

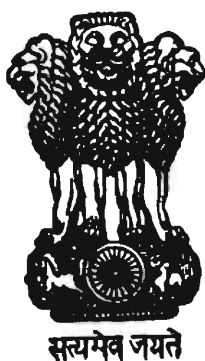
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NOTES ON FISHES FROM BHARATPUR DISTRICT, RAJASTHAN

By

JAGDISH CHANDRA MOONA

Department of Zoology, Ramjas College, Delhi

(With 1 Text-figure)

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I—INTRODUCTION

Rajasthan, although an arid zone, has a number of water sources where fishes flourish very well. Chopra and Roonwal of the Zoological Survey of India surveyed this area in 1941, and in 1948 Pradhan collected several fishes from the same region. The entire collection has been systematically studied and recorded by Mathur (1953). All the surveys were made particularly in the region of Aravalli Range from the states of Udaipur, Jodhpur, Sirohi and Palanpur, but no attempt has so far been made to collect fishes from the eastern part of Rajasthan which remains unexplored. On the suggestion of Dr. B. M. Sinha, Head of the Department of Zoology, Meerut College, Meerut, I took up the work of collection of fishes from the eastern districts of Rajasthan. This paper is based on the collections made from Bharatpur District, adjoining the Agra and Mathura Districts of Uttar Pradesh.

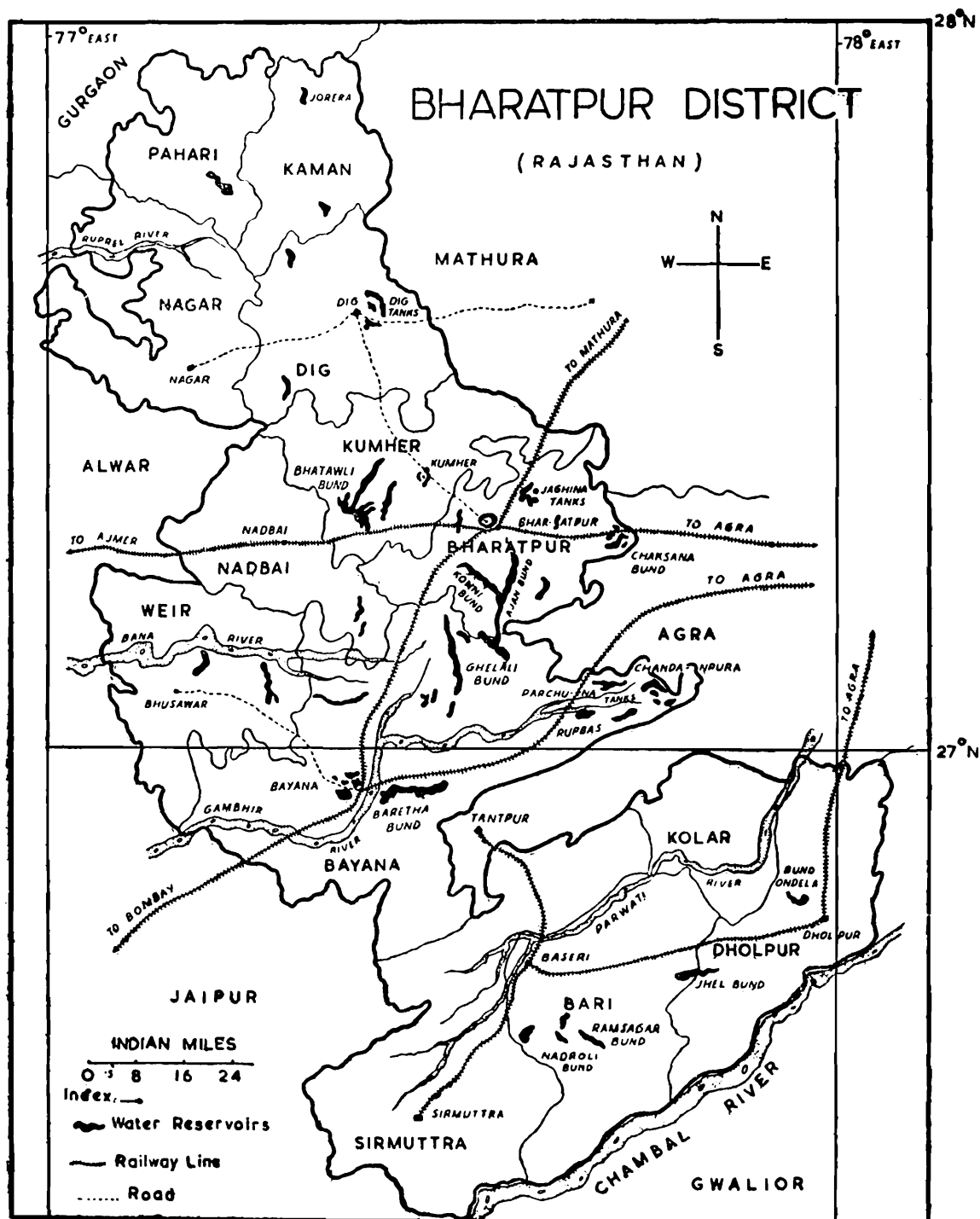
I am indebted to Dr. M. L. Bhatia, Head of the Department of Zoology, University of Delhi, for valuable suggestions and correcting the manuscript. Thanks are due to Dr. N. N. Majumdar for helping me in the identification of the fishes and in preparation of the manuscript. I am also thankful to Dr. A. G. K. Menon of the Zoological Survey of India, for confirming the identifications.

II—PHYSICAL FEATURES

Bharatpur District is situated at the Eastern border of Rajasthan and is thus surrounded by the Agra and Mathura Districts of U. P. on one side, Gurgaon District on its north, Alwar and Jaipur Districts on its west, and Gwalior on its south. It occupies a central position between the Uttar Pradesh, Madhya Pradesh and parts of Rajasthan. The whole district is divided into two divisions, Bharatpur and Dholpur.

Bharatpur includes nine tehsils—Pahari, Kaman, Nagar, Dig, Nadbai, Kumher, Bharatpur, Weir and Bayana, whereas Dholpur includes four tehsils—Dholpur, Kolar, Bari and Sirmuttra.

A number of water sources in the form of bunds, tanks, pools and rivers are present in this district, out of which the places shown in the map were surveyed for fish fauna.



TEXT-FIG. 1.—Map of Bharatpur District, Rajasthan, showing the various water sources and localities from where fish were collected.

III—CLASSIFIED LIST OF THE FISHES COLLECTED AND THEIR LOCAL NAMES

The Zoological Survey of India has confirmed the identification of the fishes listed herein and the classification followed is the one proposed by Berg (1940).

Class TELEOSTOMI

Subclass ACTINOPTERYGII

Order Cypriniformes

Division Cyprini

Suborder Cyprinoidei

Family CYPRINIDAE

Subfamily *CYPRININAE*

- | | |
|--|------------|
| 1. <i>Labeo rohita</i> (Ham.) | 'Rohu' |
| 2. <i>Labeo calbasu</i> (Ham.) | 'Kalonli' |
| 3. <i>Labeo gonius</i> (Ham.) | 'Khurchia' |
| 4. <i>Labeo dyocheilus</i> (McClell.) | — |
| 5. <i>Cirrhina mrigala</i> (Ham.) | 'Mrigal' |
| 6. <i>Catla catla</i> (Ham.) | 'Katla' |
| 7. <i>Barbus (Puntius) sarana</i> Ham. | 'Puthi' |
| 8. <i>Barbus (Tor) tor</i> Ham. | 'Mahasir' |
| 9. <i>Chela bacaila</i> (Ham.) | 'Chela' |

Division Siluri

Suborder Siluroidei

Family SILURIDAE

- | | |
|---|---------|
| 10. <i>Wallago attu</i> (Bloch & Schn.) | 'Lachi' |
| 11. <i>Ompok bimaculatus</i> (Bloch) | 'Papta' |

Family BAGRIDAE

- | | |
|---|------------|
| 12. <i>Mystus (Osteobagrus) seenghala</i> (Sykes) | 'Singhara' |
| 13. <i>Mystus cavasius</i> (Ham.). | 'Tigra' |

Family SACCOBRANCHIDAE

- | | |
|--|----------|
| 14. <i>Heteropneustes fossilis</i> (Bloch) | 'Singhi' |
|--|----------|

Order Ophiocephaliformes

Family OPHIOCEPHALIDAE

- | | |
|-------------------------------------|----------|
| 15. <i>Channa punctatus</i> (Bloch) | 'Shauli' |
| 16. <i>Channa marulius</i> (Ham.) | 'Shaul' |

Order Perciformes

Suborder Gobioidae

Family GOBIIDAE

17. *Glossogobius giuris* (Ham.) 'Bheula'

Suborder Percoidei

Family CENTROPOMIDAE

18. *Ambassis nama* (Ham.) 'Chanda'

Order Mastacembeliformes

Family MASTACEMBELIDAE

19. *Mastacembelus armatus* (Lacép.) 'Bam'

Order Clupeiformes

Suborder Notopteroidei

Family NOTOPTERIDAE

20. *Notopterus chitala* (Ham.) 'Cheetal'
21. *Notopterus notopterus* (Pallas.) 'Patulia'

Suborder Clupeoidei

Family CLUPEIDAE

Subfamily CLUPEINAE

22. *Gadusia chapra* (Ham.) 'Khera'

IV—DESCRIPTION OF LOCALITIES, WITH LISTS OF FISHES COLLECTED FROM EACH LOCALITY

1. AJAN BUND.—It is situated at a distance of seven miles from Bharatpur City. It is a well managed bund under the supervision of the Government of Rajasthan. The water in this bund is controlled by the gates and, when needed, superfluous water is removed. The total water area of this bund is thirteen square miles and maximum water depth is about 15 feet. The following fishes were collected on the 5th June, 1956.

Note.—ex., example ; exs., examples.

- | | |
|--|--------|
| 1. <i>Notopterus notopterus</i> (Pallas) | 5 exs. |
| 2. <i>Notopterus chitala</i> (Ham.) | 2 „ |
| 3. <i>Labeo rohita</i> | 3 „ |
| 4. <i>Labeo gonius</i> (Ham.) | 5 „ |
| 5. <i>Labeo calbasu</i> (Ham.) | 4 „ |
| 6. <i>Mystus</i> (<i>Osteobagrus</i>) <i>seenghala</i> (Sykes) | 4 „ |
| 7. <i>Wallago attu</i> (Bloch & Schn.) | 5 „ |
| 8. <i>Channa punctatus</i> (Ham.) | 2 „ |
| 9. <i>Chela bacaila</i> (Ham.) | 1 ex. |
| 10. <i>Ompok bimaculatus</i> (Bloch) | 1 „ |

2. **KOHNI BUND.**—It is situated seven miles away from Bharatpur City and is connected with Ajan bund by an elbow-shaped band, hence the name. It has an area of about 8 square miles with a water depth of about 15 feet. This bund is also under the management of the Government of Rajasthan. In addition to the species found in Ajan Bund, the following species were collected from this bund on the 5th June, 1956.

1. <i>Barbus (Puntius) sarana</i> Ham.	3 exs.
2. <i>Barbus (Tor) tor</i> Ham.	5 „
3. <i>Glossogobius giuris</i> (Ham.)	1 ex.
4. <i>Mastacembelus armatus</i> (Lacép.)	2 exs.
5. <i>Cirrhina mrigala</i> (Ham.)	5 „

3. **BARETHA BUND.**—It is situated at a distance of 32 miles from Bharatpur City and is also under the control of Government of Rajasthan. It is the biggest bund in Bharatpur district, having an area of about 30 square miles with a maximum water depth of 22 feet. Fishes of great commercial value are present in this bund. The following fishes were collected on the 12th June, 1956.

1. <i>Labeo rohita</i> (Ham.)	5 exs.
2. <i>Labeo calbasu</i> (Ham.)	5 „
3. <i>Wallago attu</i> (Bloch & Schn.)	5 „
4. <i>Mystus (Osteobagrus) seenghala</i> (Sykes)	3 „
5. <i>Channa marulius</i> (Ham.)	1 ex.
6. <i>Barbus (Puntius) sarana</i> Ham.	1 „
7. <i>Notopterus chitala</i> (Ham.)	1 „

4. **AGHAPUR BUND.**—It is situated 10 miles away from Bharatpur City and is about 10 to 12 feet in water depth. The following fishes were collected on the 13th June, 1956.

1. <i>Labeo rohita</i> (Ham.)	4 exs
2. <i>Barbus (Puntius) sarana</i> Ham.	3 „
3. <i>Mystus (Osteobagrus) seenghala</i> (Sykes)	3 „
4. <i>Wallago attu</i> (Block & Schn.)	5 „
5. <i>Channa punctatus</i> (Bloch)	1 ex.
6. <i>Labeo gonius</i> (Ham.)	1 „

5. **CHAKSANA BUND, DITCHES AND PONDS.**—They are situated 10 miles away from Bharatpur City. Near the bund are some ditches and ponds from where small fishes were collected in large numbers. The following fishes were collected on the 20th December, 1956.

1. <i>Channa punctatus</i> (Bloch)	1 ex.
2. <i>Heteropneustes fossilis</i> (Bloch)	5 exs.
3. <i>Glossogobius giuris</i> (Ham.)	1 ex.
4. <i>Labeo rohita</i> (Ham.)	5 exs.
5. <i>Labeo gonius</i> (Ham.)	5 „
6. <i>Labeo dyocheilus</i> (McClell.)	1 ex.
7. <i>Catla catla</i> (Ham.)	2 exs.
8. <i>Wallago attu</i> (Bloch & Schn.)	3 „
9. <i>Mystus (Osteobagrus) seenghala</i> (Sykes)	„

6. MOAT AROUND THE BHARATPUR FORT.—It is about 15 feet deep and 100 feet wide, and encircles the Fort. The following fishes were collected on the 20th December, 1956.

1. <i>Gadusia chapra</i> (Ham.)	5 exs.
2. <i>Mastacembelus armatus</i> (Lacép.)	5 „
3. <i>Ambassis nama</i> (Ham.)	4 „
4. <i>Channa marulius</i> (Ham.)	1 ex.
5. <i>Labeo rohita</i> (Ham.)	5 exs.
6. <i>Labeo gonius</i> (Ham.)	2 „

7. DIG TANKS.—They are situated 26 miles away from the City of Bharatpur with the water depth of 6 to 8 feet. The following fishes were collected on the 24th December, 1956.

1. <i>Wallago attu</i> (Bloch & Schn.)	5 exs.
2. <i>Labeo rohita</i> (Ham.)	5 „
3. <i>Catla catla</i> (Ham.)	2 „

8. RUPREL RIVER.—It runs from Alwar district boundary to Sikari village in Nagar tehsil of Bharatpur district. It is a temporary source of water, which exists only during the rainy season. The following fishes were collected on the 20th July, 1956.

1. <i>Channa punctatus</i> (Bloch)	2 exs.
2. <i>Labeo rohita</i> (Ham.)	5 „

9. BANA RIVER.—It is a small river passing through the centre of Weir tehsil. It dries up during the summer months. The following fishes were collected on the 5th August, 1956.

1. <i>Labeo calbasu</i> (Ham.)	2 exs.
2. <i>Labeo rohita</i> (Ham.)	4 „
3. <i>Cirrhina mrigala</i> (Ham.)	5 „

10. GAMBHIR RIVER.—It passes through the centre of the Bayana tehsil. The following fishes were collected on the 5th August, 1956.

1. <i>Labeo rohita</i> (Ham.)	5 exs.
2. <i>Labeo calbasu</i> (Ham.)	2 „

11. PARCHUNA TANKS.—They are situated at a distance of 14 miles from Bharatpur City. The following fishes were collected on the 21st December, 1956.

1. <i>Wallago attu</i> (Bloch & Schn.)	5 exs.
2. <i>Channa punctatus</i> (Bloch)	1 ex.
3. <i>Labeo rohita</i> (Ham.)	5 exs.

12. KHANWAY BUND.—It is 17 miles away from Bharatpur City in Bayana tehsil. The following fishes were collected on the 25th July, 1956.

1. <i>Labeo rohita</i> (Ham.)	2 exs.
2. <i>Wallago attu</i> (Bloch & Schn.)	2 „
3. <i>Ompok bimaculatus</i> (Bloch)	1 ex.

13. RAMSAGAR BUND.—It is in Dholpur Division. The following fishes were collected on the 4th July, 1956.

1. <i>Wallago attu</i> (Bloch & Schn.)	5 exs.
2. <i>Mystus (Osteobagrus) seenghala</i> (Sykes)	2 „
3. <i>Labeo rohita</i> (Ham.)	4 „
4. <i>Mastacembelus armatus</i> (Lacép.)	2 „
5. <i>Channa marulius</i> (Ham.)	1 ex.
6. <i>Catla catla</i> (Ham.)	1 „

14. ONDELA BUND.—It is situated at a distance of 5 miles from Dholpur City and is about 8 feet in depth. The following fishes were collected on the 24th December, 1956.

1. <i>Labeo dyocheilus</i> (McClell.)	1 ex.
2. <i>Labeo calbasu</i> (Ham.)	5 exs.
3. <i>Labeo gonius</i> (Ham.)	1 ex.
4. <i>Notopterus notopterus</i> (Pallas)	1 „
5. <i>Notopterus chitala</i> (Ham.)	1 „
6. <i>Barbus (Tor) tor</i> Ham.	1 „

15. PARWATI RIVER.—It passes through the northern part of Dholpur region from Sirmuttra to Koları tehsil. It also dries up during summer season, but during rains fries can be collected from it. The following fishes were collected on the 8th July, 1956.

1. <i>Barbus (Puntius) sarana</i> Ham.	4 exs.
2. <i>Labeo calbasu</i> (Ham.)	2 „
3. <i>Labeo rohita</i> (Ham.)	5 „

Out of the entire collections made from different water sources the following were reported by Mathur (1953).

1. *Barbus (Puntius) sarana* Ham.
2. *Labeo calbasu* (Ham.)
3. *Glossogobius giuris* (Ham.)
4. *Channa punctatus* (Ham.)
5. *Mastacembelus armatus* (Lacép.)

The other fishes listed above have not yet been reported from Rajasthan.

V—GENERAL REMARKS

Five different species of fishes of economic importance, namely, *Labeo calbasu* (Ham.), *Labeo rohita* (Ham.), *Mystus (Osteobagrus) seenghala* (Sykes), *Wallago attu* (Bloch & Schn.), and *Cirrhina mrigala* (Ham.), are very commonly found in whole of the district and good supply can be readily obtained from these places.

VI—REMARKS ON THE POSSIBILITIES OF FISH CULTURE

The whole district of Bharatpur has a large number of bunds, some of which are so big that water remains in them for a major period in the year and are therefore suitable for the fish culture. Baretha bund is the only perennial water-bund and can be used for stocking fish, as it has a depth of 22 feet, which can allow all economically important fishes to develop to their maximum size.

Besides this, Ajan bund and Kohni bund, which are very near Bharatpur City proper, can serve the purpose of good fish culture grounds. Although a large number of fry is available during the rainy season, the Government has not yet taken any step to make it suitable for fish culture. Attention of fish experts of the Rajasthan Government can be of great help in the advancement of pisciculture in this part of the state.

VII—REFERENCES

AUDEN, J. B. 1950. Introductory report on the ground-water resources of western Rajasthan.—*Bull. Geol. Surv. India*, (B), pp. 1-59.

BERG, L. S. 1940. Classification of fishes both recent and fossil.—*Trav. Inst. Zool. Acad. Sci. U. S. S. R.*, 5, Leningrad.

MATHUR, B. B. L. 1953. Notes on fishes from Rajasthan, India.—*Rec. Indian Mus.*, Delhi, 50, pp. 105-110.

TWO NEW ACANTHOCEPHALA FROM THE FISH, *SCATOPHAGUS ARGUS* (BLOCH), FROM INDIA

By

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and

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(With 2 Text-figures)

Five Acanthocephalan species, all from fishes, are so far known of the genus *Filisoma* van Cleave (1928), as follows :—

Species	Host (Fishes)	Locality
1. <i>Filisoma indicum</i> van Cleave, 1928 (Generi-type of <i>Filisoma</i>)	<i>Scatophagus argus</i> (Bloch)	Chilka lake (Orissa, India)
2. <i>F. microcanthi</i> Harda, 1938	<i>Microcanthus strigatus</i> (Cuv. & Val.)	Taiwan (Formosa), China
3. <i>F. bucerium</i> van Cleave, 1940	<i>Kyphosus elegans</i> (Peters)	Socorro Is. (off Pacific coast of Mexico)
4. <i>F. rhizalium</i> Tubangui & Masilungan, 1946	<i>Scatophagus argus</i> (Bloch)	Manila Bay (Philippines)
5. <i>F. fidum</i> van Cleave & Manter, 1947	<i>Kyphosus sectatrix</i> (Linn.)	Dry Tortugas (Florida, U. S. A.)

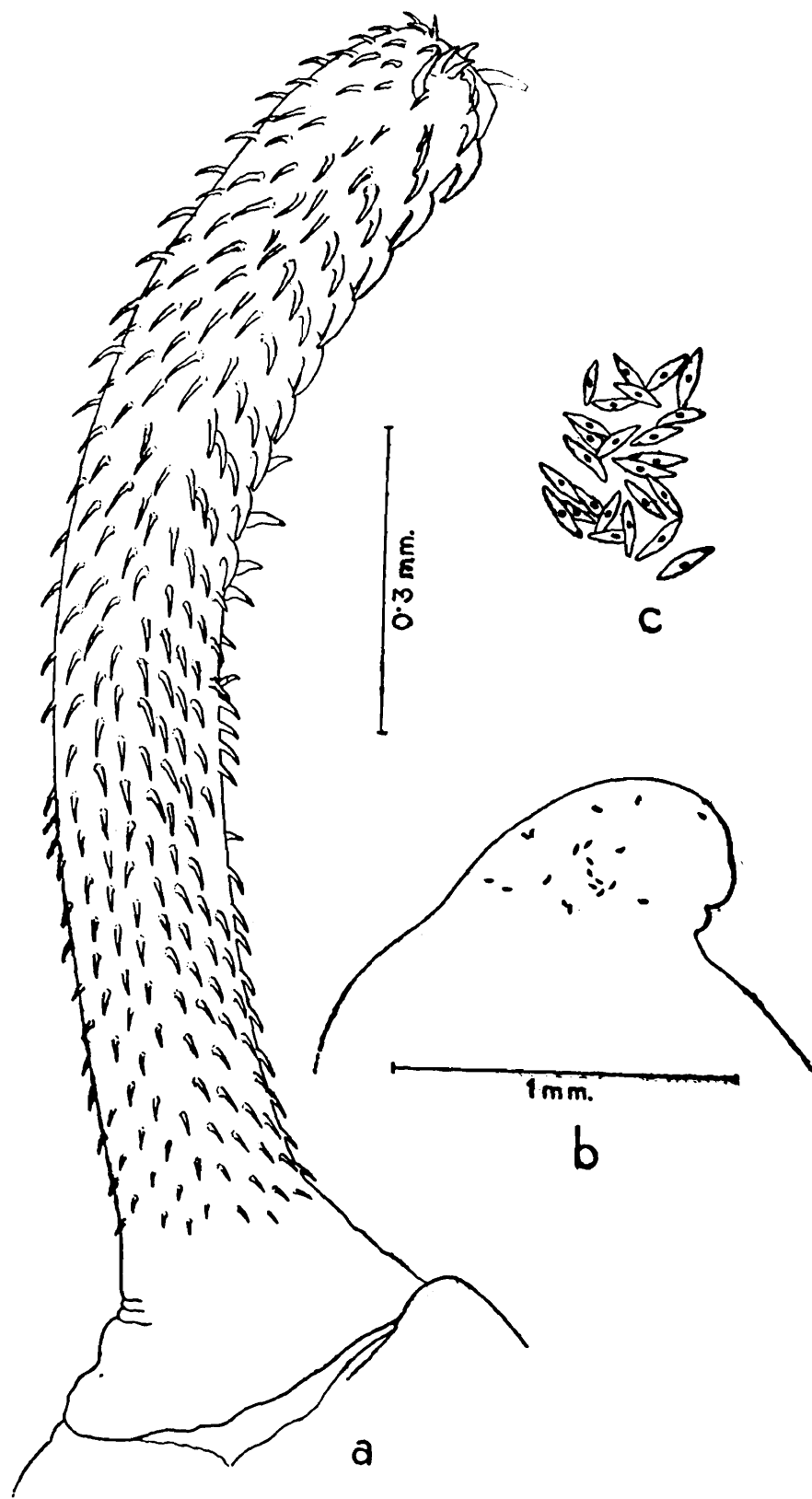
Two new species from India, as discovered in the collections of the Zoological Survey of India, are described below.

1. *Filisoma scatophagusi* Datta & Soota, sp. nov.

(Text-fig. 1)

Diagnosis.—A zonal differentiation between dorsal and ventral hooks clearly discernible, the former being thicker and less pointed than the latter. First ten hooks of median dorsal row exceptionally conspicuous—0.04—0.06 mm. long and 0.01—0.02 mm. broad ; subsequent hooks progressively diminishing towards the posterior end and measuring 0.02—0.04 mm. long and 0.004—0.02 mm. broad ; first submedian dorsal row measuring 0.02—0.04 mm. in length and 0.004—0.01 mm. in breadth ; the second submedian dorsal row 0.02—0.04 mm. long and 0.008 mm.

broad ; ventrals measuring 0.008—0.03 mm. in length and 0.004 mm. in maximum thickness, all gradually diminishing in size antero-posteriorly.



TEXT-FIG. 1.—*Fillisoma scatophagusi* Datta & Soota, sp. nov. Holotype (♀).
(a). Proboscis. (b). Posterior end. (c). Eggs.

Description.—The female specimen nearly 115 mm. long, narrow anteriorly (0.5 mm. wide) and broad posteriorly (1.6 mm. wide). Proboscis 1.1 mm. in length, 0.9 mm. in greatest width ; with 14—16 longitudinal rows of hooks (26—32 hooks in each row). Dorsal and ventral hooks clearly differentiated, the former being thicker and stouter

than the latter. Proboscis receptacle double-walled. A small spineless neck-like region (0.1 mm. long and 0.3 mm. broad) towards the base, interrupting the proboscis and the body proper. Body spineless. Ova crowding the entire body. Genitalia not traceable.

Type-specimen.—*Holotype* (♀) Zoological Survey of India Registered No. W 3988/1, mounted on a slide, deposited in the collections of the Zoological Survey of India, Calcutta.

Type-locality.—River Hooghly, Calcutta, India.

Type-host.—From the intestine of the brackish water fish *Scatophagus argus* (Bloch) (order Perciformes ; family Scatophagidae.)

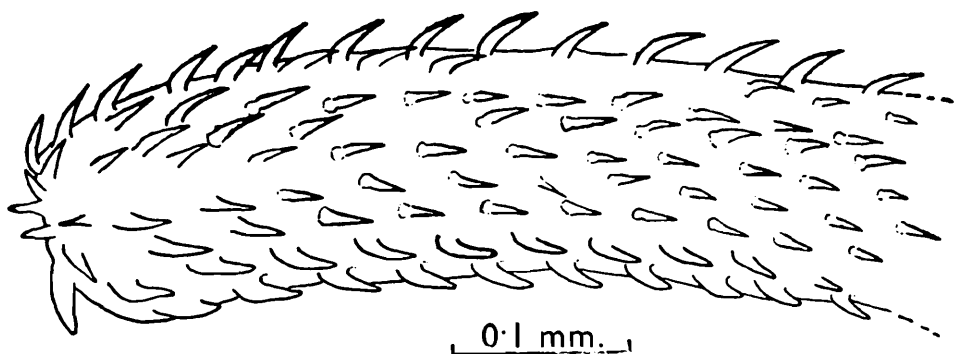
Remarks.—The present species can be easily separated from its nearest allies, namely, *F. bucerium* van Cleave and *F. rhizalium* Tubangui & Masilungan in the following respects :

(i) In showing zonal differentiation in both, median and submedian dorsal hooks, whereas in the former (*F. bucerium*) this differentiation is met with only in the median dorsal row and the latter (*F. rhizalium*) in the anterior 8 to 10 hooks of submedian dorsal rows. (ii) In the possession of very conspicuous first ten median dorsal hooks.

2. *Filisoma hoogliensis* Datta & Soota, sp. nov.

(Text-fig. 2)

Diagnosis.—The median dorsal and the first row of submedian dorsal row of hooks stouter than the rest, measuring 0.02—0.04 mm. in length and 0.004—0.1 mm. in breadth, thus marking a zonal differentiation ; the ventrals measuring 0.01—0.04 mm. in length and 0.008 mm. in maximum thickness ; all the hooks progressively diminishing in size antero-posteriorly.



TEXT-FIG. 2.—*Filisoma hoogliensis* Datta & Soota, sp. nov. Holotype (♀) : Proboscis.

Description.—The single female specimen nearly 43 mm. long ; broadest in middle. Proboscis 0.8 mm. long and 0.1 mm. broad, studded with 12-14 longitudinal rows of hooks (24-28 hooks in a row) ; median dorsal and first row of submedian dorsals quite distinct from the rest ; a neck-like region 0.15 mm. long and 0.3 mm. broad lying between the proboscis and the body proper. Genitalia not traceable.

Type-specimen.—*Holotype* (♀), Zoological Survey of India Registered No. W 3989/1, mounted on a slide ; deposited in the collections of the Zoological Survey of India, Calcutta.

Type-locality.—River Hooghly, Calcutta, India.

Type-host.—From the intestine of the fish *Scatophagus argus* (Bloch) (*vide supra* also).

Remarks.—The new species is easily distinguishable from its closest ally, *F. bucerium* van Cleave, in the differentiation of the median and the first submedian dorsal rows ; in the latter only the median dorsal row is present.

REFERENCE

VAN CLEAVE, H. J. 1928. Two new genera and species of Acanthocephala from fishes of India.—*Rec. Indian Mus.*, Calcutta, 30, pp. 147-149.

EXTERNAL MORPHOLOGY OF THE TERMITE, *ODONTO-TERMES OBESUS* (RAMBUR) (ISOPTERA : TERMITIDAE).
 PART 3. CHAETOTAXY OF THE SOLDIER, WORKER
 AND ALATE CASTES

By

KALYAN SINGH KUSHWAHA*

(From the Zoological Survey of India, Calcutta, and the Branch of Forest Entomology, Forest Research Institute, Dehra Dun.)

(With 13 Tables, 25 Text-figures, and 5 Plates)

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I—INTRODUCTION

The chaetotaxy (*i.e.*, the arrangement and distribution of the bristle-like hairs or chaetae on the various external body-parts) has been extensively studied in some insect groups, *e.g.*, Diptera adults by Osten-Sacken (1884), Williston (1908), Walton (1909); Lepidoptera larvae by Hinton (1946), Singh (1953), etc., and has been found to be of considerable use in taxonomic differentiation between species of higher groups. No such study has so far been made for the Isoptera. As a first step, the chaetotaxy in the common mound-building termite, *Odontotermes obesus* (Rambur) (Isoptera : Termitidae), was studied. For the general external morphology of this species, see Kushwaha (1955; 1959, 1960a, b).

