

TERMITES OF KANHA NATIONAL PARK (MADHYA PRADESH), INDIA

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(With 5 plates and 4 text-figures)

INTRODUCTION

(a) General

Kanha National Park is situated at about 22°45' N. latitude and 80°45' E. longitude, in District Mandla of Madhya Pradesh, India. It covers an area of about 245 sq. km. The approximate elevation varies from about 535-880 m. The landscape and the valleys are open.

The average annual rainfall is about 180 cm. The maximum temperature in shade is about 40° C in hot season and the minimum temperature is 5° C in winter.

The Park is full of belts and islands of 'Sal' (*Shorea robusta*) forests and is very rich in insects and wildlife.

The author made an intensive collection of termites in the Park in June, 1964, and the present publication is based on the study of this collection, and some other collections made by Dr. M. L. Roonwal and Dr. K. K. Tiwari of the Zoological Survey of India and Dr. George B. Schaller of Johns Hopkins University (U.S.A.). Sixteen species belonging to two families are reported and field observations in respect of their nesting habits are recorded.

(b) Abbreviations used

The following abbreviations are used: *coll.*, collected by; *ex.*, extracted from; *exs.*, examples; *Im.*, imago; *K.*, king; *Ny.*, nymphs; *Q.*, queen; *S.*, soldier; *W.*, worker; Z.S.I., Zoological Survey of India.

SYSTEMATIC ACCOUNT AND BIOLOGICAL OBSERVATIONS

Family 1 RHINOTERMITIDAE

Subfamily (i) COPTOTERMITINAE

1. *Coptotermes heimi* (Wasmann)

(a) *Material examined*.—A vial with 2 S. and 1 W., coll. K. K. Tiwari, 10.i.1966.

(b) *Measurements*.—(in mm), etc.—*Soldier*: Range (2 exs.): Total body-length, c 3.80—4.00, head-length to lateral base of mandibles 1.27—1.30, maximum width of head 1.01—1.03, length of left mandible 0.73—0.77, maximum diameter of fontanelle 0.13, maximum width of pronotum 0.67—0.70, No. of antennal segments 14.

(c) *Distribution*.—*C. heimi* is widely distributed in India and Pakistan. For detailed distribution *vide* Roonwal and Chhotani, 1962a.

(d) *Biological notes*.—It damages dead and live trees of forestry importance, agricultural crops, converted wood and timber in houses. Roonwal (1959) gives its biology.

Family 2 TERMITIDAE

Subfamily (i) AMITERMITINAE

2. *Speculitermes sinhalensis* Roonwal and Sen-Sarma

(a) *Material examined*.—(i) Two vials with *W.* only, one coll. O. B. Chhotani (026/15.6.64), 15.vi.1964, “under stone and in soil, making narrow galleries”; and the other coll. K. K. Tiwari, 10.i.1966, 600 m alt. (ii) A vial with *W.* and *Ny.*, coll. K. K. Tiwari, 13.i.1966, Bamhni Dadar, c 900 m alt.

(b) *Measurements (in mm), etc.*—*Worker*: Range (5 exs.): Total body length, c 4.40—5.70, head length to tip of labrum 1.70—1.80, head-length of lateral base of mandibles 1.03—1.10, maximum width of head 1.30—1.37, diameter of mid-dorsal spot 0.07—0.08, maximum width of pronotum 0.70—0.77, No. of antennal segments 14.

(c) *Distribution*.—*S. sinhalensis* is known from Sri Lanka and India. It is fairly well distributed in southern India where the author collected it extensively in the year 1962. For detailed distribution in Sri Lanka and southern India, *vide* Roonwal and Chhotani, 1966a.

The present record of the species from Kanha National Park, Madhya Pradesh, shows the northward extent of its distribution.

(d) *Remarks*.—It was believed that the soldier caste in the genera *Speculitermes* and *Anoplotermes* had been lost secondarily, until Roonwal and Chhotani (1960) reported its occurrence in *S. sinhalensis*.

(e) *Biological notes*.—Roonwal and Chhotani (1966a) have given a detailed description of the species, its biology, etc. In Kanha National Park, it was collected from under a stone, making narrow galleries running horizontally a little below the ground-level for some distance.

3. *Euhamitermes kanhaensis* Roonwal and Chhotani

(a) *Material examined*.—The holotype *S.*, morphotype and paramorphotype *W.*, as mentioned in Roonwal & Chhotani (1965).

(b) *Distribution*.—This species is known only from Khana National Park, M. P., India.

(c) *Biological notes*.—*E. kanhaensis* has been collected from under a stone along with the species *Odontotermes obesus* (Ramb.). It makes narrow, longitudinal galleries in the soil.

4. *Eurytermes boveni* Roonwal and Chhotani

(a) *Material examined*.—Holotype *S.*, morphotype and paramorphotype *Im.*, and *W.*, as mentioned in Roonwal and Chhotani (1966b).

(b) *Distribution*.—India: Madhya Pradesh : Kanha National Park (type-locality).

(c) *Biological notes*.—*E. boveni* has been collected from soil making long and narrow galleries, running horizontally about 2-5 cm below the ground-level. The galleries are flattened at places into small, round pockets. The species *Odontotermes assmuthi* Holmgren was also collected from galleries very close to the galleries of the species.

5. *Synhamitermes quadriceps* (Wasmann)

(a) *Material examined*.—Two vials, one (No. 010/16.6.64) with *K.*, *Q.*, *S.* and *W.*, and the other (No. 029/15.6.64) with *Im.*, *S.*, and *W.*, both coll. O. B. Chhotani, June, 1964, nesting in type 'D' mounds of *Odontotermes abesus* (Rambur).

(b) *Measurements (in mm), etc.*—(i) *Imago* : Range (7 exs.) : Total body-length with wings, *c* 9.20—10.40, total body length without wings 4.50—5.00, length of head to tip of labrum 0.97—1.10, length of head to lateral base of mandibles 0.70—0.73, width of head with eyes. 0.83—0.90, max. diameter of eye 0.20—0.21, max. diameter of ocellus 0.09—0.10, min. eye-ocellus distance 0.04—0.05, width of pronotum 0.67—0.70, length of forewing with scale 7.35—8.20, length of hindwing with scale 7.05—8.00, No. of antennal segments 15. (ii) *Soldier* : Range (5 exs.) : Total body-length, *c* 3.10—4.30, length of head of lateral base of mandibles 0.90—1.00, max. width of head 0.80—0.83, length of left mandible 0.60, length of right mandible 0.60—0.63, max. width of pronotum 0.50, No. of antennal segments 13.

(c) *Distribution*.—*S. quadriceps* is known from Maharashtra, Madhya Pradesh, Assam and Rajasthan in India, as follows:—*Maharashtra*: Bombay; Khandala; Kusgaon Forest, Lonavala; Vardhangad Forest, Koregaon. *Madhya Pradesh*: Kanha National Park (present record). *Rajasthan*: Chitenpura near Kotah. *Assam*: Gotanagar.

The distribution of this species in Sri Lanka, as given by Roonwal and Chhotani (1962b), is actually the distribution for *S. ceylonicus* (Holmgren).

(d) *Biological notes*.—In Kanha National Park, the species has been found inhabiting large, dome-shaped, type 'D' mounds of *Odontotermes obesus*. The nests are generally confined to the wall area of the mounds. They are in the form of narrow galleries which get flattened and enlarged into small, round or oval chambers of 2-3 cm diameter. A queen and king were collected from one such chamber.

