Termite (Insecta : Isoptera) Fauna

of Gujrat and Rajasthan

Present State of Knowledge

Narendra S. Rathore
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INTRODUCTION

Termites belonging to the order Isoptera (Gk. "Iso" - same / equal; Gk. "Ptera" - wing), commonly known as white ants are one of the most abundant terrestrial animals on earth. Their numbers are so huge that it is estimated there might be several metric tons of termites for every human being on earth. Because of their destructive habit these tiny creatures were able to draw our attention from the very beginning of human civilization. Apart from grass-eating termites, which forage in the open, all termites remain within a closed system of galleries in their mound. Termites are reported from all zoogeographical regions of the world, but most of the termite species are known from the tropics.

Gujarat and Rajasthan provides an interesting field of study on the isopteran fauna over certain types of diverse ecosysytems varying from the arid region in the east upto the salty marsh land of Rann of Kutch in the west and over and above the Aravallis. Gujarat is probably one of the Indian states, which is least surveyed for its faunal resources, especially the invertebrates. The study of termites in India was initiated by Konig in 1779, but the first published record of termites from Gujarat dates back to the year 1913 when Holmgren studied Assmuth's collection and recorded five species. In the same year, Assmuth published the records of four other species for the first time from Gujarat. Later Chatterjee and Thakur (1968) and Roonwal (1973) dealt with taxonomy and biology of several termite species from Gujarat. In his two subsequent publications, M.L. Thakur (1976, 1981) recorded five species of *Odontotermes* from various localities in Gujarat. R.K. Thakur (1989) did the most commendable work on Gujarat termite fauna. In addition to the already known taxa of three families, six genera and thirteen species, he (*loc. cit.*) added one more family, eight genera and thirty-three species, including six new species. R.K. Thakur (1984, 1985, 1991) reported on the field ecology, eco-biogeography, and economic importance of termites in Gujarat. In view of its poor taxonomic information, it is therefore timely to assess the state of knowledge of this group in Gujarat. In this paper, the authors have increased the taxonomic strength of termite fauna from Gujarat by adding one more genus and fourteen species.

Adams was the first author to publish the first record of termite from Rajasthan in the year 1899 but he did not mention about any particular species. In contrary to the existing inadequate knowledge on the isopteran fauna from Gujarat, information in respect of taxonomy, biology and ecology on the termite fauna from Rajasthan is superbly enriched by a number of valuable contributions made by Indian termitologist, M.L. Roonwal (1968, 1970, 1973, 1975a,b,c,d, 1976, 1977a,b, 1981, 1982a,b, 1983, 1988), Roonwal and Bose (1960, 1962a,b,

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* The publication is dedicated to late Professor Mithan L. Roonwal, without whose support it would not have been possible for us to complete this work.

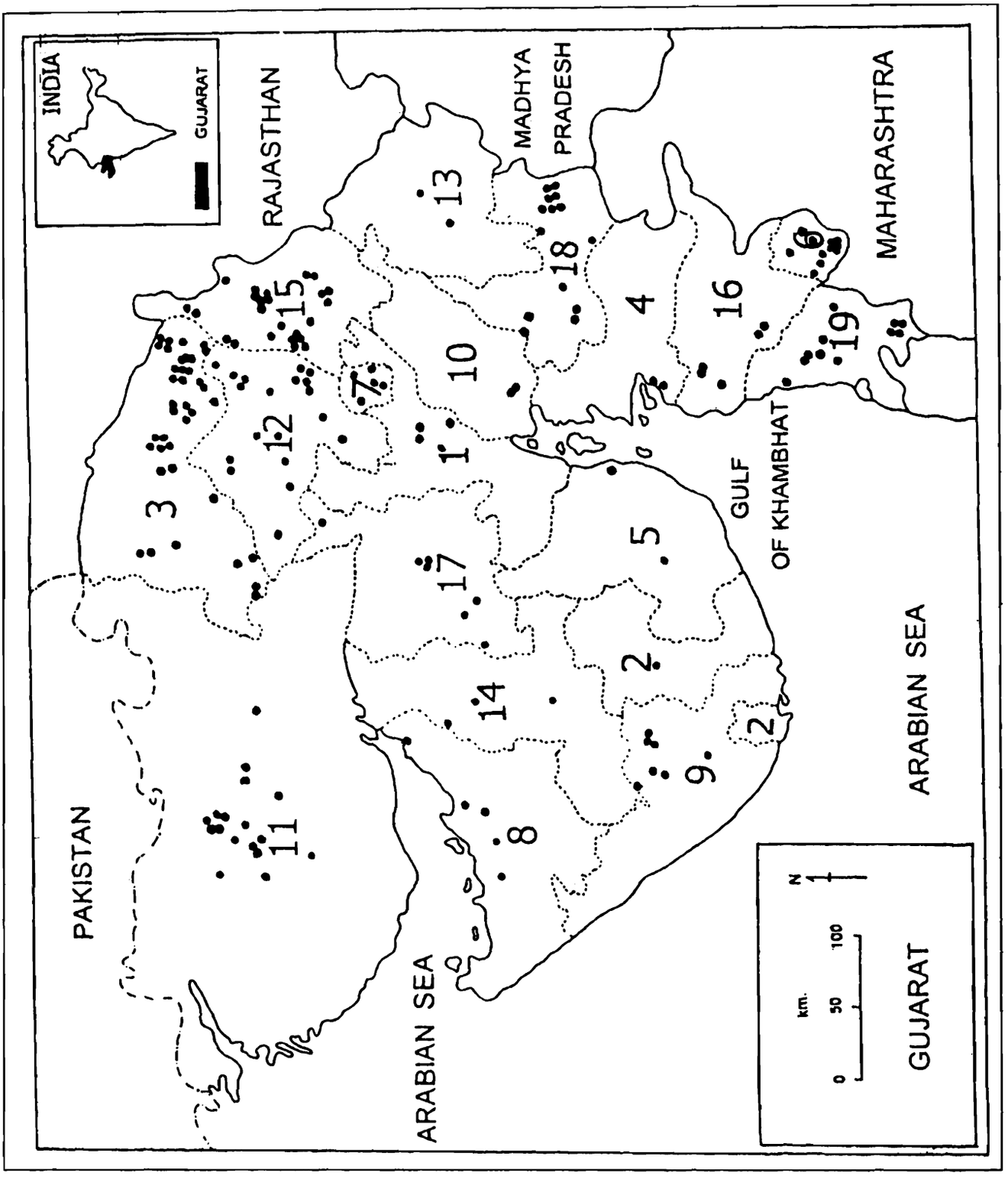


Fig. 1. Map of Gujarat, showing collection localities. Names of districts. 1. Ahmedabad. 2. Amreli. 3. Banaskantha. 4. Bharuch. 5. Bhavnagar. 6. Dangs. 7. Gandhinagar. 8. Jamnagar. 9. Junagadh. 10. Kheda. 11. Kutch. 12. Mahesana. 13. Panchmahal. 14. Rajkot. 15. Sabarkantha. 16. Surat. 17. Surendranagar. 18. Vadodara. 19. Valsad.

1964, 1969, 1973, 1978), Roonwal and Verma (1973a,b, 1977a,b, 1991) and others (Rathore, 1986, 1987a,b, 1989, 1995, 1996, 1998; Parihar 1977, 1978a,b, 1980a,b, 1981a,b,c; Verma and Rathore 1995; Thakur and Rathore 1982, 2000; Kushwaha 1960a,b, 1961; Pruthi and Bhatia 1952; Verma and Thakur, 1977 etc.). The latest available publication (Rathore, 1998) indicates that forty species belonging to sixteen genera grouped under four families are known to occur in Rajasthan. Besides new distribution data the present publication contains the new records of two species.

Isopteran taxonomy was comprehensively reviewed by Krishna (1970). Roonwal and Chhotani (1989) and Chhotani (1997) proposed a classification where they considered nine families (instead of six of Krishna, 1970) and twelve subfamilies. However, most recently Myles (1998) proposed a new taxonomic scheme, which is entirely based on cladistic principles. However, the new classification (Myles, 1998) is yet to gain its acceptance. In these circumstances, we have prefered to follow the classification of Roonwal and Chhotani (1989) and Chhotani (1997), which are more acceptable to us, and seems to be more practicable and satisfactory in the Indian context as the entire study is solely based on the materials from India and its subcontinent.

MATERIAL AND METHODS

References pertaining to only the first record from Rajasthan and Gujarat are mentioned under each species and these should not be considered as a comprehensive list. For detailed references, readers may please refer to Roonwal and Chhotani (1989), Chhotani (1997). Since a huge collection data is available from both states, the authors considered it worthwhile to deal mainly with the unpublished data. However, all the materials were examined to ascertain the authentic validity of the species. At the time of last collection (1992) from Gujarat, the state had a total of 19 administrative districts (Ahmedabad, Amreli, Banaskantha, Bharuch, Bhavnagar, Dangs, Gandhinagar, Jamnagar, Junagadh, Kheda, Kutch, Mahesana, Panchmahal, Rajkot, Sabarkantha, Surat, Surendranagar, Vadodara and Valsad). Recently some new administrative districts are created thus increasing the total number upto 26. For the sake of simplicity, the authors preferred to follow the older ones (after all the distribution of an animal group is governed by their ecological requirements, not by political/ administrative boundaries!). At the same time Rajasthan was divided into 26 administrative districts (Ajmer, Alwar, Banswara, Barmer, Bharatpur, Bhilwara, Bikaner, Bundi, Chittorgarh, Churu, Dungarpur, Ganganagar, Jaipur, Jaisalmer, Jalore, Jhalawar, Jhunjhunu, Jodhpur, Kota, Nagaur, Pali, Sawai Madhopur, Sikar, Sirohi, Tonk and Udaipur). There are now 32 administrative districts in Rajasthan. Collection localities in Gujarat and Rajasthan dealt in the present study are shown in figs. 1 and 2 respectively.

Dominance index has been calculated using the formula, $d_i = (n_i \times 100)/N$, where d_i = Dominnace index, n_i = Number of individuals of taxa, N = Total number of individuals of that taxa.

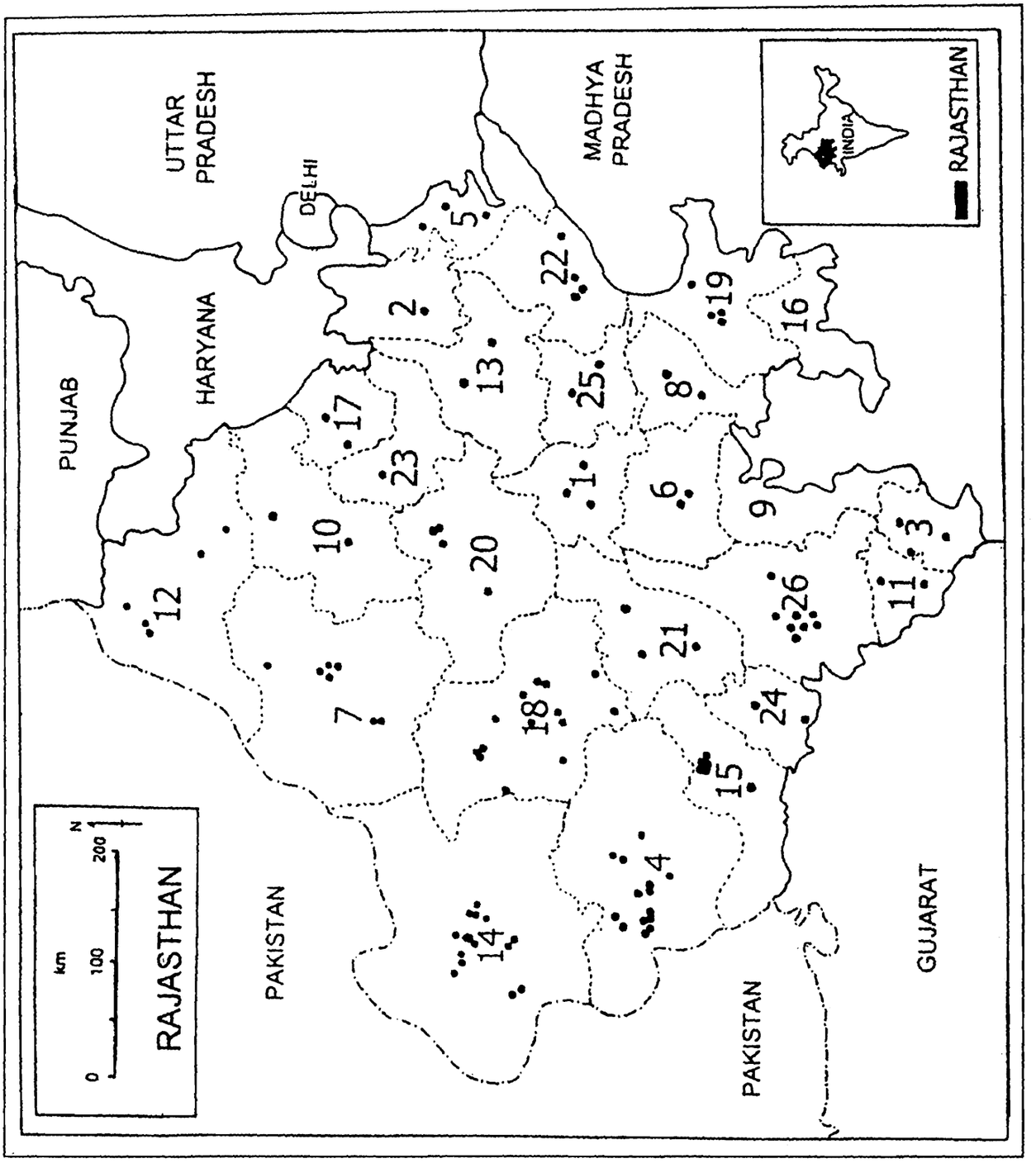


Fig. 2. Map of Rajasthan, showing collection localities. Names of districts. 1 Ajmer. 2. Alwar. 3. Banswara. 4. Barmer. 5. Bharatpur. 6. Bhilwara. 7 Bikaner. 8. Bundi. 9. Chittorgarh. 10. Churu. 11. Dungarpur. 12. Ganganagar. 13. Jaipur. 14. Jaisalmer. 15. Jalore. 16. Jhalawar. 17. Jhunjhunu. 18. Jodhpur. 19. Kota. 20. Nagaur. 21. Pali. 22. Sawai Madhopur. 23. Sikar. 24. Sirohi. 25. Tonk. 26. Udaipur.

LIST OF TERMITES KNOWN FROM GUJARAT AND RAJASTHAN

Family I KALOTERMITIDAE Froggatt, 1896

1. *Incisitermes didwanensis* Roonwal & Verma, 1973
2. *Neotermes fletcheri* Holmgren & Holmgren, 1917
3. *Cryptotermes bengalensis* (Snyder, 1934)
4. *Cryptotermes daulti* Rathore, 1994
5. *Cryptotermes havilandi* (Sjostedt, 1900)

Family II HODOTERMITIDAE Desneux, 1904

Subfamily (i) HODOTERMITINAE Desneux, 1904

6. *Anacanthotermes macrocephalus* (Desneux, 1906)

Family III RHINOTERMITIDAE Froggatt, 1896

Subfamily (ii) PSAMMOTERMITINAE Holmgren, 1911

7. *Psammotermes rajasthanicus* Roonwal & Bose, 1960

Subfamily (iii) COPTOTERMITINAE Holmgren, 1911

8. *Coptotermes heimi* (Wasmann, 1902)
9. *Coptotermes kishori* Roonwal & Chhotani, 1960

Subfamily (iv) HETEROTERMITINAE Froggatt, 1896

10. *Heterotermes gertrudae* Roonwal, 1953
11. *Heterotermes indicola* (Wasmann, 1902)
12. *Heterotermes malabaricus* Snyder, 1933

Family IV TERMITIDAE Westwood, 1840

Subfamily (v) AMITERMITINAE Kemner, 1934

13. *Eurytermes mohana* Rathore, 1995
14. *Speculitermes cyclops* Wasmann, 1902
15. *Speculitermes dharwarensis* Roonwal & Chhotani, 1964
16. *Speculitermes sinhalensis* Roonwal & Sen-Sarma, 1960
17. *Speculitermes triangularis* Roonwal & Sen-Sarma, 1960
18. *Synhamitermes labioangulatus* Thakur, 1989
19. *Synhamitermes quadriceps* (Wasmann, 1902)
20. *Amitermes belli* (Desneux, 1906)
21. *Eremotermes dehraduni* Roonwal & Sen-Sarma, 1960
22. *Eremotermes fletcheri* Holmgren & Holmgren, 1917

23. *Eremotermes neoparadoxalis* Ahmad, 1955
24. *Eremotermes paradoxalis* Holmgren, 1912
25. *Eremotermes sanyuktae* Thakur, 1989
26. *Microcerotermes annandalei* Silvestri, 1923
27. *Microcerotermes baluchistanicus* Ahmad, 1955
28. *Microcerotermes beesoni* Snyder, 1933
29. *Microcerotermes cameroni* Snyder, 1934
30. *Microcerotermes dumasensis* Thakur, 1989
31. *Microcerotermes heimi* Wasmann, 1902
32. *Microcerotermes laxmi* Roonwal & Bose, 1964
33. *Microcerotermes palestinensis* Spaeth, 1962
34. *Microcerotermes raja* Roonwal & Bose, 1964
35. *Microcerotermes sakesarensis* Ahmad, 1955
36. *Microcerotermes tenuignathus* Holmgren, 1913

Subfamily (vi) TERMITINAE Sjostedt, 1926

37. *Angulitermes dehraensis* (Gardner, 1945)
38. *Angulitermes jodhpurensis* Roonwal & Verma, 1974
39. *Dicuspiditermes incola* (Wasmann, 1893)

Subfamily (vii) MACROTERMITINAE Kemner, 1934

40. *Odontotermes anamallensis* Holmgren & Holmgren, 1917
41. *Odontotermes assmuthi* Holmgren, 1913
42. *Odontotermes bellahunisensis* Holmgren & Holmgren, 1917
43. *Odontotermes bhagwathi* Chatterjee & Thakur, 1967
44. *Odontotermes brunneus* (Hagen, 1858)
45. *Odontotermes dehraduni* (Snyder, 1934)
46. *Odontotermes distans* Holmgren & Holmgren, 1917
47. *Odontotermes feae* (Wasmann, 1896)
48. *Odontotermes giriensis* Roonwal & Chhotani, 1962
49. *Odontotermes girnarensis* Thakur, 1989
50. *Odontotermes guptai* Roonwal & Bose, 1961
51. *Odontotermes gurdaspurensis* Holmgren & Holmgren, 1917
52. *Odontotermes horai* Roonwal & Chhotani, 1962
53. *Odontotermes indicus* Thakur, 1981
54. *Odontotermes kushwahai* Roonwal & Bose, 1964
55. *Odontotermes latiguloides* Roonwal & Verma, 1973
56. *Odontotermes lokanandi* Chatterjee & Thakur, 1967
57. *Odontotermes malabaricus* Holmgren & Holmgren, 1917

58. *Odontotermes microdentatus* Roonwal & Sen-Sarma, 1960
59. *Odontotermes obesus* (Rambur, 1842)
60. *Odontotermes paralatiguloides* Thakur, 1989
61. *Odontotermes parvidens* Holmgren & Holmgren, 1917
62. *Odontotermes redemanni* (Wasmann, 1893)
63. *Odontotermes sasangirensis* Thakur, 1989
64. *Odontotermes wallonensis* (Wasmann, 1902)
65. *Microtermes bharatpurensis* Rathore, 1989
66. *Microtermes incertoides* Holmgren, 1913
67. *Microtermes mycophagus* (Desneux, 1905)
68. *Microtermes obesi* Holmgren, 1911
69. *Microtermes unicolor* Snyder, 1933

Subfamily (viii) NASUTITERMITINAE Hare, 1937

70. *Trinervitermes biformis* (Wasmann, 1902)
71. *Trinervitermes fletcheri* Chatterjee & Thakur, 1965

KEY TO THE TAXA OF TERMITE FROM GUJARAT AND RAJASTHAN

Key to the families

Imago caste

1. Fontanelle absent 2

- Fontanelle present 3

2. Ocelli absent; right mandible with a small subsidiary tooth at the base of anterior cutting edge of first marginal tooth; left mandible with three marginal teeth; cerci long, with 3-8 articles ..... *Hodotermitidae*

- Ocelli present; right mandible always without any subsidiary tooth; left mandible with two marginal teeth; cerci short, with 2 articles ..... *Kalotermitidae*

3. Fontanelle without plate; right mandible with a distinct subsidiary tooth at the base of anterior cutting edge of first marginal tooth; left mandible always with three marginal teeth; forewing scales large, overlapping hindwing scales; wing membrane strongly reticulate ..... *Rhinotermitidae*

- Fontanelle with plate; right mandible with a minute subsidiary tooth; left mandible with 1-2 marginal teeth; forewing scales small, not overlapping hindwing scales; wing membrane either not reticulate or with a weak reticulation ..... *Termitidae*

Soldier caste

1. Head without fontanelle and frontal gland; eyes present; mandible with prominent marginal teeth 2

- Head with fontanelle and frontal gland; eyes if present, dot like; mandible with or without marginal teeth 3

2. Cerci long, with 3-8 articles, antennae with 22-32 articles ..... *Hodotermitidae*

- Cerci short, with 2 articles, antennae with 10-18 articles ..... *Kalotermitidae*

3. Pronotum flat ..... *Rhinotermitidae*

- Pronotum saddle-shaped ..... *Termitidae*

Key to the genera

1(2) Head-capsule long, not phragmotic, mandible comparatively long ..... *Neotermes* Holmgren, 1911

2(1) Head-capsule short, phragmotic, mandible comparatively short ..... *Cryptotermes* Banks, 1960

3(4) Larger species (10-16 mm. long), eye spots prominent ..... *Anacanthotermes* Jacobson, 1905

4(3) Smaller species (7.4-8.2 mm. long), eye spots absent; mandible with several large to small well-developed teeth on inner margin; soldier trimorphic ..... *Psammotermes* Desneux, 1902

5(6) Head-capsule oval-shaped; fontanelle large, circular and lying on antero-median margin ..... *Coptotermes* Wasmann, 1896

6(5) Head-capsule subrectangular; fontanelle small, lying at the middle of head dorsum ... . *Heterotermes* Froggatt, 1896

7(8) Mandible with serrated inner margin ..... *Microcerotermes* Silvestri, 1901

8(7) Mandible without serrated inner margin

9(10) Head-capsule with frontal protuberance; mandible slender, weakly incurved apically ..... *Eremotermes* Silvestri, 1911

10(9) Head-capsule without frontal protuberance; mandible strongly built

11(12) Clypeus bilobed, frontal projection absent ..... *Amitermes* Silvestri, 1901

12(11) Clypeus not bilobed, frontal projection present ..... *Angulitermes* Sjostedt, 1924

13(14) Soldier caste rare; pronotum strongly saddle-shaped; anterior lobe longer than posterior; worker and alate with large, prominent circular ocellus-like mid-dorsal spot on head ..... *Speculitermes* Wasmann, 1902

14(13) Soldier caste common; pronotum rather weakly saddle-shaped; anterior lobe smaller than posterior; worker and alate without mid-dorsal spot on head ..... *Synhamitermes* Holmgren, 1912

15(16) Mandible short, thin, delicate; soldier smaller than workers, smaller species ..... *Microtermes* Wasmann, 1902

16(15) Mandible large and generally strong, soldiers usually larger than worker, larger species ..... *Odontotermes* Holmgren, 1912

17(18) Mandible strongly asymmetrical, antero-lateral corners of head formed into tubercle-like projections ..... *Dicuspiditermes* Krishna, 1965

18(17) Mandible degenerated, non-functional, head capsule produced into a nasus, soldier dimorphic ..... *Trinervitermes* Holmgren, 1912

Key to the species of the genus *Cryptotermes*

Imagoes

1(2) Ocelli nearer to antennae (min. ocellus-antennal distance 0.13-0.17 mm.); head capsule somewhat sub-straight at posterior margin ..... *C. bengalensis*

2(1) Ocelli widely separated from antennae (min. ocellus-antennal distance 0.17-0.20 mm.); head capsule with rounded posterior margin ..... *C. daulti*

3(4) Sides of head-capsule incurved in region of eye, eye generally smaller

4(3) Sides of head-capsule substraight in region of eye, eye generally larger ..... *C. havilandi*

Soldiers

1(2) Mandible larger, frontal ridge thick with a median cleft, pushed back and raised; median length of head upto frontal ridge less (0.82-0.93 mm.) ..... *C. bengalensis*

2(1) Mandible shorter, frontal ridge without median cleft, not pushed back or sometimes projecting in front laterally; median length of head upto frontal ridge more (0.90-1.20 mm.) ..... *C. daulti*

3(4) Ventral tubercle small, shorter than the dorsal one and not visible dorsally; head smaller (length to base of mandible 0.83 - 1.10 mm., max. width 0.75-1.03 mm.)

4(3) Ventral tubercle horn-like, large, a little longer than the dorsal one and visible dorsally; head larger (length to base of mandible 1.13-1.47 mm., max. width 1.10 - 1.35 mm.) ..... *C. havilandi*

Key to the species of the genus *Coptotermes*

Soldier

1(2) Waist of postmentum lying in the middle of line connecting the level of max. width and hind margin; postmentum with minimum width of 0.25-0.34 mm. ..... *C. heimi*

2(1) Waist of postmentum lying below the middle of line connecting the level of max. width and hind margin; postmentum with minimum width of 0.23-0.25 mm ..... *C. kishori*

Key to the species of the genus *Heterotermes*

Soldier

1(4) Generally larger in size; head strongly diverged anteriorly; pronotum flat, anterior and posterior margin with a weak notch in the middle; antennal segments 12-17 in number; head length to base of mandible 1.50-1.78 mm. and width of head 0.97-1.05 mm. ... . *H. gertrudae*

2(3) Pronotum distinctly notched at both anterior and posterior direction; antennal segments generally more than 14; head length to base of mandible 1.33-1.77 mm., head width 0.83-1.00 mm. ..... *H. indicola*

3(2) Posterior margin of pronotum nearly staright or with an imperceptable emargination; antennal segments 12-14 in number; head length to base of mandible 1.23-1.54 mm.; head width 0.77-0.95 mm.; smaller species ..... *H. malabaricus*

4(1) Generally smaller species; head either not or very weakly diverging in front; head length 1.3-1.99 mm.

Key to the species of the genus *Speculitermes*

Worker

1(2) Soldier caste present; mid-dorsal spot on head smaller (max. diameter 0.075-0.11 mm.) ..... *S. sinhalensis*

2(1) Soldier caste absent; mid-dorsal spot larger, always more than 0.11 mm.

3(4) Mid-dorsal spot circular, well-defined (max. diameter 0.15-0.18 mm.) ..... *S. cyclops*

4(3) Mid-dorsal spot triangular, ill-defined and large (max. diameter 0.21-0.28 mm.) .... *S. triangularis*

5(4) Mid-dorsal spot rounded, smaller species (max. diameter 0.11-0.13 mm.) .... *S. dharwarensis*

Key to the species of the genus *Synhamitermes*

Soldier

1(2) Smaller species; anterior margin of pronotum not notched in the middle; labrum tongue-shaped; length of mandible 0.45-0.50 mm. ..... *S. quadriceps*

2(1) Larger species; anterior margin of pronotum notched in the middle; labrum pentagonal; length of mandible 0.68-0.70 mm. ..... *S. labioangulatus*

Key to the species of the genus *Eremotermes*

Soldier

1(2) Tooth prominent, straight and pointed; third segment of the antennae shortest..... ..... *E. sanyuktae*

2(1) Tooth backwardly directed, not straight; second segment of the antennae shortest

3(4) Mandible distinctly longer than head capsule (head-mandibular index 1.12 and above); mandibular tooth weakly developed or absent, if present placed below the middle of mandible ..... *E. neoparadoxalis*

4(3) Mandible either subequal or shorter than head capsule (head-mandibular index usually 1.00 or below); mandibular tooth prominent and placed in the middle of mandible

5(6) Larger species (max. head width 0.80-0.85 mm.; max. pronotum width 0.50-0.55 mm.); mandiblular length sub-equal to head length (head-mandibular index 1.00-1.05) .... *E. fletcheri*

6(5) Smaller species (max. head width 0.68-0.75 mm.; max. pronotum width 0.40-0.45 mm.); mandible distinctly shorter than head length (head-mandibular index 0.78-0.98) ..... *E. paradoxalis*

7(8) Mandibular apices not strongly incurved; frontal protuberance of head weak to moderately well-developed; frontal slope gradual to steep; swelling of postmentum at or near middle, not far forward

8(7) Mandible apically incurved strongly; frontal protuberance prominent, never small; frontal slope steeply inclined in front; swelling of postmentum beyond anterior third..... ..... *E. dehraduni*

Key to the species of the genus *Microcerotermes*

Soldier

1(7) Inner margin of the mandible finely serrated

2(3) Mandible shorter; index mandible-length/ head-length 0.82-0.87 mm.; head capsule in comparison to length wider, index width/ length 0.77-0.86 mm. .... *M. baluchistanicus*

3(4) Mandible larger, almost as long as head; index mandible-length/ head-length 0.98 mm.; pronotum strongly emarginate ..... *M. laxmi*

4(5) Head-length smaller (1.0-1.27 mm); mandible shorter than head-length by 3/4 times; index mandible-length/ head-length 0.70-0.79 mm; pronotum weakly emarginate ..... *M. tenuignathus*

5(6) Head generally larger, length 1.19-1.25 mm; mandibular apices weakly incurved; labrum sharply pointed at tip ..... *M. heimi*

6(5) Labrum with broadly rounded tip; mandible relatively weakly hooked ..... *M. palestinensis*

7(8) Inner margin of the mandible finely serrated

8(9) Larger species; mandible with less incurved apices; head-index 0.56-0.60 mm. ..... *M. annandalei*

9(10) Mandible with apices strongly hooked; head-index 0.54-0.56 mm. ..... *M. dumasensis*

10(9) Smaller species; mandible with weakly hooked apices; head-index 0.56-0.64 mm.

