.

1977. Lahiri *et al.*, *Meghalaya Sci. Soc.*, **2** : 37.

Material studied : Identified : From *Eastern Himalaya* : S. and W., Itanagar, Arunachal Pradesh. coll. B. Nandi and S.K. Chakraborty, 14.vii.1985, ex. "rotten wood"

Diagnostic Character : (i) Imago : Known, but not from the study area, hence not dealt with.

(ii) Soldier (Fig. 91a-d) : Head pale yellow to yellowish brown, body whitish. Head and pronotum sparsely and body moderately densely hairy.

Head almost subcircular and as wide as long with outcurved sides. Antennae with 15-segments, 3 shortest. Labrum tongue-shaped with pointed tip. Mandibles thin, sickle-shaped, almost strongly incurved from middle onwards; a little longer than half the head-length. Left mandible with a minute tooth above middle of mandible, sometimes absent. Right with a similar denticle a little below level of tooth in left mandible. Postmentum strongly arched outward with waist on basal fourth. Pronotum saddle-shaped, anterior margin with weak median notch and posterior margin almost substraight.

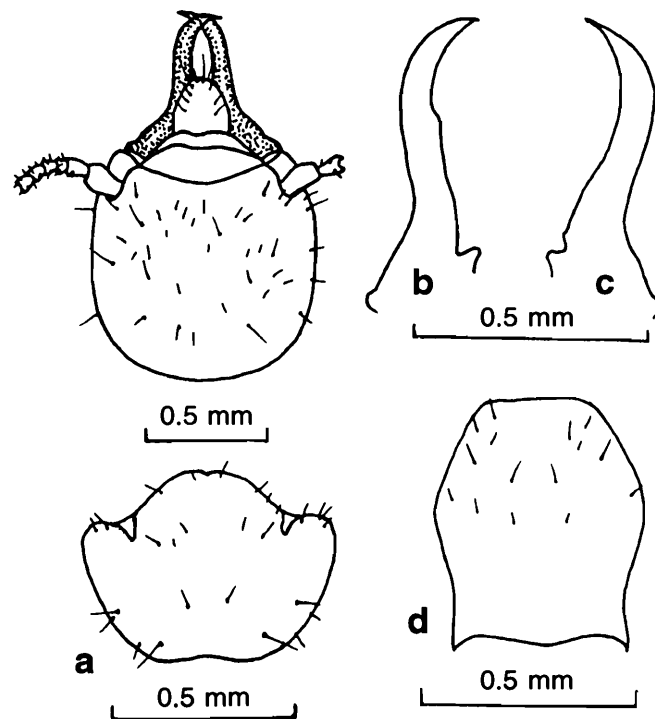


Fig. 91. : *Ancistrotermes pakistanicus* (Ahmad); a-d, Soldier. a. Head and pronotum, dorsal view; b. Left mandible; c. Right mandible; d. Postmentum.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : Kimin and on road from Kimin to Ziro. Assam. Meghalaya. Tripura. Nagaland. Mizoram.

Elsewhere : Bangladesh. Burma. Malaysia and Indonesia.

Remarks : The species is confined in the *Eastern Himalaya* and in the eastern India, and extends its distribution in the Burma, Malaysia and Indonesia.

Table 59 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Ancistrotermes pakistanicus</i>	
	Soldier major	
	Sev. S.	Known Range
Length of head to lateral base of mandibles	0.94–1.00	0.80–1.03
Maximum width of head	0.94–1.00	0.79–1.00
Head index (width/length)	1.00	–
Maximum length of labrum	0.23–0.27	0.23–0.29
Maximum width of labrum	0.23–0.28	0.23–0.28
Length of left mandible (Upper base of condyle to tip)	0.55–0.62	0.55–0.65
Head-mandibular length Index (left mandible-length/head-length)	0.62	0.60–0.61
Minimum median length of postmentum	0.55–0.60	0.47–0.60
Maximum width of postmentum	0.42–0.50	0.41–0.52
Width of postmentum at waist	–	–
Maximum length of pronotum	0.38–0.51	0.37–0.49
Maximum width of pronotum	0.65–0.75	0.55–0.76
Pronotum index (length/width)	0.58–0.68	–
Number of antennal segments	15	15

Genus *Nasutitermes* DudleyKey to the species of genus *Nasutitermes* Dudley

I. IMAGOS :

1. Smaller species 2
- Larger species 3
2. Ocelli separated from the eyes by their long diameter, head less hairy, Y-suture faintly marked; head smaller, head-length 0.87-0.95 mm (0.85-0.95 mm) *N. chhotani* Bose
- Ocelli almost touching the eyes; head more densely hairy; Y-suture indistinct; head larger, head-length 1.12 mm (0.90-1.10 mm) *N. garoensis* Roonwal and Chhotani
3. Ocelli separated from the eyes by little less than their short diameter; Y-suture absent; pronotum somewhat triangular with emarginate posterior margin *N. gardneri* Snyder
- Ocelli separated from the eyes by one-third of their short diameter; Y-suture indistinctly marked; pronotum somewhat squarish with substraight posterior margin *N. dunensis* Chatterjee and Thakur

II. SOLDIERS :

1. Mandible without any lateral spine-like process 2

- Mandible with lateral spine-like process 4
2. Rostrum somewhat cylindrical, narrow and slender; head pyriform; 3rd segment of antennae longer than 2nd; head-length with rostrum 1.53-1.85 mm and head-width 0.90-1.05 mm (0.88-1.10 mm) *N. gardneri* Snyder
- Rostrum strongly conical and thick; head subcircular; 3rd segment of antennae longer than 2nd; head-length with rostrum 1.58-1.80 mm and head-width 0.95-1.08 mm 3
3. Larger species, head-length with rostrum 1.70-1.80 mm and without rostrum 1.08 mm (0.98-1.05 mm); maximum width of head almost at the middle, head-width 1.10 mm (0.98-1.08 mm); head-dorsum almost straight; rostrum thicker; head more hairy *N. tandoni* Bose
- Smaller species, head-length with rostrum 0.90-1.03 mm and without rostrum 0.90 mm (0.90-1.03 mm); maximum width of head at posterior third, head-width 0.97 mm (0.95-1.02 mm); head-dorsum feebly incurved at middle; rostrum thinner; head less hairy *N. chhotanii* Bose
4. Head subcircular; head-width equal to or more than length without rostrum; head-length with

- rostrum 1.40-1.92 mm, without rostrum 0.88-1.20 mm, head-width 0.84-1.26 mm
..... *N. matangensisformis* (Holmgren)
 - Head pyriform; head-width less than length without rostrum 5
 5. Spine-like process of mandibles short and blunt..... 6
 - Spine-like process of mandibles long and prominent..... 7
 6. Head dorsum incurved behind rostrum, devoid of any rostral hump; head-length with rostrum 1.70-1.87 mm; soldier dimorphic
..... *N. cherraensis* Roonwal and Chhotani
 - Head dorsum substraight, with a feeble rostral hump; head-length with rostrum 1.55-1.60 mm; soldier monomorphic
..... *N. suknsensis* Prashad and Sen-Sarma
 7. Head substraight or indistinctly incurved at posterior margin 8
 - Head uniformly rounded at posterior margin 10
 8. Antennae with 13 segments; head-length with rostrum 1.67-1.73 mm, without rostrum 1.02 mm (1.00-1.05 mm); head-width 0.93 mm (0.96-1.00 mm) *N. moratus* (Silvestri)
 - Antennae with 12 segments; head-length with rostrum 1.50-1.70 mm, without rostrum 0.87-1.05 mm; head-width 0.87-1.05 mm 9
 9. Head indistinctly incurved at posterior margin; smaller species, head-length with rostrum 1.50-1.60 mm, without rostrum 0.87-0.92 mm (0.87-0.93 mm), head-width 0.87-0.93 mm; head with short hairs all over; spine on mandible more prominent; rostrum longer in comparison to head-length (index 0.65-0.77)
..... *N. garoensis* Roonwal and Chhotani
 - Head substraight at posterior margin; larger species, head-length with rostrum 1.55-1.70 mm, without rostrum 0.90-1.03 mm (0.98-1.05 mm), head-width 0.85-1.03 mm (0.95-1.05 mm); head without any short hair; spine on mandible less prominent; rostrum shorter in comparison to head-length [index, 0.63 (0.60-0.63)] *N. emersoni* Snyder
 10. Larger species, head-length with rostrum 1.70-1.80 mm, head-length without rostrum 1.00 mm (1.10-1.12 mm), head-width 0.95 mm (1.00-1.07 mm)
..... *N. thanensis* Prasad and Sen-Sarma
 - Smaller species, head-length with rostrum 1.30-1.60 mm, without rostrum 0.80 mm, head-width 0.90-0.98 mm 11
 11. Head dorsum incurved with a feeble basal hump; head with scanty fairly long hairs (rostrum pale brown to deep brown basally, darker distally, 3rd antennal segment subequal to 2nd) *N. dunensis* Chatterjee and Thakur
 - Head dorsum almost straight and devoid of any basal hump; head with few minute hairs 12
 12. Larger species, head-length with rostrum 1.40-1.60 mm, without rostrum 0.94-1.00 mm (0.85-1.00 mm); maximum width of head at posterior third, head-width 0.81-1.00 mm (0.85-1.03 mm); head with very minute projection at base of rostrum; antennae with 12 segments
..... *N. jalpaigurensis* Prashad and Sen-Sarma
 - Smaller species, head-length with rostrum 1.30-1.36 mm, without rostrum 0.78-0.80 mm (0.80-0.83 mm); maximum width of head almost at the middle, head-width 0.73-0.77 mm, head with very minute projection at base of rostrum; antennae with 11-12 segments ...
..... *N. kali* Roonwal and Chhotani
92. *Nasutitermes cherraensis* Roonwal and Chhotani
(Fig. 92, Table 60)
1. *Nasutitermes cherraensis* Roonwal and Chhotani
- 1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) 28(4) : 297, 374, 379, pls. 37, 38. S. (maj. and min.) and W. Holotype : S. (major), in ZSI. Type-locality : Cherrapunji, Meghalaya, India.
1983. Sen-Sarma and Verma, *Orient. Insects*, 17 : 98.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 623-625 (detailed synonymy).
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 119-120.
- Material studied* : Identified : From *Eastern Himalaya* : S. (maj. and min.) and W., on road from Ziro to Yazali, Lower Subansiri Dist.,

Arunachal Pradesh, coll. T. K. Pal., 16.ix.1988, det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier : Dimorphic. (a) Soldier (major) (Fig. 92a-e) : Head yellowish to brownish yellow, pale yellowish in posterior region. Head with a single pair of long bristles on vertex and a few minute ones elsewhere, very hairy at rostral tip.

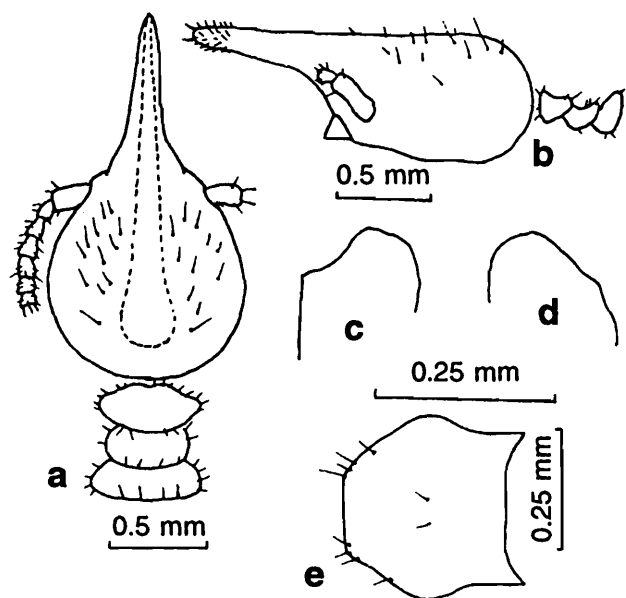


Fig. 92. : *Nasutitermes cherraensis* Roonwal and Chhotani; a-e, Soldier major. a. Head, pronotum, mesonotum and metanotum, dorsal view; b. Head, pronotum, mesonotum and metanotum, side view; c. Left mandible; d. Right mandible; e. Postmentum.

Head pyriform, a little longer than wide without rostrum, in profile, weakly depressed behind rostrum. Rostrum sub-cylindrical and slender. Antennae with 12-14 segments (generally 12 or 13), 3 longer than 2 (shorter in 14-segmented antennae). Mandibles rudimentary with minute lateral spine-like process. Postmentum subhexagonal, widest medially whence narrowing posteriorly. Pronotum saddle-shaped, sparsely hairy, anterior margin weakly notched; posterior margin convex, devoid of any notch.

(b) Soldier (minor) : Very similar to soldier major except the following character. Generally smaller. Head generally constricted behind antennae and narrower. Antennae with 11-12 segments, 3 longer and more slender.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : Itanagar and on road from Ziro to Yazali. Meghalaya : Cherrapunji (type-locality); Khasi and Jaintia Hills Dist. : Mawsamai cave.

Remarks : The species was so far known to remain confined to its type-locality, until Bose (1999) had reported it from Arunachal Pradesh.

Table 60 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Nasutitermes cherraensis</i>	
	Soldier major	
	Sev. S.	Known Range
Length of head without rostrum	0.90–1.01	0.90–1.13
Maximum width of head	0.82–1.00	0.80–1.07
Head index (width/length without rostrum)	0.91–0.99	–
Maximum length of labrum	–	–
Maximum width of labrum	–	–
Length of left mandible (Upper base of condyle to tip)	0.62–0.77	0.60–0.77
Head-rostrum length Index (rostrum-length/head-length without rostrum)	0.68–0.77	0.65–0.78
Minimum median length of postmentum	–	–
Maximum width of postmentum	–	–
Width of postmentum at waist	–	–
Maximum length of pronotum	0.24	0.20–0.24
Maximum width of pronotum	0.50	0.46–0.57
Pronotum index (length/width)	0.48	–
Number of antennal segments	13	12–14 (generally 12–13)

93. *Nasutitermes chhotani* Bose
(Fig. 93, Tables 61 and 62)

1. *Nasutitermes chhotani* Bose

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 625-628.

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 120-124. Im., S. and W. Holotype : S., in ZSI. Type-locality : Lake Ganga, Itanagar, Arunachal Pradesh.

Material studied : Identified : From *Eastern Himalaya* : Holotype S. and Paratypes 4 Im., sev. S. and sev. W., Lake Ganga, Itanagar, Arunachal Pradesh, coll. O.B. Chhotani, 15.v.1989, ex. "damaged portion of tree trunk", det. G. Bose.

Diagnostic Character : (i) Imago (Fig. 93a-b) : Head dark brown, with a pair of line-like spots between fontanelle and postclypeus; antennae and legs paler than head, a paler T-mark with a short stump and a pair of paler medial spots little above posterior margin present; abdominal tergites as dark as pronotum; sternites paler; wings pale brown. Head and body densely hairy.

Head subcircular. Fontanelle elongate. Ocelli oval, separated from eyes by about half the width. Antennae 15-segmented, segment 3 shortest. Postclypeus weakly swollen with or without median line. Labrum dome-shaped. Pronotum trapezoidal, a little narrower than head with eyes, anterior margin substraight with a faint median notch; posterior margin convex with a deep, median invagination. Wings hairy along margins and in distal part.

(ii) Soldier (Fig. 93c-f) : Head yellowish brown to pale brown; thorax creamish; abdomen with contents showing through. Head with a pair of hairs at base of rostrum and a pair of a long hairs a little below the middle and several short, minute hairs all over; rostrum with a pair of long hairs near the tip and several shorter ones, sometimes 1 or 2 extra long hairs present; pronotum with a few short hairs on margins and body; abdominal tergites with several short hairs and two pairs of longer hairs on each tergite at posterior margin, last tergites and sternites with several long and short hairs.

Head subcircular, broader than long, in profile depressed behind nasute, without rostral hump.

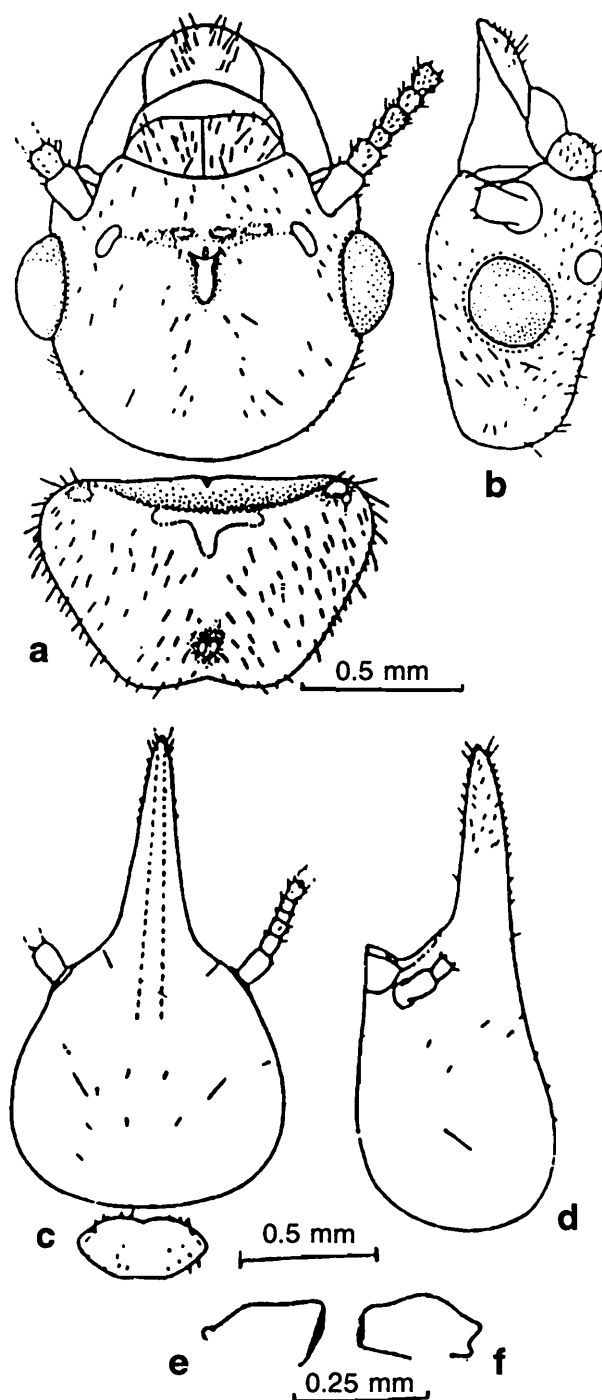


Fig. 93. : *Nasutitermes chhotani* Bose; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-f, Soldier. c. Head and pronotum, dorsal view; d. Head, side view; e. Left mandible; f. Right mandible.

Rostrum thick, conical, gradually narrowing in front, shorter than head without nasute. Fontanelle tube prominent. Antennae with 13 segments, 4 shortest. Mandibles vestigial, without any apical spine. Postmentum subsquarish. Pronotum saddle-shaped, anterior margins faintly notched medially; posterior margin substraight.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist. : Lake Ganga, Itanagar (type-locality).

Remarks : Bose recognized this new species based on the material from Itanagar, Arunachal Pradesh and deposited the types in ZSI, Kolkata prior to its publication. Subsequently, Chhotani (1997) described the species based on those types giving the due authorship to Bose whose original description was published (Bose, 1999) after that Chhotani's Fauna (1997). According to publication priority, Chhotani may get the authorship of species, since his description appeared first, but he himself had rightly assigned the authorship to Bose in his fauna which, had been accepted here.

94. *Nasutitermes dunensis* Chatterjee and Thakur

(Fig. 94, Tables 61 and 62)

1. *Nasutitermes dunensis* Chatterjee and Thakur

1969. Chatterjee and Thakur, *Bull. syst. Zool.*, 1(2) : 57-65. Im., S. and W. Holotype : S., in FRI. Type-locality : Mohamedpur Block, Asarori Range, Dehra Dun Forest Div., Dehra Dun, Uttaranchal, India.
1978. Verma and Thakur (R.K.), *J. Indian Acad. Wood Sci.*, 9(1) : 53.
1983. Sen-Sarma and Verma, *Orient. Insects*, 17 : 98.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 630-633 (detailed synonymy).