6. *Microcerotermes beelsoni* Snyder

(Pl. VIII, figs. 1 and 2)

1933. *Microcerotermes beelsoni* Snyder, T. E. *Proc. U. S. nat. Mus.*, **82** (Art. 16) : 12-14. *Im. Type-locality* : Chakata Range, Haldwani, U. P., India.
1933. *Microcerotermes championi* Snyder, T. E. *Proc. U. S. nat. Mus.*, **82** (Art. 16) : 14-15 *Im.*, *S. Type-locality*: Haldwani District, Kumaon, U. P., India, *New synonymy*.
1967. *Microcerotermes beelsoni* Prashad, B., Thapa, R. S. and Sen-Sarma, P. K. *Indian For. Bull.* (N. S., Ent., No. 246: 6, 14-18; and 6, 31-34 (for *championi*).

(a) *Material examined*.—10 vials, all coll. O. B. Chhotani; June, 1964, as follows:—Six vials with *Im.*, *S.* and *W.*, 03/14.6.64 and 031/15.6.64 from carton nests in mounds (type 'D') of *Odontotermes obesus*; 02, 03 and 019/15.6.64, from dead stumps of wood lying on ground; and 027/15.6.64, from under a stone. Three vials (013, 016 and 020/15.6.64) with *S.* and *W.*, from pieces of wood lying on jungle floor; and one vial (05/16.6.64) with *Q.*, *S.* and *W.*, from under a stone.

(b) *Measurements (in mm), etc.*—(i) *Imago*: Range (14 exs.): Total body-length with wings, *c* 8.50—9.90, total body length without wings. *c* 4.80—5.90, length of head to tip of labrum 1.07—1.17, length of head to lateral base of mandibles 0.80—0.90, width of head with eyes 0.83—0.90, max. diameter of eye 0.18—0.23, max. diameter of ocellus 0.07—0.10, min. eye-ocellus distance 0.05—0.07, width of pronotum 0.65—0.73, length of forewing with scale 7.00—8.00, length of hindwing with scale 6.70—7.70, No. of antennal segments 14 (rarely 13). (ii) *Soldier*: Range (12 exs.): Total body-length, *c* 4.70—5.50, length of head to lateral base of mandibles 1.40—1.67, max. width of head 0.87—1.00, length of left mandible 0.87—0.93, width of pronotum 0.57—0.63, No. of antennal segments 13 (rarely 12).

(c) *Distribution*.—*India*: Uttar Pradesh: New Forest, Dehra Dun; Jhajra, Dehra Dun; Chakata Range, Haldwani (type-locality); Hald-

wani (type-locality for *championi*). Delhi: Vijaya Nagar, Delhi. Madhya Pradesh : Kanha National Park (present record).

(*t*) *Remarks*.—Snyder (1933) separated the imago of *M. championi* from that of *M. beelsoni*, described by him in the same paper, for having ocelli slightly larger and separated from eyes by a distance of less than the long diameter, slightly smaller eyes and longer pronotum. I have examined the cotypes of both *beelsoni* and *championi* and also a long series of imagos collected by me in Kanha National Park. These characters, on which the species have been separated, have been found to be variable. In the figures as given by Snyder (1933), the mesonotum and metanotum are shown to have deep emargination of posterior margin in case of *beelsoni* and weaker emargination in *championi*, this character is very variable and was also noted by Snyder in *beelsoni*. As such *championi* Snyder is treated here as a synonym of *beelsoni* Snyder.

(*e*) *Biological notes*.—In Kanha National Park this species has been observed nesting in dead stumps, under stones, in soil, etc. In soil, it makes narrow galleries which are coated with greyish material and at one place, under a stone, a physogastric queen and soldiers and workers were collected from a small chamber from which the galleries ran to different sides. It was also observed nesting in a what appeared to be a deserted mound (type 'D') of *Odontotermes obesus*, making extensive galleries running from almost the top to the base of the mound. A large number of imagos, soldiers, workers and young ones were found in the wood pieces of a dead plant which was completely covered by the mound soil. The wood was transformed into a carton-like structure (Pl. 1 figs. 1 and 2). No queen was found in the carton structure. Roonwal (1970) describes the nest of this species as large, hard, dark brown structures of semi-digested wood and lignine and of varying shapes. A large nest, according to him weighs about 15 kg.

Subfamily (ii) TERMITINAE

7. *Dicuspiditermes obtusus* (Silvestri)

(*a*) *Material examined*.—Four vials with soldiers and workers, coll. O. B. Chhotani, as follows:—One vial (No. 01/9.6.64), 9.vi.64, nesting in *Odontotermes obesus* mound (type 'D') and three vials (Nos. 023 and 025/15.6.64 and 04/16.6.64), 15-16.vi. 1964, ex. under stones.

(*b*) *Measurements (in mm), etc.*—*Soldier* : Range (5 examples) : Total body length, c 5.80—7.00, length of head with mandibles 3.88—4.40, length of head to lateral base of mandibles 2.00—2.33, width of head 1.25—1.40, median length of labrum 0.30—0.50, width of labrum 0.27—0.33, length of left mandible 1.80—2.10, width of pronotum 0.73—0.90, No. of antennal segments 14.

(c) *Distribution*.—*India*: Orissa: Barkuda Island, Chilka Lake, type-locality. *Madhya Pradesh*: Kanha National Park (present record).

(d) *Biological notes*.—This species has been collected from under stones and soil. In the soil, it makes narrow, longitudinal galleries, which are coated with blackish faecal material. It has also been noted to nest in the walls of *Odontotermes obesus* mound (type 'D').

8. *Pericapritermes tetraphilus* (Silvestri)

(Pl. VIII, fig. 3)

(a) *Material examined*.—A vial with several *S.* and *W.*, *O. B. Chhotani* coll. (02/14.6.64), 14.vi.64, ex. *Odontotermes obesus* mound (type 'D').

(b) *Measurements (in mm), etc.*—*Soldier*: Range (5 examples): Total body-length, c 8.00—9.00, length of head with mandibles 4.60—4.73, length of head to lateral base of mandibles 2.83—3.05, max. width of head 1.60—1.70, length of left mandible 1.63—1.70, max. width of labrum 0.30—0.33, max. length of labrum 0.20—0.23, width of pronotum 1.03—1.13, No. of antennal segments 14.

(c) *Distribution*.—*India*: Kanha National Park, Madhya Pradesh (present record). *Bangladesh*: Rangamati, Chittagong Hill Tracts (type-locality). *Burma*: Maymyo; Yegaw, Pa-an (Karen State).

(d) *Remarks*.—Mathur and Sen-Sarma (1961) described *Capritermes orientalis* from Maymyo, Burma, but Krishna (1965) treated it as a synonym of *Pericapritermes tetraphilus* Silvestri. I have examined the paratypes of *orientalis* Mathur and Sen-Sarma and the present specimens from Kanha National Park agree with them in all respects. As I have had no access to the types of *tetraphilus* Silvestri, I have followed Krishna (1965).

