

TAXONOMY OF WORKER CASTE OF TERMITES (ISOPTERA) OF LAHORE

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Abstract.- Worker castes, belonging to 13 species of termites from Lahore, are described for the first time. These studies will be of great assistance to termite ecologists interested in population studies, because, now, the presence of only workers in soil samples will not be a serious problem for correct identification.

In *Microtermes mycophagus* (Desneux) the structure of postclypeus is very characteristic and quite different from the remaining species of the genus *Microtermes*. Akhtar and Hussain (1981) have already reported the unique feature of the enteric valve armature of its worker caste. The studies carried out so far by the above authors clearly indicate that *Microtermes* is not the appropriate genus for *mycophagus*.

INTRODUCTION

Simpson (1945) commented that taxonomy is the most elementary and most inclusive part of zoology, elementary because animals cannot be discussed or treated in a scientific way until taxonomy has been achieved, and most inclusive because taxonomy in its guises and branches gathers together, utilizes, summarize and implements everything that is known about animals, whether morphological, physiological, psychological or ecological. Elton (1947) reports that taxonomy is the essential basis of the whole thing, without it the ecologist is helpless, and the whole of his work may be rendered useless.

Keeping in mind importance of correct identification, taxonomic studies on worker caste of termites from Lahore were undertaken. Illustration of the worker castes are drawn for the first time to enable correct identification which is critical in their control.

MATERIAL AND METHODS

The collection was made by the usual method employed for termite collection. Colonies collected in the field were preserved in 80 per cent alcohol. The specimens were examined under a Leitz Stereoscopic microscope with built in magnification changer. Measurements were taken with the aid of a calibrated ocular micrometer. Drawings were made with the help of camera lucida.

The taxonomic terms and measurements used in the present study are as explained by Ahmad (1955) and Krishna (1961).

SYSTEMATIC ACCOUT

Key to the species (Workers)

1. Pronotum flat 2
Pronotum saddle-shaped 4
2. Eyes present; length of head to tip of labrum 1.62-2.06 mm; maximum width of head 1.31-1.65 mm; long diameter of eye 0.15-0.25 mm; short diameter of eye 0.10-0.23 mm; length of pronotum 0.69-0.85 mm; width of pronotum 1.29-1.98 mm ... *Bifiditermes besoni* (Gardner) 3
Eye absent 3
3. Postclypeus not well developed, median line indistinct; length of head to side base of mandibles 0.87-1.18 mm; maximum width of head 0.98-1.34 mm *Coptotermes heimi* (Wasmann)
Postclypeus well developed, median line distinct, length of head to side base of mandibles 0.61-0.86 mm; maximum width of head 0.82-0.93 mm *Heterotermes indicola* (Wasmann)
4. Tibial spurs 2:2:2; Length of head to tip of labrum 1.13-1.33 mm; maximum width of head 0.90-1.03 mm; length of postclypeus 0.22-0.30 mm; length of pronotum 0.24-0.47 mm. *Amitermes belli* (Desneux)
Tibial spurs 3:2:2 5
5. Left mandible with a notch between marginal teeth 6
Left mandible without a notch between marginal teeth 8
6. Antennae with 14 articles, 4th articles shortest *Microtermes obesi* Holmgren
..... *Microtermes unicolor* Snyder
Antennae with 15-18 articles 7
7. Length of postclypeus 0.18-0.20 mm; length of head to tip of labrum 1.52-2.03 mm; width of head 1.18-1.56 mm; length of pronotum 0.25-0.38 mm. *Microtermes mycophagus* (Desneux)
Length of postclypeus 0.23-0.30 mm. *Odontotermes gurdaspurensis*
Holmgren and Holmgren *Odontotermes lokanandi*
Chatterjee and Thakur *Odontotermes obesus* (Rambur)
8. Right mandible with posterior edge of second marginal tooth deeply concave; length of pronotum 0.28-0.41 mm. *Eremotermes paradoxalis* Holmgren
Right mandible with posterior edge of second marginal tooth straight; length of pronotum 0.18-0.26 mm. 9
9. Larger species, total body length 4.19-4.61 mm. *Microcerotermes championi* Synder
Smaller species, total body length less than 4.19 mm. *Microcerotermes heimi* Wasmann

Family KALOTERMITIDAE Enderlein
Genus *BIFIDITERMES* Krishna

Bifiditermes beelsoni (Gardner)

Kalotermes beelsoni Gardner, 1944, p. 103.

Bifiditermes beelsoni, Krishna, 1961, p. 369; Akhtar, 1972, p. 46.

Nymph (Fig. 1).

Head brownish yellow, slightly darker posteriorly; labrum yellowish brown; anteclypeus yellowish brown; eyes dark brown; antennae uniformly coloured, brownish yellow; pronotum yellowish brown, much darker than head; meso and meta-nota lighter than pronotum, brownish yellow; legs and abdomen yellowish.

Head sparsely hairy with many scattered hairs and bristles; labrum with many bristles arranged in a row near anterior margin, six in middle; posterior margin of anteclypeus with four bristles; pronotum with many scattered hairs and bristles.

Head round, length to side base of mandibles slightly less than maximum width (Table I); labrum wider than long, anterior margin slightly rounded, lateral sides converging posteriorly; anteclypeus subtrapezoid, anterior margin depressed; postclypeus not clearly marked, indistinct, not bulging; eyes slightly longer than wide; mandibles as shown in figure, left mandible with anterior margin of 3rd marginal tooth one-and-half times as long as posterior margin of first plus second marginal tooth; antennae with 12-15 articles, in antenna with 15 articles, 4th short, pronotum flat semicircular, anterior margin distinctly depressed, lateral and posterior sides convex. Tibial spurs 3:3:3; Tarsi four joined.

TABLE I.- MEASUREMENTS (in mm) OF 10 WORKERS OF *BIFIDITERMES BEELSONI* (GARDNER).

	Range	Mean±S.E.*
Length of head to tip of Labrum	1.62-2.06	1.83±0.041
Length of head to side base of mandibles	1.18-1.54	1.36±0.028
Width of head	1.31-1.65	1.53±0.031
Longh diameter of eye	0.15-0.25	0.20±0.072
Short diameter of eye	0.10-0.23	0.20±0.009
Length of pronotum	0.69-0.85	0.75±0.015
Width of pronotum	1.29-1.98	1.68±0.056

* ± Standard error of mean.

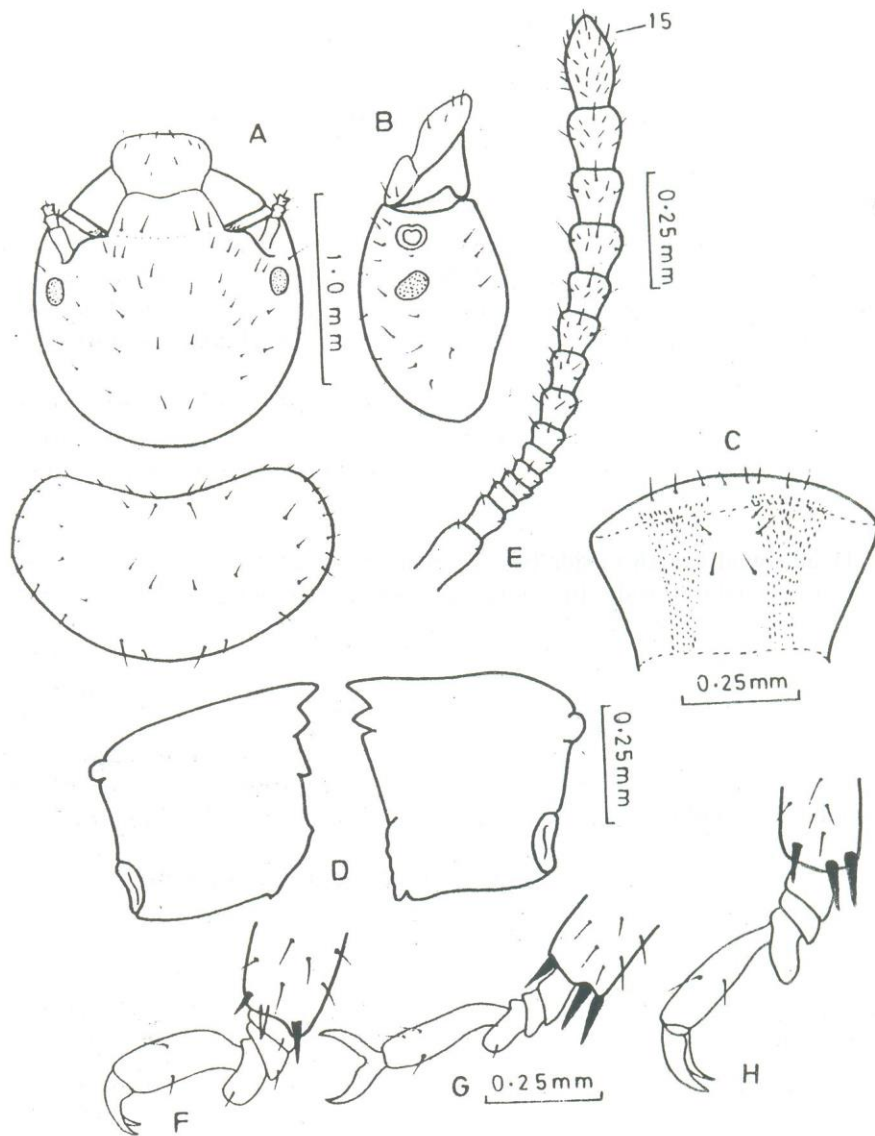


Fig. 1. Nymph of *Bifütermes becsoni* (Gardner). A, head and pronotum from above, B, Head from side. C, labrum from above, D, mandibles, E, antenna, F, Fore leg, G, middle leg, H, hind leg.