2. *Nasutitermes lambai* Verma and Thakur

1978. Verma and Thakur (R.K.) *J. Indian Acad. Wood Sci.*, 9(1) : 50-55. Im., S. and W. Type-locality : Corbett National Park, Uttar Pradesh.
1983. Sen-Sarma and Verma, *Orient. Insects*, 17 : 100.

3. *Nasutitermes guptai* Sen-Sarma and Thakur

1980. Sen-Sarma and Thakur, *Indian For. Rec. (N.S.) Ent.*, 14(1) : 25-29. S. and W. Type-locality : Kumaon Hills, Uttaranchal.
1983. Sen-Sarma and Verma, *Orient. Insects*, 17 : 99.

Material studied : Identified : From *Western Himalaya* : 1 Im., 2S., 4W., Dhikola, Pauri Dist.,

Uttaranchal, coll. S. C. Verma, i.vii.1976, det. S.C. Verma.

Diagnostic Character : (i) Imago (Fig. 94a-b) : Head light brown; antennae; labrum; postclypeus, pronotum and legs brownish yellow; abdominal tergites smoky brown; sternites yellowish brown with smoky brown spots laterally. Head and body densely hairy with short hairs and some long hairs.

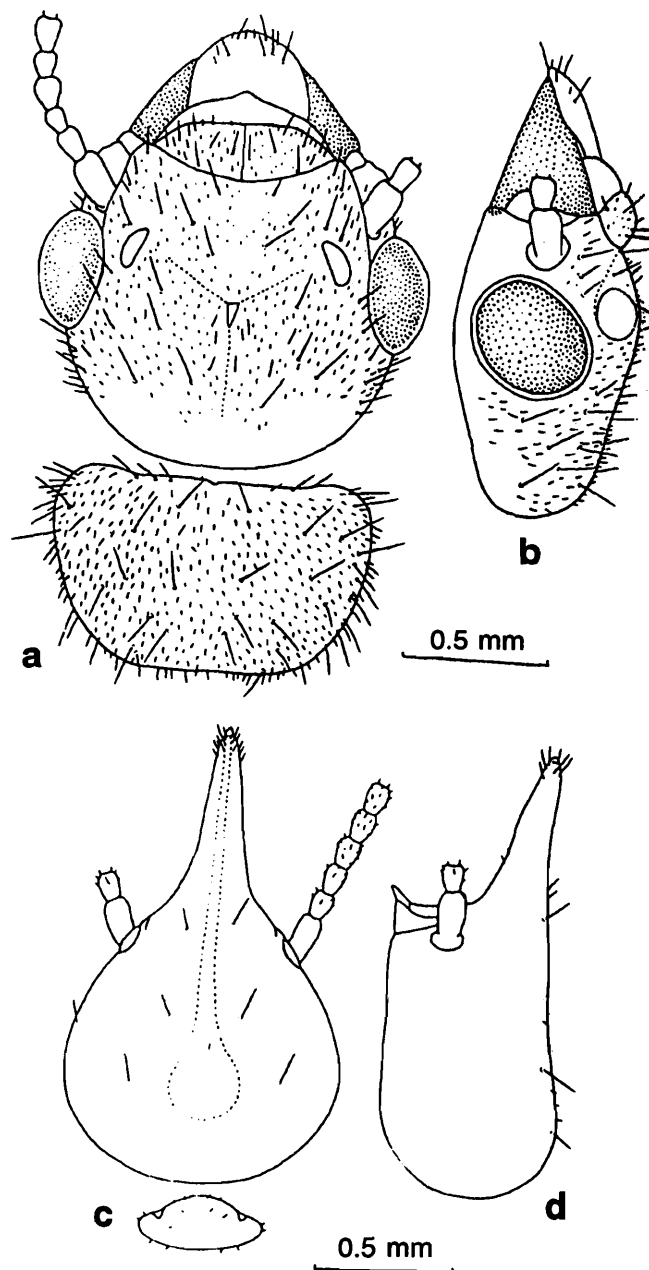


Fig. 94. : *Nasutitermes dunensis* Chatterjee and Thakur; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-d, Soldier. c. Head and pronotum, dorsal view; d. Head, side view.

Head subsquarish, median arm of epicranical suture indistinct. Fontanelle elongate, Y-shaped. Ocelli oval, situated at about one-third of short diameter from eyes (eye-ocellus distance 0.04-

0.05 mm). Antennae with 15 segments, 3 subequal to or slightly longer than 2. Postclypeus moderately swollen with faint median line, anterior margin almost straight; posterior margin convex. Pronotum trapezoidal, anterior margin without any median notch at middle; posterior margin convex, with a distinct median invagination. Wings smoky gray, membrane covered with minute hairs and thin non-asteroid micrasters.

(ii) Soldier (Fig. 94c-d) : Head pale reddish brown; body pale yellow. Head, and pronotum sparsely and abdominal tergites with numerous minute hairs, head with 2 or 3 longer hairs at vertex on either side.

Head without rostrum broadly pear-shaped, in profile, weakly incurved behind rostrum with feeble hump. Rostrum short, conical, tip with a tuft of hairs. Antennae with 12 segments, 3 slightly longer than 2; 4 almost as long as 3. Mandibles vestigial, each with a short spine-like process. Pronotum saddle-shaped, both anterior margin and posterior margin convex, but devoid of any distinct median notch.

Distribution : INDIA : Western Himalaya : Uttaranchal : Dehra Dun Dist. : Mohamedpur Block, Asarori Range; Pauri Dist. : Dhikola.

Remarks : The species is primarily recognized by its weakly incurved head dorsum of soldiers with low basal hump and known so far to occur solely from Dehradun. Subsequently, two species, namely *N. lambai* Verma and Thakur from Corbett National Park and *N. guptai* Sen-Sarma and Thakur from the Kumaon Hills have been synonymised (Chhotani, 1997) under it, thus extending its distribution range in wide areas of Uttaranchal.

95. *Nasutitermes emersoni* Snyder (Fig. 95, Table 62)

1. *Nasutitermes/Nasutitermes (Nasutitermes) emersoni* Snyder

1934. Snyder, *Indian For. Rec.*, 20(11) : 11-12. S. only. Lectotype : S., in FRI. Type-locality : Sunderbans, Bangladesh.

1959. Prashad and Sen-Sarma, *Rev. Termite Genus Nasutitermes Indian Region* (ICAR Ent. Monogr. 10.23) : 5, 26-28. Synonymy, description, lectotype designation.

1975. Akhtar, *Bull. Dept. Zool. Univ. Panjab. (N.S.)*, Art. 7 : 131, 132-135.

1983. Sen-Sarma and Verma, *Orient. Insects*, 17 : 98.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 633-635.

Material studied : Unidentified : From Eastern Himalaya : (i) Sev. S. and sev. W., Gangtok, South Sikkim, coll. P. H. Roy and party, 5.iv.1994, ex. "soil"; (ii) 10S. and 12W., Jalipool, 13 km South of Gangtok, South Sikkim, coll. P. H. Roy and party, 6.iv.1994, ex. "under bamboo leaves."

Diagnostic Character : (i) Imago : Known but not from the Himalaya, hence not dealt with.

(ii) Soldier (Fig. 95a-c) : Head reddish yellow to castaneous brown; rostrum reddish basally and darker near tip; abdomen straw yellow to yellowish brown above. Head sparsely hairy, with few minute hairs; tergites and sternites with a few long bristles and many shorter hairs.

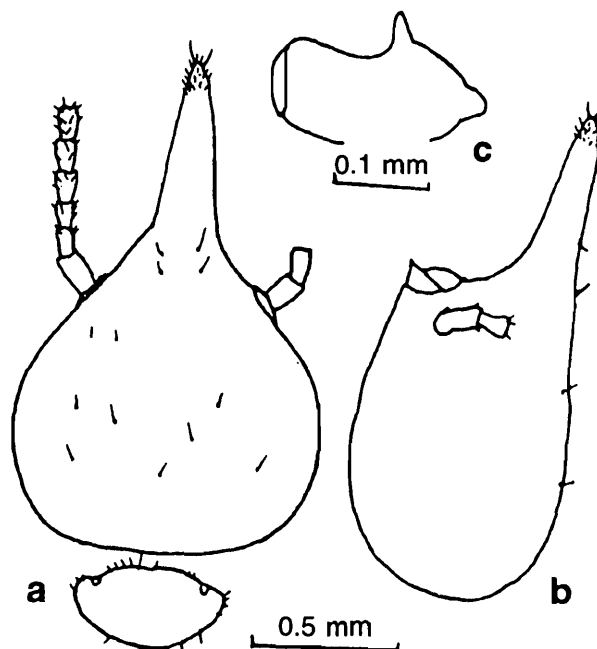


Fig. 95. : *Nasutitermes emersoni* Snyder; a-c, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Right mandible.

Head pear-shaped without rostrum, posterior margin straight, in profile almost straight, rostral hump faint. Rostrum slightly conical. Antenna with 12 segments, 2-3 subequal. Mandibles

Table 61 : Measurements (in mm) etc. of Caste—Imago.

	<i>Nasutitermes chhotani</i>		<i>Nasutitermes dunensis</i>	
	4Im.	Known Range	1Im.	Known Range
Total body-length with wings (excluding antennae), ca.	10.00–12.00	10.00–12.50	15.00	14.50–15.00
Total body-length without wings (excluding antennae), ca.	6.50–7.20	6.00–7.20	8.68	8.50–8.70
Length of head to lateral base of mandibles	0.87–0.95	0.85–0.95	1.20	1.05–1.20
Maximum width of head (with eyes)	1.10–1.15	1.10–1.18	1.25	1.30–1.38
Maximum length of postclypeus	–	–	–	–
Maximum width of postclypeus	–	–	–	–
Maximum length of labrum	0.25	0.28–0.30	–	–
Maximum width of labrum	0.37	0.35–0.43	–	–
Maximum diameter of compound eye (with ocular sclerite)	0.30–0.32	0.30–0.35	0.44	0.43–0.45
Length of lateral ocellus	0.13	0.13	0.18	0.15–0.18
Width of lateral ocellus	0.10	0.10	–	0.13–0.15
Minimum eye-ocellus distance	0.05	0.05	0.04	0.04–0.05
Maximum length of pronotum	0.63	0.60–0.68	0.70	0.65–0.70
Maximum width of pronotum	1.00	0.88–0.98	1.13	1.10–1.13
Length of forewing with scale	9.60–11.0	9.5–11.0	–	12.25–12.60
Length of hindwing with scale	9.2–10.0	9.0–10.0	–	11.20–11.60
Number of antennal segments	15	15	15	15

Table 62 : Measurements (in mm) etc. of Caste—Soldier.

	<i>Nasutitermes chhotani</i>		<i>N. dunensis</i>		<i>N. emersoni</i>	
	Holotype	Known Range	2S.	Known Range	Sev. S.	Known Range
Length of head without rostrum	0.90	0.90–1.03	0.95–1.00	0.95–1.03	0.90–1.03	0.87–1.05
Maximum width of head	0.97	0.95–1.05	0.90–0.99	0.90–0.98	0.85–1.03	0.83–1.05
Head index (width/length without rostrum)	1.07	–	0.94–0.99	–	0.94–1.00	–
Maximum length of labrum	–	–	–	–	–	–
Maximum width of labrum	–	–	–	–	–	–
Length of rostrum	0.75	0.60–0.75	0.51–0.59	0.50–0.60	0.62–0.65	0.60–0.65
Head-mandibular length Index (rostrum-length/head-length without rostrum)	0.83	0.709–0.806	0.53–0.59	0.50–0.60	–	0.63–0.68
Minimum median length of postmentum	–	0.28–0.30	–	–	–	–
Maximum width of postmentum	–	0.25–0.28	–	–	–	–
Width of postmentum at waist	–	0.23–0.25	–	–	–	–
Maximum length of pronotum	0.24	0.26–0.28	0.19–0.20	0.18–0.20	0.15–0.25	0.13–0.25
Maximum width of pronotum	0.51	0.48–0.50	0.45–0.48	0.43–0.48	0.44–0.50	0.41–0.53
Pronotum index (length/width)	0.47	–	0.41–0.42	–	0.34–0.50	–
Number of antennal segments	13	13	12	12	12	12

vestigial, each with a minute apical process. Pronotum saddle-shaped, both anterior and posterior margin weakly convex and devoid of median notch.

Distribution : INDIA : *Eastern Himalaya* : Sikkim : South Sikkim : Jalipool, Mongon, Gangtok.

Elsewhere : Bangladesh.

Remarks : The species has been recorded for the first time from Sikkim in the Eastern Himalaya.

96. *Nasutitermes gardneri* Snyder
(Fig. 96, Tables 63 and 64)

1. *Nasutitermes (Subulitermes) gardneri* Snyder

1933a. Snyder, *Proc. U. S. natn. Mus.*, 82(Art. 16) : 12. S. and W. Lectotype : S., in FRI. Type-locality : Rangirum, Darjiling Dist., West Bengal, India.

2. *Nasutitermes gardneri* Snyder

1958b. Ahmad, *Biologia, Lahore*, 4(2) : 155.

1977. Roonwal and Chhotani, *Ent. Basil.*, 2 : 76-77.

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 27, 121-122, map, 3.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 639-642 (detailed synonymy).

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 125-128.

Material studied : Unidentified : From *Eastern Himalaya* : Following 3 vials from Darjiling Dist., W. B. as (i) with 2 Im., 10S. and 12W., two and a half km North of Takdah F. R. H., coll. H. S. Sharma & party, 26.iii.1973, ex. "rotten wood"; (ii) 12S. and 11W., one km West of Reyang F. R. H. in and around Reyang Nalk, coll. H. S. Sharma & party, 30.iii.1973, ex. 'rotten log' (F. C. No. 90/30.3.73); (iii) 1S., three km North-West of Bhanjang Youth Hostel, coll. P. K. Maiti, 13.xi.1973 (F. C. No. 6/13.11.73). (iv) 6S. and 12W., Dophabum expedition, Glo-Howel, Lohit Dist., Arunachal Pradesh, coll. J. M. Julka & party, 9.xii.1969. (v) 10S. and 10W., Dawing, Arunachal Pradesh, coll. J. M. Julka & party, 22.i.1975. (vi) 8S. and 10W., Galensinaik, Subansiri, Arunachal Pradesh, coll. J. M. Julka & party,

8.xii.1974. (vii) 10S. and 10W., Kameng Frontier Dist., Arunachal Pradesh, coll. K. C. Jayramkrishnan, 24.v.1961, ex. 'from dead tree trunk, fallen wood & rotten logs on the bank of Norgum river.' (viii) 7S. and 10W., Doginale, ca 12 km from Nadrer, Subansiri Dist., Arunachal Pradesh, coll. J. M. Julka & party, 29.xi.1974. (ix) 10S. and 14W., Kameng Frontier Dist., NEFA, coll. K. C. Jayramkrishnan, 11.iii.1961, ex. 'from the jungle of Norgum river bank.' (x) 3S. and 11W., Pinjuli, Kameng Dist., Arunachal Pradesh, coll. A. N. T. Joseph, 4.v.1966.

Diagnostic Character : (i) Imago (Fig. 96a-b) : Head reddish brown; antennae; labrum; postclypeus and legs yellowish brown. Wings pale

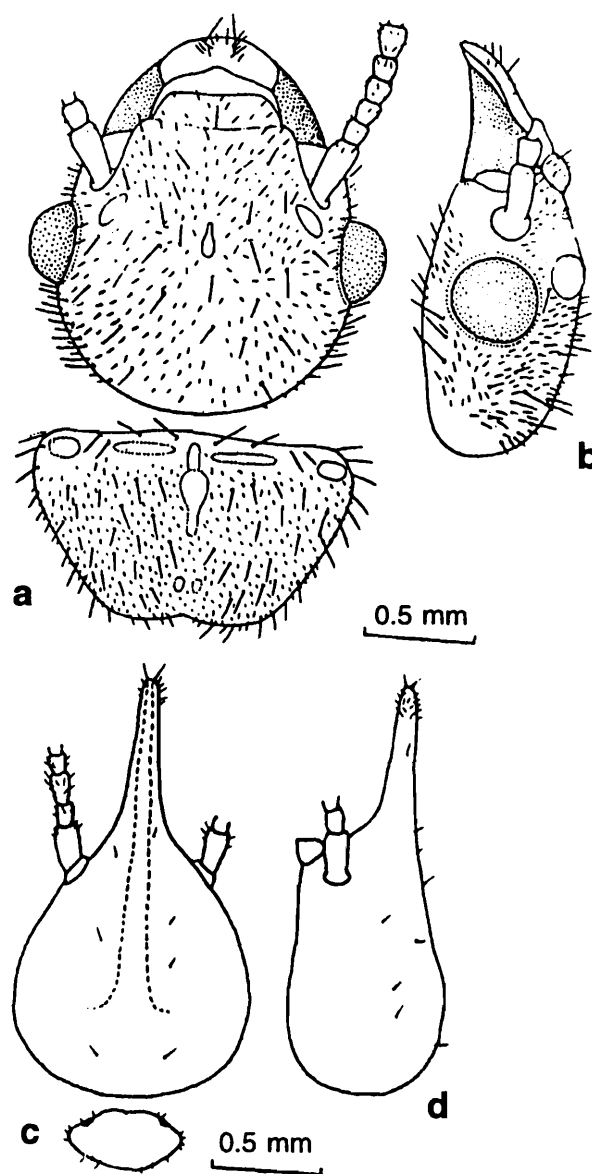


Fig. 96. : *Nasutitermes gardneri* Snyder; a-b, Imago. a. Head and pronotum, dorsal view; b. Head, side view; c-d, Soldier. c. Head and pronotum, dorsal view; d. Head, side view.

brown; abdomen brownish above, paler than pronotum and yellowish brown below. Head and pronotum densely and abdomen with a thick coat of fine hairs and several longer hairs. Wing margins and membrane fairly hairy.

Head subcircular, epicranial suture faintly marked. Fontanelle elongately oval. Ocelli broadly oval, separated from eyes by a little less than their short diameter (eye-ocellus distance 0.10-0.11 mm). Antennae with 15 segments, 3 little shorter and narrower than 2; 5 shortest. Postclypeus swollen with a short median line and hairy. Pronotum subtrapezoidal, narrowed posteriorly, anterior margin almost substraight; posterior margin rounded with a well marked invagination. Wing-membrane covered with plenty hairs.

(ii) Soldier (Fig. 96c-d) : Head pale brown; abdomen creamy white. Head with a pair of long hairs at vertex and a pair at base of rostrum; pronotum with several short and a few long hairs; abdominal tergites each with a long hair laterally and a pair at middle, otherwise densely covered with short hairs.

Head pear-shaped, sides distinctly converging anteriorly, in profile, dorsal margin faintly incurved and with very weak rostral hump. Rostrum subcylindrical to slightly conical with a tuft of hairs at tip. Antennae with 13 segments, 3 much longer than 2; 4 shortest. Mandibles vestigial, without any spine-like process. Pronotum saddle-shaped, anterior margin round with a faint emargination medially and posterior margin almost feebly outcurved.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Canaught Place. *Eastern Himalaya* : West Bengal : Darjiling Dist. : Rangirum (type-locality), two and a half km North of Takdah F. R. H., one km West of Reyang F. R. H., Barbatia Basti, three km North-West of Ghoom Bhanjang Yough Hostel. Arunachal Pradesh : Kameng Dist. : Norgum River Bank, Pinjali; Upper Subansiri Dist. : Doginala, ca 12 km from Nacho, Galensinaik, Damin; Lohit Dist. : Glo

Howel. Assam. Manipur. BHUTAN (*Eastern Himalaya*). ELSEWHERE : None.

Remarks : The species can easily be distinguished from all other members of the Himalayan *Nasutitermes* by the absence of spine-like lateral processes of the mandibles of the soldier castes. However, other taxonomic characters, such as shape and size of the head and rostrum of the soldiers are highly variable, sometimes leading to its confused identity. The species restricts itself in the north-eastern India and especially is very common in the hilly forested areas of the Eastern Himalaya. In the area, it generally attacks the rotten and dead wood of both standing and felled trees. In many occasions, it has been collected from the decaying wood lying on soil (Maiti, 1983).