(e) *Biological notes*.—In Kanha National Park this species was found inhabiting the mound (type 'D') of *Odontotermes obesus* (Rambur). It makes small, narrow (2-15 mm wide) galleries which lead into chambers of different sizes (3-4 cm in diameter) and shapes. At one place near the top of the mound, the galleries lead into larger (6-8 cm in diameter) chambers, arranged in tiers one above the other, having flat floors and arched roofs (Pl. VIII, fig. 3). From this set of chambers, galleries of variable sizes lead to about the base of the mound. The galleries and chambers are all coated with greyish faecal matter. A large number of soldiers and workers were collected from these chambers. No royal chamber with queen and the king was, however, found.

Subfamily (iii) MACROTERMITINAE

9. *Odontotermes assmuthi* Holmgren

(a) *Material examined*.—(i) One vial (028/15.6.64) with *Im.*, *S.* and *W.* and two vials (022/15.6.64 and 06/16.6.64) with *S.* and *W.* only,

all coll. *O. B. Chhotani*, June, 1964. (ii) One vial with *S.* and *W.*, Kisli, Kanha National Park, coll. *K. K. Tiwari*, 10.i.1966.

(b) *Measurements (in mm), etc.*—(i) *Imago*: Range (3-5 exs.) : Total body-length with wings, *c* 24.80—26.00, total body-length without wings, *c* 11.80—13.00, length of head to tip of labrum 2.25—2.60, length of head to lateral base of mandibles 1.50—1.80, width of head with eyes 2.20—2.27, max. diameter of eye 0.57—0.60, max. diameter of ocellus 0.19—0.20, min. eye-ocellus distance 0.20—0.25, width of pronotum 1.87—2.03, length of forewing with scale 21.00—22.00, length of hindwing with scale 19.30—20.00, No. of antennal segments 19. (ii) *Soldier*: Range (5 exs.): Total body-length *c* 4.80—5.30, length of head to lateral base of mandibles 1.50—1.70, max. width of head 1.07—1.20, length of left mandibles 0.77—0.80, distance of tooth from the tip in left mandible 0.25—0.28, width of pronotum 0.75—0.86, No. of antennal segments 16.

(c) *Distribution*.—This species is known only from India and is recorded as follows: *India*: Jammu and Kashmir: Gangara and Tanden Forest, Udhampur. Panjab : Gurdaspur; Hoshiarpur; Hamirpur. Uttar Pradesh: Dehra Dun (Malhan and New Forest). Madhya Pradesh : Kanha National Park (present record). Bihar : Burgeri; Pusa. Maharashtra: Bombay (Borivili Jungle, type locality; Salsette Is.). Karnataka : Karwar; Mercara. Tamil Nadu : Shevaroy Hills.

(d) *Biological notes*.—*O. assmuthi* does not construct any mounds; its nests are underground. In Kanha National Park it has been collected, along with *Eurytermes boveni*, from under stones, 2-5 cm below the ground surface, and from a mound of *Odontotermes obesus*. In the later case, it was observed making small, round chambers near the ground surface. From these chambers, imagos, soldiers and workers were collected. The main nest, it is presumed, was below the ground-level as the galleries lead downwards into the soil.

The author has collected this species while swarming and coming out of a hole in the ground at about 4.45 P.M. on 28th June, 1955, at New Forest, Dehra Dun. Swarming has also been reported during July and August.

10. *Odontotermes bhagwatii* Chatterjee and Thakur

(Pl. VIII, figs. 4 and 5; Text-fig. 1; Table 1)

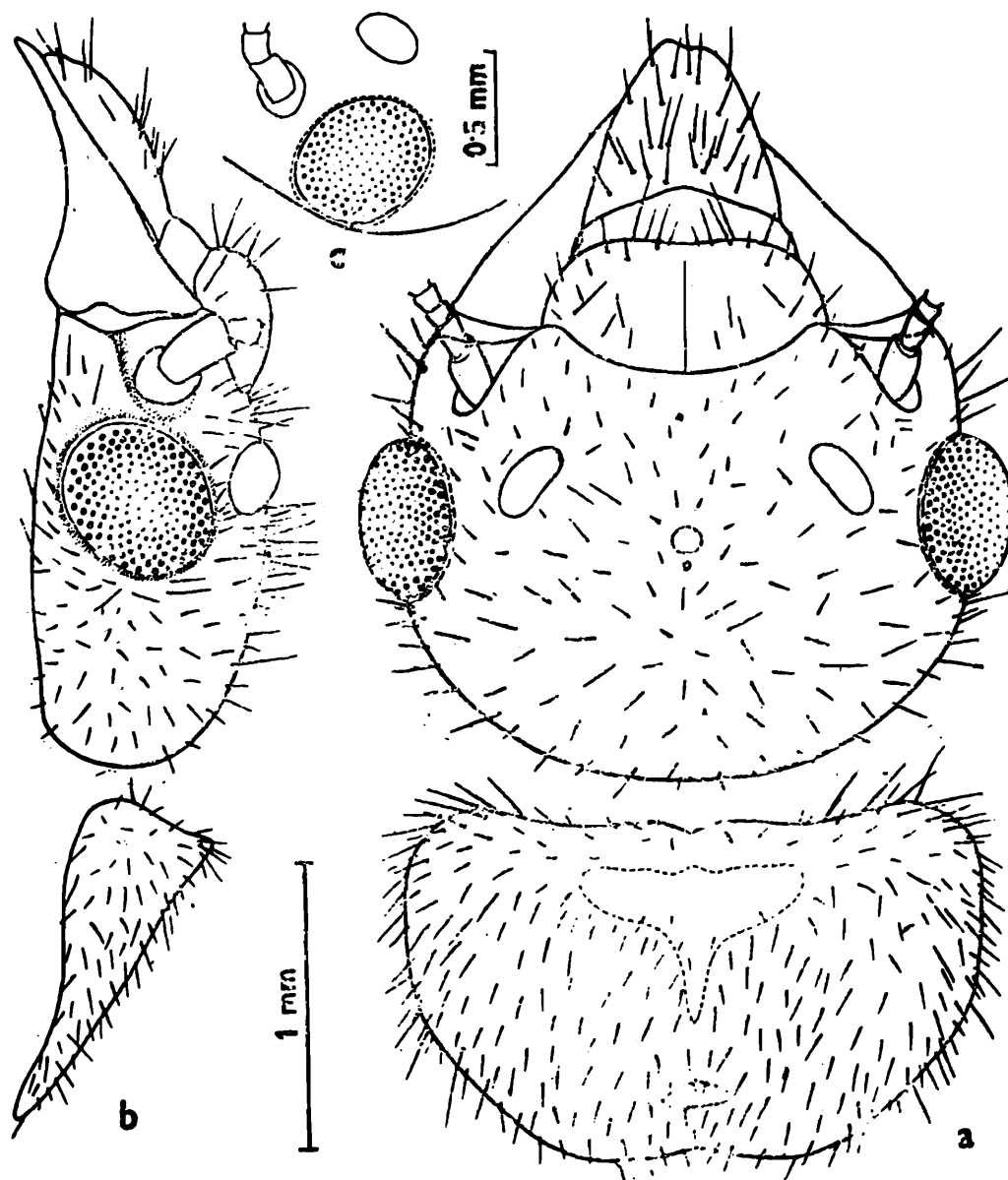
(a) *Material examined*.—Nine vials with *S.* and *W.*, coll. *O. B. Chhotani*, June 1964, thus : 03/13.6.64, from bark of a "Serai" tree; 05, 8, 9, 10, 11, 14 and 15/15.6.64, from twigs of unknown plants lying on ground and 024/15.6.64, from under a stone. Two vials with *S.* and *W.*, coll. *K. K. Tiwari*, Dec. 1965—Jan. 1966, Kanha Rest House (1 vial)

and Kisli Rest House (1 vial). One vial with four *Im.* and one *S.*, coll. George B. Schaller, 27.vi.1964, "coming in swarms from holes in ground."