Locality

Lahore (Botanical garden), Soliders, nymphs, collected by M.S. Akhtar, 29.iii.1981, from *Bauhinia Variegata*.

Family RHINOTERMITIDAE Light
Subfamily COPTOTERMITINAE Holmgren

Genus *COPTOTERMES* Wasmann

Coptotermes heimi (Wasmann)

Arrhinotermes Heimi Wasmann, 1902, p. 104.

Coptotermes heimi; Synder, 1949, p. 79.

Worker (Fig. 2).

Head brownish yellow, slightly darker posteriorly; labrum yellowish; anteclypeus brownish yellow; postclypeus as dark as anteclypeus; antennae uniformly coloured, yellow; thorax and abdomen yellowish white; legs brownish yellow.

Head sparsely hairy with many scattered hairs and bristles; labrum with six long bristles in middle, three on each side, and a few scattered hairs present; postclypeus with a few scattered hairs; anteclypeus with a few bristles; antennal distal articles more densely hairy than the basal; pronotum with many scattered hairs and bristles.

Head rectangularly oval, length to side base of mandibles slightly less than maximum width (Table II); labrum slightly wider than long; anteclypeus trapezoid; postclypeus slightly wider than long; anteclypeus trapezoid; postclypeus slightly swollen, much smaller than anteclypeus, median line weakly indicated; mandible as shown in figure; antennae with 13-15 articles, 4th shortest, pronotum flat, distinctly notched anteriorly. Tibial Spurs 3:2:2. Tarsi four-jointed.

TABLE II.-

(WASMANN).

TABLE II.- MEASUREMENTS (in mm) OF
10 WORKERS OF *COP*

	Range	Mean±S.E.
Length of head to tip of labrum	1.08-1.47	1.32±0.041
Length of head of side base of mandibles	0.87-1.18	1.03±0.035
Width of head	0.98-1.34	1.16±0.038
Length of Postclypeus	0.10-0.20	0.14±0.011
Width of postclypeus	0.36-0.49	0.40±0.015
Length of pronotum	0.25-0.41	0.32±0.017
Width of pronotum	0.61-1.00	0.76±0.037

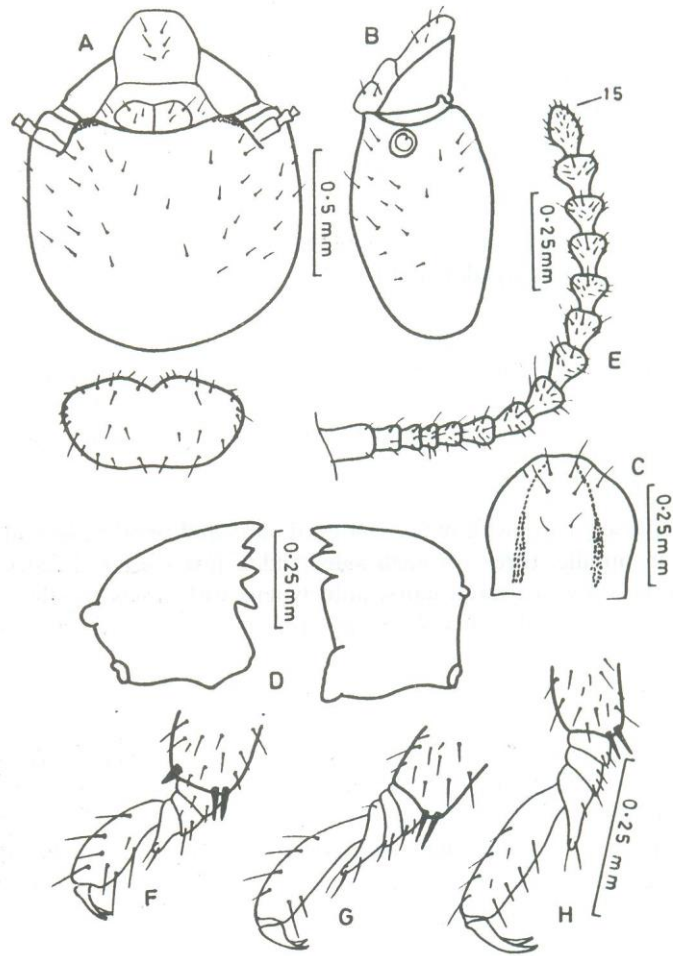


Fig. 2. Worker of *Coptotermes heimi* (Wasmann). A. head and pronotum from above. B. head from side. C. labrum from above. D. mandibles. E. antenna. F. fore leg, G. middle leg. H. hind leg.

Locality

Lahore, Soliders, workers, collected by M.S. Akhtar, 2.V. 1976, from *Populus euamericana*.

Subfamily HETEROTERMITINAE Froggatt.

Genus *HETEROTERMES* Froggatt.

Heterotermes indicola (Wasmann).

Leucotermes indicola Wasmann, 1902, p. 118.

Heterotermes indicola: Synder, 1949, p. 68.

Worker (Fig. 3).

Head whitish yellow, slightly darker posteriorly; labrum yellow; anteclypeus yellowish white; postclypeus yellow; antennae uniformly coloured, yellowish; thorax, abdomen and legs lighter than head, yellowish white.

Head sparsely hairy with many scattered hairs and bristles; labrum with six long bristles, three on each side, a few hairs present; anteclypeus without hairs or bristles; postclypeus with six bristles; pronotum with many scattered bristles and hairs of different size; distal articles more densely hairy than the basal.

Head nearly rectangular, length of head to side base of mandibles slightly less than maximum width (Table III); labrum wider than long; anteclypeus trapezoid; postclypeus moderately swollen, slightly longer than half of its width, median line indicated; mandibles shown in figure; antennae with 12-15 articles, in antennae with 14 articles, 4th shortest; pronotum flat, distinctly notched anteriorly, posteriorly emarginate. Tibial spurs 3:2:2. Tarsi four jointed.

TABLE III.- MEASUREMENTS (in mm) OF 10 WORKERS OF *HETEROTERMES INDICOLA* (WASMANN).

	Range	Mean±S.E.*
Length of head to tip of Labrum	0.96-1.19	1.07±0.025
Length of head of side base of mandibles	0.61-0.86	0.79±0.023
Width of head	0.82-0.93	0.88±0.015
Length of Postclypeus	0.15-0.29	0.20±0.018
Width of postclypeus	0.30-0.39	0.35±0.009
Length of pronotum	0.24-0.39	0.33±0.017
Width of pronotum	0.49-0.65	0.57±0.016

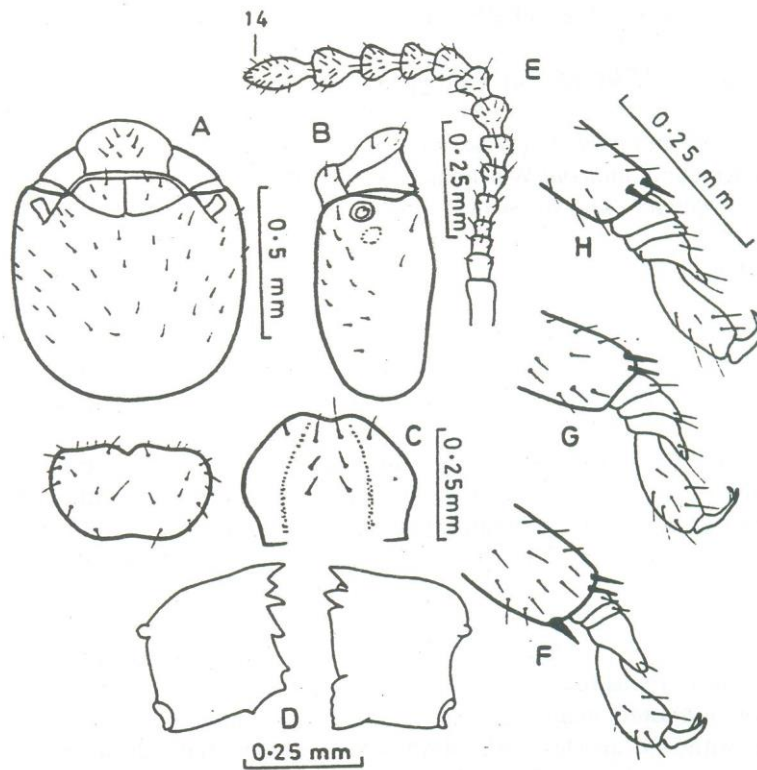


Fig. 3. Worker of *Heterotermes indicola* (Wasmann). A, head and pronotum from above. B, head from side. C, labrum from above. D, mandibles. E, antenna. F, fore leg. G, middle leg. H, hind leg.