11(12) Antero-median margin of pronotum weakly notched; postmentum relatively less narrowed at the posterior fourth ..... *M. beesoni*

12(13) Antero-median margin of pronotum distinctly notched; mandible with one larger tooth-like serration behind middle; anterior margin of labrum bluntly rounded ..... *M. cameroni*

13(14) Smaller species; mandible coarsely serrated without large tooth; labrum tongue-shaped, pentagonal ..... *M. raja*

14(13) Larger species; head-length with mandible 2.25-2.29 mm.; head-length to base of mandible 1.48-1.58 mm. ..... *M. sakesarensis*

Key to the species of the genus *Angulitermes*

Soldier

1(2) Head weakly incurved on medio-lateral side; antero-lateral corners of head sharply angulate; length of frontal projection of head 0.10-0.13 mm. ..... *A. dehraensis*

2(1) Head straight on medio-lateral side, narrowed posteriorly; length of frontal projection of head 0.26 mm. ..... *A. jodhpurensis*

Key to the species of the genus *Odontotermes*

(*O. dehraduni* is known only from imago, hence not included in the key)

Soldier

1(25) Antennae distinctly darker distally and paler basally

2(5) Tooth on the left mandible placed near the apices; tooth-index less than 0.28 mm.

3(4) Head capsule densely pilose; head-mandibular index more than 0.60-0.68 mm. ..... *O. sasangirensis*

4(3) Head capsule moderately pilose; head-mandibular index more than 0.50-0.59 mm. .... *O. giriensis*

5(2) Tooth on left mandible placed near apical third; tooth-index always more than 0.28 mm.

6(11) Postmentum extraordinarily wide; sides strongly arched (broad postmentum group)

7(8) Mandible shorter (0.55-0.89 mm.); head-mandibular index 0.54-0.63 mm. ..... *O. lokanandi*

8(7) Mandible longer (0.74-0.89 mm.); head-mandibular index 0.68-0.79 mm.

9(10) Labrum tounge-shaped, broadly rounded anteriorly, mandible larger (0.79-0.89 mm.); head-mandibular index higher (0.75-0.79 mm.) ..... *O. latiguloides*

10(9) Labrum longer than broad, with slightly pointed tip mandible shorter (0.74-0.78 mm.); head-mandibular index lower (0.66-0.76 mm.) ..... *O. paralatiguloides*

11(6) Post-mentum not wide; sides sub-parallel to weakly arched

12(13) Head and body more hairy; antennae with 15-16 segments; mandible shorter and stouter; labrum broadly rounded anteriorly; post-mentum convex laterally ..... *O. guptai*

13(14) Head and body less hairy; antennae with 16-17 segments; mandible comparatively less stout and longer; labrum narrowing anteriorly; post-mentum laterally substraight... *O. bellahunisensis*

14(15) Left mandibular tooth minute, rudimentary; mandible substraight, long, slender and very slightly bent inwards near distal tip; post-mentum laterally weakly arched ..... *O. microdentatus*

15(16) Head capsule subrectangular laterally, almost parallel upto the base of antennae .... *O. gurdaspurensis*

17(18) Head capsule oval, distinctly narrowed anteriorly

18(19) Mandible longer; outer margin strongly bent near the basal third; index mandible length/ head length to base of mandible 0.69-0.79 mm. ..... *O. redemanni*

19(20) Mandible short, slender, with weakly curved outer margin; index mandible length/ head length 0.59-0.68 mm; labrum short, broadly rounded anteriorly ..... *O. obesus*

20(21) Head capsule subrectangular; teeth on left mandible placed near the distant end of the middle one-third portion

21(22) Head capsule with sides almost parallel in the middle; inner margin of left mandible beyond the tooth strongly incurved; index mandible length/head length to base of

mandible 0.56-0.62 mm.; tooth of left mandible forwardly placed (tooth distance 0.33-0.45 mm.); mandible tooth index 0.34-0.42 mm ..... *O. brenneus*

22(23) Head capsule with sides convex in the middle; inner margin of left mandible beyond the tooth sickle-shaped; index mandible length/ head length to base of mandible 0.61-0.67 mm.; tooth of left mandible not much forwardly placed (tooth distance 0.43-0.50 mm.); mandible tooth index 0.41-0.44 mm. ..... *O. kushwahai*

23(24) Tooth distance from the tip of left mandible 0.34-0.38 mm.; tooth index less (0.34-0.39 mm.); antennae 16-segmented ..... *O. girnarensis*

24(25) Tooth distance from the tip of left mandible 0.43-0.53 mm.; tooth index high (0.43-0.53 mm.); antennae 16-17 segmented ..... *O. walloensis*

25(1) Antennae uniformly coloured, not darker distally

26(27) Inner margin anterior to tooth on the left mandible wavy, parrot's beak-like; smaller species; distance of teeth from the tip of mandible 0.28-0.35 mm.; mandible tooth index 0.33-0.37 mm. ..... *O. assmuthi*

27(26) Inner margin anterior to tooth on the left mandible not wavy; comparatively larger species; distance of teeth from the tip of mandible 0.38-0.50 mm.; mandible tooth index 0.34-0.43 mm. ..... *O. malabaricus*

28(29) Angle between the tooth and inner margin of left mandible much wider (nearly 90^0); tips weakly incurved; tooth sharply pointed

29(30) Angle between the tooth and inner margin of left mandible distinctly acute; tips strongly incurved; tooth bluntly pointed ..... *O. anamallensis*

30(31) Tooth on left mandible placed a little below the middle; mandible tooth-index 0.51-0.55 mm; smaller species ..... *O. bhagwathi*

31(32) Tooth on left mandible rudimentary and placed near the basal third; mandible-tooth index 0.58-0.66; cmparartively larger species; antennae 17-segmented .... *O. distans*

32(33) Tooth on left mandible minute and placed at basal third of mandible; antennae 16-17 segmented ..... *O. parvidens*

33(34) Head capsule with sides almost parallel; tooth distance from tip of mandible 0.63-0.68 mm.; mandible-tooth index 0.60-0.66 mm.; head length with mandible 2.70-3.30 mm; tooth on left mandible prominent ..... *O. horai*

34(33) Head capsule with sides not parallel; tooth distance from tip of mandible 0.62-0.80 mm.; mandible-tooth index 0.50-0.55 mm.; head length with mandible 3.45-4.35 mm; tooth on left mandible very prominent ..... *O. indicus*

35(36) Tooth on left mandible placed near the proximal end of mdiddle one-third; mandible-tooth index 0.56-0.60; head-capsule widest in the middle

36(35) Tooth on left mandible placed near the middle; mandible-tooth index 0.50-0.54; head-capsule widest near the posterior third ..... *O. feae*

Key to the species of the genus *Microtermes*

1(2) Antennae with 15 segments ..... *M. mycophagus*

2(1) Antennae with less than 15 segments

3(4) Antennae with 13 segments; smaller species, 2.39 to 2.47 mm. ..... *M. bharatpurensis*

4(3) Antennae with 14 segments; larger species, 3.2 to 5.0 mm.

5(6) Labrum comparartively narrow at tip ..... *M. incertoides*

6(5) Labrum comparatively broad at tip

7(8) Head-capsule moderately hairy; second segment of antennae equal to the combined length of third and fourth segments; labrum reaching upto 2/3rd of mandible .... *M. obesi*

8(7) Head-capsule densely hairy; second segment of antennae shorter than combined length of third and fourth segments; labrum reaching upto 3/4th of mandible ..... *M. unicolor*

Key to the species of the genus *Trinervitermes*

Soldier major

1(2) Antennae 14-segmented, third segment 1.5 times larger than second segment; pronotum markedly invaginated anteriorly ..... *T. fletcheri*

2(1) Antennae 12-14 segmented, in fourteen-segmented condition third segment slightly longer than second segment; pronotum weakly invaginated anteriorly ..... *T. biformis*

Soldier minor

1(2) Anterior margin of pronotum without any emergination ..... *T. biformis*

2(1) Anterior margin of pronotum weakly to deeply emerginate ..... *T. fletcheri*

SYSTEMATIC ACCOUNT

Family I KALOTERMITIDAE Froggatt, 1896

1. ***Incisitermes didwanensis*** Roonwal & Verma, 1973

(Pl I, fig. 1)

1973. *Incisitermes didwanensis* Roonwal & Verma, *Zool. Anz.*, **191** (5 & 6) : 390.

Caste known : Imago, soldier, pseudoworker.

Material examined : RAJASTHAN : 1 imago, 10 soldiers, 24 psudoworkers, ex. wood of *Prosopis spicigera*, Didwana, Nagaur district, 11.xi.1972, S.C. Verma coll. 10 soldiers, 22 workers, ex. wood, Daulatpura, Nagaur district, 3.iii.1975, S.C. Verma coll.

Distribution : INDIA : Rajasthan (Nagaur).

Remarks : This endemic species is an exclusively wood-dwelling one. It is an arid zone species.

2. ***Neotermes fletcheri*** Holmgren & Holmgren, 1917
(Pl. I, fig. 2)

1968. *Neotermes fletcheri*, Chatterjee & Thakur, *Indian Forester,* **94** (7) : 561.

Caste known : Imago, soldier, pseudoworker.

Material examined : GUJARAT : 3 soldiers, 28 pseudoworkers, ex. Mango tree, Kunta village, Valsad district, 8.x.1965, M.L. Thakur coll.

Distribution : INDIA : Gujarat (Valsad), Kerala, Tamil Nadu. *Elsewhere* : Bangladesh, Sri Lanka.

Remarks : This species is being reported for the first time from Gujarat. Earlier the species was reported in south India from dead wooden log of two different tree species.

3. ***Cryptotermes bengalensis*** (Snyder, 1934)
(Pl. I, fig. 3)

1989. *Cryptotermes bengalensis,* Thakur, *Ind. For. Rec.,* **15** (1) : 10.

Caste known : Imago, soldier, pseudoworker.

Material examined : GUJARAT : 9 soldiers, 35 pseudoworkers, ex. Kaprada Teak Plantation, near water tank, Valsad district, 27.xii.1980, N.S. Rathore coll.

Distribution : INDIA : Andaman & Nicobar Islands, Andhra Pradesh, Assam, Gujarat, (Valsad), Karnataka, Madhya Pradesh, Orissa, Tripura, Uttar Pradesh, West Bengal. *Elsewhere* : Bangladesh, Sri Lanka.

Remarks : This is a dry-wood termite and known to attack woodwork and trees. This is being reported for the first time from the teak plantation.

4. ***Cryptotermes daulti*** Rathore, 1994
(Pl. I, fig 4)

1994. *Cryptotermes daulti* Rathore, *Hexapoda,* **6** (1) : 19.

Caste known : Imago, soldier, pseudoworker.

Material examined : GUJARAT : 5 imagoes, 75 soldiers, 63 pseudoworkers, ex. tree trunk of Dhak, Taranga village, Mahesana district, 23.ii.1992, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Mahesana).

Remarks : The species made very extensive nesting galleries in tree trunk. Large number of small pellets of fecal matter scattered on ground near tree trunk also suggests their presence.

5. ***Cryptoermes havilandi*** (Sjostedt, 1900)
(Pl. I, fig. 5)

1987. *Cryptotermes havilandi*, Rathore, *J. Bombay nat. Hist. Soc.*, **84** (3) : 694.

Caste known : Soldier, worker.

Material examined : RAJASTHAN : 7 soldiers, 33 workers, ex. dead wood of Mahowa tree (*Madhuca indica*), Tamatia village, Banswara district, 29.viii.1984, N.S. Rathore coll.

Distribution : INDIA : Andaman & Nicobar Islands, Assam, Karnataka, Kerala, Madhya Pradesh, Orissa, Rajasthan (Banswara), West Bengal. *Elsewhere* : Bangladesh, Brazil, British Guyana, Cameron, Comoro Islands, Congo, Europa Islands, Fernando Poo, Ivory Coast, Madagascar, Mombasa, Nigeria, Senegal, Sri Lanka, Surinam, Trinidad and Tobago.

Remarks : The species is distributed worldwide and dispersed itself with the help of human agencies, probably by means of wooden logs.

Family II HODOTERMITIDAE Desneux, 1904

Subfamily (i) HODOTERMITINAE Desneux, 1904

6. ***Anacanthotermes macrocephalus*** (Desneux, 1906)
(Pl. I, fig. 6)

1952. *Hodotermes macrocephalus*, Pruthi & Bhatia, *Bull. Natnl. Inst. Sci.*, **1** : 241.

1989. *Anacanthotermes macrocephalus*, Thakur, *Ind. For. Rec.*, **15** (1) : 12.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 2 soldiers, 32 workers, ex. mound, Kukama village, Kutch district, 24.ii.1989, N.S. Rathore coll. 65 workers, ex. mound, Ratanpur village, Kutch district, 2.iii.1989, N.S. Rathore coll. RAJASTHAN : 13 workers, ex. ground, Sam dunal area, Jaisalmer-Khuri Road, Jaisalmer district, 5.ii.1995, N.S. Rathore coll. 21 workers, ex. ground, west of Jaisalmer, Jaisalmer district, 7.ii.1995, N.S. Rathore coll. 3 workers, ex. mound, Baisala, Barmer district, 12.ii.1995, N.S. Rathore coll. 4 soldiers, 15 workers, 10 alates, ex. mound, Pithla, Jaisalmer district, 24.vii.1995, N. S. Rathore coll.

Distribution : INDIA : Gujarat (Kutch), Punjab, Rajasthan (Barmer, Bikaner, Jaisalmer, Jalore, Jodhpur). *Elsewhere* : Afghanistan, Pakistan.

Remarks : This large-sized species is a typically deserticolous one and the only free-foraging species found in arid region of Rajasthan and Gujarat. This is also a major food for reptiles and insectivorous birds.

Family III RHINOTERMITIDAE Froggatt, 1896

Subfamily (ii) PSAMMOTERMITINAE Holmgren, 1911

7. ***Psammotermes rajasthanicus*** Roonwal & Bose, 1960
(Pl. I, fig. 7)

1960. *Psammotermes rajasthanicus* Roonwal & Bose, *Sci. & Cult.*, **26** (1) : 38.

1989. *Psammotermes rajasthanicus*, Thakur, *Ind. For. Rec.*, **15** (1) : 13.

Caste known : Soldier, worker.

Material examined : GUJARAT : 79 soldiers, 32 workers, ex. cow-dung, Thordoi, Kutch district, 16.i.1981, N.S. Rathore coll. RAJASTHAN : 2 soldiers, 5 workers, ex. dry wooden stick, Sam, Jaisalmer district, 7.ii.1995, N.S. Rathore coll. 2 soldiers, 6 workers, ex. cow-dung, Turvi village, Barmer district, 13.ii.1995, N.S. Rathore coll. 8 soldiers, ex. ground, Nahar Singh Ki Dhani, Jaisalmer district, 15.ii.1995, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Banaskantha, Kutch), Rajasthan (Barmer, Bikaner, Jaisalmer, Jodhpur). *Elsewhere* : Pakistan.

Remarks : This primarily sand-dwelling termite species is widely distributed in hot and semi-arid areas of Gujarat and Rajasthan, and has also been found to be associated with dry cow-dung, fallen twigs and dry logs etc.

Subfamily (iii) COPTOTERMITINAE Holmgren, 1911

8. ***Coptotermes heimi*** (Wasmann, 1902)
(Pl. I, fig. 8)

1913. *Coptotermes heimi*, Assmuth, *J. Bombay nat. Hist.*, **23** (2) : 376.

1962. *Coptotermes heimi*, Roonwal & Chhotani, *Ind. Counc. agric. Res. Monogr.*, No. 2 : 38.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 34 soldiers, 59 workers, ex. cow-dung and dry log, Danta, Palanpur, Banaskantha district, 19.ii.1992, N.S. Rathore coll. 23 soldiers, 19 workers, ex. under fallen tree trunk, Taranga Hill, Mahesana district, 23.ii.1992, N.S. Rathore coll. 9 soldiers, 43 workers, ex. wooden racks, Narmada Irrigation Rest House, Alkapuri, Vadodara district, 20.x.1982, N.S. Rathore coll. 18 soldiers, 62 workers, ex. under grass, Pimpri village, Ahwa, Dangs district, 10.viii.1989, R. Sewak coll. RAJASTHAN : 8 soldiers, 20 workers, ex. dry tree trunk, Pithla, Jaisalmer district, 24.vii.1995, N.S. Rathore coll. 4 soldiers, 15 workers, ex. date palm tree, shoreline of Pichola Lake, Udaipur district, 9.ix.1994, N.S. Rathore & S. Kumar coll. 18 soldiers, 5 workers, ex. *Ficus* tree trunk, shoreline of Pichola Lake, Udaipur district, 9.ix.1994, N.S. Rathore & S. Kumar coll.

Distribution : INDIA : Gujarat (Banaskantha, Dangs, Mahesana, Vadodara), Rajasthan (Jaisalmer, Jaipur, Jodhpur, Nagaur, Pali, Sikar, Udaipur). *Elsewhere* : Bangladesh, Bhutan, Java, Nepal, Oman, Pakistan.

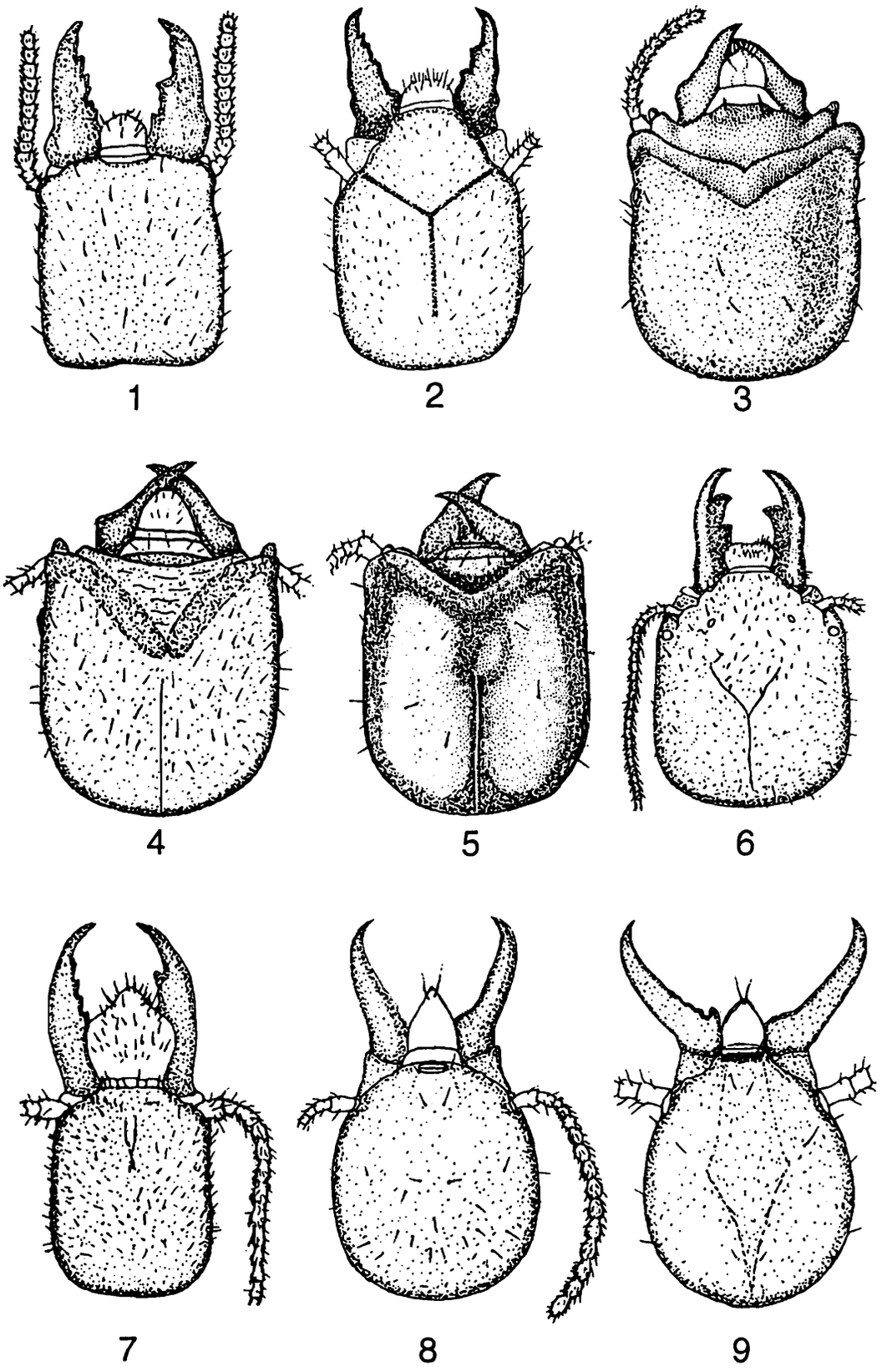


PLATE I : Heads of soldiers. (1) *Incisitermes didwanensis.* (2) *Neotermes fletcheri.* (3) *Cryptotermes bengalensis.* (4) *Cryptotermes daulti.* (5) *Cryptotermes havilandi.* (6) *Anacanthotermes macrocephalus.* (7) *Psammotermes rajasthanicus.* (8) *Coptotermes heimi.* (9) *Coptotermes kishori.*

Remarks : It is basically a wood-inhabiting species and are known to make tunnels in any dry wood above ground. It is a serious pest of woodwork. It is known to attack the dead wood of a large number of trees; two-third of the tree trunk from which it is collected were found to be damaged. As soon as the nesting site is disturbed large number of soldiers come up with milky exudation oozing out from fore-head.

9. ***Coptotermes kishori*** Roonwal & Chhotani, 1960
(Pl. I, fig. 9)

1989. *Coptotermes kishori*, Thakur, *Ind. For. Rec.*, **15** (1) : 15.

1996. *Coptotermes kishori*, Thakur, *Ind. J. Forestry,* **19** (3) : 238.

Caste known : Soldier, worker.

Material examined : GUJARAT : 37 soldiers, 74 workers, ex. bamboo plant, Jhear village, Danta Forest, Banaskantha district, 25.xi.1986, N.S. Rathore coll. RAJASTHAN : 10 soldiers, ex. wood, Didwana, Nagaur district, 15.xi.1974, S.C. Verma coll.

Distribution : INDIA : Gujarat (Banaskantha, Valsad), Kerala, Madhya Pradesh, Rajasthan (Nagaur), Tripura, West Bengal.

Remarks : The species is a versatile one.

Subfamily (iv) HETEROTERMITINAE Froggatt, 1896

10. ***Heterotermes gertrudae*** Roonwal, 1953
(Pl. II, fig. 10)

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 7 soldiers, 5 workers, ex. dry bamboo, in association with *Microtermes obesi*, Ambaji Forest, Palanpur, Banaskantha district, 24.xi.1986, N.S. Rathore coll. RAJASTHAN : 5 soldiers, 30 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 9.ix.1994, N.S. Rathore & S. Kumar coll.

Distribution : INDIA : Gujarat (Banaskantha), Himachal Pradesh, Rajasthan (Udaipur), Uttar Pradesh.

Remarks : The species require thick vegetation cover. This species is recorded for the first time from Rajasthan and Gujarat and are found to cause extensive damage to the date palm trees around the Pichola Lake area.

11. ***Heterotermes indicola*** (Wasmann, 1902)
(Pl. II, fig. 11)

1953. *Heterotermes indicola*, Roonwal & Pant, *Ind. For. Leafl.*, **121** (3) : 47.

1989. *Heterotermes indicola*, Thakur, *Ind. For. Rec.*, **15** (1) : 14.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 19 soldiers, 39 workers, ex. under wooden log, Jhear village, Danta, Banaskantha district, 25.xi.1986, N.S. Rathore coll. 61 soldiers, 49 workers, ex. under wooden log, Magodi village, Gandhinagar district, 26.ii.1991, N.S. Rathore coll. RAJASTHAN : 32 soldiers, 63 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 9.ix.1994, N.S. Rathore & S. Kumar coll. 8 soldiers, 40 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 12.ix.1994, N.S. Rathore & S. Kumar coll. 4 soldiers, 10 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 3.iv.1996, N.S. Rathore & S. Kumar coll. 3 soldiers, 30 workers, ex. dry tree trunk, Nahar Singh ki Dhani, Jaisalmer district, 6.ii.1995, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Banaskantha, Gandhinagar, Kutch), Rajasthan (Bikaner, Jaisalmer, Jodhpur, Sirohi, Udaipur). *Elsewhere* : Afghanistan, Pakistan.

Remarks : It's a wood-inhabiting termite species and causes serious damage to wooden material as well as a number of tree species in Rajasthan. Although it is a wood-destroying termite species but due to changes in vegetation, the species is well-adapted to the dry desertic condition of Rajasthan.

12. ***Heterotermes malabaricus*** Snyder, 1933
(Pl. II, fig. 12)

1968. *Heterotermes malabaricus,* Chatterjee & Thakur, *Indian Forester,* **94** (7) : 562.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 49 soldiers, 72 workers, ex. wooden fence support, Kunta village, Valsad district, 8.xii.1965, M.L. Thakur coll.

Distribution : INDIA : Gujarat (Valsad), Karnataka.

Remarks : This species causes extensive damage to large number of tree species as well as wooden structures.

Family IV TERMITIDAE Westwood, 1934

Subfamily (v) AMITERMITINAE Kamner, 1934

13. ***Eurytermes mohana*** Rathore, 1995
(Pl. II, fig. 13)

1995. *Eurytermes mohana* Rathore, *Entomon,* **20** (3 & 4) : 203.

Caste known : Soldier, worker.

Material examined : RAJASTHAN : 5 soldiers, 25 workers, ex. under stone, Mandal, 71 km. E of Bhilwara, Bhilwara district, 4.ix.1986, N.S. Rathore coll.

Distribution : INDIA : Rajasthan (Bhilwara).

Remarks : The species is endemic to Rajasthan and occurs in moderate rainfall area.

14. ***Speculitermes cyclops*** Wasmann, 1902
(Pl. II, fig. 14)

1960. *Speculitermes cyclops*, Roonwal & Sen-Sarma, *Ind. Counc. agric Res. Entom. Monogr.*, No. 1 : 16.

1989. *Speculitermes cyclops*, Thakur, *Ind. For. Rec.*, **15** (1) : 18.

Caste known : Imago, worker.

Material examined : GUJARAT : 61 workers, ex. under stone, Ambaji Forest, Palanpur, Banaskantha district, 24.xi.1986, N.S. Rathore coll. 1 worker, ex. ground, in association with *Microtermes unicolor*, Chhota Udaipur, Vadodara district, 24.xii.1980, N.S. Rathore coll.

Distribution : INDIA : Andhra Pradesh, Gujarat (Banaskantha, Bharuch, Vadodara), Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan (Dungarpur, Kota), Uttar Pradesh.

Remarks : This species requires relatively more moist condition and found in forested areas of both the state.

15. ***Speculitermes dharwarensis*** Roonwal & Chhotani, 1964
(Pl. II, fig. 15)

Caste known : Imago, worker.

Material examined : GUJARAT : 2 workers, ex. under stone, Limbhoi village, Sabarkantha district, 28.xi.1986, N.S. Rathore coll.

Distribution : INDIA : Andhra Pradesh, Gujarat (Sabarkantha), Karnataka.

Remarks : The species is being recorded for the first time from Gujarat.

16. ***Speculitermes sinhalensis*** Roonwal & Sen-Sarma, 1960
(Pl. II, fig. 16)

1989. *Speculitermes sinhalensis*, Thakur, *Ind. For. Rec.*, **15** (1) : 19.

Caste known : Imago, soldier, worker.

Material examined GUJARAT : 10 workers, ex. under stone, Khambhalia village, Jamnagar district, 18.viii.1988, R.N. Bhargava coll.

Distribution : INDIA : Andhra Pradesh, Gujarat (Dangs, Jamnagar, Junagadh), Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu. *Elsewhere* : Sri Lanka.

Remarks : The species generally made mud tunnels under the stone.

17. ***Speculitermes triangularis*** Roonwal & Sen-Sarma, 1960
(Pl. II, fig. 17)

1989. *Speculitermes triangularis*, Thakur, *Ind. For. Rec.*, **15** (1) : 20.