97. *Nasutitermes garoensis* Roonwal and Chhotani
(Fig. 97, Tables 63 and 64)

1. *Nasutitermes garoensis* Roonwal and Chhotani

- 1962a. Roonwal and Chhotani, *Proc. natn., Inst. Sci. India*, (B) 28(4) : 297, 384-397. S. and W. Holotype : S., in ZSI. Type-locality : Rongrengiri (Garo Hills), Meghalaya, India.
- 1957a. Chhotani, *Orient Insects*, 9(2) : 152, 153-154. Im. described.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 27, 123-124.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 642-645 (detailed synonymy).
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 13, 128-130.

Material studied : Unidentified : From *Eastern Himalaya* : Following 2 vials from Sikkim as (i) with 10S. and 14W., Samdur, Gangtok, coll. A. C. Mishra and party, 4.ix.1978, ex. 'maize fruit wood'; (ii) with 12S. and 2W., three km East of Rongpo F. R. H., coll. H. S. Sharma and party, 5.iv.1973 (F. C. No. 1/5.4.73). Following four vials from Darjiling Dist., W. B. as (iii) with 5S. and 12W., Mal Forest, two km South-West of Garubathan, coll. G. K. Srivastava and P. K. Maiti,

18.iii.1973, ex. 'under stone' (F. C. No. 10/18.3.73); (iv) with 12S. and 12W., four km South-East of Goke F. R. H., Singla, coll. *H. S. Sharma and party*, 18.iv.1973 (F. C. No. 89/18.4.73); (v) 11S. and 4W., near Barbatia Basti, three km North-West of Bhanjang Y-Hostel, coll. *P. K. Maiti and party*, 18.iii.1973 (F. C. No. 2/18.3.73); (vi) 12S. and 14W., around Khumani F. R. H., coll. *G. K. Srivastava and P. K. Maiti*, 25.xii.1973, ex. 'nest inside hollow of a standing tree' (F. C. No. 2/25.12.73). Following 20 vials from Arunachal Pradesh as (vii) with 10S. and 11W., Pakha Camp, Daporijo, Subansiri Dist., coll. *S. K. T. and G. S. A.*, 26.x.1966; (viii) with 11S. and 12W., Nirjuli, Itanagar, coll. *P. T. Bhutia*, 3.vi.1977 (F. C. No. 17/3.6.77); (ix) with 10S. and 14W., Tago, ten km O-Yazali, L. Subansiri, coll. *B. K. Pal and party*, 17.ix.1988; (x) with 6S. and 11W., Pabin, coll. *J. M. Julka and party*, 17.i.1975; (xi) with 3S. and 2W., Tappi, Siang Dist., coll. *S. K. T. and G. S. A.* 23.x.1966, ex. 'from wood'; (xii) with 12S. and 12W., Tenga river side, coll. *S. K. B.*, 19.xii.1965, ex. 'living tree'; (xiii) with 7S. and 10W., Siki, 15 km from Talika, Subansiri Dist., coll. *J. M. Julka and party*, 24.xi.1974; (xiv) with 12S. and 11W., Bela village, Subansiri Dist., coll. *S. K. T. and G. S. A.*, 27.x.1966; (xv) with 5S. and 8W., Isarapani, coll. *R. K. Varshney* 24.vii.1967; (xvi) with 11S. and 13W., Kimin, Subansiri Dist., coll. *O. B. Chhotani*, 17.v.1989, ex. 'wood'; (xvii) with 12S. and 2W., Kimin, Subansiri Dist., coll. *A. N. T. Joseph*, 9.i.1966; (xviii) with 11S. and 14W., Norgum river bank—below Bitselling village, coll. *K. C. Jayramkrishnan*, 16.v.1961, ex. 'from a log of wood'; (xix) with 10S. and 12W., Bhalukpong, Kameng Dist., coll. *A. N. T. Joseph*, 6.v.1966; (xx) with 11S. and 3W., from the jungle at one mile East of Bairabkunda, coll. *K. C. Jayramkrishnan*, 5.iii.1961; (xxi) with 1S. and 11W., Peding village, Siang Dist., coll. *S. K. T. and G. S. A.*, 11.x.1966; (xxii) with 4S. and 11W., Kimin, Subansiri Dist., coll. *A. N. T. Joseph*, 11.v.1966; (xxiii) with 8 Im., Nirjuli, Itanagar, coll. *P. T. Bhutia*, 3.vi.1967; (xxiv) 12S. and 10W.,

Likhabali, Sigang Dist., coll. *S. K. Gupta and M. P. Prasad*, 17.x.1981; (xxv) 9 Im., 12S. and 14W., Tipi (Bhalukpong), Kameng Dist., coll. *A. N. T. Joseph*, 3.v.1966; (xxvi) 10S. and 14W., Norgum river bank—two miles North to Bokhar, on way to Kalaktang, coll. *K. C. Jayramkrishnan*, 28.v.1961, ex. 'from a rotting log of wood'.

Diagnostic Character : (i) Imago (Fig. 97a-d) : Head dark brown; postclypeus; labrum; antennae and legs yellowish brown; abdomen above brown; paler than head, below pale yellowish brown. Head and body fairly densely hairy with short and long hairs.

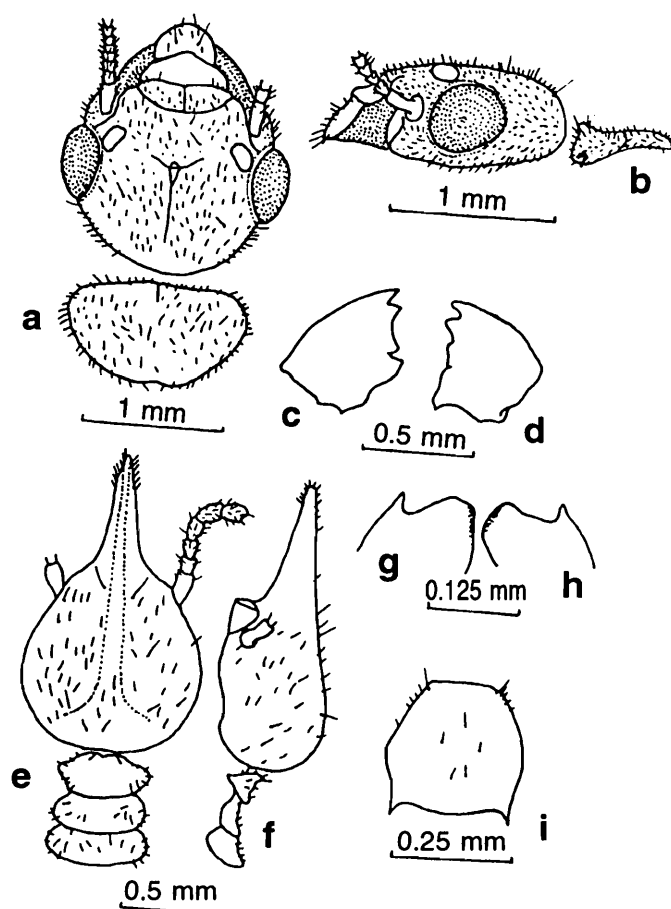


Fig. 97. : *Nasutitermes garoensis* Roonwal and Chhotani; a-d, Imago. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Left mandible; d. Right mandible; e-i, Soldier. e. Head, pronotum, mesonotum and metanotum, dorsal view; f. Head, pronotum, mesonotum and metanotum, side view; g. Left mandible; h. Right mandible; i. Postmentum.

Head subcircular, epicranial suture incomplete but distinct. Fontanelle elongate and Y-shaped. Ocelli suboval, situated very close to eyes, almost touching. Postclypeus weakly swollen with marked

median line, anterior margin weakly incurved. Antennae with 15 segments, 3 subequal to or slightly shorter than 2; 5 shortest. Pronotum flat, anterior margin with a faint median notch; posterior margin faintly to appreciably incurved medially. Wings hairy, punctate, wing venation of *Nasutitermes* type.

(ii) Soldier (Fig. 97e-i) : Head yellowish; thorax and abdominal tergites yellowish brown. Head with several short and 3 pairs of long hairs; thorax with several short and abdomen with both short and a few long hairs.

Head pyriform, width subequal to length without rostrum or slightly more. Rostrum subcylindrical and slender, tip with several short and with 2-3 longer hairs. Antennae with 12 segments, 3 longer than 2 and club-shaped; 4 subequal to 3. Mandibles rudimentary, each with a spine-like, lateral process. Postmentum subhexagonal, as wide as long. Pronotum saddle-shaped, anterior margin with a weak median invagination and posterior margin weakly outcurved.

Distribution : INDIA : *Eastern Himalaya* : Sikkim : East Sikkim Dist. : Gangtok, Rongpo F. R. H. West Bengal : Darjiling Dist. : Mal Forest, Goke F. R. H., Bhanjang Youth Hostel, Khumani F. R. H. Arunachal Pradesh : East Kameng Dist. : Norgum River Bank, Bhairavkonda; West Kameng Dist. : Tenga River side, Bhalukpong; Upper Subansiri Dist. : Daporijo, Siki, Bela Village; Lower Subansiri Dist. : Itanagar, Tago, Kimin; East Siang Dist. : Tappi; West Siang Dist. : Pading Village, Likhabali. West Bengal (other than Darjiling and Jalpaiguri) : Koch Bihar Dist. : Koch Bihar Forest Range, Atiamochar Beat. Assam : Goalpara Dist. : Raimona. Meghalaya : Garo Hills Dist. : Rongrengiri (type-locality). BHUTAN (*Eastern Himalaya*).

Remarks : By far the most common species found in the Eastern Himalaya is the *N. garoensis*, a species closely similar to a sparsely known one *N. emersoni*. The smaller size of head with

longer rostrum and prominent mandibular spine of the soldier keeps the species separate from *N. emersoni*.

However, the species has been collected in numerous occasions from dead portion of standing trees, felled fresh or decaying logs, maize fruit, under stone, etc. in the Eastern Himalaya. Imagoes have been found in the nest in the month of May in Arunachal Pradesh. Nothing more is known about its field biology.

98. *Nasutitermes jalpaigurensis* Prashad and Sen-Sarma
(Fig. 98, Table 64)

1. *Nasutitermes jalpaigurensis* Prashad and Sen-Sarma

1959. Prashad and Sen-Sarma, *Rev. Termite Genus Nasutitermes Indian Region (ICAR Ent. Mongr. 10.23)* : 5, 38, 39-41, 43. Holotype : S., in FRI. Type-locality : Jalpaiguri (Teesta For. Div.), West Bengal, India.
1977. Sen-Sarma and Thakur, *Indian For. Rec. (N.S.) Ent.*, 13(1) : 6, 31, 54.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 27, 124-126.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 650-653 (detailed synonymy).
1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 130-131.

Material studied : Unidentified : From *Eastern Himalaya* : Following 12 vials from Darjiling Dist., W. B. as (i) with 11S. and 3W., Samsing, coll. G. K. Srivastava and P. K. Maiti, 24.iii.1973, ex. 'under bark' (F. C. No. 7/24.3.73); (ii) with 12S. and 11W., three km South-East of Rambi, coll. H. S. Sharma and party, 2.iv.1973 (F. C. No. 5/2.4.73); (iii) with 12S. and 12W., Rambi, coll. G. K. Srivastava and P. K. Maiti, 6.i.1974, ex. 'stump' and 'gallery on tree trunk' (F. C. No. 2/6.1.74); (iv) with 12S. and 4W., one km East of Reyang F. R. H., on the Western bank of river Teesta, coll. H. S. Sharma and party, 29.iii.1973, ex. 'earthen gallery on the bark of the tree' and 'rotten bamboo' (F. C. No. 31/29.3.73); (v) with 12S. and 11W., Nazeok, coll. G. K. Srivastava and P. K. Maiti, 7.i.1974, ex. 'under log' (F. C. No.

30/7.1.74); (vi) with 14S. and 11W., Mongpong, ten km West of Bagrakote, *coll. G. K. Srivastava and P. K. Maiti*, 29.xii.1973, ex. 'under bark' and 'nest in hollow of a standing tree' (F. C. No. 6/29.12.73); (vii) with 12S. and 15W., one km South-West of Reyang F. R. H., on the way to Rambhi, *coll. H. S. Sharma and party*, 31.iii.1973 (F. C. No. 25/31.3.73); (viii) with 14S. and 15W., Dalincoat, four km North of Garubathan, *coll. G. K. Srivastava and P. K. Maiti*, 20.xii.1973, ex. 'gallery on log' (F. C. No. 1/20.12.73); (ix) with 4S. and 2W., Ghoomti Forest, five km North of Reyang, *coll. G. K. Srivastava and P. K. Maiti*, 5.i.1974, ex. 'log' (F. C. No. 6/5.1.74); (x) with 1S. and 2W., Botanical garden, *coll. D. N. Tiwari*, 28.iii.1979; (xi) with 5S. and 10W., four km radius around Gorumara F. R. H., *coll. D. N. Tiwari*, 17.iii.1979; (xii) with 7S. and 12W., one km East of Goke F. R. H. Singla, *coll. H. S. Sharma and party*, 19.iv.1973. (xiii) 2S. and 5W., Chapramari Sanctuary, forest near F. R. H., three km North of Khunia Junc., Jalpaiguri Dist., W. B., *coll. G. K. Srivastava and P. K. Maiti*, 24.xii.1973, ex. 'under bark of log lying on ground' (F. C. No. 7/24.12.73).

Diagnostic Character : (i) Imago : Unknown.

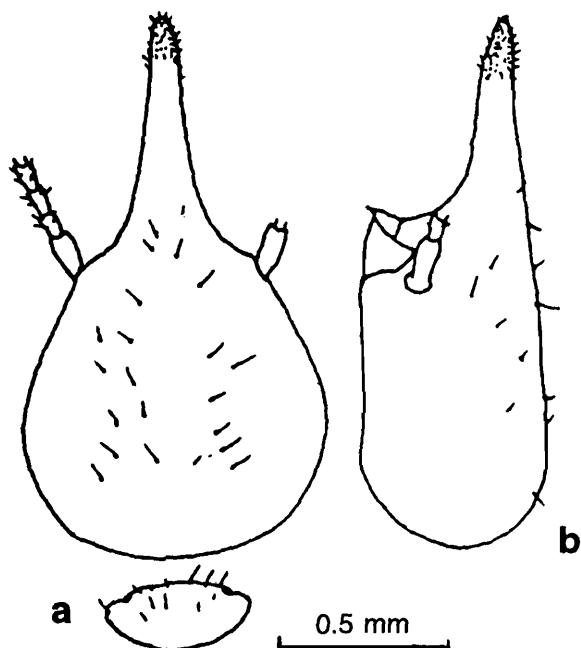


Fig. 98. : *Nasutitermes jalpaigurensis* Prasad and Sen-Sarma; a-b, Soldier. a. Head and pronotum, dorsal view; b. Head, side view.

(ii) Soldier (Fig. 98a-b) : Head pale brown; pronotum and abdomen with brownish tinge. Head covered with numerous minute hairs and a pair of long hairs on vertex and a pair at base of rostrum nearby; rostrum with a few long and short hairs at tip; pronotum with numerous short hairs; abdominal tergites with a pair of long hairs at middle and one either side laterally.

Head pear-shaped, in profile head dorsum substraight, rostral hump weakly marked. Rostrum somewhat conical. Antennae with 12 segments, 3 subequal to or slightly longer than 2. Mandibles vestigial, each with a short, spine-like process. Pronotum saddle-shaped, both anterior and posterior margin rather slightly outcurved.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Samsing, Rambhi, on the Western bank of Teesta River, Nazeok, Mongpong, Dalincoat, Garubathan, Ghoomti Forest, Botanical Garden, Singla, Tarkhola, Tashiding Forest, North-East of Teesta Bridge, Gailikhola Forest, Teesta Valley Forest, Pesok Tea Estate, Bong Basti, Kalimpong; Jalpaiguri Dist.; Jalpaiguri, Teesta Division (type-locality), Chapramari Sanctuary, forest near F. R. H., three km North of Khunia Junc. Arunachal Pradesh : West Kameng Dist. : Charduar Forest, Bhalukpong; East Siang Dist. : Tapi. Tripura : Tilamura.

Elsewhere : Bangladesh.

Remarks : Apart from its single isolated distribution in Tripura, the species seems to have well spread distribution in the Darjiling Himalaya. It occurs almost in similar habitats as that *N. gardneri* and *N. garoensis* in the undulating forest area in the Darjiling Hills. The strictly pyriform head of soldier widest with width at the posterior portion serve as the distinguishing feature of the species. In the Eastern Himalaya, it is commonly found in soil under stones, logs, etc. in addition to its infection in dead dying and decaying stump, tree trunk, felled logs etc. Imagoes still remain unknown in spite of so many collection made in the study area.

Table 63 : Measurements (in mm) etc. of Caste-Imago.

	<i>Nasutitermes gardneri</i>		<i>N. garoensis</i>	
	2Im.	Known Range	1Im.	Known Range
Total body-length with wings (excluding antennae), ca.	16.5–17.5	16.20–17.8	15.0	13.50–15.50
Total body-length without wings (excluding antennae), ca.	8.90–9.00	8.80–9.00	8.80	6.80–8.90
Length of head to lateral base of mandibles	1.2–1.30	1.20–1.30	1.12	0.90–1.10
Maximum width of head (with eyes)	1.56–1.58	1.55–1.60	1.50	1.20–1.37
Maximum length of postclypeus	–	–	–	–
Maximum width of postclypeus	–	–	–	–
Maximum length of labrum	–	–	–	–
Maximum width of labrum	–	–	–	–
Maximum diameter of compound eye (with ocular sclerite)	0.41–0.43	0.40–0.43	–	0.38–0.50
Minimum diameter of compound eye (with ocular sclerite)	–	0.35–0.38	–	–
Long diameter of lateral ocellus	0.17–0.18	0.16–0.18	0.18	0.17–0.19 (Length)
Short diameter of lateral ocellus	–	0.13–0.15	0.15	0.13–0.15 (Width)
Minimum eye-ocellus distance	0.10–0.11	0.10–0.11	0.04	0.02–0.04
Maximum length of pronotum	0.83–0.84	0.83–0.84	0.70	0.60–0.68
Maximum width of pronotum	1.38–1.43	1.35–1.43	1.13	0.97–1.13
Length of forewing with scale	15.5–15.7	15.50–15.70	–	10.5–13.0
Length of hindwing with scale	14.5–15.0	14.50–15.0	12.10	9.50–12.20
Number of antennal segments	–	15	–	15

Table 64 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Nasutitermes gardneri</i>		<i>N. garoensis</i>		<i>N. jalpaigurensis</i>	
	Sev. S.	Known Range	Sev. S.	Known Range	11S.	Known Range
Length of head without rostrum	0.98–1.17	0.95–1.15	0.87–0.92	0.85–0.93	0.94–1.00	0.82–1.00
Maximum width of head	0.90–1.05	0.88–1.10	0.87–0.93	0.85–0.93	0.81–1.00	0.70–1.03
Head index (width/length without rostrum)	0.89–0.91	–	1.00	0.94–1.03	0.86	–
Maximum length of labrum	–	–	–	–	–	–
Maximum width of labrum	–	–	–	–	–	–
Length of rostrum	0.60–0.70	0.57–0.70	0.57–0.67	0.57–0.67	0.57–0.60	0.55–0.60
Head-mandibular length Index (rostrum-length/head-length without rostrum)	0.59–0.6	0.57–0.70	0.65	–	0.61	0.61–0.67
Minimum median length of postmentum	–	–	0.30	–	–	–
Maximum width of postmentum	–	–	0.30	0.30 (subequal to length)	–	–
Width of postmentum at waist	–	–	–	–	–	–
Maximum length of pronotum	0.21–0.25	0.20–0.25	0.15–0.21	0.13–0.18	0.14–0.19	0.13–0.20
Maximum width of pronotum	0.50–0.57	0.50–0.58	0.42–0.48	0.40–0.48	0.44–0.50	0.39–0.51
Pronotum index (length/width)	0.42–0.43	–	0.35–0.43	–	0.31–0.38	–
Number of antennal segments	13	13	12	12	12	12

99. *Nasutitermes kali* Roonwal and Chhotani
(Fig. 99, Table 65)

1. *Nasutitermes kali* Roonwal and Chhotani

- 1962a. Roonwal and Chhotani, *Proc. natn. Inst. Sci. India*, (B) 28(4) : 297, 384-388. S. and W. (maj. & min.). Holotype : S., in ZSI. Type-locality : Umsa Nongkharai, Khasi and Jaintia Hills, Meghalaya, India.
1965. Roonwal and Chhotani, *J. Bombay nat. Hist. Soc.*, 62 : 21.
1983. Sen-Sarma and Verma, *Orient. Insects*, 17 : 99.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 652-653 (detailed synonymy).
1999. Bose. *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 131-132.