Acknowledgments.—My sincere thanks are due to Dr. M. L. Roonwal, formerly Chief Research Officer (Forest Entomologist), Forest Research Institute, Dehra Dun, and presently Director, Zoological Survey of India, Calcutta, for his guidance and supervision during the progress of the work and for laboratory facilities. I am also very grateful to the Additional Chief Secretary, Government of Rajasthan for according me Government permission to continue my research work besides my teaching duties. I am highly indebted to Dr. S. Venkatachary, Professor of Botany, Maharana Bhupal College, Udaipur, for the assistance he kindly rendered in the photomicrographs besides other valuable suggestions. My thanks are also due to Shri Balwant Singh, Research Assistant (I), Dehra Dun, and my colleague Shri B. K. Kaul at S. K. N. Agricultural Institute, Jobner, for kind suggestions.

II—MATERIAL AND METHODS

The material for the study of the soldiers, workers, and alates was collected from mounds in the areas of New Forest and Jhajra Forest near Dehra Dun (U.P.), *ca.* 600 metres above sea level.

Twenty-five specimens of each caste were studied, except in the case of the soldier labrum where 40 specimens were examined as this structure showed greater variability than the other body-parts. It was observed that the arrangement of bristles resembles each other closely in the case of workers and alates in the head region and in the case of soldier and worker in the thoracic and abdominal regions. Careful observations have been made under high magnification in locating the bristles since they easily fall off leaving only their scars behind. In case any scar was observed it was taken into consideration, according to its size, to represent a bristle of comparable size in that area. In order to be more exact in relative size and location of the various bristles, photomicrographs were taken in almost all cases.

III—HEAD

(a) *General*

In the study of chaetotaxy of the head only those parts which depict prominent constancy of arrangement of bristles have been discussed. Mainly the large and differentiated bristles have been discussed but some smaller ones which show characteristic location have also been considered.

A nomenclature comprising of Arabic numerals has been used for the labral bristles, but in most other cases the bristles have been named according to their location on a body-part. In the study of bilateral arrangement, which was commonly observed in the case of these large bristles, individual aberrations have been observed in some cases.

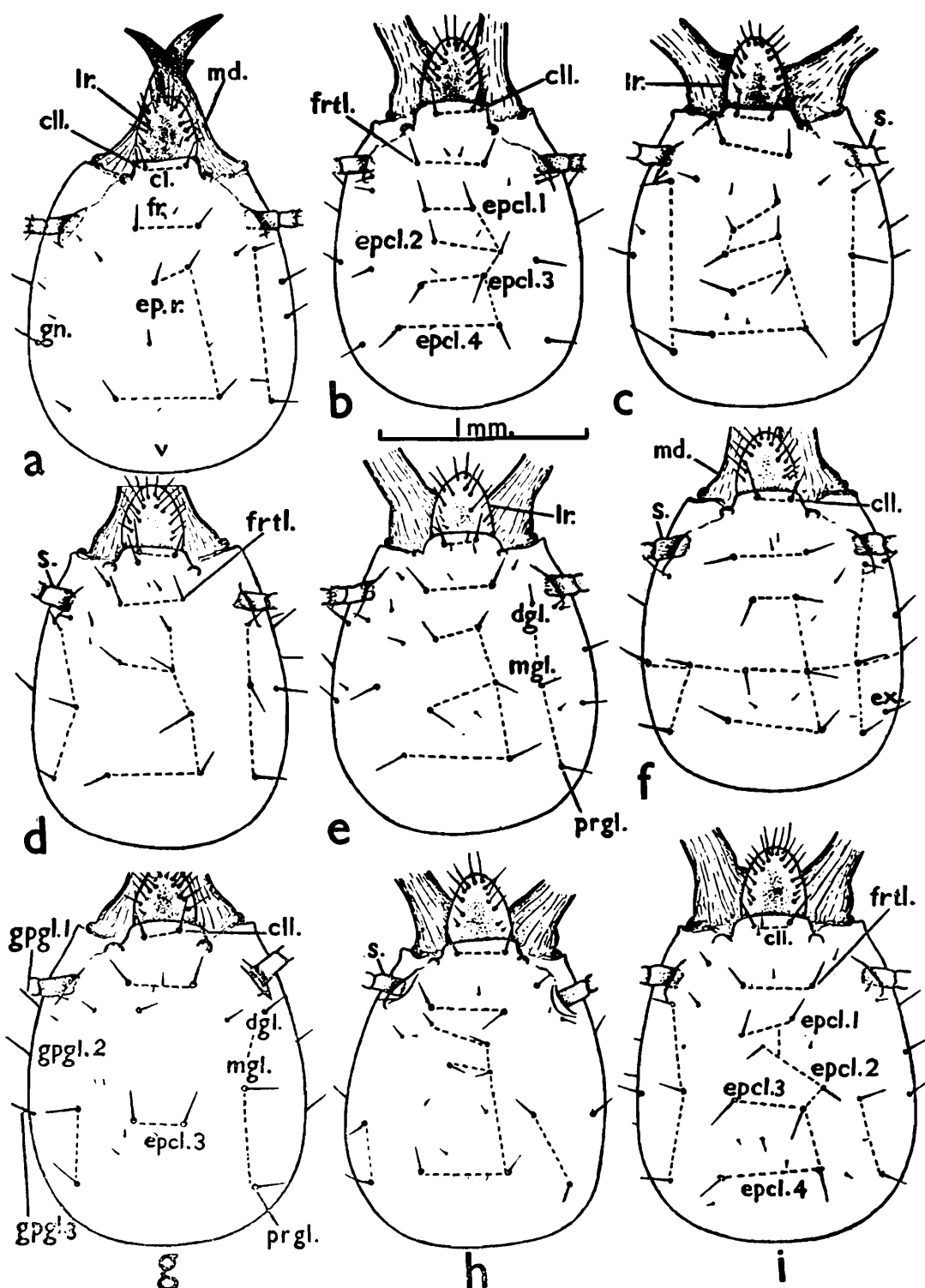
(b) *Chaetotaxy of the head-capsule*

1. *Soldier* (Text-figs. 1*a-i* ; 2*a-f*).—In general the soldier head-capsule or cranium is sparsely bristled. In absence of the various sutures demarcating the definite cranial areas the location of the various bristles in these has been approximately considered and named correspondingly. The percentage of their occurrence has been calculated (Table 1) on the basis of 25 specimens to show their frequency. In border cases where their location may correspond to two or more cranial areas, the nomenclature has been adapted to suit convenient description in order to avoid confusion.

TABLE 1.—*Percentage of individuals of soldier caste of Odontotermes obesus (Rambur), showing the different larger cranial bristles on the basis of 25 specimens examined.*

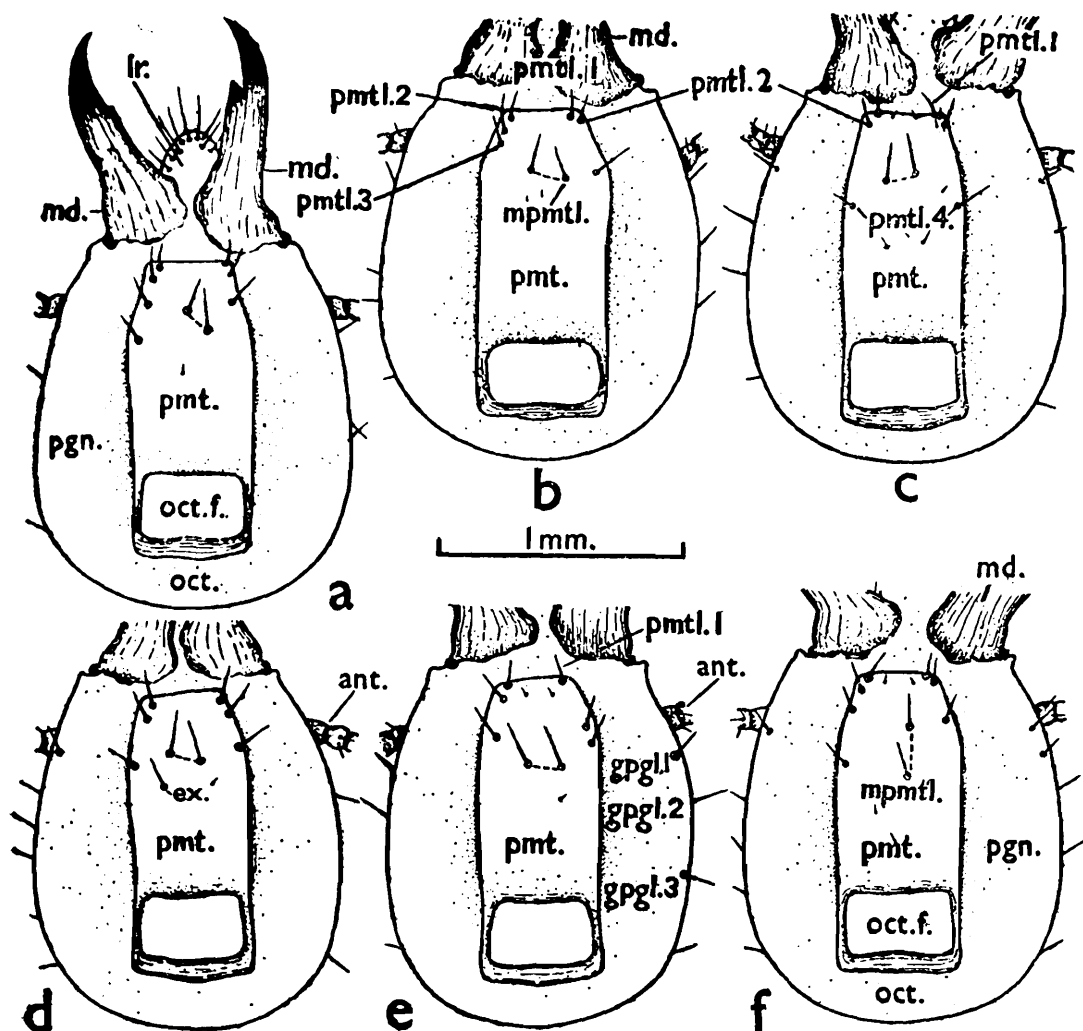
Nomenclature of bristles.	Abbreviations used.	Per cent. of individuals with bilateral symmetry.	Per cent. of individuals with asymmetry.		Per cent. of individuals with both the bristles absent.
			Only left bristle present.	Only right bristle present.	
<i>clypeal</i>	<i>cyl.</i>	100	—	—	—
<i>frontal</i>	<i>frtl.</i>	100	—	—	—
<i>epicranial 1</i>	<i>epcl. 1</i>	92	—	8	—
<i>epicranial 2</i>	<i>epcl. 2</i>	16	—	—	—
<i>epicranial 3</i>	<i>epcl. 3</i>	88	4	8	—
<i>epicranial 4</i>	<i>epcl. 4</i>	96	—	—	4
<i>medio-genal</i>	<i>mgl.</i>	96	—	—	4
<i>proximo-genal</i>	<i>prgl.</i>	88	—	8	4
<i>geno-postgenal 1</i>	<i>gppl. 1</i>	56	12	16	16
<i>geno-postgenal 2</i>	<i>gppl. 2</i>	76	—	16	8
<i>geno-postgenal 3</i>	<i>gppl. 3</i>	76	12	12	—

Note.—In case any bristle was of comparatively much smaller size than normal it was counted towards asymmetry.



TEXT-FIG. 1.—*Odontotermes obesus* (Rambur), soldier caste.

(a). Dorsal view of the cranium, showing only a few symmetrical pairs of large bristles. (b). Ditto, showing nearly all the symmetrical pairs of large bristles. (c). Ditto, showing all the symmetrical pairs medially but some lateral bristles missing. (d). Ditto, showing asymmetry in respect to some medial as well as lateral pairs of large bristles. (e). Ditto, showing asymmetry in respect of some lateral pairs including *prgl.* and total absence of the pair *epcl. 2* medially. (f). Ditto, showing nearly all the pairs except *epcl. 2*. An *extra bristle* (*ex.*) adjacently outwards to the right *prgl.* has been observed in this specimen alone. Also note the transverse row formed by the paired bristles, namely, *epcl. 3*, *mgl.* and *gpgl. 3*, and another row posteriorly by *epcl. 4* and *prgl.* (g). Ditto, showing more symmetry in respect of lateral pairs of bristles. Of the 4 pairs of epicranial bristles only *epcl. 3* is located symmetrically, the *epcl. 2* and *epcl. 4* being entirely absent. (h). Ditto, showing comparatively an asymmetrical location of the various bristles of the different pairs. (i). Ditto, showing asymmetrical location of the *epcl. 2*, most of the other pairs being located more symmetrically.



TEXT-FIG. 2.—*Odontotermes obesus* (Rambur), soldier caste.

(a). Ventral view of the cranium, showing lateral postmental (*pmtl.*) and medio-postmental (*mpmtl.*) bristles, the left bristle of the fourth postmental pair (*pmtl.* 4) being absent. (b). Ditto, showing asymmetrical location of the bristles of the third postmental pair (*pmtl.* 3), whereas the fourth pair (*pmtl.* 4) being entirely missing. (c). Ditto, showing the third pair of postmental bristles (*pmtl.* 3) missing, whereas the fourth pair (*pmtl.* 4) shows bilateral symmetry which has been rarely observed. (d). Ditto, showing the fourth pair of postmental bristles missing and an *extra bristle* (*ex.*) located posterior to *mpmtl.*, pair. (e). Ditto, showing the fourth pair of postmental bristles (*pmtl.* 4) missing and the individual bristles of the second postmental pair (*pmtl.* 2) located somewhat asymmetrically. The geno-postgenal bristles (*gppl.*) are also shown approximately in their usual location. (f). Ditto, showing the left bristle of the fourth postmental pair (*pmtl.* 4) missing and the medio-postmental pair showing an asymmetrical location of its bristles.

Except the vertex, all the dorsal cranial areas *i.e.*, clypeus, frons and epicranial area medially and the genae laterally show some conspicuously elongated bristles arranged more or less in symmetrical pairs in addition to some smaller ones occurring here and there.

A symmetrical pair of large *clypeal bristles* (*cll.*), located about the median transverse line separating the *anteclypeus* (*acl.*) from the *postclypeus* (*pcl.*), was present in all the 25 individuals examined (Table 2). In a line between these, or posteriorly on the postclypeus, are a few more bristles, singly or paired, mostly distributed irregularly. There is no bristle on the anteclypeus.

TABLE 2.—Percentage of individuals showing various proportions of different labral bristles (both smaller and larger) and clypeal bristles (largest anterior-most pair) in the soldier caste of *Odontotermes obesus* (Rambur). Based on 40 specimens.

For explanations, also see "Abbreviations used in Text-figures and Tables" *infra*.

Nomenclature of bristles starting from apical end.	Percentage of individuals having complete set of left bristle.	Percentage of individuals having complete set of right bristle.	Percentage of individuals showing bilateral symmetry in regard to different bristles.
<i>ap.</i>	100	100	100
1	100	100	100
2	97.5	100	97.5
3	95	100	95
4	97.5	97.5	95
5	87.5	90	77.5
6	75	87.5	62.5
7	82.5	95	77.5
8	80	85	67.5
9	60	75	47.5
10	47.5	35	27.5
11	17.5	12.5	10
12	5	2.5	2.5
<i>cli.</i>	100	100	100
G (4-5)	10 per cent.	} 12.5 per cent.	
G (3-4)	2.5 per cent.		

The *frons* (*fr.*) similarly shows a single pair, with bilaterally symmetrical bristles in 100% individuals, more or less in line with the two *antennal foveolae* (*ant. f.*) and called the *frontal bristles* (*frtl.*).

The *epicranial region* (*ep.*) has four pairs of larger bristles named from anterior region posteriorly as *epicranial 1* (*epcl. 1*), *epicranial 2* (*epcl. 2*), *epicranial 3* (*epcl. 3*) and *epicranial 4* (*epcl. 4*) with 92%, 16%, 88% and 96% bilateral symmetry. Evidently, the *second pair* (*epcl. 2*) has been observed only rarely with its individual bristles relatively asymmetrical in their location. Of all these epicranial pairs, the individual bristles of the *fourth pair* (*epcl. 4*) are located the widest apart.

The *vertex* (*v.*) is naked, showing no bristles.

The *genae* (*gn.*) show medially a pair of bristles. Each bristle is located more or less symmetrically on either side of the *third epicranial pair* (*epcl. 3*) outwards and called the *medio-genal pair* (*mgl.*), showing 96% bilateral symmetry. Another pair of bristles has been observed proximally on the genae at the rounded postero-lateral corners of the cranium dorsally. Each of these bristles is located on either side more or less at the level of the *fourth epicranial pair* (*epcl. 4*) and called the *proximo-genal pair* (*prgl.*) with 88% bilateral symmetry.

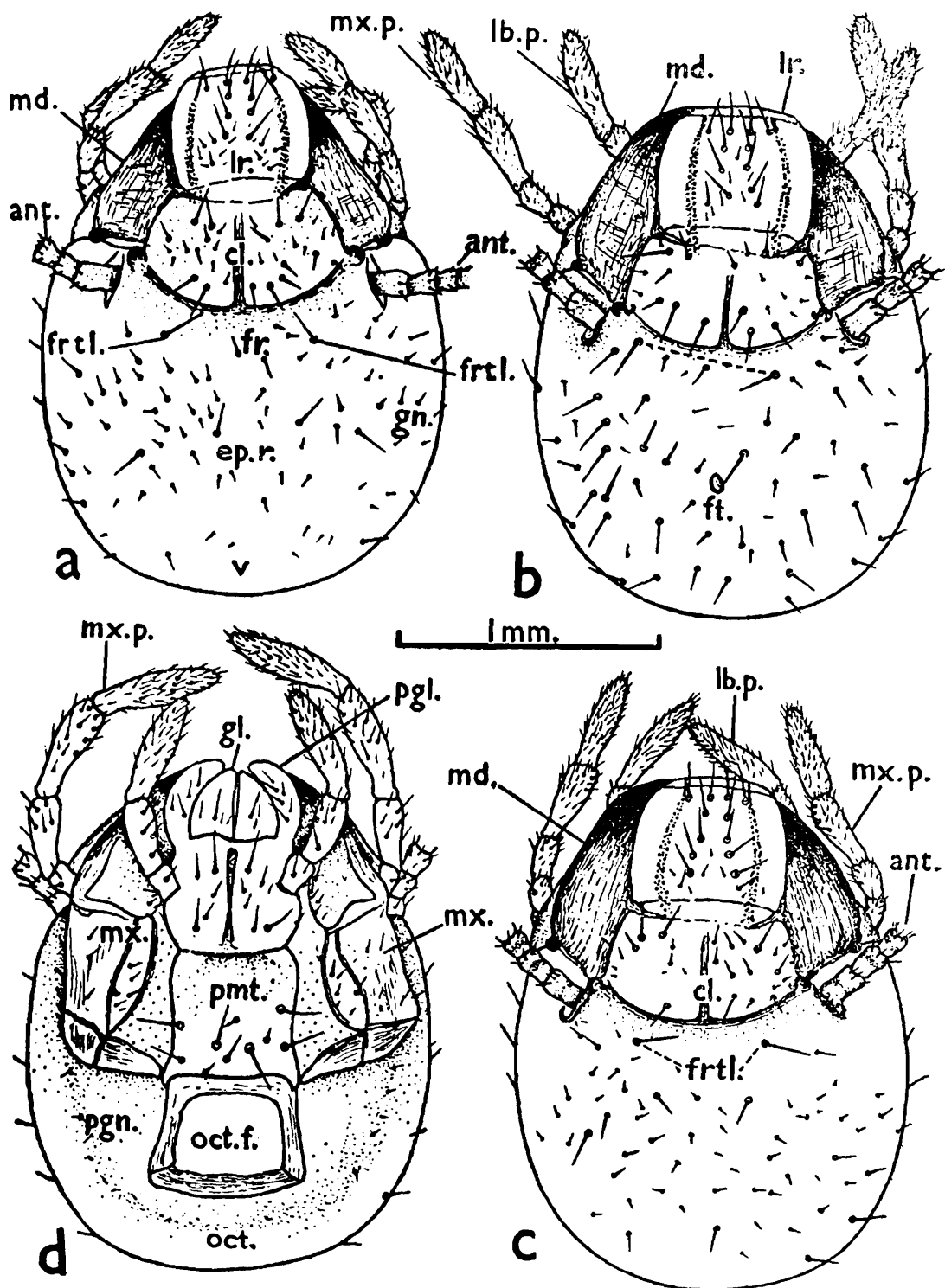
Occasionally, a few smaller bristles have been observed near the antennal foveolae or other regions dorsally.

Ventrally the labium and the postgenae show some regular symmetrical pairs, whereas the occiput and postocciput are almost naked. The labial bristles show a comparatively more regular and symmetrical occurrence than the postgenal bristles and would be discussed under the chaetotaxy of head-appendages.

The postgenal bristles are located more or less at the extreme lateral margins of the postgenae confluent with the genae dorsally and thus named as *geno-postgenal bristles*, numbered from anterior cranial margin posteriorly. The *first geno-postgenal bristle* (*gppl. 1*) is located

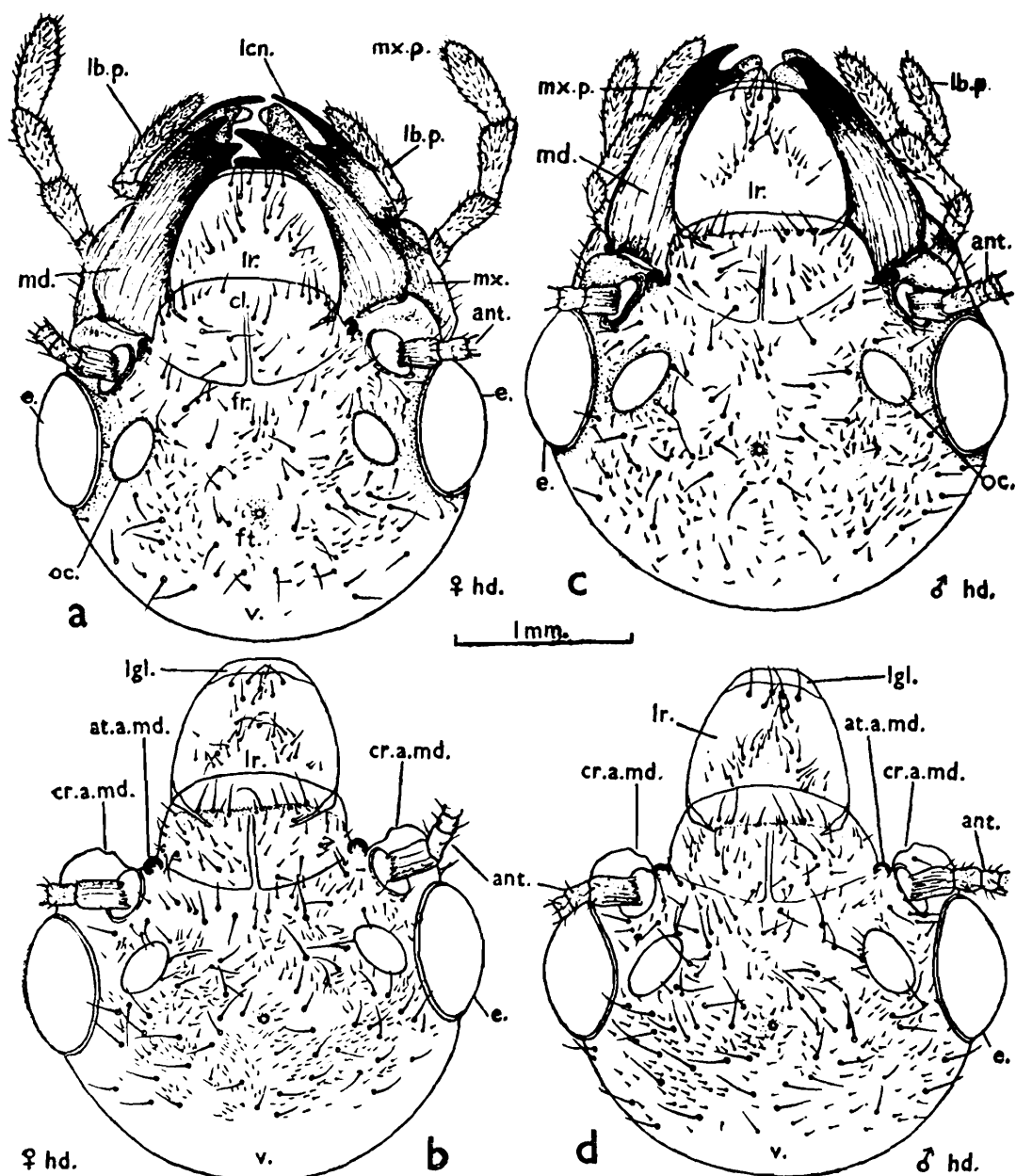
laterally in line with the antennal foveola outwards, showing 56 per cent. bilateral symmetry. *Geno-postgenal 2* (gpgl. 2) and *geno-postgenal 3* (gpgl. 3) with 76 per cent. bilateral symmetry each are located posterioral—one behind the other approximately at equal interval; the latter being situated somewhere at the medio-lateral margin of the cranium approximately in transverse row with the *epicranial 3* and *medio-genal pair* of bristles.

Occasionally, there may occur some additional bristle ventrally her and there as observed dorsally.



TEXT-FIG. 3.—*Odontotermes obesus* (Rambur), worker caste.

(a). Dorsal view of the cranium, showing only a few large bristles including the frontal pair which are located symmetrically. (b). Ditto, showing many large bristles distributed irregularly except the frontal pair. (c). Ditto, showing a few large bristles distributed irregularly except the frontal pair. (d). Ventral view of the cranium, showing practically no bristles on occiput and postgenae.

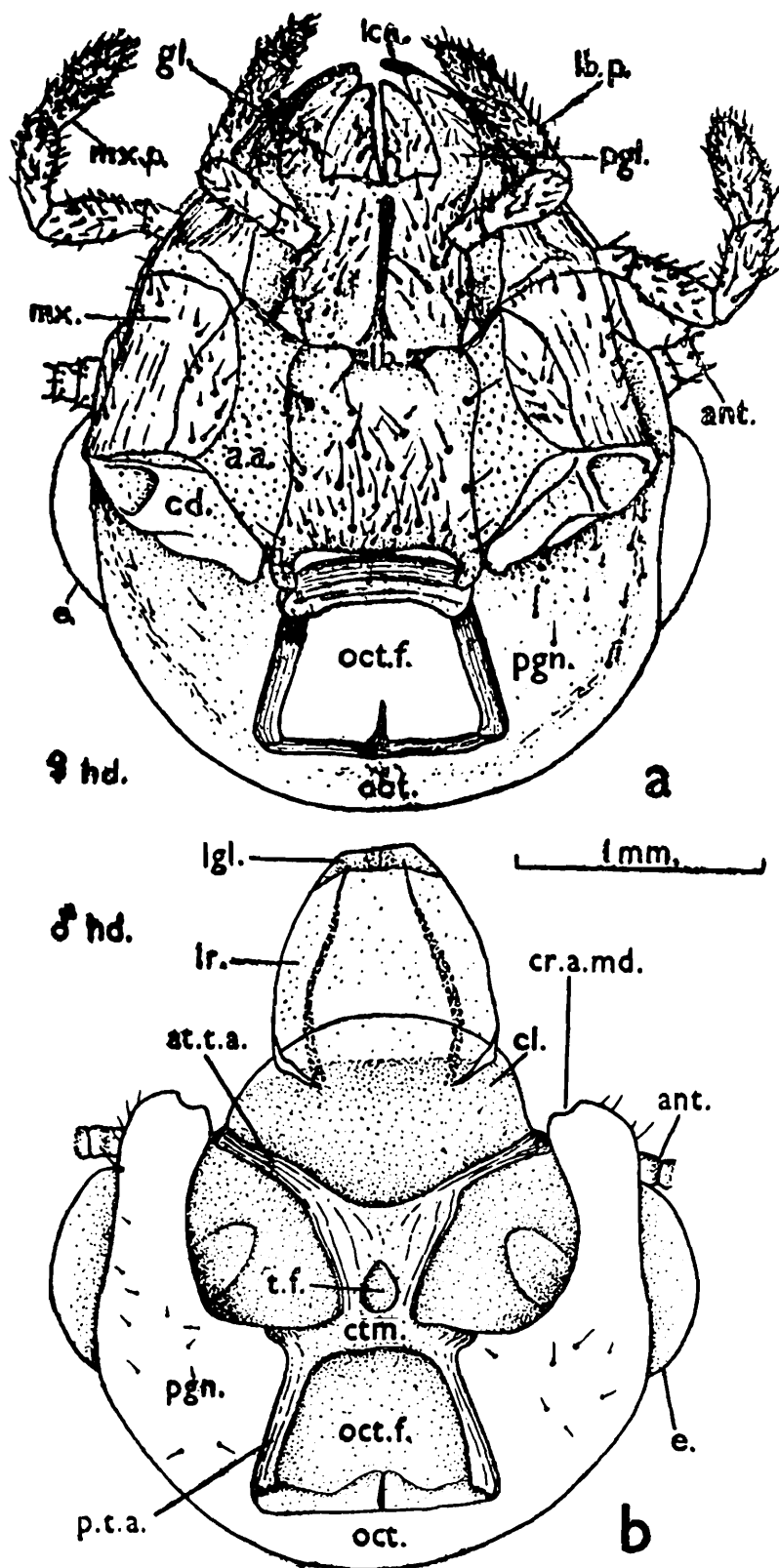


TEXT-FIG. 4.—*Odontotermes obesus* (Rambur), alate caste.

(a and b). Dorsal views of the female cranium, showing irregular and hirsute growth of the bristles. (c and d). Dorsal views of the male cranium, ditto. (Diagrams b and d have been drawn from permanent preparations mounted in cavity slides, whereas a and c from unmounted specimens under clove oil.)

2. *Worker and alate* (Text-figs. 3a-d ; 4a-d ; 5a, b).—The worker and the alate resemble each other considerably. Dorsally they show an irregular and denser growth of larger and smaller bristles as compared to the soldier. Further, the alates show denser growth as compared to the workers which show a variable density particularly of larger bristles, i.e., some individuals show only a few of these, whereas others are liberally provided.