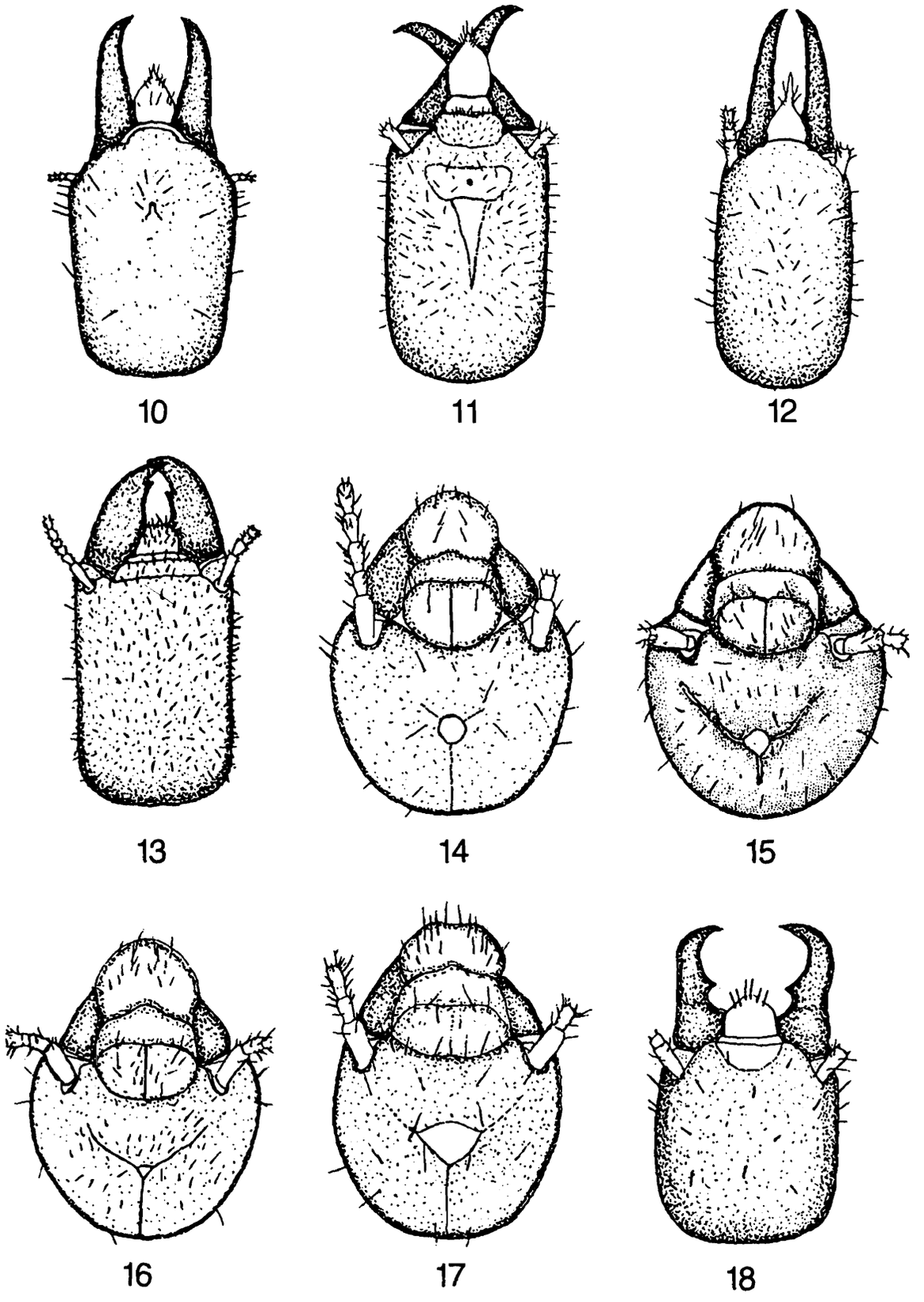


PLATE II : Heads of soldiers and workers. (10) *Heterotermes gertrudae*, S. (11) *Heterotermes indicola*, S. (12) *Heterotermes malabaricus*, S. (13) *Eurytermes mohana*, S. (14) *Speculitermes cyclops*, W. (15) *Speculitermes dharwarnensis*, W. (16) *Speculitermes sinhalensis*, W. (17) *Speculitermes triangularis*, W. (18) *Synhamitermes labioangulatus*, S. [S = Soldier, W = Worker].

Caste known : Worker.

Material examined : GUJARAT : 72 workers, ex. cow-dung, Govtka village, near Kaprada Forest, Valsad district, 28.xii.1980, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Valsad), Uttar Pradesh.

Remarks : Not much information is available on this species mainly because of its rare occurrence.

18. ***Synhamitermes labioangulatus*** Thakur, 1989
(Pl. II, fig. 18)

1989. *Speculitermes labioangulatus,* Thakur, *Ind. For. Rec.,* **15** (1) : 22.

Caste known : Soldier, worker.

Material examined : GUJARAT : 5 soldiers, 35 workers, ex. cow-dung, Govtka village, near Kaprada Forest, Valsad district, 28.xii.1980, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Valsad).

Remarks : The species is a rare one and are not reported from any other state.

19. ***Synhamitermes quadriceps*** (Wasmann, 1902)
(Pl. III, fig. 19)

1960. *Synhamitermes quadriceps,* Roonwal & Sen-Sarma, *Ind. Counc. agric. Res. Monogr.,* No. 1 : 7.

1989. *Synhamitermes quadriceps,* Thakur, *Ind. For. Rec.,* **15** (1) : 24.

Caste known : Soldier, worker.

Material examined : GUJARAT : 53 soldiers, 11 workers, ex. decaying wood of *Madhuca indica*, Bokhra, Dangs district, 30.xii.1980, N.S. Rathore coll.

Distribution : INDIA : Assam, Daman & Diu, Goa, Gujarat (Dangs), Karnataka, Kerala, Maharashtra, Rajasthan (Kota), Tripura, West Bengal. *Elsewhere* : Bangladesh, Sri Lanka.

Remarks : This species occurs in well-forested areas, with high amount of moisture.

20. ***Amitermes belli*** (Desneux, 1906)
(Pl. III, fig. 20)

1964. *Amitermes belli,* Roonwal & Bose, *Zoologica,* **40** (3) (Heft 113) : 19.

1989. *Amitermes belli,* Thakur, *Ind. For. Rec.,* **15** (1) : 21.

Caste known : Imago, worker, soldier.

Material examined : GUJARAT : 61 soldiers, 23 workers, ex. wooden log, Raigadh, Modesa, Sabarkantha district, 1.ii.1982, N.S. Rathore coll. 9 soldiers, 15 workers, ex. tree

trunk, Gomadi village, Sabarkantha district, 29.xi.1986, R.C. Sharma coll. 27 soldiers, 38 workers, ex. tree trunk, Lakhtar Dam area, Surendranagar district, 13.ii.1991, N.S. Rathore coll. 63 soldiers, 33 workers, ex. tree trunk, Lakhtar, Surendranagar district, 1.ix.1991, R. Sewak coll. 4 soldiers, 21 workers, ex. date palm tree trunk, Khambhat, Kheda district, 22.ii.1991, N.S. Rathore coll. 52 soldiers, 29 workers, ex. *Salvadora* tree trunk, 23.ii.1991, N.S. Rathore coll. 32 soldiers, 15 workers, ex. mound, Aithor village, Mahesana district, 25.ii.1992, N.S. Rathore coll. 51 soldiers, 16 workers, ex. *Acacia* tree trunk, Chawna village, Ahmedabad district, 19.ii.1991, N.S. Rathore coll. 27 soldiers, 15 workers, ex. dry stump, Gola village, Banaskantha district, 20.ii.1992, N.S. Rathore coll. RAJASTHAN : 12 soldiers, 87 workers, ex, dry husk of Pearl Millet, Turvi, Barmer district, 20.vii.1995, N.S. Rathore coll. 18 soldiers, 5 workers, ex. *Ficus* tree trunk, shoreline of Pichola Lake, Udaipur district, 9.ix.1994, N.S. Rathore & S. Kumar coll. 10 soldiers, 55 workers, ex. date palm tree trunk, shoreline of Pichola Lake, Udaipur district, 9.ix.1994, N.S. Rathore & S. Kumar coll. 6 soldiers, 18 workers, ex. date palm tree trunk, shoreline of Pichola Lake, Udaipur district, 12.ix.1994, N.S. Rathore & S. Kumar coll.

Distribution : INDIA : Delhi, Gujarat (Ahmedabad, Banaskantha, Kheda, Kutch, Mahesana, Sabarkantha, Surendranagar), Madhya Pradesh, Rajasthan (Barmer, Bundi, Jaipur, Jaisalmer, Jodhpur, Kota, Nagaur, Udaipur). *Elsewhere* : Pakistan.

Remarks : This species causes damage to large number of trees as well as small bushes. Although it is a moisture-loving species and found in wet and semi-arid areas but recently it has been recorded from heaps of pearl millet seed husk in the extreme arid region of Barmer.

21. ***Eremotermes dehraduni*** Roonwal & Sen-Sarma, 1960
(Pl. III, fig. 21)

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 1 soldier, 83 workers, ex, cow-dung, Dantiwada Dam Hill area, Banaskantha district, 23.xi.1986, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Banaskantha), Uttar Pradesh.

Remarks : The species is being recorded for the first time from Gujarat.

22. ***Eremotermes fletcheri*** Holmgren & Holmgren, 1917
(Pl. III, fig. 22)

1984. *Eremotermes fletcheri,* Thakur, *J. Bombay nat. Hist. Soc.*, **81** (2) : 496.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 31 soldiers, 62 workers, ex. soil, Thordoi, Khavda, Kutch district, 16.i.1981, N.S. Rathore coll. RAJASTHAN : 43 soldiers, 10 workers, ex. cotton field, Bikaner, Bikaner district, 22.ii.1989, H.K. Vyas coll.

Distribution INDIA : Gujarat (Kutch), Rajasthan (Bikaner), Tamil Nadu. *Elsewhere* : Pakistan.

Remarks : This is the first record of the species from Rajasthan. Further studies are needed to determine its pest status.

23. ***Eremotermes neoparadoxalis*** Ahmad, 1955
(Pl. III, fig. 23)

1960. *Eremotermes neoparadoxalis*, Roonwal & Sen-Sarma, *Ind. Counc. agric. Res. Entom. Monogr.*, No. 1 : 79.

1989. *Eremotermes neoparadoxalis*, Thakur, *Ind. For. Rec.*, **15** (1) : 27.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 35 soldiers, 51 workers, ex. dry twig, Dantiwada, Banaskantha district, 23.xii.1986, N.S. Rathore coll. 1 soldier, 9 workers, ex. under heaps of leaves, Gomadi village, Sabarkantha district, 29.xi.1986, N.S. Rathore coll. RAJASTHAN : 23 soldiers, 28 workers, ex, soil, Pithla, Jaisalmer district, 24.vii.1995, N.S. Rathore coll. 17 soldiers, 5 workers, ex. ground, Balewa, Barmer district, 18.vii.1995, N.S. Rathore coll. 4 soldiers, 6 workers, ex. roots of linseed, Nandiad, Jodhpur district, 19.ix.2000, A.K. Bhattacharyya coll.

Distribution : INDIA : Delhi, Gujarat (Banaskantha, Dangs, Sabarkantha, Valsad), Rajasthan (Barmer, Bikaner, Jaipur, Jaisalmer, Jodhpur). *Elsewhere* : Pakistan.

Remarks : This is a soil-dwelling species, earlier mostly collected from cow-dung, decaying wood, open as well as cultivated fields. The present record of this species from Gomadi village is an extension of range within the Gujarat state from southern towards northern Gujarat.

24. ***Eremotermes paradoxalis*** Holmgren, 1912
(Pl. III, fig. 24)

1960. *Eremotermes paradoxalis*, Roonwal & Sen-Sarma, *Ind. Counc. agric. Res. Entom. Monogr.*, No. 1 : 85.

1989. *Eremotermes paradoxalis*, Thakur, *Ind. For. Rec.*, **15** (1) : 27.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 31 soldiers, 153 workers, ex. cow-dung, Dantiwada, Banaskantha district, 24.xii.1986, N. S. Rathore coll. RAJASTHAN : 30 alates, ex. ground, Barna village, Jaisalmer district, 24.vii.1995, N.S. Rathore coll. 50 soldiers, ex. under stone, Pithla, Jaisalmer district, 24.vii.1995, N.S. Rathore coll. 3 soldiers, 20 workers, ex. cotton field, Bikaner, Bikaner district, 22.ii.1989, H.K. Vyas coll. 2 soldiers, 14 workers, ex. castor field, Bikaner, Bikaner district, 22.ii.1989, H.K. Vyas coll.

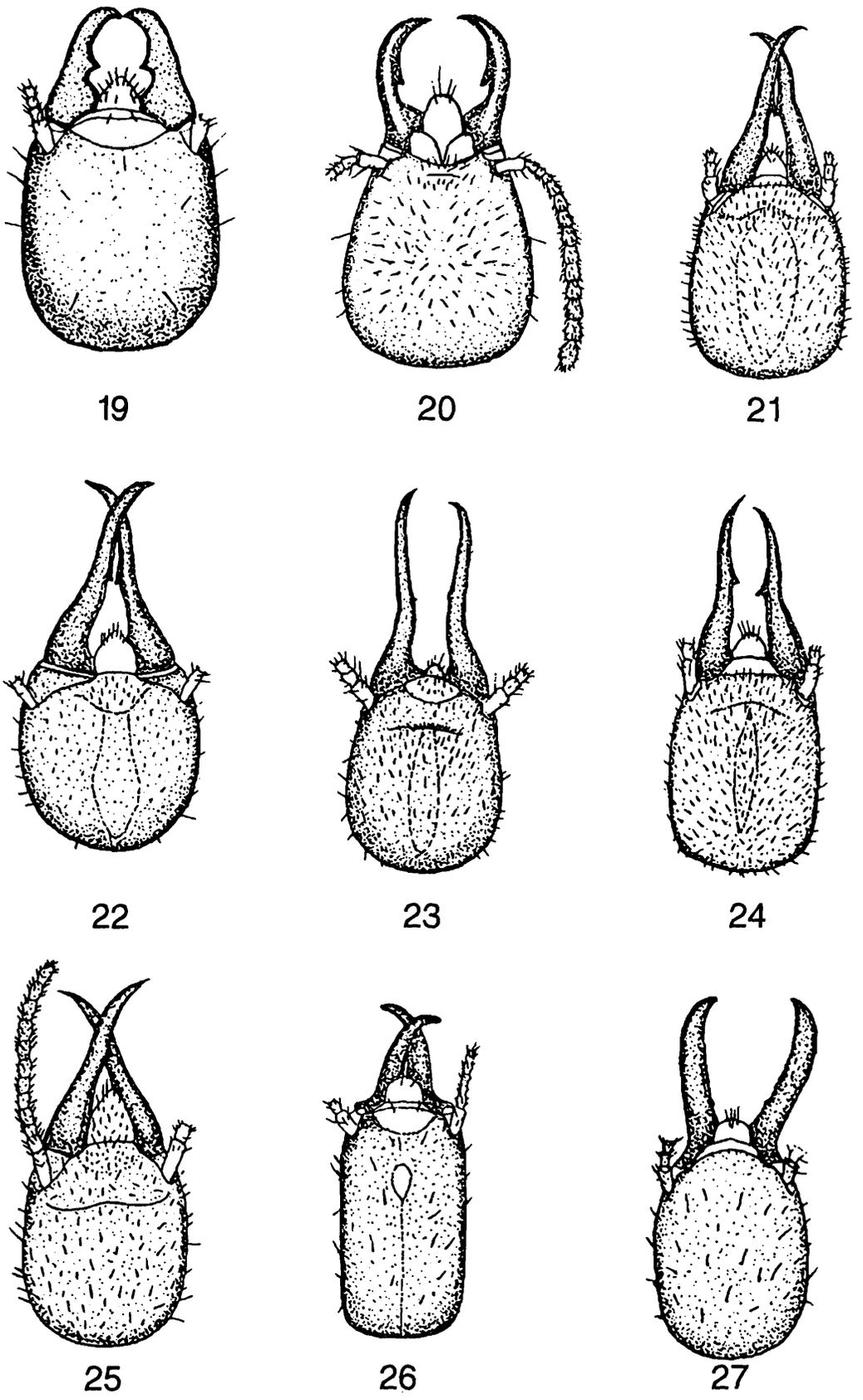


PLATE III : Heads of soldiers. (19) *Synhamitermes quadriceps.* (20) *Amitermes belli.* (21) *Eremotermes dehraduni.* (22) *Eremotermes fletcheri.* (23) *Eremotermes neoparadoxalis.* (24) *Eremotermes paradoxalis.* (25) *Eremotermes sanyuktae.* (26) *Microcerotermes annandalei.* (27) *Microcerotermes baluchistanicus.*

Distribution : INDIA : Bihar, Delhi, Gujarat (Banaskantha, Vadodara), Karnataka, Kerala, Madhya Pradesh, Punjab, Rajasthan (Bikaner, Kota, Jaipur, Jaisalmer, Jodhpur, Nagaur), Tamil Nadu. *Elsewhere* : Pakistan.

Remarks : The species has been found to damage the cotton and castor plantation.

25. ***Eremotermes sanyuktae*** Thakur, 1989
(Pl. III, fig. 25)

1989. *Eremotermes sanyuktae* Thakur, *Ind. For. Rec.*, **15** (1) : 28.

Caste known : Soldier, worker.

Material examined : GUJARAT : 1 soldier, 59 workers, ex. dry stump and root of Bajra plant, agricultural field near Magdalla Port, Surat district, 25.xii.1980, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Surat).

Remarks : The species is known only from its type-locality. Economic importance of this species is not yet known.

26. ***Microcerotermes annandalei*** Silvestri, 1923
(Pl. III, fig. 26)

1986. *Microcerotermes annandalei,* Rathore, *J. Bombay nat. Hist. Soc.*, **83** (1) : 244.

Caste known : Alate, soldier, worker.

Material examined : RAJASTHAN : 1 alate, 5 soldiers, 2 workers, ex. dry trunk of date palm tree, Sariska Forest, Alwar district. 18.vi.1983, N.S. Rathore coll.

Distribution : INDIA : Bihar, Nagaland, Orissa, Rajasthan (Alwar), Tripura.

Remarks : It is basically wet zone species and are reported from heavy rainfall areas of Nagaland.

27. ***Microcerotermes baluchistanicus*** Ahmad, 1955
(Pl. III, fig. 27)

1977. *Microcerotermes baluchistanicus,* Verma & Thakur, *Newsl. zool. Surv. India,* **3** (1) : 14.

Caste known : Imago, soldier, worker.

Material examined : RAJASTHAN : 2 soldiers, 18 workers, ex. dry wooden log, Central Arid Zone Research Institute, Jodhpur, Jodhpur district, 11.ix.1975, D.R. Parihar coll. 2 soldiers, 28 workers, ex. dry wooden log, Central Arid Zone Research Institute, Jodhpur, Jodhpur district, 25.x.1975, D.R. Parihar coll.

Distribution : INDIA : Rajasthan (Jodhpur). *Elsewhere* : Pakistan.

Remarks : The species is evidently an arid zone species and endemic to Rajasthan.

28. ***Microcerotermes beesoni*** Snyder, 1933
(Pl. IV, fig. 28)

1989. *Microcerotermes beesoni*, Thakur, *Ind. For. Rec.*, **15** (1) : 31.

Caste known : Soldier, worker.

Material examined : GUJARAT : 27 soldiers, 57 workers, ex. wild bush, Chhani village, Vadodara district, 13.xi.1976, N.S. Rathore coll.

Distribution : INDIA : Assam, Delhi, Gujarat (Vadodara), Haryana, Madhya Pradesh, Orissa, Punjab, Uttar Pradesh, West Bengal. *Elsewhere* : Bangladesh, Bhutan, Pakistan.

Remarks : This versatile species occurs in moderate to heavy rainfall area.

29. ***Microcerotermes cameroni*** Snyder, 1934
(Pl. IV, fig. 29)

1968. *Microcerotermes cameroni*, Chatterjee & Thakur, *Indian Forester*, **94** (7) : 565.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 3 soldiers, 19 workers, ex. under wooden log, Gomadi village, Sabarkantha district, 29.xi.1986, R.C. Sharma coll.

Distribution : INDIA : Andhra Pradesh, Gujarat (Banaskantha, Kutch, Sabarkantha, Valsad), Kerala, Tamil Nadu, West Bengal.

Remarks : The species is equally distributed in the low rainfall areas of Kutch to the heavy rainfall area of Kheda, indicating its versatile nature.

30. ***Microcerotermes dumasensis*** Thakur, 1989
(Pl. IV, fig. 30)

1989. *Microcerotermes dumasensis*, Thakur, *Ind. For. Rec.*, **15** (1) : 32.

Caste known : Soldier, worker.

Material examined : GUJARAT : 163 soldiers, 93 workers, ex. carton nest on *Prosopis julliflora* plant, Dumas, Surat district, 25.ii.1981, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Surat).

Remarks : The species is known only from its type-locality. Although the genus is brodaly termed as a subterranean one but the only known habitat (*i.e.*, carton nest) of this species indicate its moisture-loving nature also.

31. ***Microcerotermes heimi*** Wasmann, 1902
(Pl. IV, fig. 31)

1913. *Microcerotermes heimi*, Assmuth, *J. Bombay nat. Hist. Soc.*, **23** (2) : 374.

Caste known : Soldier, worker.

Material examined : GUJARAT : 72 soldiers, 24 workers, ex. dry twigs, Ratanpur village, Kutch district, 2.iii.1989, N.S. Rathore coll. 37 soldiers, 69 workers, ex. dry tree stump, Radhanpur, Banaskantha district, 21.ii.1989, N.S. Rathore coll. 9 soldiers, 17 workers, ex. dry bush, Dantiwada Dam area, Banaskantha district, 9.iii.1992, N.S. Rathore coll. 8 soldiers, 31 workers, ex. under stone, Modera, Mahesana district, 13.ix.1992, N.S. Rathore coll. 41 soldiers, 29 workers, ex. cow-dung, Dharoi Dam area, Mahesana district, 14.ix.1992, N.S. Rathore coll. RAJASTHAN : 3 soldiers, 15 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 10.ix.1994, N.S. Rathore & S. Kumar coll. 1 soldier, 12 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 3.iv.1996, N.S. Rathore & S. Kumar coll.

Distribution : INDIA Assam, Gujarat (Banaskantha, Kutch, Mahesana), Karnataka, Maharashtra, Rajasthan (Nagaur, Udaipur). *Elsewhere* : Sri Lanka.

Remarks : The present record is for the first time from Rajasthan. The species is basically a wet zone species and strays into the arid and semi-arid zone of Gujarat.

32. ***Microcerotermes laxmi*** Roonwal & Bose, 1964
(Pl. IV, fig. 32)

1964. *Microcerotermes tenuignathus laxmi* Roonwal & Bose, *Zoologica*, **40** (3) (Heft 113) : 29.

Caste known : Soldier, worker.

Material examined : RAJASTHAN : 5 soldiers, 30 workers, ex. dry stems of Bajra, Harsani, Barmer district, 19.vii.1995, N.S. Rathore coll.

Distribution INDIA : Rajasthan (Barmer, Bikaner).

Remarks : The species is endemic to Rajasthan and evidently an arid zone species.

33. ***Microcerotermes palestinensis*** Spaeth, 1962
(Pl. IV, fig. 33)

1989. *Microcerotermes palestinensis*, Thakur, *Ind. For. Rec.*, **15** (1) : 36.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 31 soldiers, 62 workers, ex. dry twigs, Tharad village, Radhanpur, Banaskantha district, 22.ii.1989, N.S. Rathore coll. 3 soldiers, 27 workers, ex. trunk of mango tree, Khambhat, Kheda district, 22.ii.1991, N.S. Rathore coll. 16 soldiers, 25 workers, ex. dry straw, Kheroj village, Sabarkantha district, 6.iii.1992, N.S. Rathore coll. RAJASTHAN : 7 soldiers, 18 workers, ex. lemon tree stem, Mandore Garden, Jodhpur, Jodhpur district, 18.vi.1987, N.S. Rathore coll. 2 soldiers, 30 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 10.ix.1994, N.S. Rathore & S. Kumar coll.

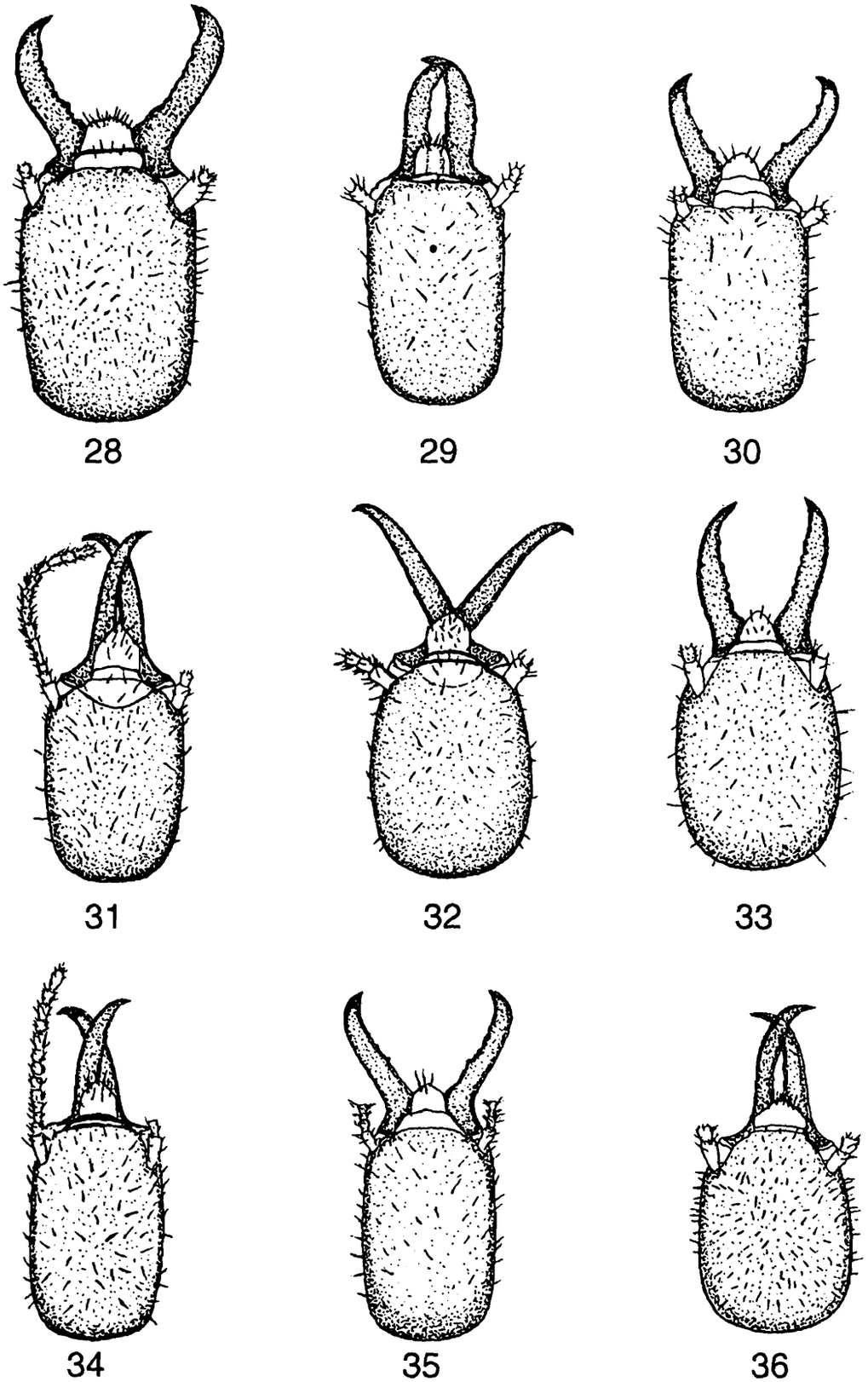


PLATE IV : Heads of soldiers. (28) *Microcerotermes beesoni.* (29) *Microcerotermes cameroni.* (30) *Microcerotermes dumasensis.* (31) *Microcerotermes heimi.* (32) *Microcerotermes laxmi.* (33) *Microcerotermes palestinensis.* (34) *Microcerotermes raja.* (35) *Microcerotermes sakesarensis.* (36) *Microcerotermes tenuignathus.*

Distribution : INDIA : Gujarat (Banaskantha, Kheda, Kutch, Sabarkantha), Rajasthan (Jodhpur, Udaipur). *Elsewhere* : Israel.

Remarks : Distribution of this species in two widely separated geographical areas can be explained only after the complete exploration of the isopteran fauna of the neighbouring countries. The economic importance of the species in Indian context is not known.

34. ***Microcerotermes raja*** Roonwal & Bose, 1964
(Pl. IV, fig. 34)

1964. *Microcerotermes championi raja* Roonwal & Bose, *Zoologica*, **40** (3) (Heft 113) : 26.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 9 soldiers, 137 workers, ex. dry tree stump, Jhear village, Danta, Banaskantha district, 25.ii.1986, R.C. Sharma coll. RAJASTHAN : 76 alates, 4 workers, 20 soldiers, ex. swarming, Turvi, Barmer district, 20.vii.1995, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Banaskantha), Rajasthan (Barmer, Jaisalmer, Jodhpur, Nagaur, Udaipur).

Reamrks : This is the first record of the species from Gujarat. It is basically a semi-arid and arid zone species, but its occurrence from Udaipur area further extends its range in Aravallis.

35. ***Microcerotermes sakesarensis*** Ahmad, 1955
(Pl. IV, fig. 35)

1976. *Microcerotermes sakesarensis*, Roonwal, *Zool. Jb. Syst. Bd.*, **103** : 464.

1984. *Microcerotermes sakesarensis*, Thakur, *J. Bombay nat. Hist. Soc.*, **81** (2) : 496.

Caste known : Soldier, worker.

Material examined : GUJARAT : 29 soldiers, 49 workers, ex. under tree bark, Danta Forest area, Palanpur, Banaskantha district, 19.ii.1992, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Banaskantha), Madhya Pradesh, Rajasthan (Jaipur). *Elsewhere* : Pakistan.