The hitherto undescribed imago is described here from a collection associated with soldiers.

IMAGO (Text-fig. 1; Table 1).

Head-capsule dark brown; postclypeus, labrum and antennae brownish; pronotum, legs and wing-scales dark brown, paler than head-capsule; wings pale brown, transparent; abdominal tergites brownish, paler than postclypeus; sternites yellowish brown. Head body and legs densely hairy; wings hairy along costal border and in distal one-third.



TEXT-FIG. 1. *Odontotermes bhagwatii* Chatterjee and Thakur. Imago. (a) Head, and pronotum, dorsal view. (b) Ditto, side view. (c) Portion of head, showing position of eye, ocellus and antenna.

Head-capsule subcircular; wider than its length to base of mandibles; sutures indistinct; frons weakly depressed. Fontanelle minute, point-like; slightly raised; small area around fontanelle and a little area distal to it, paler. Eyes roundly suboval, only slightly longer than broad; situated obliquely (Text-fig. 1 *b*) little above lateral margin; maximum diameter 0.57—0.60 mm., minimum diameter 0.50—0.53 mm. Ocelli oval, translucent; moderately large 0.30—0.33 mm long and 0.20—0.23 mm wide; from the eyes separated by about short diameter. Antennae with 19 segments; segment 1 long cylindrical; 2 about half of 1, cylindrical; 3-5 short, subequal; 6 to 10 gradually increasing in length; 11 to penultimate subequal, pyriform; last ovate, subequal to preceding-ones. Postclypeus pilose, swollen, little shorter than to half as long as its width; medially divided by dark longitudinal line. Anteclypeus subtrapezoidal, whitish, apilose. Labrum broadly tongue-shaped; little wider than long. Mandibles typically *Odontotermes*-type. Pronotum trapezoidal; narrower than head with eyes; anterior margin weakly incurved, with prominent median notch; posterior margin convex, incurved medially; sides narrowing behind; antero-lateral corners narrower than postero-lateral ones. Mesonotum and metanotum deeply incurved at posterior margin; densely pilose. Legs long; apical tibial spurs 3:2:2. Wings long, pale brownish. Forewing longer than hindwing; scale also longer than that of hindwing and not covering the latter; costa-subcosta fused, thick, running along anterior margin; radius short, fusing with costa-subcosta just outside scale; radial sector as thick as costa-subcosta, running parallel with latter upto distal margin; radial streak separating before middle of wing membrane; median thin, arising from cubitus in wing-membrane and running closer to and parallel with latter, giving off 2-4 branches in distal third; Cubitus weak, giving off 13-15 branches to posterior margin. Hindwing with costa-subcosta, radius and radial-sector as in forewing; median arising from radial sector outside scale and giving off some branches in distal half; cubitus as in forewing, giving off 11-13 branches to posterior margin. Abdomen oblong; densely hairy. Cerci 2-segmented, hairy. styli short, point like.

Comparison: In size it comes close to the imago of *Odontotermes assmuthi* but is generally paler (dark brown vs blackish brown), and has the ocellus larger in size and situated at about its short diameter (vs long diameter) from the eye.

(*b*) *Measurements (in mm), etc.*—(i) *Imago*: Table 1. (ii) *Soldier*: Range (10 exs.) : Total body-length, c 4.50—5.50, length of head to aternal base of mandibles 1.50—1.67, maximum width of head 1.13—1.23, length of left mandible 0.83—0.97, distance of tooth from tip in left mandible 0.47—0.52, maximum width of pronotum 0.80—0.87, No. of antennal segments 15-16.

TABLE 1.—Measurements (in mm) etc., of *Odontotermes bhagwatii* Chatterjee and Thakur.

CASTE.—Imago.	
Body-parts	Range (4exs.)
1. Total body-length <i>with</i> wings (excluding antennae), <i>c</i>	24.60—26.00
2. Total body-length <i>without</i> wings, (excluding antennae), <i>ca.</i> ..	10.00—13.20
3. Length of head to lateral base of mandibles	1.67— 1.83
4. Maximum width of head (with eyes)	2.17— 2.37
5. Maximum height of head	0.83— 0.87
6. Maximum length of postclypeus	0.43— 0.50
7. Maximum width of postclypeus ..	0.93— 1.03
8. Maximum length of labrum	0.53— 0.67
9. Maximum width of labrum	0.67— 0.73
10. Maximum diameter of compound eye (with ocular sclerite)	0.57— 0.60
11. Minimum eye—lateral margin distance	0.10— 0.17
12. Maximum diameter of lateral ocellus ..	0.30
13. Minimum diameter of lateral ocellus	0.20— 0.23
14. Minimum eye-ocellus distance	0.20
15. Minimum eye-antennal distance	0.13— 0.17
16. Minimum Ocellus-antennal distance	0.27— 0.30
17. Maximum length of pronotum	1.17— 1.23
18. Maximum width of pronotum	1.83— 2.13
19. Length of forewing with scale	21.60—23.10
20. Length of forewing scale	1.10— 1.17
21. Length of hindwing with scale .	20.20—22.00
22. Length of hindwing scale	1.00

(c) *Distribution*.—*India*: Punjab : Pathankot (type-locality). Madhya Pradesh : Kanha National Park; Kisli (present record).

(d) *Remarks*.—The soldiers present before me from Madhya Pradesh are somewhat smaller than those available to Chatterjee and Thakur (1967) and have 15-16 segmented antennae (16-segmented *vide* Chatterjee and Thakur, 1967).

(e) *Biological notes*.—The species feeds on dead wood and has been collected from bark of a 'Serai' tree and from twigs and logs of unknown woods lying on the ground in the forest. It has also been found cultivating fungus under a stone. The fungus combs are small, flat, cake-like structures (Pl. VIII, figs. 4 and 5) made from pellets of excreta which are laid in thin, flake-like, upright sheaths. The whole structure is very porous and looks something like a brain coral.

11. *Odontotermes guptai* Roonwal and Bose

1961. *Odontotermes bellahunisensis guptai* Roonwal, M. L. and Bose, G., *J. Bombay nat. Hist. Soc.*, 58 (3) : 588-593, S., W. Type-locality : India : Near Gudha village, Nagpur District, Rajasthan.
1967. *Odontotermes lokanandii* Chatterjee, P. N. and Thakur, M. L., *Indian For. Rec. (N. S.) Ent.*, 11(1) : 5, 7, 38-41, pls. 5 and 6. Type-locality : India : Residence plot No. 6, near River Tavi, Jammu, Jammu and Kashmir. *New Synonymy*.
1975. *Odontotermes guptai*, Roonwal, M. L., in *Environment Analysis of the Thar Desert* (Ed. R. K. Gupta and I. Prakash) : 409.

(a) *Material examined*.—A vial (No. 08/13.6.64) with S. and W., coll. O. B. Chhotani, 13. vi.1964., ex. "under dung."