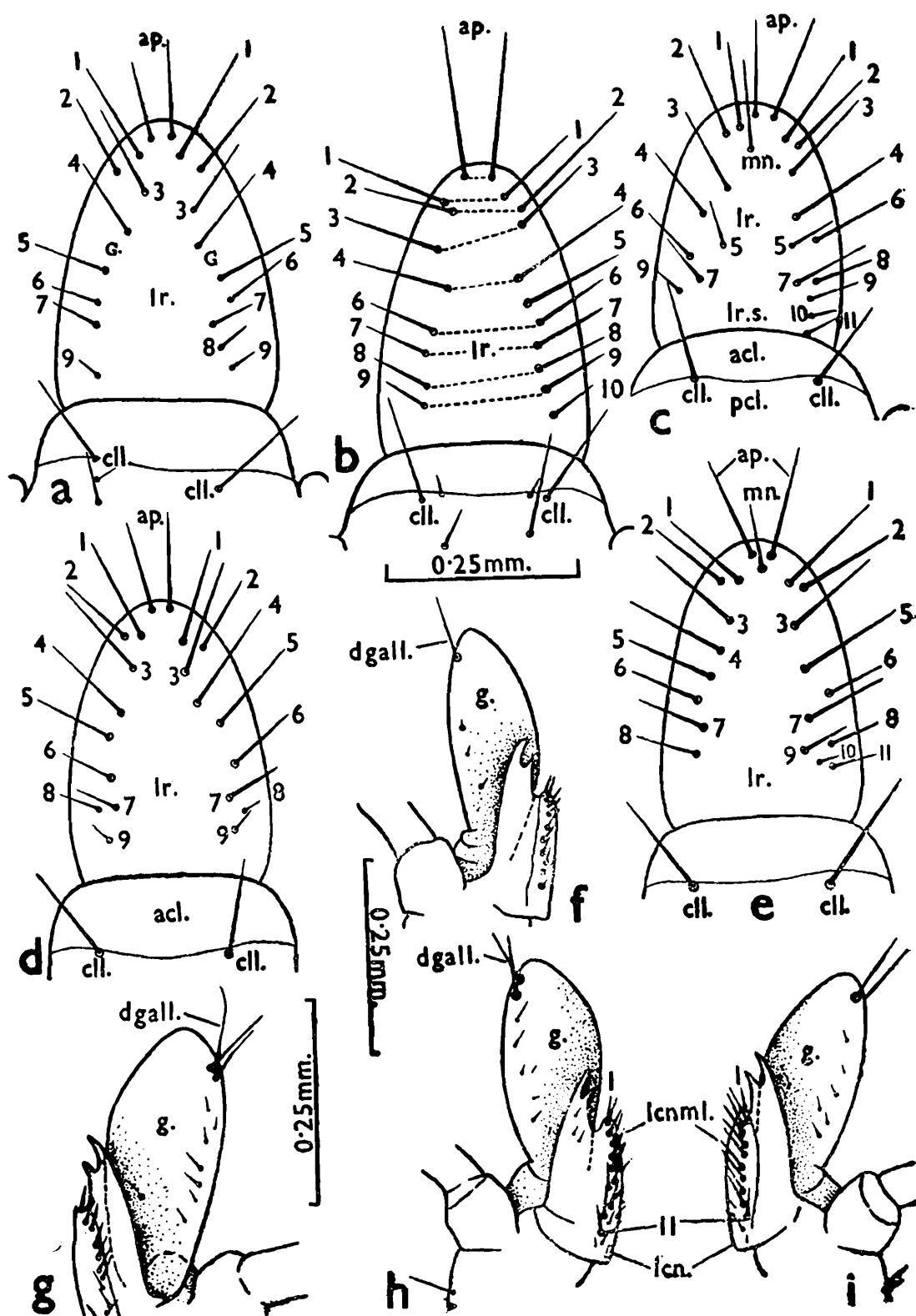
The *clypeal pair* (cll.), as was observed in the soldier, is also present in both the worker and the alate in similar locations with 96 per cent. and 48 per cent. bilateral symmetry, respectively (Table 4). The *frontal pair* (frtl.), on the other hand, has been more distinctly observed in the worker than the alate ; the worker showing 92 per cent. bilateral symmetry. This pair, in the alates, is generally confused amongst other larger bristles.



TEXT-FIG. 5.—*Odontotermes obesus* (Rambur), alate caste.

(a). Ventral view of the female cranium, showing no large bristles on ventral cranial areas. (b). Ventral view of the male cranium, ditto. (Diagram *a* has been drawn from a specimen under clove oil and *b* drawn from permanent preparation in cavity slide.)

Ventrally, the *occiput* (*oct.*) and the *postgenae* (*pgn.*) are almost naked in both the castes as observed in the soldier. The labium is bristled in either case, being denser in the alate, and the characteristic bristles of the same would be discussed under head-appendages.



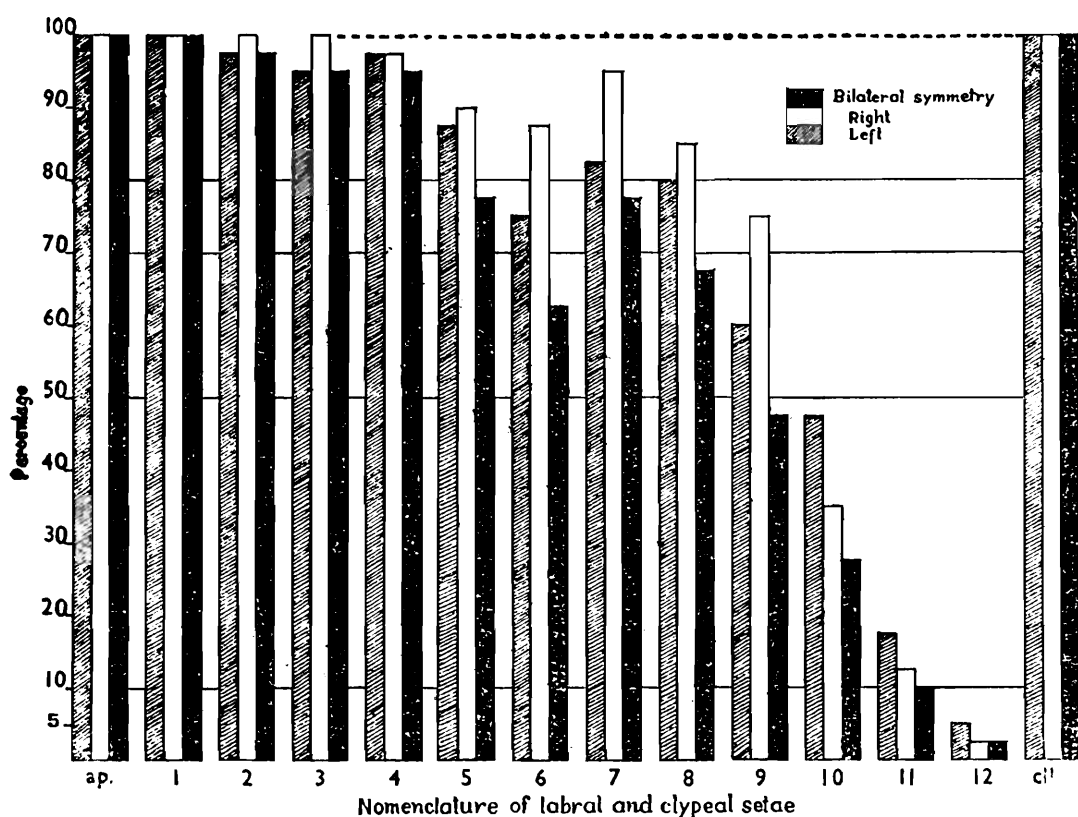
TEXT-FIG. 6.—*Odontotermes obesus* (Rambur), soldier caste.

(a). Labrum, together with clypeal region, showing a bilaterally symmetrical gap between 4th and 5th pair of bristles; left 8th bristle missing. Clypeus, showing the anterior bilaterally symmetrical pair of clypeal bristles besides other rear asymmetrical bristles posteriorly. (b). Ditto, left 5th and 10th bristle missing. (c). Ditto, median bristle present, left 8th, 10th and 11th bristles missing. (d). Ditto, showing bilaterally symmetrical condition of bristles. (e). Ditto, median bristle present; right 4th bristle and left 9th, 10th, and 11th bristles missing. (f). Left lacinia and galea. Galea showing only one distogaleal bristle. (g). Right lacinia and galea. Galea showing three distogaleal bristles. (h and i). Left and right lacinia and galea, respectively, each lacinia showing 11 lacino-marginal bristles and each galea showing a pair of distogaleal bristles.

(c) *Chaetotaxy of the head-appendages*

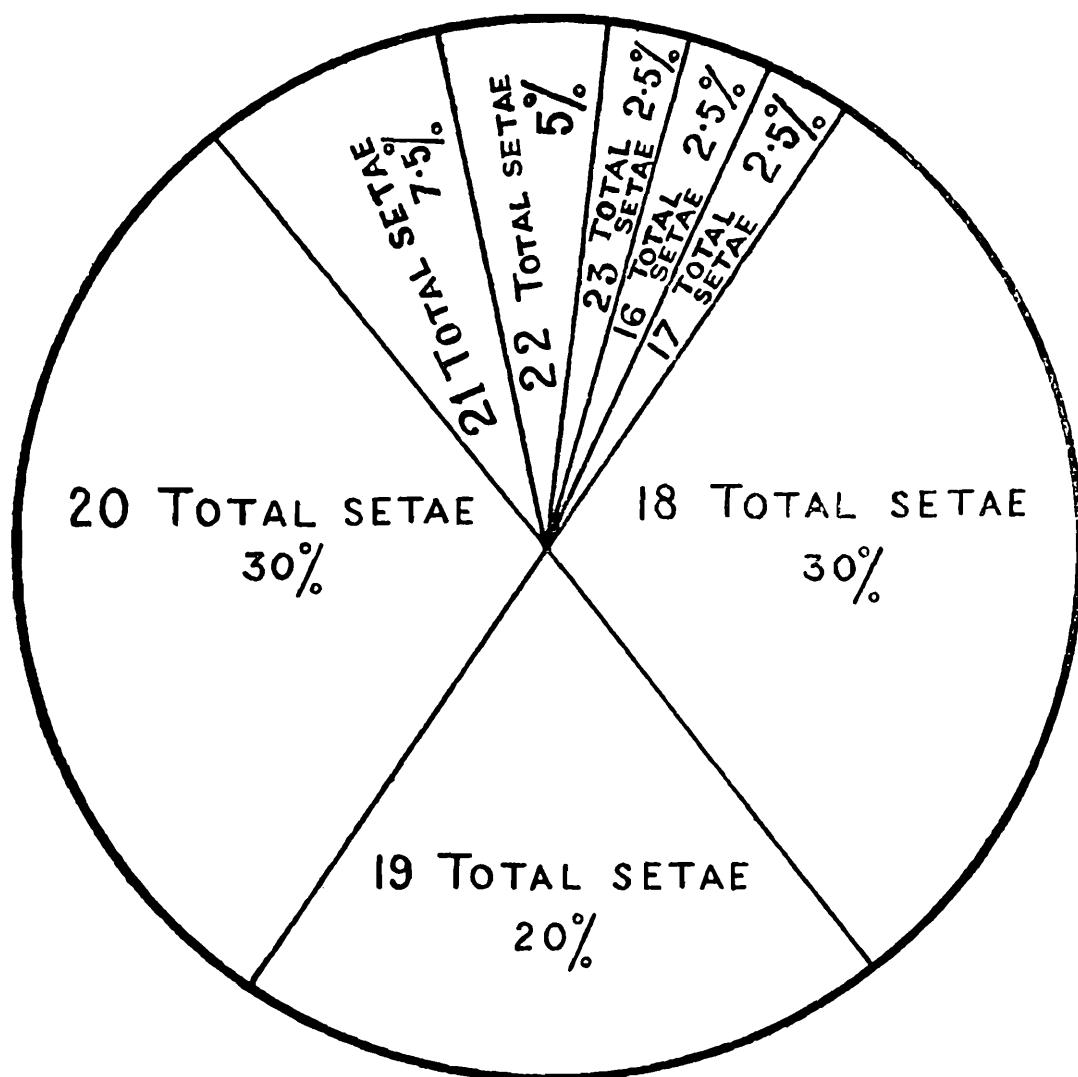
The head-appendages showing characteristic arrangement of bristles include the labrum, the scape of antenna, the lacinia and the galea of the maxilla, and the labium.

The characteristic bristles on the labrum, antenna, lacinia and labium have been discussed in the case of all the three castes. The galea, on the other hand, has been observed to show characteristic bristles in the soldier caste only.



TEXT-FIG. 7.—*Odontotermes obesus* (Rambur), soldier caste.

Bar diagram, showing the percentage of individuals with different labral and clypeal bristles on left and right sides, together with the bilaterally symmetrical condition.



TEXT-FIG. 8.—*Odontotermes obesus* (Rambur), soldier caste.

Circle diagram, showing proportional percentage of the varying total number (16-23) of labral bristles.

1. *Labrum*.—

(i) *Soldier* (Text-figs. 6a-e ; 7 and 8).—The bristles in the soldier show a bilaterally symmetrical arrangement. The anteriormost pair of bristles are the *apical pair of bristles* (*ap.*) and are generally proclinate, *i.e.*, directed forward. Sometimes there occurs a *median bristle* (*mn.*) mostly just behind and between the apical pair. Other bilaterally marginal bristles rear to the apical pair have been numbered 1, 2, 3, etc. The bristles are generally divaricate or divergent, *i.e.*, inclined outwards from the median line. Because of their limited number and a comparatively more orderly arrangement, both the larger and the smaller bristles have been considered in this case.

Occasionally, a conspicuous and bilaterally symmetrical gap has been observed on either side and might probably be due to the displacement of certain bristles more anteriorly or posteriorly, though it could as well be interpreted to indicate absence of a symmetrical pair of bristles. The percentage of individuals showing such a gap has been indicated in Table 2 to the extent of 12.5 per cent. and denoted as $G(n-n^1)$, where G represents the gap and n and n^1 being the nomenclature of the bristles between which the gap exists.

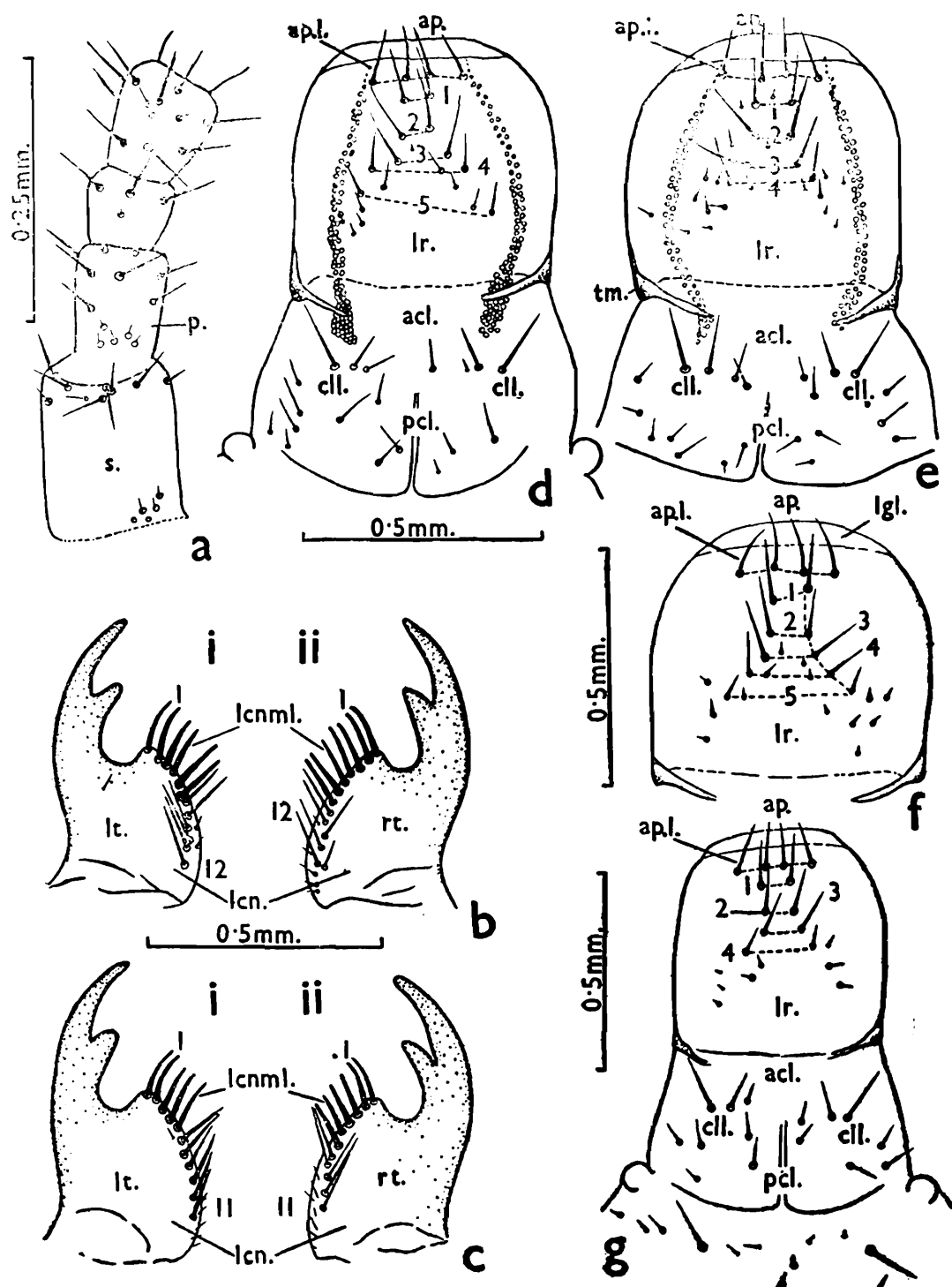
The first five anterior pairs of bristles, including the apical pair, indicate more or less an absolute bilateral symmetry (95-100 per cent.) and may probably provide an important characteristic feature. The symmetry becomes progressively irregular posteriorly and a few of the posteriormost bristles, namely, Nos. 11 and 12, seem to be distributed without any apparent arrangement (Table 2).

There are 7 or 8 to 12 bristles on either side, with a total number of bristles on the whole labrum varying from 16 to 23. A total number of 18 and 20 bristles have been observed in 30 per cent. individuals and 19 bristles in 20 per cent. individuals ; other cases of the total count of bristles on the labrum being rather insignificant (Table 3).

TABLE 3.—*Percentage of individuals of soldier caste of Odontotermes obesus (Rambur), showing total labral bristles varying from 16-23. Based on 40 specimens.*

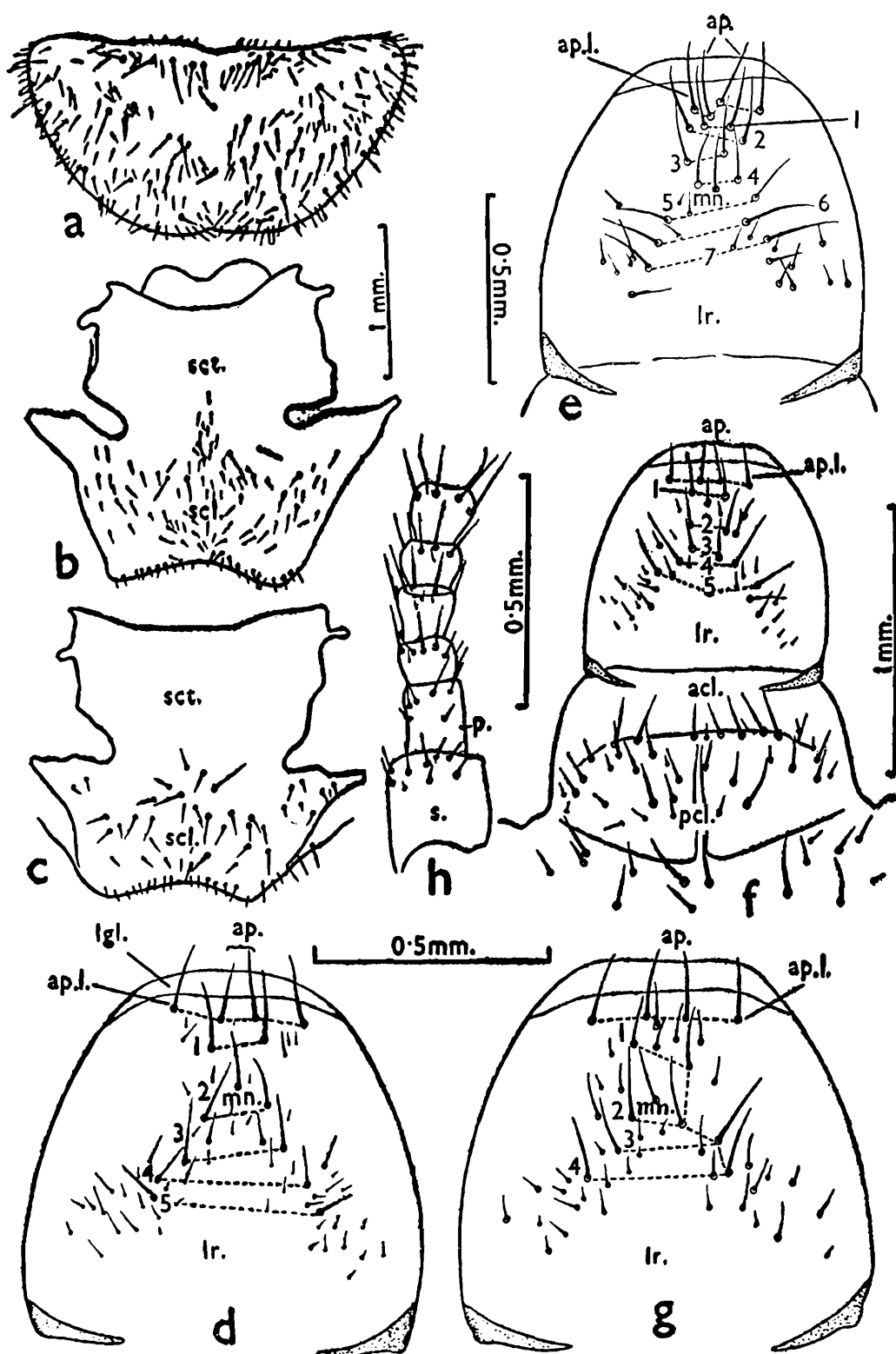
For explanations, also see “Abbreviations used in Text-figures and Tables”, *infra*.

Serial No. of individual.	Total No. of bristles on left half.	Median bristle (mn.).	Total No. of bristles on right half.	Total No. of bristles on labrum.	Percentage of individuals.
1	8	—	8	16	—2·5
2	7	—	10	17	—2·5
3	8	—	10	18	—30
4	8	—	10	18	
5	8	—	10	18	
6	8	—	10	18	
7	9	—	9	18	
8	9	—	9	18	
9	9	—	9	18	
10	9	—	9	18	
11	9	—	9	18	
12	9	—	9	18	
13	9	—	9	18	
14	10	—	8	18	
15	8	—	11	19	—20
16	9	—	10	19	
17	9	—	10	19	
18	9	—	10	19	
19	10	—	9	19	
20	10	—	9	19	
21	10	—	9	19	
22	10	—	9	19	
23	9	—	11	20	—30
24	9	—	11	20	
25	10	—	10	20	
26	10	—	10	20	
27	10	—	10	20	
28	10	—	10	20	
29	10	—	10	20	
30	10	—	10	20	
31	10	—	10	20	—7·5
32	11	—	9	20	
33	11	—	9	20	
34	11	—	9	20	
35	9	1	11	21	—5
36	10	—	11	21	
37	10	—	11	21	
38	10	—	12	22	
39	11	—	11	22	—5
40	12	—	11	23	—2·5

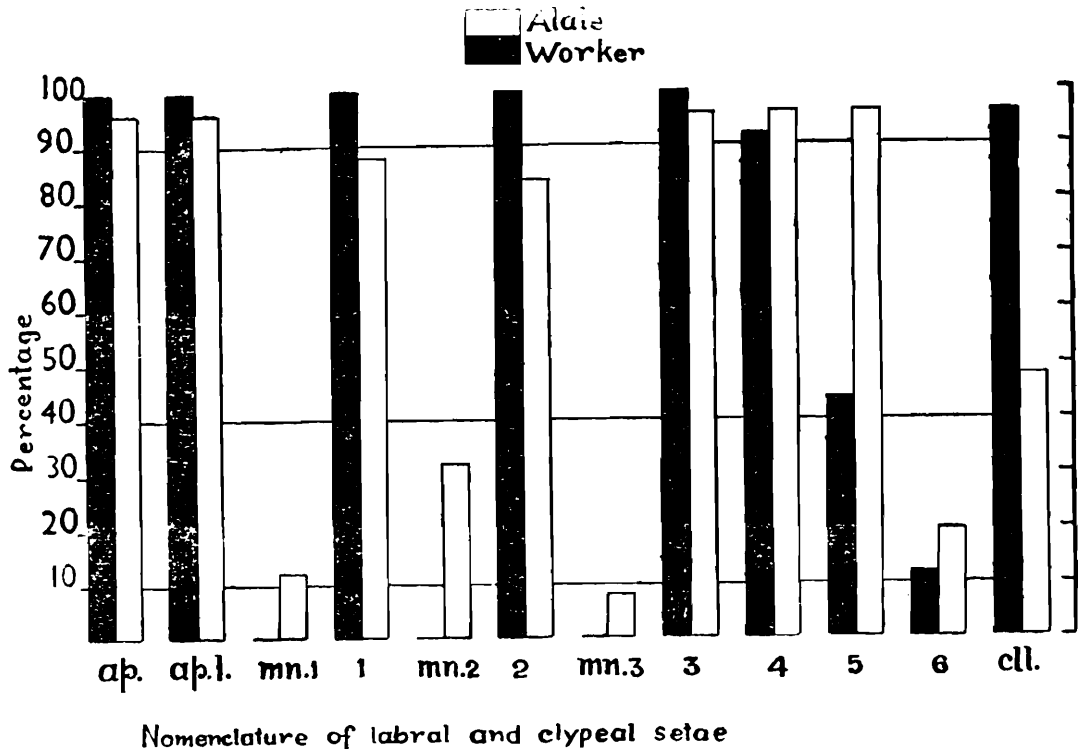


TEXT-FIG. 9.—*Odontotermes obesus* (Rambur), worker caste.

(a). Proximal end of antenna. Scape showing a number of bristles distally. (bi, bii) Left and right lacinia, respectively with 12 lacino-marginal bristles. (ci, cii). Ditto, with 11 lacino-marginal bristles. (d). Labrum together with clypeal region. Labrum, showing five pairs of large bristles in addition to apical and apical-lateral pairs. Clypeus, showing a symmetrical pair of large clypeal bristles besides many other smaller ones scattered irregularly. (e). Ditto, labrum with only four pairs of large bristles in addition to other usual apical, apical-lateral and clypeal bristles. (f). Labrum, showing five pairs of large bristles in addition to apical and apical-lateral pairs. (g). Labrum, clypeus and part of frons. Arrangement of longer bristles same as in (e). Larger pair of bristles on frons not showing any constancy.

TEXT-FIG. 10.—*Odontotermes obesus* (Rambur), alate caste.

(a, b, c). Pro-, meso and metanotum showing no regular arrangement of bristles. (d). Labrum, showing five pairs of large bristles besides apical and apical-lateral pairs, and median bristle 2 between 1st and 2nd pair of bristles. (e). Ditto, showing 7 pairs of larger bristles more or less asymmetrically located. A median bristle, unusually present between the 4th and 5th pairs of bristles. (f). Labrum, clypeus and part of frons. Labrum, showing 5 symmetrical pairs of bristles in addition to apical and apical-lateral pairs. Clypeus and frons showing no symmetrical arrangement of bristles. (g). Labrum, showing 4 symmetrical pairs of larger bristles in addition to apical and apical-lateral pairs. (h). Proximal part of right antenna with scape showing a number of bristles distally.



TEXT-FIG. 11.—*Odontotermes obesus* (Rambur), alate and worker caste.

Bar diagram, showing the relative percentage of individuals of alate and worker with different labral and clypeal bristles.

(ii) *Worker and alate* (Text-figs. 9*d-g* ; 10*d-g* and 11).—The alates and workers show a considerable similarity among themselves. The large and small bristles are more or less intermixed, but the larger ones gradually increase in size, particularly in the worker towards the apex. The bristles are denser in the alate than in the worker and are distributed in both the castes in a specific inverted V-shaped area, the two arms of the V converging from the posterolateral corners to the apex of the labrum.

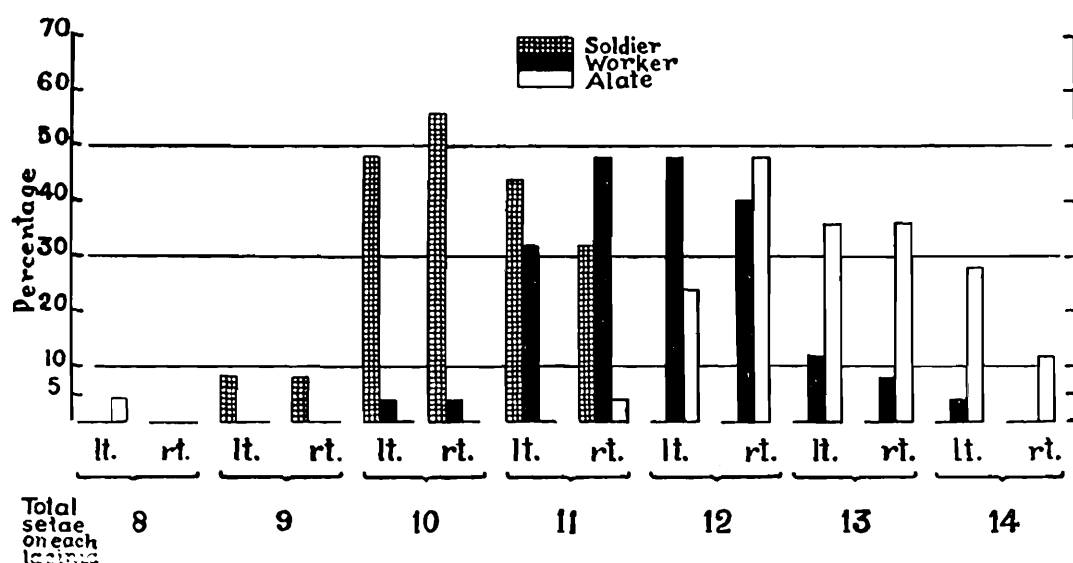
There are two pairs of “apical” bristles—an inner pair, the true *apical bristles* (*ap.*) and an outer pair, the *apical lateral bristles* (*ap. 1.*)—in both the worker and the alate. The apical bristles show a significant symmetry, *i.e.*, 100 per cent. and 96 per cent. in workers and alates respectively. In addition, they are followed by other larger symmetrical pairs labelled 1,2,3, etc. posteriorly ; here 92–100 per cent. symmetry has been observed upto the 4th pair in the worker and 84–96 per cent. upto the 5th pair in alate (Table 4), but the individual

TABLE 4.—*Percentage of individuals, showing bilateral symmetry in respect to different larger bristles in addition to median bristles (mn. 1, mn. 2, mn. 3) on the labrum and the paired clypeal bristles (cll.) of the worker and alate castes of Odontotermes obesus (Rambur). Based on 25 specimens examined.*

For explanations, also see “Abbreviations used in Text-figures and Tables” *infra*.