Material studied : Unidentified : From *Eastern Himalaya* : Sev. S. and 5W., around Kimin, Lower Subansiri Dist., Arunachal Pradesh, coll. G. Thirumalai and party, 11.ii.1996.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 99a-e) : Head brownish yellow; thorax and abdomen pale brownish yellow. Head with several short and 3 pairs of long hairs;

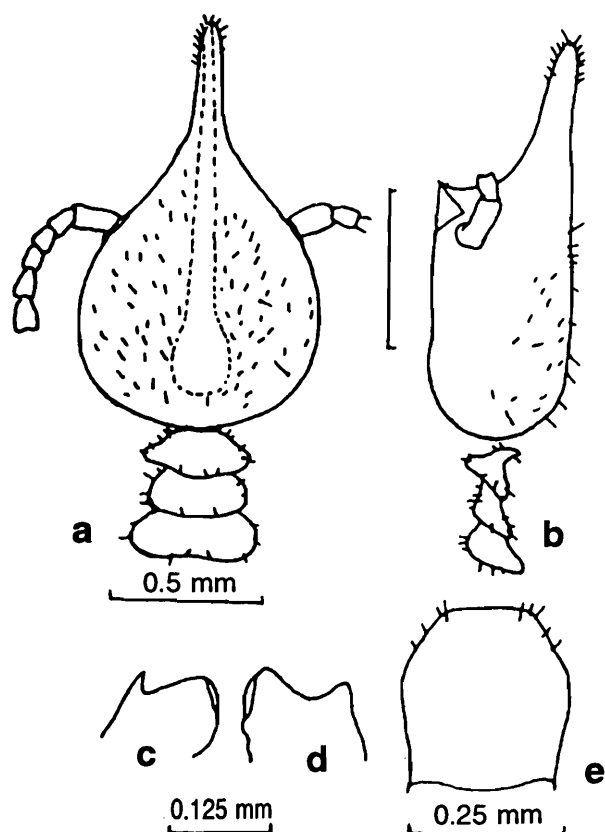


Fig. 99. : *Nasutitermes kali* Roonwal and Chhotani; a-e, Soldier. a. Head, pronotum, mesonotum and metanotum, dorsal view; b. Head, pronotum, mesonotum and metanotum, side view; c. Left mandible; d. Right mandible; e. Postmentum.

thorax and abdomen with several short and a few long hairs.

Head pyriform. Rostrum subcylindrical, tip hairy with short and 2 long hairs. Antennae with 11-12 segments, in 11-segmented ones, 3 subdivided; in 12-segmented ones, 3 subequal to 2. Mandibles rudimentary, each with a lateral, spine-like process. Postmentum subhexagonal. Pronotum saddle-shaped, anterior margin convex with a weak median notch; posterior margin convex.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Lower Subansiri Dist.; around Kimin. Meghalaya.

Remarks : The species has been recorded here for the first time from the Eastern Himalaya. So far it was only known from its type-locality in Meghalaya.

100. *Nasutitermes matangensisformis*
(Holmgren)

(Fig. 100, Table 65)

1. *Eutermes (Eutermes) matangensisformis*
(Holmgren)

- 1913b. Holmgren, K. *svenska Vetensk-Akad. Handl.*, 50(2) : 159, 162, 185. Im., S., W maj., W min. Lectotype : S., in FRI. Type-locality : Sarawak, Borneo, Malaysia.

2. *Nasutitermes matangensisformis/*
matangensis matangensisformis
(Holmgren)

1956. Roonwal and Sen-Sarma, *Indian J. Agric. Sci.*, 26(1) : 27-28.
1970. Roonwal and Bose, *Rec. zool. Surv. India*, 62(3 & 4) : 120, 162-163.
1981. Roonwal *et al.*, *Proc. Indian natn. Sci. Acad.*, (B) : 47(3) : 354.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 657-660 (detailed synonymy).

Material studied : Unidentified : From *Eastern Himalaya* : S. and W., Deban, Tirap Dist., Arunachal Pradesh, coll. P. K. Maiti, 11.vii.1983, ex. "under bark."

Diagnostic Character : (i) Imago : Known but not from the Himalaya, hence not dealt here with.

(ii) Soldier (Fig. 100a-d) : Head brownish yellow to blackish brown; abdomen above as dark as head, sternites paler. Head with 4 long hairs near base of nasus and a pair on vertex along with several short hairs, nasus with 2-4 hairs at tip; pronotum with short hairs and a few longer ones along margins; abdominal tergites with many short hairs and a pair of longer hairs at middle and one on either side.

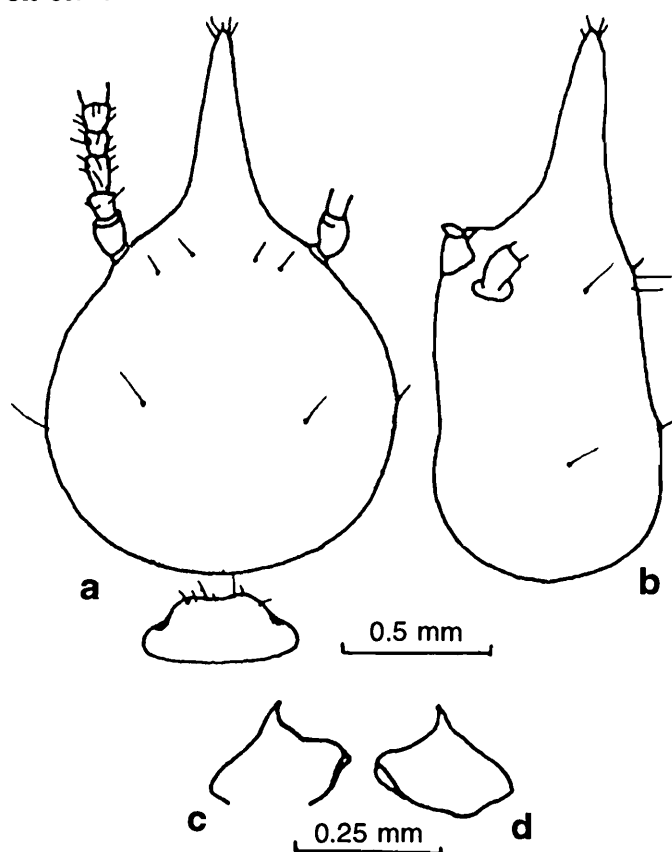


Fig. 100. : *Nasutitermes matangensiformis* (Holmgren); a-d, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible.

Head almost circular without rostrum, slightly wider than long, in profile head dorsum almost straight, basal hump distinct. Rostrum strictly conical. Antennae with 13-14 segments; segment 3 almost twice as long as 2 in 13-segmented; 3 as long as 2 in 14-segmented. Mandibles vestigial with short spine-like processes. Postmentum almost as long as broad. Pronotum saddle-shaped, devoid of any emargination on anterior or posterior margins.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Tirap Dist. : Miao. Little Andamans and Nicobars.

Elsewhere : Bangladesh. Malaysia. Indonesia (Java, Sumatra, Borneo) and Thailand.

Remarks : The species is distinct and dissimilar to any other species of *Nasutitermes* occurring in the Himalaya by its large, dark and almost circular head with comparatively short rostrum. It is quite a common species in the south-east Asian country including the Andamans and Nicobar Islands being unknown in the Indian mainland. Bose (1999) recorded it for the first time from Arunachal Pradesh to which a single population have been added herewith.

101. *Nasutitermes moratus* (Silvestri)
(Fig. 101, Table 65)

1. *Eutermes moratus* (Silvestri)

1914. Silvestri, *Rec. Indian Mus.*, 8 : 431. Ny. and S. Lectotype : S., in ZSI. Type-locality : Yambung, Siang District, Arunachal Pradesh, India.

2. *Nasutitermes moratus* (Silvestri)

1958b. Ahmad, *Biologia, Lahore*, 4(2) : 157.

1962a. Roonwal and Chhotani, *Proc. nat. Inst. Sci. India*, (B) 28(4) : 297, 389-390.

1997. Chhotani, *Fauna of India : Isopetra (Termites)*, 2 : 663-665.

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 133-134.

Material studied : Identified : From *Eastern Himalaya* : S. and W., Lemeking, Upper Subansiri Dist., Arunachal Pradesh, coll. J. M. Julka, 3.xii.1974, det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 101a-b) : Head pale straw yellow; body yellowish white. Head with several minute hairs and a pair of long hairs on vertex and a pair of shorter hairs at base of rostrum; rostrum with several shorter hairs and a pair of longer hairs at tip; abdominal tergites with several minute hairs and a longer hair on either side and a pair at the middle.

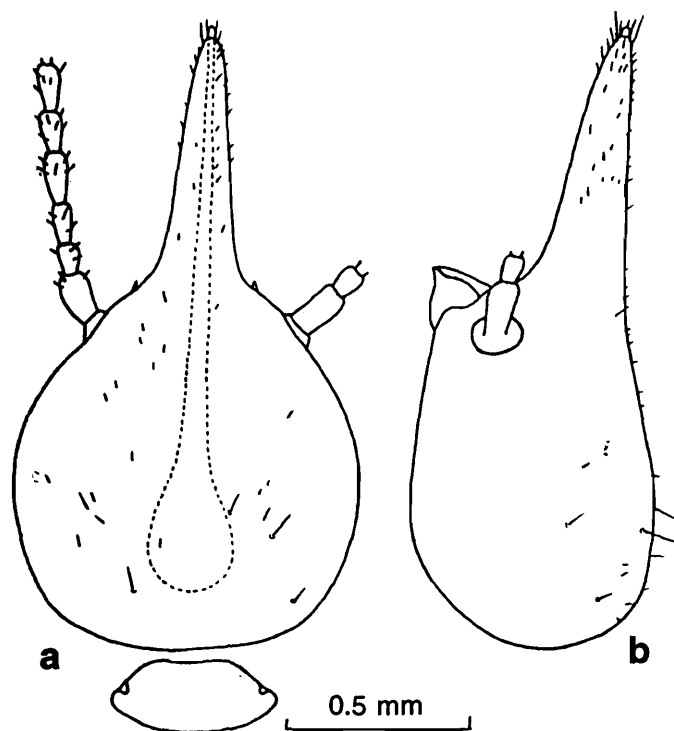


Fig. 101. : *Nasutitermes moratus* (Silvestri); a-b, Soldier.
a. Head and pronotum, dorsal view; b. Head, side view.

Head subround, sides not regularly round, in profile, slightly incurved, rostral hump absent. Rostrum subcylindrical. Antennae with 12-13 (generally 13) segments, 3 a little longer than 2. Mandibles vestigial, each with a short spine-like process. Pronotum saddle-shaped, anterior margin faintly emarginate; posterior margin substraight.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : Upper Subansiri Dist. : Lemeking; East Siang Dist. : Yabung (type-locality).

Remarks : It is a very unfamiliar species described long back in 1914 which has recently been collected from considerable height (1400 m) at Lemeking as reported by Bose (1999).

Table 65 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Nasutitermes kali</i>		<i>N. matangensiformis</i>		<i>N. moratus</i>	
	Sev. S.	Known Range	1S.	Known Range	1S.	Known Range
Length of head without rostrum	0.78–0.80	0.78–0.83	1.27	1.10–1.30	1.02	0.95–1.05
Maximum width of head	0.75–0.90	0.73–0.90	1.25	1.30–1.50	0.93	0.93–1.00
Head index (width/length without rostrum)	0.96–1.12	–	0.98	–	0.91	–
Maximum length of labrum	–	–	–	–	–	–
Maximum width of labrum	–	–	–	–	–	–
Length of rostrum	0.56	–	0.68	0.70–0.85	0.64	–
Head-rostrum length Index (rostrum-length/head-length without rostrum)	0.71	–	–	0.58–0.68	–	0.663
Minimum median length of postmentum	0.27	–	–	–	–	–
Maximum width of postmentum	0.26	–	–	–	–	–
Width of postmentum at waist	–	–	–	–	–	–
Maximum length of pronotum	0.10–0.15	0.10–0.18	0.27	0.30–0.35	0.19	0.20–0.25
Maximum width of pronotum	0.35–0.45	0.35–0.48	0.58	0.60–0.65	0.45	0.45–0.50
Pronotum index (length/width)	0.28–0.33	–	0.46	–	0.42	–
Number of antennal segments	11	11–12	13	13–14 (generally 13)	13	12–13 (generally 13)

102. *Nasutitermes suknensis* Prashad and Sen-Sarma
(Fig. 102, Table 66)

1. *Nasutitermes suknensis* Prashad and Sen-Sarma

1959. Prashad and Sen-Sarma, *Rev. Termite Genus Nasutitermes Indian Region (ICAR Ent. Monogr. 10.23)* : 64-66. S. only. Holotype : S., in FRI. Type-locality : Sukna, West Bengal, India.

1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 35.

1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 27, 126, 127, map. 4.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 670-671.

Material studied : Unidentified : From *Eastern Himalaya* : S. and W., Kalimpong, Darjiling Dist., W. B., coll. G. K. Srivastava and P. K. Maiti, 1973, ex. "felled log."

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 102a) : Head and abdominal tergites pale, sternites yellowish white. Head with numerous minute hairs and a pair of longer hairs at base of rostrum and a pair at vertex, rostrum with a few long and several minute hairs at tip,

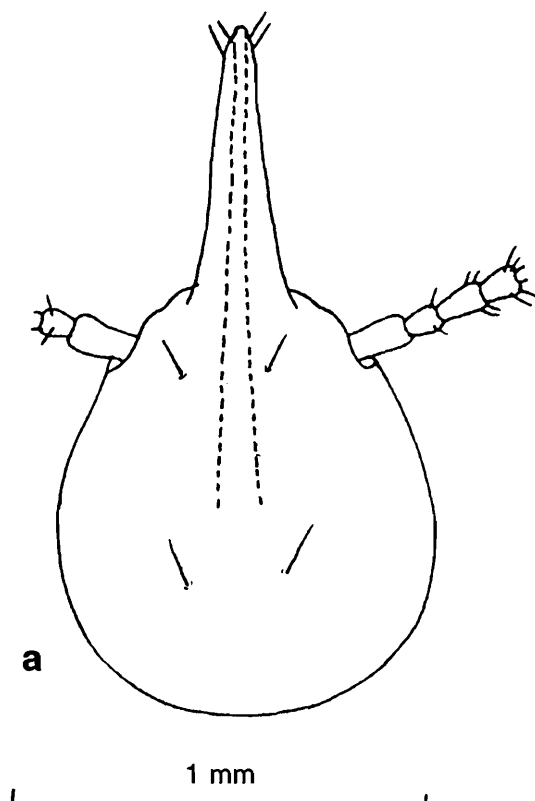


Fig. 102. : *Nasutitermes suknensis* Prasad and Sen-Sarma; a, Soldier. a. Head, dorsal view.

first five tergites without any long hairs on lateral margin but with a pair of longer hairs.

Head pear-shaped, in profile head dorsum substraight with a weak rostral hump, feeble constriction behind antennae, rostrum weakly conical. Antennae with 13 segments, 3 longer than 2; 4 shortest. Mandibles vestigial, without any spine but each with short, conical process. Pronotum saddle-shaped, anterior margin with a weak median emargination and posterior margin somewhat straight.

Distribution : INDIA : *Eastern Himalaya* : West Bengal : Darjiling Dist. : Sukna (type-locality), Kalimpong. ELSEWHERE : None.

Remarks : It is a very rare species so far known only from its type-locality at Sukna. Only a single collection from Kalimpong could be recognized as this species in the present context.

103. *Nasutitermes tandoni* Bose
(Fig. 103, Table 66)

1. *Nasutitermes tandoni* Bose

1999. Bose, *Occ. Pap. Rec. zool. Surv. India*, No. 171 : 134-137. Holotype : S., in ZSI. Type-locality : Tappi, Siang Dist., Arunachal Pradesh, India.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 671-673.

Material studied : Identified : From *Eastern Himalaya* : Holotype S. and Paratypes S. and W., Tappi, Siang Dist., Arunachal Pradesh, coll. S. K. Tandon and G. S. Arora, 23.x.1966, ex. "wood", det. G. Bose.

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 103a-d) : Head yellowish brown; abdominal tergites whitish. Head with sparse minute hairs with a pair of longer hairs at vertex, rostral tip with numerous minute hairs.

Head broadly pyriform, slightly wider than long without rostrum, in profile, depressed behind rostrum, rostrum thickly conical. Antennae with 13 segments, 3 slightly shorter than 2; 4 shortest. Mandibles rudimentary, knob-like, devoid of any

lateral spine-like process. Pronotum weakly saddle-shaped, margins fringed with minute hairs and one or two long hairs, anterior margin feebly notched; posterior margin straight.

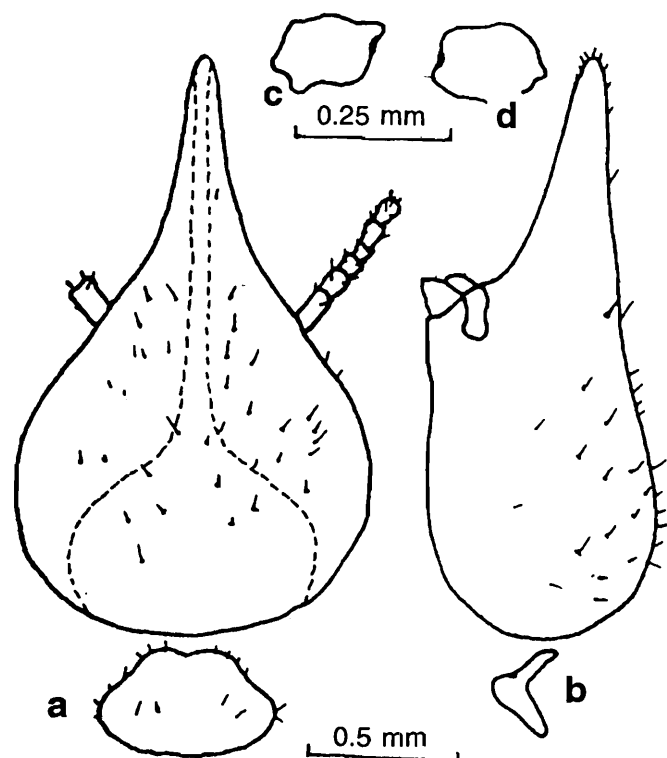


Fig. 103. : *Nasutitermes tandoni* Bosc; a-d, Soldier. a. Head and pronotum, dorsal view; b. Head and pronotum, side view; c. Left mandible; d. Right mandible.

Distribution : INDIA : *Eastern Himalaya* : Arunachal Pradesh : East Siang Dist. : Tappi (type-locality).

Remarks : The species was cited in Fauna (Chhotani, 1997) as new species described by Bose (in press). The original description by Bose had been published much latter (1999) than that of Chhotani in 1997. Since then, no further collection could be available for study.

104. *Nasutitermes thanensis* Prashad and Sen-Sarma
(Fig. 104, Table 66)

1. *Nasutitermes thanensis* Prashad and Sen-Sarma

1959. Prashad and Sen-Sarma, *Rev. Termite Genus Nasutitermes Indian Region* (ICAR Ent. Monogr. 10.23) : 4, 61-63. S. and W. Holotype : S., in FRI. Type-locality : Thano, Dehra Dun, Uttaranchal, India.

1977a. Chhotani, *Occ. Pap. Rec. zool. Surv. India*, No. 9 : 35.

1983. Sen-Sarma and Verma, *Orient. Insects*, 17 : 101.

1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 673-674.

Material studied : Unidentified : From *Eastern Himalaya* : 1S. and 4W., Bong Basti, Kalimpong, Darjiling Dist., W. B., coll. G. K. Srivastava and P. K. Maiti, 3.i.1974, ex. 'hollow of a tree' (F. C. No. 2/3.1.74).