Remarks : This species is known from all the three well-connected neighbouring states.

36. ***Microcerotermes tenuignathus*** Holmgren, 1913
(Pl. IV, fig. 36)

1913. *Microcerotermes tenuignathus* Holmgren, *J. Bombay nat. Hist. Soc.*, **22** (1) : 116.

1964. *Microcerotermes tenuignathus tenuignathus* Roonwal & Bose, *Zoologica*, **40** (3) (Heft 113) : 28.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 52 soldiers, 63 workers, ex. dry twigs, Varahi village, Radhanpur, Banaskantha district, 21.ii.1989, N.S. Rathore coll. 42 soldiers, 39 workers, ex. dry twigs, Kandhoka Dunger village, Kutch district, 14.iii.1989, N.S. Rathore coll. 9 soldiers, 15 workers, ex. dry tree stump, Lakhtar Dam area, Surendranagar district, 13.ii.1991, N.S. Rathore coll. RAJASTHAN : 11 workers, 3 soldiers, ex. dry stem, Girab, Barmer district, 10.ii.1995, N.S. Rathore coll. 3 soldiers, 22 workers, ex. date palm tree, shoreline of Pichola Lake, Udaipur district, 28.viii.1995, N.S. Rathore & S. Kumar coll. 2 soldiers, 29 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 28.viii.1995, N.S. Rathore & S. Kumar coll.

Distribution : INDIA : Delhi, Gujarat (Banaskantha, Junagadh, Kutch, Surendranagar), Maharashtra, Rajasthan (Barmer, Jaisalmer, Jaipur, Jodhpur, Kota). *Elsewhere* : Pakistan.

Remarks : The species is a verstile one and occurs in dry to wet and moist areas.

Subfamily (vi) TERMITINAE Sjostedt, 1926

37. ***Angulitermes dehraensis*** (Gardner, 1945)
(Pl. V, fig. 37)

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 2 soldiers, 9 workers, in association with *Microtermes mycophagous*, ex. dry twig, Ambaji Forest area, Palanpur, Banaskantha district, 24.xi.1986, R.C. Sharma coll. RAJASTHAN : 2 soldiers, 8 workers, ex. under stone, Jalipa Tank, 13 km. E of Barmer, Barmer district, 15.viii.1978, N.S. Rathore coll. 4 soldiers, 12 workers, ex. dry twig, Neemadi village, 22 km. W of Barmer, Barmer district, 16.viii.1978, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Banaskantha), Rajasthan (Barmer), Uttar Pradesh, *Elsewhere* : Afghanistan, Pakistan.

Remarks : This is the first record of the species from Gujarat and Rajasthan.

38. ***Angulitermes jodhpurensis*** Roonwal & Verma, 1977
(Pl. V, fig. 38)

1976. *Angulitermes jodhpurensis* Roonwal & Verma, *Zool. Jb. Syst. Bd.*, **103** : 464. (Ms. name).

Caste known : Imago, soldier, worker.

Material examined : RAJASTHAN : 15 soldiers, 60 workers, ex. ground, Paota, Jodhpur, Jodhpur district, 1.vi.1972, M.L. Roonwal coll. 77 alates, ex. ground, Paota, Jodhpur, Jodhpur district, 10.vii.1972, M.L. Roonwal coll.

Distribution : INDIA : Rajasthan (Jodhpur).

Remarks : This arid zone species shows endemicity to Rajasthan.

39. ***Dicuspiditermes incola*** (Wasmann, 1893)
(Pl. V, fig. 39)

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 5 soldiers, 38 workers, ex. under stone, Saputara Hills, Dangs district, 9.viii.1989, R. Sewak coll.

Distribution : INDIA : Gujarat (Dangs), Karnataka, Kerala, Maharashtra, Madhya Pradesh, Tamil Nadu, West Bengal. *Elsewhere* : Sri Lanka.

Remarks : The species is being reported for the first time from Gujarat.

Subfamily (vii) MACROTERMITINAE Kemner, 1934

40. ***Odontotermes anamallensis*** Holmgren & Holmgren, 1917
(Pl. V, fig. 40)

Caste known : Soldier, worker.

Material examined : GUJARAT : 20 soldiers, 57 workers, ex. under stone, Karjan, Vadodara district, 21.iii.1988, R. Sewak coll.

Distribution : INDIA : Gujarat (Vadodara), Karnataka, Kerala, Tamil Nadu.

Remarks : This is the first record of the species from Gujarat.

41. ***Odontotermes assmuthi*** Holmgren, 1913
(Pl. V, fig. 41)

1981. *Odontotermes assmuthi,* Thakur, *Ind. For. Rec.,* **14** (2) : 16.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 62 soldiers, 73 workers, ex. cow-dung, Thordoi village, Khavda, Kutch district, 16.i.1981, N.S. Rathore coll. 17 soldiers, 6 workers, ex. under log, Saputara Hills, Dangs district, 14.i.1989, R.K. Singh coll.

Distribution : INDIA : Assam, Bihar, Gujarat (Dangs, Kutch), Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Tamil Nadu. *Elsewhere* : Bangladesh, Pakistan.

Remarks : Earlier this species was known from Saurashtra (Sasan Gir) and Kutch-Bhuj. In the present study it has been found to extend the range to south Gujarat (Dangs).

42. ***Odontotermes bellahunisensis*** Holmgren & Holmgren, 1917
(Pl. V, fig. 42)

1962. *Odontotermes bellahunisensis bellahunisensis,* Roonwal & Bose, *J. Bombay nat. Hist. Soc.,* **58** (3) : 580.

1989. *Odontotermes bellahunisensis,* Thakur, *Ind. For. Rec.,* **15** (1) : 40.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 5 soldiers, 20 workers, ex. grass, Harij, Mahesana district, 17.iii.1986, R. Sewak coll. 87 soldiers, 43 workers, ex. cow-dung, Vijapur, Mahesana district, 15.iii.1986, R. Sewak coll. 13 soldiers, 73 workers, ex. under stone, Jhear village, Dantiwada, Banaskantha district, 23.xi.1986, R.C. Sharma coll. 6 soldiers, 34 workers, ex. under stone, Waghai, 32 km. E of Ahwa, Dangs district, 14.iii.1988, R. Sewak coll. 13 soldiers, 27 workers, ex. dry twig, Dantiwada, Banaskantha district, 23.xi.1986, R.C. Sharma coll. 6 soldiers, 14 workers, ex. dry twig, Navalpur, 21 km. E of Himmatnagar, Sabarkantha district, 30.xi.1986, R.C. Sharma coll. 3 soldiers, 7 workers, ex. dry twig, Limbhoi village, Sabarkantha district, 28.xi.1986, R.C. Sharma coll. 2 soldiers, 8 workers, ex. dry stem of Babool, Jhear village, Danta, Banaskantha district, 25.xi.1986, R.C. Sharma coll. 8 soldiers, 27 workers, ex. under stone, Mahuva, 48 kms. SW of Surat, Surat district, 5.iii.1988, R. Sewak coll.

Distribution : INDIA : Andhra Pradesh, Assam, Bihar, Gujarat (Banaskantha, Bharuch, Dangs, Gandhinagar, Jamnagar, Kheda, Kutch, Mahesana, Rajkot, Sabarkantha, Surat, Vadodara, Valsad), Karnataka, Maharashtra, Rajasthan (Jhunjhunu, Nagaur, Sikar, Udaipur), Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Pakistan

Remarks : This species is widely distributed in both the states.

43. ***Odontotermes bhagwathi*** Chatterjee & Thakur, 1967
(Pl. V, fig. 43)

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 6 soldiers, 59 workers, ex. under wooden log, Navalpur, Sabarkantha district, 30.xi.1986, R.C. Sharma coll. 4 soldiers, 11 workers, ex. under stone, Kim, Surat district, 4.iii.1988, R. Sewak coll.

Distribution : INDIA : Delhi, Gujarat (Sabarkantha, Surat), Jammu & Kashmir, Madhya Pradesh, Punjab, Uttar Pradesh.

Remarks : This is the first record of the species from Gujarat.

44. ***Odontotermes brunneus*** (Hagen, 1858)
(Pl. V, fig. 44)

1961. *Odontotermes (Odontotermes) brunneus*, Kushwaha, *Curr. Sci.*, **30** : 230.

1973. *Odontotermes brunneus,* Roonwal, *Proc. Ind. natnl. Sci. Acad.*, **39** (1) : 6.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 32 soldiers, 74 workers, ex. under stone, Tankara, Rajkot district, 8.ix.1990, R. Sewak coll. 2 soldiers, 2 workers, ex. under stone, Carzan, Vadodara district, 21.iii.1988, R. Sewak coll.

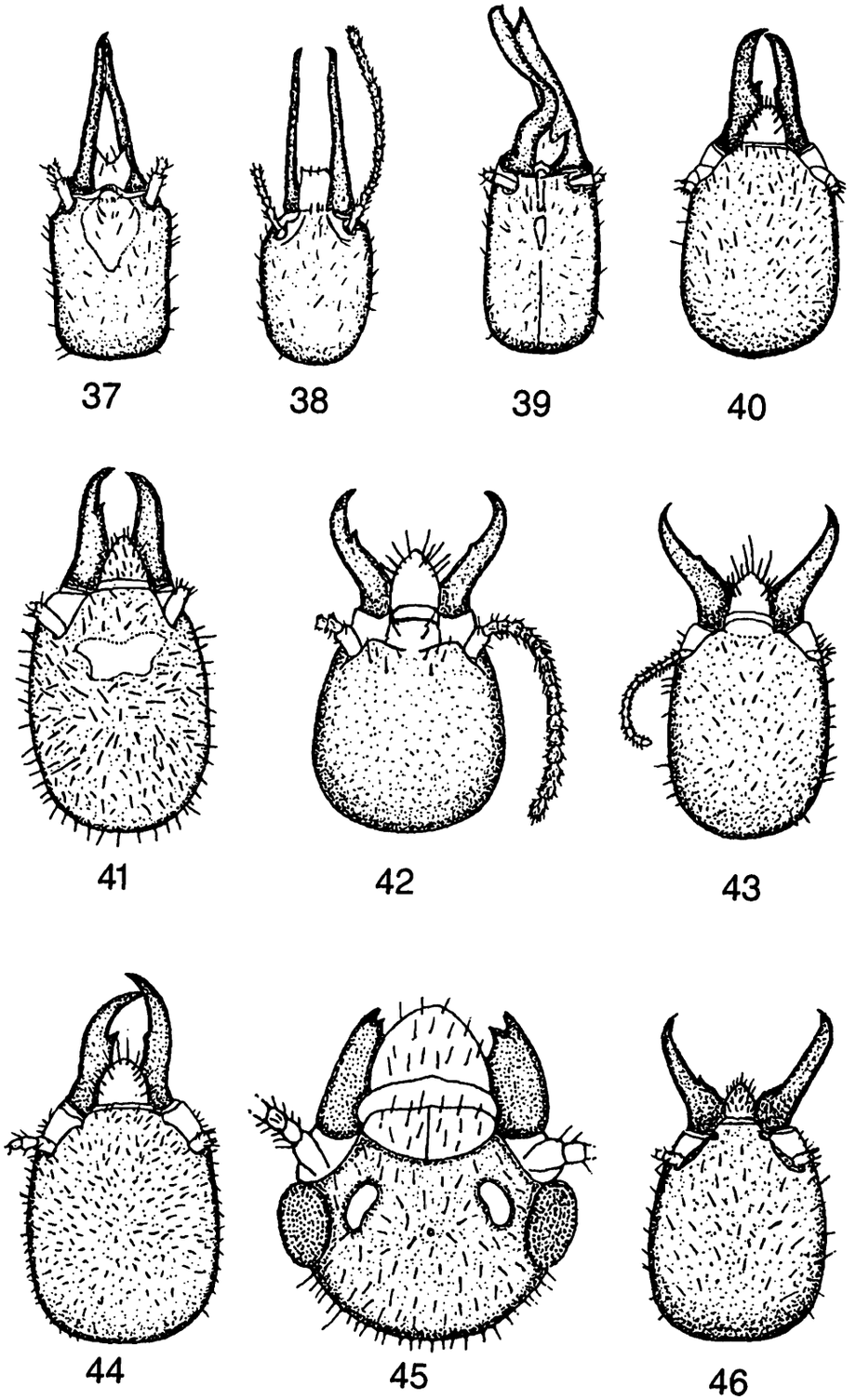


PLATE V : Heads of soldiers and alate. (37) *Angulitermes dehraensis*, S. (38) *Angulitermes jodhpurensis*, S. (39) *Dicuspiditermes incola*, S. (40) *Odontotermes anamallensis*, S. (41) *Odontotermes assmuthi*, S. (42) *Odontotermes bellahunisensis*, S. (43) *Odontotermes bhagwathi*, S. (44) *Odontotermes brunneus*, S. (45) *Odontotermes dehraduni*, A. (46) *Odontotermes distans*, S. [S = Soldier, A = Alate].

Distribution : INDIA : Andhra Pradesh, Gujarat (Rajkot, Vadodara), Karnataka, Kerala, Maharashtra, Orissa, Rajasthan (Tonk), Tamil Nadu, Uttar Pradesh. *Elsewhere* : Sri Lanka.

Remarks : This species builts earthen mounds of 3 to 4 feet height.

45. ***Odontotermes dehraduni*** (Snyder, 1934)
(Pl. V, fig. 45)

1976. *Odontotermes dehraduni,* Roonwal, *Zool. Jb. Syst. Bd.,* **103** : 488.

Caste known : Imago, soldier, worker.

Material examined : RAJASTHAN : 100 imagoes, ex. light trap, Paota, Jodhpur district, 5.vii.1985, P.D. Gupta coll. 2 soldiers, 9 workers, ex. cotton field, Bikaner, Bikaner district, 22.ii.1989, H.K. Vyas coll.

Distribution : INDIA : Delhi, Jammu & Kashmir, Karnataka, Kerala, Rajasthan (Bikaner, Jodhpur), Tamil Nadu, Uttar Pradseh. *Elsewhere* : Pakistan, Sri Lanka.

Remarks : The species has been collected from cotton field and are found to damage the crop plants. Further exploration is needed to determine whether this species is considered to be a pest. Earlier only imagoes were known from Rajasthan.

46. ***Odontotermes distans*** Holmgren & Holmgren, 1917
(Pl. V, fig. 46)

1976. *Odontotermes distans,* Roonwal, *Zool. Jb. Syst. Bd.,* **103** : 464.

1981. *Odontotermes distans,* Thakur, *Ind. For. Rec.,* **44** (2) : 16.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 9 soldiers, 15 workers, ex. under stone, Danta Forest, Palanpur, Banaskantha district, 22.i.1978, N.S. Rathore coll. 16 soldiers, 3 workers, ex. bark of mango tree, Kaprada village, Valsad district, 28.xii.1980, N.S. Rathore coll. 9 soldiers, 16 workers, ex. dead tree trunk, Bordevi Forest area, near Girnar Hill, Junagadh district, 7.1.1981, N.S. Rathore coll.

Distribution : INDIA : Assam, Gujarat (Banaskantha, Bharuch, Bhavnagar, Junagadh, Valsad), Rajasthan (Jodhpur), Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Bhutan, Pakistan.

Remarks : This species shows its uniqueness in its adaptability as it is evidenced that its occurrence has been reported at an altitude of 2100 m. in the Himalayas.

47. ***Odontotermes feae*** (Wasmann, 1896)
(Pl. VI, fig. 47)

1976. *Odontotermes feae,* Roonwal, *Zool. Jb. Syst. Bd.,* **103** : 488.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 4 soldiers, 6 workers, ex. under stone, from Surat Road, 6 km. N of Valsad, Valsad district, 8.iii.1988, R. Sewak coll. 8 soldiers, 78 workers, ex. under wooden log, Jogbel, Valsad district, 15.viii.1989, R. Sewak coll.

Distribution : INDIA : Assam, Gujarat (Valsad), Karnataka, Madhya Pradesh, Orissa, Rajasthan (Sirohi), Tamil Nadu, West Bengal. *Elsewhere* : Bangladesh, Bhutan, Myanmar, Nepal, Sri Lanka, Thailand, Vietnam.

Remarks : This is the first record of the species from Gujarat.

48. ***Odontotermes giriensis*** Roonwal & Chhotani, 1962
(Pl. VI, fig. 48)

1976. *Odontotermes giriensis,* Roonwal, *Zool. Jb. Syst. Bd.,* **103** : 488.

1989. *Odontotermes giriensis,* Thakur, *Ind. For. Rec.,* **15** (1) : 45.

Caste known : Soldier, worker.

Material examined : GUJARAT : 30 Soldiers, 54 workers, ex. ground, Gomadi village, Sabarkantha district, 29.xi.1986, R.C. Sharma coll.

Distribution : INDIA : Arunachal Pradesh, Assam, Delhi, Gujarat (Bharuch, Bhavnagar, Dangs, Junagadh, Sabarkantha, Valsad), Manipur, Meghalaya, Orissa, Rajasthan (Nagaur, Sikar), Tripura, Uttar Pradesh. *Elsewhere* : Bangladesh.

Remarks : This species is recorded from a number of districts in Gujarat state with relatively thick vegetation whereas from Rajasthan it is recorded from arid areas only.

49. ***Odontotermes girnarensis*** Thakur, 1989
(Pl. VI, fig. 49)

1984. *Odontotermes girnarensis,* Thakur, *J. Bombay nat. Hist. Soc.,* **81** (2) : 496. (Ms. name).

Caste known : Soldier, worker.

Material examined : GUJARAT : 2 soldiers, 27 workers, ex. ground, Mahesana district, 27.x.1964, V.C. Agarwal coll. 7 soldiers, 18 workers, ex. ground, Manawat village, Chhota Udaipur, Vadodara district, 23.xii.1980, N.S. Rathore coll. 13 soldiers, 35 workers, ex. ground, Mankodi village, Chhota Udaipur, Vadodara district, 24.xii.1980, N.S. Rathore coll. 5 soldiers, 17 workers, ex. teak plantation, Forest Rest House, Kaprada, Valsad district, 27.xii.1980, N.S. Rathore coll. 2 soldiers, 8 workers, ex. ground, Pathik Ashram compound, Gandhinagar, Gandhinagar district, 1.i.1981, N.S. Rathore coll. 5 soldiers, 25 workers, ex. agricultural field, Amreli, Amreli district, 5.i.1981, N.S. Rathore coll. 6 soldiers, 24 workers, ex. litter, Forest area, Bordevi, Junagadh district, 7.i.1981, N.S. Rathore coll. 3 soldiers, 17 workers, ex. ground, Bhavnath Panchayat Rest House, Nalpani, Junagadh District, 7.i.1981, N.S. Rathore coll. 7 soldiers, 18 workers, ex. ground, Jhodiya village, Jamnagar district, 13.i.1981,

N.S. Rathore coll. 2 soldiers, 8 workers, ex. ground, Agricultural field, Jamnagar district, 14.i.1981, N.S. Rathore coll. 3 soldiers, 12 workers, ex. wild vegetation, Thordoi village, Khavda, Kutch district, 16.i.1981, N.S. Rathore coll. 1 soldier, 9 workers, ex. ground, Chekkar village, Kutch district, 17.i.1981, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Amreli, Gandhinagar, Jamnagar, Junagadh, Kutch, Mahesana, Panchmahal, Vadodara, Valsad).

Remarks : This seems to be well-distributed species in Gujarat state and almost covers east to west and north to south.

50. ***Odontotermes guptai*** Roonwal & Bose, 1961
(Pl. VI, fig. 50)

1961. *Odontotermes guptai* Roonwal & Bose, *J. Bombay nat. Hist. Soc.*, **58** (3) : 588.

Caste known : Imago, soldier, worker.

Material examined : RAJASTHAN : 32 soldiers, 112 workers, ex. ground, Didwana, Nagaur district, 12.ii.1974, S.C. Verma coll. 12 soldiers, 38 workers, ex. soil, Sambhar Lake, Nagaur district, 7.ii.1972, S.C. Verma coll.

Distribution : INDIA : Assam, Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Rajasthan (Ajmer, Bikaner, Jhunjhunu, Nagaur, Sikar, Udaipur), Uttar Pradesh. *Elsewhere* : Bangladesh, Pakistan.

Remarks : The species is a versatile one.

51. ***Odontotermes gurdaspurensis*** Holmgren & Holmgren, 1917
(Pl. VI, fig. 51)

1976. *Odontotermes gurdaspurensis*, Roonwal, *Zool. Jb. Syst. Bd.*, **103** : 464.

1989. *Odontotermes gurdaspurensis*, Thakur, *Ind. For. Rec.*, **15** (1) : 49.

Caste known : Alate, soldier, worker.

Material examined : GUJARAT : 27 soldiers, 17 workers, ex. under stone, Junagadh Rampur-Rajkot Road, Junagadh district, 4.iii.1986, R. Sewak coll. 21 soldiers, 28 workers, ex. under stone, Chotilla and Soyla, Surendranagar district, 13.iii.1986, R. Sewak coll. 6 soldiers, 32 workers, ex. under stone, Jainabad, Surendranagar district, 12.iii.1986, R. Sewak coll. 8 soldiers, 51 workers, ex. under stone, Limbhoi village, Sabarkantha district, 28.xi.1986, R.C. Sharma coll. 7 soldiers, 19 workers, ex. under stone, Tilakwada, Vadodara district, 20.iii.1988, R. Sewak coll. 7 soldiers, 31 workers, ex. ground, Deshalpar village, Kutch district, 25.ii.1989, N.S. Rathore coll. RAJASTHAN : 7 soldiers, 18 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 9.iii.1995, N.S. Rathore & S. Kumar coll. 6 soldiers, 11 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 1.iv.1997, N.S. Rathore & S. Kumar coll.

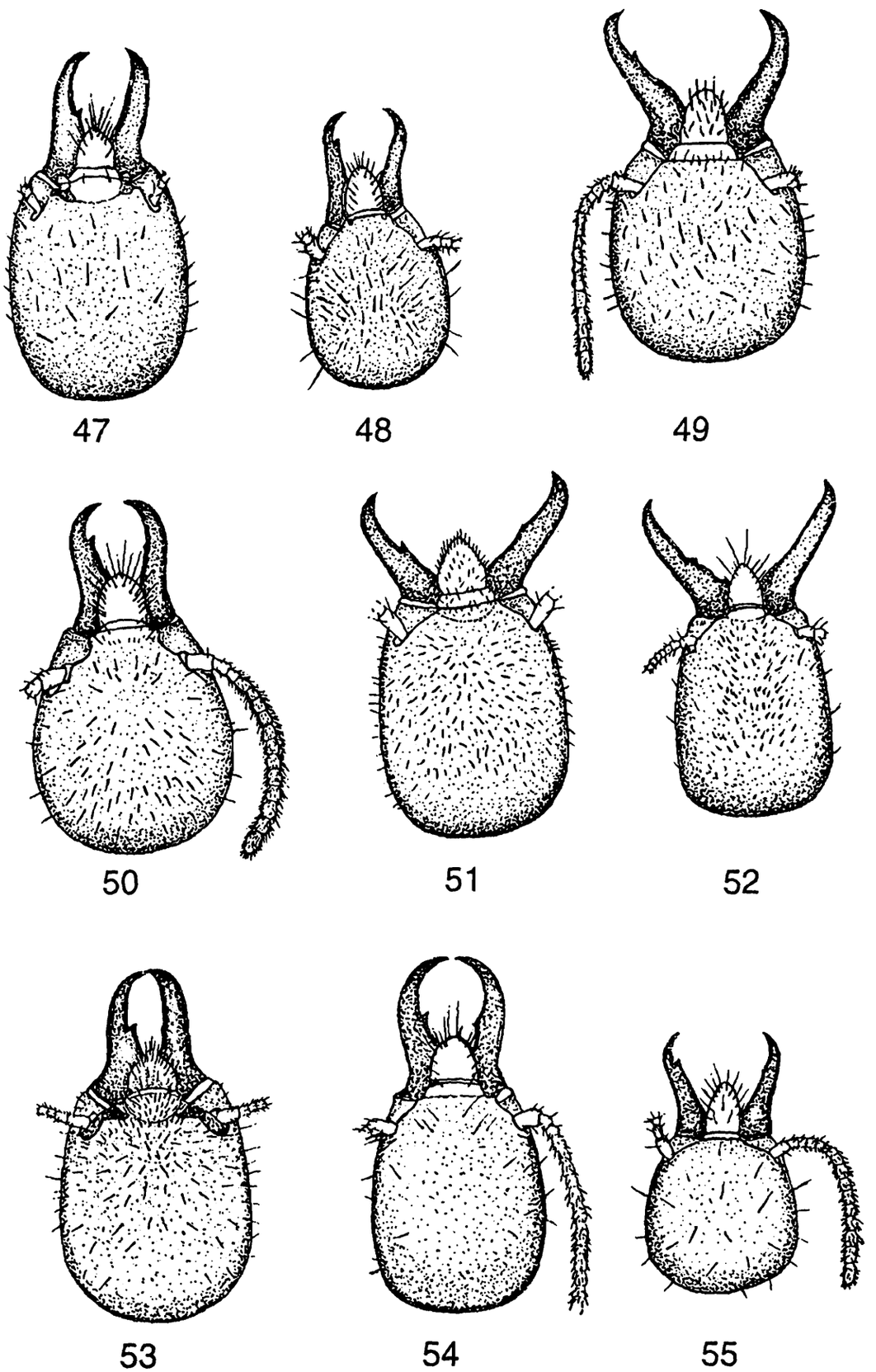


PLATE VI : Heads of soldiers. (47) *Odontotermes feae.* (48) *Odontotermes giriensis.* (49) *Odontotermes girnarensis.* (50) *Odontotermes guptai.* (51) *Odontotermes gurdaspurensis.* (52) *Odontotermes horai.* (53) *Odontotermes indicus.* (54) *Odontotermes kushwahai.* (55) *Odontotermes latiguloides.*

Distribution : INDIA : Gujarat (Ahmedabad, Amreli, Banaskantha, Dangs, Jamnagar, Mahesana, Rajkot, Valsad, Junagadh, Kutch, Surendranagar, Sabarkantha, Vadodara), Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Punjab, Rajasthan (Ajmer, Banswara, Bharatpur, Jodhpur, Nagaur, Udaipur), Uttar Pradesh, West Bengal. *Elsewhere* : Pakistan.

Remarks : It is a well-known mound building termite species and have capability to attack wood-work in houses.

52. ***Odontotermes horai*** Roonwal & Chhotani, 1962
(Pl. VI, fig. 52)

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 2 soldiers, 16 workers, ex. under wooden log, Navalpur, Sabarkantha district, 30.xi.1986, R.C. Sharma coll.

Distribution : INDIA : Gujarat (Sabarkantha), Madhya Pradesh, Meghalaya, Nagaland, Uttar Pradesh, West Bengal. *Elsewhere* : Nepal, Pakistan.

Remarks : The species is being recorded for the first time from Gujarat.

53. ***Odontotermes indicus*** Thakur, 1981
(Pl. VI, fig. 53)

1981. *Odontotermes indicus*, Thakur, *Ind. For. Rec.*, **14** (2) : 70.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 62 soldiers, 91 workers, ex. under stone, Saputara Hills, Dangs district, 15.iii.1988, R. Sewak coll.

Distribution : INDIA : Gujarat (Dangs, Junagadh, Kheda, Panchmahal), Maharashtra, Orissa.

Remarks : The species live where sufficient moist condition is available.

54. ***Odontotermes kushwahai*** Roonwal & Bose, 1964
(Pl. VI, fig. 54)

1964. *Odontotermes brunneus kushwahai*, Roonwal & Bose, *Zoologica*, **40** (3) (Heft 113) : 33.

1973. *Odontotermes brunneus kushwahai*, Roonwal, *Proc. Ind. Sci. Acad.*, (B) **39** : 63.

Caste known : Soldier, worker.

Material examined : GUJARAT : 14 soldiers, 62 workers, ex. cow-dung, Bodeli, Vadodara district, 18.iii.1988, R. Sewak coll. 5 soldiers, 19 workers, ex. ground, Adara village, Rajkot district, 23.viii.1988, R.N. Bhargava coll. 8 soldiers, 37 workers, ex. cow-dung, Kathor, Surat district, 7.viii.1989, R. Sewak coll.

Distribution : INDIA : Gujarat (Kheda, Rajkot, Surat, Vadodara), Rajasthan (Jodhpur, Udaipur), Tamil Nadu.

Remarks : The species is known to infest the sugarcane crops in Udaipur but its pest status is yet to be studied.

55. ***Odontotermes latiguloides*** Roonwal & Verma, 1973
(Pl. VI, fig. 55)

1973. *Odontotermes latiguloides,* Roonwal, *J. Ind. Acad. Wood Sci.,* **4** (2) : 88.

1989. *Odontotermes latiguloides,* Thakur, *Ind. For. Rec.,* **15** (1) : 51.

Caste known : Soldier, worker.

Material examined : GUJARAT : 9 soldiers, 16 workers (in association with *O. assmuthi* Holmgren), ex. under wooden log, Saputara Hills, Dangs district, 14.i.1989, R.K. Singh coll.

Distribution : INDIA : Rajasthan (Banswara, Bhilwara, Dungarpur, Jaipur, Jhunjhunu, Jodhpur, Nagaur, Sikar, Sirohi), Gujarat (Ahmedabad, Amreli, Bharuch, Dangs, Gandhinagar, Junagadh, Kheda, Kutch, Mahesana, Panchmahal, Rajkot, Sabarakantha, Vadodara, Valsad).