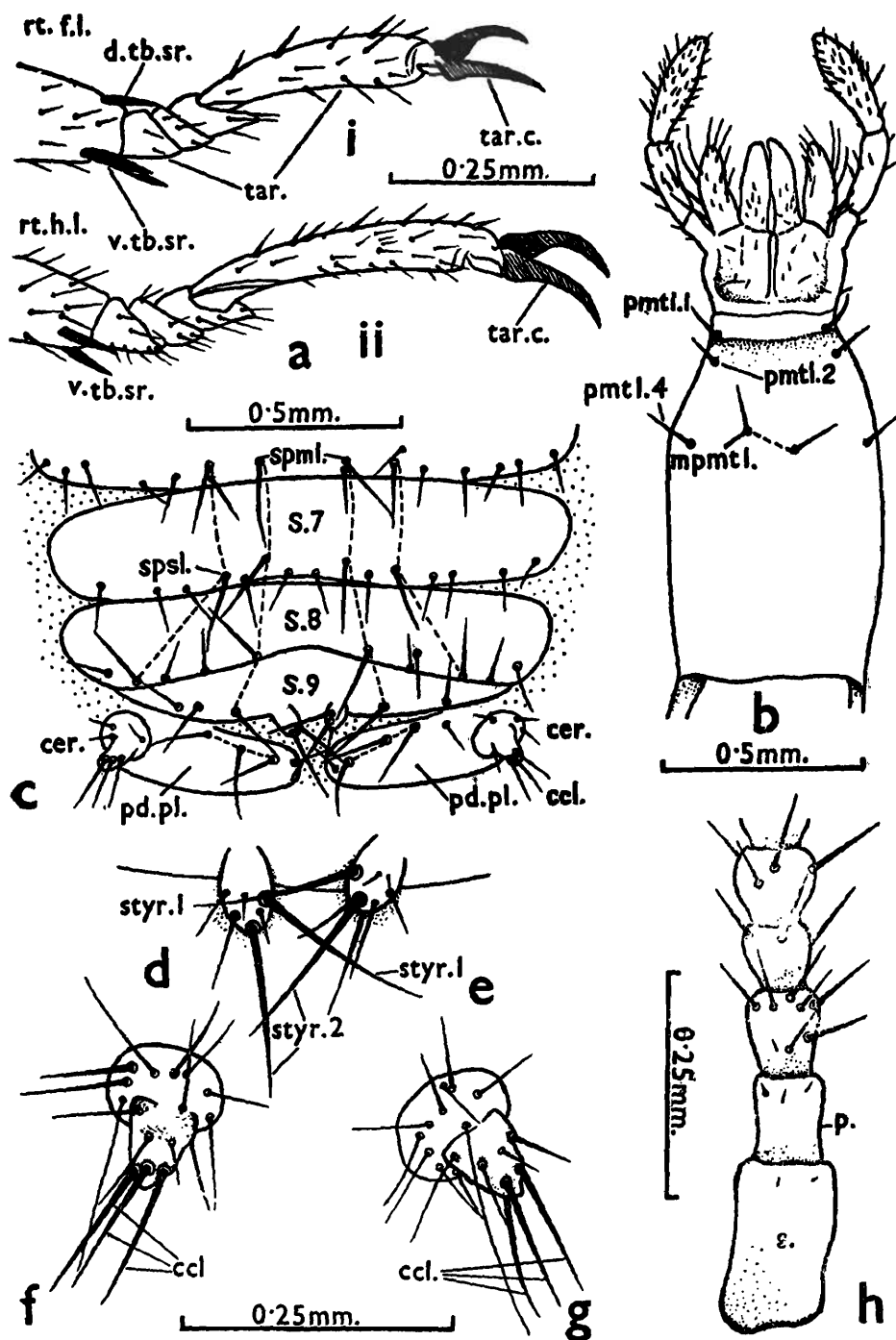
Caste	Nomenclature of bristles											
	ap.	ap. 1.	mn. 1	1	mn. 2	2	mn. 3	3	4	5	6	cll.
Worker	100	100	—	100	—	100	—	100	92	44	12	96
Alate	96	96	12	88	32	84	8	96	96	96	20	48

bristle of each pair is more symmetrically located in the worker than in the alates. There also occurs sometimes in the alates a prominent *median bristle 1* (*mn. 1*) between the *apical* (*ap.*) and No. 1 pair observed to the extent of 12 per cent., *mn. 2* between Nos. 1 and 2 pairs of bristles and *mn. 3* between Nos. 2 and 3 pairs of bristles upto 8 per cent. (Table 4).



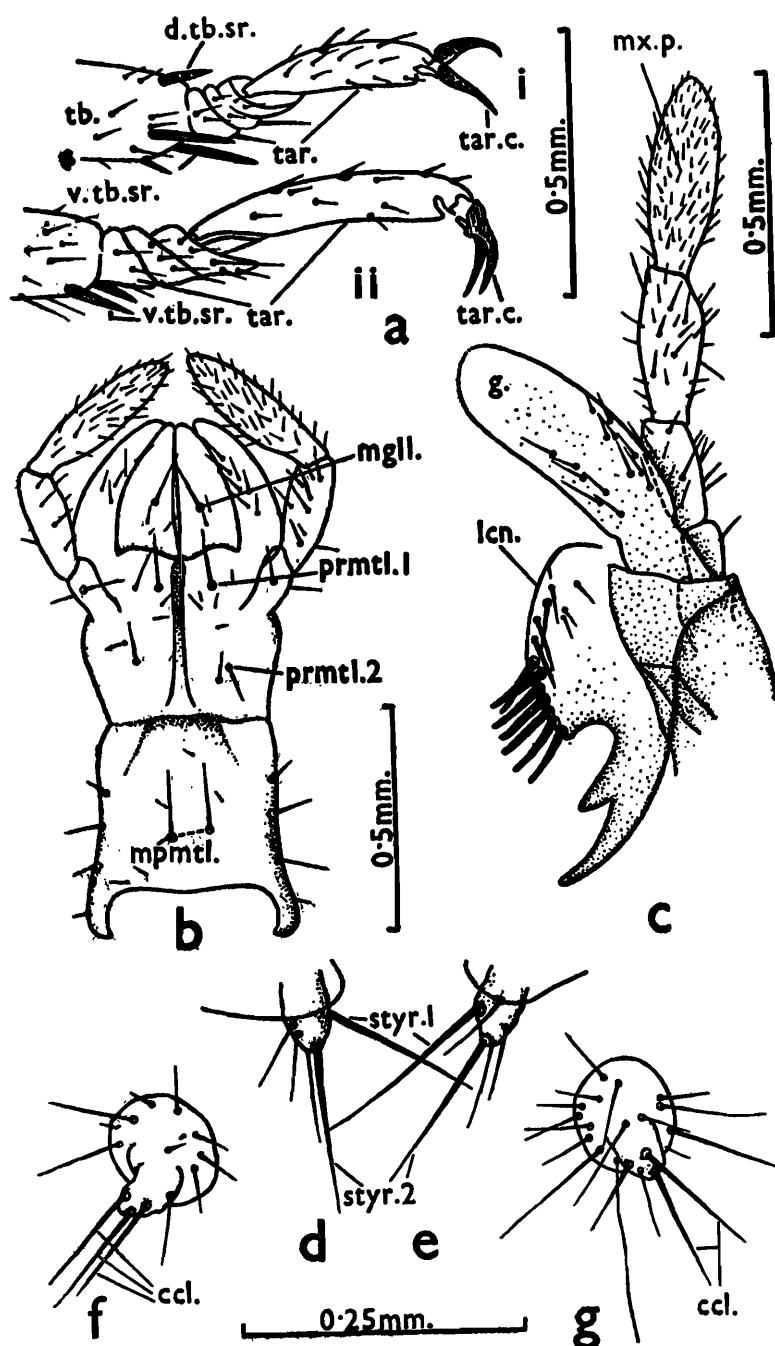
TEXT-FIG. 12.—*Odontotermes obesus* (Rambur), soldier, worker and alate.

Bar diagram, showing the relative percentage of individuals of the three castes with the full complement of the lacino-marginal bristles on left and right lacinia separately.



TEXT-FIG. 13.—*Odontotermes obesus* (Rambur), soldier caste.

(ai, aii). Distal portion of right fore-leg and hind-leg, respectively. The distal end of tibia in the fore-leg showing a dorsal tibial spur in addition to a pair of ventral tibial spurs, the hind-tibia showing only a pair of ventral spurs. (b). Labium, showing only a few large bristles on pre- and postmentum. (c). Ventral abdominal tip, showing sternites 6 (only partly seen) to 10. Smaller bristles have not been shown. Note the row of sterno-postero-medial and sterno-postero-sublateral bristles, joined by dotted lines. (d, e). Left and right subanal styles, respectively, showing a pair of large bristles on each—the inner bristle being stylar 1 and the outer bristle stylar 2. (f, g). Left and right anal cerci, respectively, showing three large cercal bristles. (h). Right antenna, showing no prominent bristles on scape.



TEXT-FIG. 14.—*Odontotermes obesus* (Rambur), worker caste.

(ai, aii). Distal portion of right fore-leg and hind-leg. The distal end of tibia in the fore-leg showing a dorsal tibial spur in addition to a pair of ventral spurs; the hind-tibia showing only a pair of ventral spurs. (b). Labium, showing large paired bristles: medio-glossal, premental 1, premental 2, and 5 postmental pairs. (c). Maxilla, showing general distribution of bristles on right lacinia, galea and maxillary palp (.d, e). Left and right subanal styles, respectively, showing a pair of large bristles on each—the inner bristles being styler 1 and the outer styler 2. (f, g). Left and right anal cerci, respectively, left showing three and right showing only two cercal bristles.

2. Antenna.—

Soldier, worker and alate (Text-figs. 9a ; 10h ; and 13h).—In the soldier, the first segment or *scape* (s.) of the antenna is more or less naked with a few microscopic bristles, whereas it is conspicuously bristled anteriorly in the case of worker and alate.

3. Galea.—

Soldier (Text-figs. 6*f-i*).—Apically on the galea at its outer disto-lateral margin is present a bilaterally symmetrical pair of conspicuously elongated and superposed bristles called *disto-galeal bristles* (*dgall.*) closely set together and observed in 92 per cent. individuals (25 counts). Of the remainder, 4 per cent. had only one bristle on the left galea and the other 4 per cent. had 3 such bristles on the right galea ; the opposite galea of these specimens showed the usual paired condition of the disto-galeal bristles.

4. Lacinia.—

Soldier, worker and alate (Text-figs. 6*h, i* ; 9*b, c* ; 12 and 18*a, b*).—The lacinia is fringed throughout its inner margin with robust bristles called the *lacino-marginal bristles* (*lcnml.*), besides some minor ones not considered here. The total number of large bristles on each lacinia varies from 9-12 in the soldier, 10-14 in the worker and 8-14 in the alate (25 counts in each case). The more commonly observed numbers are 10 or 11 bristles (with 24 per cent. and 16 per cent. bilateral symmetry respectively) in the soldier, 11 or 12 bristles (with 16 per cent. bilateral symmetry in each case) in the worker and 12 or 13 bristles (with 16 per cent. bilateral symmetry in each case) in the alate (Tables 5 and 6).

TABLE 5.—*Total lacino-marginal bristles on left and right lacinia together with percentage of bilateral symmetry in respect to their total number, in the soldier, worker and alate of Odontotermes obesus (Rambur). Based on 25 specimens each.*

	Soldier			Worker			Alate		
Serial No.	Total No. of bristles.		Per cent. bilateral symmetry.	Total No. of bristles.		Per cent. bilateral symmetry.	Total No. of bristles.		Per cent. bilateral symmetry.
	Left lacinia.	Right lacinia.		Left lacinia.	Right lacinia.		Left lacinia.	Right lacinia.	
1	9	10		10	11	16	8	12	
2	9	10		11	11		11	12	
3	10	9		11	11		11	13	
4	10	10	24	11	11		12	11	16
5	10	10		11	11		12	12	
6	10	10		11	12		12	12	
7	10	10		11	12		12	12	
8	10	10		11	12		12	12	
9	10	10		11	13		12	13	
10	10	11		12	10		13	12	
11	10	11		12	11	13	12		
12	10	11		12	11	13	12		
13	10	11		12	11	13	13	16	
14	10	12	12	11	13	13			
15	11	10	12	11	13	13			
16	11	9	12	11	13	13			
17	11	10	12	11	13	14			
18	11	10	12	12	13	14			
19	11	10	12	12	14	12			
20	11	10	12	12	14	12			
21	11	10	12	12	14	12			
22	11	11	16	13	12	14	13		4
23	11	11		13	12	14	13		
24	11	11		13	12	14	13		
25	11	11		1	13	14	14		

TABLE 6.—*Percentage of individuals showing a variable number of bristles on left and right lacinia of soldier, worker and alate of Odontotermes obesus (Rambur). Based on 25 specimens each.*

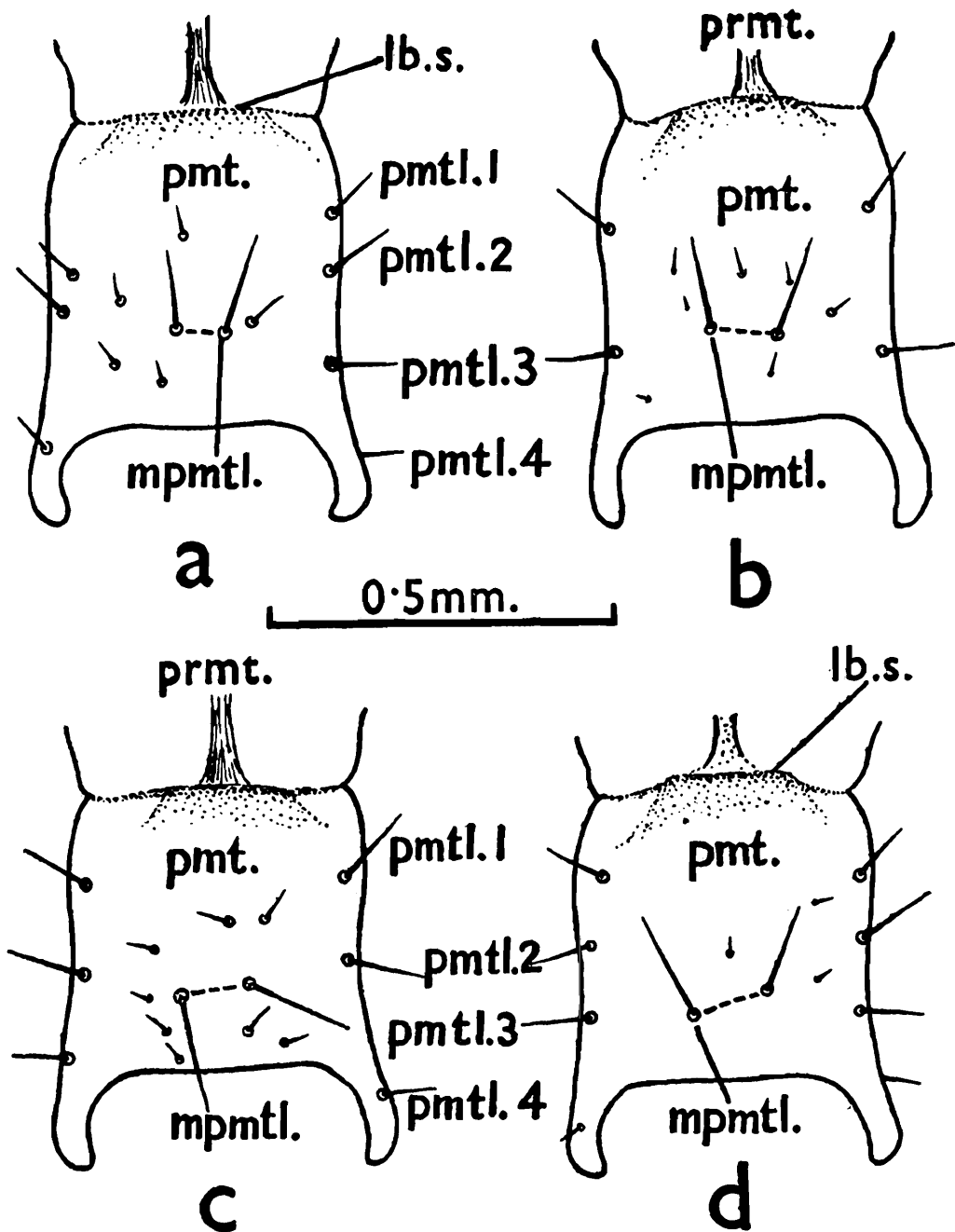
Total No. of bristles.	Soldier		Worker		Alate	
	Per cent. of individuals with bristles on		Per cent. of individuals with bristles on		Per cent. of individuals with bristles on	
	Left lacinia.	Right lacinia.	Left lacinia.	Right lacinia.	Left lacinia.	Right lacinia.
8	—	—	—	—	4	—
9	8	8	—	—	—	—
10	48	56	4	4	—	—
11	44	32	32	48	8	4
12	—	4	48	40	24	48
13	—	—	12	8	36	36
14	—	—	4	—	28	12

5. Labium.—

Soldier, worker and alate (Text-figs. 2a-f ; 13b ; 15a-d ; 16a-d ; 17a-f ; and 18c).—The labium in the alate caste is more densely bristled, particularly in the pre- and postmental regions, as compared to that of the soldier and the worker castes. A few large bristles have been observed with regular and characteristic location, in all the three castes, besides other bristles distributed more or less irregularly. The workers show such characteristic bristles on the glossae, prementum and postmentum, whereas the soldiers and the alates have been observed to show only on the postmentum.

In general, 3 or 4 postmental bristles are located latero-marginally on either side in all the three castes. In soldier these bristles are located only in the distal half of the postmentum but in the other two castes the bristles are distributed throughout the lateral margins. Of these, the anteriormost bristles have shown more significant frequency and bilateral symmetry in their location and size in all the castes. These bristles have been called the *postmental bristles* (*pmtl.*) and numbered serially from anterior end posteriorly. In addition, a conspicuous medial pair has been observed only in the soldier and the worker castes and named as the *medio-postmental pair* (*mpmtl.*).

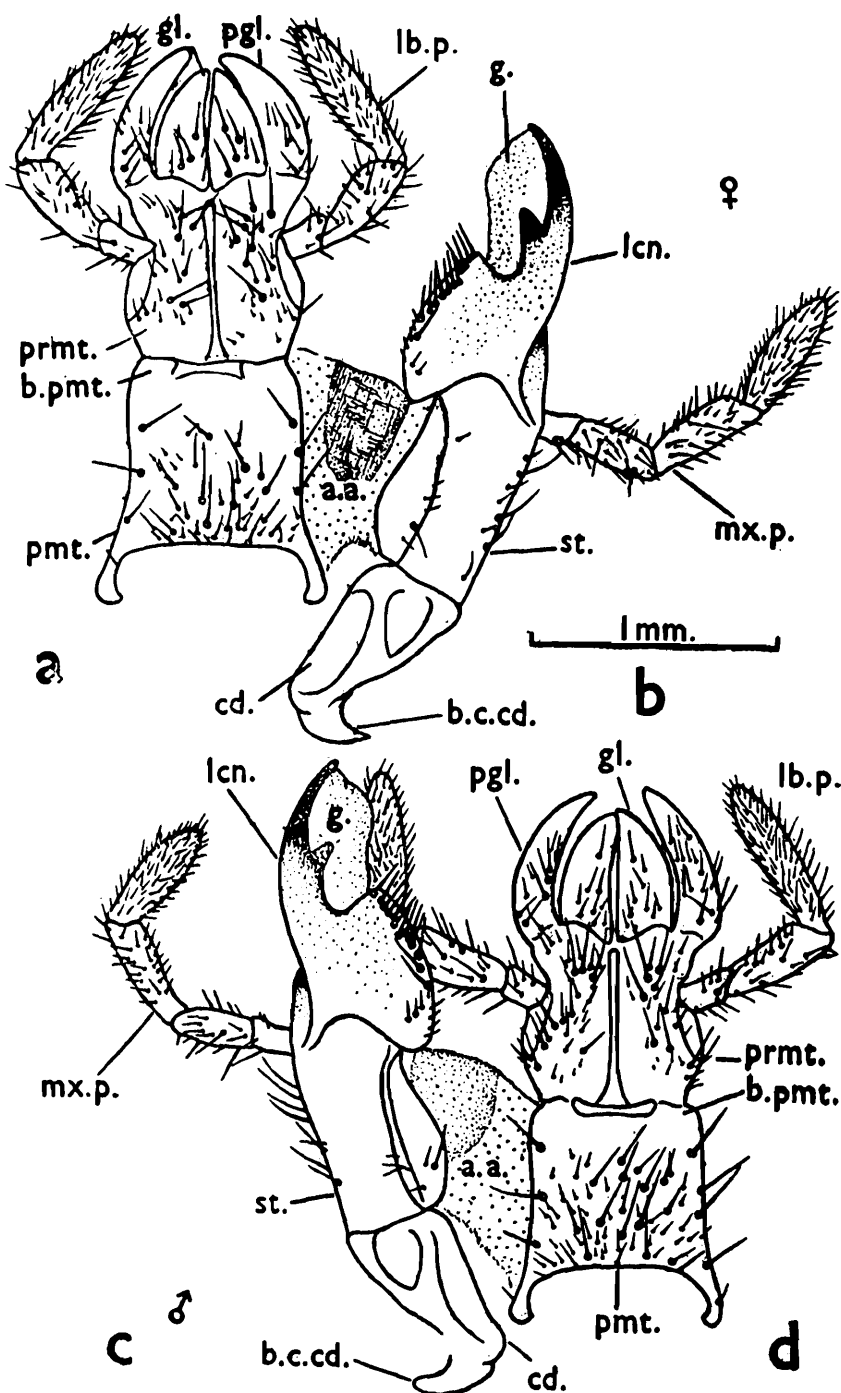
In the soldier caste 4 *postmental bristles* (*pmtl.*) have been observed latero-marginally on either side in the distal half of the postmentum. Of these, the first three occur more commonly than the fourth. They have been numbered serially from anterior end as *postmental 1* (*pmtl. 1*), *postmental 2* (*pmtl. 2*), *postmental 3* (*pmtl. 3*) and *postmental 4* (*pmtl. 4*) showing 92 per cent., 76 per cent., 72 per cent. and 16 per cent. bilateral symmetry, respectively. The *medio-postmental pair* (*mpmtl.*) is located medially, approximately between the third and the fourth postmental pair, showing 96 per cent. bilateral symmetry (Table 7).



TEXT-FIG. 15.—*Odontotermes obesus* (Rambur), worker caste.

Diagrams showing variations in location of the characteristic postmental bristles located lateromarginally and medially.

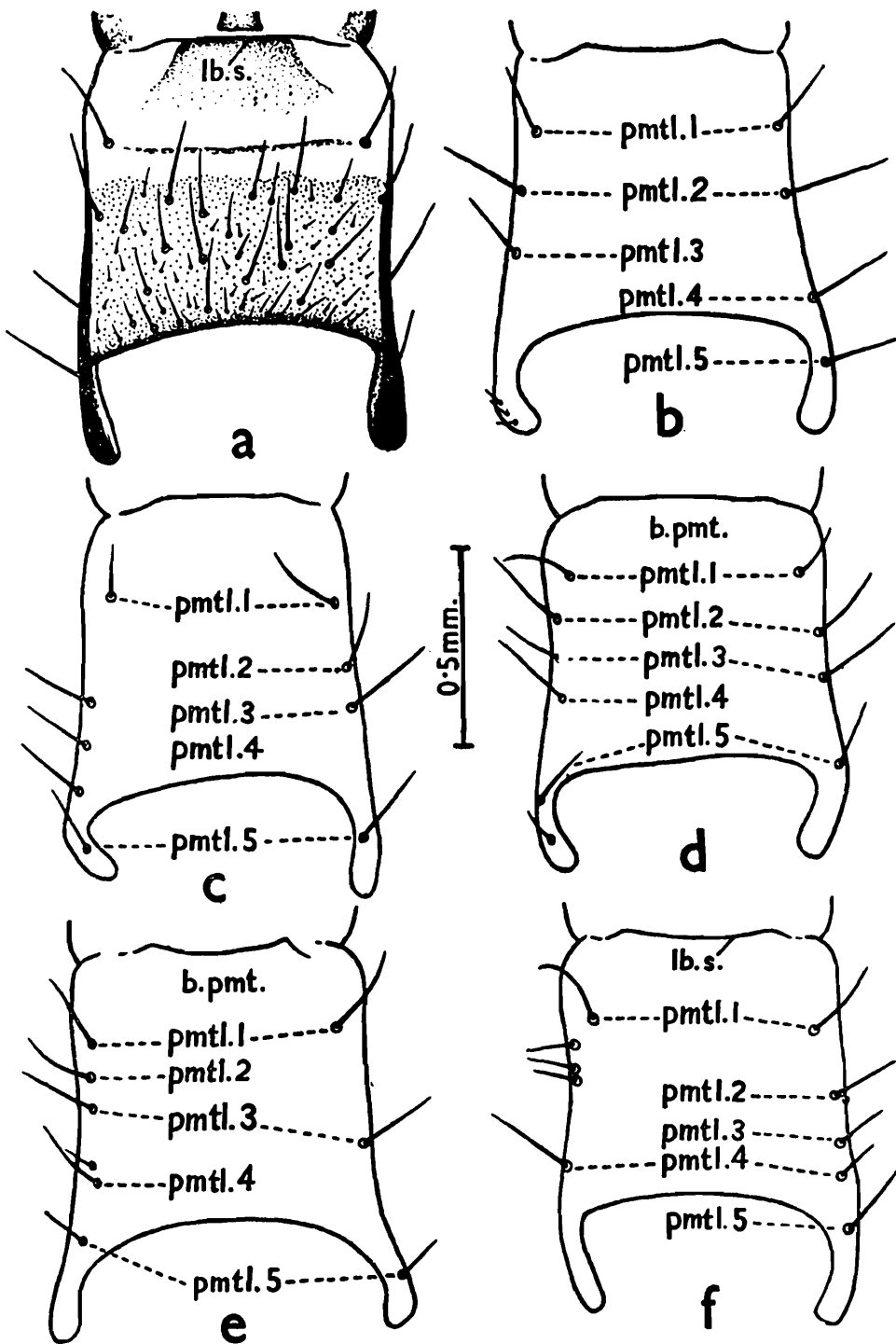
(a). Ventral view of the postmentum, showing more or less normal arrangement of the four postmental bristles at its left margin. Its right margin shows *pmtl. 1* missing and *pmtl. 3* located asymmetrically. (b). Ditto, showing only *pmtl. 1* and *pmtl. 3* in symmetrical pairs. (c). Ditto, showing only *pmtl. 1*, *pmtl. 2* and *pmtl. 4* in symmetrical pairs. (d). Ditto, all the four pairs located more or less symmetrically, *mpmtl.* pair located symmetrically in all the cases.



TEXT-FIG. 16.—*Odontotermes obesus* (Rambur), alate caste.

Diagrams showing no sexual differentiation in the arrangement of the bristles on the labium and maxilla of the two sexes.

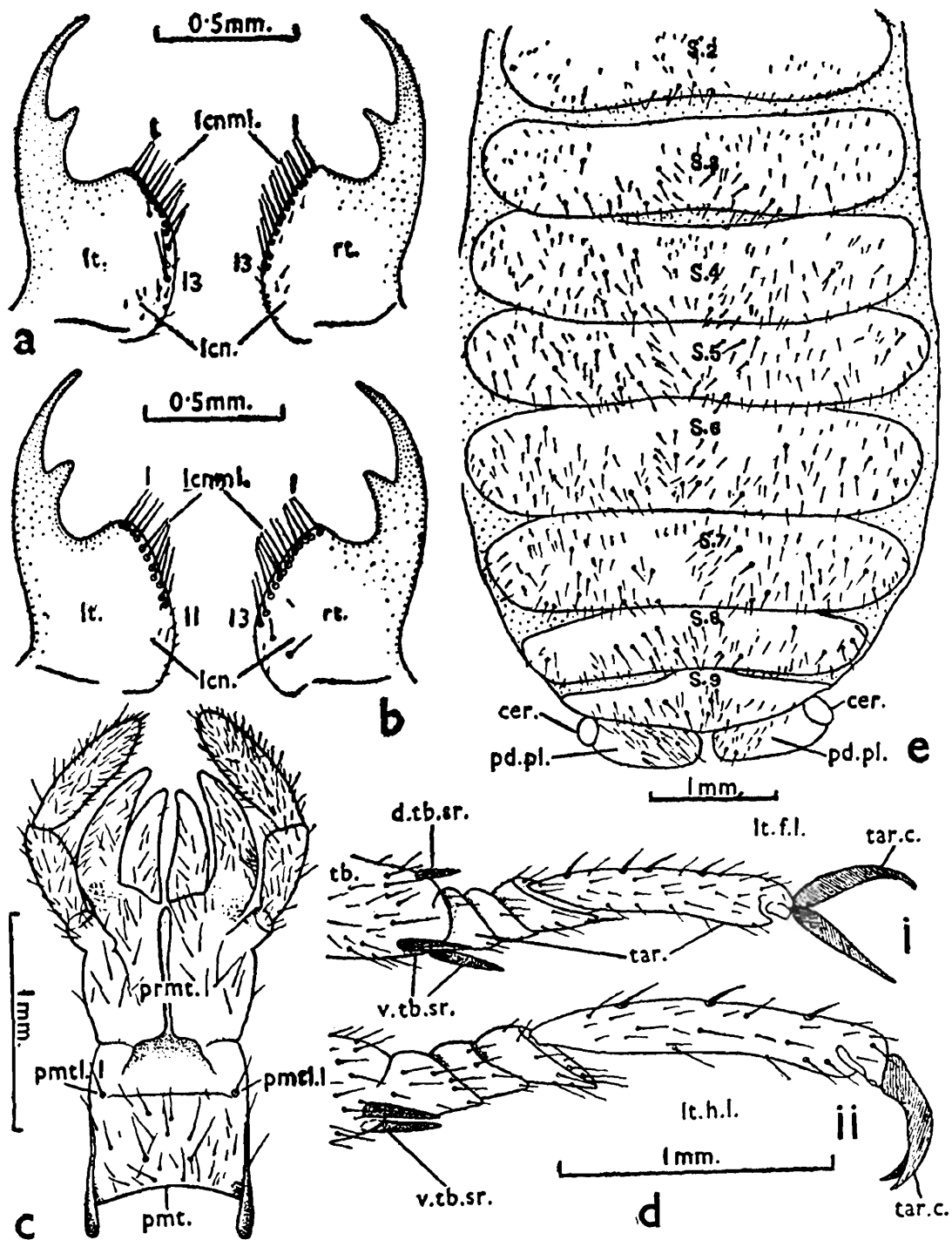
(a and b). Ventral view of the labium and maxilla, respectively, of the female.
(c and d). Ventral view of the labium and maxilla, respectively, of the male.



TEXT-FIG. 17.—*Odontotermes obesus* (Rambur), alate caste.

Diagrams showing variations in arrangement of the characteristic postmental bristles located lateromarginally.

(a). Ventral view of the postmentum, showing bilateral symmetry in respect of *pmtl. 1*, *pmtl. 2*, *pmtl. 3* or *pmtl. 4* (?) and *pmtl. 5*, together with other bristles distributed irregularly on the whole posterior surface. (b). Ventral view of the postmentum, showing only the lateral bristles. Only *pmtl. 1* and *pmtl. 2* showing bilateral symmetry. (c). Ditto, only *pmtl. 1* and *pmtl. 5* showing bilateral symmetry; the remainder located asymmetrically. (d). Ditto, only *pmtl. 1*, *pmtl. 2*, *pmtl. 3* and *pmtl. 5* showing bilateral symmetry. (e). Ditto, only *pmtl. 1*, *pmtl. 3* and *pmtl. 5* located symmetrically. (f). Ditto, only *pmtl. 1* located symmetrically. *pmtl. 4* also showing bilateral symmetry, but left bristle is comparatively much smaller.