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 104a-b) : Head brown; abdomen whitish yellow. Head with several minute hairs but devoid of any long hair, rostrum with a tuft of hairs at tip; pronotum with several minute hairs; abdominal tergites and sternites with only short hairs.

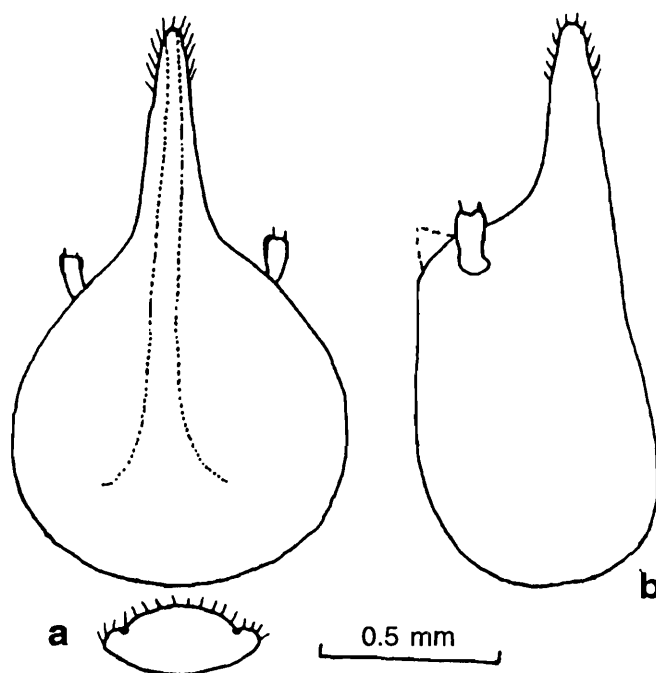


Fig. 104. : *Nasutitermes thanensis* Prasad and Sen-Sarma; a-b, Soldier. a. Head and pronotum, dorsal view; b. Head, side view.

Head subround, sides uniformly round, length to base of mandibles subequal to width; rostral hump weak marked. Rostrum conical, length half the head-length. Antennae with 12-segments, 3 about one-and-a-half times of 2, 4 shorter than 3. Mandibles vestigial, each with a lateral spine-like process. Pronotum saddle-shaped, anterior margin without any notch and posterior margin outcurved.

Table 66 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Nasutitermes suknensis</i>		<i>N. tandoni</i>		<i>N. thanensis</i>	
	Sev. S.	Known Range	Holotype	Known Range	1S.	Known Range
Length of head without rostrum	0.92–1.00	0.90–1.00	1.08	0.98–1.05	1.00	1.10–1.12
Maximum width of head	0.90–0.94	0.90–0.95	1.10	0.98–1.08	0.95	1.00–1.07
Head index (width/length without rostrum)	0.94–0.97	–	1.01	–	0.95	–
Maximum length of labrum	–	–	–	–	–	–
Maximum width of labrum	–	–	–	–	–	–
Length of rostrum	0.60–0.62	0.60–0.65	0.72	–	0.58	0.60–0.70
Head-rostrum length Index (rostrum-length/head-length without rostrum)	0.65	0.65–0.72	0.66	0.68–0.80	0.58	0.54–0.64
Minimum median length of postmentum	–	–	–	0.26–0.38	–	–
Maximum width of postmentum	–	–	–	0.30–0.35	–	–
Width of postmentum at waist	–	–	–	0.28–0.29	–	–
Maximum length of pronotum	–	0.15	0.28	0.23–0.25	0.20	0.20–0.25
Maximum width of pronotum	–	0.40	0.54	0.48–0.55	0.45	0.45–0.55
Pronotum index (length/width)	–	–	0.51	–	0.44	–
Number of antennal segments	13	13	13	13	12	12

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Dehra Dun Dist. : Thano (type-locality). *Eastern Himalaya* : West Bengal : Darjiling Dist. : Bong Basti, Kalimpong.

Remarks : The study of a single collection from Kalimpong has extended its distribution upto the *Eastern Himalaya* from its localized distribution in Dehra Dun, *Western Himalaya*.

Genus *Ahmaditermes* Akhtar

Key to the species of genus *Ahmaditermes* Akhtar

I. IMAGOES : Unknown for both the species.

II. SOLDIERS :

1. Head wider, head-width 0.95 mm (1.00 mm); posterior margin of head distinctly emarginated; head-dorsum almost straight with a very weak rostral hump *A. sikkimensis* sp. nov.
- Head narrower, head-width 0.83–0.93 mm; posterior margin of head substraight; head-

dorsum weakly incurved, devoid of any distinct rostral hump *A. emersoni* (Maiti)

105. *Ahmaditermes emersoni* (Maiti)

(Fig. 105, Table 67)

1. *Bulbitermes emersoni* Maiti

1977. Maiti, In : *Roonwal and Chhotani, Ent. Basil.*, 2 : 78–79, 81 (fig. 21 and soldier measurements from Bhutan).
 1979. Maiti, *Proc. zool. Soc., Calcutta*, 30 : 25–29. S. and W. Holotype : S., in ZSI. Type-locality : Tahsiding Forest, five km North-East of Teesta Bridge, Darjiling Dist., West Bengal, India.
 1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 26, 127–129.

2. *Ahmaditermes emersoni* (Maiti)

1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 688–689 (new comb.).

Material studied : Unidentified : From *Eastern Himalaya* : 1S., Miao, Tirap Dist., Arunachal Pradesh, coll. Shyamrup Biswas, 30.xi.1982, ex. 'unknown.'

Diagnostic Character : (i) Imago : Unknown.

(ii) Soldier (Fig. 105a-d) : Head straw yellow; pronotum and abdomen paler than head. Head sparsely and body fairly densely hairy.

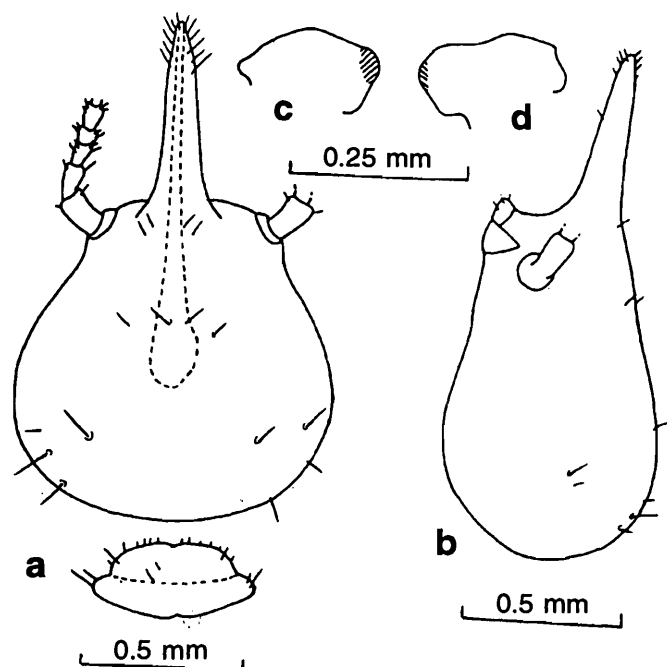


Fig. 105. : *Ahmaditermes emersoni* (Maiti); a-d, Soldier. a. Head and pronotum, dorsal view; b. Head, side view; c. Left mandible; d. Right mandible.

Head pyriform, fairly strongly constricted behind antennae and broadest towards posterior margin, in profile, weakly depressed behind rostrum and with a weak basal hump. Rostrum cylindrical, a little longer than half the head-length. Fontanelle gland and tube prominent. Antennae with 13 segments, 4 shortest. Mandibles vestigial, without any lateral spine like process. Pronotum saddle-shaped, anterior lobe weakly raised and its anterior margin without any median notch; posterior margin somewhat convex.

Distribution : INDIA : *Eastern Himalaya* : West Bengal. Arunachal Pradesh : Tirap Dist. : Miao. BHUTAN (*Eastern Himalaya*).

Remarks : The species was first established by Maiti as a new species under the genus *Bulbitermes* from the sub-Himalayan West Bengal and deposited its Types in ZSI, Kolkata prior to its publication. Roonwal and Chhotani (1977) has assigned some material from Bhutan to this species which was published as *nom. nud.* much earlier

to that of Maiti (1979). However, Chhotani (1997) had transferred this species to *Ahmaditermes* on the characteristic feature of pyriform head with distinct constriction behind the antennae, emarginated posterior margin and mandibles devoid of any lateral processes. The species has the restricted distribution in the Eastern Himalaya.

106. *Ahmaditermes sikkimensis* sp. nov.

(Fig. 106, Table 67)

2008. Mukherjee and Maiti, *Rec. zool. Surv. India*, **108**(1) : 1-8.

Material studied : From *Eastern Himalaya* : IS. and sev. W., Ranipool, near Gangtok, East Sikkim, coll. G. K. Srivastava and G. S. Arora, 20.xii.1973.

Description : (i) Imago : Unknown.

(ii) Soldier (Fig. 106a-b) : Head pale brown; rostrum yellowish brown, darker at the apex. Antennae; pronotum and abdominal tergites pale brown. Head and pronotum with sparse minute hairs; abdomen with more erect hairs.

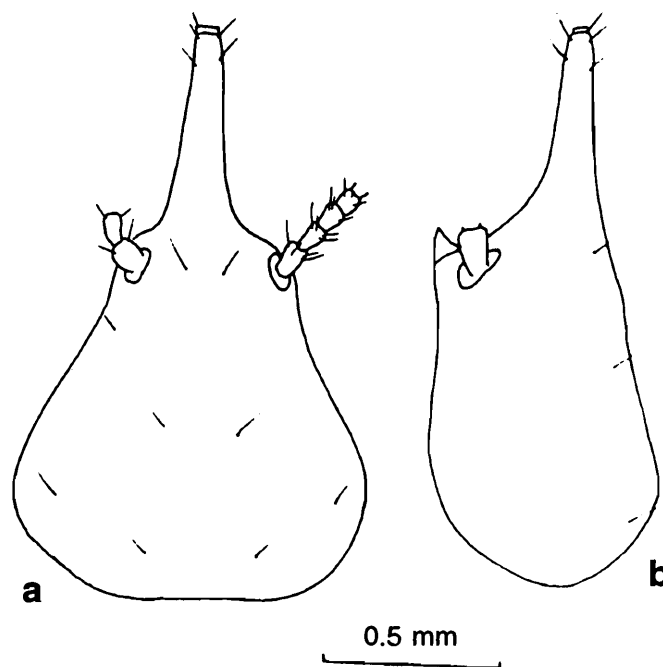


Fig. 106. : *Ahmaditermes sikkimensis* sp. nov.; a-b, Soldier. a. Head, dorsal view; b. Head, side view.

Head excluding antennae almost pear-shaped with distinct constriction behind the base of the antennae; head slightly longer than broad, broadest posteriorly and slightly smaller than the double

Table 67 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Ahmaditermes emersoni</i>		<i>Ahmaditermes sikkimensis</i> sp. nov.
	1S.	Known Range	Holotype
Length of head with rostrum	—	—	1.57
Length of head without rostrum	1.00	0.90–1.00	1.00
Maximum width of head	0.95	0.83–0.93	1.00
Head constriction width	—	—	0.61
Posterior head bulge	—	—	0.42
Head index (width/length without rostrum)	0.95	—	1.00
Maximum length of labrum	—	—	—
Maximum width of labrum	—	—	—
Length of left rostrum (Upper base of condyle to tip)	0.56	0.46–0.60	0.57
Nasute-head length Index (nasute-length/ head-length without rostrum)	—	0.51–0.53	—
Minimum median length of postmentum	—	—	—
Maximum width of postmentum	—	—	—
Width of postmentum at waist	—	—	—
Maximum length of pronotum	0.22	0.14–0.20	0.15
Maximum width of pronotum	0.50	0.37–0.53	0.45
Pronotum index (length/width)	0.44	—	0.33
Number of antennal segments	13	13	—

the width of constriction below the antennae; lateral margin strongly bulging out. Posterior margin broadly rounded with distinct median emargination; head in dorsal profile almost straight with a feeble hump on rostrum-base; posterior bulge of head moderate (0.42 mm). Rostrum short almost sub-cylindrical, slightly more than half the head-length with few minute hairs at the tip. Fontanelle gland and its tube prominent. Antennae broken, 2nd segment somewhat thicker than 3rd, 3 smaller than 2nd and double the 4th and 5th onwards increasing in length and width with profuse hairs. Labrum small, broader than long. Anteclypeus whitish, much broader than long, anterior margin convex; postclypeus distinct with convex anterior margin. Mandibles reduce, small and devoid of any denticle or any spine like process. Molar plates with irregular margin. Postmentum broader than long, broadest in the middle, anterior and posterior margin substraight.

Pronotum strongly saddle-shaped, anterior margin with a median feeble emargination, posterior margin weakly convex.

Measurements (in mm) :

	Holotype Soldier
1. Length of head with rostrum	1.57
2. Length of head without rostrum	1.00
3. Maximum width of head	1.00
4. Head constriction width	0.61
5. Posterior head bulge	0.42
6. Head index (width-length)	1.00
7. Maximum length of labrum	—
8. Maximum width of labrum	—
9. Length of left rostrum (Upper base of condyle to tip)	0.57
10. Nasute-head-length Index (nasute-length/head-length without rostrum)	—

	Holotype Soldier
11. Minimum median length of postmentum	—
12. Maximum width of postmentum	—
13. Width of postmentum at waist	—
14. Maximum length of pronotum	0.15
15. Maximum width of pronotum	0.45
16. Pronotum index (length/width)	0.33
17. Number of antennal segments	—

Type specimens : All specimens, in spirit and from a single source (vide, Material), deposited as follows :

Holotype Soldier and Paratype Workers in ZSI, Kolkata.

Type-locality and distribution : Type-locality : INDIA : *Eastern Himalaya* : Ranipool, near Gangtok, East Sikkim. Known only from the type locality.

Comparison : Of the two species known so far from the Indian subregion, *A. pyricephalus* Akhtar from Bangladesh and Southern China has the dimorphic soldiers, whereas the new species is monomorphic one. However, the species comes close to *A. emersoni* (Maiti) from the Eastern Himalaya, but differs as follows :

From *A. emersoni* : Soldier : (i) Head-wider, head-width 1.00 mm (vs. head narrower, 0.83-0.93 mm in *A. emersoni*); (ii) Posterior margin of head distinctly emarginate (vs. substraight in *A. emersoni*); (iii) Head in dorsal profile almost straight with a very weak rostral (basal) hump (vs. head in dorsal profile incurved and devoid of any distinct hump in *A. emersoni*).

Genus *Trinervitermes* Holmgren

107. *Trinervitermes biformis* (Wasmann) (Fig. 107, Table 68)

1. *Eutermes biformis* Wasmann

1902. Wasmann, *Zool. Jb. Syst.*, 17(1) : 133-135, pl. 4, figs. 10, 10a. Lectotype : S. maj., in NHM. Type-locality : Bandarawella, Sri Lanka.

2. *Trinervitermes biformis* (Wasmann)

1963. Mathur and Thapa, *Indian Forester*, 3(3 & 4) : 110.
1974. Akhtar, *Pakistan J. Zool.*, 6(1 & 2) : 93, 94, 102.
1983. Maiti, *Occ. Pap. Rec. zool. Surv. India*, No. 42 : 129-131.
1987. Chhotani, *Beitr. Ent.*, 37 : 444.
1995. Verma, *Himalayan Ecosystem Series : Fauna of Western Himalaya, Part 1, Uttar Pradesh* : 47-50. Uttaranchal.
1997. Chhotani, *Fauna of India : Isoptera (Termites)*, 2 : 726-732 (detailed synonymy).

3. *Eutermes biformis* Wasmann

1902. Wasmann, *Zool. Jb. Syst.*, 17(1) : 135-137.

4. *Trinervitermes heimi* (Wasmann)

1964. Roonwal and Bose, *Zoologica*, 40(3) : (Heft 113) : 45.

5. *Nasutitermes (Trinervitermes) longinotus* Snyder

1934. Snyder, *Indian For. Rec.*, 20(11) : 14-15.

Material studied : Unidentified : From *Central Himalaya* : 5S. (maj.) and 4W., Koila Bansa, 12 miles North of Janakpur, Dang Dist., Nepal, coll. K. Krishna, 22.i.1953, ex. 'under stone in galleries in rocky soil.' Identified : From *Western Himalaya* : (i) 5S., 4W., Dhikola, Pauri Dist., Uttaranchal, coll. S. C. Verma, 15.ii.1978, det. S. C. Verma. (ii) 2S. (maj.) and 3S. (min.) Bijrani, Nainital, Uttaranchal, coll. S. C. Verma, 28.ii.1973, det. S. C. Verma

Diagnostic Character : (i) Imago : Known but not from the Himalaya, hence not dealt with.

(ii) Soldier : Dimorphic. (a) Soldier (major) (Fig. 107a) : Head golden yellow to brown; rostrum dark brown; abdomen pale brown to dark smoky brown above; sternites straw coloured. Head with minute hairs all over, longer hairs generally absent, a pair at about middle and nasute with minute hairs all over and one or two slightly longer hairs at tip; pronotum with minute hairs along margins.

Head without rostrum broadly pyriform to almost round, anteriorly sharply convergent, in

profile fairly incurved behind rostrum and strongly arched at occiput. Rostrum short, conical. Antenna with 12-14 segments. Mandibles vestigial

without any spine. Pronotum strongly saddle-shaped, anterior margin with weak median emargination.

(b) Soldier (minor) (Fig. 107b) : Very similar to *S. major*. Body colour and pilosity same as in soldier major.

Head elongately pyriform to subrectangular, in profile, head dorsum weakly to appreciably incurved, with indistinct hump. Rostrum long, cylindrical. Antenna with 12-14 segments, 3 more than twice to nearly three times that of 2. Mandibles and pronotum as in major soldier, anterior margin of pronotum sometimes without any median emargination.

Distribution : INDIA : *Western Himalaya* : Uttaranchal : Nainital Dist. : Bijrani; Pauri Dist. : Dhikola. West Bengal. Maharashtra. Madhya Pradesh. Tamilnadu. Karnataka. Rajasthan. NEPAL (*Central Himalaya*) : Dang Dist. : Koila Bansa, 12 miles North of Janakpur.

Elsewhere : Pakistan. Sri Lanka : Bandarwalla (one of the type-localities).

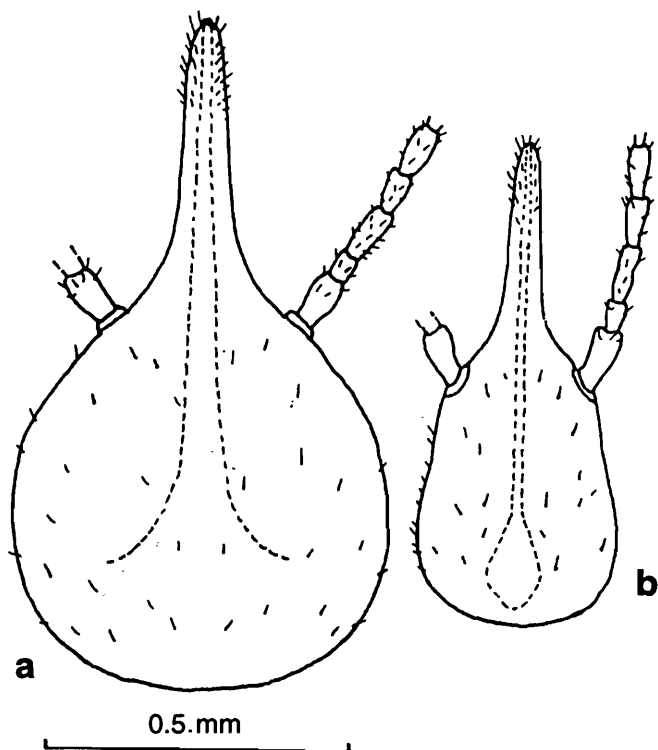


Fig. 107. : *Trinervitermes biformis* (Wasmann); a, Soldier major. a. Head, dorsal view; b, Soldier minor. b. Head, dorsal view.

Table 68 : Measurements (in mm) etc. of Caste-Soldier.