Locality

Lahore, soldiers, workers, collected by M.S. Akhtar 6.ii.1976, ex. log.

Family TERMITIDAE Westwood.

Subfamily MACROTERMITINAE Kemner.

Genus *ODONTOTERMES* Holmgren.

Odontotermes gurdaspurensis Holmgren and Holmgren.

Odontotermes (cyclotermes) obesus f. *gurdaspurensis* Holmgren and *Odontotermes (Odontotermes) obesus* f. *gurdaspurensis*: Snyder, 1949, p. 235.

Odontotermes (O). *gurdaspurensis*: Ahmad, 1955, pp. 222-224.

Odontotermes gurdaspurensis: Chatterjee and Thakur, 1964, pp. 76-16.

Workers (Fig. 4).

Head reddish brown, slightly darker posteriorly; labrum brownish yellow, with a brownish transverse band; anteclypeus yellowish, with a V-shaped brownish mark; postclypeus yellowish brown; antennae not uniformly coloured, basal antennal articles light brown, distal darker, smoky brown; pronotum much lighter than head, yellowish brown; meso, meta-notum, abdomen and legs brownish yellow.

Head sparsely hairy with many scattered hairs and bristles; labrum with eight bristles in middle, four on each side, a few hairs present; anteclypeus without hairs or bristles; anterior margin of postclypeus with long bristles, rest with scattered hairs; pronotum with many scattered hairs and bristles; distal articles more densely hairy than the basal.

Head squarish, length to side base of mandibles slightly less than maximum width (Table IV); labrum slightly wider than long, lateral sides nearly parallel in posterior half, anteclypeus subtrapezoid; postclypeus slightly swollen, less than half as long as wide, median line distinct; mandibles as shown in figure; antennae with 17 articles, 3rd article shortest; pronotum extremely saddle-shaped, notched anteriorly, posterior margin emarginate. Tibial spurs 3:2:2. Tarsi four jointed.

TABLE IV.- MEASUREMENTS (in mm) OF 10 WORKERS OF *ODONTOTERMES GURDASPURENSIS* (HOLMGREN AND HOLMGREN).

	Range	Mean±S.E.*
Length of head to tip of Labrum	1.85-2.14	2.03±0.030
Length of head of side base of mandibles	1.28-1.47	1.36±0.016
Width of head	1.47-1.67	1.55±0.017
Length of Postclypeus	0.23-0.25	0.23±0.003
Width of postclypeus	0.54-0.59	0.56±0.006
Length of pronotum	0.30-0.38	0.37±0.008
Width of pronotum	0.77-0.87	0.83±0.011

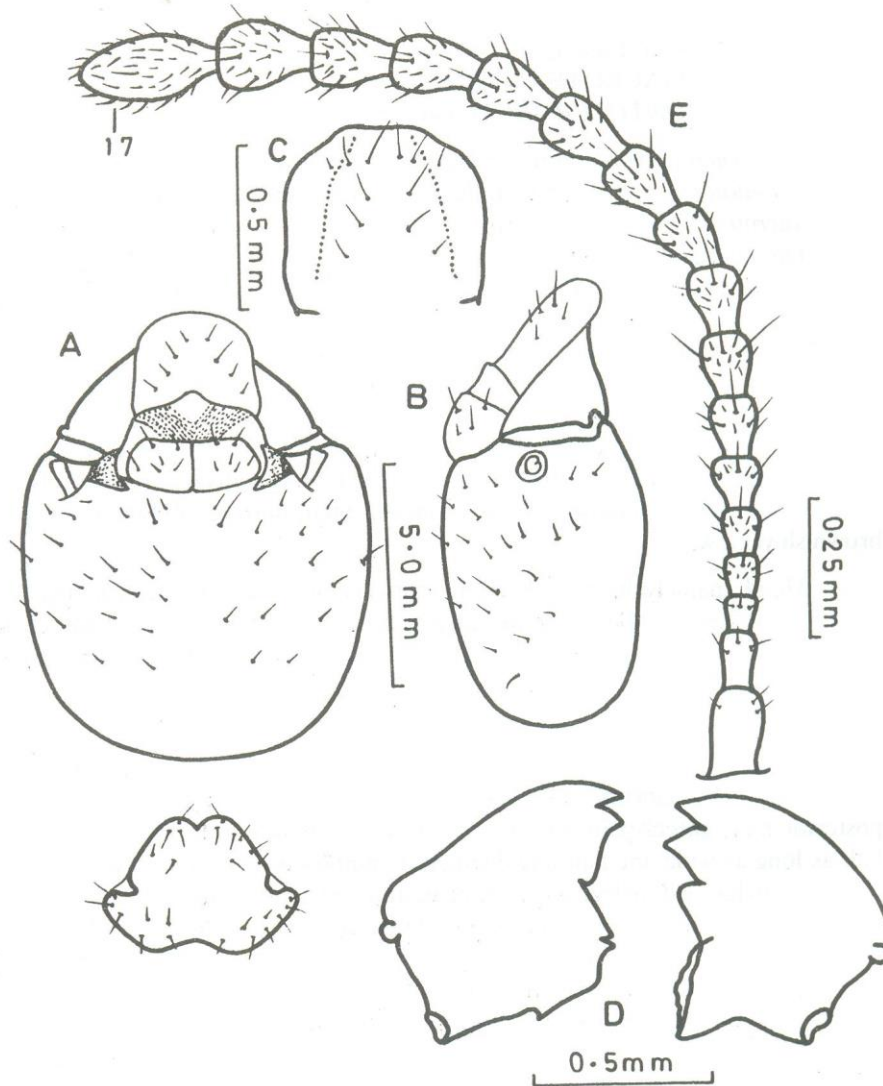


Fig. 4. Worker of *odontotermes gurdaspurensis* (Wasmann). A, head and pronotum from above. B, head from side. C, labrum from above. D, mandibles. E, antenna. F, fore leg. G, middle leg. H, hind leg.

Locality

Lahore, Soliders, Workers, Collected by M.S. Akhtar 21.ii. 1968, ex. Sercanda.

Odontotermes lokanandi Chatterjee and Thakur.

Odontotermes lokananadi Chatterjee and Thakur, 1967, p. 38. Akhtar, M.S. 1972, p. 161.

Workers (Fig. 5).

Head light raddish brown, slightly darker posteriorly; labrum yellowish white, with a brownish transverse band; anteclypeus whitish yellow, with a V-shaped brownish mark; postclypeus brownish; antennae not uniformly coloured, basal articles yellowish brown, distal smoky brown; pronotum lighter than head; meso and meta-nota and abdomen brownish yellow; legs slightly darker than meso and meta-nota, light brownish yellow.

Head sparsely hairy with many scattered hairs and bristles; labrum with eight long bristles, four on each side, a few hairs present; postclypeus with four on bristles; distal articles more densely hairy than the basal; pronotum with many scattered hairs and bristles.

Head nearly squarish, length to side base of mandibles slightly less than maximum width (Table V); labrum wider than long, lateral sides nearly parallel in posterior half, anterior margin slightly depressed; anteclypeus trapezoid; postclypeus swollen, median line distinct; mandibles as shown in figure; antennae with 15-17 articles, in antenna with 17 articles 3rd and 5th articles nearly equal, shortest; pronotum extremely saddle-shaped, anterior margin slightly emarginate. Tibial spurs 3:2:2. Tarsi four-jointed.

TABLE V.- MEASUREMENTS (in mm) OF 10 WORKERS OF *ODONTOTERMES LOKANANDI* CHATTERJEE AND THAKUR.