TEXT-FIG. 18.—*Odontotermes obesus* (Rambur), alate caste.

(a). Left and right lacinia, showing 13 symmetrically arranged lacino-marginal bristles. (b). Ditto, left lacinia with only 11, and right lacinia with 13 lacino-marginal bristles. (c). Labium, showing regular pairs of lateral postmental bristles. (d, dii). Distal portion of left fore-leg and hind-leg, respectively. The distal end of tibia in the fore-leg showing a dorsal tibial spur in addition to a pair of ventral tibial spurs; the hind-tibia showing only a pair of ventral spurs. (e). Abdominal sternites 2-10, showing a thick growth of smaller bristles distributed irregularly.

TABLE 7.—Percentage of bilateral symmetry of larger labial bristles in the soldier, worker and alate caste of *Odontotermes obesus* (Rambur). Based on 25 specimens each.

Castes.	% of individuals showing bilateral symmetry of <i>medio-glossal</i> bristles (<i>mgll.</i>).	% of individuals showing bilateral symmetry of <i>premental</i> bristles (<i>prmtl.</i>).		% of individuals showing bilateral symmetry of <i>postmental</i> bristles (<i>pmtl.</i>).					
		<i>prmtl. 1</i>	<i>prmtl. 2</i>	<i>pmtl. 1</i>	<i>pmtl. 2</i>	<i>pmtl. 3</i>	<i>pmtl. 4</i>	<i>pmtl. 5</i>	<i>mpmtl.</i>
Soldier	—	—	—	92	76	72	16	—	96
Worker	88	100	44	92	92	84	12	—	100
Alate	—	—	—	100	80	68	20	24	—

The workers have shown a conspicuous medial bristle on each glossa, two pairs of bristles on prementum, and 4 pairs on postmentum. The glossal bristles called the *medio-glossal* (*mgll.*) have shown 88 per cent. bilateral symmetry. The remaining 12 per cent. have also shown similar bristles, but not distinctly differentiated from other bristles on that part. The premental pairs of bristles include an anterior pair called the *premental 1* (*prmtl. 1*) showing 100 per cent. bilateral symmetry, and a posterior pair called the *premental 2* (*prmtl. 2*) with 44 per cent. bilateral symmetry. The lateral postmental pairs are the *postmental 1* (*pmtl. 1*), *postmental 2* (*pmtl. 2*), *postmental 3* (*pmtl. 3*) and *postmental 4* (*pmtl. 4*) with 92 per cent., 92 per cent., 84 per cent. and 12 per cent. bilateral symmetry, respectively. The *medio-postmental pair* (*mpmtl.*) has been observed with 100 per cent. bilateral symmetry (Table 7).

Of the various characteristic labial bristles discussed in the soldier and the worker castes, the *medio-postmental pair* is the most conspicuously located showing a very significant frequency of occurrence (*vide supra*).

The alate caste has shown much closer similarity with the worker caste in arrangement of the latero-marginal bristles on the postmentum. There are five pairs of these which are similarly called *postmental 1* (*pmtl. 1*), *postmental 2* (*pmtl. 2*), *postmental 3* (*pmtl. 3*), *postmental 4* (*pmtl. 4*) and *postmental 5* (*pmtl. 5*), observed more or less in the same relative position as in the worker, showing 100 per cent., 80 per cent., 68 per cent., 20 per cent. and 24 per cent. bilateral symmetry, respectively (Table 7).

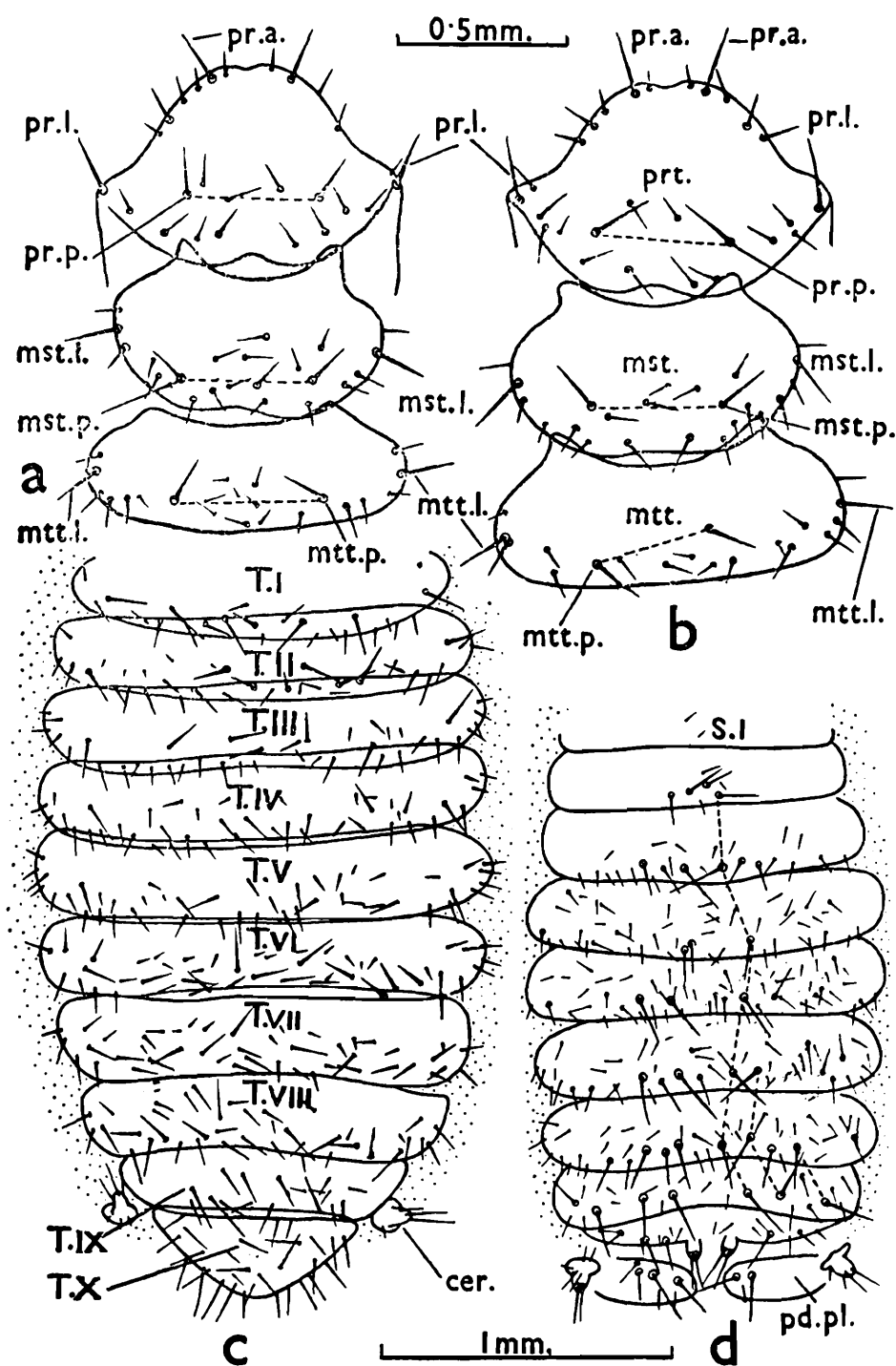
IV—CHAETOTAXY OF THE THORAX

(a) *Thoracic sclerites*

Soldier, worker and alate (Text-figs. 10a-c ; 19a, b ; 20a, b ; and 21).—The alates are hirsute, showing a thick growth of bristles distributed irregularly. The soldier and the worker, on the other hand, closely resemble each other, showing more or less a bilaterally symmetrical arrangement of the larger bristles on the thoracic tergites besides smaller ones distributed irregularly. The sternites lack such prominent larger bristles.

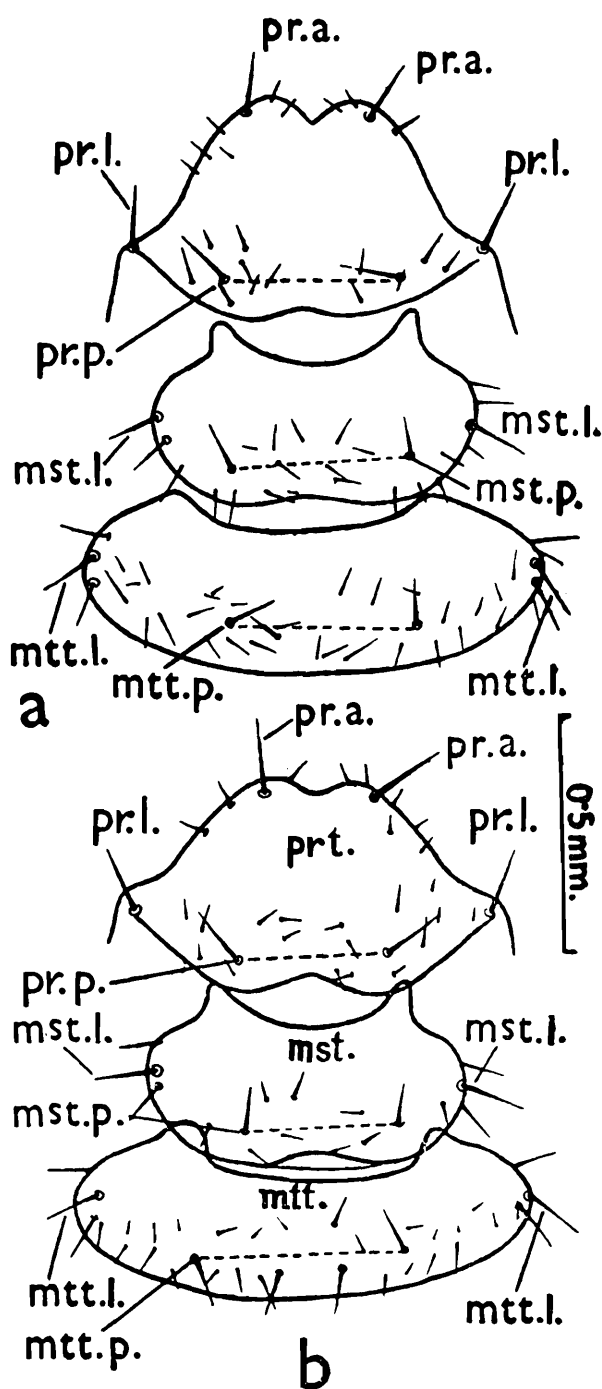
25 specimens were examined in each case to find the percentage of bilateral symmetry of the larger bristles. The nomenclature used is based on the location of bristles in the different regions of the tergites.

In the soldier there are three pairs of large bilaterally symmetrical pronotal bristles and two pairs of similar mesonotal and metanotal bristles each. The pronotal pairs are located anteriorly, laterally and posteriorly, and called the *pronoto-anterior* (*pr.a.*), the *pronoto-lateral* (*pr.l.*) and the *pronoto-posterior* (*pr.p.*). They were observed in 100 per cent., 96 per cent., and 100 per cent. individuals, respectively (Table 8). The mesonotal and metanotal pairs are located only laterally and posteriorly and are accordingly called the *mesonoto-lateral* (*mst.l.*), *mesonoto-posterior* (*mst.p.*), *metanoto-lateral* (*mtt.l.*), and *metanoto-posterior* (*mtt.p.*). Of the mesonotal pairs, each pair was observed in



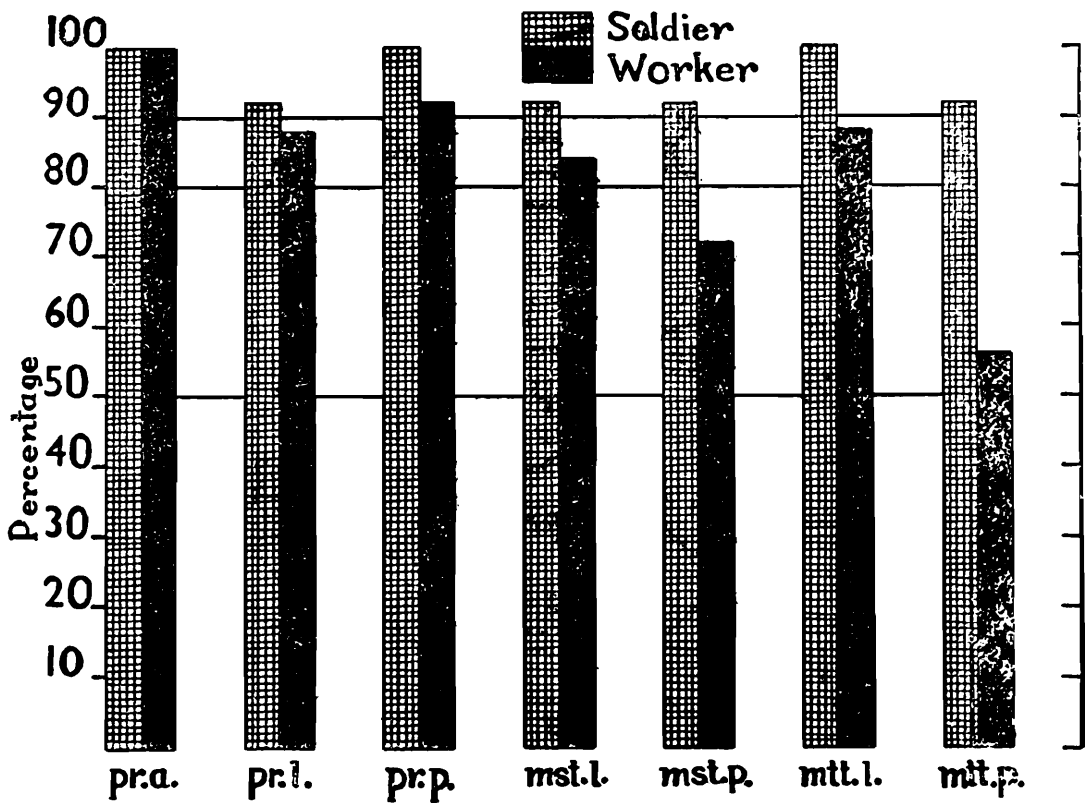
TEXT-FIG. 19.—*Odontotermes obesus* (Rambur), soldier caste.

(a, b). Three thoracic tergites; the pronotum showing three pairs of large symmetrical bristles, i.e., pronoto-anterior, pronoto-lateral and pronoto-posterior; the meso- and metanotum showing only two pairs each, i.e., mesonoto- or metanoto-lateral and mesonoto- or metanoto-posterior. (c). Abdominal tergites I-X, showing irregular distribution of bristles. (d). Abdominal sternites 1-10, showing a row of larger sterno-posteromedial, sterno-postero sublateral and a few other lateral bristles; first two rows of bristles on the left joined by dotted lines.



TEXT-FIG. 20.—*Odontotermes obesus* (Rambur), worker caste.

(a, b). Three thoracic tergites; the pronotum showing three pairs of large symmetrical bristles, *i.e.*, pronoto-anterior, pronoto-lateral and pronoto-posterior; the meso- and metanotum showing only two pairs each, *i.e.*, mesonoto- or metanoto-lateral and mesonoto- or metanoto-posterior.



Nomenclature of thoracic tergal setae

TEXT-FIG. 21.—*Odontotermes obesus* (Rambur), soldier and worker castes.

Bar diagram, showing the relative percentage of individuals of soldiers and workers with different pronotal, mesonotal and metanotal bristles.

96 per cent. individuals. Of the metanotal pairs, the lateral pair was observed in 100 per cent. and the posterior pair in 96 per cent. individuals (Table 8).

TABLE 8.—Percentage of bilateral symmetry of the larger dorsal thoracic bristles in the soldier and worker of *Odontotermes obesus* (Rambur). Based on 25 specimens examined.

						Pronotum.			Mesonotum.		Metanotum.	
Castes.						<i>Pronoto- anterior (pr. a.).</i>	<i>Pronoto- lateral (pr. l.).</i>	<i>Pronoto- posterior (pr. p.).</i>	<i>Mesonoto- lateral (mst. l.).</i>	<i>Mesonoto- posterior (mst. p.).</i>	<i>Metanoto- lateral (mtt. l.).</i>	<i>Metanoto- posterior (mtt. p.).</i>
Soldier	.	.	.	.	.	100	96	100	96	96	100	96
Worker	.	.				100	88	92	84	76	88	56

The worker also shows the above mentioned pairs of bristles. The *pronoto-anterior*, the *pronoto-lateral*, and the *pronoto-posterior* were observed in 100 per cent., 88 per cent. and 92 per cent. individuals, respectively; the *mesonoto-lateral*, the *mesonoto-posterior* in 84 per cent. and 76 per cent. individuals, respectively; and the *metanoto-lateral* and *metanoto-posterior* in 88 per cent. and 56 per cent. individuals, respectively (Table 8).

(b) Legs

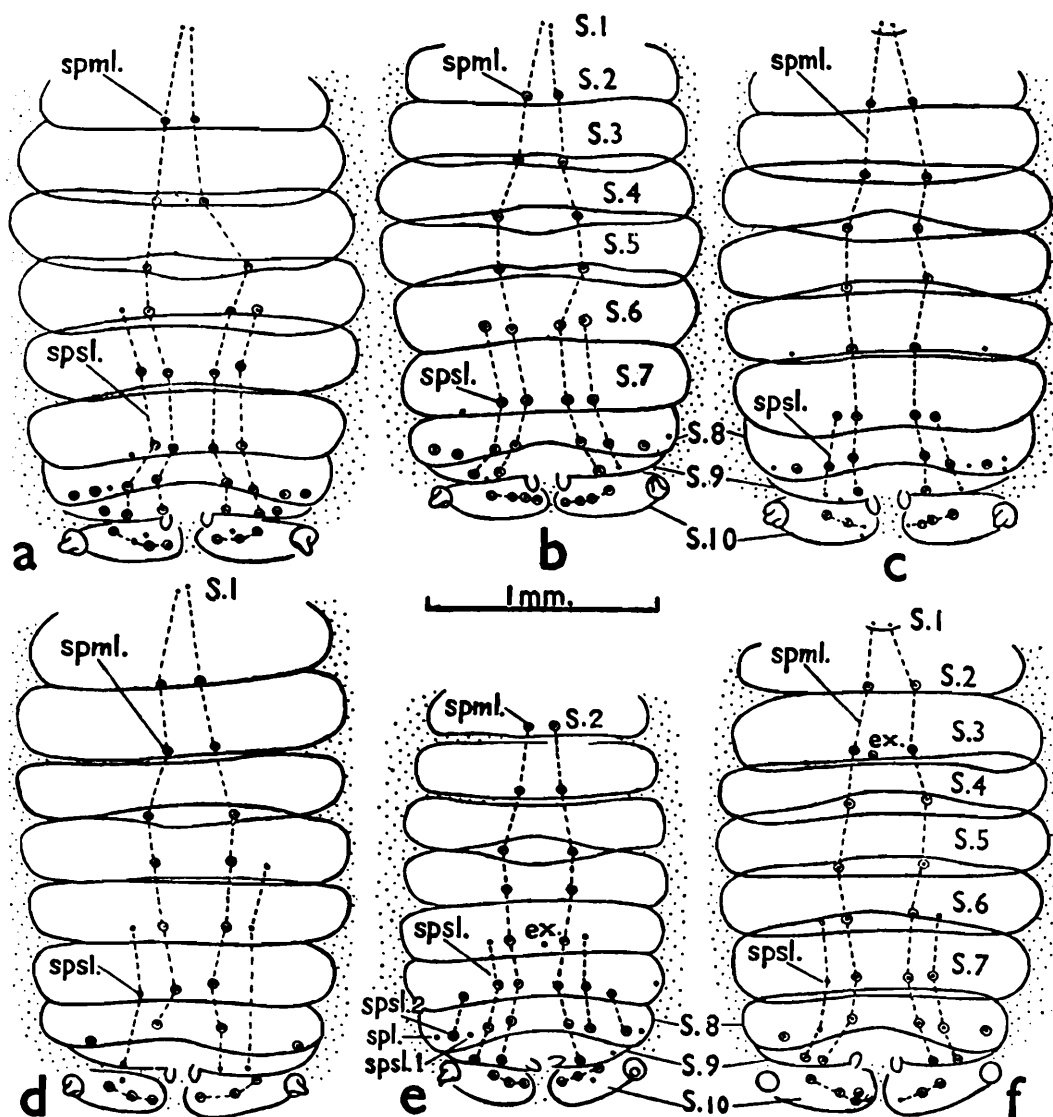
Soldier, worker and alate (Text-figs. 13a; 14a; and 18d).—The legs in all the three castes are more or less thickly bristled in the distal segments. All the three pairs, *i.e.*, pro-, meso-, and metathoracic legs, at the distal end of their tibiae and provided ventrally with a pair of thick and robustly built spines, called the *ventral-tibial spurs* (*v. tb. sr.*). In addition to the said spurs, the fore-legs are, in all the three castes, provided with a single, more or less similar spur dorsally called the *dorsal tibial spur* (*d. tb. sr.*). The above condition was found in all the 25 specimens examined for each caste.

V—CHAETOTAXY OF THE ABDOMEN

(a) Abdominal sclerites

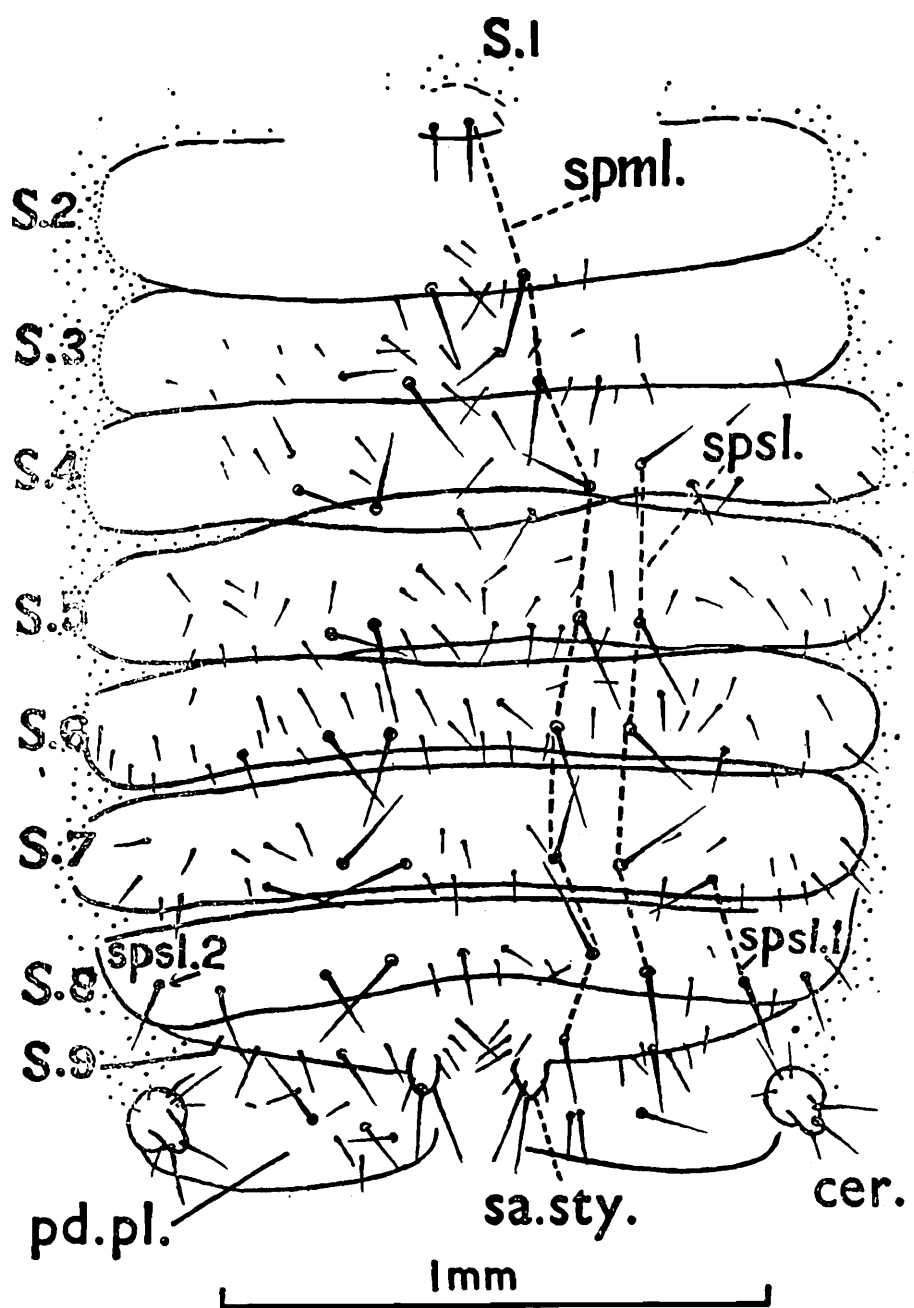
Soldier, worker and alate (Text-figs. 13c; 18e; 19c, d; 22a-f; 23; 24a-f and 25a).—The abdominal sternites of the soldiers and the workers present a similar and more or less a regular pattern of arrangement of the larger bristles, the alates showing only the smaller bristles which are distributed irregularly. Considering the entire abdomen ventrally, most of the larger bristles seem to be arranged in bilateral longitudinal rows extending from the anterior to the posterior sternites. It was further observed that these larger bristles are located in the posterior half of each sternite rather at the posterior margin in most cases.

Starting from the medial region outwards to the lateral margins of the individual sternites, the larger bristles have been named as *sterno-posteromedial* (*spml.*), *sterno-posterosublateral* (*spsl.*), *sterno-posterosublateral 1* (*spls. 1*), *sterno-posterosublateral 2* (*spsl. 2*), and *sterno-posterolateral* (*spl.*). Considering their constant position and size on individual sternite, the first atrophied sternite shows a pair of comparatively much smaller bristles set very close together forming the first anterior pair of the row of the *sterno-posteromedial* bristles; there are a few more extra bristles of the same size round about occurring irregularly. The *sterno-posteromedial* bristles in the following sternites posteriorly get wider apart gradually, those on the 4th and 5th sternites being generally the widest apart. These bristles show an absolute regularity from the 1st sternite to the 8th in the worker and from the 2nd to 8th sternite in the soldier (Tables 9 and 10). The 1st sternite of the soldier and the last two sternites, *i.e.*, 9th and 10th (podical plates), of both the soldier and the worker do not show such a constant position and distribution, only 60 per cent. to 75 per cent. individuals showing this constancy. Occasionally (5-10 per cent. individuals) a few larger *extra bristles* (*e.x.*) were observed in variable positions.



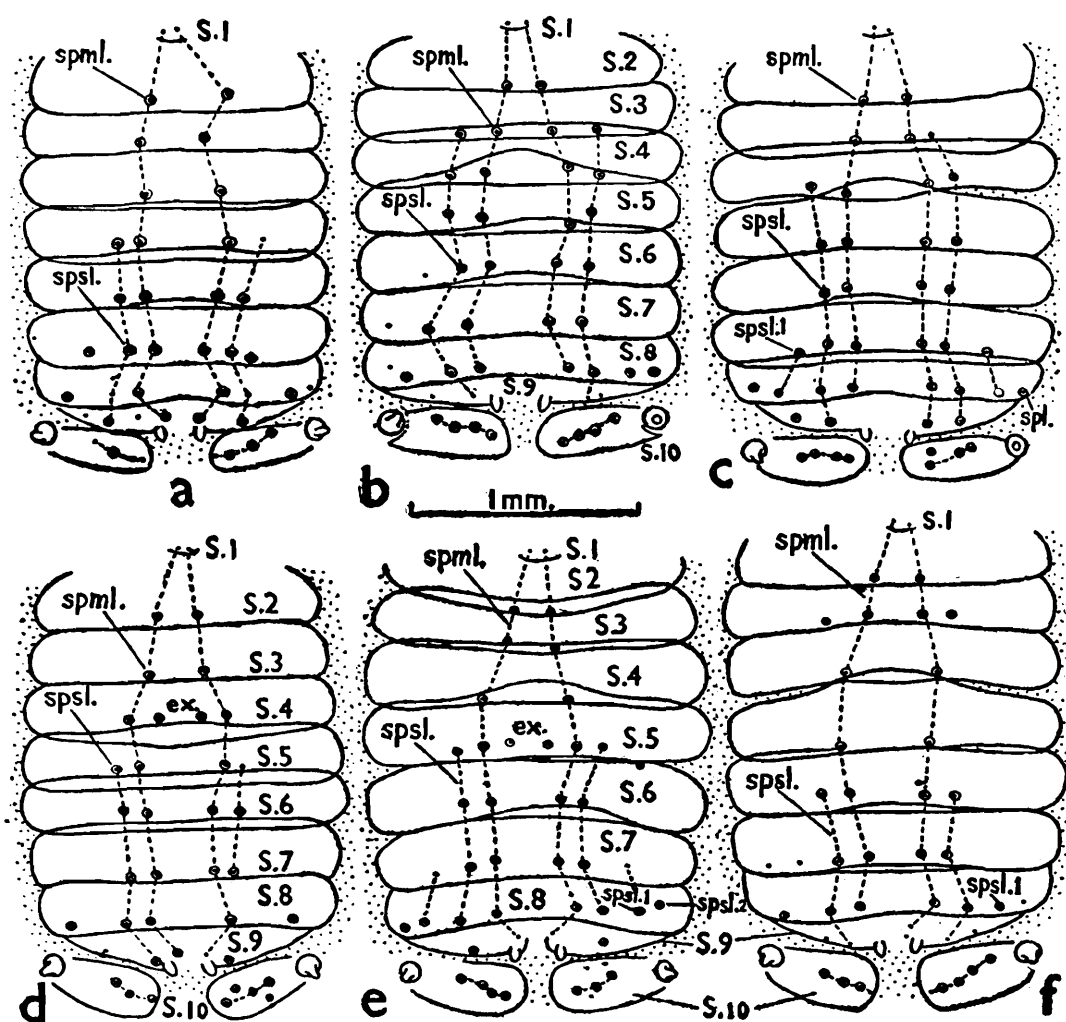
TEXT-FIG. 22.—*Odontotermes obesus* (Rambur), soldier caste.

(a-f). Abdominal sternites 1-10, showing rows of scars of sterno-posteromedial bristles; sterno-posterosublateral bristles joined by dotted lines and other bristles, e.g., extra inner, sterno-posterosublateral 1 and 2 and sterno-posterolateral on posterior sternites mostly as such.