	<i>Trinervitermes biformis</i>			
	<i>Soldier major</i>		<i>Soldier minor</i>	
	5S.	Known Range	4S.	Known Range
Length of head without rostrum	1.35–1.60	1.35–1.62	0.86–0.97	0.85–1.10
Maximum width of head	1.25–1.60	1.23–1.63	0.60–0.63	0.55–0.70
Head index (width/length without rostrum)	0.92–1.00	–	0.64–0.69	–
Maximum length of labrum	–	–	–	–
Maximum width of labrum	–	–	–	–
Length of rostrum	0.80–0.95	0.77–0.95	0.63	0.58–0.73
Head rostral length index (rostrum-length/head-length without rostrum)	–	0.50–0.67	–	0.62–0.76
Minimum median length of postmentum	–	–	–	–
Maximum width of postmentum	–	–	–	–
Width of postmentum at waist	–	–	–	–
Maximum length of pronotum	–	–	–	–
Maximum width of pronotum	–	–	–	–
Pronotum index (length/width)	–	–	–	–
Number of antennal segments	12–14	12–14	12–14	12–14

Remarks : This common foraging termite of the Indian subregion is the only representative of the genus in the *Western* and *Central Himalaya* being unknown yet from the other regions of the Himalaya. In the study area, the species nests in the rocky soil which are more common in the dry plainland soil also. The nests are entirely subterranean lying generally about 5-30 cm below ground with small heaps of soil on surface being thrown from the excavated galleries of the nests. The foraging workers in thousands move in orderly column at about sun set being guarded by the soldiers for their safe return to nests. Apart from cutting and damaging grasses, it is known as pests of many fruit trees in India. Biological information can be had from publications by John, 1925; Hingston, 1928; Beeson, 1941; Roonwal and Bose, 1964; Maiti, 1983.

6.0 ZOOGEOGRAPHICAL ANALYSIS

6.1 Faunal Composition and Distribution

6.1.1 Faunal composition

Although it is well known that the large number species of termites are found in the humid tropics, their general activities seem to be very high in the deciduous forest and dry cultivated land. But the number of species and individuals present in any locality fall appreciably outside the tropics as well as high altitudes where temperature also drops considerably. As such, it is justified to trace the detailed distribution pattern of termites with gradients of physiographic set up in the Himalaya to which these insects are very sensitive.

A total of 107 species of termites belonging to 29 genera under 6 families are known so far from the Himalayan mountain ecosystem. The families not represented in the area are the most primitive ones, namely, Mastotermitidae (Australian), Hodotermitidae (Cosmopolitan) and Serritermitidae (Neotropical) which mostly occur outside the Orient. The termite fauna seems to be an assemblage of heterogeneous genera and species including the Himalayan endemics, constituting

roughly one-third of the total termite fauna of the Indian subregion. Almost half (29) of the total Indian genera is found in the area. The most common species to a total of 21 (about 50 percent of the total fauna) belong to the genus *Odontotermes* which is by far the largest and most common genus represented in the Indian subregion. Likewise, *Nasutitermes* is the next genus containing maximum number to a total of 13 species in the area. There are eight genera represented in each with 4-5 species and equal number of genera are represented by single species in each (Table-B).

However, the species composition as well as the distribution pattern of different species under each genera of termites in the Himalaya has been discussed, family-wise.

6.1.2 Horizontal distribution

Family Termopsidae :

The most primitive and relict species occurring in the Himalaya, is the *Archotermopsis wroughtoni* which is the sole representative of the family and occurs in the coniferous forest in the North-Western Himalaya including Pakistan and Afghanistan (Palearctic) at higher altitudes (900 m-3000 m).

Family Kalotermitidae :

Out of two dozen of living and fossil genera of this family, only *Neotermes*, *Glyptotermes*, *Bifiditermes* and *Cryptotermes* are so far known from the Himalaya.

Only five species, out of 24 wood-eating termites of *Neotermes* from the Indian subregion, are recorded mostly from the foothills of the Himalaya, with the record of *N. kalimpongensis* at a moderate altitude of Kalimpong (1209 m) in the Eastern Himalaya, with which another species *N. buxensis* may be named from Buxa forest at lower elevation. Other two species, *N. megaoculatus* and *N. microculatus* are so far known only from the Western Himalaya, while *N. bosei* is a wide spread species occurs from the Kumaon Hills in the west to Darjiling Hills in the

east. Like *Neotermes*, its allied genus *Glyptotermes* is also represented by five species in the Himalayan foothills. Out of these, *G. ukhiensis* and *G. teknaensis* occur in the Teesta Valley and *G. tikaderi* and *G. taruni* in Arunachal Pradesh. Thus, all these four species have their distribution in the Eastern Himalaya. The lone species, *G. almoresis* occurs in the Western Himalaya from the foothills upto the higher elevation in the Kumaon Hills.

Family Rhinotermitidae :

Out of eight genera belonging to the damp-wood termites of this family known so far from the Indian subregion, only four genera with 12 species have been recorded from the Himalayan belt.

Subfamily Coptotermittinae :

The most common genus *Coptotermes* is represented by three species, of which *C. heimi* is the most familiar species distributed both horizontally and vertically from the plains to the high mountain ranges of the Himalaya between 2600 m and 3400 m in Bhutan Himalaya. Its allied species *C. travians*, a common species in the South-East Asian countries is distributed from Sikkim eastwards. Likewise, *C. gestroi* spreads from the Eastern Himalaya (Arunachal Pradesh) eastwards to Myanmar.

Subfamily Heterotermittinae :

The genus *Heterotermes* is represented by three species, of which *H. indicola* is by far the most common species, usually well recognized as the household pest in India and adjacent countries (Pakistan and Afganistan) and occurs mostly above 20°N latitude in India. It is more so common in the entire ranges of the Western Himalaya than in the Eastern Himalaya and is known from quite higher elevation of Ranikhet (1860 m) in the Kumaon Himalaya.

The other two species, namely, *H. balwanti* which is a very rare species so far known to confine only in Uttarkashi, Uttaranchal and Melha, Himachal Pradesh and the other one, *H. gertrudae*

is a more common one from the foothills to an altitude of 1350 m at Almora in Kumaon Hills.

Another rhinotermitid genus *Reticulitermes* is recognized by four species in the warm temperate belt of only the Eastern Himalayan ranges. Among these, *R. chinensis* and *R. assamensis* are well recognized species in the Eastern Himalayan tracts being stretched from the lower to upper ridges. On the other hand, other two species, *R. ganga* and *R. tirapi* are recently described, each based on material collected from single locality in Arunachal Pradesh.

Subfamily Rhinotermitinae :

The most uncommon genus *Parrhinotermes* is only known by two species *khassii* from Teesta Valley and *shamimi* from Arunachal Pradesh.

Family Stylotermittidae :

Stylotermes, a very primitive lone, oriental genus of the family, is well established in the Himalayan foothills represented by four species, all of which are mostly localized in some pockets, except *S. bengalensis* having extended distribution in both the Kumaon and Darjiling Hills. The other species, *S. chakratensis*, *S. dunensis* and *S. faveolus* are endemic to the Kumaon Hills, while *S. parabengalensis* is found in the foothills of the Darjiling Hills.

Family INDOTERMITIDAE

This soil-inhabiting and purely Oriental monogeneric family is represented in the Himalaya by *Indotermes* containing seven species all together in the Orient. The species, *I. rongrensis* is known to occur in the Bhutan Himalaya in addition to its occurrence in the north-eastern India. The other species, *I. capillosus* is known from the Kumaon Hills.

Family TERMITIDAE

Subfamily AMITERMITINAE

The soil-inhabiting genus *Speculitermes*, an endemic to the Indian subregion (India, Pakistan and Sri Lanka) remained soldierless until the

discovery of soldier caste from Dharwar, Karnataka in a single species, *S. sinhalensis*. Out of eight species known from India (Roonwal and Chhotani, 1997), all based on workers only, two species, *S. triangularis* endemic to Dehra Dun and *S. cyclops* from the Western Himalayan tracts, are on record.

The dominance of another soil-inhabiting genus *Euhamitermes* is indicated by the occurrence of five species from the lower to upper ridges of the entire Himalayan mountain system. Except *E. kanhaensis* known from Arunachal Pradesh and Madhya Pradesh, other species are endemic to the Himalaya. *E. lighti* confines to Doon Valley, *E. aruna* to Arunachal Pradesh, and *E. urbanii* and *E. wittmeri* to the Bhutan Himalaya.

Synhamitermes like *Speculitermes*, is well known for its discontinuous distribution in two most isolated Oriental (Indian subregion) and Neotropical Zoogeographical regions. The well spread plainland species *Synhamitermes quadriceps* extends its population to the Eastern Himalaya. The another genus *Eremotermes* represented by lone species *E. dehraduni* remains endemic around Dehra Dun. *Microcerotermes* occurs in all the Zoogeographical regions, except Nearctic and contains 29 species in the Indian subregion, of which only five species extend to the Himalaya. *M. cameroni*, *M. beelsoni*, *M. fletcheri* and *M. tenuignathus* are widely found in the plain and also extend to the Himalayan ranges. The only species, *M. rambanensis* is endemic to Kashmir and *M. labioangulatus* is known from the Kumaon Hills.

Subfamily TERMITINAE

The genus *Angulitermes* contains 18 species from the Indian subregion of which only six species occur in the Himalaya. *A. acutus*, *A. akhorisainensis* and *A. dehraduni* have their presence in the Western Himalaya, while the latter have extended distribution to Afghanistan. *A. kashmirensis* and *A. tilaki* are also an endemic one

to the Kashmir Himalaya. *A. nepalensis* sp. nov. is found only in Nepal. *Dicuspiditermes laetus* is the only species of the genus *Dicuspiditermes* found in the Eastern Himalaya in addition to its distribution in the plain land also. *Pericapritermes*, a very allied genus of *Dicuspiditermes*, supports four species from the Himalaya, of which *P. dunensis* is known from Doon Valley, while the others namely, *P. assamensis*, *P. durga* and *P. tetraphilus* from the Eastern Himalaya. The genus *Malaysiocapritermes* is represented by three species from the Indian subregion, of which only one species *M. holmgreni* has its presence in the Eastern Himalaya. Another genus *Pseudocapritermes* is represented by only two species from the Himalayan belt, namely, *P. bhutanensis* and *P. tikaderi*, both occur in the Bhutan Himalaya, while the latter has also its distribution in Arunachal Pradesh.

Subfamily MACROTERMITINAE

This subfamily includes fungus-growing species which is represented in the Himalaya by five genera. The large species with hyaline labrum tip are included under the genus *Macrotermes* which supports four species from the Eastern Himalaya. The species are *M. aleemi*, *M. convulsionarius*, *M. gilvus* and *M. khajurii*.

The Afro-Asian genus *Odototermes* visibly dominates both in number and variety of species. They are equally dominant in the Himalaya represented by 21 species, of which three widespread species are mound-building forms in the Himalaya. The species remain mostly confined to the lower altitudes and only a few, *O. redemanni* and *O. obesus* extend to the higher altitudes. Among these, *O. parvidens* (referred to as *O. distans* Holmgren and Holmgren in some references) occurs in the highest altitude of 2250 m at Chaubatia, Ranikhet (Uttaranchal), above which none could be found.

O. adampurensis is described from Bangladesh and subsequently has been reported from foothills

of Arunachal Pradesh including its record from Assam and Meghalaya. *O. assmuthi*, a very widespread species in the Indian plains including Pakistan and Bangladesh, is also quite common in this mountain system. *O. bellahunisensis* a plain land species, is well established in the Western Himalaya. *O. bhagwatii* extends its distribution from foothills of Doon Valley to a considerable elevation of the Western Himalaya. *O. brunneus* a fairly common species in the plains also occurs in the Western Himalaya. *O. feae* is one of the largest and widespread species both in the plains as well as on the mountain tracts, probably with dense concentration in the Eastern Himalaya. *O. giriensis* extends from the Eastern to the Western Himalaya. *O. globicola*, a species, earlier known as *O. dehraduni*, is predominantly found in the Kashmir Hills in addition to its wide occurrence in the Indian plains. *O. guptai* and *O. gurdaspurensis* mainly occur in the entire foothills of Nepal westwards. *O. horai* is predominantly found only in the Western Himalaya upto the western fringe and is not so uncommon in the plains also. *O. horni*, a very closely allied species of *O. feae*, dominates in the peninsular India, but also remains relatively common in the northern plains. *O. kapuri* occurs in the north-east India with its sparse record in Bhutan. *O. microdentatus*, a distinctive species with its minute size of mandibular tooth, is distributed from Nepal westwards upto Kashmir Hilly tracts including the plainlands of the northern India. *Odontotermes obesus* is by far the most widely distributed common mound building species in the Indian subregion including the entire range of the Himalaya upto the altitude of 2600-3400 m in the Bhutan Himalaya. A very large species, *O. parvidens* occurs abundantly in the Western and Eastern Himalaya, including the plains of Indian subcontinent. *O. proformosanus*, a predominant species in the territories of the Orient extends westwards upto Arunachal Pradesh including Bangladesh. However, *O. prolatigula* from

Arunachal Pradesh and *O. sikkimensis* from Sikkim are only two endemic species of the genus known from the Eastern Himalaya. The species, *O. redemanni* is by far the most common mound building species like *O. obesus* occurs in the Indian subcontinent including the Himalayan belt but excluding the Kashmir area. It occurs upto the altitudes of 3000 m at Naryangarh, Nepal.

Subfamily NASUTITERMITINAE

The dominance of nasute-form genus *Nasutitermes* is well documented in the Eastern Himalayan belt with the record of 12 species, with exception of *N. dunensis*, *N. gardneri* and *N. thanensis* found in the Doon Valley in the Western Himalaya. However, the Eastern Himalaya is very rich in containing endemic species of the genus. *N. cherraensis* is sparsely known from Arunachal Pradesh, where *N. chhotani* is known as an endemic one. *N. dunensis* is endemic to Dehra Dun and *N. emersoni* is another endemic to the Eastern Himalaya. *N. gardneri* spreads from Darjiling to Arunachal Pradesh including Bhutan. *N. garoensis* and *N. jalpaigurensis* are two sympatric species in the north-east India including the Himalayan belt. Another very unfamiliar species *N. kali*, so far known from eastern India is now recorded from the Eastern Himalaya. One of the most common species in the Orient is *N. matangensisiformis* which extends westwards upto Arunachal Pradesh including Andaman Island. *N. moratus* and *N. tandoni* are endemic to Arunachal Pradesh, *N. suknensis* to Darjiling Hills and *N. thanensis* to Dehra Dun. *Ahmaditermes*, a purely oriental genus and very closely allied to *Bulbitermes*, is represented so far by two species from the Indian subregion, of which only single species *A. emersoni* is known from Bhutan Himalaya including Assam plains. However, a new species *A. sikkimensis* has been discovered herewith. Another nasuteform genus *Trinervitermes* is represented by six species from the Indian subregion, of which only single species *T. biformis* is distributed in the Western Himalaya.

6.1.3 Vertical distribution

In the Eastern Himalaya, three species, namely *Coptotermes heimi*, *Odontotermes obesus* and *Nasutitermes garoensis* are known to occur at the highest altitude between 2600 m and 3400 m on Kathoka-Gagona route in the Bhutan Himalaya. *Reticulitermes assamensis* and *Odonotermes kapuri* are the other two species have been recorded at the next higher elevation between 1600 and 2600 m on Sampa-Kathoka route in the same mountain range. The number of species at the lower altitude at Samchi (300 m) is quite rich to a total of 12 species under 9 genera. *Odontotermes obesus* and *Nasutitermes garoensis* are so far known from the foothills of Samchi to the higher elevation of 2600-3400 m on Kathoka-Gagona route in region (Table-C).

However, the occurrence of *Reticulitermes assamensis* at higher altitudes at Sampa-Kothoka route in the Bhutan Himalaya (1600-2600 m) with temperate climate is no surprise, since the members of this genus are habitually adapted to the warm temperate climate which is quite uncommon to termites generally preferring hot and humid climate.

In the Darjiling Himalaya, *Nasutitermes gardneri* is the only species so far recorded from the higher elevation of about 1846 m at Rangirum. On the Kalimpong Hill ranges, Nazeok situated at 1363 m supports nine species under six genera, while Kalimpong at 1209 m supports eight species under six genera. The number of species increases steadily towards lower altitude of 300 m at Teesta Bazar, where there are 11 species under six genera are on record. Only two species, namely, *Odontotermes parvidens* and *Nasutitermes jalpaigurensis* occur throughout the range of lower to higher elevation of the Darjiling Mountain ranges. *Neotermes kalimpongensis* is the only kalotermitid species occurring at higher elevation of 1209 m at Bong Basti, Kalimpong (Table-C). The allied genus *Glyptotermes* represented by *G. ukhiaensis* and *G. teknaensis* mostly occur at lower elevation in the Teesta valley.

In the Central Himalaya or Nepal Himalaya, the altitudinal distribution pattern of termite species is not at all clear, since no thorough survey has yet been undertaken in the area. Only 13 species have so far been recorded mostly from the foothills of the Himalaya.

In the Western Himalaya or Kumaon Hills, termite species richness gradually decreases with the increasing altitude. Only two species, *Heterotermes indicola* and *Odontotermes parvidens* have so far been recorded from Ranikhet (Chaubatia) situated at an altitude of 2500 m, while three other species, namely, *Archotermopsis wroughtoni*, *Stylotermes bengalensis* and *Heterotermes indicola*, are on record from the township of Ranikhet (1860 m) situated slightly at lower elevation. With these three species, *Angulitermes akhorisainensis* is further addition to existing species of Bhowali (1650 m) situated at lower altitude. Almora (1350 m) situated further down contains atleast five species, of which two species *Glyptotermes almorensis* and *Odontotermes obesus* are addition to the existing species at Ranikhet, but lacking *Stylotermes bengalensis*. The number of species increases at Askot (1250 m) to a total of 12 species, wherein *Nasutitermes dunensis*, *N. gardneri* and *N. thanensis* are the representatives of nasute termites in the Kumaon Hills. By far the largest number of species to a total of 14 species under nine genera are found in Bageshwar (820 m) situated almost at the foothills of the Kumaon Hills. *Heterotermes indicola* is the only species occurring throughout the entire altitudinal ranges of the Kumaon Himalaya. Quite a number of species of *Odontotermes* mostly occur below 1250 m altitude, above which only two species, *Odontotermes obesus* and *Odontotermes parvidens* have been recorded so far.

In the North-Western Himalaya or Kashmir Himalaya, the occurrence of only single species, *Archotermopsis wroughtoni* is known at highest elevation of 1823 m at Achhabal. However, at lower altitude there are six species on record at

Sarda and Gangara (1063 m-1215 m), all of which are soil inhabiting forms (Table-C).

By far the largest number of species concentration at a single locality namely, Udhampur (634 m), situated almost in the plains, could be recorded to a total of 11 species under six genera, where kalotermitid species are absent and only rhinotermitid species *Heterotermes indicola* is present. Three species, namely, *Odontotermes parvidens*, *Microtermes obesi* and *Microtermes unicolor*, are generally found in all the altitudinal gradients upto 1215 m in the Kashmir range.

From the above data, it is quite clear that *Coptotermes heimi*, *Odontotermes obesus* and *Nasutitermes garoensis* occur in the highest altitudes (2600 m-3400 m) of the Bhutan Himalaya. In the Kumaon Hills, *Odontotermes parvidens* is found on higher elevation at Chaubatia (2250 m). *Archotermopsis wroughtoni*, a sole representative of the family Termopsidae, occurs at the highest altitude of Achhabal (1823 m) or in the Kashmir Himalaya.

6.1.4 Faunal composition in biotic provinces :

The study of the faunal composition of the Himalaya indicates the highest concentration of species to a total of 68 species occur in the Eastern Himalaya. The next rich area in species concentration is the Western Himalaya to a total of 49, while only 15 species occurring in the North-Western Himalaya. Minimum number of species to a total of 13 is so far recorded from the Nepal Himalaya (Tables D & E).

However, out of so many species, only soldierless and soil inhabiting species *Speculitermes cyclops* spreads all over the entire range of the Himalaya. The other wide spread species are *Odontotermes horni*, *O. redemanni* and *Microtermes obesi* which occur in the entire range except in the North-Western province.