(b) *Measurements (in mm), etc.*—Soldier: Range (5 exs.) : Total body-length, c 4.20—4.80, length of head to lateral base of mandibles 1.07—1.20, maximum width of head 1.00—1.07, length of left mandible 0.60—0.63, distance of tooth in left mandible from tip 0.19—0.20, maximum width of pronotum 0.77—0.83, No. of antennal segments 16.

(c) *Distribution*.—India : Rajasthan: Near Gudha village; Sayadpur salt colony; and Bikaner and vicinity. Jammu and Kashmir: Jammu. Madhya Pradesh : Kanha National Park (present record). Pakistan : Karachi and vicinity.

(d) *Remarks*.—I have compared the paratype soldier of *O. lokanandii* Chatterjee and Thakur with the holotype of *O. bellahunisensis guptai* Roonwal and Bose and have found them to be identical. *O. bellahunisensis guptai* has priority over *lokanandii*, therefore, the later is treated as a synonym. *O. b. guptai* has recently been raised to the specific level by Roonwal (1975).

12. *Odontotermes horni* (Wasmann)

(a) *Material examined*.—Four vials with S. and W. as follows:—Two vials, coll. O. B. Chhotani, June, 1964, No. 016/15.6.64 ex. "a twig lying on ground" and No. 03/16.6.64 ex. "under a stone"; and two vials coll. K. K. Tiwari, January, 1966, Kisli, Kanha National Park.

(b) *Measurements (in mm), etc.*—Soldier: Range (5 exs.): Total body-length c 7.00—7.70, length of head to lateral base of mandibles 2.50—2.60, maximum width of head 1.97—2.05, length of left mandible 1.27—1.33, distance of tooth in left mandible from tip 0.70—0.73, maximum width of pronotum 0.77—0.83, No. of antennal segments 17.

(c) *Distribution*.—It is a widely distributed species in India and Sri Lanka.

(d) *Biological notes*.—This species is not known to construct any mounds; its nests are subterranean. It feeds on dead logs and bark of trees. In Kanha National Park, it has been collected from dead twigs lying on the ground and from under stones.

13. *Odontotermes microdentatus* Roonwal and Sen-Sarma

(Pl. IX, Text-fig. 2)

(a) *Material examined*.—A vial with *S.* and *W.*, coll. *M. L. Roonwal* (R1/21.4.63), ex. mound. Two vials (Nos. 01/13.6.64 and 01/16.6.64) with *Im.*, *S.* and *W.*; two vials (Nos. 01/10.6.64 and 01/12.6.64) with *K.*, *Q.*, *S.* and *W.*; and two vials (Nos. 03/8.6.64 and 03/11.6.64) with *S.* and *W.*, all coll. *O. B. Chhotani*, June, 1964, from mounds. Two vials with *S.* and *W.*, one from a log of wood (No. 09/13.6.64) and other from bark of a 'Sal' tree (No. 05/13.6.64), and a vial (032/15.6.64) with one *Im.*, "at light at 8 P.M." coll. *O. B. Chhotani*, June, 1964. A vial with *S.* and *W.*, Kisli, Kanha National Park, c 600 m. altitude, coll. *K. K. Tiwari*, 9.i.1966, "below a wooden log in the forest around Kisli village"

(b) *Measurements (in mm), etc.*—(i) *Imago* : Range (5 exs.) : Total body-length with wings, c 28.40—30.00, total body-length without wings, c 12.40—14.40, length of head to tip of labrum 2.60—2.80, length of head to lateral base of mandibles 2.00—2.13, width of head with eyes 2.73—2.80, max. diameter of eye. 0.77—0.83, max. diameter of ocellus 0.33—0.37, minimum eye-ocellus distance 0.13—0.17, width of pronotum 2.37—2.50, length of forewing with scale 24.25—26.60, length of hindwing with scale 22.60—25.50, No. of antennal segments 19. (ii) *Soldier* : (Range 10 exs.) : Total body-length, c 4.60—5.30, length of head to lateral base of mandibles 1.37—1.43, maximum width of head 1.10—1.17, length of left mandible 0.87—0.90, distance of tooth from tip in left mandible 0.23—0.27, maximum width of pronotum 0.87—0.93, No. of antennal segments 16—17.

(c) *Distribution*.—*India*: Himachal Pradesh : Bilaspur. Punjab : Palampur. Uttar Pradesh : Dehra Dun; Kalsi. Bihar : Netarhat, Gumla; Porabat; Saranda. Madhya Pradesh : Kanha National Park (present record).

(d) *Biological notes*.—Its mounds (Text-fig. 2; Pl. IX, fig.1), in Kanha National Park are dome-shaped, have a few round swelling and vary from 28-100 cm in height and 4.50—6.30 m in circumference at the base. Inside the mound, there is generally a large, central, multi-tiered fungus comb in a central cavity and a number of smaller combs in vaults or chambers (pl. IX, fig. 2). Sometimes the central comb is not

formed. The royal cell is spindle-shaped, flat-floored and arched-roofed cell (14-15×9-12 cm) situated at ground-level to a depth of about 10 cm below. The fungus combs (pl. IX, figs. 3 and 4) are fairly large, irregular, cake-like structures. They are made up of pellets of excreta laid in horizontal sheaths. The upper side of the combs has fewer pores than on the lower side.



TEXT-FIG. 2. Mound of *Odontotermes microdentatus* Roonwal and Sen-Sarma.

This species has also been observed attacking logs of wood lying on ground and making earthen galleries on and under the bark of "Sal" trees.

14. *Odontotermes obesus* (Rambur)

(Pls. X-XII, Text-figs. 3 & 4; Table 2)

In Kanha National Park, four types of mounds were observed from which extensive collections were made. The mounds are easily separable but it is not possible to differentiate the specimens from these various types of mounds as they are morphologically similar. As such, it is not easy to refer specimens from different mounds to different species but the structure of the mounds is so different that it seems very unlikely that the same species would construct four different kinds of mounds in the same area and locality. It appears to be a case of sibling species and only some other aspects of taxonomy like the protein analysis, cytotaxonomy, etc. can solve this problem. Unfortunately, I do not have any termitophilous insects from these mounds except some Collembola which could throw some light. The Collembola, however, from all the four types of mounds belong to the species *Pseudocypoderus annandalei* Imms. This does not help as this species has also been recorded from *O. redemanni* (Wasm.) (Imms, 1912), *O. wallonesis* (Wasmann) from Madhya Pradesh (Srivastava, unpublished record) and from ground nest of a termite from Lonavala, Maharashtra (Yosii, 1966). It is also collected in association with *O. microdentatus* in Kanha National Park.

Holmgren (1912, pp. 778-781), while studying collections of termites from Bombay and neighbourhood, has referred to three different type of mounds and the collection therefrom to three different biological types of *Odontotermes obesus* (Rambur). Later in a note in the same publication (pp. 781-783), he concluded that these were not distinct forms and that they merged into one another with regards to their morphological characters as well as the structure of their nests.

In Kanha National Park, the mound type 'A' (*vide* below), in general shape and structure, is same as described by Holmgren (1913, Pl. E), referring it to *Odontotermes bangalorensis* (nec. *bengalensis* Holmgren which is not described, though the plates are labelled as *Odontotermes bengalensis*); Annandale (1923), referring to *O. obesus oculatus* Silvestri; Roonwal (1962), referring to *O. obesus*; and Becker (1962), referring it to *O. redemanni* (Wasmann). The mound type 'B' is like the one correlated to form 'a' by Holmgren (1912) and Roonwal and Chhotani (1963). The type 'C' mound cannot be compared with any described earlier and type 'D' is most probably deserted mound of type 'B'.