Remarks : The species is commonly found in Gujarat and Rajasthan and very versatile in habitat preference.

56. ***Odontotermes lokanandi*** Chatterjee & Thakur, 1967
(Pl. VII, fig. 56)

1984. *Odontotermes lokanandi,* Thakur, *J. Bombay nat. Hist. Soc.,* **81** (2) : 496.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 2 soldiers, 8 workers, ex. cow-dung, Mansarover bank area, Banaskantha district, 11.x.1964, V.C. Agarwal coll. 4 soldiers, 6 workers, ex. cow-dung, Mansarover bank area, Banaskantha district, 12.x.1964, V.C. Agarwal coll. 3 soldiers, 7 workers, ex. cow-dung, Deesa, Banaskantha district, 16.x.1964. 12 soldier, 9 workers, Ser-Talab, Kudi village, Banaskantha district, 1.xi.1964, R.N. Bhargava coll. 4 soldiers, 6 workers, ex. teak plant, Ahwa, Dangs district, 4.ii.1979, T.G. Vazirani coll. 3 soldiers, 12 workers, ex. ground, Chovda village, Kutch district, 10.ii.1978, N.S. Rathore coll. 5 soldiers, 10 workers, ex. ground, Jumba village, Chhota Udaipur, Vadodara district, 24.xii.1980, N.S. Rathore coll. 6 soldiers, 14 workers, ex. ground, Bhekhadia village, Rajvasna, Vadodara district, 24.xii.1980, N.S. Rathore coll. 2 soldiers, 8 workers, ex. ground, Forest Rest House compound, Ahwa, Dangs district, 29.xii.1980, N.S. Rathore coll. 4 soldiers, 6 workers, ex. ground, Kaprada Forest, Kaprada, Valsad district, 28.xii.1980, N.S. Rathore coll. 3 soldiers, 7 workers, ex. ground, Bordevi Forest, Bordevi, Junagadh district, 7.1.1981, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Banaskantha, Dangs, Junagadh, Kutch, Mahesana, Vadodara, Valsad), Himachal Pradesh, Jammu & Kashmir, Uttar Pradesh. *Elsewhere* : Bangladesh, Pakistan.

Remarks : This is a soil-dwelling species and are commonly associated with either cow-dung or small bushes.

57 ***Odontotermes malabaricus*** Holmgren & Holmgren, 1917
(Pl. VII, fig. 57)

Caste known : Soldier, worker.

Material examined : GUJARAT : 6 soldiers, 15 workers, ex. root of *Acacia* tree, Ghogha, Bhavnagar district, 24.ii.1986, R. Sewak coll.

Distribution : INDIA : Gujarat (Bhavnagar), Karnataka, Kerala, Tamil Nadu, Uttar Pradesh.

Remarks : This is the first record of the species from Gujarat.

58. ***Odontotermes microdentatus*** Roonwal & Sen-Sarma, 1960
(Pl. VII, fig. 58)

1989. *Odontotermes microdentatus*, Thakur, *Ind. For. Rec.*, **15** (1) : 34.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 27 soldiers, 16 workers, ex. dry twig, Bokhara, Dangs district, 30.ii.1980, N.S. Rathore coll.

Distribution : INDIA : Bihar, Gujarat (Dangs), Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Orissa, Uttar Pradesh.

Remarks : The species is being recorded for the first time from Gujarat.

59. ***Odontotermes obesus*** (Rambur, 1842)
(Pl. VII, fig. 59)

1960. *Odontotermes (Odontotermes) obesus*, Kushwaha, *Sci. Cult.*, **27** (1) : 39.

1981. *Odontotermes obesus*, Thakur, *Ind. For. Rec.*, **14** (2) : 100.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 37 soldiers, 21 workers, ex. wooden log, Palanpur, Banaskantha district, 21.xi.1986, R.C. Sharma coll. 9 soldiers, 12 workers, ex. under stone, Himmatnagar, Sabarkantha district, 26.xi.1986, R.C. Sharma coll. 71 soldiers, 24 workers, Kim, Surat district, 4.iii.1988, R. Sewak coll. 6 soldiers, 17 workers, ex. under stone, Mahuva, Surat district, 5.iii.1988, R. Sewak coll. 9 soldiers, 14 workers, ex. under stone, Saputara, Ahwa, Dangs district, 15.xi.1988, R. Sewak coll. RAJASTHAN : 12 soldiers, 25 workers, ex. mud shelter tubes on ground, Bhopa village, Jaisalmer district, 25.vii.1995, N.S. Rathore coll. 20 soldiers, 15 workers, ex. shoreline habitat of Pichola Lake, Udaipur district, 12.ix.1994, N.S. Rathore & S. Kumar coll. 12 soldiers, 33 workers, ex. shoreline habitat of Pichola Lake,

Udaipur district, 27.viii.1995, N.S. Rathore & S. Kumar coll. 4 soldiers, 4 workers, ex. soil, Osian, Jodhpur district, 11.i.2001, A.K. Bhattacharyya coll.

Distribution : INDIA : Andhra Pradesh, Assam, Gujarat (Ahmedabad, Banaskantha, Bharuch, Dangs, Kutch, Kheda, Jamnagar, Mahesana, Panchmahal, Sabarkantha, Surat, Vadodara, Valsad), Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan (Ajmer, Barmer, Bikaner, Udaipur, Jaisalmer, Jodhpur, Jhunjhunu, Pali, Bundi, Ganganagar, Jaipur, Jalore, Kota, Nagaur, Sawai Madhopur, Sikar), Tamil Nadu, Tripura, Uttar Pradesh, West Bengal. *Elsewhere* : Bangladesh, Myanmar, Pakistan.

Remarks : Although it is a mound building species but in dry and desertic condition, it makes underground nest and above the surface it has been found to build mud shelter-tubes on grasses.

60. ***Odontotermes paralatiguloides*** Thakur, 1989
(Pl. VII, fig. 60)

1984. *Odontotermes paralatiguloides,* Thakur, *J. Bombay nat. Hist. Soc.*, **81** (2) : 496. (Ms. name).

Caste known : Soldier, worker.

Material examined : GUJARAT : 27 soldiers, 16 workers, ex. decaying wooden log, Vijarkhi village, Jamnagar district, 12.ix.1975, R.C. Sharma coll. 5 soldiers, 21 workers, ex. cow-dung, Thordoi, Kutch district, 16.i.1981, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Dangs, Jamnagar, Junagadh, Kutch).

Remarks : The species is endemic to Gujarat.

61. ***Odontotermes parvidens*** Holmgren & Holmgren, 1917
(Pl. VII, fig. 61)

1976. *Odontotermes parvidens,* Roonwal, *Zool. Jb. Syst. Bd.*, **103** : 464.

Caste known : Imago, soldier, worker.

Material examined : RAJASTHAN 2 soldiers, in association with *Odototermes obesus*, ex. cow-dung, Kokunda village, 25 km. NE of Raghunathgarh, Jhunjhunu district, 27.ix.1973, Y.P. Singh coll.

Distribution : INDIA : Assam, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Meghalaya, Punjab, Rajasthan (Jhunjhunu), Uttar Pradesh, West Bengal. *Elsewhere* : Bangladesh, Bhutan, Myanmar, Pakistan.

Remarks : This is the only record of the species from arid region of Rajasthan.

62. ***Odontotermes redemanni*** (Wasmann, 1893)
(Pl. VII, fig. 62)

1984. *Odontotermes redemanni,* Thakur, *J. Bombay nat. Hist. Soc.*, **81** (2) : 496.

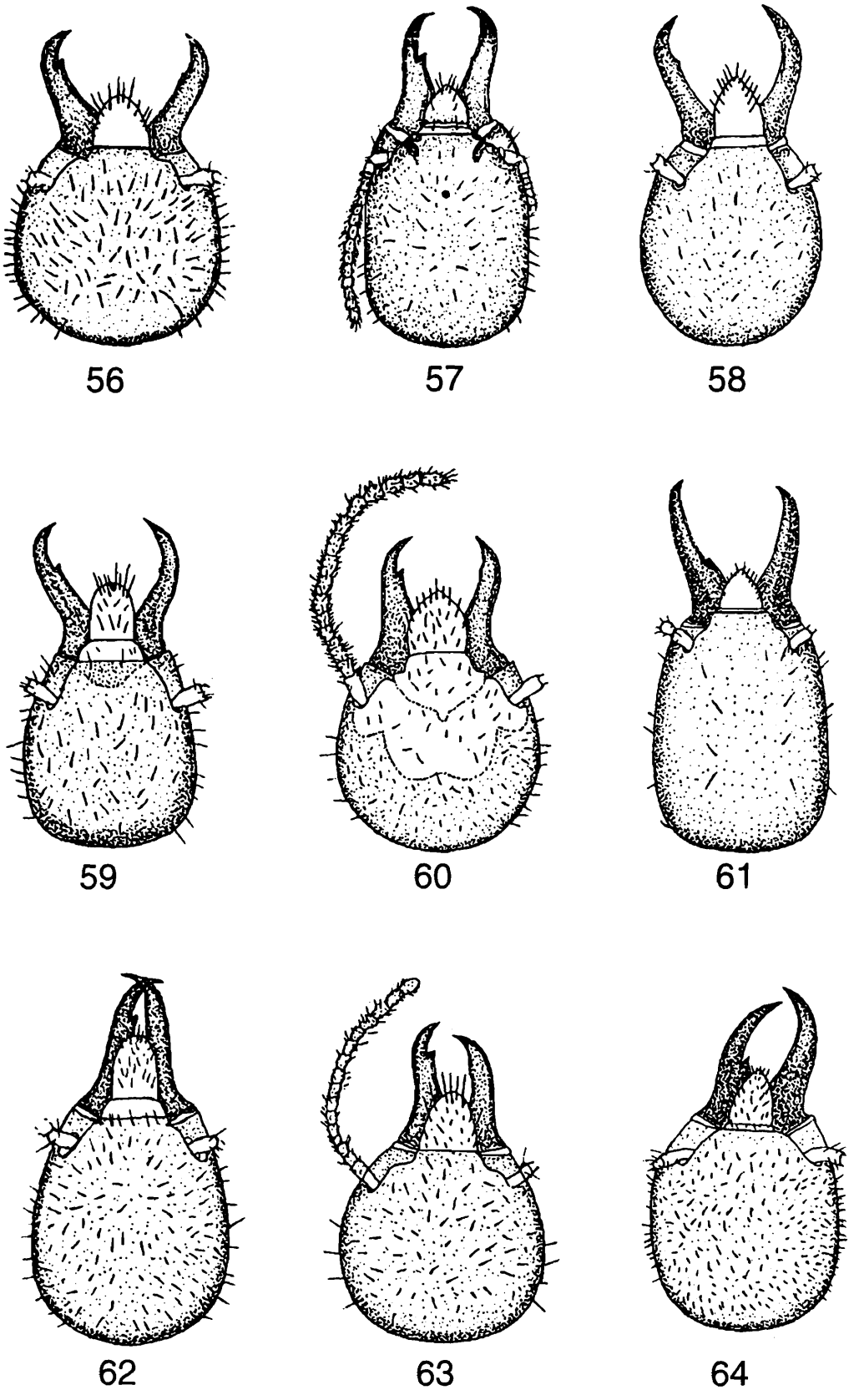


PLATE VII : Heads of soldiers. (56) *Odontotermes lokanandi.* (57) *Odontotermes malabaricus.* (58) *Odontotermes microdentatus.* (59) *Odontotermes obesus.* (60) *Odontotermes paralatiguloides.* (61) *Odontototermes parvidens.* (62) *Odontotermes redemanni.* (63) *Odontotermes sasangirensis.* (64) *Odontotermes wallonensis.*

1994. *Odontotermes redemanni,* Thakur, *Indian Forester,* **120** (5) : 459.

Caste known : Soldier, worker.

Material examined : GUJARAT : 6 soldiers, 2 workers, ex. bark of Neem tree, Ganeshpura, Nandasan, Mahesana district, 16.iii.1986, R. Sewak coll. 14 soldiers, 5 workers, ex. grass, Mahi River area, 21 km. away from Vadodara, Vadodara district, 19.iii.1988, R. Sewak coll.

Distribution : INDIA : Andhra Pradesh, Bihar, Gujarat (Banaskantha, Bharuch, Mahesana, Panchmahal, Vadodara), Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan (Nagaur, Sirohi), Tamil Nadu, Tripura, West Bengal. *Elsewhere* : Sri Lanka.

Remarks : The specis is not only widely didtributed in southern and eastern India but also extends to western part in Gujarat and Rajasthan state.

63. ***Odontotermes sasangirensis*** Thakur, 1989
(Pl. VII, fig. 63)

1984. *Odontotermes sasangirensis,* Thakur, *J. Bombay nat. Hist. Soc.,* **81** (2) : 496. (Ms. name).

Caste known : Soldier, worker.

Material examined : GUJARAT : Paratype soldier and paramorphotype worker, ex. soil tunnels on ground, Sasan Gir Forest, Sasan Gir, Junagadh district, 8.i.1981, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Banaskantha, Bharuch, Kutch, Jamnagar, Junagadh, Mahesana, Panchmahal, Sabarkantha, Vadodara).

Remarks : The species is very widely distributed in Gujarat.

64. ***Odontotermes wallonensis*** (Wasmann, 1902)
(Pl. VII, fig. 64)

1976. *Odontotermes wallonensis,* Roonwal, *Zool. Jb. Syst. Bd.,* **103** : 466.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT 16 soldiers, 17 workers, ex. ground, Limbhoi village, Sabarkantha district, 28.xi.1986, R.C. Sharma coll.

Distribution : INDIA : Andhra Pradesh, Bihar, Delhi, Gujarat (Sabarkantha), Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan (Ajmer), Tamil Nadu.

Remarks : This is the first record of the species from Gujarat.

65. ***Microtermes bharatpurensis*** Rathore, 1989
(Pl. VIII, fig. 65)

1989. *Microtermes bharatpurensis* Rathore, *Entomon,* **14** (1 & 2) : 53.

Caste known : Soldier, worker.

Material examined : RAJASTHAN : 4 soldiers, 48 workers, ex. dry grass, agricultural field, 5 km. NW of Kumher, Bharatpur district, 20.vi.1983, N.S. Rathore coll.

Distribution : INDIA : Rajasthan (Bharatpur).

Remarks : The species is endemic to Rajasthan.

66. ***Microtermes incertoides*** Holmgren, 1913
(Pl. VIII, fig. 66)

1989. *Microtermes incertoides,* Thakur, *Ind. For. Rec.,* **15** (1) : 66.

Caste known : Soldier, worker.

Material examined : GUJARAT : 8 soldiers, 12 workers, ex. decaying wood, Ahwa Rest House compound, Ahwa, Dangs district, 29.xi.1980, N.S. Rathore coll.

Distribution : INDIA : Andhra Pradesh, Daman & Diu, Gujarat (Dangs), Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu.

Remarks : The species is subterranean in habit.

67. ***Microtermes mycophagus*** (Desneux, 1905)
(Pl. VIII, fig. 67)

1964. *Microtermes mycophagus*, Chatterjee & Thakur, *Ind. For. Rec.*, **10** (11) : 230.

1989. *Microtermes mycophagus,* Thakur, *Ind. For. Rec.,* **15** (1) : 67.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 17 soldiers, 39 workers, ex. wood, Navalpur village, Sabarkantha district, 30.xi.1986, R.C. Sharma coll. 83 soldiers, 72 workers, ex. dry *Acacia* branch, Varahi village, Radhanpur, Banaskantha district, 21.ii.1989, N.S. Rathore coll. 17 soldiers, 37 workers, ex. wooden log, Jetda village, Tharad, Banaskantha district, 7.iii.1989, N.S. Rathore coll. 25 soldiers, 15 workers, ex. *Acacia tortalis* stump, Gomadi village, Sabarkantha district, 29.xi.1986, N.S. Rathore coll. 61 soldiers, 32 workers, ex. dry twig, Navalpur village, Sabarkantha district, 30.xi.1986, N.S. Rathore coll. 7 soldiers, 17 workers, ex. *Salvadera* tree, Dantiwada, Banaskantha district, 27.ii.1992, N.S. Rathore coll. 29 soldiers, 37 workers, ex. ground, Devpura, Banaskantha district, 6.iii.1989, N.S. Rathore coll. 51 soldiers, 71 workers, ex. dry cactus, Mahudi village, Mahesana district, 27.ii.1992, N.S. Rathore coll. 11 soldiers, 41 workers, ex. under wooden log, Dhorai Dam area, Khed Brahma, Sabarkantha district, 5.iii.1992, N.S. Rathore coll. 51 soldiers, 24 workers, ex. dry twig, Rama Rampura village, Banaskantha, Banaskantha district, 10.iii.1992, N.S. Rathore coll. 9 soldiers, 28 workers, ex. under stone, Visnagar village, Mahesana district, 15.ix.1992, R.

Sewak coll. 4 soldiers, 9 workers, ex. ground, Loria, Kutch district, 26.ii.1989, R. Sewak coll. 8 soldiers, 18 workers, ex. ground, Bandwad, Banaskantha district, 20.ii.1989, N.S. Rathore coll. 3 soldiers, 8 workers, ex. soil, Navalpur village, Himmatnagar, Surendranagar district, 30.xi.1986, N.S. Rathore coll. 72 soldiers, 17 workers, ex. soil, Thara village, Banaskantha district, 22.ii.1989, N.S. Rathore coll. 2 soldiers, 9 workers, ex. wooden log, Vijapur Guest House compound, Vijapur, Mahesana district, 1.iii.1992, N.S. Rathore coll. 7 soldiers, 11 workers, ex. under wooden log, Mansa, Mahesana district, 29.ii.1992., N.S. Rathore coll. 31 soldiers, 16 workers, ex. *Eucalyptus* tree bark, Gomadi village, Sabarkantha district, 29.xi.1986, N.S. Rathore coll. 3 soldiers, 11 workers, ex. ground, Navalpur village, Sabarkantha district, 30.xi.1986, N.S. Rathore coll. 41 soldiers, 17 workers, ex. dry stump, Mahudi village, Mahesana district, 27.ii.1982, N.S. Rathore coll. 9 soldiers, 13 workers, ex. ground, Navalpur village, Sabarkantha district, 23.xi.1986, N.S. Rathore coll. 3 soldiers, 8 workers, ex. ground, Loria village, Kutch district, 26.ii.1989, N.S, Rathore coll. 21 soldiers, 17 workers, ex. dry twig, Gola village, Banaskantha district, 20.ii.1992, N.S. Rathore coll. 7 soldiers, 2 workers, ex. dry coconut, Gola village, Banaskantha district, 20.ii.1992, N.S. Rathore coll. 16 soldiers, ex. dry stump, Sabarmati River bank, Gandhinagar district, 25.ii.1991, N.S. Rathore coll. 51 soldiers, 27 workers, ex. ground, Ratanpur village, Kutch district, 2.iii.1989, N.S. Rathore coll. 8 soldiers, 2 workers, ex. cow-dung, Vautha village, Ahmedabad district, 18.ii.1989, N.S. Rathore coll. 2 soldiers, 7 workers, ex. dry twig, Samgam village, Sabarkantha district, 28.ii.1992, N.S. Rathore coll. 21 workers, ex. ground, Kukama village, Kutch district, 24.ii.1989, N.S. Rathore coll. ex. 4 soldiers, 8 workers, dry wood, Magodi village, Gandhinagar district, 26.ii.1991, N.S. Rathore coll. 27 soldiers, 18 workers, ex. under stone, Vizapur, Mahesana district, 8.ix.1992. R. Sewak coll. 15 soldiers, 18 workers, ex. under stone, Kankrol village, Sabarkantha district, 30.viii.1992, R. Sewak coll. 7 soldiers, 21 workers, ex. under *Acacia* stem, Reserve Forest area, Dholka town, Ahmedabad district, 16.ii.1991, N.S. Rathore coll. 51 soldiers, 28 workers, ex. cow-dung, Pudugam village, Mahesana district, 24.ii.1992, N.S. Rathore coll. RAJASTHAN : 1 soldier, 26 workers, ex. dry grass, Sam, Jaisalmer district, 7.ii.1995, N.S. Rathore coll. 2 soldiers, 10 workers, ex. dry stem of *Calotropis* sp., Nahar Singh Ki Dhani, Jaisalmer district, 6.ii.1995, N.S. Rathore coll. 4 soldiers, 8 workers, ex. cow-dung, Harsani, Barmer district, 11.ii.1995, N.S. Rathore coll. 6 soldiers, 11 workers, ex. dry stem, Girab, Barmer district, 10.ii.1995, N.S Rathore coll. 1 soldier, 2 workers, ex. dry stump, Turvi village, Barmer district, 10.ii.1995, N.S. Rathore coll. 7 soldiers, 13 workers, ex. soil, Khatubana, Ganganagar district, 13.xi.2001, A.K. Bhattacharyya coll. 2 soldiers, 8 workers, ex. roots and stem of chilli plant, Khandadeol, Jalore district, 7.xii.2000, A.K. Bhattacharyya coll. 8 soldiers, 12 workers, ex. roots of chilli plant, Osian, Jodhpur district, 11.i.2001, A.K. Bhattacharyya coll. 8 soldiers, ex. sugarcane stubble, 122 RD, Ganganagar district, 14.ii.2001, A.K. Bhattacharyya coll.

Distribution : INDIA : Delhi, Gujarat (Ahmedabad, Banaskantha, Dangs, Gandhinagar, Kutch, Mahesana, Sabarkantha, Surendranagar, Vadodara), Haryana, Punjab, Rajasthan (Alwar, Barmer, Bikaner, Churu, Ganganagar, Jaipur, Jaisalmer, Jodhpur, Nagaur, Sikar). *Elsewhere* : Pakistan.

Remarks : It is a soil-dwelling species but attacks a number of crops, grasses, plants etc. Available records from Gujarat indicate that the species has also been collected from the following plants : *Acacia tortalis, A. jacquemonti, Salvadera oleoides, Calotropis procera, Zizyphus numularia, Euphorbia caducifolia* and *Eucalyptus* sp.

68. ***Microtermes obesi*** Holmgren, 1913
(Pl. VIII, fig. 68)

1913. *Microtermes obesi*, Holmgren, *J. Bombay nat. Hist. Soc.*, **22** (1) : 108.

1964. *Microtermes obesi*, Chatterjee & Thakur, *Ind. For. Rec.*, **10** (2) : 234.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 13 soldiers, 59 workers, ex. dry wooden stick, Ani Dam submergence area, Chhota Udaipur, Vadodara district, 21.x.1992, N.S. Rathore coll. 3 soldiers, 54 workers, ex. dry bamboo, Ambaji Forest, Banaskantha district, 24.xi.1986, N.S. Rathore coll. 21 soldiers, 71 workers, ex. cow-dung, Danta, Palanpur, Banaskantha district, 19.ii.1992, N.S. Rathore coll. 6 soldiers, 51 workers, ex. dry wooden log, Navalpur, Himmatnagar, Sabarkantha district, 30.xi.1986, R.C. Sharma coll. RAJASTHAN : 4 soliders, 31 workers, ex. dry stem, Baisala, Barmer district, 12.ii.1995, N.S. Rathore coll. 7 soldiers, 43 workers, ex. soil, Pithla, Jaisalmer district, 24.vii.1995, N.S. Rathore coll. 2 soldiers, 18 workers, ex. ground, Bhopa village, Jaisalmer district, 25.vii.1995, N.S. Rathore coll. 4 soldiers, 20 workers, ex. soil, Harsani, Barmer district, 19.vii.1995, N.S. Rathore coll. 4 soldiers, 20 workers, ex. *Ficus* tree trunk, banks of Pichola Lake, Udaipur district, 9.ix.1994, N.S. Rathore & S. Kumar coll. 5 soldiers, 9 workers, ex. roots of chilli, Sikar, Sikar district, 8.xi.2000, S.I. Kazmi coll. 9 soldiers, ex. roots of linseed, Nandiad, Jodhpur district, 19.ix.2000, A.K. Bhattacharyya coll.

Distribution : INDIA : Bihar, Gujarat (Banaskantha, Sabarkantha, Vadodara), Madhya Pradesh, Orissa, Punjab, Rajasthan (Barmer, Jaipur, Jaisalmer, Jodhpur, Kota, Nagaur, Sikar, Udaipur), West Bengal. *Elsewhere* : Bangladesh, Bhutan, Combodia, Kampuchea, Myanmar, Pakistan, Sri Lanka, Thailand, Vietnam.

Remarks : Being one of the most common and widely distributed species of genus *Microtermes* it inflicts heavy economic damage to agricultural crops, fencing and fallen stems, twigs etc.

69. ***Microtermes unicolor*** Snyder, 1933
(Pl. VIII, fig. 69)

1976. *Microtermes unicolor*, Roonwal, *Zool. Jb. Syst. Bd.*, **103** : 466.

1989. *Microtermes unicolor*, Thakur, *Ind. For. Rec.*, **15** (1) : 70.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 6 soldiers, 19 workers, ex. dry tree stump, Lakhtar Dam area, 4 km. from Lakhtar town, Surendranagar district, 13.ii.1991, N.S. Rathore coll. 3 soldiers, 12 workers, ex. under stone, Ani dam submergence area, Choota Udaipur, Vadodara district, 21.x.1982, N.S. Rathore coll. 2 soldiers, 18 workers, ex. ground, Navalpur, 21 km. E of Himmatnagar, Sabarkantha district, 30.xi.1986, R.C. Sharma coll. 4 soldiers, 23 workers, ex. plant bark, forest area, 14 km. NE of Danta, Palanpur, Banaskantha district, 19.ii.1992, N.S. Rathore coll. 3 soldiers, 17 workers, ex. under stone, Kapra village, Tharad road, west of Palanpur, Banaskantha district, 22.viii.1992, R. Sewak coll. 7 soldiers, 23 workres, ex. dry bamboo, Ambaji Forest area, Palanpur, Banaskantha district, 24.xi.1986, R.C. Sharma coll. 5 soldiers, 33 workers, ex. dry wooden twig, Aithar village, 13 km. from Unjha, Mahesana district, 25.ii.1992, N.S. Rathore coll. RAJASTHAN : 3 soldiers, 37 workers, ex. soil, Turvi village, Barmer district, 20.vii.1995, N.S. Rathore coll. 20 alates, 2 soldiers, 8 workers, Bhopa, Jaisalmer district, 18.vii.1995, Jaisalmer, 23.vii.1995, N.S. Rathore coll. 8 soldiers, 2 workers, ex. soil and litter, Arid Forest Research Institute Nursery, Jodhpur, Jodhpur district, 13.xi.2000, A.K. Bhattacharyya coll. 4 soldiers, ex. roots of gram, Bhairuprava, Bikaner district, 7.ii.2001, A.K. Bhattacharyya coll. 10 soldiers, ex. roots of chilli, Osian, Jodhpur district, 11.i.2001, A.K. Bhattacharyya coll. 11 soldiers, 9 workers, ex. soil, Sahabsinghwala, Ganganagar district, 14.ii.2001, A.K. Bhattacharyya coll. 13 soldiers, 7 workers, ex. roots of chilli, Jaliwara, Jodhpur district, 15.i.2001, A.K. Bhattacharyya coll. 4 soldiers, 8 workers, ex. roots of cumin plant, Siddheswar, Jalore district, 9.xii.2001, A.K. Bhattacharyya coll.

Distribution : INDIA : Gujarat (Banaskantha, Dangs, Junagadh, Mahesana, Sabarkantha, Surendranagar, Vadodara), Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan (Jalore, Jodhpur, Ganganagar, Barmer, Jaisalmer), Uttar Pradesh. *Elsewhere* : Pakistan.

Remarks : This species is not very common in the desert area. Swarming alates were collected at Jaisalmer and Jodhpur from light source at 8 PM.

Subfamily (viii) NASUTITERMITINAE Hare, 1937

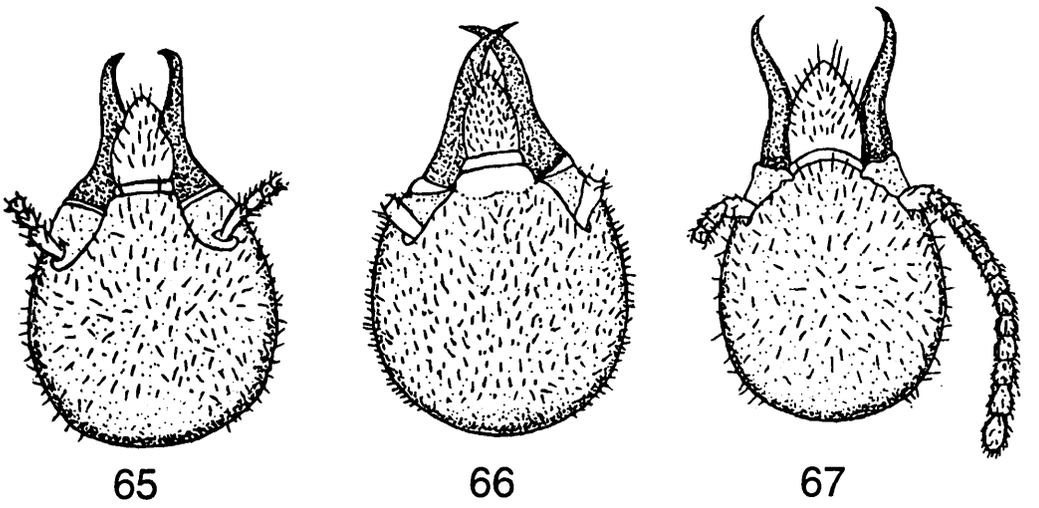
70. ***Trinervitermes biformis*** (Wasmann, 1902)
(Pl. VIII, fig. 70A, B)

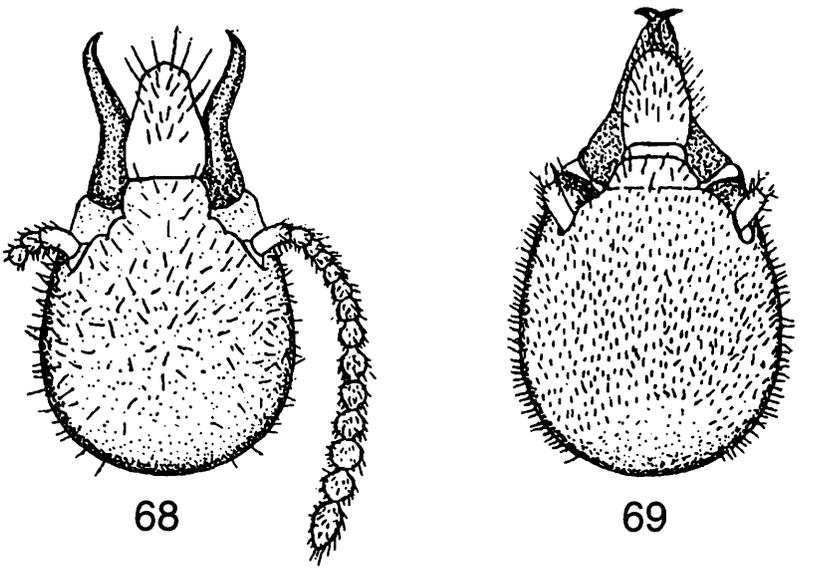
1960. *Trinervitermes biformis*, Kushwaha, *Sci. Cult.*, **20**(1) : 40.