However, there are 10 species which are in common occurrence in both the North-Western and

Western provinces. These species are *Archotermopsis wroughtoni*, *Heterotermes indicola*, *H. gertrudae*, *Odontotermes globicola*, *O. guptai*, *O. giriensis*, *O. gurdaspurensis*, *O. microdentatus*, *O. obesus* and *Microtermes obesi*.

The Western and Central provinces support three species, namely, *Odontotermes assmuthi*, *O. boveni* and *O. microdentatus* in common.

The Central and Eastern provinces have only single species, *Trinervitermes biformis* in common. Interestingly enough, the Western and Eastern Himalaya situated so widely apart, have three species, namely *Neotermes bosei*, *Stylotermes bengalensis* and *Nasutitermes thanensis* which are disjunct in distribution.

6.2 Faunal Affinities :

Whatever may be the magnitude of the Himalayan termite concentration, it always becomes a point of interest to trace the distribution pattern and affinities of such fauna with that of three pronounced subregions (i.e., Indian, Indo-Chinese and Indo-Malayan subregions) of the Orient as well as with different physiographic units (i.e., Gangetic, Peninsular and Insular units) of the Indian subregion.

The analysis of the distribution pattern of 107 species occurring in the Himalaya shows that all the species are oriental in distribution. Not a single exotic species could be found among the Himalayan elements. The existing species could be grouped in several categories based on their status of restricted and overlapping distribution. To name those groupings, first comes the category of 38 endemic species which occur nowhere else (Tables-F, G, H).

Out of remaining 69 species, only three species, namely, *Macrotermes gilvus*, *Hypotermes xenotermitis* and *Nasutitermes matangensisiformis* occur in all the subregions of the Orient including the Himalaya. These species are more common in the Indo-Malayan than the other two subregions.

Excluding these three species, there remains 66 species of which 50 occur in the Indian subregion, 13 in the Indo-Chinese and 6 in the Indo-Malayan subregion. This clearly indicates that the Himalayan species show strong affinities to the Indian fauna with gradual decreasing affinities to the Indo-Chinese and Indo-Malayan fauna respectively.

The Indian subregion can conveniently be divided into four broad physiographic units, namely, the Himalayan (extra-peninsular), the Indo-Gangetic Plains (including Pakistan, Assam plains and adjoining Hilly tracts and Bangladesh), Peninsular (Southern India, below 20°N latitude) and Insular (the Andaman and Nicobar Islands).

As already mentioned, out of 107 species, 50 species occur in the Himalayan mountain system excluding its own endemics (38 species) which also share their distribution with different physiographic units within India. A total of 34 species share with Indo-Gangetic unit, 14 species with Peninsular and 2 with Insular unit (Table-D).

The faunal affinities, studied within the Himalaya in its four distinct biotic provinces (North-Western, Western, Central and Eastern Himalaya) clearly indicates the gradual increase in faunal richness from the North-Western towards the Eastern Himalaya with regard to total fauna as well as the endemic ones. There are 15 species so far recorded from the North-Western, 49 in the Western, 13 in the central and as many as 68 species in the Eastern Himalaya (Table-D). Of course, there are some species which are common to all the provinces. Likewise, the endemic species are on record with increasing sequence from the Western to Eastern Himalayan tracts. Four species are found in the North-Western, 11 in the Western, one in the central and 19 species in the Eastern Himalaya which are all endemics to the specific region (Table-F).

The representation of poor-fauna in the Central Himalaya is due to incomplete survey undertaken in Nepal, keeping wide scope for further study.

6.3 Critical Faunal Analysis

The detailed analysis of the termite fauna of the Himalaya, especially its numerical strength, taxonomic composition, distribution pattern and affinities within and outside of India, etc. leads to arrive at certain persimonus hypothesis about the geographical origin, dispersal and evolution of termites in the area. Although such deduction and conclusions remain purely tentative at the moment unless further detailed study is undertaken in the area concerned.

There is no doubt that the termite fauna of the Himalaya is the product of some disharmonic assemblage of termite species being accumulated from the different subregions of the oriental region including India, as well as its own endemics (38 species, 35 per cent of the Himalayan fauna). The Himalayan species are all predominantly, oriental elements, except *Archotermopsis wroughtoni* has its extended distribution upto the Afghanistan situated in the fringe of the Palaearctic Region.

Since the tectonic break up of the Gondwana land and subsequent drift and collision of peninsular plate at Assam resulted into the continuous upliftment of the Himalaya, the fauna, flora start transgressing in this mountain system both from the Orient and the Palaearctic Region (Mani, 1974).

However, the Himalayan termite fauna is predominantly Indian in origin (50 species) with more similarity with the Indo-Chinese (13 species) than the Indo-Malayan (6 species) termities.

This is due to the fact that the Indo-Chinese and Indo-Malayan faunal derivatives largely accumulated in the Assam-Burma area which start radiating westwards to the Himalaya indicating the rich faunal share with the Himalaya especially in the Eastern Himalaya (Mani, 1974). The Indo-Gangetic termite fauna also contribute to enrich the Himalayan faunal composition to a large extent with the record of 34 species in common. The continued ecological succession between these two

adjacent physiographic units has resulted into sharing so much similarity. On the other hand, the peninsular elements which are considered as most primitive and relicts, are less represented in the Himalaya with the record of only 14 species. There is relative poverty of relict species in the Himalaya which is generally characterized with the youngest, high plastic and ecologically specialized fauna in general. This stands valid for termite fauna also. Only one relict, *Archotermopsis wroughtoni* and some primitive species of *Bifiditermes* and *Styloterme*s are so far known from the Himalaya, while the large majority of species belong to the advanced general like *Nasutitermes* and others.

The estimation made for each of the biotic provinces within the Himalaya indicates the richest fauna in the Eastern Himalaya (68 species) with decreasing sequence of 49 species in the Western, followed by the North Western Himalaya with 15 species and Central Himalaya with 13 species. This estimation is not a very convincing one, since the species richness related to area is a complicated one and the boundary of each province is often arbitrary. As such, extreme caution must be taken

in comparing faunal diversity of the provinces that differ greatly in size.

It would be a pretentious claim to argue in favour of this "Faunal Account of the Himalayan Termites" as a complete one devoid of any lacunae. No doubt, this is an ideal aid and first of its kind to the study of the termite fauna of the entire Himalaya. This is a huge task to compile the collections from the vast, varied and inaccessible ridges and valleys of the Himalaya and to complete in many years to come. The Himalayan termites certainly await discovery of many more species. The detailed surveys remain to be done resulting into extension or shrinkage of ranges of variations and distribution of numerous species which are sparsely known so far. The numerical strength of both endemic and non-endemic species may also alter if thorough study and collection are made in future.

Some of the general conclusion made on faunal numerical strength and affinities in different subregions, etc. may stand valid in the broad perspective, but further study will certainly substantiate these propositions.

Table B : Percent of the Himalayan species under different genera of termites compared to that of the Indian subregion.

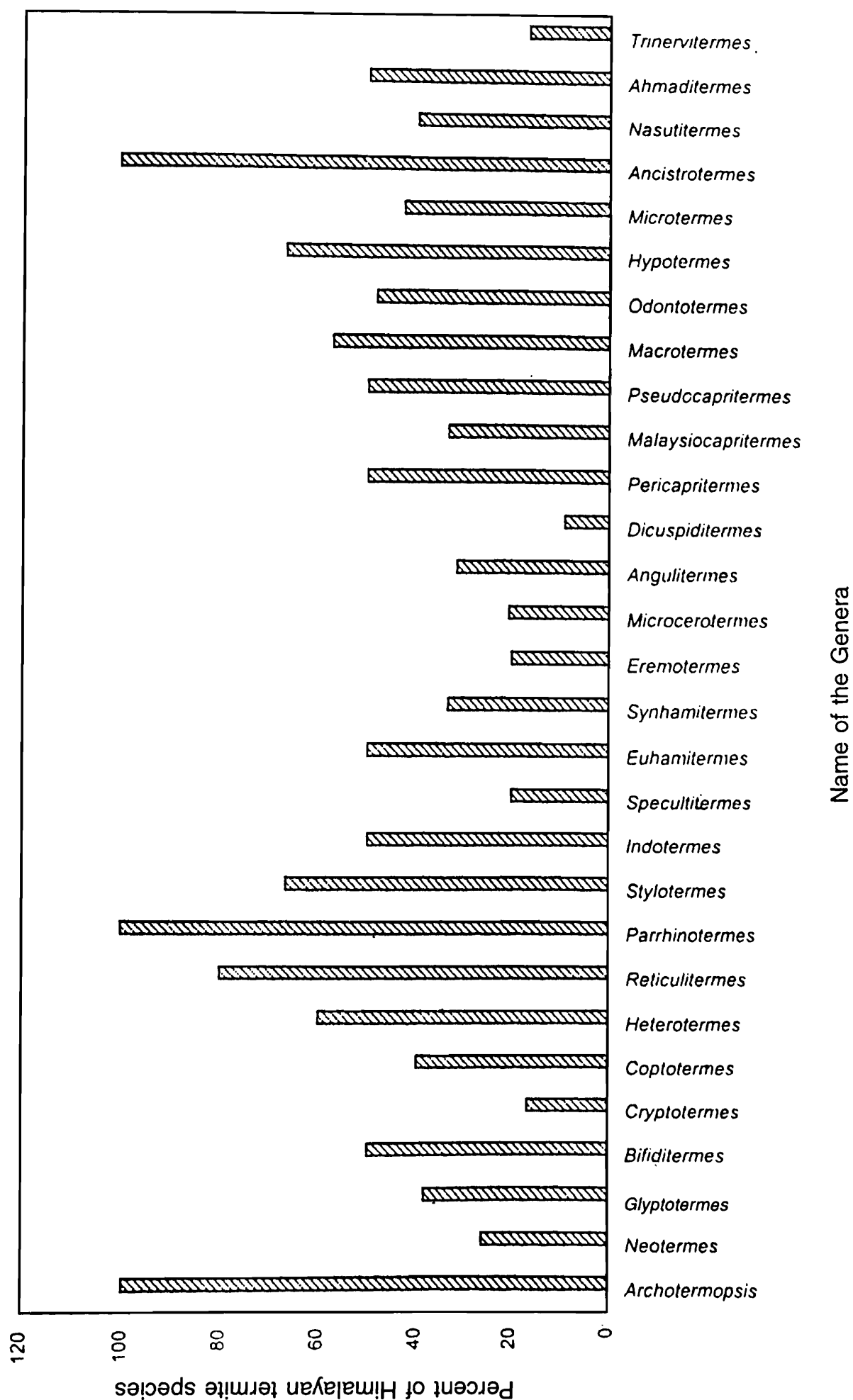


Table C : List of species in some localities of varied altitudes.

Name of Locality	Number of Species	Height
Samchi	<i>Neotermes bosei</i> , <i>Coptotermes heimi</i> , <i>Indotermes rongrensis</i> , <i>Euhamitermes wittmeri</i> , <i>Pericapritermes dunensis</i> , <i>P. durga</i> , <i>Odontotermes feae</i> , <i>O. obesus</i> , <i>O. parvidens</i> , <i>Hypotermes xenotermitis</i> , <i>Microtermes obesi</i> , <i>Nasutitermes garoensis</i> .	300 m
Nazeok	<i>Odontotermes parvidens</i> , <i>O. horni</i> , <i>O. guptai</i> , <i>O. boveni</i> , <i>Hypotermes obscuriceps</i> , <i>Microtermes obesi</i> , <i>Prorhinotermes flavus</i> , <i>Pericapritermes dunensis</i> , <i>Nasutitermes jalpaigurensis</i> .	1363 m
Kalimpong	<i>Neotermes kalimpongensis</i> , <i>Reticulitermes assamensis</i> , <i>Parrhinotermes khasii</i> , <i>Odontotermes boveni</i> , <i>O. parvidens</i> , <i>Microtermes obesi</i> , <i>Nasutitermes jalpaigurensis</i> , <i>N. thanensis</i> .	1209 m
Teesta Bazar	<i>Glyptotermes caudomunitus</i> , <i>G. chinpingensis</i> , <i>Pericapritermes ceylonicus</i> , <i>P. dunensis</i> , <i>P. tetraphilus</i> , <i>Macrotermes estherae</i> , <i>M. khajurii</i> , <i>Odontotermes parvidens</i> , <i>O. redemanni</i> , <i>Nasutitermes jalpaigurensis</i> , <i>Bulbitermes emersoni</i> .	300 m
Askot	<i>Neotermes megaoculatus</i> , <i>Glyptotermes almorensis</i> , <i>Stylotermes bengalensis</i> , <i>Heterotermes indicola</i> , <i>Speculitermes cyclops</i> , <i>Odontotermes giriensis</i> , <i>O. microdentatus</i> , <i>O. parvidens</i> , <i>O. obesus</i> , <i>Nasutitermes guptai</i> , <i>Microtermes obesi</i> , <i>Coptotermes heimi</i> .	1250 m
Dehra Dun	<i>Archotermopsis wroughtoni</i> , <i>Neotermes bosei</i> , <i>N. megaoculatus</i> , <i>N. microculatus</i> , <i>Coptotermes heimi</i> , <i>Heterotermes gertrudae</i> , <i>H. indicola</i> , <i>Stylotermes bengalensis</i> , <i>S. chakratensis</i> , <i>S. dunensis</i> , <i>Indotermes capillosus</i> , <i>Speculitermes triangularis</i> , <i>Euhamitermes lighti</i> , <i>Eremotermes dehraduni</i> , <i>Microcerotermes beelsoni</i> , <i>Angulitermes dehraensis</i> , <i>Pericapritermes dunensis</i> , <i>Odontotermes bhagwatii</i> , <i>O. feae</i> , <i>O. giriensis</i> , <i>O. globicola</i> , <i>O. guptai</i> , <i>O. horni</i> , <i>O. microdentatus</i> , <i>O. parvidens</i> , <i>O. redemanni</i> , <i>Microtermes obesi</i> , <i>M. unicolor</i> , <i>Nasutitermes dunensis</i> , <i>N. gardneri</i> and <i>N. thanensis</i> .	682 m
Udhampur	<i>Archotermopsis wroughtoni</i> , <i>Coptotermes heimi</i> , <i>Heterotermes indicola</i> , <i>Speculitermes cyclops</i> , <i>Odontotermes assmuthi</i> , <i>O. gurdaspurensis</i> , <i>O. lokanandi</i> , <i>O. obesus</i> , <i>O. parvidens</i> , <i>Microtermes obesi</i> , <i>M. unicolor</i> .	634 m
Sarda and Gangara	<i>Odontotermes assmuthi</i> , <i>O. gurdaspurensis</i> , <i>O. obesus</i> , <i>O. parvidens</i> , <i>Microtermes obesi</i> , <i>M. unicolor</i> .	1063-1215 m

Table D : Distribution of the Himalayan termite species in the different physiographic units.

ZOOGEOGRAPHICAL REGIONS		ORIENTAL									PALAEARCTIC	
ORIENTAL SUB-REGIONS		INDIAN SUB-REGION							Indo-Malayan Sub-Region	Indo-Chinese Sub-Region		
PHYSIOGRAPHIC UNITS IN INDIA		HIMALAYAN BIOTIC PROVINCES				Indo-gangetic unit (including Bangladesh)	North-Eastern unit*	Penin-sular unit (South India & Sri Lanka)	Insular Unit (Anda-man and Nicobar Islands)			
BIOTIC PROVINCES		North-Western	Western	Central	Eastern							
		1	2	3	4	5	6	7	8	9	10	11
1.	<i>Archotermopsis wroughtoni</i>	+	+									
2.	<i>Neotermes bosei</i>		+		+							
3.	<i>Neotermes buxensis</i>				+							
4.	<i>Neotermes kalimpongensis</i>				+							
5.	<i>Neotermes megaoculatus</i>		+									
6.	<i>Neotermes microculatus</i>		+									
7.	<i>Glyptotermes almorensis</i>		+									
8.	<i>Glyptotermes taruni</i>				+							
9.	<i>Glyptotermes teknaensis</i>				+	+						
10.	<i>Glyptotermes tikaderi</i>				+							
11.	<i>Glyptotermes ukhiaensis</i>				+	+						
12.	<i>Bifiditermes beelsoni</i>		+			+						
13.	<i>Cryptotermes bengalensis</i>		+			+	+	+	+			
14.	<i>Coptotermes gestroi</i>				+						+	
15.	<i>Coptotermes heimi</i>		+	+	+	+		+				

Table D : (Contd.).

ZOOGEOGRAPHICAL REGIONS		ORIENTAL									PALAEARCTIC	
ORIENTAL SUB-REGIONS		INDIAN SUB-REGION							Indo-Malayan Sub-Region	Indo-Chinese Sub-Region		
PHYSIOGRAPHIC UNITS IN INDIA		HIMALAYAN BIOTIC PROVINCES				Indo-gangetic unit (including Bangladesh)	North-Eastern unit*	Penin-sular unit (South India & Sri Lanka)	Insular Unit (Anda-man and Nicobar Islands)			
BIOTIC PROVINCES		North-Western	Western	Central	Eastern							
		1	2	3	4	5	6	7	8	9	10	11
16.	<i>Coptoterems travians</i>				+	+	+	+	+	+		
17.	<i>Heterotermes balwanti</i>		+					+				
18.	<i>Heterotermes gertrudae</i>	+	+									
19.	<i>Heterotermes indicola</i>	+	+	+		+		+				+
20.	<i>Reticulitermes assamensis</i>				+		+				+	
21.	<i>Reticulitermes chinensis</i>				+						+	
22.	<i>Reticulitermes ganga</i>				+							
23.	<i>Reticulitermes tirapi</i>				+							
24.	<i>Parrhinotermes khasii</i>				+		+					
25.	<i>Parrhinotermes shamimi</i>				+							
26.	<i>Stylotermes bengalensis</i>		+		+							
27.	<i>Stylotermes chakratensis</i>		+									
28.	<i>Stylotermes dunensis</i>		+									
29.	<i>Stylotermes faveolus</i>	+										
30.	<i>Stylotermes parabengalensis</i>				+							

Table D : (Contd.).

ZOOGEOGRAPHICAL REGIONS		ORIENTAL									PALAEARCTIC
ORIENTAL SUB-REGIONS		INDIAN SUB-REGION							Indo-Malayan Sub-Region	Indo-Chinese Sub-Region	
PHYSIOGRAPHIC UNITS IN INDIA		HIMALAYAN BIOTIC PROVINCES				Indo-gangetic unit (including Bangladesh)	North-Eastern unit*	Peninsular unit (South India & Sri Lanka)	Insular Unit (Andaman and Nicobar Islands)		
BIOTIC PROVINCES		North-Western	Western	Central	Eastern						
		1	2	3	4	5	6	7	8	9	10
31.	<i>Indotermes capillosus</i>		+								
32.	<i>Indotermes rongrensis</i>				+	+	+				+
33.	<i>Speculitermes cyclops</i>	+	+	+	+	+		+			
34.	<i>Speculitermes triangularis</i>		+								
35.	<i>Euhamitermes aruna</i>				+						
36.	<i>Euhamitermes kanhaensis</i>				+	+		+			
37.	<i>Euhamitermes lighti</i>		+								
38.	<i>Euhamitermes urbanii</i>				+						
39.	<i>Euhamitermes wittmeri</i>				+						
40.	<i>Synhamitermes quadriceps</i>		+			+	+	+			
41.	<i>Eremotermes dehraduni</i>		+								
42.	<i>Microcerotermes beelsoni</i>		+		+	+		+			
43.	<i>Microcerotermes cameroni</i>				+	+		+			
44.	<i>Microcerotermes fletcheri</i>		+					+			
45.	<i>Microcerotermes labioangulatus</i>		+				+				

Table D : (Contd.).