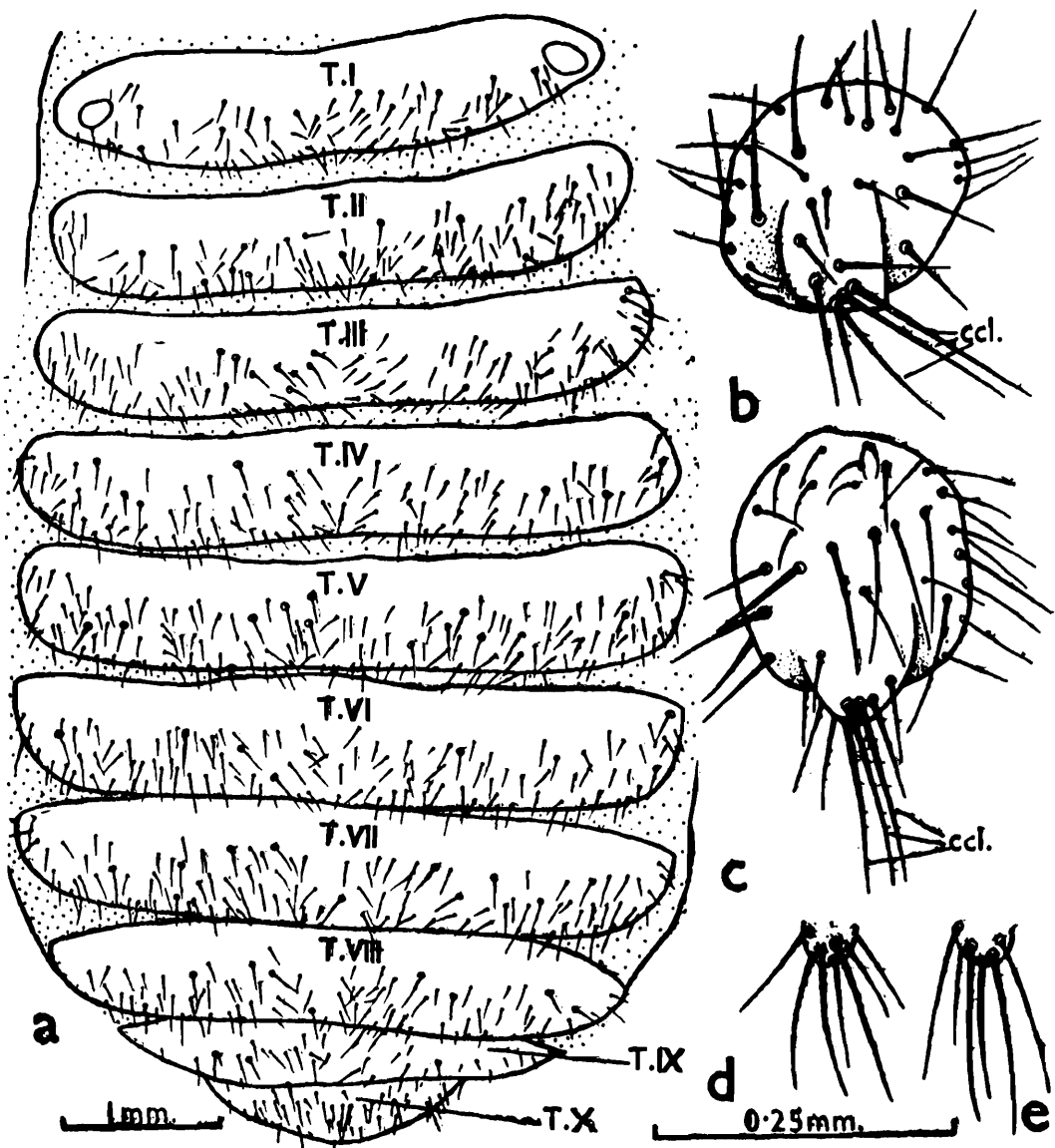
TEXT-FIG. 23.—*Odontotermes obesus* (Rambur), worker caste.

Abdominal sternites 1-10, showing general distribution of bristles. The large bristles of one side joined by dotted lines to show the rows of sterno-posteromedial, sterno-posterosublateral and sterno-posterosublateral 1 bristles.



TEXT-FIG. 24.—*Odontotermes obesus* (Rambur), worker caste.

(a-f). Abdominal sternites 1-10, showing rows of scars of sterno-posteromedial and sterno-posterosublateral bristles, joined by dotted lines; and other bristles, e.g., extra-inner, sterno-posterosublateral 1 and 2, and sterno-posterolateral, on posterior sternites, shown mostly as scars.



TEXT-FIG. 25.—*Odontotermes obesus* (Rambur), alate caste.

(a). Abdominal tergites I-X, showing irregularly distributed bristles. (b, c). Left and right anal cerci, respectively, without any characteristic cercal bristles. (d, e). Left and right subanal styles, respectively, without any characteristic bristles.

TABLE 9.—Percentage of individuals, showing arrangement of the different larger bristles on the abdominal sternites of the soldier caste of *Odontotermes obesus* (Rambur), Based on 20 specimens. *lt.*, left ; *rt.*, right.

Sternites	Sterno-postero-medial (<i>spml.</i>)		Sterno-postero-sublateral (<i>spsl.</i>)		Sterno-postero-sublateral 1 (<i>spsl. 1</i>)		Sterno-postero-sublateral 2 (<i>spsl. 2</i>)		Sterno-postero-lateral (<i>spl.</i>)		Extra (<i>ex.</i>)			
	<i>lt.</i>	<i>rt.</i>	<i>lt.</i>	<i>rt.</i>	<i>lt.</i>	<i>rt.</i>	<i>lt.</i>	<i>rt.</i>	<i>lt.</i>	<i>rt.</i>	Outer*		Inner*	
											<i>lt.</i>	<i>rt.</i>	Single	Paired
S. 1	70	70	..	..	..	..	..	..	..	..	..	..	..	..
S. 2	100	100	..	..		..	..	..	..	..	5	—	10	—
S. 3	100	100	..	..		..	..	..	..	..	—	5	—	5
S. 4	100	100	—	5		..	..	..		..	..	..	..	..
S. 5	100	100	40	45		..	..	..	..		—	—	—	5
S. 6	100	100	90	90	—	10	—	—	10	5	..	..	..	..
S. 7	100	100	100	95	40	50	5	10	10	5	..	..	..	..
S. 8	100	100	85	90	50	50	80	80	65	60	10	—	..	..
S. 9	70	75	65	71	45	50	—	—	10	10	..	..	..	..

* Outer and inner in respect to the bilateral rows of bristles.

TABLE 10.—Percentage of individuals, showing the arrangement of the different larger bristles on the abdominal sternites of the worker caste of *Odontotermes obesus* (Rambur). Based on 20 specimens, *lt.*, left ; *rt.*, right

Sternites	Sterno-postero-medial (<i>spml.</i>)		Sterno-postero-sublateral (<i>spsl.</i>)		Sterno-postero-sublateral 1 (<i>spsl. 1</i>)		Sterno-postero-sublateral 2 (<i>spsl. 2</i>)		Sterno-postero-lateral (<i>spl.</i>)		Extra (<i>ex.</i>)			
	<i>lt.</i>	<i>rt.</i>	<i>lt.</i>	<i>rt.</i>	<i>lt.</i>	<i>rt.</i>	<i>lt.</i>	<i>rt.</i>	<i>lt.</i>	<i>rt.</i>	Outer*		Inner*	
											<i>lt.</i>	<i>rt.</i>	Single	Paired
S. 1	100	100			..	..	..	..	..				5	—
S. 2	100	100		..	..	..		..	..	..			5	—
S. 3	100	100	25	25	..	..	..	..	..	..			—	5
S. 4	100	100	20	25	..		..	..		..			—	10
S. 5	100	100	95	85	..	..							15	15
S. 6	100	100	95	100	5	10			...					..
S. 7	100	100	100	100	60	45	30	15	10	20	..	..	..	..
S. 8	100	100	90	100	100	100	5	5	65	50	—	—	5	5
S. 9	70	60	90	100	40	60	—	10	—	..	..			..

* Outer and inner in respect to the bilateral rows of bristles.

The next outer row laterally consists of the *sterno-posterosublateral bristles* (*spsl.*) which, in the soldier, was observed from the 5th sternite and in the worker from the 3rd sternite posteriorly, in a somewhat variable percentage of individuals (Tables 9 and 10).

The other sublateral and lateral bristles were observed generally from the 7th sternite posteriorly in both the soldier and the worker, though not very regularly. In the 8th sternite they are comparatively better developed. In the 9th sternite they are frequently absent, and the *sterno-posteromedial bristles* here are closer together in the worker than in the soldier.

The 10th sternite (podical plates) shows 3 or 4 bristles very closely set together in a somewhat transverse row on either side. The number, however, varies frequently.

The bristles on the abdominal tergites are distributed irregularly in all the three castes, showing no characteristic arrangement whatsoever.

(b) *Abdominal appendages*

1. *Anal cerci.*—

Soldier and worker (Text-figs. 13*f, g* ; 14*f, g* ; and 25*b, c*).—In both the soldier and the worker caste, the *anal cerci* (*cer.*) bear three robust bristles distally, called the *cercal bristles* (*ccl.*), and a few comparatively minor ones. A few individuals show only 2 robust bristles instead. The bilateral symmetry noted in respect of the 3 robust bristles is 84 per cent. in the soldier and 72 per cent. in the worker (Table 11). The alates also possess such larger bristles but show no such distinction and constancy.

TABLE 11—*Percentage of individuals, showing bilateral symmetry in respect of the large bristles on anal cerci (ccl.) in the soldier and the worker of Odontotermes obesus (Rambur). Based on 25 specimens.*

Caste	Left anal cercus		Right anal cercus		Percent- age of bilateral symmetry in respect of the 3 large bristles (<i>ccl.</i>)	Percent- age of bilateral symmetry in respect of the 2 large bristles (<i>ccl.</i>)
	Percent- age of indivi- duals with 3 large bristles	Percent- age of indivi- duals with 2 large bristles	Percent- age of indivi- duals with 3 large bristles	Percent- age of indivi- duals with 2 large bristles		
Soldier	92	8	88	12	84	4
Worker	92	8	80	20	72	—

2. *Subanal styles.*—

Soldier and worker (Text-figs. 13*d, e* ; 14*d, e*, and 25*d, e*).—The *subanal styles* (*sa. sty.*) in both the soldier and the worker comprise a pair of conspicuously elongated and thick bristles on each style, and a few other smaller bristles. Of the former, one bristle is distinctly located towards the inner margin and called the *stylar bristle 1* (*styr. 1*), whereas the other is located more or less apically and called the *stylar bristle 2* (*styr. 2*). Both the stylar bristles show 96 per cent. bilateral symmetry (Table 12) in both the castes ; in the remaining 4 per cent. cases only the *stylar bristle 1* is present. The alates neither show such constant number nor can these bristles be distinctly differentiated from the other bristles present.

TABLE 12.—Percentage of individuals, showing bilateral symmetry in respect of the larger bristles on subanal styles, called stylar bristles (styr.), in the soldier and worker of *Odontotermes obesus* (Rambur). Based on 25 specimens.

Caste	Left subanal style		Right subanal style		Percent- age of bilateral symmetry in respect to 2 large bristles (styr.)	Percent- age of bilateral symmetry in respect to 1 large bristle (styr.)
	Percent- age of indi- viduals with 2 large bristles	Percent- age of indi- viduals with 1 large bristle	Percent- age of indi- viduals with 2 large bristles	Percent- age of indi- viduals with 1 large bristle		
Soldier	100	—	96	4	96	—
Worker	100	—	96	4	96	—

TABLE 13.—Summary of the characteristic bristles observed in more than 80 per cent. of the individuals of the three castes of *Odontotermes obesus* (Rambur) (Isoptera : Termitidae).

Body regions and appendages	Nomenclature of the bristles	Abbrevia- tions used for bristles	Frequency percentage of bilateral symmetry		
			Soldier	Worker	Alate
I—HEAD-CAPSULE					
Dorsal view					
Clypeus	Clypeal	<i>cll.</i>	100	96	—
Frons	Frontal	<i>frtl.</i>	100	92	—
Epicranial region	Epicranial 1	<i>epcl. 1</i>	92	—	—
	Epicranial 3	<i>epcl. 3</i>	88	—	—
	Epicranial 4	<i>epcl. 4</i>	96	—	—
Genae	Medio-genal	<i>mgl.</i>	96	—	—
	Proximo-genal	<i>prgl.</i>	88	—	—
II—HEAD-APPENDAGES					
Labrum	Apical	<i>ap.</i>	100	100	96
	Apical lateral	<i>ap. l.</i>	—	100	96
	1	1	100	100	88
	2	2	97.5	100	84
	3	3	95	100	96
	4	4	95	92	96
Galea	5	5	—	—	96
	Disto-galeal	<i>dgall.</i>	92	—	—
Glossa	Medio-glossal	<i>mgl.</i>	—	88	—
Prementum	Premental 1	<i>prmtl. 1</i>	—	100	—
	Postmental 1	<i>pmtl. 1</i>	92	92	100
Postmentum	Postmental 2	<i>pmtl. 2</i>	—	92	80
	Postmental 3	<i>pmtl. 3</i>	—	84	—
	Medio-postmental	<i>mpmtl.</i>	96	100	—
III—THORAX					
Prothorax	Pronoto-anterior	<i>pr. a.</i>	100	100	—
	Pronoto-lateral	<i>pr. l.</i>	96	88	—
	Pronoto-posterior	<i>pr. p.</i>	100	92	—
Mesothorax	Mesonoto-lateral	<i>mst. l.</i>	96	84	—
	Mesonoto-posterior	<i>mst. p.</i>	96	—	—
Metathorax	Metanoto-lateral	<i>mtl. l.</i>	100	88	—
	Metanoto-posterior	<i>mtl. p.</i>	96	—	—
IV—LEGS					
Fore-leg	Dorsal tibial spur	<i>d. tb. sr.</i>	100	100	100
Fore-leg	Ventral tibial spurs	<i>v. tb. sr.</i>	100	100	100
Middle-leg					
Hind-leg					
V—ABDOMEN					
Sternite 1	Sterno-posteromedial	<i>spml.</i>	—	100	—
Sternite 2	Ditto	<i>spml.</i>	100	100	—
Sternite 3	Ditto	<i>spml.</i>	100	100	—
Sternite 4	Ditto	<i>spml.</i>	100	100	—
Sternite 5	Ditto	<i>spml.</i>	100	100	—
Sternite 6	Sterno-posterosublateral	<i>spsl.</i>	—	80	—
	Sterno-posteromedial	<i>spml.</i>	100	100	—
	Sterno-posterosublateral	<i>spsl.</i>	80	95	—
Sternite 7	Sterno-posteromedial	<i>spml.</i>	100	100	—
	Sterno-posterosublateral	<i>spsl.</i>	95	100	—
Sternite 8	Sterno-posteromedial	<i>spml.</i>	100	100	—
	Sterno-posterosublateral	<i>spsl.</i>	80	90	—
	Sterno-posterosublateral 1	<i>spsl. 1</i>	—	100	—
Sternite 9	Sterno-posterosublateral	<i>spsl.</i>	—	90	—
VI—CERCI	Cercal (3 setae)	<i>ccl.</i>	84	—	—
VII—SUBANAL STYLES	Stylar 1	<i>styr. 1</i>	100	100	—
	Stylar 2	<i>styr. 2</i>	96	96	—

VI—SUMMARY

1. The chaetotaxy of the soldier, the worker and the alate castes of *Odontotermes obesus* (Rambur), was studied from the material collected from areas around Dehra Dun (U.P.).

2. The soldier and the worker closely resemble each other and present a considerably regular and symmetrical arrangement of bristles. The alate caste shows some symmetrical and regular bristles only on head-appendages.

3. The nomenclature of the bristles is based mostly on their location on the particular body-part except in the case of the labral setae where a connotation in Arabic numerals has been adopted.

4. In the head, the larger bristles on the cranium and some head-appendages, e.g., labrum, lacinia and labium have been described to show characteristic arrangement in the case of all the three castes. The bristles on the galea have been described in the soldier caste only.

5. The first segment or scape of the antenna is naked in the soldier, while in the worker and the alate it is bristled.

6. In the thorax only the tergites, and in the abdomen only the sternites, of the soldier and the worker castes have been described ; they show a characteristic and regular arrangement of the larger bristles. Alates do not show such a characteristic or regular arrangement.

7. All the three castes show a pair of ventral tibial spurs distally on the fore-, middle-, and hind-legs in addition to a dorsal tibial spur on the fore-leg alone.

8. The anal cerci and the subanal styles show some characteristic large and robust bristles in the soldier and the worker castes, besides other smaller and less differentiated bristles. The alates show no such differentiation between large and small bristles.

VII—REFERENCES

- HINTON, H. E. 1946.—On the homology and nomenclature of the bristles of Lepidopterous larvae, with some notes on the phylogeny of the Lepidoptera.—*Trans. R. ent. Soc. Lond.*, London, 97, pp. 1-37.
- KUSHWAHA, K. S. 1955.—External morphology of the soldier of *Odontotermes obesus* (Rambur).—*Curr. Sci.*, Bangalore, 24, pp. 203-204.
- KUSHWAHA, K. S. 1959.—A preliminary account of external morphology of the worker and alate of *Odontotermes obesus* (Rambur).—*Curr. Sci.*, Bangalore, 28, pp. 298-299.
- KUSHWAHA, K. S. 1960a.—External morphology of the termite *Odontotermes obesus* (Rambur) (Isoptera : Termitidae). Part Soldier.—*Rec. Indian Mus.*, Delhi, 55 [1957], pp. 209-227.
- KUSHWAHA, K. S. 1960b.—External morphology of the termite *Odontotermes obesus* (Rambur) (Isoptera : Termitidae). Part 2. Alate and worker.—*Rec. Indian Mus.*, Delhi, 55 [1957], pp. 229-250.

- OSTEN-SACKEN, C. R. 1884.—An essay of Comparative Chaetotaxy, or the arrangement of characteristic bristles of Diptera.—*Trans. ent. Soc. Lond.*, London, pp. 497-517.
- SINGH, B. 1953.—Immature stages of Indian Lepidoptera.—*Indian For. Rec. (Ent.)*, Delhi, 8(7), pp. 67-158, 10 pls.
- WALTON, W. R. 1909.—An illustrated glossary of chaetotaxy and anatomical terms used in describing Diptera.—*Ent. News*, Philadelphia, 20, pp. 307-319, 4 pls.
- WILLISTON, S. W. 1908.—Chaetotaxy. In : *Manual of North American Diptera*. Ed. 2, pp. liv+167, New Haven (Hathaway).

VIII—ABBREVIATIONS USED IN TEXT-FIGURES AND TABLES

- a.a.*, articulating area between maxilla and labium.
acl., anteclypeus.
ant., antenna.
ap., apical bristles of labrum.
ap. l., apical lateral bristles of labrum.
at. a. md., anterior articulation of mandible.
b. c. cd., basal condyl of cardo.
at. t. a., anterior tentorial arm.
b. pmt., blade of postmentum.
ccl., cercal bristle.
cd., cardo.
cer., cercus.
cl., clypeus.
cll., clypeal bristle.
cr. a. md., cranial articulation of mandible.
ctm., corporotentorium.
dgall., disto-galeal bristle.
d. tb. sr., dorsal tibial spur.
e., eye.
epcl. 1, epcl. 2, epcl. 3, epcl. 4, epicranial bristles 1, 2, 3, 4, respectively.
ep. r., epicranial region.
ex., extra bristle.
fr., frons.
jrtl., frontal bristle.
ft., fontanelle.
G., Gap between labral bristles.
g., galea.
gl., glossa.
gn., gena.
gppl. 1, gppl. 2, gppl. 3, geno-postgenal bristles 1, 2, 3, respectively.
hd. head.
lb. labium.
lb. p., labial palp.
lb. s., labial suture.
lcn., lacinia.
lgl., lingula (hyaline tip of labrum).
lr. labrum.
lr. s., labral suture.
lt. f. l., left fore-leg.
lt. h. l., left hind-leg.
mgl., medio-genal bristle.
md., mandible.
mgll., medio-glossal bristle.
mn., median bristle.
mn. 1, mn. 2, mn. 3, median bristles 1, 2, 3, respectively.
mpmtl., medio-postmental bristle.
mst., mesonotum.
mst. l., mesonoto-lateral bristle.

mst. p., mesonoto-posterior bristle.

mtt., metanotum.

mtt. l., metanoto-lateral bristle.

mtt. p., metanoto-posterior bristle.

mx., maxilla.

mx. p., maxillary palp.

oc., ocellus.

oct., occiput.

oct. f., occipital foramen.

p., pedicel.

pcl., postclypeus.

pd. pl., podical plate.

pgl., paraglossa.

pgn., postgena.

pmt., postmentum.

pmtl. 1, pmtl. 2, pmtl. 3, pmtl. 4, pmtl. 5, postmental bristles 1,2,3,4,5, respectively,

poct., postocciput.

prgl., proximo-genal bristle.

prmtl. 1, prmtl. 2, premental bristles 1 and 2, respectively.

pr. a., pronoto-anterior bristle.

pr. l., pronoto-lateral bristle.

pr. p., pronoto-posterior bristle.

prt., pronotum.

p. t. a. posterior tentorial arm.

rt. f. l., right fore-leg.

rt. h. l., right hind-leg.

s., scape.

sa. sty., subanal style.

scl., scutellum.

sct., scutum.

st., stipes.

styr. 1., stylar bristle 1.

styr. 2., stylar bristle 2.

su. g., sutural groove of stipes.

T. I., T. II., tergum first, second, etc.

tar., tarsus.

tar. c., tarsal claw.

tb., tibia.

t. f., tentorial foramen.

v., vertex.

v. tb. sr., ventral tibial spur.

♀, female.

♂, male.

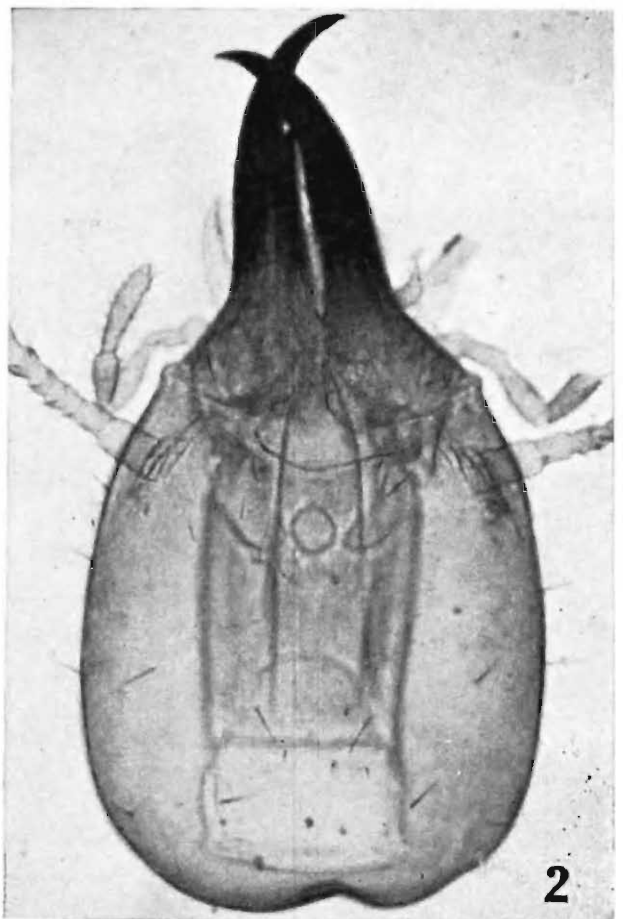
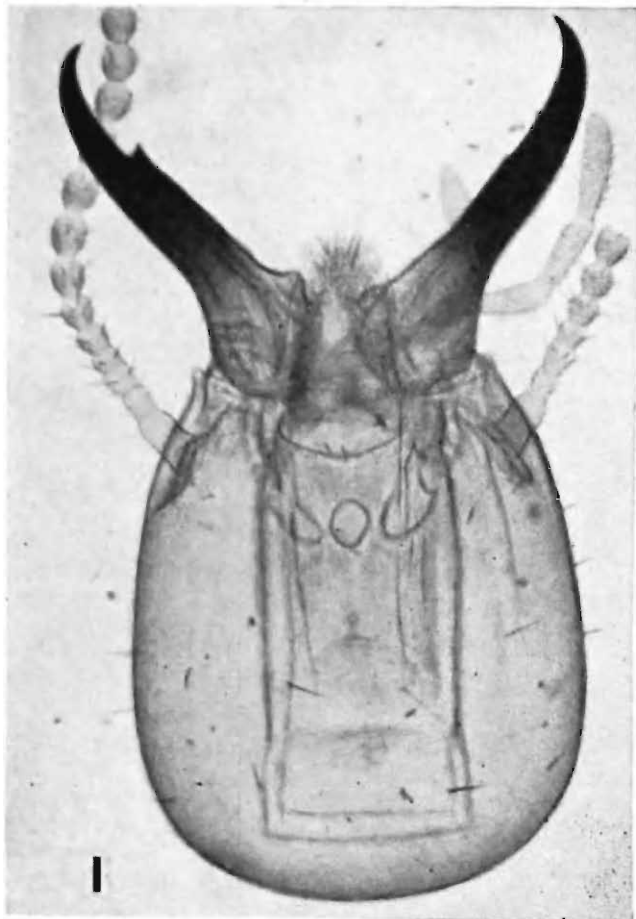
PLATE 1

Photomicrographs of head-capsule of soldier and worker of *Odontotermes obesus* (Rambur),

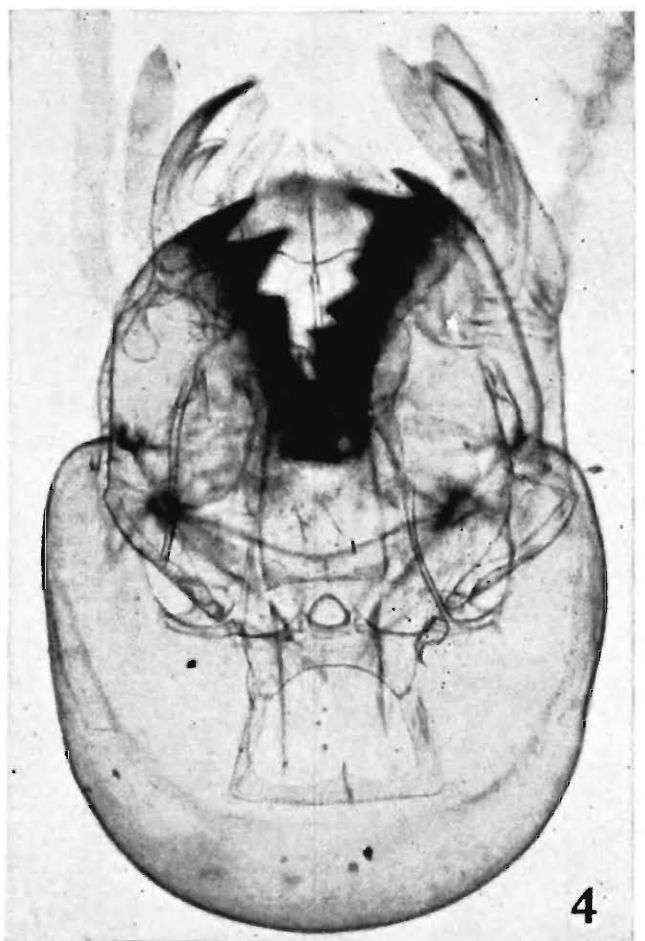
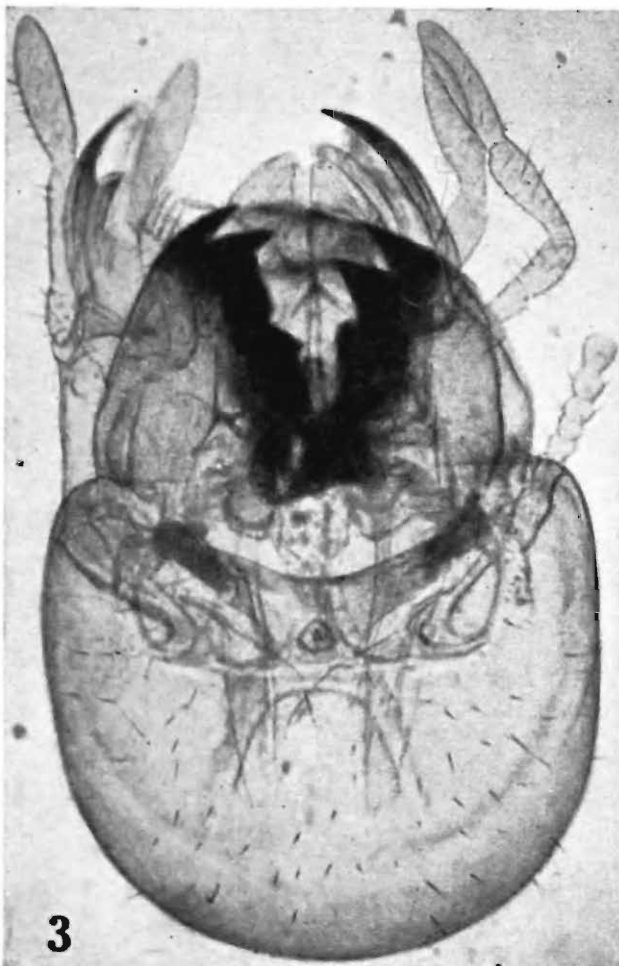
Figs. 1 and 2.—Head in dorsal view, showing nearly symmetrical location of the bristles.

Fig. 3.—Head in dorsal view, showing nearly an irregular arrangement of the bristles.

Fig. 4.—Head in ventral view, showing almost no bristles.



1 mm.



1 mm.

Photomicrographs of the head-capsule of soldier and worker: *Odontotermes obesus* (Rambur).

PLATE 2

Photomicrographs of head-appendages of soldier *Odontotermes obesus* (Rambur).

Fig. 1.—Labrum, with 18 bristles.