	Range	Mean±S.E.*
Length of head to tip of Labrum	1.39-1.14	1.89±0.060
Length of head of side base of mandibles	0.87-1.131	1.25±0.044
Width of head	0.98-1.57	1.40±0.052
Length of Postclypeus	0.25-0.28	0.25±0.003
Width of postclypeus	0.41-0.59	0.55±0.15
Length of pronotum	0.25-0.43	0.40±0.017
Width of pronotum	0.64-0.87	0.78±0.019

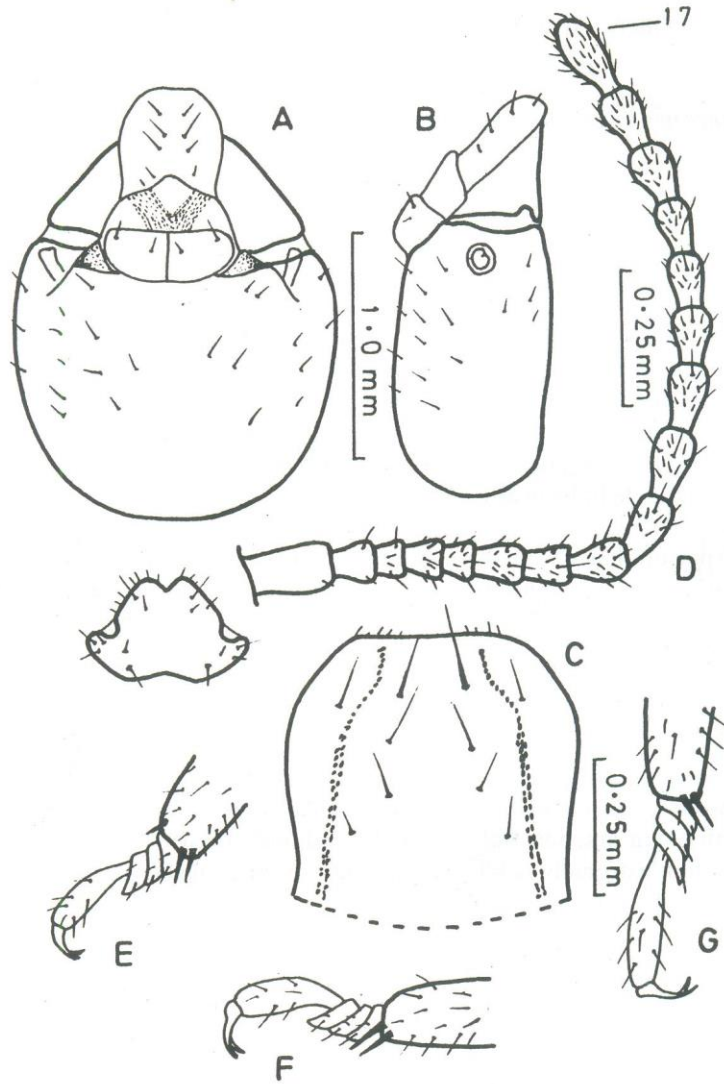


Fig. 5. Worker of *Odontotermes lokanandi* (Wasmann). A. head and pronotum from above. B. head from side. C. labrum from above. D. mandibles. E. antenna. F. fore leg. G. middle leg. H. hind leg.

Locality

Lahore. soliders, workers. collected by M.S. Akhtar. 21.2.1968. under cow dung.

Odontotermes obesus (Rambur)

Termes obesus Rambur, 1842, p. 304; Hagen, 1858, 2. 145.

Odontotermes (*Cyclotermes*) *obesus*: Holmgren, 1912, p. 38.

Odontotermes (*Odontotermes*) *obesus*: Synder, 1949, p. 235; 108.

Odontotermes obesus: Roonwal and Bose, 1964.

Worker (Fig. 6).

Head light brown, slightly darker posteriorly; labrum yellowish brown, tip hyaline; anteclypeus yellowish, with V-shaped brownish mark; postclypeus brownish yellow; not uniformly coloured, basal antennal articles light brown, distal much darker, smoky brown; pronotum yellow, much lighter than head; meso and meta-nota slightly lighter than head; legs as dark as meso and meta-nota, abdomen pale white.

Head sparsely hairy with many scattered hairs and bristles; labrum with long bristles near middle, short hairs near anterior margin, a few short bristles near posterior half; anteclypeus without hairs or bristle; anterior margin of postclypeus with long bristles, rest of the portion with scattered bristles of different size; distal articles more densely hairy than the basal; pronotum with scattered hairs and bristles.

Head squarish, length of head to side base of mandibles slightly less than maximum width (Table VI); labrum wider than long, lateral sides nearly parallel in posterior half; anteclypeus subtrapezoid; postclypeus slightly swollen, anterior margin not strongly sclerotized, median line distinct, slightly shorter than half of its width; mandibles as shown in figure; antennae with 17-18 articles, in antenna with 18 articles, 2nd distinctly longer than third, latter shortest; pronotum extremely saddle-shaped; slightly notched anteriorly; posterior margin indistinctly emarginate. Tibial spurs 3:3:2. Tarsi four-jointed.

TABLE VI.- MEASUREMENTS (in mm) OF 10 WORKERS OF *ODONTOTERMES OBESUS* (RAMBUR).

	Range	Mean±S.E.*
Length of head to tip of Labrum	2.01-2.19	2.08±0.018
Length of head of side base of mandibles	1.29-1.44	1.38±0.15
Width of head	1.52-1.70	1.61±0.018
Length of Postclypeus	0.25-0.30	0.28±0.003
Width of postclypeus	0.67-0.77	0.71±0.006
Length of pronotum	0.33-0.51	0.44±0.015
Width of pronotum	0.82-1.0	0.89±0.018

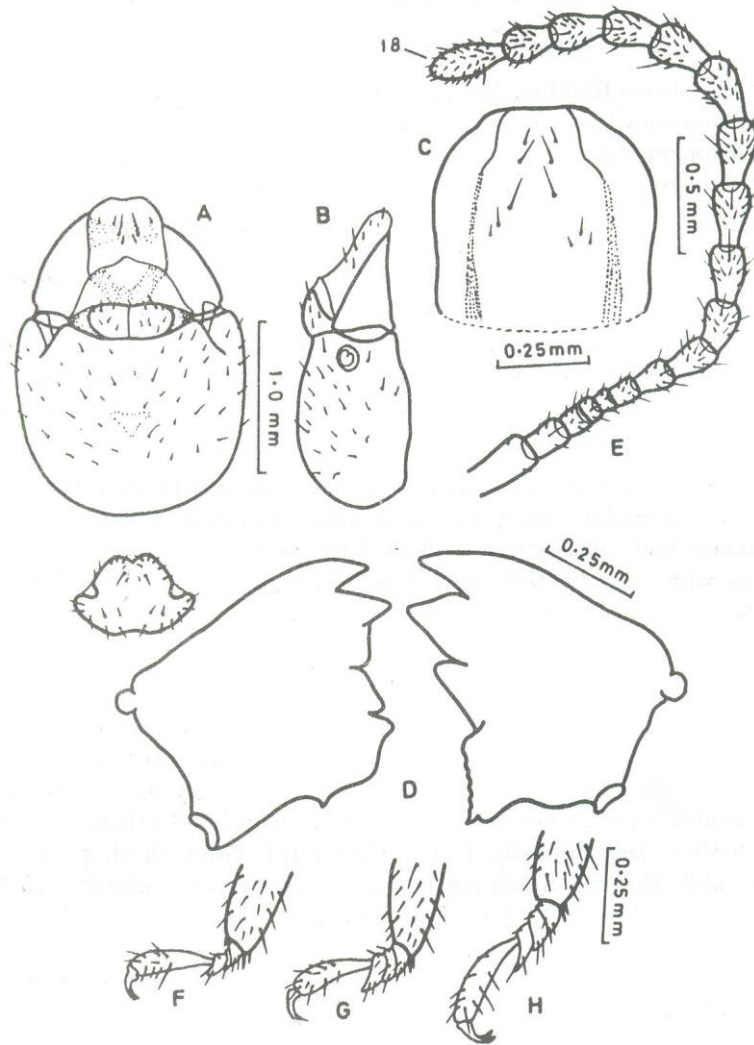


Fig. 6. Worker of *Odontotermes obesus* (Rambur). A. head and pronotum from above. B. head from side. C. labrum from above. D. mandibles. E. antenna. F. fore leg. G. middle leg. H. hind leg.

Locality

Lahore (Botanical Garden), soldiers, workers, collected by Miss Shafqat Parveen, 22.vi, 1980, from mound.

Genus *MICROTERMES* Wasmann

Microtermes mycophagus (Desneux)

Termes mycophagus Desneux, 1906, p. 348.

Microtermes mycophagus, Holmgren, 1913a.

Worker (Fig. 7).

Head light brown, darker posteriorly; labrum brownish yellow, tip hyaline; anteclypeus brownish yellow; postclypeus yellowish brown, area surrounding postclypeus reddish brown; antennae uniformly coloured, yellowish; pronotum brownish yellow, much lighter than head; meso and meta-nota, legs and abdomen lighter than head, yellowish.

Head sparsely hairy with many scattered hairs and bristles, labrum with a few long bristles and short hairs; postclypeus with many scattered bristles and hairs of different size; antennae with distal articles more densely hairy than the basal; pronotum with many scattered hairs and bristles.

Head nearly rectangular, length of head to side base of mandibles slightly less than width (Table VII); labrum slightly wider than long, lateral sides nearly parallel in posterior two third; anteclypeus trapezoid; postclypeus slightly swollen, surrounded by slightly sclerotized area, shorter than half of its width; mandibles robust, broader anteroposteriorly than laterally, as shown in figure; antennae with 15-17 articles, in antennae with 17 articles 5th article shortest; pronotum extremely saddle-shaped, notched anteriorly and posteriorly. Tibial spurs 3:2:2. Tarsi four-jointed.

TABLE VII.- MEASUREMENTS (in mm) OF 10 WORKERS OF *MICROTERMES MYCOPHAGUS* (DESNEUX).