ZOOGEOGRAPHICAL REGIONS		ORIENTAL									PALAEARCTIC	
ORIENTAL SUB-REGIONS		INDIAN SUB-REGION							Indo-Malayan Sub-Region	Indo-Chinese Sub-Region		
PHYSIOGRAPHIC UNITS IN INDIA		HIMALAYAN BIOTIC PROVINCES				Indo-gange-tic unit (includ-ing Bangla-desh)	North-Eastern unit*	Penin-sular unit (South India & Sri Lanka)	Insular Unit (Anda-man and Nicobar Islands)			
BIOTIC PROVINCES		North-Western	Western	Central	Eastern							
		1	2	3	4	5	6	7	8	9	10	11
46.	<i>Microcerotermes rambanensis</i>	+										
47.	<i>Angulitermes acutus</i>		+					+				
48.	<i>Angulitermes akhorisainensis</i>		+									
49.	<i>Angulitermes dehraensis</i>		+	+		+						+
50.	<i>Angulitermes kashmirensis</i>	+										
51*.	<i>Angulitermes nepalensis</i> sp. nov.			+								
52.	<i>Angulitermes tilaki</i>	+										
53.	<i>Dicuspiditermes laetus</i>				+	+	+				+	
54.	<i>Pericapritermes assamensis</i>				+		+					
55.	<i>Pericapritermes dunensis</i>		+		+		+					
56.	<i>Pericapritermes durga</i>				+		+					
57.	<i>Pericapritermes tetraphilus</i>				+	+		+			+	
58.	<i>Malaysiocapritermes holmgreni</i>				+	+	+					
59.	<i>Pseudocapritermes bhutanensis</i>				+							
60.	<i>Psedocapritermes tikadari</i>				+							

Table D : (Contd.).

ZOOGEOGRAPHICAL REGIONS		ORIENTAL									PALAEARCTIC	
ORIENTAL SUB-REGIONS		INDIAN SUB-REGION							Indo-Malayan Sub-Region	Indo-Chinese Sub-Region		
PHYSIOGRAPHIC UNITS IN INDIA		HIMALAYAN BIOTIC PROVINCES				Indo-gangetic unit (including Bangladesh)	North-Eastern unit*	Penin-sular unit (South India & Sri Lanka)	Insular Unit (Anda-man and Nicobar Islands)			
BIOTIC PROVINCES		North-Western	Western	Central	Eastern							
		1	2	3	4	5	6	7	8	9	10	11
61.	<i>Macrotermes aleemi</i>				+	+						
62.	<i>Macrotermes convulsionarius</i>				+			+				
63.	<i>Macrotermes gilvus</i>				+					+	+	
64.	<i>Macrotermes khajuriae</i>				+		+					
65.	<i>Odontotermes adampurensis</i>				+	+	+					
66.	<i>Odontotermes assmuthi</i>		+	+		+		+				
67.	<i>Odontotermes bellahunisensis</i>		+			+		+				
68.	<i>Odontotermes bhagwatii</i>		+			+		+				
69.	<i>Odontotermes boveni</i>		+	+								
70.	<i>Odontotermes brunneus</i>		+					+				
71.	<i>Odontotermes feae</i>		+		+	+	+	+			+	
72.	<i>Odontotermes giriensis</i>	+	+		+	+	+					
73.	<i>Odontotermes globicola</i>	+	+			+		+				
74.	<i>Odontotermes guptai</i>	+	+			+		+				
75.	<i>Odontotermes gurdaspurensis</i>	+	+			+		+				
76.	<i>Odontotermes horai</i>		+	+		+	+	+				

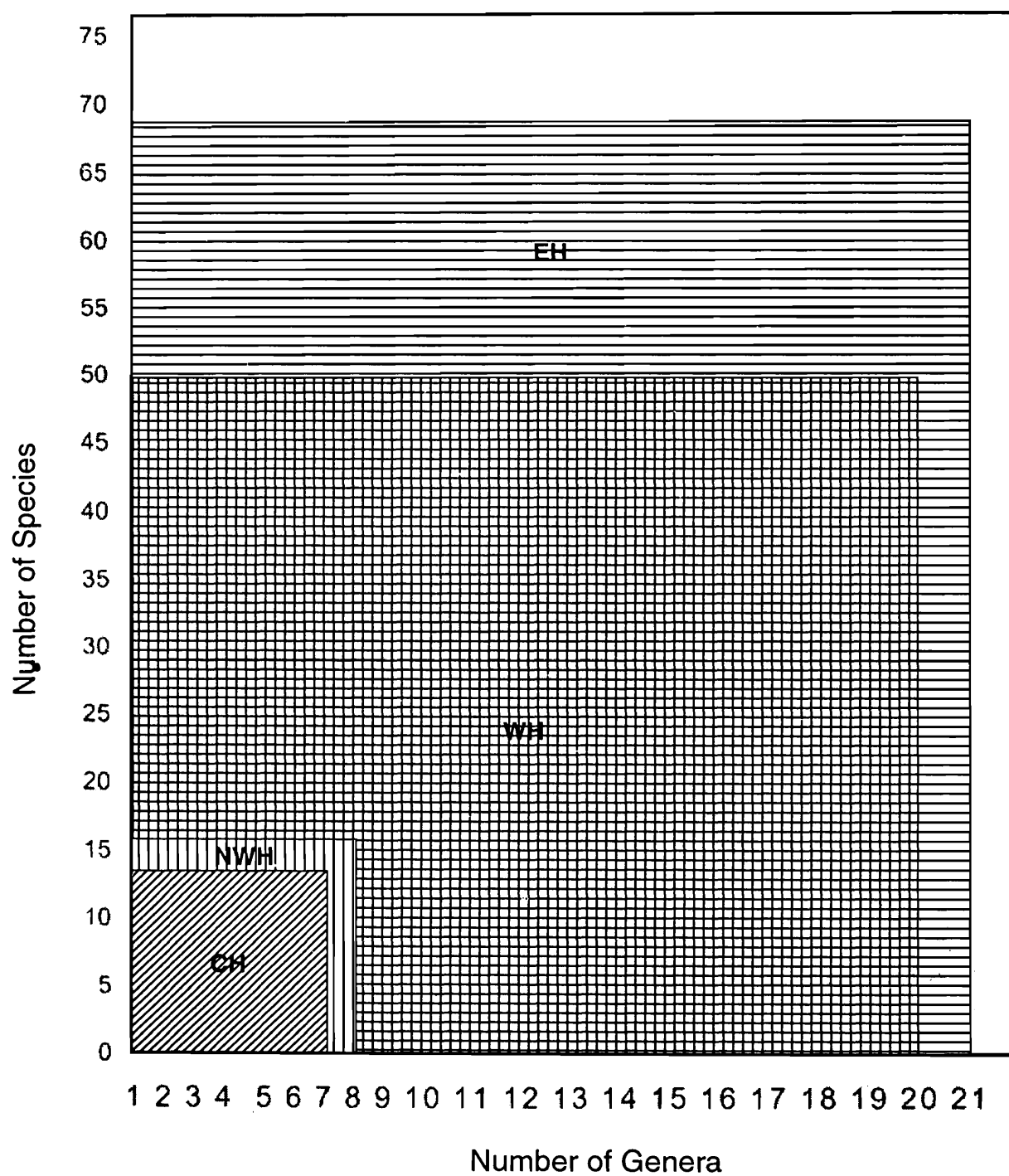
Table D : (Contd.).

ZOOGEOGRAPHICAL REGIONS		ORIENTAL									PALAEARCTIC	
ORIENTAL SUB-REGIONS		INDIAN SUB-REGION							Indo-Malayan Sub-Region	Indo-Chinese Sub-Region		
PHYSIOGRAPHIC UNITS IN INDIA		HIMALAYAN BIOTIC PROVINCES				Indo-gange-tic unit (includ-ing Bangla-desh)	North-Eastern unit*	Penin-sular unit (South India & Sri Lanka)	Insular Unit (Anda-man and Nicobar Islands)			
BIOTIC PROVINCES		North-Western	Western	Central	Eastern							
		1	2	3	4	5	6	7	8	9	10	11
77.	<i>Odontotermes horni</i>		+	+	+			+			+	
78.	<i>Odontotermes kapuri</i>				+		+					
79.	<i>Odontotermes microdentatus</i>	+	+	+		+						
80.	<i>Odontotermes obesus</i>	+	+		+	+		+				
81.	<i>Odontotermes parvidens</i>		+		+	+						
82.	<i>Odontotermes proformosanus</i>				+	+				+		
83.	<i>Odontotermes prolatigula</i>				+							
84.	<i>Odontotermes redemanni</i>		+	+	+	+		+				
85.	<i>Odontotermes sikkimensis</i>				+							
86.	<i>Hypotermes obscuriceps</i>				+	+		+			+	
87.	<i>Hypotermes xenotermitis</i>				+	+				+	+	
88.	<i>Microtermes imphalensis</i>				+		+					
89.	<i>Microtermes obesi</i>		+	+	+	+		+		+	+	
90.	<i>Microtermes unicolor</i>	+	+			+						
91.	<i>Ancistrotermes pakistanicus</i>				+	+	+					
92.	<i>Nasutitermes cherraensis</i>				+							

Table D : (Contd.).

ZOOGEOGRAPHICAL REGIONS		ORIENTAL									PALAEARCTIC	
ORIENTAL SUB-REGIONS		INDIAN SUB-REGION							Indo-Malayan Sub-Region	Indo-Chinese Sub-Region		
PHYSIOGRAPHIC UNITS IN INDIA		HIMALAYAN BIOTIC PROVINCES				Indo-gange-tic unit (inclu-ding Bangla-desh)	North-Eastern unit*	Penin-sular unit (South India & Sri Lanka)	Insular Unit (Anda-man and Nicobar Islands)			
BIOTIC PROVINCES		North-Western	Western	Central	Eastern							
		1	2	3	4	5	6	7	8	9	10	11
93.	<i>Nasutitermes chhotani</i>				+							
94.	<i>Nasutitermes dunensis</i>		+									
95.	<i>Nasutitermes emersoni</i>				+	+	+					
96.	<i>Nasutitermes gardneri</i>		+		+							
97.	<i>Nasutitermes garoensis</i>				+							
98.	<i>Nasutitermes jalpaigurensis</i>				+							
99.	<i>Nasutitermes kali</i>				+							
100.	<i>Nasutitermes matangensiformis</i>				+	+				+	+	
101.	<i>Nasutitermes moratus</i>				+							
102.	<i>Nasutitermes suknensis</i>				+							
103.	<i>Nasutitermes tandoni</i>				+							
104.	<i>Nasutitermes thanensis</i>		+		+							
105.	<i>Ahmaditermes emersoni</i>				+							
106*.	<i>Ahmaditermes sikkimensis</i> sp. nov.				+							
107.	<i>Trinervitermes biformis</i>		+	+		+		+				

*Assam Valley, Khasi-Jaintia Hills and Purbanchal

Table E : Generic/Species Richness of Termites in the Himalayan Biotic Provinces.

EH – Eastern Himalaya

WH – Western Himalaya

NWH – North-Western Himalaya

CH – Central Himalaya

Table F : Endemic species of Termites in the Himalayan Biotic Provinces.

Name of the species endemic only to NW Himalaya (4 spp.)	Name of the species endemic only to W Himalaya (11 spp.)	Name of the species endemic only to C Himalaya (1 spp.)	Name of the species endemic only to E Himalaya (19 spp.)
<i>Styloterme faveolus</i>	<i>Neotermes megaoculatus</i>	<i>Angulitermes nepalensis</i> sp. nov.	<i>Neotermes buxensis</i>
<i>Microcerotermes rambanensis</i>	<i>N. microculatus</i>		<i>N. kalimpongensis</i>
<i>Angulitermes kashmirensis</i>	<i>Glyptotermes almorensis</i>		<i>Glyptotermes taruni</i>
<i>A. tilaki</i>	<i>Styloterme chakratensis</i>		<i>G. tikaderi</i>
	<i>S. dunensis</i>		<i>Reticulitermes ganga</i>
	<i>Indotermes capillosus</i>		<i>R. tirapi</i>
	<i>Speculitermes triangularis</i>		<i>Parrhinotermes shamimi</i>
	<i>Euhamitermes lighti</i>		<i>Euhamitermes aruna</i>
	<i>Eremotermes dehraduni</i>		<i>E. urbanii</i>
	<i>Angulitermes akhorisainensis</i>		<i>E. wittmeri</i>
	<i>Nasutitermes dunensis</i>		<i>Pseudocapritermes bhutanensis</i>
			<i>Odontotermes prolatigula</i>
			<i>O. sikkimensis</i>
			<i>Nasutitermes chhotani</i>
			<i>N. moratus</i>
			<i>N. suknensis</i>
			<i>N. tandoni</i>
			<i>Ahmaditermes emersoni</i>
			<i>A. sikkimensis</i> sp. nov.

Note : Three species namely, *Heterotermes gertrudae*, *Syloterme bengalensis* and *Nasutitermes thanensis* occur in more than one provinces.

Table G : Percent of the Himalayan endemic species under different genera compared to that of the Indian subregion.

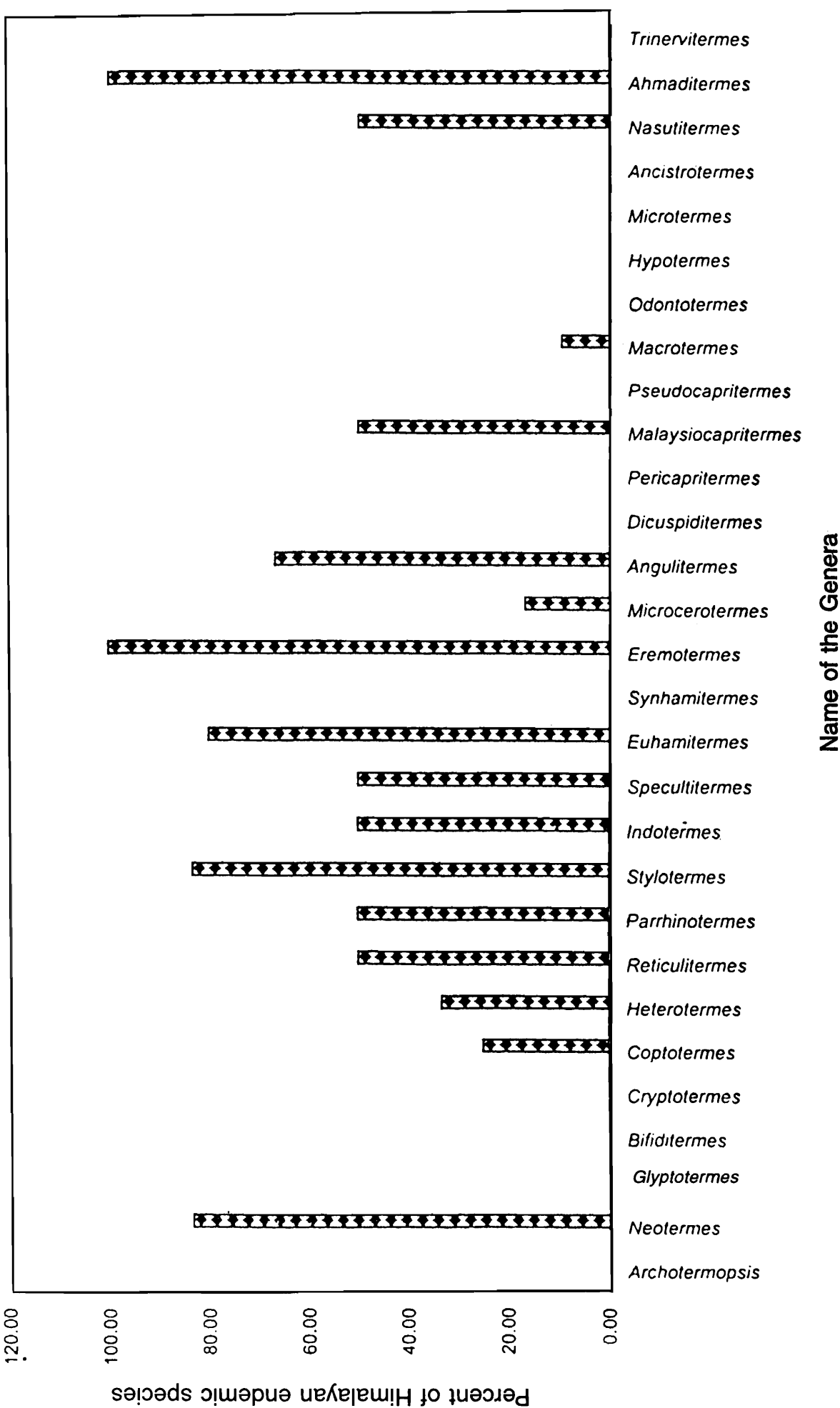
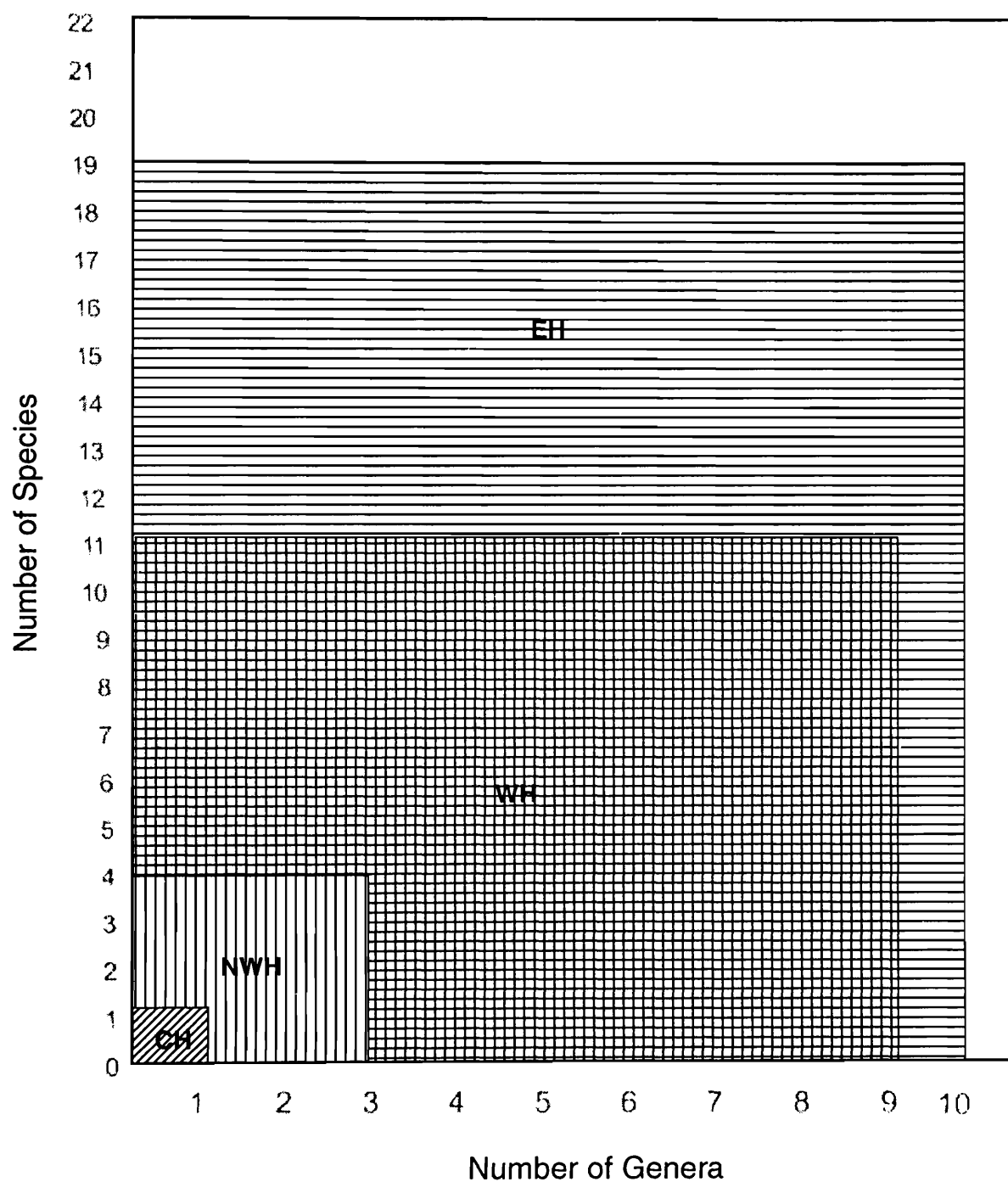


Table H: Generic/Species Richness of Termites (Endemic species) in the Himalayan Biotic Provinces.



EH – Eastern Himalaya

WH – Western Himalaya

NWH – North-Western Himalaya

CH – Central Himalaya

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