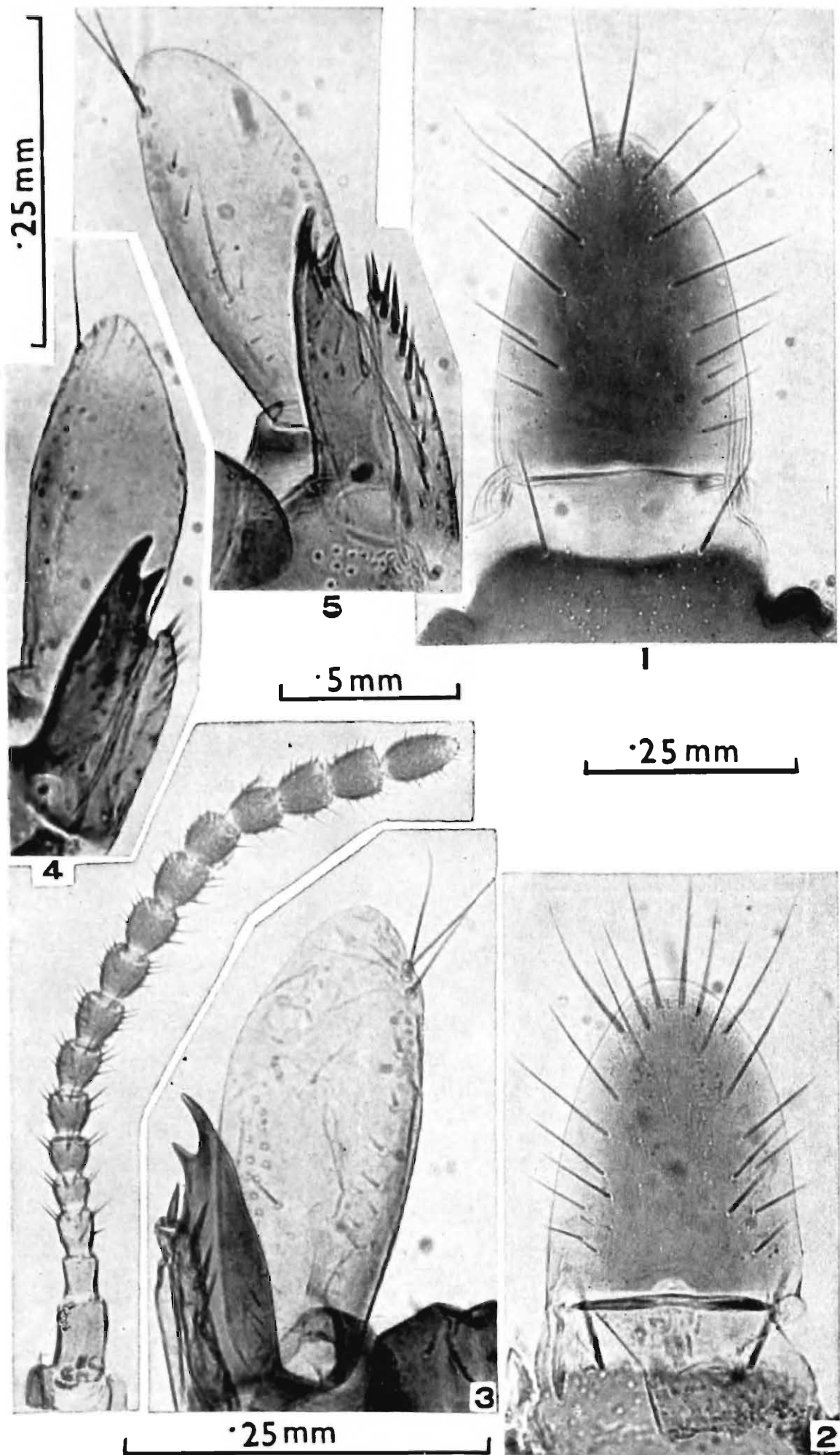
Fig. 2.—Ditto, with 22 bristles.

Fig. 3.—Galea, showing an unusual number of 3 apical bristles ; and part of lacinia.

Fig. 4.—Ditto, showing an unusual number of 3 apical bristles ; and part of lacinia.

Fig. 5.—Ditto, showing the usual number of 2 apical bristles ; and lacinia with 11 large bristles.

Fig. 6.—Antenna, showing naked scape and pedicel without any bristles.



Photomicrographs of the head-appendages of soldier: *Odontotermes obesus* (Rambur)

PLATE 3

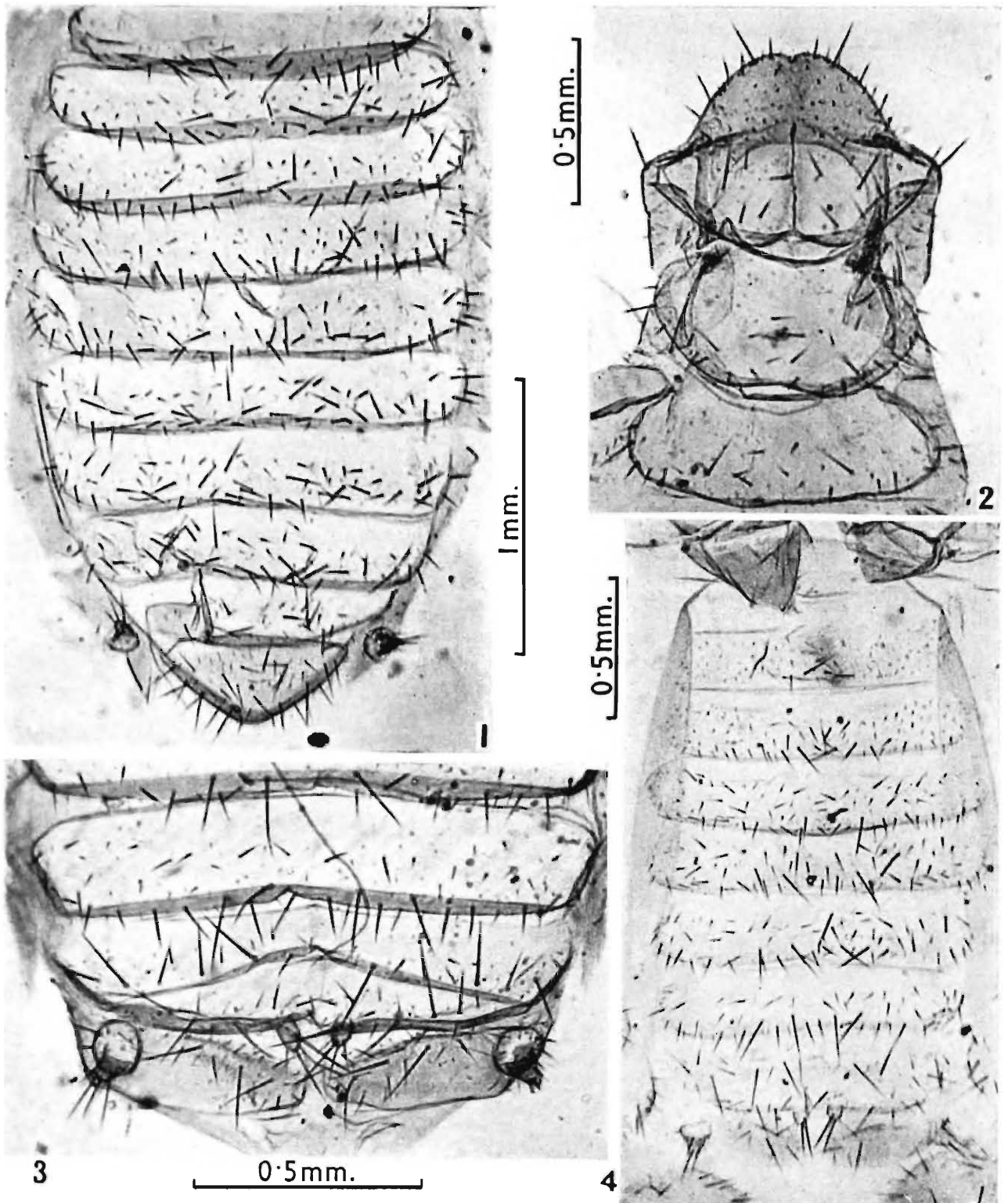
Photomicrographs of thorax and abdomen of soldier *Odontotermes obesus* (Rambur).

Fig. 1.—Abdominal tergites, showing irregular arrangement of bristles.

Fig. 2.—Pro-, meso-, and metanotum, showing regular arrangement of larger anterior, lateral and posterior bristles.

Fig. 3.—Terminal abdominal sternites, highly magnified to show the bristles on subanal styles, anal cerci and podical plates.

Fig. 4.—Abdominal sternites, showing a more or less regular arrangement of larger bristles.



Photomicrographs of the thorax and abdomen of soldier: *Odontotermes obesus* (Rambur).

PLATE 4

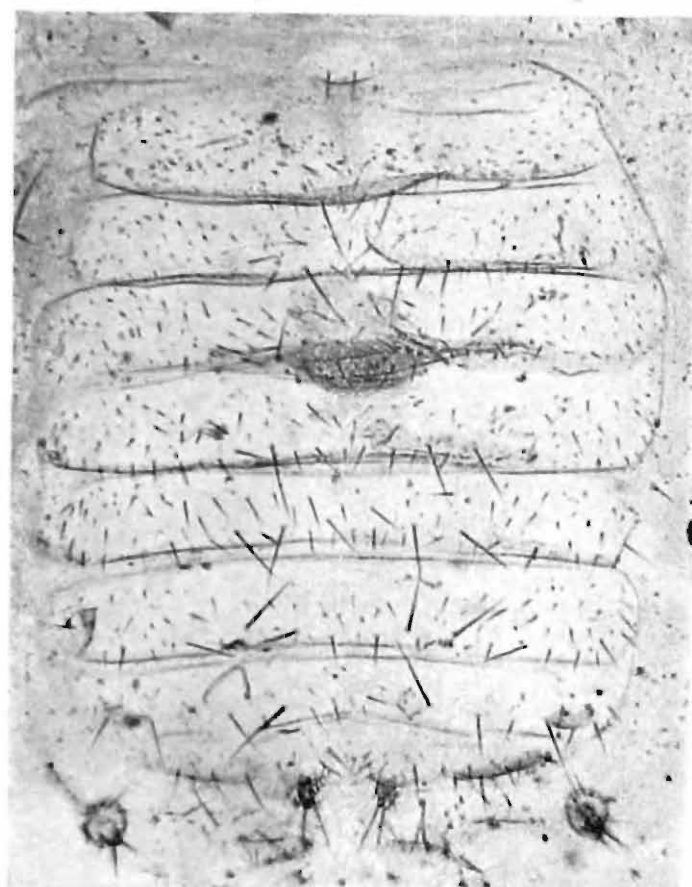
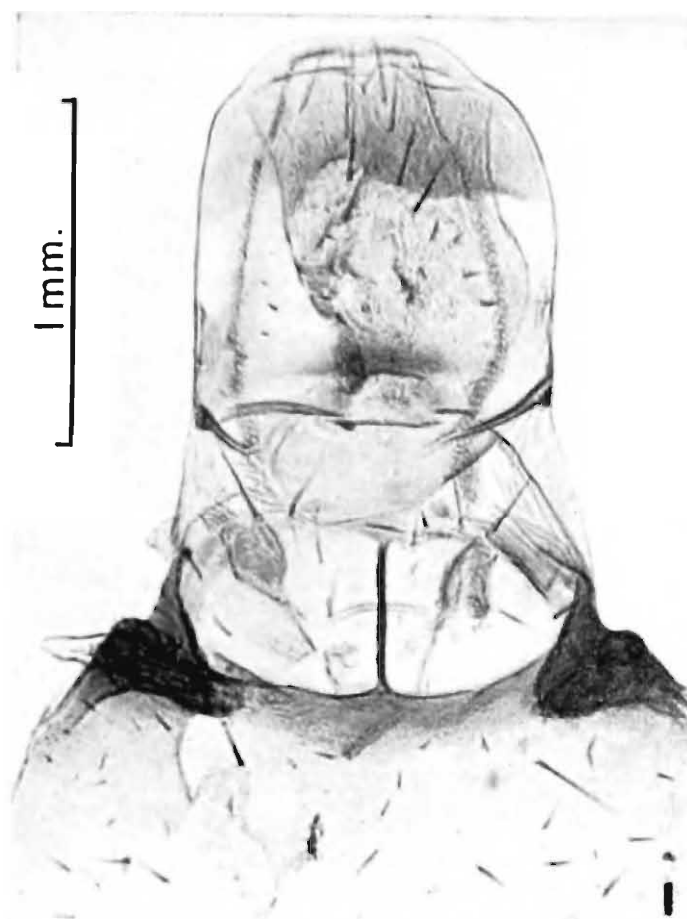
Photomicrographs of labrum, abdominal sternites and thoracic tergites of worker caste of *Odontotermes obesus* (Rambur).

Fig. 1.—Labrum, together with clypeal and frons regions, showing more or less symmetrical arrangement of larger bristles.

Fig. 2.—Labium, showing symmetrical arrangement of larger bristles.

Fig. 3.—Abdominal sternites, showing a more or less regular arrangement of larger bristles.

Fig. 4.—Pro-, meso-, and metanotum, showing regular arrangement of larger anterior, lateral and posterior bristles.



3 1mm.

0.5mm. 4

Photomicrographs of the labrum, labium, etc., of worker: *Odontotermes obesus*. (Rambur).

PLATE 5

Photomicrographs of labium and labrum of alate caste of *Odontotermes obesus* (Rambur).

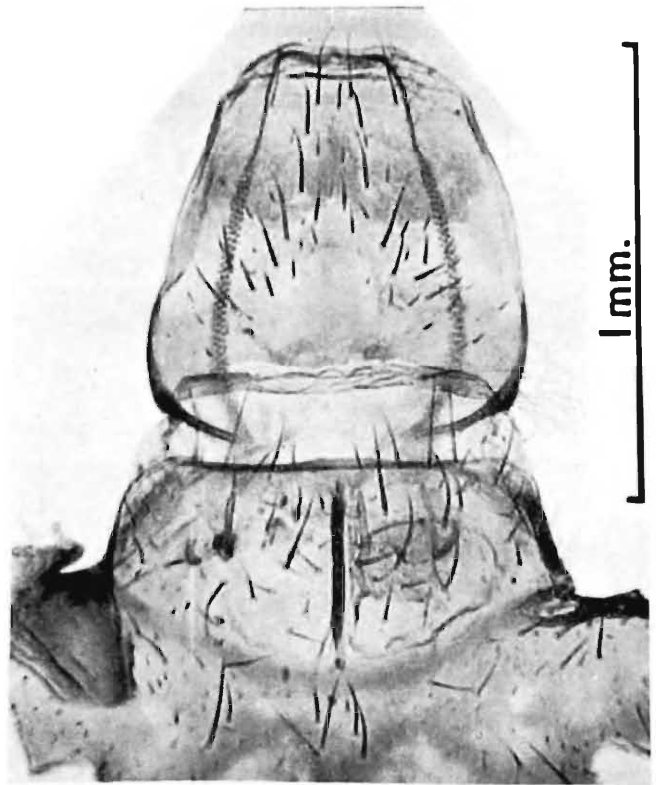
Fig. 1.—Labium, showing a more or less thick growth of irregularly distributed bristles.

Figs. 2 and 3.—Labrum together with clypeal region, showing symmetrical arrangement of apical and other anterior bristles.

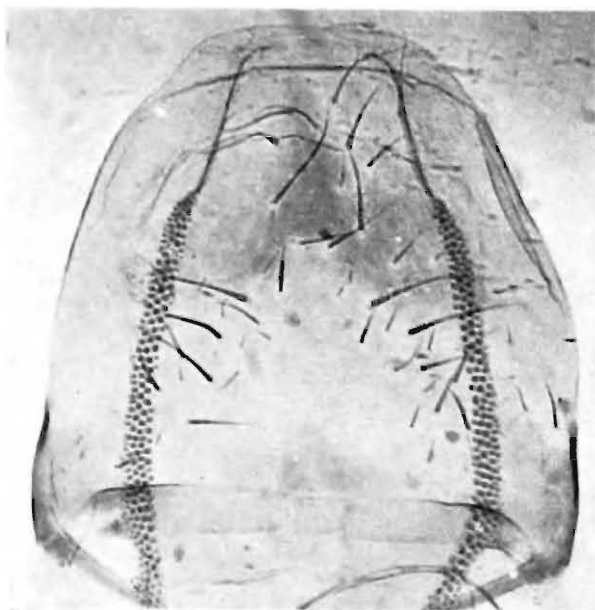
Fig. 3 -Labrum to show an unusual asymmetrical arrangement of apical bristles.



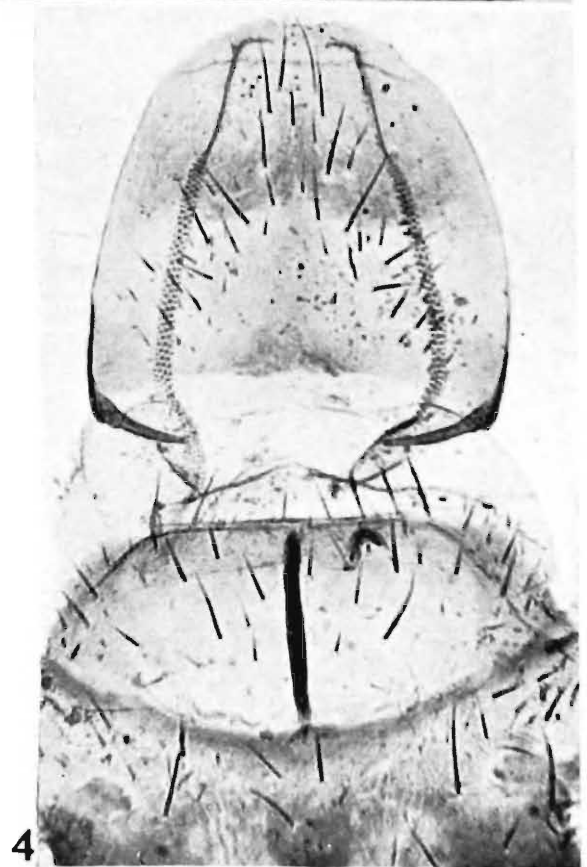
1 mm. 1



2



0.5 mm. 3



4

1 mm.

Photomicrographs of labrum and labium of alate: *Odontotermes obesus* (Rambur).

ON THE GENUS *CTEIPOLIA* STAUDINGER (LEPIDOPTERA,
NOCTUIDAE), WITH DESCRIPTION OF A NEW SPECIES
FROM NEPAL

By

A. P. KAPUR

Zoological Survey of India, Calcutta

(With 3 Text-figures and 1 Plate)

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I—INTRODUCTION

The genus *Cteipolia* Staudinger is of interest from several points of view. It is a denizen of the colder regions of central Asia and of the high altitudes in the Himalayas. The body is densely covered with long hair and is apparently adapted to living under rigorous climatic conditions prevailing there. The coloration, which is generally fuscous and irrorated with black and white, matches that of rocks on which the moths are generally found.

When the genus was first described by Staudinger in 1896, it contained only one species, namely *Cteipolia sacelli* Staudinger, from Issy Kul, in Kargiz, Russian Turkestan. Ten years later, in 1906, Hampson described another species, *Cteipolia acrophila*, from Kashmir, the exact localities being Kardong, 14,000 ft. (4267·20 m.) in Ladak, and Hunza in Gilgit. In 1914, Pungeler described the third species, *Cteipolia isotoma*, from Tien-Shan mountains in Chinese Turkestan. From the published records it would appear that Ladak and Tien-Shan are the most southern and eastern localities, respectively, in the distribution of the genus. Lately, however, the present writer has come across material which extends its distribution to Rohtang Pass, ca. 13,800-14,000 ft. (4206·24—4267·20 m.), and its environs in the Kulu Valley in the Punjab and to Khumbu, ca. 16,000 ft. (4876·80 m.), above the Bhote Kosi Valley, in eastern Nepal. While the material from the former belongs to *C. acrophila* and was collected by me in 1955, the example from the latter appears to belong to an hitherto undescribed species of the genus and was collected by my colleague, Dr. B. Biswas, who visited the area in 1954 as a member of the 'Daily Mail' Himalayan Expedition. The present note is written with a view to record further observations on the genus and to describe the material from eastern Nepal.

I am grateful to Dr. B. Biswas for the opportunity to examine insects collected by him. In 1956, during a brief visit, I examined the material of *Cteipolia* in the British Museum (N.H.), London, and received valuable help from Mr. W.H.T. Tams of the said Museum. My sincere thanks are due to him and to Dr. M. L. Roonwal, Director of this Survey, for showing interest and providing facilities for this piece of work.

II—SYSTEMATIC ACCOUNT

Genus *Cteipolia* Staudinger

1896. *Cteipolia* Staudinger, *Iris*, 9, p. 191.

1906. *Cteipolia*, Hampson, *Catalogue of the Lepidoptera Phalaenae in the British Museum*, 6, p. 421.

The genus *Cteipolia* constitutes a rather aberrant group of species in the subfamily Cucullianae of the family Noctuidae. Its closest ally is *Dasypolia* Guen. from which it is easily distinguished by the rather small and elliptical eyes (Pl. 6, fig. 3), the narrow forewings (Pl. 6, figs. 1-2) and the shortly stalked veins 6 and 7 of the hind-wings (Text-fig. 2).

Hampson, while redescribing the genus *Cteipolia*, divided it into two sections, the first being with veins 3 and 4 of the hind-wings strongly stalked and the second in which these veins arise from the cell (Text-fig. 2). *C. sacelli* was placed by him in the first section and *C. acrophila* in the second. The present writer has not seen an example of *C. isotoma*, but from the description and illustration available this species would appear to belong to first section. The new species, that is being described below as *Cteipolia lithophila*, falls in the second section and is also otherwise fairly closely related to *C. acrophila*. Both these species are further characterised by the presence of hair (hair-scales) which are dispersed among scales all over the dorsal surface of the forewings (Pl. 6, fig. 4). Excepting a few fine hairs at the base of the forewing, this condition is absent in the examples of *C. sacelli* in the British Museum collection. Although more extensive material would be necessary for a better understanding of the phylogenetic relationship between various species, the division of the genus into two sections, as made by Hampson, appears to gain support by the presence of the characteristic hair-scales on the forewing of species included in the second section.

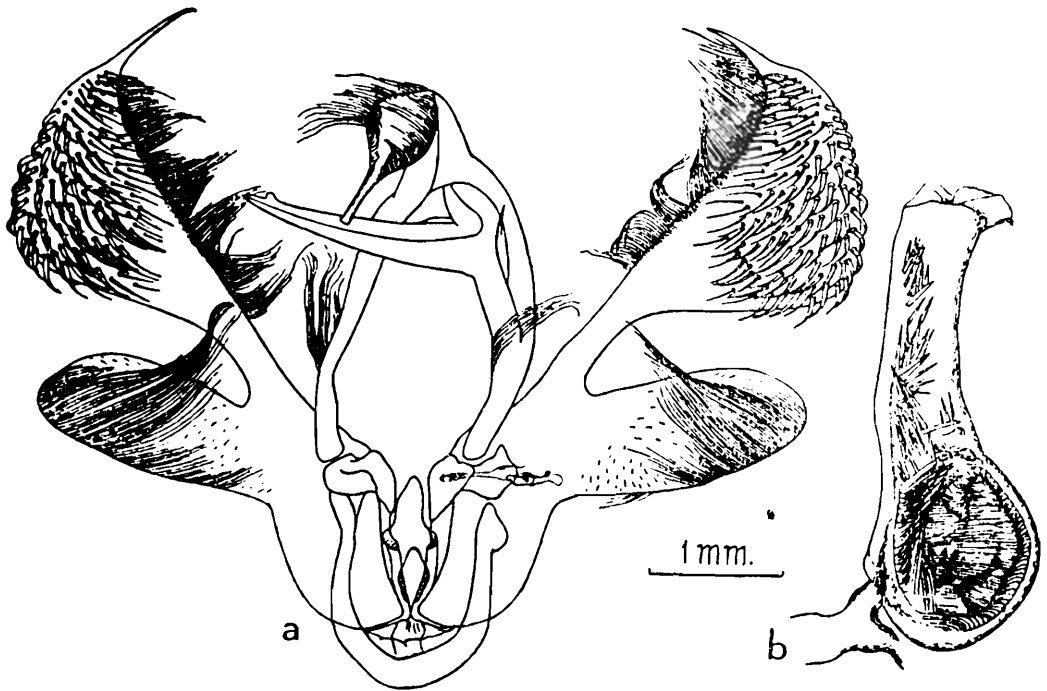
Cteipolia acrophila Hampson

1906. *Cteipolia acrophila* Hampson, *Catalogue of Lepidoptera Phalaenae in the British Museum*, 6, pp. 421-422, fig. 144.

The material, comprising ten examples of the species, before me agrees with the description and type from Kardong, except for minor differences in coloration (Pl. 6, fig. 2) and wing-expanse. While in some examples the sub-basal line of forewing is 'indistinct diffused blackish,' as stated by Hampson, in others it is distinct, diffused blackish in the anterior two-thirds and is incurved below costa and before the basal dash which is also diffused blackish in colour. The orbicular and the reniform are variable in size and outline; the former may be small and roundish to fairly large and oval; the latter may be oblique and narrow to subtriangular with the apex of the triangle pointing towards the costa. In all the female examples before me the reniform is narrow and oblique, while in the males it shows a tendency to increase and become subtriangular. The males are smaller than the females, the expanse of the forewings in each sex being: ♂—25.5 mm. (3 examples), 26.0 mm. (1 ex.); ♀—28.0 mm. (1 ex.); 28.5 mm. (1 ex.); 29.0 mm. (1 ex.); 30.0 mm. (3 exs.). Hampson gave the wing expanse as 24-28 mm.

The genitalia of none of the species of the genus have been described before. A brief description of the genitalia of *C. acrophila* is as follows:—

♂ genitalia (Text-fig. 1) : Tegumen hood-like, laterally sclerotized, rounded at apex, and twice as long as wide. Uncus mostly ovate except



TEXT-FIG. 1.—Male genitalia of *Cteipolia acrophila* Hampson.
(b) Aedeagus (detached).

the distal part, drawn out and truncate at apex ; covered dorsally with long hair situated mostly along the margins. Gnathos like an elongate shelf, gradually tapering towards the apex and about five times as long as broad. Valvae very well developed, produced at the apex to a narrow, elongate point ; sharply bilobed about the middle into the distal cuculus and the proximal sacculus ; the former mostly covered with many stout and sharply pointed setae and long, dense hair, especially near the inner margin ; the sacculus bears fine, long hair which are specially long and dense along the outer margin ; near the inner margin of sacculus and costae arise a pair of small processes. Anellus ovate, moderately sclerotized. Aedeagus stout, bulbous proximally, slightly narrowed distally with many cornuti. Vinculum a little longer than wide, rounded at terminal margin.

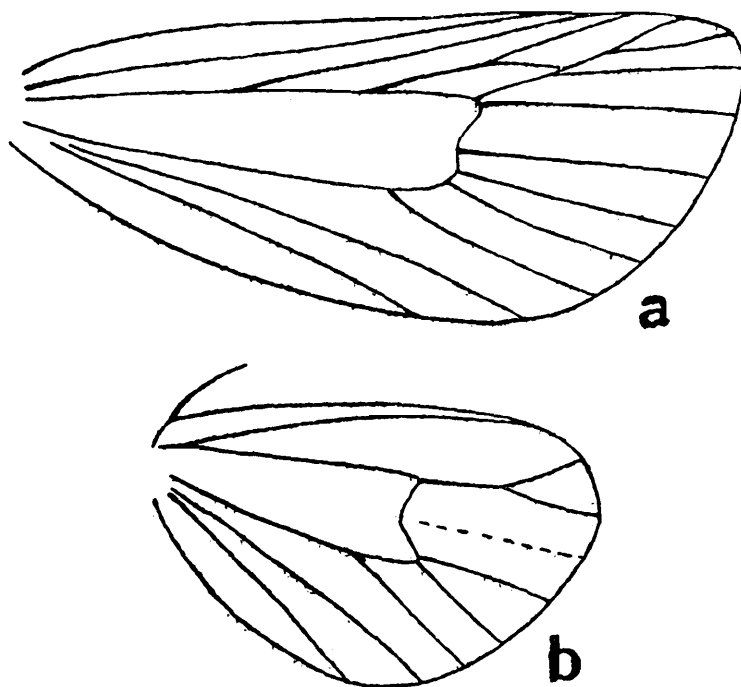
♀ genitalia (Text-fig. 3a) : Ovipositor moderately long ; papillae analis subquadrangular, when viewed from the side and with rather dense and long hair, postapophyses 1.5 mm. long, uniformly narrowed towards apex ; the eighth segment unevenly chitinized dorsally, forming a narrow, medianly incomplete band, and margined posteriorly with short and moderately long hair, wide and strongly chitinized latero—ventrally, especially towards the base where it gives the appearance of two roundish discs, the median part weakly chitinized, antapophyses about two-thirds the length of postapophyses, compressed and gradually tapering towards apex ; sinus bursae moderately wide, ductus bursae long and moderately wide and chitinized at the base but gradually narrowed and weakly chitinized distally, forming a simple loop anterior to corpus bursae, one or two short folds of the wall of ductus bursae visible in the middle ; corpus bursae broadly club-shaped, without signum.

Material.—10 examples as follows :—INDIA, Punjab, Kulu Subdivision (N. W. Himalayas) : Kulu Valley, 2 miles north of Ralha, ca. 11,800 ft. (3,596·64 m.), May 30, 1955, (1 ♀) ; Rohtang Pass, ca. 13,800-14,000 ft. (4,206·24-4,267·20 m.), on grey (granite) rocks surrounded by snow, June 4-5, 1955, (4♂, 4♀), June 19, 1955 (1♀), (all *A. P. Kapur coll.*).

Remarks.—The grey colour of the moths matched perfectly the colour of a few bare rocks on and among which the moths were collected. At the time of collection the Pass was covered by winter snow and it was only in some sheltered nooks in the neighbourhood that the vegetation had begun to sprout. The females contained relatively large, and rounded eggs. The moths, when disturbed, would fly only short distances ; none was seen in copula.