	Range	Mean±S.E.*
Length of head to tip of Labrum	1.52-2.03	1.70±0.44
Length of head of side base of mandibles	1.03-1.44	1.23±0.034
Width of head	1.18-1.56	1.31±0.034
Length of Postclypeus	0.18-0.20	0.19±0.002
Width of postclypeus	0.43-0.56	0.45±0.012
Length of pronotum	0.25-0.38	0.28±0.012
Width of pronotum	0.59-0.77	0.64±0.018

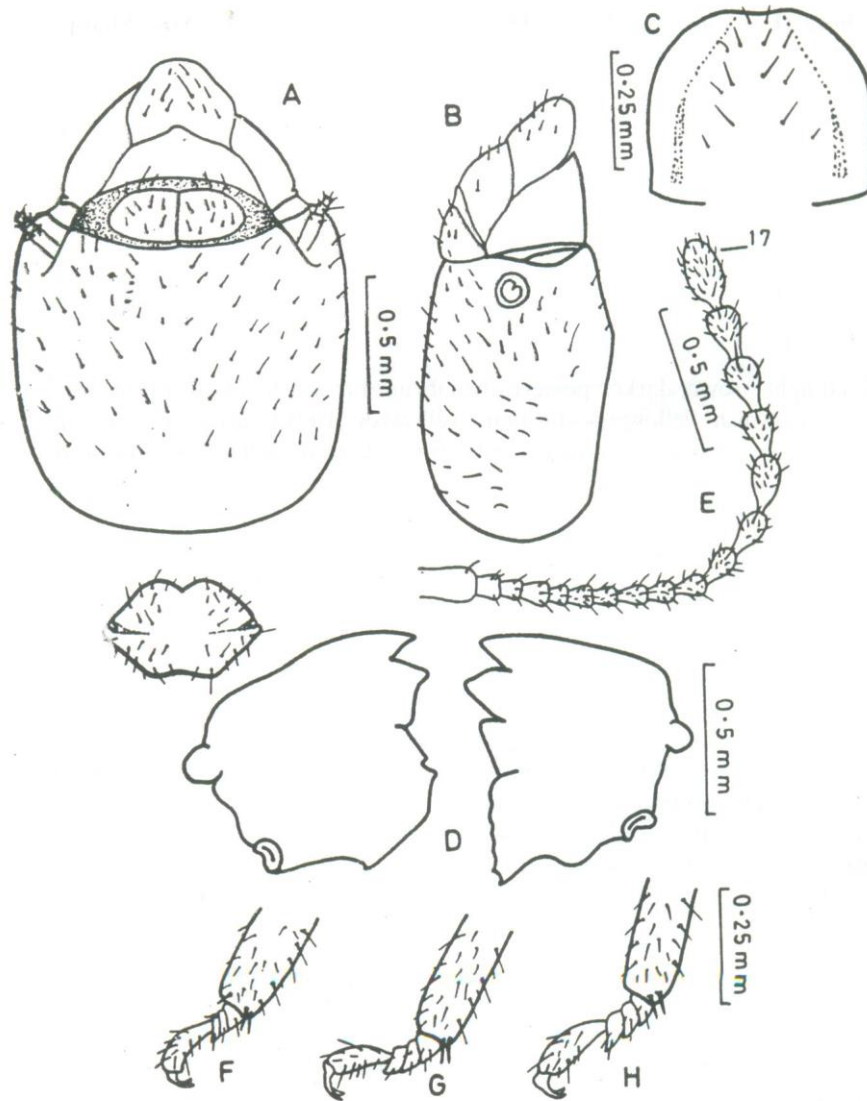


Fig. 7. Worker of *Microtermes mycophagus* (Desneux). A, head and pronotum from above. B, head from side. C, labrum from above. D, mandibles. E, antenna. F, fore leg. G, middle leg. H, hind leg.

Locality

Lahore (Dhobi Ghat, Baghbanpura), soldiers, workers collected by M.S. Akhtar, 22.ii. 1968, from *Calatropis*.

Microtermes obesi Holmgren

Microtermes obesi Holmgran, 1912a.

Worker (Fig. 8).

Head brownish, slightly darker posteriorly; labrum brownish yellow with brownish transverse band; anteclypeus yellowish brown, with V-shaped brownish yellow mark; postclypeus yellowish brown; antennae uniformly coloured, yellowish, thorax, legs and abdomen lighter than head, brownish yellow.

Head sparsely hairy with many scattered hairs and bristles; labrum with eight long bristles, four on each side, and a few scattered hairs, anteclypeus without hairs or bristles; postclypeus with a few scattered hairs and bristles; distal articles more densely hairy than the basal; pronotum with many scattered hairs and bristles.

Head squarish, length of head to side base of mandibles nearly equal to maximum width (Table VIII); labrum wider than long; anteclypeus subtrapezoid, with a distinct-V-shaped mark; postclypeus slightly swollen, median line distinct; mandibles as shown in figure; antennae with 14 articles, 4th shortest; pronotum saddle-shaped, distinctly notched anteriorly, slightly emarginate posteriorly. Tibial spurs 3:2:2. Tarsi four-jointed.

TABLE VIII.-MEASUREMENTS (in mm) OF 10 WORKERS OF *MICROTERMES OBESI* HOLMGREN.

	Range	Mean±S.E.*
Length of head to tip of Labrum	1.13-1.44	1.35±0.037
Length of head of side base of mandibles	0.72-1.07	0.98±0.37
Width of head	0.76-1.07	1.00±0.035
Length of Postclypeus	0.18-0.20	0.19±0.003
Width of postclypeus	0.30-0.41	0.38±0.010
Length of pronotum	0.22-0.28	0.25±0.005
Width of pronotum	0.51-0.63	0.57±0.013

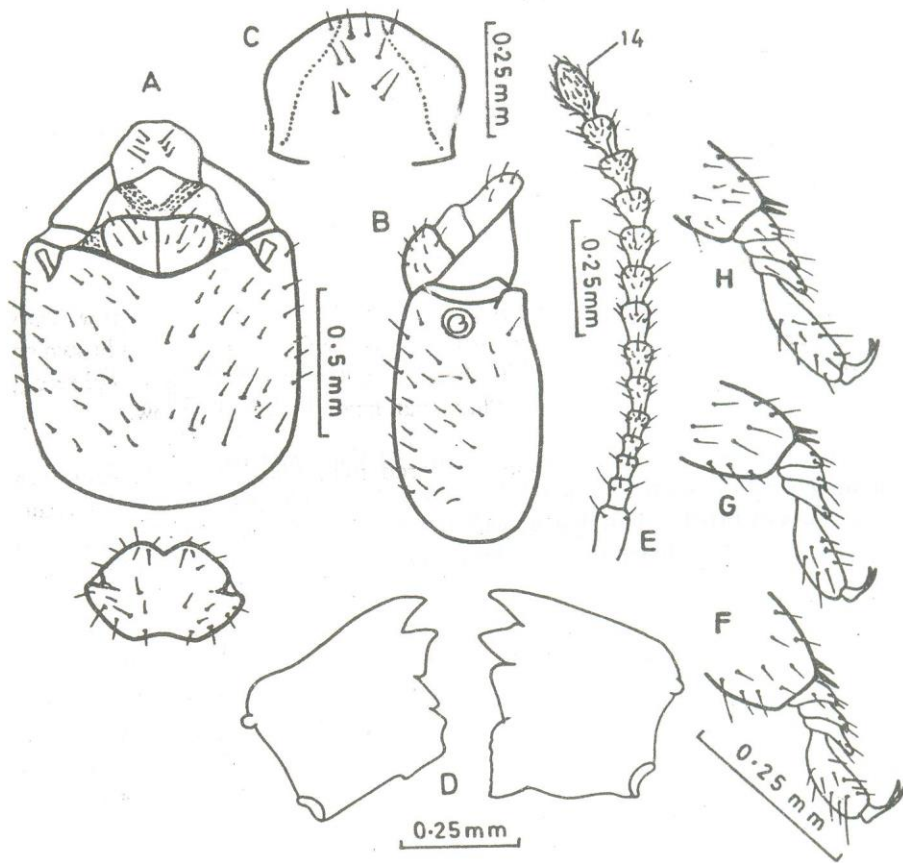


Fig. 8. Worker of *Microtermes obesi* Holmgren. A, head and pronotum from above. B, head from side, C, labrum from above. D, mandibles. E, antenna. F, fore leg, G, middle leg. H, hind leg.

Locality

Lahore, soliders, workers, collected by A. Aleem, 24.ii. 1968, in a stump.

Microtermes unicolor Snyder.

Microtermes unicolor Snyder, 1933, pp. 92-93.

Worker (Fig. 9).

Head light brown, slightly darker posteriorly, labrum yellowish, tip hyaline; anteclypeus whitish yellow; postclypeus yellowish brown; antennae uniformly coloured, yellowish; thorax, legs and abdomen lighter than head, brownish yellow.

Head sparsely hairy with many scattered hairs and bristles; labrum with six long bristles toward anterior side, three on each side, and a few scattered hairs of different size; anteclypeus without hairs or bristles; postclypeus with scattered hairs and bristles; pronotum with many scattered hairs and bristles; distal articles more densely hairy than the basal.