Until some definite conclusions are reached, I refer my observations on the mounds and the material separately in respect of the four types of mounds under the species *O. obesus* (Rambur) as some of these mounds have been referred to this species at one time or the other.

(a) *Material examined*.—All coll. *O. B. Chhotani*, June, 1964, except otherwise mentioned, as follows:—

From type 'A' mound: Coll. *M. L. Roonwal* (R5/21.4.63), *S.* and *W.* 02/9.6.64, *K.*, *Q.*, *S.*, *W.* and *Ny.*; 03/12.6.64; *K.*, *Q.*, *W.*, *Ny.* and eggs; 05/14.6.64, *S.* and *W.*; and 08/16.6.64, *K.*, *Q.*, *S.*, and *W.*

From type 'B' mound: 01/8.6.64, *K.*, *Q.*, *S.*, *W.* and *Ny.*; 02/12.6.64, *K.*, *Q.*, *S.*, *W.* and *Ny.*; and 010/13.6.64, *K.*, *Q.*, *S.* and *W.*

From type 'C' mound: 01/11.6.64, 2 *Q.*, *K.*, *Im.*, *S.* and *W.*; and 02/11.6.64, *K.*, *Q.*, *S.*, *W.* and *Ny.*

From type 'D' mound: 03/10.6.64, *S.*, *W.* and young-ones; 01/14.6.64, *S.*, *W.* and dead *Im.*; and 030/15.6.64, *S.* and *W.*

Apart from the above collection from mounds, the following material was also available for study:—

Two vilas with *S.* and *W.*, 04/13.6.64, ex. under cowdung; and 06/14.6.64, ex. under stone, coll. *O. B. Chhotani*, June 1964; one vial with *Im.*, coll. *O. B. Chhotani* (01/15.6.64), "while swarming at about 5.30 A.M. after a rain the evening before"; and one vial with *Im.*, coll. *George B. Schaller*, 21.vi.1964.

(b) *Measurements, etc.*—Table 2.

TABLE 2.—Measurement (in mm), etc. of *Odontotermes odesus* (Rambur)

Body-Parts	Type of mound and range				
	'A' (2-3 exs.)	'B' (4 exs.)	'C' (5 exs.)	'D' (3 exs.)	
(a) IMAGO					
1. Total body-length with wings <i>c</i>	Only King & queen available	Only king & queen available	29.60—30.70	25.30—26.00	
2. Total body-length without wings <i>c</i>	10.8—13.00 (dealate <i>K.</i>)	11.60—12.20	14.00—15.30	10.60—12.00	
3. Length of head to tip of labrum	2.80— 3.00	3.00— 3.05	2.57— 3.07	2.63— 2.70	
4. Length of head to lateral base of mandibles	1.83— 2.00	1.90— 2.00	1.83— 2.07	1.73— 1.87	
5. Width of head with eyes	2.50— 2.73	2.67— 2.83	2.60— 2.83	2.43— 2.50	
6. Maximum diameter of eye	0.77— 0.87	0.80— 0.87	0.73— 0.87	0.73	
7. Maximum diameter of ocellus	0.33— 0.38	0.33— 0.40	0.30— 0.43	0.33— 0.37	
8. Minimum eye-ocellus distance	0.09— 0.12	0.10— 0.13	0.11— 0.13	0.13	
9. Width of pronotum	2.33— 2.43	2.33— 2.47	2.30— 2.43	2.10— 2.23	
10. Length of forewing with scale	—	—	26.00—26.90	20.00—22.80	
11. Length of hindwing with scale	—	—	24.00—24.70	19.30—22.30	
12. No. of antennal segment	Broken	Broken	19	19	
(b) SOLDIER	(8 exs.)	(8 exs.)	(8 exs.)	(6 exs.)	
1. Total body-length <i>c</i>	4.95— 6.50	4.25— 5.80	4.20— 5.00	4.90— 5.20	
2. Length of head to lateral base of mandibles	1.33— 1.67	1.23— 1.40	1.30— 1.43	1.20— 1.40	
3. Maximum width of head	1.13— 1.37	1.07—1.23	1.17— 1.20	1.00— 1.20	
4. Length of left mandible	0.90— 1.00	0.80— 0.87	0.87— 0.90	0.75— 0.90	
5. Distance of tooth from tip in left mandible	0.27— 0.35	0.27— 0.31	0.30— 0.33	0.27— 0.30	
6. Maximum width of pronotum	0.90— 1.07	0.87—1.00	0.90— 0.97	0.80— 0.90	
7. No. of antennal segments	16—17	16—71	16—71	16—17	