1989. *Trinervitermes biformis*, Thakur, *Ind. For. Rec.*, **15**(1) : 71.

Caste known : Imago, soldier, worker.

Material examined : GUJARAT : 24 soldiers, 56 workers, ex. under stone, Dantiwada Forest area, Banaskantha District, 23.xi.1986, N.S. Rathore coll. 34 soldiers, 59 workers, ex. ground, Limbhoi village, Himmatnagar, Sabarkantha District, 28.xi.1986, N.S. Rathore coll. 9 soldiers, 56 workers, ex. under stone, forest plantation, Navalpur, Sabarkantha District, 29.xi.1986, N.S. Rathore coll. 4 soldiers, 32 workers, ex. wooden stump, Dharoi Dam plantation





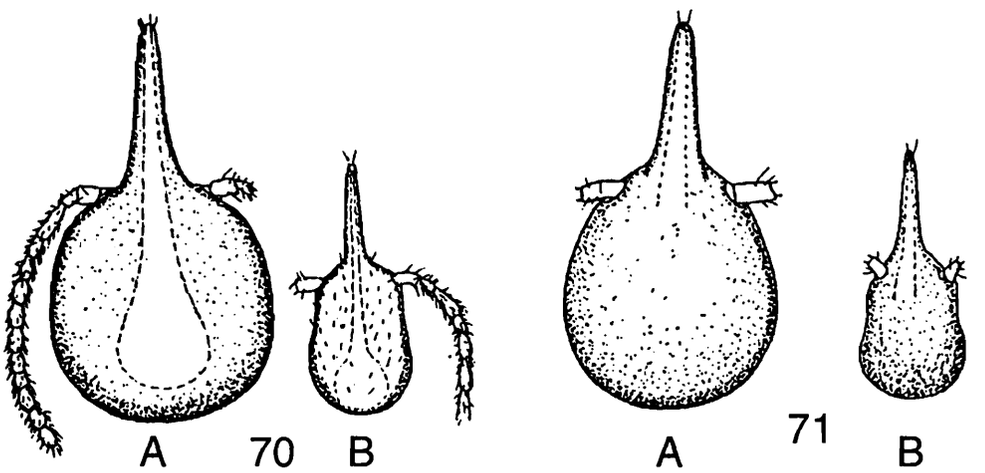


PLATE VIII : Heads of soldiers. (65) *Microtermes bharatpurensis.* (66) *Microtermes incertoides.* (67) *Microtermes mycophagus.* (68) *Microtermes obesi.* (69) *Microtermes unicolor.* (70) *Trinervitermes biformis.* A. Major, B. Minor. (71) *Trinervitermes fletcheri* A. Major, B. Minor.

area, Khedbrahama, Himmatnagar, Sabarakantha District, 5.iii.1992, N.S. Rathore coll. 31 soldiers, 45 workers, ex. under stone, Kheroj village, Khedbrahama, Himmatnagar, Sabarkantha District, 6.iii.19992, N.S. Rathore coll. 7 soldiers, 27 workers, ex. under stone, Medari village, Vijaynagar Forest area, Himmatnagar, Sabarkantha District, 7.iii.1992, N.S. Rathore coll. 3 soldiers, 43 workers, ex. under stone, Bhanvad village, Jamnagar district, 28.viii.1990. R. Sewak coll. 7 soldiers, 19 workers, ex. cow-dung, Talala village, Junagadh district, 31.viii.1990, R. Sewak coll. 12 soldiers, 39 workers, ex. under stone, Gondal village, Rajkot district, 6.ix.1990, R. Sewak coll. 16 soldiers, 21 workers, ex. cow-dung, Dolia, Surendranagar district, 30.viii.1991, R. Sewak coll. 3 soldiers, 26 workers, ex. under stone, Taranga Hills, Unjha, Mahesana district, 23.ii.1992, N.S. Rathore coll.

Distribution : INDIA : Andhra Pradesh, Delhi, Gujarat (Banaskantha, Gandhinagar, Jamnagar, Junagadh, Kutch, Mahesana, Panchmahal, Rajkot, Sabarkantha, Surendranagar, Valsad), Karnataka, Kerala, Maharashtra, Madhya Pradesh, Orissa, Rajasthan (Ajmer, Bhilwara, Jaipur, Jodhpur, Kota, Nagaur, Pali, Udaipur), Tamil Nadu, West Bengal. *Elsewhere* : Pakistan, Sri Lanka.

Remarks : This is free-foraging, moisture-loving and widely distributed species in Gujarat and Rajasthan.

71. ***Trinervitermes fletcheri*** Chatterjee & Thakur, 1965
(Pl. VIII, fig. 71A, B)

1989. *Trinervitermes fletcheri*, Thakur, *Ind. For. Rec.*, **15** (1) : 72.

Caste known : Soldier, worker.

Material examined : GUJARAT : 4 soldiers, 39 workers, ex. under stone, Govtka village, near Kaprada Forest, Valsad district, 28.xii.1980, N.S. Rathore coll. 23 soldiers, 45 workers, ex. under stone, roadside 15 km. from Gandhinagar, Gandhinagar district, 3.i.1981, N.S. Rathore coll. 3 soldiers, 28 workers, ex. under stone, Forest Rest House compound, Bukhra, Dangs district, 29.xii.1980, N.S. Rathore coll.

Distribution : INDIA : Gujarat (Dangs, Gandhinagar, Valsad), Tamil Nadu.

Remarks : The species is a versatile one.

DISCUSSION

Emerson (1952) postulated that during late Mesozoic, living termite families dispersed to major tropical areas of the world, but differentiation of subfamilies and genera took place later in Tertiary. Termites originating in South America dispersed to Australian, Oriental and Ethiopian regions and *vice versa* during late Mesozoic through a hypothetical land bridge. Several authors (Imms, 1937; Weidner, 1966, 1970; Krishna, 1970) have reconstructed the phylogeny of different termite taxa. Although a number of fossils dating back from as early

Tertiary or late Cretaceous are available but such fossils are not clearly distinguishable from modern day isopteran genera because of their fossilised nature. Above authors have opined that Problattoidea (roachlike ancestor) which originated in the late Carboniferous or early Devonian served as the probable ancestor of Blattoidea and modern day Isoptera. Based on zoogeographical evidences Myles (1998) provided further evidence that modern day termites had evolved from roachlike proto-termites prior to continental fragmentation. A hypothetical phylogenetic diagram of the representative termite taxa (excluding species) is presented in fig. 3.

Presently there are around 38 exotic (*sensu stricto* occurring outside India) elements in Gujarat and Rajasthan fauna (Table 3). Before going into the discussion on endemism, we should keep in mind that in some instances it is difficult to determine whether a particular species is a native or an introduced one. In our limited scope, here we discuss endemism mainly in terms of Gujarat and Rajasthan and in a broad sense to India. Endemism in either of the two states are much less than what should be for any specialised biotope. Endemism of Gujarat termite fauna is slightly higher (14% or 10 species) than that of Rajasthan (10% or 7 species). More than 50% of the total species (36 out of 71) strength occurring in Gujarat and Rajasthan are endemic to India (Fig. 4). It has been noted that 15% (36 out of 240) of the termite species believed to be endemic to India are known from these two states. Some termite species are also known to occur in the neighbouring countries : 25 species from Pakistan; 16 species from Bangladesh; 12 species from Sri Lanka; 5 species from Bhutan; 4 species from Myanmar; 3 species from Nepal and 2 species from Afghanistan. *Coptotermes heimi* shows a wide distribution in India and Pakistan. It is an extremely destructive one, which attacks not only buildings and furnitures but living trees as well. Besides its occurrence in neighbouring countries, the species is also reported from Oman, Java and Singapore. Gay (1969) reported *Cryptotermes havilandi* from a number of tropical countries (Madagascar, Fernando Poo, Nigeria, Senegal, Comoro Islands, Europa Islands, Trinidad & Tobago, British Guyana, Surinam, Ivory Coast, Brazil, Cameron, Mombasa, Congo). In India the same species has been collected from a wide range of habitat. It is probable that the species also occur in our neighbouring countries. Although Pakistan and India have most species in common but it is too early to conclude anything on their faunal similarity as the faunal distribution of other neighbouring countries are known only from some stray published records. Using the available distributional records an attempt has been made to identify the various elements primarily at generic and later at species level. Eighteen genera are classified according to their known/ probable origin (Table 1). Generawise both the Oriental and the Ethiopian elements are equally represented (6 genera or 33%). Similarly Palaearctic and Neotropical elements also have equal share but to a much lesser extent (1 genus or 5%). It is evident that 55% (*i.e.*, 10 out of 18) of the generic elements belong to the higher family Termitidae. At the same time it is also interesting to note that the "doubtful" group is strongly represented by primitive families (*i.e.*, 75% or 3 out of 4). No ready explanation is available for this. Surprisingly no Australian and Nearctic elements are encountered in this region. From the analysis of species

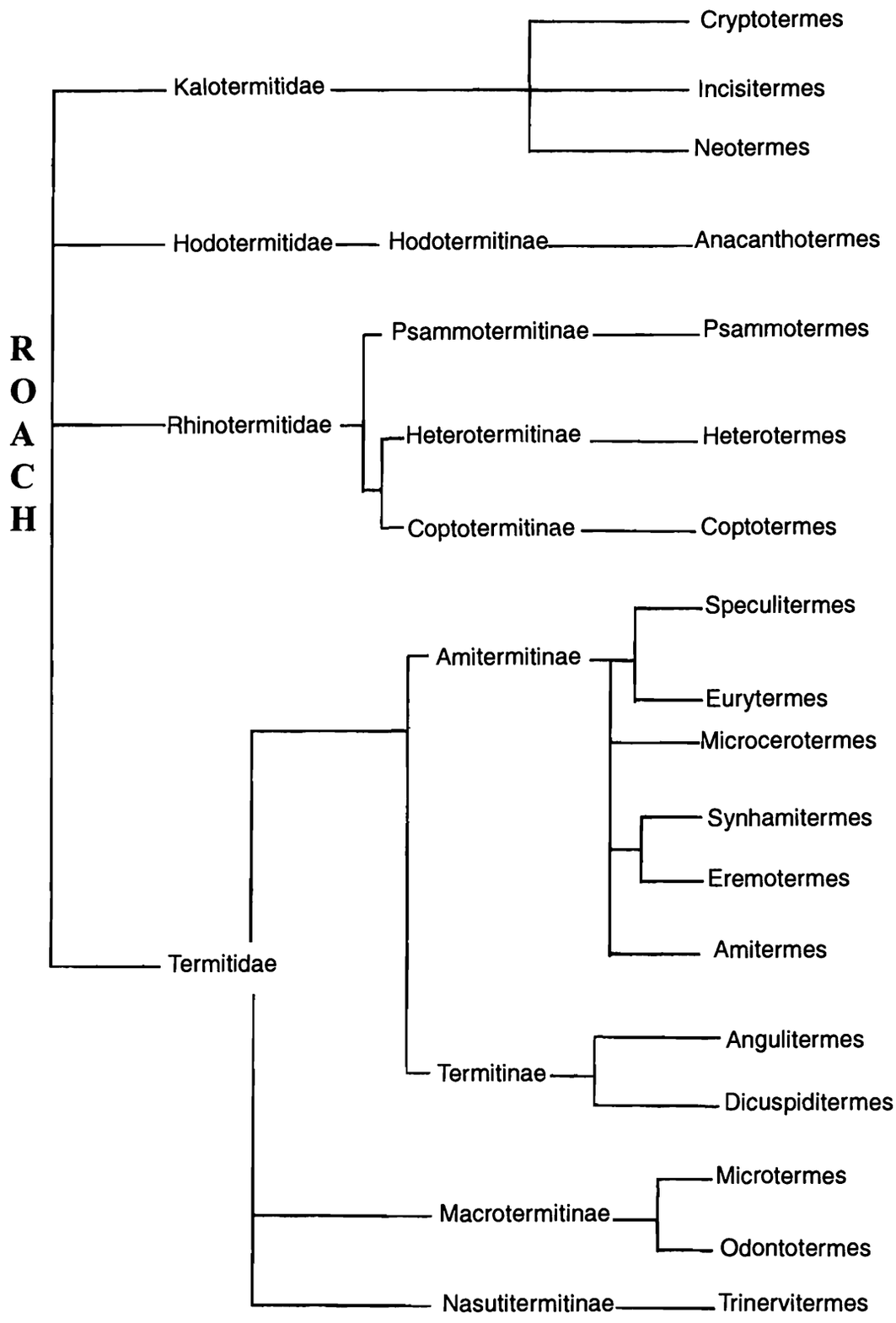


Fig. 3. Hypothetical phylogenetic diagram of isopteran taxa (taxa reported from Gujarat and Rajasthan are only mentioned; after Krishna, 1970).

distribution it is evident that *in origin,* the concerned termite fauna is largely Ethiopian (46 species or 65%) which is supplemented by the Oriental fauna (15 species or 21%). The origin of 8 species remains doubtful. Palaearctic and Neotropical components constitute a very little portion (1 species or 1%). The major portion of the study area consists of a typical, specialised biotope *i.e.,* Indian Thar Desert, but the striking feature of the representing termite taxa is the absence of endemism at the generic and suprageneric level. Although no genus has been found to be endemic either to Rajasthan or Gujarat, but there are a few species which are endemic as discussed earlier.

Table 1 : Distribution of termite genera in the present study according to their origin

Center of origin	Termite genera		Number (Percentage)
	Primitive	Higher	
Oriental	*Coptotermes*	*Speculitermes*	6 (33%)
	Synhamitermes	*Dicuspiditermes*	
		Eremotermes	
		Eurytermes	
Ethiopian	*Psammotermes*	*Microtermes*	6 (33%)
		Angulitermes	
		Odontotermes	
		Trinervitermes	
		Microceortermes	
Neotropical	*Incisitermes*		1 (5%)
Palearctic	*Anacanthotermes*		1 (5%)
Doubtful	*Neotermes*	*Amitermes*	4 (22%)
	Cryptotermes		
	Heterotermes		

The global strength of the termite fauna is estimated to be of around 2,762 species, distributed over 11 families and 283 genera. Indian termite fauna shares a very small portion (Fig. 5) of the global fauna (*i.e.,* 240 species or 9% species strength, 37 genera or 13% generic strength and 7 families or 64% familial strength). Although both the states have same generic and familial strength (*i.e.*, 4 families and 16 genera) but Gujarat holds higher species strength (60 species, 84.5%) than Rajasthan (42 species, 59.15%). Fig. 5 also concludes that

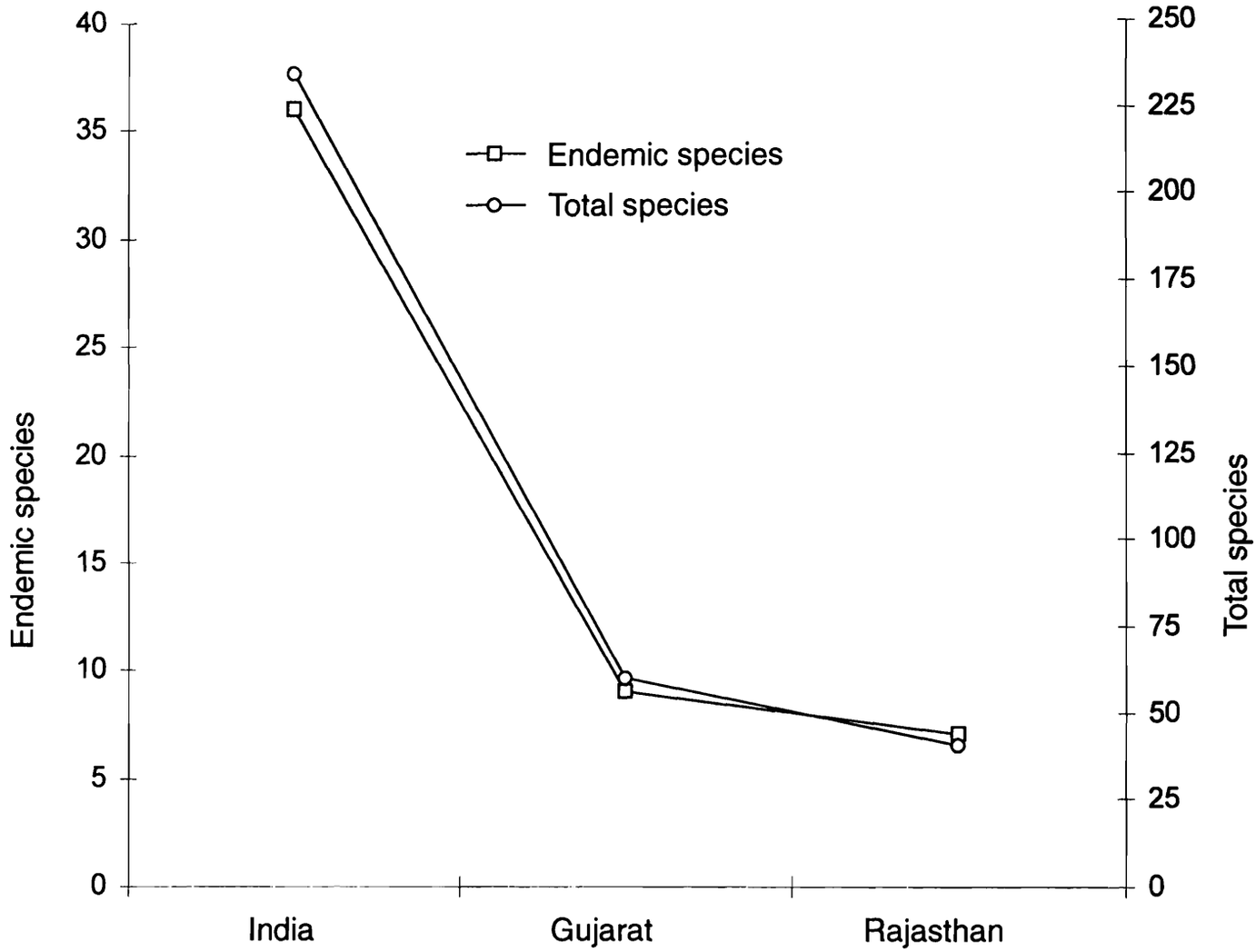


Fig. 4. Comparison of total species and endemic species known from India, Gujarat and Rajasthan.

only 25% and 17% of the Indian termite fauna is known from Gujarat and Rajasthan respectively.

Table 2 : Quantitative listing of termite taxa known from Gujarat and Rajasthan

		Number of genera		Number of species	
		Family	Subfamily	Family	Subfamily
Families	**Subfamilies**				
Kalotermitidae		3 (8)		5 (42)	
Hodotermitidae	Hodotermitinae		1 (1)		1 (2)
Rhinotermitidae		3 (5)		6 (15)	
	Psammotermitinae		1 (1)		1 (1)
	Coptotermitinae		1 (1)		2 (6)
	Heterotermitinae		1 (2)		3 (8)
Termitidae		11 (32)			59 (181)
	Amitermitinae		6 (7)		24 (52)
	Termitinae		2 (9)		3 (37)
	Macrotermitinae		2 (6)		30 (57)
	Nasutitermitinae		1 (10)		2 (35)

Number in parentheses refers to number of corresponding taxa known from India

Termite taxa : i) India : 240 species, 37 genera, 7 families

ii) Indian region* : 354 species, 59 genera, 7 families

* Including India, Pakistan, Nepal, Bhutan, Bangladesh, Myanmar and Sri Lanka (vide Roonwal & Chhotani, 1989; Chhotani, 1997)

Among the four families recorded, the primitive families are poorly represented than the higher one, Termitidae (Fig. 6). Family Termitidae is known to have eleven genera and fifty-nine species (Table 2) and enjoys the highest generic and species strength of 61% and 83% respectively. Both Kalotermitidae and Rhinotermitidae have three genera (17%) and almost same species strength (Kalotermitidae : 5 species or 7%, Rhinotermitidae : 6 species or 8%). The family Hodotermitidae is poorly represented in terms of both generic (1 genus or 5%) and species (1 species or 1%) strength (Table 2). In both the states family Termitidae occupies the highest position in respect of generic and species strength. Familywise generic strength of the two primitive families (*i.e.*, Kalotermitidae and Rhinotermitidae) occurring in both the states are same (Fig. 6).

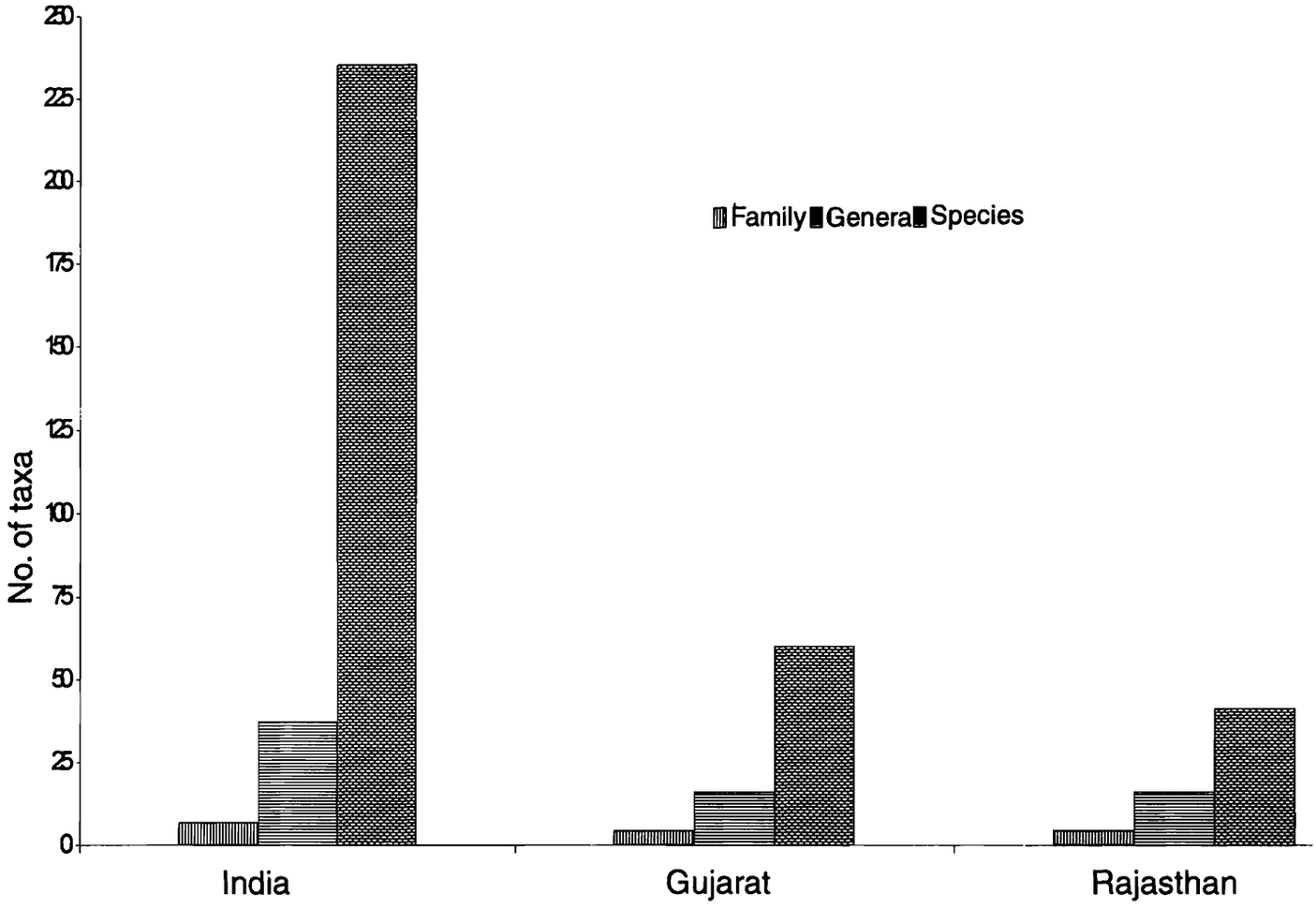


Fig. 5. Termite taxa known from Gujarat, Rajasthan and India.