Head squarish, length of head to side base of mandibles slightly less than maximum width (Table IX); labrum slightly wider than long; anteclypeus subtrapezoid; postclypeus slightly swollen, median line distinct; mandible shown in figure; antennae with 14 articles; 4th article shortest; pronotum extremely saddle-shaped, deeply notched anteriorly, slightly depressed posteriorly. Tibial spurs 3:2:2, mid tibia with two extra spines. Tarsi four jointed.

TABLE IX.- MEASUREMENTS (in mm) OF 10 WORKERS OF *MICROTERMES UNICOLOR* (SNYDER).

	Range	Mean±S.E.*
Length of head to tip of Labrum	1.07-1.48	1.25±0.051
Length of head of side base of mandibles	0.67-1.05	0.90±0.045
Width of head	0.70-1.00	0.88±0.037
Length of Postclypeus	0.14-0.18	0.16±0.004
Width of postclypeus	0.30-0.43	0.36±0.013
Length of pronotum	0.22-0.35	0.29±0.012
Width of pronotum	0.43-0.59	0.50±0.015

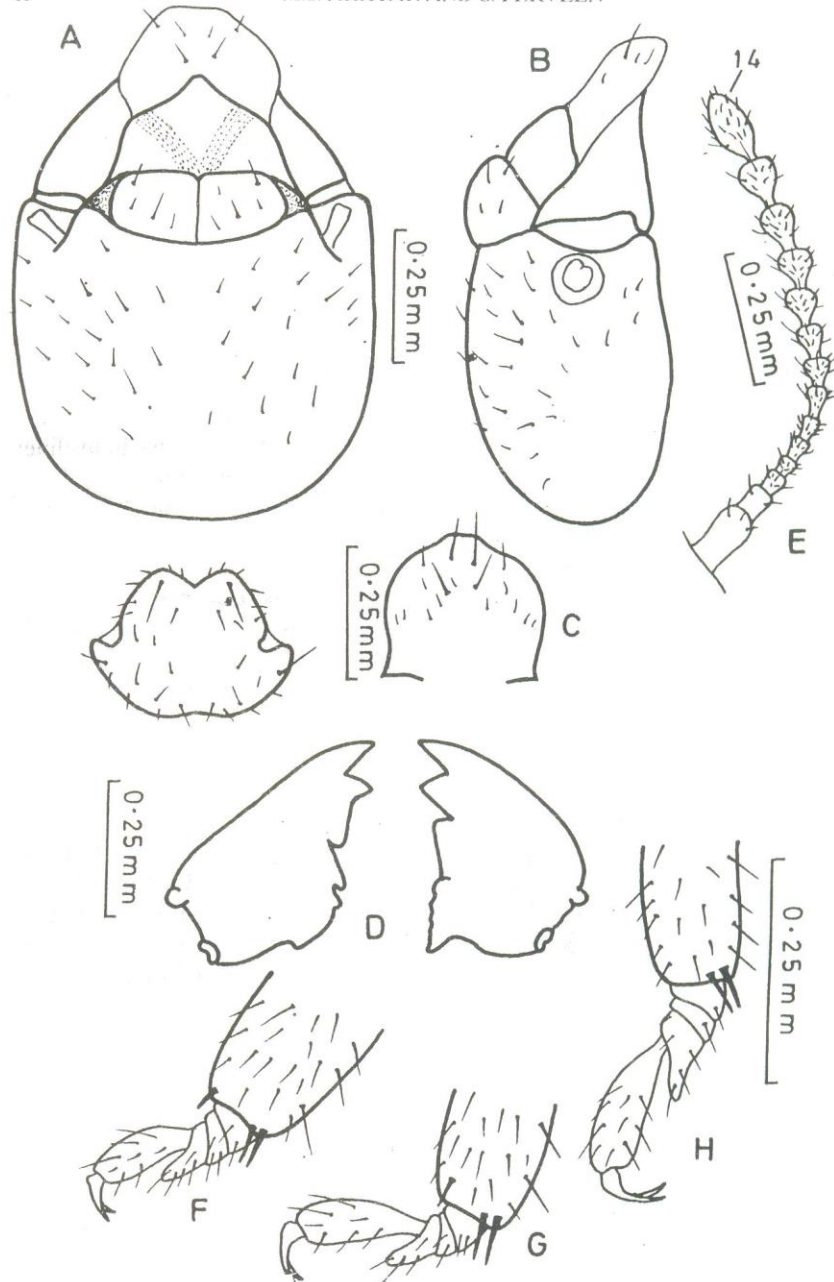


Fig. 9. Worker of *Microtermes unicolor* Snyder. A. head and pronotum from above. B. head from side. C. labrum from above. D. mandibles. E. antenna. F. fore leg. G. middle leg. H. hind leg.

Locality

Lahore, soliders, workers, collected by M.S. Akhtar, 24.i. 1968, in a stump.

Subfamily TERMITINAE Sjöstedt

Genus *MICROCEROTERMES* Silverstri

Microcerotermes championi Snyder, 1933a.

Worker (Fig. 10).

Head brownish yellow; labrum brownish yellow; anteclypeus yellowish; postclypeus yellowish; antennae uniformly coloured, yellow; thorax, legs yellowish white; abdomen pale white.

Head sparsely hairy with a few scattered hairs and bristles; labrum with long bristles in middle, two on each side, and short hairs near anterior margin; anteclypeus without hairs or bristles; postclypeus with scattered bristles of different sizes; distal articles more densely hairy than the basal; scattered bristles and hairs present on outer margin of pronotum.

Head squarish, length of head to side base of mandibles slightly less than maximum width (Table X); labrum wider than long, lateral sides nearly parallel in posterior one third, slightly convex anteriorly; anteclypeus trapezoid, with V-shaped impression weakly indicated; postclypeus slightly swollen, anterior margin slightly more sclerotized, median line distinct, slightly longer than half of its width; mandibles as shown in figure; antennae with 13-15 articles, in antennae with 15 articles, 3rd shortest; pronotum extremely saddle-shaped, slightly emarginate posteriorly. Tibial spurs 3:2:2, mid tibia with two extra spines. Tarsi four-jointed.

TABLE X.- MEASUREMENTS (in mm) OF 10 WORKERS OF *MICROCEROTERMES CHAMPIONI* SNYDER.

	Range	Mean±S.E.*
Length of head to tip of Labrum	0.98-1.23	1.09±0.031
Length of head of side base of mandibles	0.70-0.94	0.83±0.031
Width of head	0.80-0.90	0.84±0.017
Length of Postclypeus	0.19-0.22	0.20±0.003
Width of postclypeus	0.32-0.41	0.36±0.007
Length of pronotum	0.18-0.24	0.20±0.003
Width of pronotum	0.39-0.57	0.48±0.021

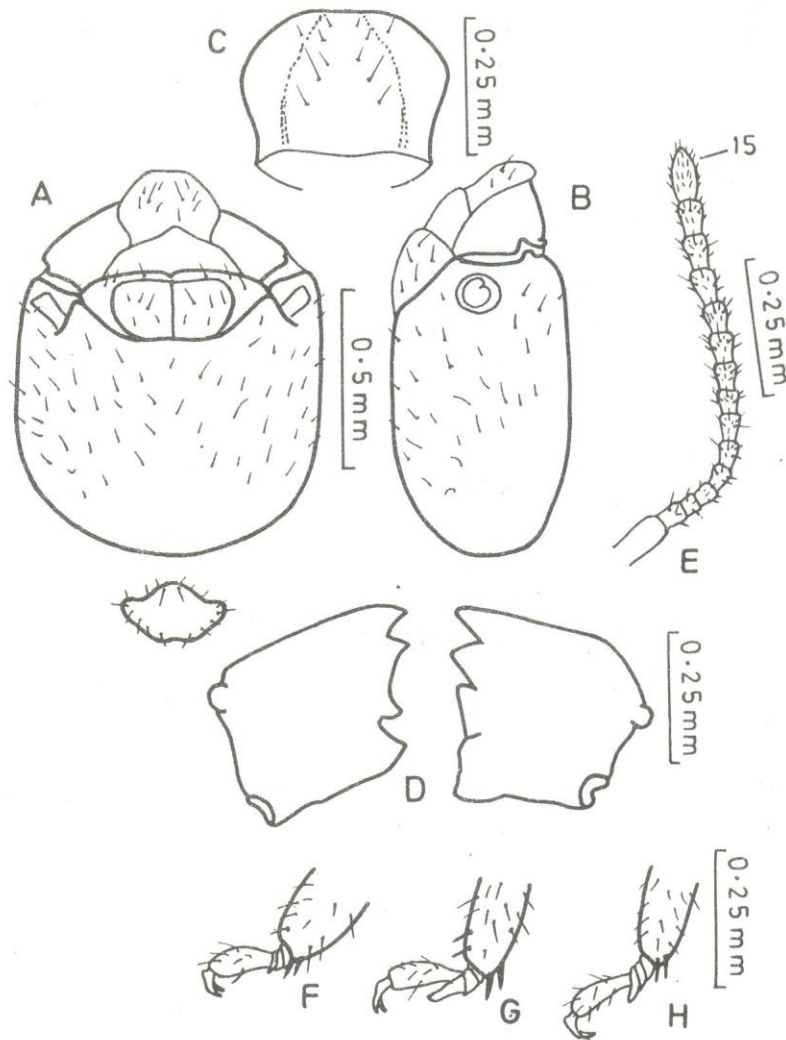


Fig. 10. Worker of *Microcerotermes championi* Synder. A, head and pronotum from above. B, head from side, C, labrum from above. D, mandibles. E, antenna. F, fore leg, G, middle leg. H, hind leg.