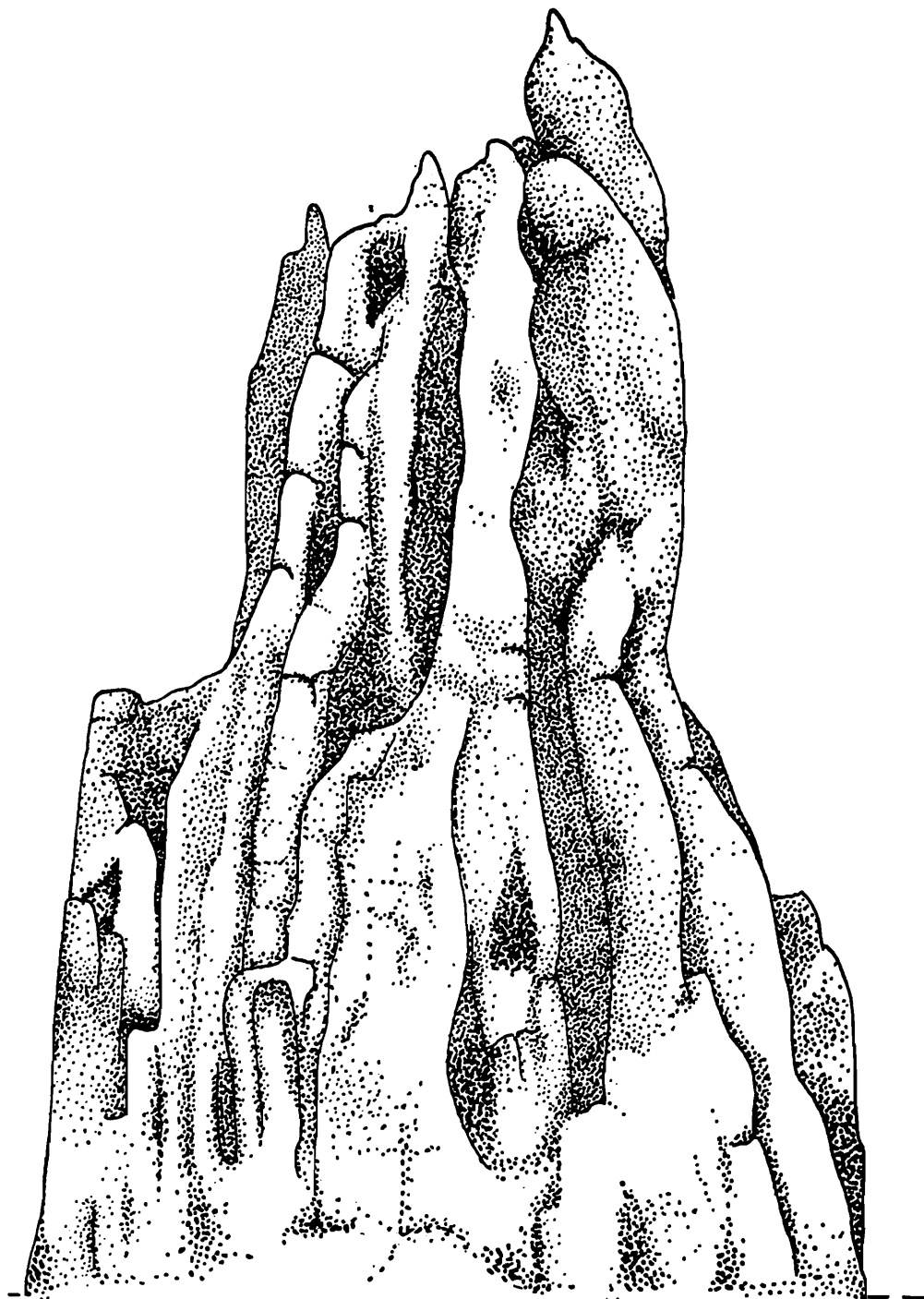
CHHOTANI : *On Termites*

(c) *Distribution*.—It is a very common termite and is widely distributed in India and Pakistan.

(d) *Biological notes*.—*O. obesus* is a common mound-building termite in India. The four types of mounds, as observed in Kanha National Park, are briefly described below.

Mound Type 'A' (Pl. X, Text-fig. 3).

The tall, unilocular (Pl. X, figs. 1 and 2) mounds with buttresses, varying from about 29 cm to 2.35 m in height and 1.14—7.2 m in circumference at base, are referred to type 'A' The structure of the mound,



TEXT-FIG. 3. Mound of *Odontotermes obesus* (Rambur), type 'A'.

the fungus combs, the royal chamber, etc. have been described in details by Roonwal (1962). The royal chamber (Pl. X, fig. 3), with a spindle-shaped cell inside, is generally an irregular mass of earth, lying approximately at the ground-level or a little below, in the middle or on one side of the mound. In one case however, it was found to have got mixed up in the walls and was located about 40 cm above the ground-level. The fungus combs (Pl. X, figs. 4 and 5) are located in the middle of the mound in a large cavity which extends into the ground to some extent. The combs are very porous and have upright sheaths.

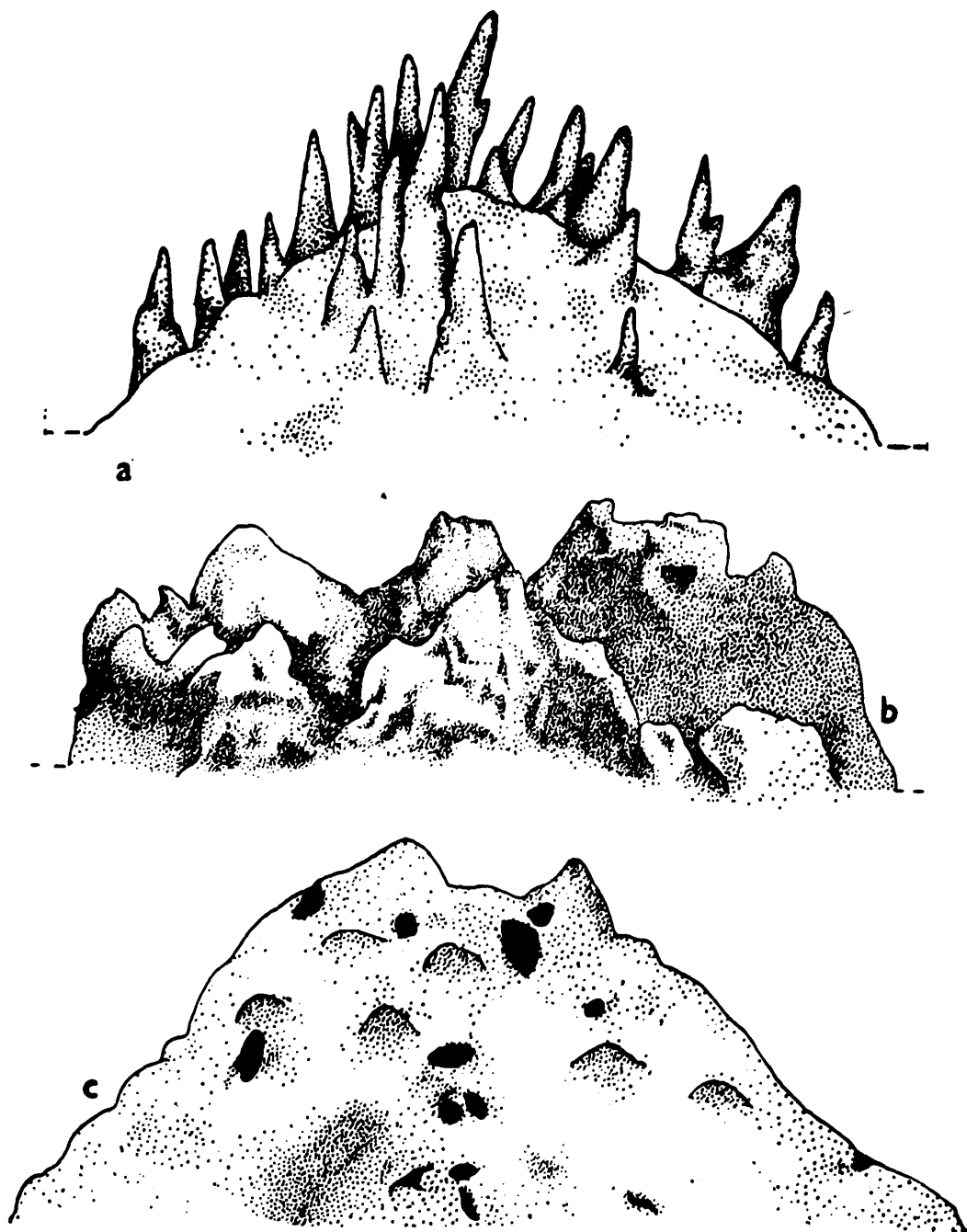
Mound type 'B' (Pl. XI; Text-fig. 4 a).

This type of mounds are dome-shaped and have large number of turrets. The height of the mounds with turrets varies from 60—110 cm and without turrets from 38-64 cm and the circumference at base is 5.80 to 9.10 m. The turrets (Pl. XI, fig. 2) are without any openings outside, have granular, irregularly-leveled outer surface and hollow tunnels leading down below into the nest. Inside, the nest extends to about the depth of its height without turrets and has a large number of vaults or chambers of varying shapes and sizes with the fungus combs. Sometimes a large cavity, divided into several, small, irregular compartments, having fungus combs, is present in the middle of the nest. The royal cell is spindle-shaped, 12-15 cm long and 6-8 cm wide and is located in soil at about the ground level. The fungus combs are flat, cake-like structures having sponge-like perforations (Pl. XI, figs. 4, 5). The sheaths or the layers of the combs are laid up horizontally.