Fig. 6. Generic and species strength of termite families in Gujarat and Rajasthan

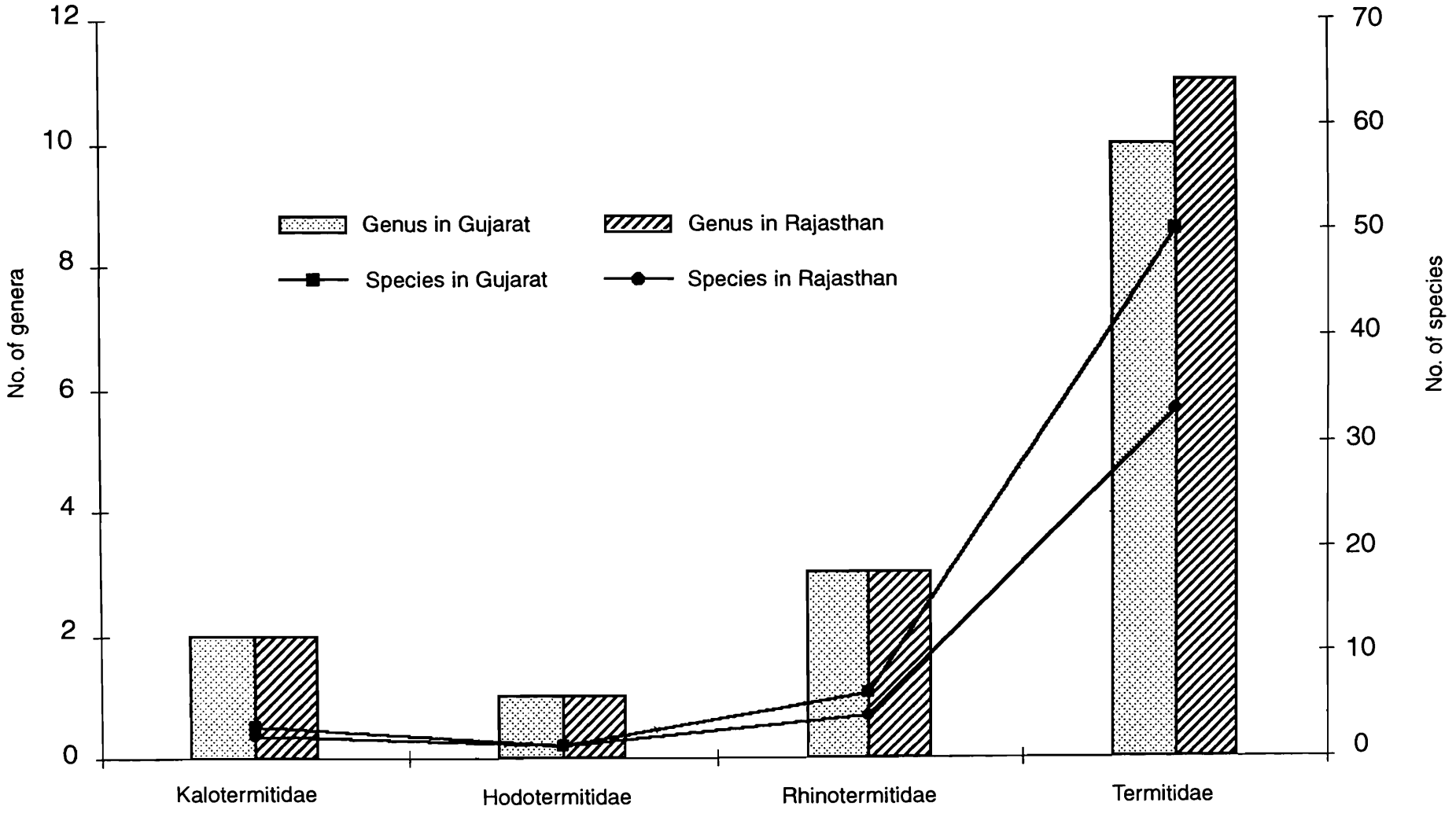
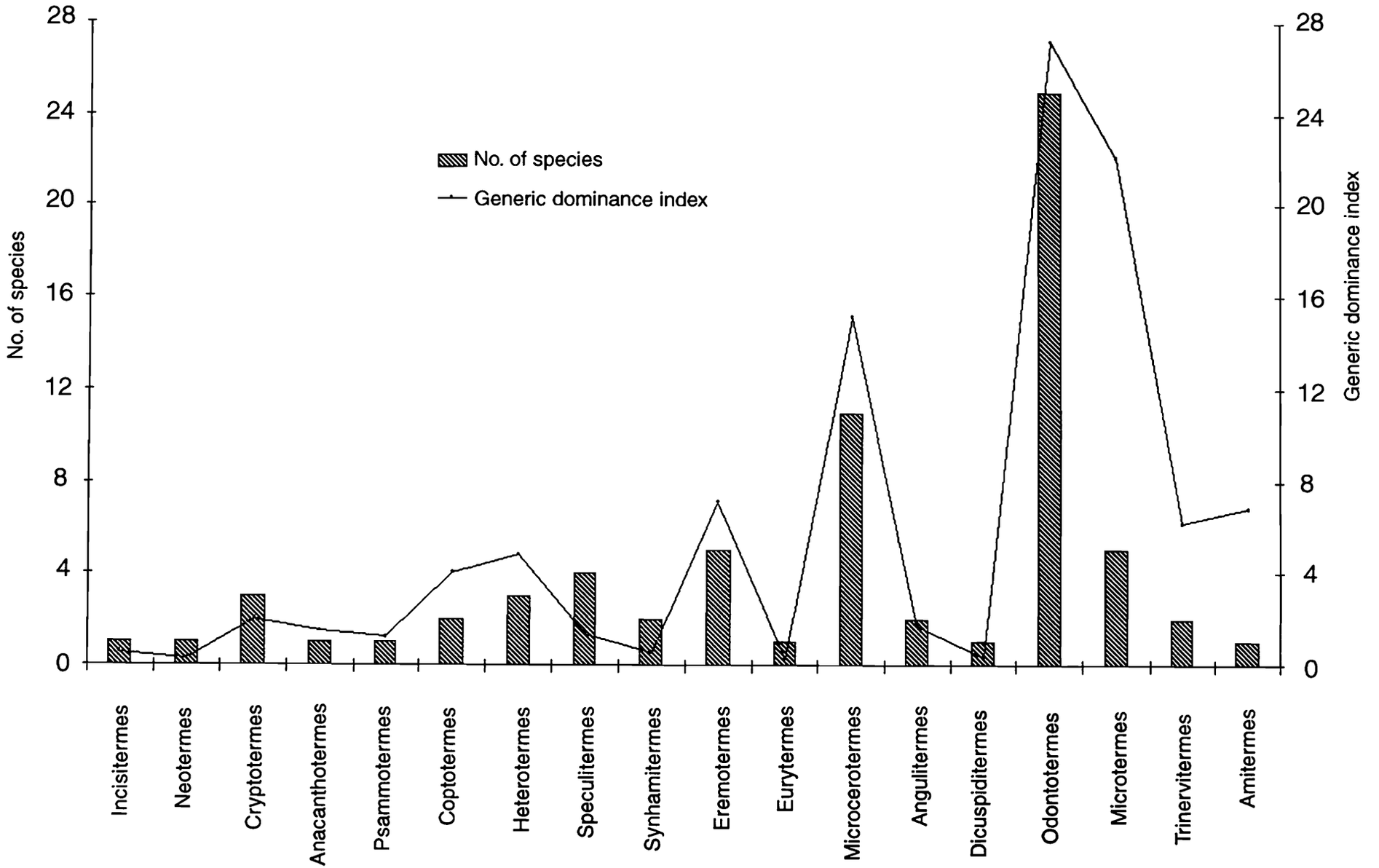


Fig. 7. Comparison between generic dominance index and species strength



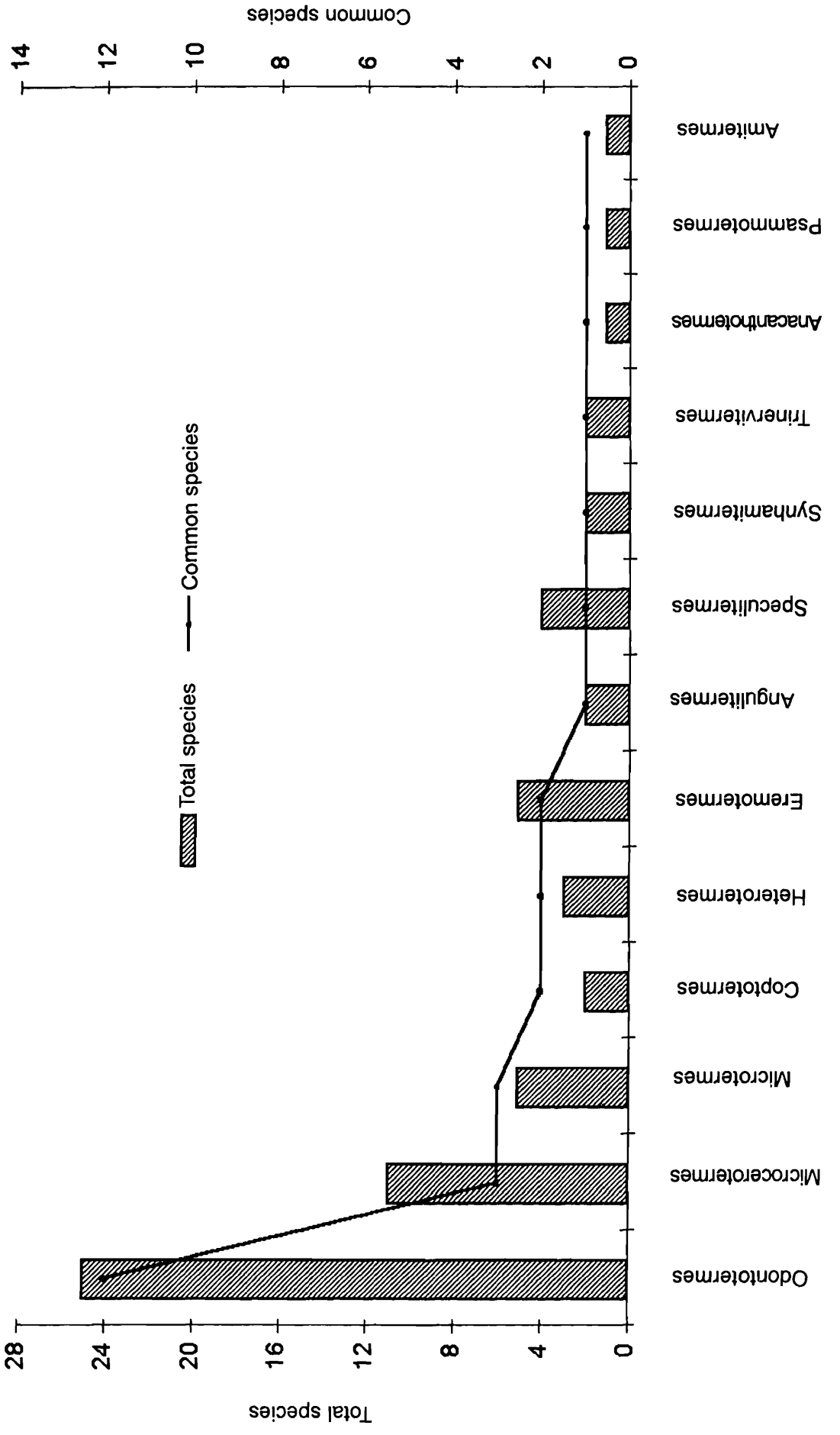


Fig. 8. Comparison between total species and common species occurring in Gujarat and Rajasthan

Dominance indices of all species are calculated and listed in table 3. Among seventy-one species, *Microtermes mycophagus* shows highest dominance of 14.44, followed by *Amitermes belli* (6.80), *Trinervitermes biformis* (5.25) and *Odontotermes bellahunisensis* (3.63) while the lowest dominance is shared by *Synhamitermes labioangulatus* (0.009) and jointly followed by *Speculitermes dharwarensis* and *Odontotermes sasangirensis,* with a dominance index of 0.01 each. Of the three species belonging to the genus *Cryptotermes*, maximum and minimum dominance are shown by *C. daulti* (61.29) and *C. havilandi* (18.43) respectively. For the genus *Heterotermes*, *H. indicola* and *H gertrudae* are the highest (68.06) and lowest (8.93) dominant species. In the scale of dominance, *Speculitermes triangularis* (49.31) shows a clear-cut dominance over *S. dharwarensis* (1.36). In the genus *Eremotermes*, dominance index has been found to be highest (39.24) and lowest (7.77) for *E. paradoxalis* and *E. sanyuktae* respectively. *Microcerotermes*, the second most commonly occurring genus in our study is represented by eleven species, of which *M. heimi* (22.31) is the most abundant species while *M. annandalei* is the least (0.48) abundant one. The versatile Indo-African genus *Odontotermes* constitutes the maximum faunal strength in Gujarat and Rajasthan. *O. bellahunisensis* is the most common species in our collection with a highest dominance of 13.33, followed by *O. obesus* (11.61). Because of their specialised type of habitat, *O. sasangirensis* and *O. parvidens* have been found to be the least dominant (0.06) species in Gujarat and Rajasthan respectively. *Microtermes mycophagus* shows almost 80 times dominance (65.23) than *M. incertoides* (0.82).

Comparison between the dominance index and the total number of species of 71 genera are shown in fig. 7. Among the seven genera with a single species each, genus *Eurytermes* shows the lowest dominance index of 0.27 followed by *Neotermes* (0.28). In our study highest dominance index (27.24) are shown by *Odontotermes,* with a strength of 25 species. Species of the genus *Odontotermes* possess a remarkably powerful mound-building and fungus-growing ability enabling it to reach awkwardly situated food materials or to overcome obstacles in its way as well as to live in most extreme condition which probably accounts for its maximum species strength and highest dominance index. Basically the genus *Odontotermes* is a mound-inhabiting one but in the present study several species belonging to the genus are collected from a wide range of habitats. Although the genus *Microcerotermes* has the second highest species strength (11) but in respect to dominance index (15.12) it is preceded by its confamilial genus *Microtermes*, with a species strength and dominance index of 5 and 22.13 respectively. *Eremotermes* is a small genus comprising of 10 species, of which 5 occur in Gujarat and Rajasthan. Species of this genus can equally thrive in dry, arid as well as wet areas of India. Its members live in the subterranean nests built under soil, among roots, cow-dung, under stone, etc. *Eremotermes* species are not commonly encountered in nature as it is evidenced by the fact that with the same species strength (5) it exhibits a dominance index of 7.08, more than half of that shown by *Microtermes*.

Similarity in faunal richness between any two places occurs due to some complicated interaction between the organism and its environment. Faunal similarity between Gujarat and

Table 3 : Distribution and endemism of termite species recorded from Gujarat and Rajasthan

		India								Endemism					
S. No.	Species	Gujarat	Rajasthan	Rest of India	Pakistan	Rest of Oriental region	Afghanistan	Elsewhere	Zoogeographical status	Gujarat	Rajasthan	India	Oriental	Origin of genera	Dominance index
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	*Incisitermes didwanensis*	-	+	-	-	-	-	-	Ori.	-	+	+	+	Neo.	0.61
2.	*Neotermes fletcheri*	+	-	+	-	Bangladesh, Sri Lanka	-	-	Ori.	-	-	-	+	?	2.89
3.	*Cryptotermes bengalensis*	+	-	+		Bangladesh, Sri Lanka	-	-	Ori.	+	-	-	+	?	0.40
4.	*Cryptotermes daulti*	+	-	-	-	-	-	-	Ori.	+	-	+	+	?	1.22
5.	*Cryptotermes havilandi*	-	+	+	-	Bangladesh, Sri Lanka	-	Bangladesh, Brazil, British Guyana, Cameron, Comoro Islands, Congo, Europa Islands, Fernando Poo, Ivory Coast, Madagascar, Mombasa, Nigeria, Senegal,							

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
								Sri Lanka, Surinam, Trinidad and Tobago	Ori.		-	-	-	?	0.36
6.	*Anacanthotermes macrocephalus*	+	+	+	-	-	+	-	Pal.	-	-	-	-	Pal.	1.51
7.	*Psammotermes rajasthanicus*	+	+	-	-	-	-	-	Ori.	-	-	+	+	Eth.	1.12
8.	*Coptotermes heimi*	+	+	-	+	Bangladesh, Bhutan, Nepal	-	Oman	Ori.	-	-	-	-	Ori.	2.91
9.	*Coptotermes kishori*	+	+	+	-	-	-	-	Ori.	-	-	+	+	Ori.	1.11
10.	*Heterotermes gertrudae*	+	+	+	-	-	-	-	Ori.	-	-	+	+	?	0.43
11.	*Heterotermes indicola*	+	+	-	+	-	+	-	Ori.	-	-	-	+	?	3.28
12.	*Heterotermes malabaricus*	+	-	+	-	-	-	-	Ori.	-	-	+	+	?	1.11
13.	*Eurytermes mohana*	-	+	-	-	-	-	-	Ori.	-	+	+	+	Ori.	0.27
14.	*Speculitermes cyclops*	+	+	+	-	-	-	-	Ori.	-	-	+	+	Ori.	0.56
15.	*Speculitermes dharwarensis*	+	-	+	-	-	-	-	Ori.	-	-	+	+	Ori.	0.01
16.	*Speculitermes sinhalensis*	+	-	+	-	Sri Lanka	-	-	Ori.	-	-	-	+	Ori.	0.09
17.	*Speculitermes triangularis*	+	-	+	-	-	-	-	Ori.	-	-	+	+	Ori.	0.66
18.	*Synhamitermes labioangulatus*	+	-	-	-	-	-	-	Ori.	+	-	+	+	Ori.	0.009
19.	*Synhamitermes quadriceps*	+	+	+	-	Bangladesh, Sri Lanka	-	-	Ori.	-	-	-	+	Ori.	0.58
20.	*Amitermes belli*	+	+	+	+	-	-	-	Ori.	-	-	-	+	?	6.80
21.	*Eremotermes dehraduni*	+	-	+	-	-	-	-	Ori.	-	-	+	+	Ori.	0.77
22.	*Eremotermes fletcheri*	+	-	+	+	-	-	-	Ori.	-	-	-	+	Ori.	1.33
23.	*Eremotermes neoparadoxalis*	+	+	+	+	-	-	-	Ori.	-	-	-	+	Ori.	1.64
24.	*Eremotermes paradoxalis*	+	+	+	+	-	-	-	Ori.	-	-	-	+	Ori.	2.87

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
25.	*Eremotermes sanyuktae*	+	-	-	-	-	-	-	Ori.	-	+	+	+	Ori.	0.55
26.	*Microcerotermes annandalei*	-	+	+	-	-	-	-	Ori.	-	-	+	+	Eth.	0.07
27.	*Microcerotermes baluchistanicus*	-	+	-	+	-	-		Ori.	-	-	-	+	Eth.	0.45
28.	*Microcerotermes beesoni*	+		+	+	Bangladesh, Bhutan		-	Ori.	-	-	-	+	Eth.	0.77
29.	*Microcerotermes cameroni*	+	-	+	-	-		-	Ori.	-	-	+	+	Eth.	0.20
30.	*Microcerotermes dumasensis*	+	-	-	-	-	-	-	Ori.	+	-	+	+	Eth.	2.34
31.	*Microcerotermes heimi*	+	-	-	-	Sri Lanka		-	Ori.	+	-	+	+	Eth.	3.37
32.	*Microcerotermes laxmi*	-	+	-	-	Bhutan		-	Ori.	-	+	+	+	Eth.	0.32
33.	*Microcerotermes palestinensis*	+	+	-	-				Ori.	-	-	-	-	Eth.	2.02
34.	*Microcerotermes raja*	-	+	-	-	-	-		Ori.	-	+	+	+	Eth.	2.25
35.	*Microcerotermes sakesarensis*	+	+	+	+	-	-	-	Ori.	-	-	-	+	Eth.	0.63
36.	*Microcerotermes tenuignathus*	+	+	+	+	-	-		Ori.	-	-	-	+	Eth.	2.66
37.	*Angulitermes dehraensis*	+	+	+	+	-	+	-	Ori.	-	-	-	+	Eth.	0.33
38.	*Angulitermes jodhpurensis*	-	+	-		-	-		Ori.	-	+	+	+	Ori.	1.39
39.	*Dicuspiditermes incola*	+	-	+	-	Sri Lanka	-		Ori.	+	-	+	+	Ori.	0.39
40.	*Odontotermes anamallensis*	+	-	+	-	-	-		Ori.	+	-	+	+	Eth.	0.70
41.	*Odontotermes assmuthi*	+	-	+	+	Bangladesh	-		Ori.	-	-		+	Eth.	1.44
42.	*Odontotermes bellahunisensis*	+	+	+	+	-			Ori.	-		-	+	Eth.	3.63
43.	*Odontotermes bhagwathi*	+	-	+	-	-	-	-	Ori.	-	-	+	+	Eth.	0.73
44.	*Odontotermes brunneus*	+	+	+	-	Sri Lanka	-	-	Ori.	-	-	-	+	Eth.	1.00
45.	*Odontotermes dehraduni*	-	+	+	+	Sri Lanka		-	Ori.	-	-	-	+	Eth.	1.01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
46.	*Odontotermes distans*	+	+	+	+	Bhutan	-	-	Ori.	-	-		+	Eth.	0.62
47.	*Odontotermes feae*	+	+	+	-	Bangladesh, Bhutan, Nepal, Sri Lanka	-	Vietnam	Ori.	-	-	-	-	Eth.	0.88
48.	*Odontotermes giriensis*	+	-	+	-	Bangladesh	-	-	Ori.	-		+	+	Eth.	0.77
49.	*Odontotermes girnarensis*	+	+	+	-	-	-	-	Ori.	+	-	+	+	Eth.	2.51
50.	*Odontotermes guptai*	-	+	+	+	Bangladesh	-	-	Ori.	-	-	-	+	Eth.	1.77
51.	*Odontotermes gurdaspurensis*	+	-	+	+	-	-	-	Ori.	-	-	-	+	Eth.	2.72
52.	*Odontotermes horai*	+	-	-	+	Nepal	-	-	Ori.	-	-	-	+	Eth.	0.16
53.	*Odontotermes indicus*	+	+	-	-	-	-	-	Ori.	+	-	+	+	Eth.	1.40
54.	*Odontotermes kushwahai*	+	+	+	-	-	-	-	Ori.	-	-	+	+	Eth.	1.33
55.	*Odontotermes latiguloides*	+	-	-	-	-	-	-	Ori.	-	-	+	+	Eth.	0.22
56.	*Odontotermes lokanandi*	+	-	+	+	Bangladesh	-	-	Ori.	-	-	+	+	Eth.	1.30
57.	*Odontotermes malabaricus*	+	-	+	-		-	-	Ori.	-	-	+	+	Eth.	0.19
58.	*Odontotermes microdentatus*	+	+	+	-	-	-	-	Ori.	-	-	+	+	Eth.	0.39
59.	*Odontotermes obesus*	+	+	+	+	Bangladesh	-	Myanmar	Ori.	-	-	-	+	?Eth.	3.16
60.	*Odontotermes paralatiguloides*	+	-	-	-	-	-	-	Ori.	-	-	+	+	Eth.	0.63
61.	*Odontotermes parvidens*	+	+	+	+	Bangladesh	-	Myanmar	Ori.	-	-	-	-	Eth.	0.01
62.	*Odontotermes redemanni*	+	-	+	-	Sri Lanka	-	-	Ori.	-	-	-	-	Eth.	0.24
63.	*Odontotermes sasangirensis*	+	+	-	-	-	-	-	Ori.	+	-	+	+	Eth.	0.01
64.	*Odontotermes wallonensis*	+	+	+	-	Sri Lanka	-	-	Ori.	-	-	-	+	Eth.	0.30
65.	*Microtermes bharatpurensis*	-	-	-	-	-	-	-	Ori.	-	+	+	+	Eth.	0.47

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
66.	*Microtermes incertoides*	+	+	+	-	-	-	-	Ori.	-	-	+	+	Eth.	0.18
67.	*Microtermes mycophagus*	+	+	+	+	Bangladesh	-	-	Ori.	-	-	-	+	Eth.	14.44
68.	*Microtermes obesi*	+	+	+	+	Bangladesh, Sri Lanka	-	Combodia, Myanmar, Thailand, Vietnam	Ori.	-	-	-	-	Eth.	3.24
69.	*Microtermes unicolor*	+	+	+	+	Bangladesh	-	-	Ori.	-	-	-	+	Eth.	2.87
70.	*Trinervitermes biformis*	+	-	+	+	Sri Lanka	-	-	Ori.	-	-	-	+	Eth.	5.26
71.	*Trinervitermes fletcheri*	+	-	+	-	-	-	-	Ori.	-			+	Eth.	0.88

Abbreviations : + Present, - Absent, Ori. Oriental, Eth. Ethiopian, Neo. Neotropical, Pal. Palearctic, ? Doubtful.

Rajasthan may be primarily due to similar type of biotopes (*i.e.*, arid region of Thar Desert). It has been noted that 31 species belonging to 13 genera occur in both states (Fig. 8). As expected most (12) of these species belongs to the genus *Odontotermes*. Distribution of commonly occurring genera are as follows : *Microcerotermes* and *Microtermes* - 3 species each; *Coptotermes*, *Heterotermes* and *Eremotermes* - 2 species each; *Angulitermes, Speculitermes, Synahmitermes* and *Trinervitermes* - 1 species each. *Anacanthotermes*, *Psammotermes* and *Amitermes* are represented by a single species each and are known to occur in both the states.

Comparative richness of termite taxa in different districts of Gujarat is presented in figure 9. In terms of richness of both genera and species Banaskantha shows highest position by having a maximum of 28 species distributed under 11 genera. Nineteen species each are known from the districts of Dangs, Kutch and Valsad. Sabarkantha and Vadodara districts each include 18 species and 7 genera. Least number of termite taxa (1 family, 1 genus and 2 species) is known from Bhavnagar district. Out of 60 species recorded in Gujarat, *Odontotermes latiguloides* is the most abundant species, occurring in 14 districts. Two other species namely, *O. gurdaspurensis* and *O. obesus* are known to occur in 13 districts. Highest specific ratio (species to genus ratio) has been shown by the genus *Odontotermes* : 11 in Vadodara, followed by 10 in Dangs, 9 in Kutch, Valsad and Sabarkantha each, and 8 in Mahesana. Family Termitidae shows its omnipresent nature in all the districts. A maximum of three families are known from Dangs, Gandhinagar and Valsad while the remaining twelve districts include only one family.

Termite fauna remains unexplored in two districts (Chittorgarh and Jhalawar) of Rajasthan. Highest number of termite taxa (3 families, 11 genera and 21 species) are recorded from Jodhpur district. Only a single species are known from Churu, Sawai Madhopur and Tonk districts. Following districts contain a considerably good number of termite species : Bikaner and Jaipur (11 species each), Barmer (13 species), Jaisalmer and Udaipur (14 species each) and Nagaur (17 species). Fifteen districts (Fig. 10) seem to be poorly explored and are known by one to five species. Sikar and Kota districts show its faunal richness by having 8 species. Genus *Odontotermes* has shown highest specific ratio in several districts : Nagaur (7), Jodhpur (6), Sikar and Udaipur (5 each). It is interesting to note that either one or two families have shown their presence in most districts, excepting the five districts (Barmer, Bikaner, Jaisalmer, Jodhpur and Nagaur) where a maximum of three families are recorded. In our study *Odontotermes obesus* is the most abundant species, occurring in 14 districts. *Microtermes mycophagus* has been reported from 10 districts. *M. obesi, O. latiguloides* and *Trinervitermes biformis* are collected from 8 districts.

The specific ratio (species to genus) is fairly high (5.4) for the family Termitidae which indicate a strong speciation trend. The specific ratio for the other two families is comparatively low, 2 for Rhinotermitidae, and 1.7 for Kalotermitidae. The trend for higher specific ratio is easily detected when considering the number of species per genus for the group : 7 genera

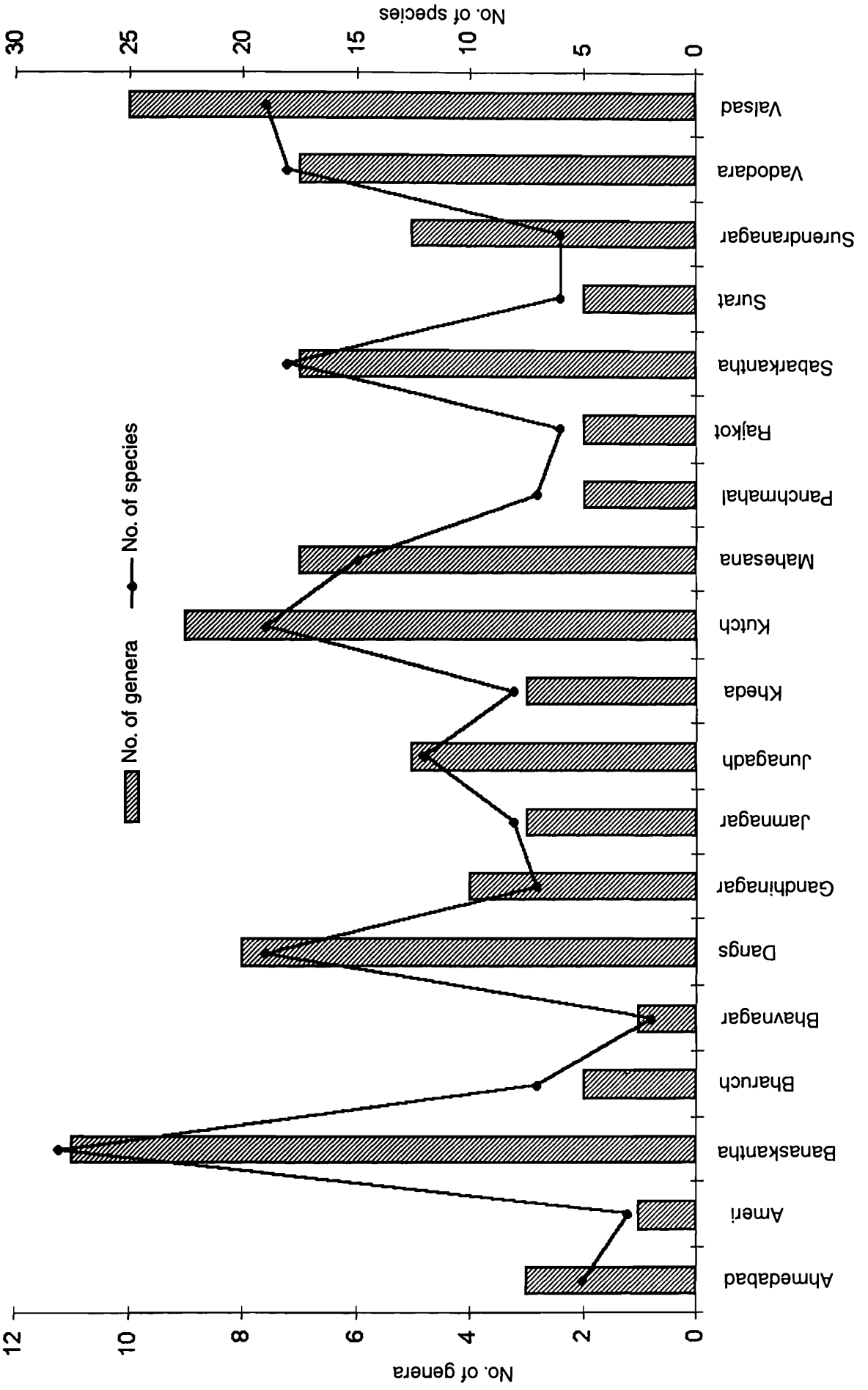


Fig. 9. Distribution of termite genera and species in Gujarat.

Fig. 10. Distribution of termite genera and species in Rajasthan.