Locality

Lahore (Daroghawala), soldiers, worker, collected by Miss Shafqat Parveen, 29.iii. 1980, ex. Serkanda.

Microcerotermes heimi Wasmann

Microcerotermes heimi Wasmann, 1902, p. 120.

Worker (Fig. 11).

Head brownish yellow; labrum, anteclypeus and antennae yellowish white; thorax and abdomen whitish yellow; legs yellowish white.

Head with a few scattered hairs and bristles; postclypeus as hairy as head with a few scattered hairs and bristles; labrum with three bristles on each side and a few scattered hairs and bristles on margins; sternites more hairy than tergites.

Head with lateral sides almost parallel, round posteriorly; postclypeus swollen, slightly longer than half of its width (Table XI); median line distinct; anteclypeus subtrapezoid, with light brownish V-shaped impression slightly indicated; labrum wider than long; mandibles as shown in figure; antennae with 13 articles, 3rd shortest; pronotum indistinctly emarginate both anteriorly and posteriorly. Tibial spurs 3:2:2, mid tibia with 2 extra spines. Tarsi four-jointed.

TABLE XI.- MEASUREMENTS (in mm) OF 10 WORKERS OF *MICROCEROTERMES HEIMI* (WASMANN).

	Range	Mean±S.E. *
Length of head to tip of Labrum	1.03-1.25	1.15±0.20
Length of head of side base of mandibles	0.76-0.94	0.87±0.016
Width of head	0.78-0.96	0.87±0.016
Length of Postclypeus	0.20-0.24	0.22±0.004
Width of postclypeus	0.32-0.37	0.34±0.004
Length of pronotum	0.22-0.26	0.25±0.004
Width of pronotum	0.51-0.59	0.55±0.008

Locality

Lahore (Wahdat Colony), soldiers, workers, collected by M.S. Akhtar, 17.vii. 1975, from a log.

Genus *EREMOTERMES* Silvestri

Eremotermes paradoxalis Holmgren

Eremotermes paradoxalis Holmgren, 1912.

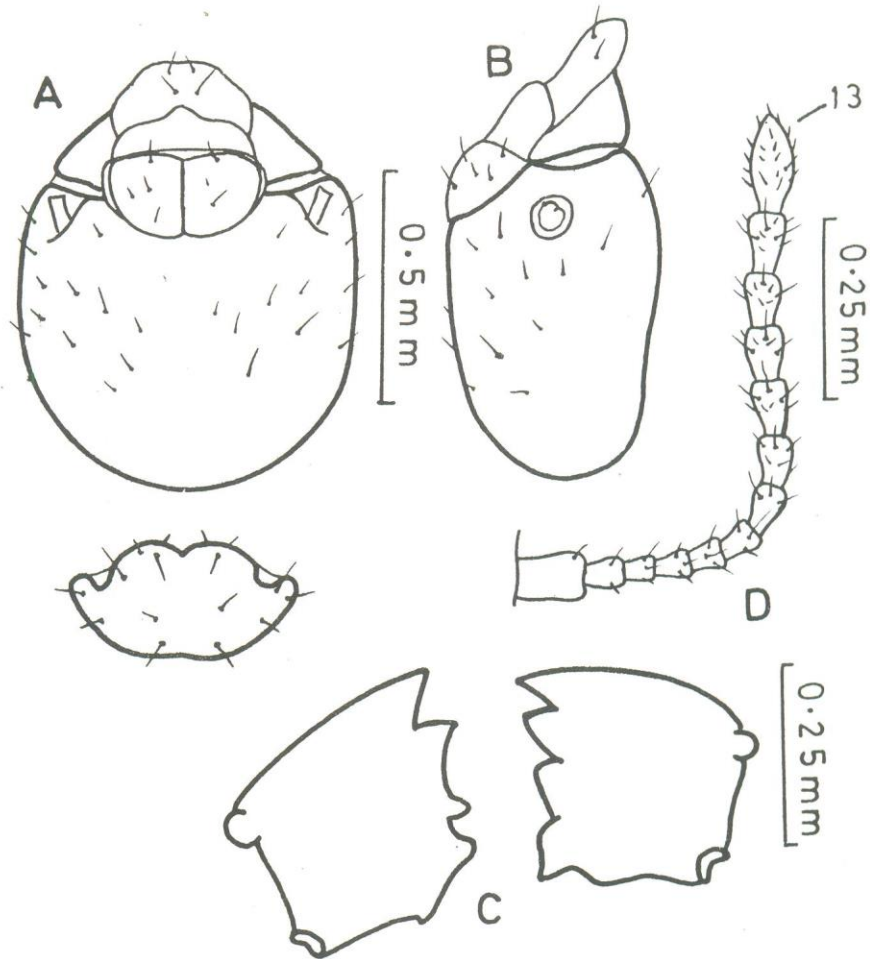


Fig. 11. Worker of *Microcerotermes heimi* Wasmann. A. head and pronotum from above. B. head from side. C. labrum from above. D. mandibles. E. antenna. F. fore leg. G. middle leg. H. hind leg.

Worker (Fig. 12)

Head yellowish brown, slightly darker posteriorly; labrum brownish yellow; anteclypeus yellowish; postclypeus slightly lighter than head; antennae uniformly coloured, brownish yellow; pronotum brownish yellow, as dark as head; meso- and metanota slightly lighter than pronotum.

Head sparsely hairy with many scattered hairs and bristles; labrum with six long bristles, three on each side; postclypeus with few bristles and hairs; pronotum with many scattered bristles and hairs of different size; distal articles more densely hairy than the basal.

Head nearly squarish, length of head to side base of mandibles slightly less than maximum width (Table XII); labrum nearly as wide as long; anteclypeus trapezoid; postclypeus moderately swollen, median line weakly indicated; mandibles as shown in figure; antennae with 13-15 articles, in antennae with 14 articles 4th article shortest; pronotum extremely saddle-shaped, posterior margin depressed. Tibial spurs 3:2:2. Tarsi four jointed.

TABLE XII.- MEASUREMENTS (in mm) OF 10 WORKERS OF *EREMOTERMES PARADOXALIS* HOLMGREN.

	Range	Mean±S.E.*
Length of head to tip of Labrum	0.94-1.15	1.03±0.015
Length of head to side base of mandibles	0.61-0.82	0.71±0.15
Width of head	0.76-0.90	0.80±0.012
Length of Postclypeus	0.16-0.24	0.2±0.003
Width of postclypeus	0.28-0.32	0.29±0.003
Length of pronotum	0.28-0.41	0.32±0.012
Width of pronotum	0.45-0.72	0.54±0.022

Locality

Lahore (Gulberg), soldiers, workers collected by M.S. Akhtar, 8.ii. 1968, ex. soil.

Genu *AMITERMES* Silvestri

Amitermes belli (Desneux)

Termes belli Desneux, 1906, p. 352.

Amitermes belli; Snyder, 1949, p. 114.