Mound type 'C' (Pl. XII, figs. 1-4; Text-fig. 4 b).

To type 'C' are referred the mounds having a number of lumps of earth over the ground surface. These structures or the lumps are 10-15 cm high, extend in an area of about 5 m circumference, have no openings outside and are hollowed inside. The main nest is below the ground surface, extends to a depth of 50-80 cm below the ground-level and has a number of fungus vaults which are generally round in shape, those just below the lumps of earth are somewhat oval. The fungus combs are thin, flat, round or irregularly-shaped, cake-like structures (Pl. XII, figs. 3 and 4) and are quite similar to those found in type 'B' mounds. The spindle-shaped royal cell is of about 12×8 cm size. In one mound it was found at about the ground-level and in another about 25 cm below the surface of ground. In the later case 2 queens of appreciably different size and one king were found, showing thereby that the smaller queen was a later addition.

The imagos were collected from under the fungus combs at a depth of 15 cm and at the extreme depth of the mound.



TEXT-FIG. 4. Mounds of *Odontotermes obesus* (Rambur). (a) Type 'B'. (b) Type 'C'. (c) Type 'D'.

Mound type 'D' (Pl. XII, figs. 5-7; Text-fig. 4 c)

To this type are referred large, (60—110 cm in height and 5.75-9.30 m in circumference at base), dome-shaped mounds (Pl. XII, fig. 5) having a number of large holes opening outside. These mounds, comparative to size, are very thinly populated, have a very few small and thin fungus combs (Pl. XII, figs. 6 and 7) and several empty fungus vaults. The royal cell too was found empty in two such mounds and not traceable in another. Most probably these mounds were deserted due to certain reasons and looked very much like the type 'B' (described above) as

the general shape of type 'B' mounds without the turrests would be like that of these except that these are larger in size.

15. *Microtermes obesi* Holmgren

(a) *Material examined*.—A vial with *Im.*, *S.* and *W.*, coll. O. B. Chhotani, (017/15.6.64). 15.vi.1964 "under a stone" Four vials with *S.* and *W.*, thus: 01c/8.6.64, ex. a mound of *Odontotermes obesus* type 'B'; 02/10.6.64 and 02/13.6.64, ex. mounds of *Odontotermes microdentatus*; and 04/14.6.64 ex. mound of *Odontotermes obesus* type 'D'; and two vials Nos. 04/15.6.64 and 021/15.6.64, ex. twigs of unknown plants, all coll. O. B. Chhotani, June 1964. Two vials, coll. K. K. Tiwari, one from Kanha National Park Rest House, 31.xii.1965 and the other from Kisli, alt. c 600 m, 10.i.1966.

(b) *Measurements (in mm), etc.*—(i) *Imago*: Range (5 exs.): Total body-length with wings, c 14.20—14.40, total body-length without wings, c 8.00—8.70, length of head to tip of labrum 1.53—1.60, length of head to lateral base of mandibles 0.93—1.03, width of head with eyes 1.27—1.33, max. diameter of eye 0.40—0.43, max. diameter of ocellus 0.11—0.13, min. eye-ocellus distance 0.06—0.07, width of pronotum 1.13—1.27, length of forewing with scale 11.70—12.75, length of hindwing with scale 10.90—11.45, No. of antennal segments 15. (ii) *Soldier*: (Range 10 exs.): Total body-length, c 3.00—3.90, length of head to lateral base of mandibles 0.83—0.87, maximum width of head 0.73—0.80, length of left mandible 0.47—0.50, max. width of pronotum 0.47—0.53, No. of antennal segments 14.

(c) *Distribution*.—It is a very common species and is known from all over the Indian subcontinent. From Sri Lanka it is recorded from Mha Illuppalama.

(d) *Biological notes*.—*M. obesi* is widely distributed. In Kanha National Park, it has been found occurring in soil and in the walls of the mounds of *Odontotermes* spp. The nest is in the form of inter-communicating galleries and small chambers or vaults of 2-4 cm diameter. In these vaults are lodged the fungus combs which are cultivated by the termites. It has also been found eating up twigs of some unknown plants lying on the ground.

16. *Microtermes unicolor* Snyder

(a) *Material examined*.—Several *Im.*, coll. M. L. Roonwal (R1/21.4.63), 21.iv.1963, ex. mound of *Odontotermes microdentatus* R. & S. and coll. George B. Schaller, 22.vi.1963. Also coll. O. B. Chhotani, June, 1964, thus: Three vials with *Im.*, *S.* and *W.*, No. 03/9.6.64, ex. mound type 'A' of *Odontotermes obesus* (Ramb.); 04/10.6.64, ex. dome-shaped mound (type 'D') of *Odontotermes obesus*; and 04/11.6.64, ex. mound

of *Odontotermes microdentatus*; three vials with *S.* and *W.*, Nos. 07 and 08/15.6.64, ex. twigs of woods lying on ground and 04/16.6.64, under stone; and one vials with two *Im.*, (No. 033/15.6.64), "at light."

(b) *Measurements (in mm), etc.*—(i) *Imago*: Range (5 exs.) : Total body-length with wings, *c* 15.00—15.80, total body-length without wings, *c* 8.80—9.30, length of head to tip of labrum 1.53—1.67, length of head to base of mandibles 1.00—1.07, width of head with eyes 1.37—1.40, maximum diameter of eye 0.39—0.40, maximum diameter of ocellus 0.17—0.20, minimum eye-ocellus distance 0.02—0.03, width of pronotum 1.20—1.30, length of forewing with scale 12.20—13.80, length of hindwing with scale 11.60—13.00, No. of antennal segments 15. (ii) *Soldier*: Range (5 exs.): Total body-length, *c* 3.00—3.90, length of head to lateral base of mandibles 0.87—0.90, maximum width of head 0.77—0.80, length of left mandible 0.43—0.47, maximum width of pronotum 0.51—0.53, No. of antennal segments 14.

(c) *Distribution*.—*M. unicolor* is known from Northern India (Punjab, Himachal Pradesh and Jammu and Kashmir), central India (present record) and Pakistan.

(d) *Biological notes*.—This species occurs in soil and in the walls of the mounds of *Odontotermes* spp. The nest is like that of *M. obesi* and it cultivates small fungus combs which are generally round structures and are made up of small granular pellets. It has also been collected eating up small twigs of wood lying on ground.

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SUMMARY

Kanha National Park is situated in Mandla District of Madhya Pradesh and is very rich in insects and wild-life. The present paper deals mainly with the study of termite collections which the author made in June, 1964.

As many as 16 species are recorded, of which one belongs to the family Rhinotermitidae and the others to Termitidae. Two species

viz. Microcerotermes championi Snyder and *Odonotermes lokanandii* Chatterjee and Thakur are relegated into synonymy and the unknown imago of *Odontotermes bhagwatii* Chatterjee and Thakur is described here for the first time.

Field observations with regards to the nesting behaviour and the biology of the different species are recorded.

Specimens from the four different types of mounds found in the Park could not be differentiated, the structure of the mounds, the fungus combs, the royal chambers, etc. are so different that it is difficult to believe that the same species makes so many different types of mounds in the same area. It is possible that these mounds belong to more than one sibling species and until some other aspect of taxonomy can solve this intricate problem the specimens are referred to the species *Odontotermes obesus* (Rambur) to which some of these mounds have at one time or the other been referred.

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