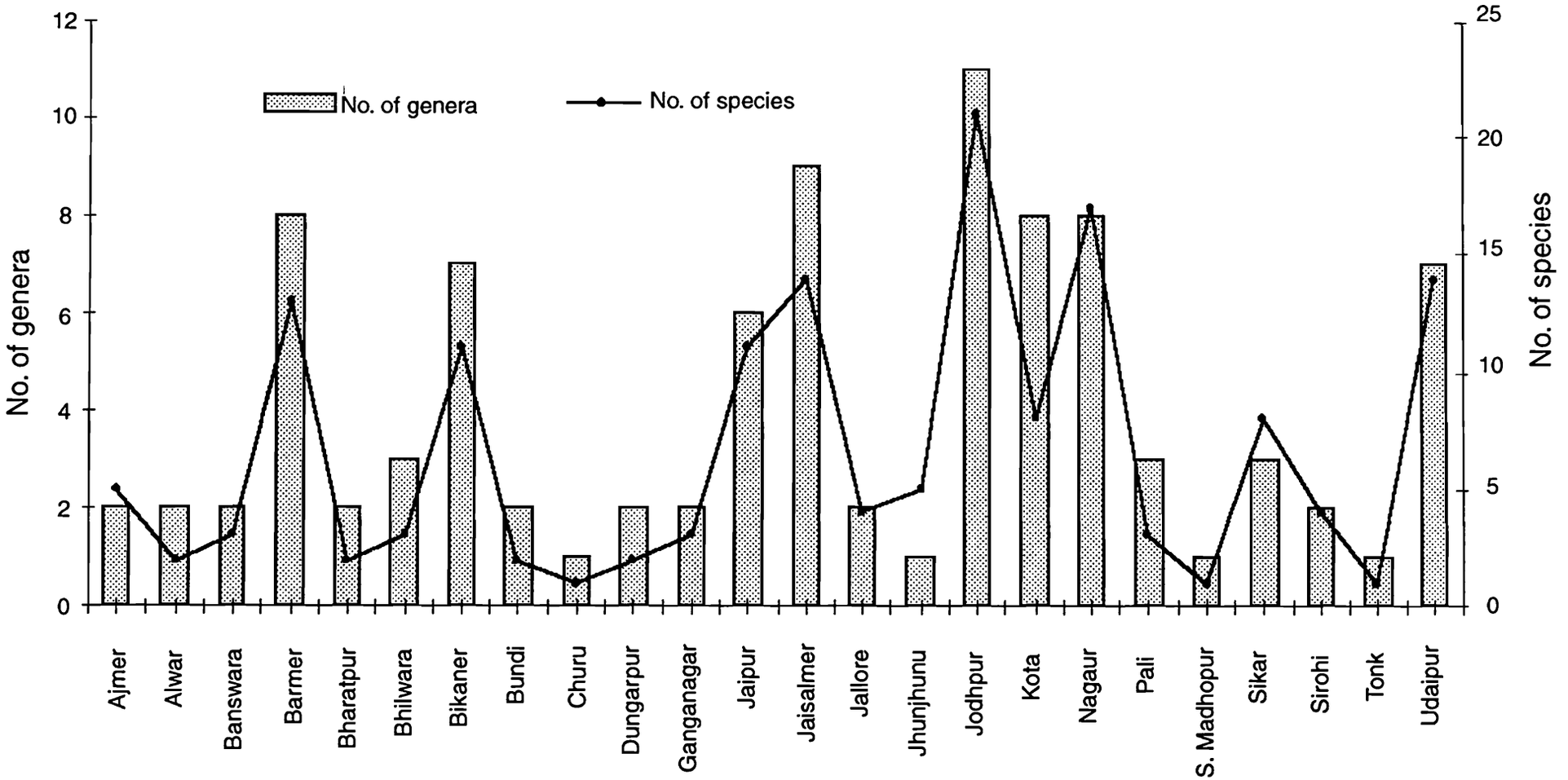
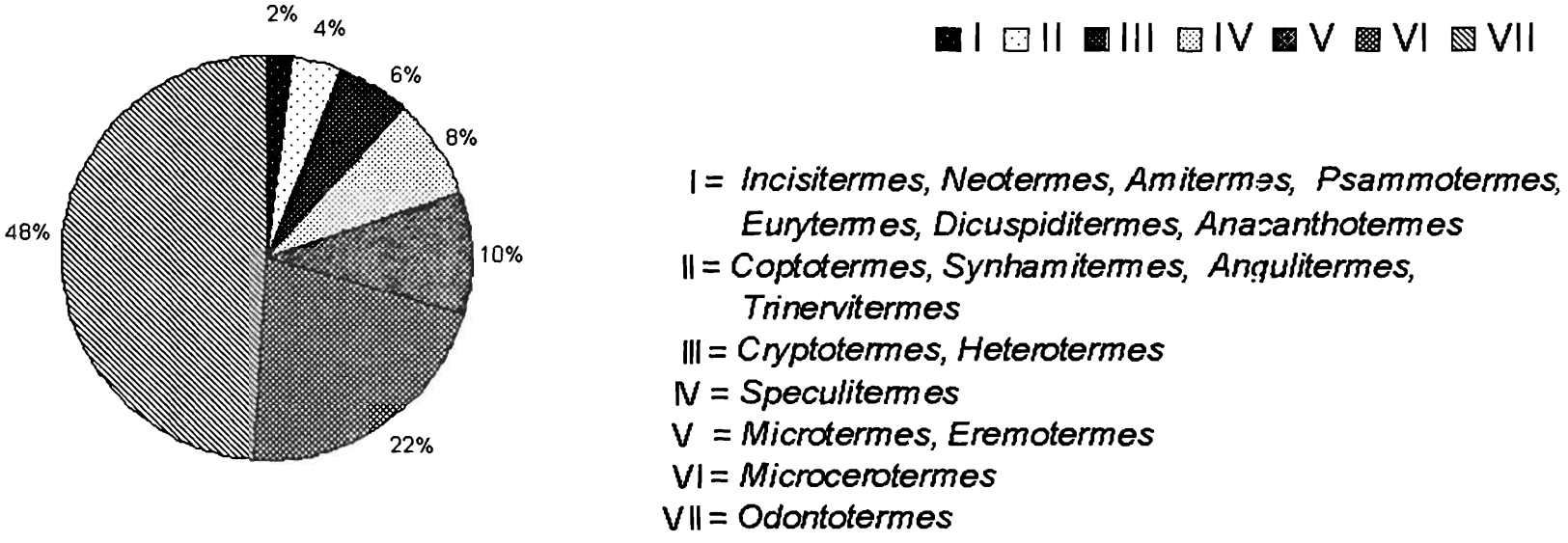


Fig. 11. Species strength under each genus.



have a single species (2%); 4 genera have 2 species (4%); 2 genera have 3 species (6%); 2 genera have 5 species (8%); 1 genus has 4 species (10%); 1 genus has 11 species (22%); 1 genus *i.e., Odontotermes* has 25 species (Fig. 11). Thus 48% of the species belong to one genus (*Odontotermes*) with a very high speciation rate. The genus *Microcerotermes* comes next in the series by occupying 22% of the total species strength.

It is more or less true that we have more information regarding the taxonomic accounts of the termites of these two states than what is available for the termite fauna of other states, but still there are many obvious deficiencies in our knowledge. We still lack a complete account of the actual limits of the distribution of various species, or the factors, which establish the limits. Some species are collected in small numbers and are not known by all castes. These species are believed to be capable of performing vertical migration in the soil or penetrating deep into the wood and are seldom present on or near the surface except after rain, so that collection is purely by chance. Such vertical movements are of great survival value, for they allow the termites to enjoy the equable temperature and moisture conditions throughout the year. Termites can take full advantage of warm, moist conditions occurring in the upper layer during rainy season and spring, and, by migrating downwards, avoid the drought and extreme temperature at the surface during summer and winter. Apart from this, majority of the species needs further consideration from the standpoint of detailed field biology and ecology. There are, however, a number of species with apparently discontinuous distribution, especially between the western and northeastern sides of Rajasthan, and about whose biology nothing or a very little is known. It is in the application of the existing data that future collection is likely to be most rewarding.

SUMMARY

Termite fauna in both the states is distributed over 4 families and 16 genera. Extensive surveys from the state of Gujarat resulted into a total of sixty species including the new records of one genus and fourteen species. Rajasthan termite fauna has been updated by adding 2 new records thus total number of species has been increased to 42. Keys to differentiate seventy-one termite species have been included. Heads of all 71 species are figured.

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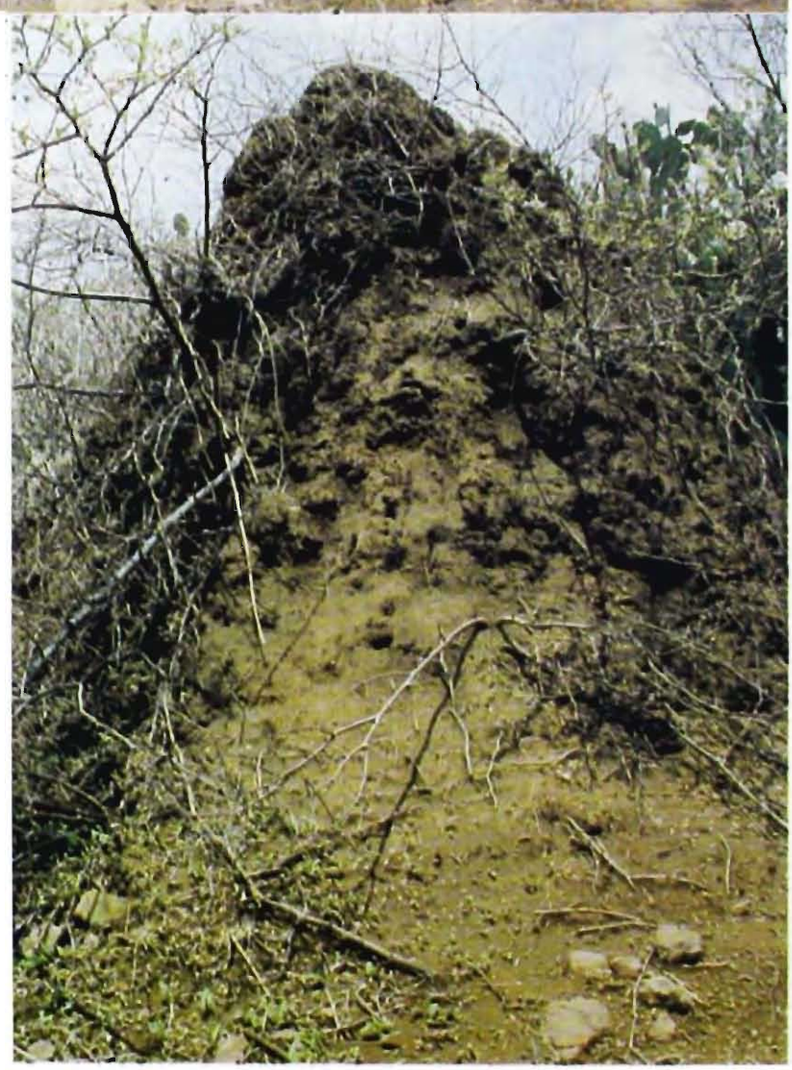
1. Earthen mound of *Odontotermes obesus* (Bundi district)

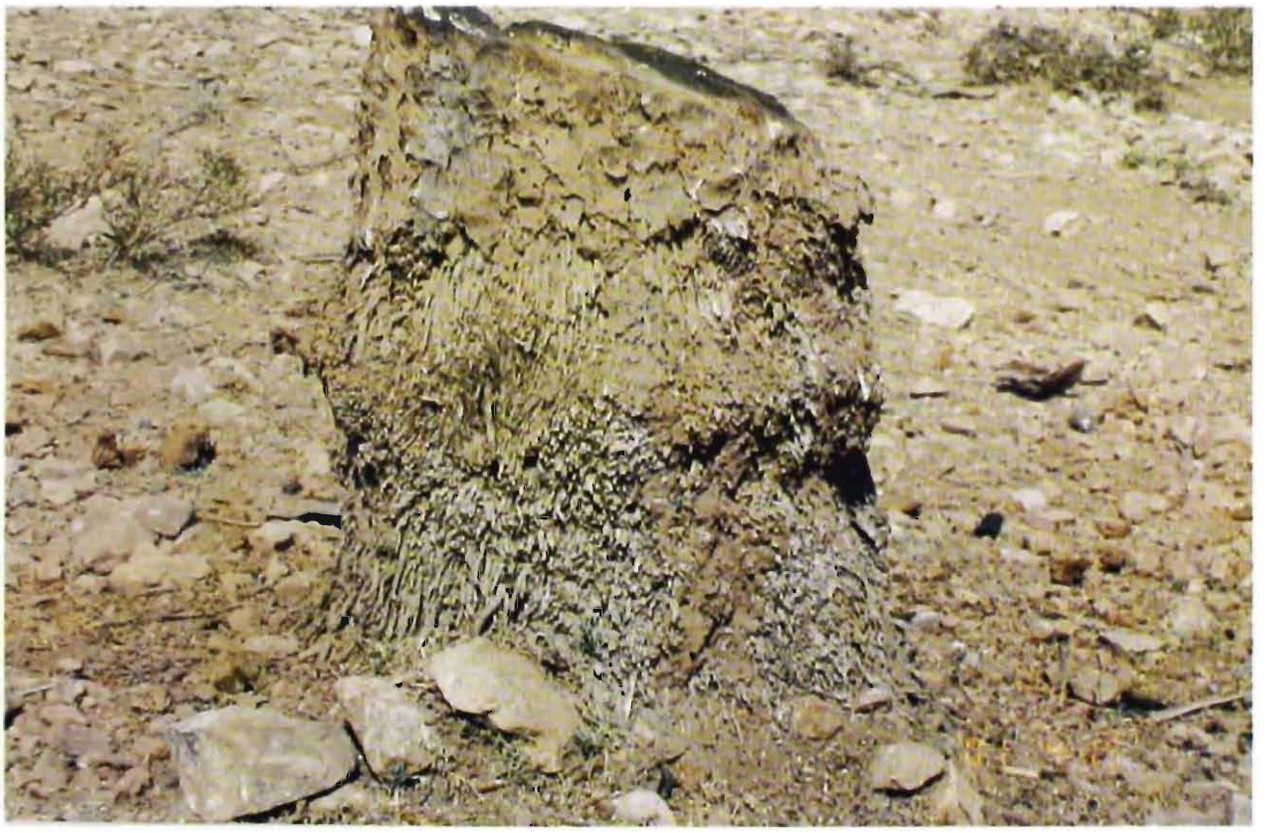
2. Earthen cathedral-like mound of *Odontotermes obesus* (Junagadh district)

3. **Small earthen mound of *Odontotermes gurdaspurensis* (Baran district)**



4. **Earthen mound of *Odontotermes brunneus* (Rajkot disrict)**

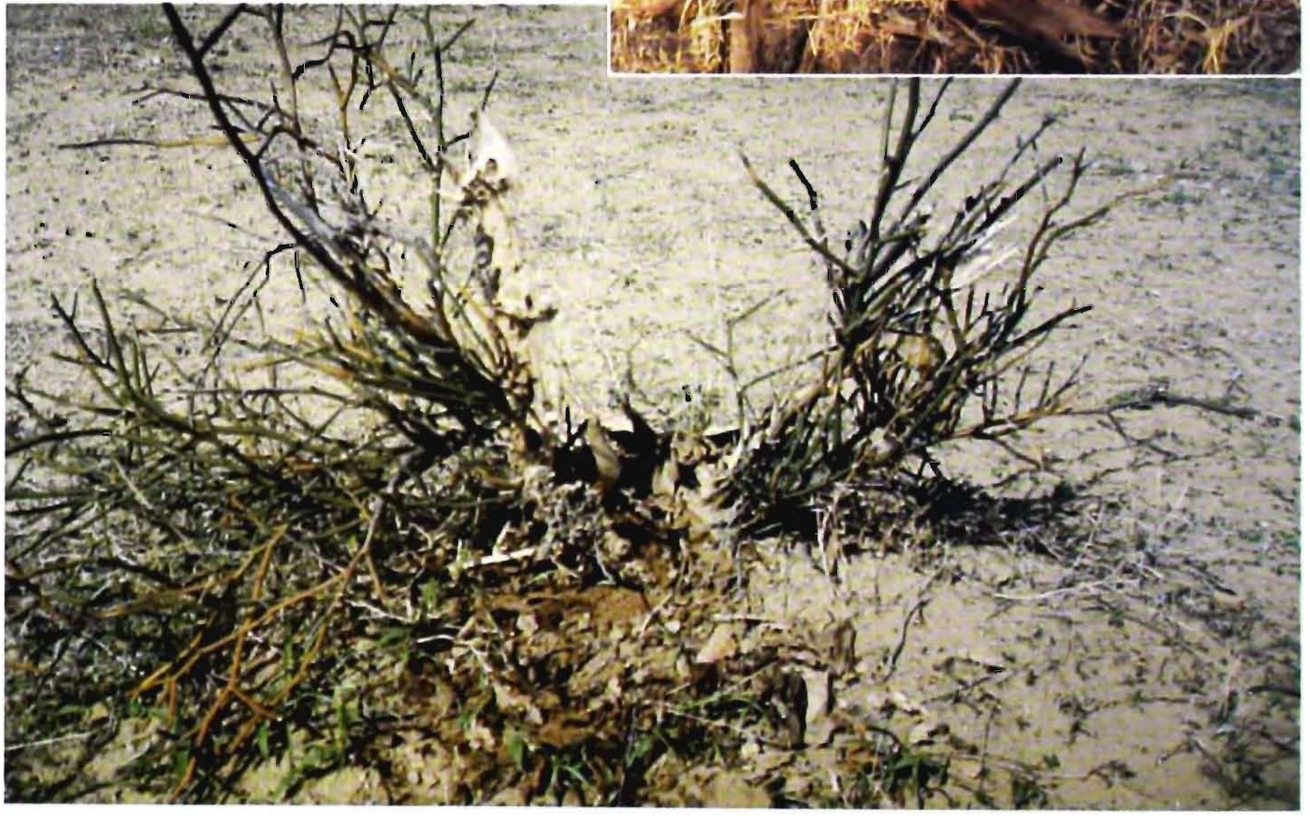
5. Damage caused by *Microtermes mycophagus* to wooden boxes and paper register (Jodhpur district)

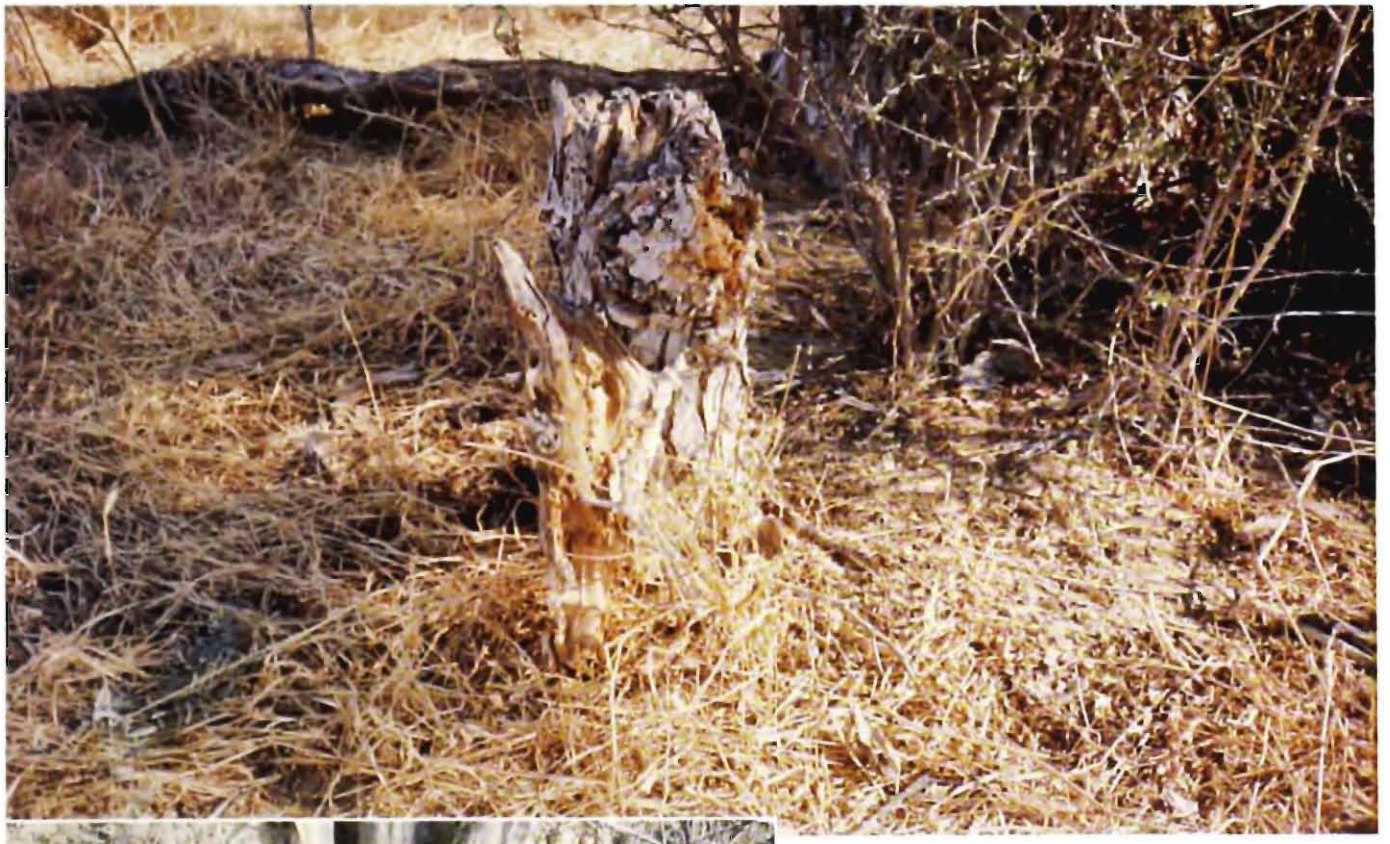


6. Date palm tree trunk damaged by *Microtermes mycophagus* (Bundi district)

7. **Eucalyptus tree trunk damaged by *Microtermes mycophagus* (Udaipur district)**

8. ***Capparis decidua* bush completely damaged by *Microtermes mycophagus* (Jaisalmer district)**





9. Dead *Prosopis cineraria* tree trunk showing damage made by *Microtermes mycophagus* (Jaisalmer district)

10. *Acacia tortilis* tree trunk showing damage made by *Microtermes mycophagus* (Jaisalmer district)

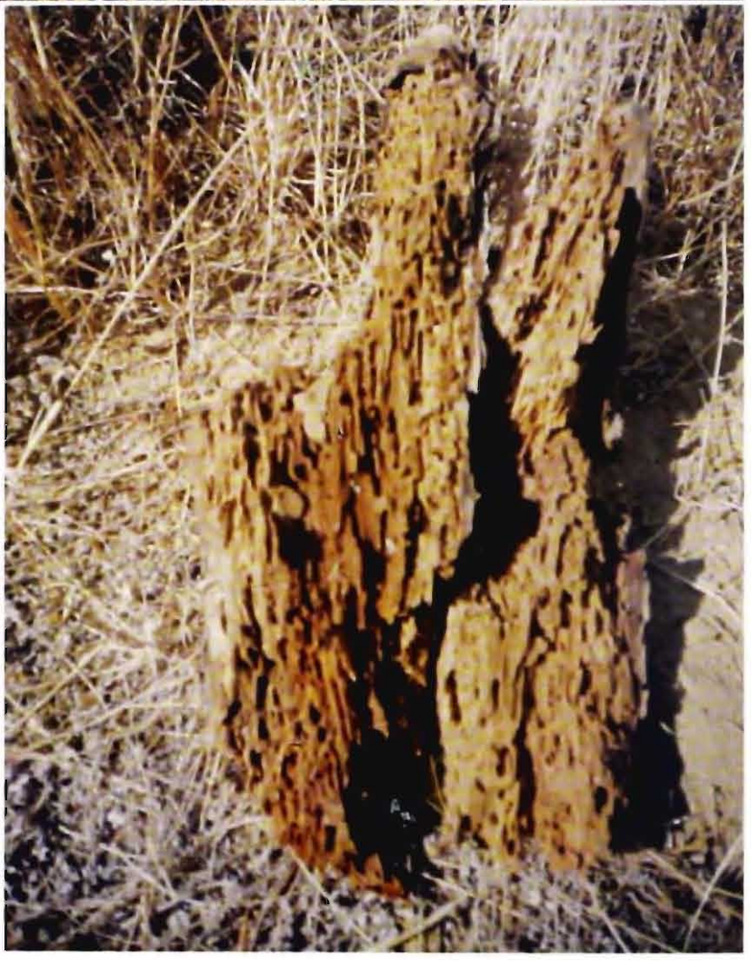
11. *Butea* sp. tree trunk showing damage made by *Microtermes mycophagus* (Sawai Madhopur district)

12. *Acacia* sp. tree trunk covered and plastered by mud of *Microtermes obesi* (Dholpur district)

13. Stems of *Zizyphus* sp. covered by earthen shelter tubes of *Microtermes obesi* (Dholpur district)

14. Small bush entirely covered by earthen shelter tubes of *Microtermes obesi* (Dholpur district)

15. Earthen shelter tubes of *Microtermes obesi* covering twigs of bushes (Jaisalmer district)

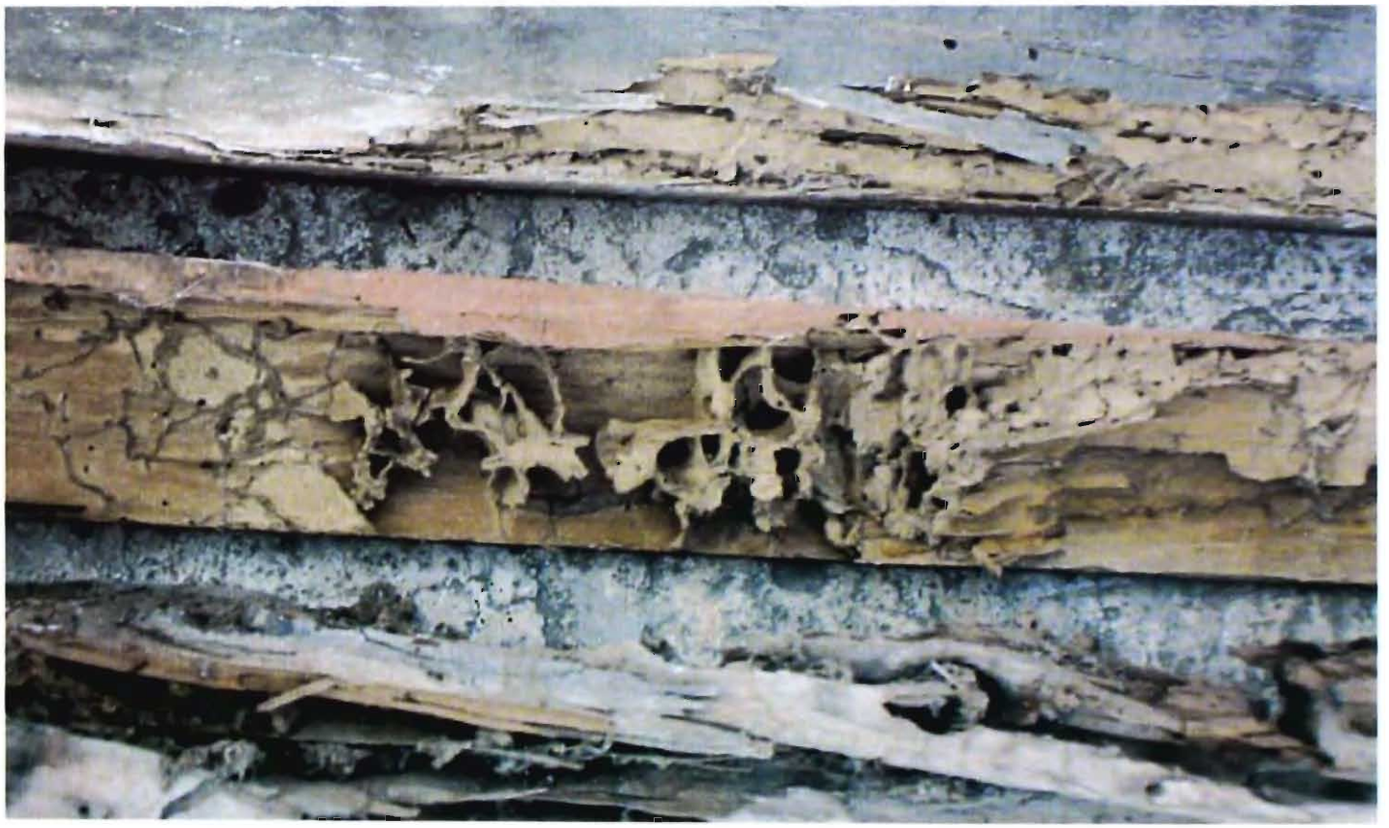


16. *Acacia* sp. tree trunk completely damaged by *Microtermes obesi* (Dholpur district)

17. *Prosospis cineraria* tree trunk damaged by *Microtermes obesi* (Jaisalmer district)

18. *Crotalaria burhia* bush covered by mud tunnels of *Microtermes obesi* (Jaisalmer district)

19. Broomstick plastered by mud of *Microtermes obesi* (Jaisalmer district)



20. Wooden door frame damaged by *Coptotermes heimi* (Jodhpur district)

21. Tree trunk showing damage made by *Coptotermes heimi* (Jaisalmer district)

22. *Albizza* sp. tree trunk damaged by *Coptotermes heimi* (Bhilwara district)

23. Hole made in the *Butea* sp. tree trunk by *Coptotermes heimi* (Bhilwara district)

24. Mango tree trunk damaged and devoured by *Amitermes belli* (Bhilwara district)

25. Hole made in the *Salvadora* sp. tree trunk by *Amitermes belli* (Barmer district)

26. Nesting comb of *Amitermes belli* in *Salvadora* sp. tree trunk (Barmer district)

27. Papaya tree damaged by *Heterotermes indicola* (Jodhpur district)

28. Closer view of the same papaya tree showing damaged root system; presence of termites notable (Jodhpur district)

29. Mounds of *Anacanthotermes macrocephalus* (Jaisalmer)

30. Mound of *Anacanthotermes macrocephalus* showing the conical shape and granular nature on gravelly background (Jaisalmer district)

31. Winged males and females of *Anacanthotermes macrocephalus* near the entrance hole with collected grass stems and leaves (Jaisalmer district)

32. Soldiers and workers of *Anacanthotermes macrocephalus* guarding the entrance with collected grass stems and leaves (Jaisalmer district)