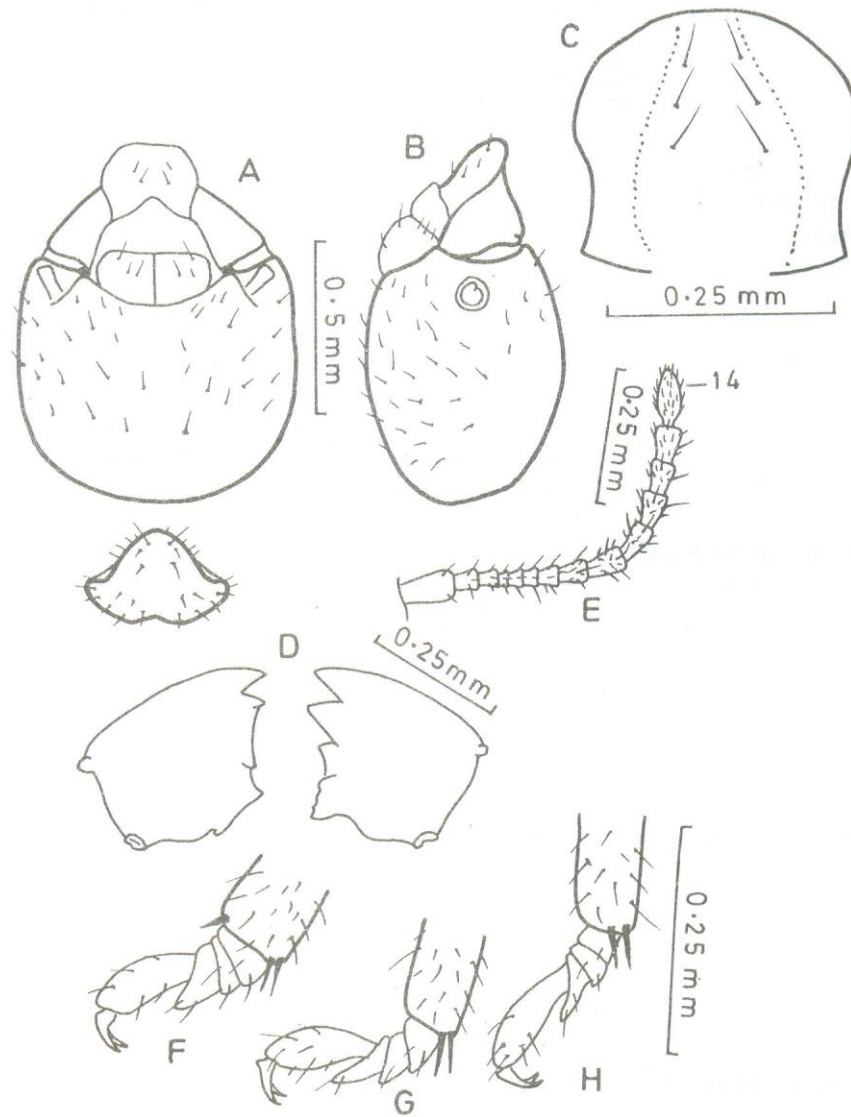


Fig. 12. Worker of *Eremotermes paradoxalis* Holmgren. A, head and pronotum from above. B, head from side, C, labrum from above. D, mandibles. E, antenna. F, fore leg, G, middle leg. H, hind leg.

Worker (Fig. 13).

Head yellowish brown, slightly darker posteriorly; labrum yellowish brown; anteclypeus whitish yellow; postclypeus slightly lighter than head; antennae uniformly coloured, pale; pronotum brownish, lighter than head; meso- and metanota slightly lighter than pronotum; legs as dark as meso and metanota; abdomen pale white.

Head sparsely hairy with many scattered hairs and bristles; labrum with six long bristles, three on each side, and a few hairs; anteclypeus with a few hairs; postclypeus with scattered bristles of different sizes; antennae with distal articles more densely hairy than the basal; pronotum with scattered hairs and bristles.

Head oval, length of head to side base of mandibles slightly less than maximum width (Table XIII), widest in anterior half; labrum wider than long; anteclypeus subtrapezoid; postclypeus moderately swollen slightly shorter than half of its width; mandibles as shown in figure; antennae with 14 articles, 4th and 5th nearly equal; pronotum slightly saddle-shaped, emarginate posteriorly. Tibial spurs 2:2:2. Tarsi four-jointed.

Locality

Lahore, soliders, workers, collected by M.S. Akhtar, i.iii. 1968 in a log.

TABLE XIII.-MEASUREMENTS (in mm) OF 10 WORKERS OF *AMITERMES BELLI* (DESNEUX).

	Range	Mean±S.E.*
Length of head to tip of Labrum	1.13-1.33	1.21±0.022
Length of head of side base of mandibles	0.80-0.92	0.85±0.009
Width of head	0.90-1.03	0.96±0.009
Length of Postclypeus	0.22-0.30	0.25±0.006
Width of postclypeus	0.41-0.47	0.43±0.003
Length of pronotum	0.24-0.47	0.31±0.022
Width of pronotum	0.51-0.88	0.63±0.034

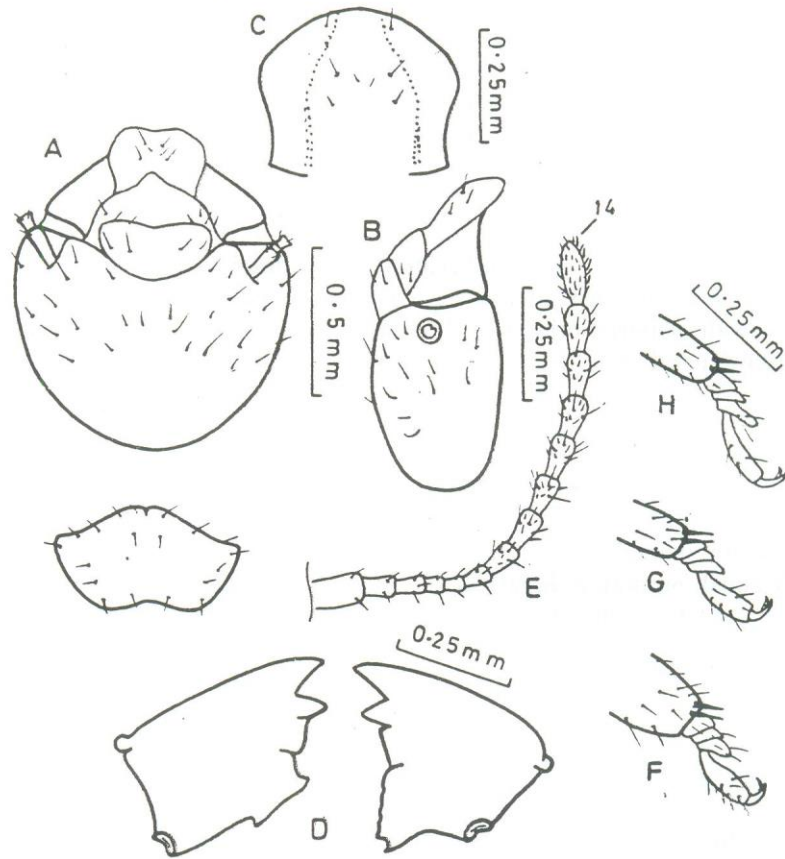


Fig. 13. Worker of *Amitermes belli* (Desneux). A, head and pronotum from above. B, head from side. C, labrum from above. D, mandibles. E, antenna. F, fore leg. G, middle leg. H, hind leg.

REFERENCES

- AIIMAD, M., 1955. Termites of West Pakistan. *Biologia Lahore*, 1: 202-264.
- AKHTAR, M.S., 1972. *Studies on Taxonomy and Zoogeography of termites of Pakistan*. Ph.D. Thesis. University of the Punjab, Lahore.
- AKHTAR, M.S. AND HUSSAIN, M., 1981. Enteric valve armature of some termite species belonging to the Genera *Hypoterme*s, *Microtermes* and *Ancistrotermes* (Isoptera) *Sociobiology*, 5: 261-271.
- CHATTERJEE, P.N. AND THAKUR, K.L., 1964. Redescription of *Odontotermes gurdaspurens* Holmg. and Holmg. (Isoptera: Termitidae: Macrotermitinae). *Bull. Ent. Loyola. Coll.*, 5: 7-16.
- CHATTERJEE, P.N. AND THAKUR, M.L., 1967. Contribution to the knowledge of systematics of North-Western Himalayan termite fauna (Isoptera: Insecta). *Indian Forest Res.*, 11: 1-55.
- DESNIJUX, J., 1906. Varieties termitologiques. *Ann. Soc. Ent. Belg.*, 49: 336-360.
- ELTON, C., 1947. *Animal ecology*. Sidgwick and Jackson, Ltd., London. xx + 209 pp. 13 figs.
- GARDNER, J.C.M., 1944. New termitidae from India and Burma (Isoptera) *Indian J. Ent.*, 6: 103-110.
- HOLMGREN, K. AND HOLMGREN, N., 1917. Report on a collection of termites from India. *Mem. Dep. Agric. India* (Ent. Ser.), 5: 138-171.
- HOLMGREN, N., 1912. Termitenstudien. 3. Systematik der Termiten. Die Familie Metatermitidae. *K. Svenska Vetensk. Akad. Handl.*, 48: 1-166.
- HOLMGREN, N., 1912a. Termites from British India (Bombay) collected by Dr. J. Assmuth. *J. Bombay Nat. Hist. Soc.*, 21: 774-793.
- KRISHNA, K., 1961. A generic revision of phylogenetic study of the family *Kalotermitidae* (Isoptera). *Bull. Am. Mus. Nat. Hist.*, 122: 303-408.
- RAMBUR, J.P., 1842. *Histoire naturelle des insectes. Neuropters*. Paris.
- ROONWAL, M.L. AND BOSE, G., 1964. Termite fauna of Rajasthan, India. *Zoologica, Stuttgart*, 40: 1-58.
- SIMPSON, G.G., 1945. The principles of classification of mammals. *Bull. Amer. Mus. Nat. Hist.*, 85: 1-350.
- SNYDER, T.E., 1933. New termites from India. *Proc. U.S. natn. Mus.*, 82: 1-15.
- SNYDER, T.E., 1949. Catalog of the termites (Isoptera) of the world. *Smithson. misc. Collns.*, 112: 1-490.
- WASMANN, R., 1902. Termiten, Termitophilen und Myrmecophilen. Gesammelt auf Ceylon von Dr. W. Horn. *Zool. Jb.*, 17: 99-164.