***Cteipolia lithophila*, sp. nov.**

♀. Head, thorax and abdomen fuscous, mixed with white. Antennae with alternate rings of brown and fuscous. Forewing (Pl. 6, fig. 1) with grey and fuscous hair (hair-scales) of moderate length dispersed among scales all over dorsal surface ; colour pattern as follows : whitish, suffused and irrorated with fuscous and brownish fuscous ; an indistinct, posteriorly interrupted basal line with two triangular emarginations externally, the emarginated area being whitish grey, irrorated with fuscous ; basal dash narrow, deep fuscous ; antemedial line indistinct and diffused ; the orbicular and the reniform represented by small whitish spots, each defined by deep fuscous laterally, and indistinctly so anteriorly and posteriorly, shape of the orbicular roundish or oblong, and of the reniform, narrow, elongate and oblique ; postmedian line rather indistinct and diffused especially in the middle and on the whole bent outward but incurved gently near middle of vein 6 (M1) and again at about two-thirds of vein 1b (1A) ; subterminal line white, irrorated with brownish fuscous mostly, rather ill-defined by fuscous suffusion and deeply fuscous irregular patches situated near the costa, in the middle, and near the hind margin, the line being excurved near each patch ; costal margin

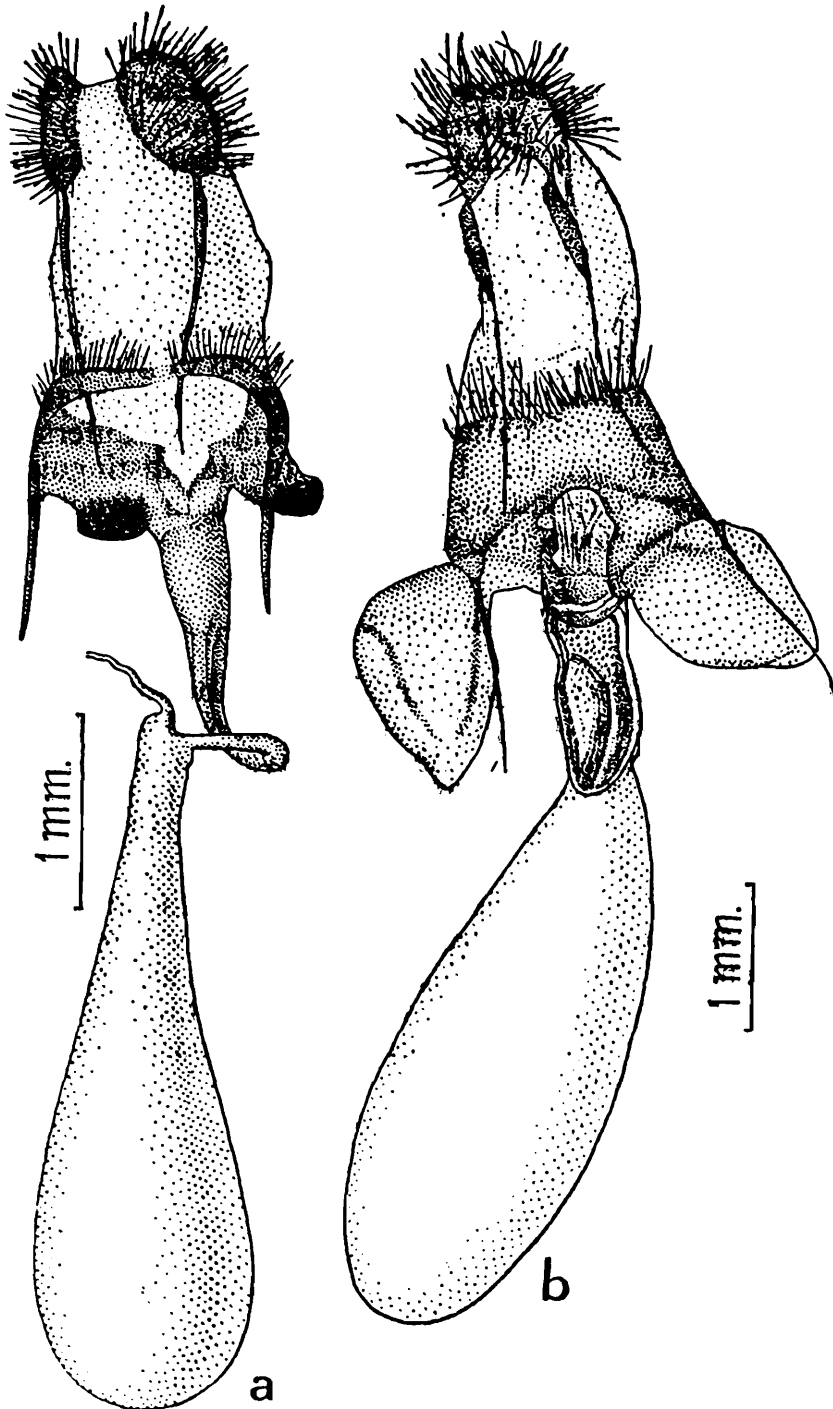


TEXT-FIG. —Venation of the fore-wing and hind-wing of *Cteipolia lithophila*, sp. nov.

with seven white spots including the two near apex or the area of sub-costal line ; terminal line with a series of eight spots of irregular outline; fringe with a median white line. Hind wing semihyaline specially near below the cell, grey, suffused with light fuscous near margins and discal area ; underside with an oblong brownish discal spot and brownish irrorations near costa and along the external margin.

Venation (Text-fig. 2) typical of the genus and with veins 3 and 4 of the hind-wing arising from angle of the cell, as in *C. acrophila*.

♀ genitalia (Text-fig. 3 b) : Ovipositor moderately long, papillae anales broadly spatulate when viewed from the side, with long hair



TEXT-FIG. 3.—Female genitalia of *Cteipolia acrophila* and *C. lithophila*.

(a). Female genitalia of *Cteipolia acrophila* Hampson. (b). The same of (*C. lithophila*, sp. nov.

all over ; postapophyses about 2 mm. long, compressed laterally in the proximal one-third and very narrow for the remainder of the length ; eighth segment rather broadly and uniformly chitinized all round, with antapophyses slender and about 1.5 mm. long and ventrally with a subtriangular, sclerotized area on either side ; ostium bursae and ductus bursae wide, the latter rather short, and showing a number of prominently chitinized, sculptured folds ; corpus bursae elongate oval, without signum. The female genitalia differ from those of *C. acrophila* in the shape and structure of bursae copulatrix, especially that of ostium and ductus bursae which are narrow, long, coiled and unsculptured in *acrophila*.

Wing expanse (♀) : 33 mm.

Type—NEPAL : Khumbu, ca. 16,000 ft. (4,876.80 m.) above Marlung, (27°53'N, 80°40'E), Bhote Kosi Valley, eastern Nepal, 9. III. 1954 (B. Biswas 'Daily Mail' Himalayan Expedition, 1954). A single female (genitalia mounted on slide), in the Zoological Survey of India, Calcutta. Reg. No. 224/H10.

Remarks.—The species is closely allied to *C. acrophila* in that veins 3 and 4 of the hind-wing arise from angle of the cell instead of being stalked, as in *C. sacelli*, and in the presence of hair (hair-scales) dispersed all over the dorsal surface of the forewings ; in respect of general coloration it may be stated that *lithophila* is more bright grey compared to *acrophila*, which is rather dull grey ; the pattern of the wings also differs considerably in regard to several details. It may be further distinguished from *acrophila* by its larger size and by the differences in structure of the female genitalia, as described above.

III.—SUMMARY

Brief notes are given on the geographical distribution and taxonomy of the species of the genus *Cteipolia* Staudinger, which inhabit central Asia and the high altitudes in the Himalayas. *Cteipolia acrophila* Hampson is recorded from Rohtang Pass, ca. 13,800—14,000 ft. (4206.24—4267.20 m.) and its environs 11,800 ft. (3596.64 m.) in the Kulu Valley, Punjab. A new species from Khumbu, ca. 16,000 ft. (4876.80, m.), in eastern Nepal is described under the name *Cteipolia lithophila*. Records from these localities considerably extend the distribution of the genus in the southern and eastern directions. Some field observations and further descriptions, including those of genitalia, are recorded for *C. acrophila*, and a comparison made between it and *C. lithophila*, where possible.

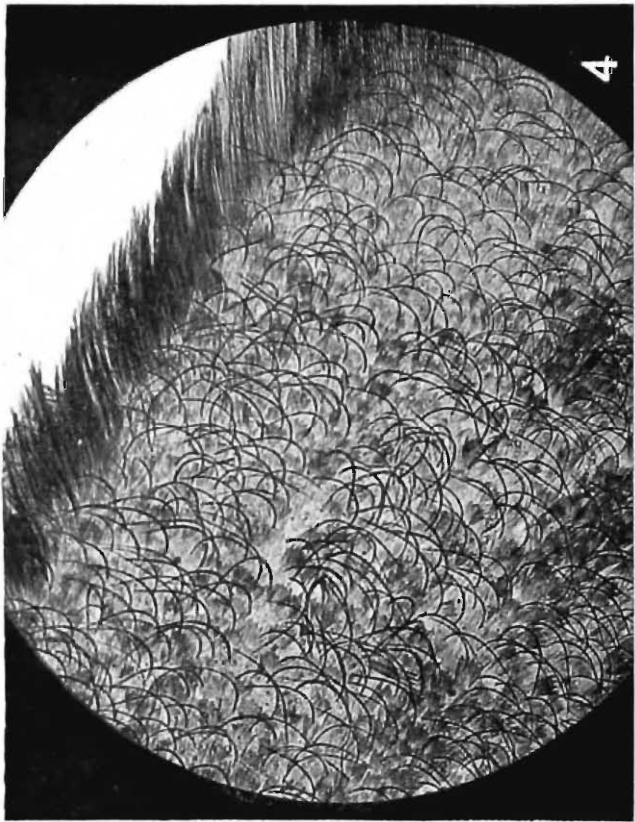
PLATE 6

Fig. 1.—Fore- and hind-wings of ♀ *Cteipolia lithophila*, sp. nov.

Fig. 2.—The same, of ♂ *C. acrophila*, Hampson.

Fig. 3.—Head of *C. acrophila*, showing elliptical eyes, atrophied proboscis, and correct palpi.

Fig. 4.—Part of the fore-wing enlarged to show hair dispersed among scales on the dorsal surface.



SOME FIELD OBSERVATIONS ON THE HABITS OF THE CAPPED LANGUR AND THE BARKING DEER IN THE GARO HILLS, ASSAM

By

H. KHAJURIA

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I—INTRODUCTION

During January-February, 1957, when the writer was engaged in field work around Rongrengiri in the Garo Hills, Assam, some hitherto unrecorded habits of the Capped Langur, *Presbytis pileatus pileatus* (Blyth), and the Barking Deer, *Muntiacus muntjak vaginalis* (Boddaert) were observed by him. They are described below.

II—THE CAPPED LANGUR

The only good account of the habits of this langur was given by McCann (1933, p. 626) which was utilized by Pocock (1939, p. 123). The following observations, although differing in details from those of McCann, are not meant to contradict them, because his account relates to the animals in the Naga Hills which may belong to the race *P. pileatus durga* Wroughton.

The capped langur was very common around Rongrengiri. The young ones observed were quite grown up, with perfect adult coloration. They may have been born in autumn as is the case with some other species of the genus, such as *P. geei* Khajuria. More than one adult males were collected from a single troop. The number of individuals composing a troop may vary from about six to about a dozen.

Once the writer with some friends and a good-sized well-fed pariah dog followed a large troop in a thick forest. On noticing the intruders the animals bounded through the forest uttering their usual barks. When, however, two individuals were shot down and the troop was further pursued, an adult male suddenly started descending to the lower branches ; and, despite the continuous yelling of the dog and the presence of two armed men some thirty metres away, it jumped to the ground. In so

doing it fractured its femur and had limped only a few metres when it was overtaken by the dog. The fight which ensued was interesting to watch as the langur even with its fractured femur was more than a match for the dog which was so fiercely bitten that it had to run for its life many times. By continuously encouraging the dog, the fight was, however, continued for about fifteen minutes and was then ended by shooting down the langur. The anecdote shows that, although avoiding human beings, the langur, at least the adult male, is by no means a coward or unduly shy animal. Like many other members of the monkey tribe, it may try to escape from the persistent danger by coming down to the ground and hiding itself in the undergrowth (*cf.* McCann *loc. cit.*).

III—THE BARKING DEER

The barking deer was the most common hoofed mammal of the area. The writer was greatly impressed by the gallantry of two adult males whose behaviour is recorded below.

One night at about 9-30 P.M., an adult male was spotted with the light of an electric torch. On being pursued, it entered a thick patch of forest and started barking which it continued even when fully aware of the writer's presence only about five metres away. When a nearer approach was attempted, it produced a heavy thumping sound by striking its front hoofs on the ground and moved a few metres away. It continued barking and each time the writer moved closer, it produced the same thumping sound and shifted by only a few metres to a new position. The animal did not mind a distance of 4 to 5 metres from the intruder. The chase was given up after about ten minutes.

On another occasion at dusk, an adult male at once hurried to an open spot from where a shot had been fired at a bird and where the writer had made some movements to pick up the bird. It was feeding on leaves dropped by a troop of the rhesus monkey some 50 metres away but had remained unnoticed. The writer could see it coming very inquisitively but because of some trees in between, it did not spot him until it was not more than 6 metres away. It then at once stood motionless and attentive with its neck stretched forward and downward and did not move even when the gun was pointed at it and kept so for a minute or so. It was then reluctantly shot down.

Since the animals, because of continuous poaching by the local people and frequent use of firearms by the writer's party for about a month, were quite scared, their behaviour as given above appears interesting. The boldness of these males does not appear to be due to the rutting season, which seemed to have passed, as a female supposed to have been killed by a leopard carried a well developed foetus and because all the animals observed were met with singly.

IV—REFERENCES

- MCCANN, C. 1933. Observations on some of the Indian langurs. *J. Bombay nat. Hist. Soc.*, Bombay, 36, pp. 618-628, 2 pls.
- POCOCK, R. I. 1939. *Fauna Brit. India, Mammalia*, 1, pp. xxxiii+463, 31 pls., 1 map.—London (Taylor and Francis).

FURTHER OBSERVATIONS ON THE GEE'S LANGUR, *PRESBYTIS GEEI* KHAJURIA¹, WITH REMARKS ON THE CLASSIFICATION OF INDIAN COLOBIDAE (MAMMALIA PRIMATES)

By

H. KHAJURIA

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(With 2 Text-figures and 1 Plate)

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I—INTRODUCTION

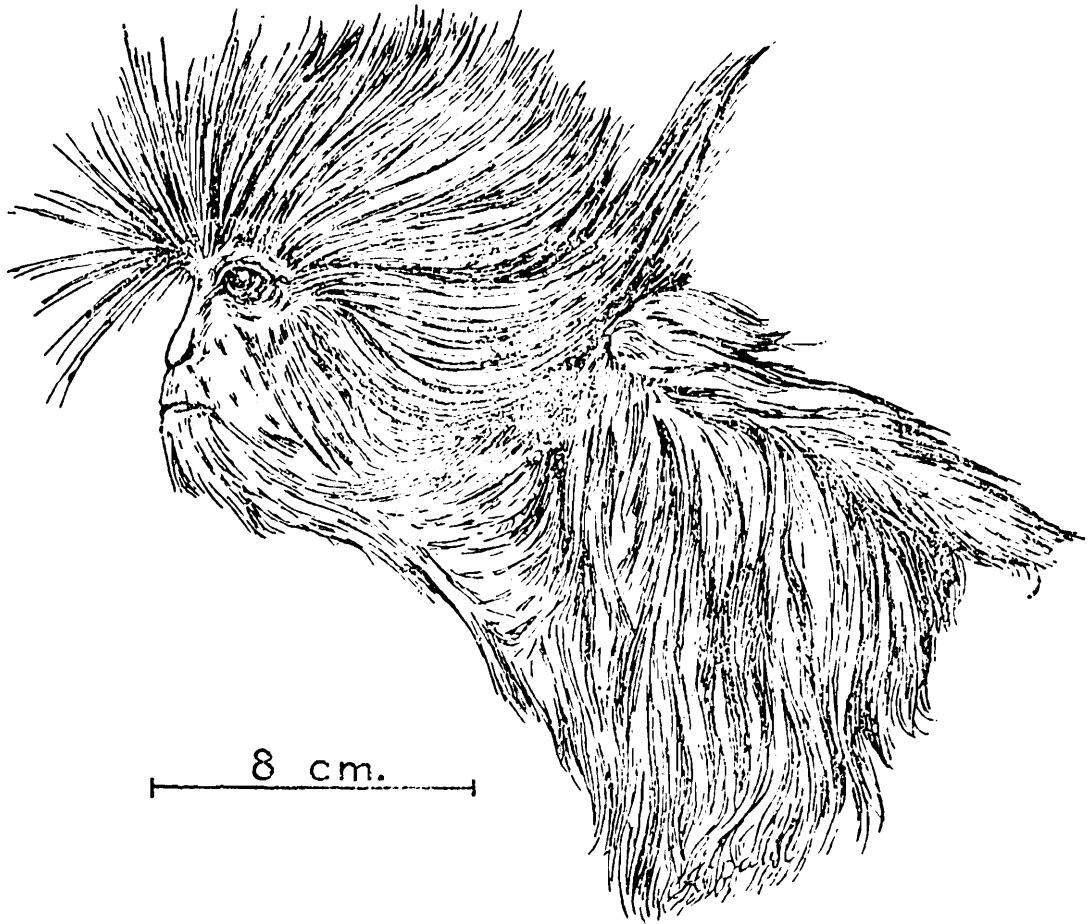
The present study embodies certain observations on the morphology, affinities, distribution and habits of the Gee's Langur, *Presbytis geei* Khajuria, from Assam. Of special interest is the information on the colour of the newly born young and that of the adult in winter obtained through various sources and especially by a fresh collection of topotypes made by Mr. R. V. Sherard of the Zoological Survey of India early in December, 1955. Studies on the external genitalia and osteometry were also undertaken and proved to be quite instructive. In the light of these investigations a further elucidation of the affinities of the species has been offered. Some suggestions on the subgeneric classification of Indian Colobidae have been given on the basis of the characteristics of scrotal sacs—an important character which has hitherto been overlooked.

The writer is indebted to the Forest Range Officer, Raimona for help rendered in various ways during the study and to Drs. M. L. Roonwal and B. Biswas of this department for their useful suggestions.

¹ The name *Presbytis geei* (Gee, 1956) is here considered as *nomen nudum*.

II—MORPHOLOGY

The distinguishing characters of the pelage of *P. geei*, which were given in the original description are now illustrated (Text-fig. 1).



TEXT-FIG. 1.—Head and neck of the holotype of *Presbytis geei* seen in profile.

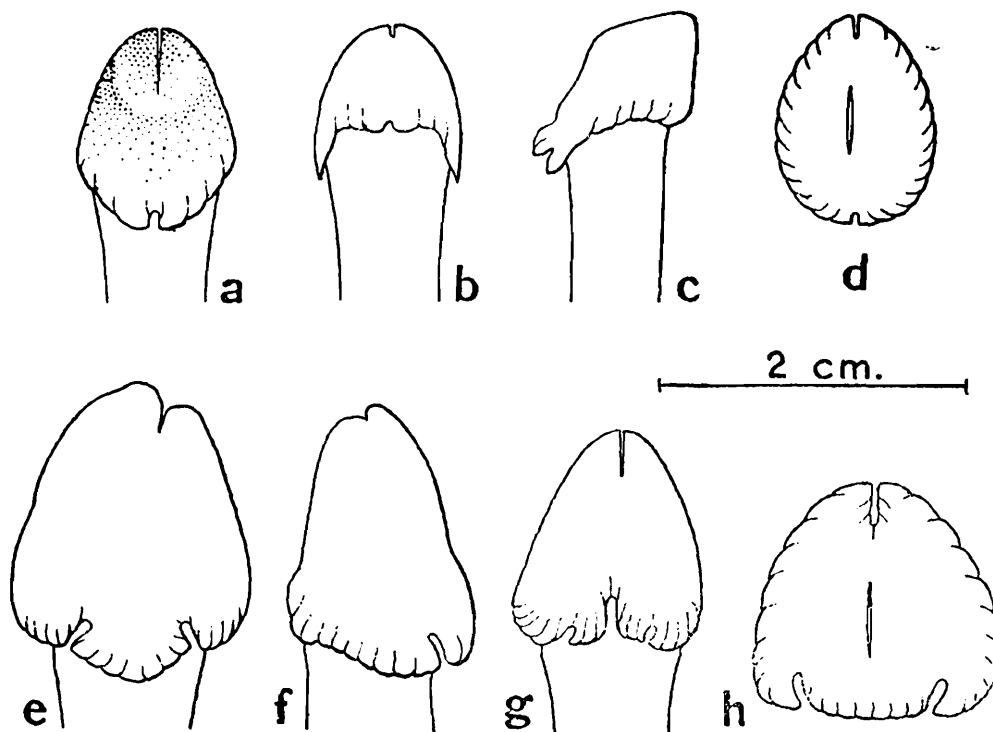
Coloration.—In the original description (Khajuria, 1956a) the general colour of *P. geei* has been recorded as creamy white on the dorsal aspect. Gee (1956), however, asserts that the colour, as observed by him in November, appears 'bright golden' in sunlight. In fact, the species is known locally to many visitors as the 'golden langur'. In view of the different observations regarding the coloration, eight adult topotypes were collected in December, 1955 by Mr. R. V. Sherard and these reveal that *P. geei* has, in fact, two colour forms : golden red in winter and creamy white in summer.

In these specimens the ventral and lateral sides of the head, the neck and the trunk and the inner sides of the limbs show various shades of orange or golden red with traces of the same coloration on the upper parts where at least the bases of hairs have become orange red. On the dorsal side the posterior part of the trunk is much redder. The parts least affected by redness up to the time of the collection are the crown, the distal parts of the tail, and the outer upper parts of the legs and the arms. Isolated patches of red may be present on various parts of the body, including the fingers and the toes. In younger individuals the colour is paler. The hairs below the callosities are paler than those around.

Pocock (1928, 1934) based his classification of langurs on the coloration of the newly born young ones. Gee (1956) observed that in *P.*

geei the young ones in November appeared a little paler than the adults ('bright golden'). The Forest Range Officer, Raimona, informs me (*in litt.*) that a few weeks old infant captured in early November is entirely white. Mr. Sherard collected three young ones in December, 1955, two of which appear to be about six weeks old (with the second milk premolar fully erupted) and the third less than four weeks old (with second milk premolar in the course of eruption). The colour of the two older infants is white or creamy white, with some cream on the dorsal surface and light orange on the sides of the neck, but the younger infant is 'golden red' all over except the ventral aspects, the inner sides of the limbs, the hands and the feet and the crown which are much paler, the head region being almost white. Under the circumstances, nothing final can be said about the colour of the infant just after birth or the changes that it may undergo subsequently, but as far as our present knowledge goes it may be described as typically white.

External genitalia.—The glans of *P. geei* principally differs from that of *P. p. pileatus* (Blyth) (Text-fig. 2) in being obliquely truncated in front (with major part of terminal slit on the dorsal side), oval in cross-section



TEXT-FIG. 2.—Glans of *Presbytis geei* and *Presbytis pileatus pileatus*.

(a, b and c). Dorsal, ventral, and lateral views of the glans of *Presbytis geei*. (d) Cross-section of the same. (e, f and g). dorsal, ventral and lateral views of the glans of *Presbytis pileatus pileatus*. (h). Cross-section of the same.

and in having much deeper excision on the postero-ventral border. These observations are based on freshly killed specimens, a single adult of *P. geei* and two adults of *P. p. pileatus*. In the latter some minor variations were observed but they do not cover the description given by Pocock (1925, p. 1564) which probably relates to some other sub-species of *P. pileatus*. As in *P. pileatus*, the testes do not descend into a pendulous scrotum in *P. geei*.

The external genitalia of the female are like those of *P. pileatus* and *P. obscurus* (Reid) as figured by Pocock (1925, p. 1552).

Skeleton.—The skull (Pl. 7) resembles that of *P. pileatus*, but the proportions of some other skeletal parts show interesting resemblances with the species of subgenus *Presbytis* (status *vide* Khajuria, 1956b). A comparison of *P. geei* with the species of subgenera *Trachypithecus* and *Presbytis* based on the data provided by Washburn (1942, 1944) is presented in Table 1. Washburn showed that on the basis of the proportions of postcranial skeleton the two groups can easily be distinguished. It will be seen that *P. geei* resembles the species of subgenus *Trachypithecus* in intermembral, femoro-humeral and prognathism indices, but in the case of brachial index it is closer to the subgenus *Presbytis*. In the palatal length given as percentage of basion-nasion length it shows overlapping with both the subgenera. It is interesting to note that except the brachial index which is uniform in both the young and the adult, all other indices in the case of the young ones of *P. geei* fall within the range of the subgenus *Presbytis*.

TABLE 1.—A comparison between *Presbytis geei* and the species of subgenera *Trachypithecus* and *Presbytis* on the basis of the proportions of some skeletal parts.†

Indices	<i>P. geei</i>	<i>Trachypithecus</i>	<i>Presbytis</i>
<i>Brachial index</i>	96.6-100.9 (9 specimens)	106-119 (52 specimens ; 6 species)	91-101 (52 specimens : 8 species)
<i>Intermembral index</i>	77.1-79.5 (7 ad. & s.ad.) 82.3-84.7 (2 juv.)	74-80 ,,	80-85 ,,
<i>Femoro-humeral index</i>	72.7-75.7 (7 ad. & s.ad.) 80.0-81.0 (2 juv.)	66-74 ,,	75-82 ,,
<i>Prognathism</i>	117.8-123.7 (3 ♂) 111.7-119.8 (7 ♀) 109.3 (1 s. ad. ♂) 99.7-107.0 (2 juv.)	115-125,, (♂) 111-122 (♀)	100-115,, (♂) 103-111 (♀)
Palate length in percentage of basion-nasion length.	60.7-65.1 (64.1)* (3 ♂) 54.1-62.0 (58.9) (7 ♀, 57.1 (1 s.ad. ♂) 48.7-56.3 (2 juv.)	63-68 (66) (12 ♂, 1 species 61-65 (63) (15 ♀, 1 speci- es)	54-61 (58) (19 ♂, 1 species). 55-58 (56 ♂ (17 ♀, 1 species).

† The measurements and indices are taken after Mollison (1911) and Washburn (1944), respectively.

*Figures in parentheses indicate mean values.

III—AFFINITIES

That *P. geei* is assignable to the subgenus *Trachypithecus* is supported by the characters of the skull, external genitalia, absence of sharply defined whiteness of the inner side of the thigh and the shin, the presence of paler hairs beneath the callosities, and by most of the osteometric data given in Table 1. The colour of the infant on which Pocock based his classification of langurs is, however, confusing as discussed earlier in this article, but the kinship with the species of subgenus *Trachypithecus* is indicated by the possible presence of partially golden form(s) in infants.

The resemblances of *P. geei* with the species of the subgenus *Presbytis* are of much less importance but are shown to some extent by some osteometric data, typically white colour of the infant, ill-defined half-whorl on the forehead and the redness of the adults. *P. geei* is, therefore, here regarded as a representative of the subgenus *Trachypithecus* which has retained a few characters of the possibly ancestral subgenus *Presbytis*.

Of all the species of the subgenus *Trachypithecus*, *P. geei* is, on account of its wholly black face, shortened hair on fore-nape, red ventral aspects and general build of the skull, closest to *P. pileatus*, but is, at the same time, sufficiently distinct from it to deserve a full specific rank. Important distinguishing characters of the two species are given in Table 2.

Table 2.—Important distinguishing characters of *Presbytis geei* and *Presbytis pileatus*.

<i>Presbytis geei</i>	<i>P. resbytis pileatus</i>
1. Newly born young typically white	1. Newly born young typically golden red.
2. Hair on the crown not forming a mat.	2. Hair on the crown forming a mat.
3. Hair on the temples not shorter than that on the crown.	3. Hair on the temples shorter than that on the crown.
4. Seasonal colour changes.	4. No seasonal colour change, as far as known.
5. An ill-defined half-whorl on forehead.	5. No whorl on forehead.
6. Crown and distal part of tail much paler than adjoining parts.	6. Crown and distal part of tail are much darker than adjoining parts.
7. Brachial index similar to that of subgenus <i>Presbytis</i> .	7. Brachial index similar to that of the subgenus <i>Trachypithecus</i> .
8. Generally silent and timid in demeanour.	8. Generally noisy and aggressive in demeanour.
9. Glans obliquely truncated in front, oval in cross-section and with deep excision on postero-ventral border in one adult studied.	9. Glans without characters given under <i>P. geei</i> in two adults of nominate subspecies studied.

IV—DISTRIBUTION

Gee (1956) has supplied detailed information about the distribution of this species. Some animal dealers have reported its occurrence near Tura, Garo Hills, Assam, along with *P. pileatus*. In January-February, 1957, the writer collected zoological specimens at Rongren-giri about thirty-five miles east of Tura. Although *P. pileatus* was common, *P. geei* was not met with.

V—HABITS

The following information regarding the habits of this species has not been recorded before :—

The young ones are born mostly in October and November. The young, when captured, is very docile and accepts food immediately after capture. At times it emits a hissing and whistling sound. A young captured by the Range Officer, Raimona (Goalpara Dist.), is progressing well as a pet. The silent and non-aggressive habits of the adults have already been reported upon (Khajuria, 1956a) ; but a troop met with at Raimona during a recent visit showed different behaviour, apparently due to molestation. The adult males on noticing the observer began to emit a loud quickly repeated short coughing sound which was preceded by a sound resembling *oon-oon* often uttered by sick persons. Some females also appeared to utter a similar sound but at a higher pitch. The animals jumped from tree to tree in great restlessness, the females and immature individuals often grouping themselves around the adult males apparently for protection.

A troop may contain more than one adult males. The animal occurs in the same area as *Macaca mulatta* Zimmermann, but the two species keep apart from each other.

VI—REMARKS ON THE CLASSIFICATION OF INDIAN COLOBIDAE

With the inclusion of *P. geei* with typically white young ones under the subgenus *Trachypithecus*, the colour of the infant ceases to be a good diagnostic character between this subgenus and the subgenus *Presbytis*. However, it has been pointed out that there are no pendulous scrotal sacs in *P. geei*. An examination of the specimens in the collection of the Zoological Survey of India shows that they are also absent in *P. pileatus* (also see McCann, 1934, p. 626), *P. phayrei* (Blyth), *P. obscurus* (Reid), and *P. cristatus* Raffles, the species by which the subgenus *Trachypithecus* is represented in the collection. It is very likely that this character may occur in all the species naturally referable to the subgenus *Trachypithecus* and turn out to be its most important distinguishing character. The scrotal sacs are reported to be present in the subgenera *Semnopithecus* and *Kasi* (vide McCann, 1934) and are also visible in the made up skins of *P. melalophos* Raffles and to some extent in those of *P. rubicundus* Müller, the only representatives of the subgenus *Presbytis* available to me. The use of this character in the subgeneric classification of Indian Colobidae is, therefore, recommended.

VII—SUMMARY

Some hitherto unrecorded observations on coloration, external genitalia, osteometry, affinities, distribution and habits of the Gee's langur, *Presbytis geei*, have been given. The species has been found to undergo interesting seasonal changes in coloration. The important character of the colour of the infant could not be fully ascertained, but it can be described as typically white. Although showing some resemblances with the species of the subgenus *Presbytis*, *P. geei* is assignable to the subgenus *Trachypithecus*.

The use of the character of scrotum is recommended for the first time in the subgeneric classification of Indian langurs.

VIII—REFERENCES

- GEE, E. P. 1956. A new species of langur from Assam.—*J. Bombay nat. Hist. Soc.*, Bombay, **53**, pp. 252-254.
- KHAJURIA, H. 1956a. A new langur (Primates : Colobidae) from Goalpara District, Assam.—*Ann. Mag. nat. Hist.*, London, (12) **9**, pp. 86-88.
- KHAJURIA, H. 1956b. Catalogue of mammals in the Indian Museum (Zool. Surv.). III. Primates : Colobidae.—*Rec. Indian Mus.*, Delhi, **52**, pp. 195-220, 1 pl.
- MCCANN, C. 1934. Observations on some of the Indian langurs.—*J. Bombay nat. Hist. Soc.*, Bombay, **36**, pp. 618-628, 2 pls.
- MOLLISON, T. 1911. Die Körperproportionen der Primaten.—*Morph. Jb.*, Leipzig, **42**, pp. 79-304.
- POCOCK, R. I. 1925. The external characters of the Catarrhine monkeys and apes.—*Proc. Zool. Soc. Lond.*, London, pp. 1479-1579.
- POCOCK, R. I. 1928. The langurs or leaf monkeys of British India.—*J. Bombay nat. Hist. Soc.*, Bombay, **32**, pp. 473-504 & 660-677.
- POCOCK, R. I. 1934. The monkeys of the genera *Pithecus* (or *Presbytis*) and *Pygathrix* found to the east of the Bay of Bengal.—*Proc. Zool. Soc. Lond.*, London, pp. 895-896, 2 pls.
- WASHBURN, S. 1942. Skeletal proportions of adult langurs and macaques.—*Hum. Biol.*, Baltimore, **14**, pp. 444-472.
- WASHBURN, S. 1944. The genera of Malaysian langurs.—*J. Mammal.*, Baltimore, **25**, pp. 289-299.

PLATE 7

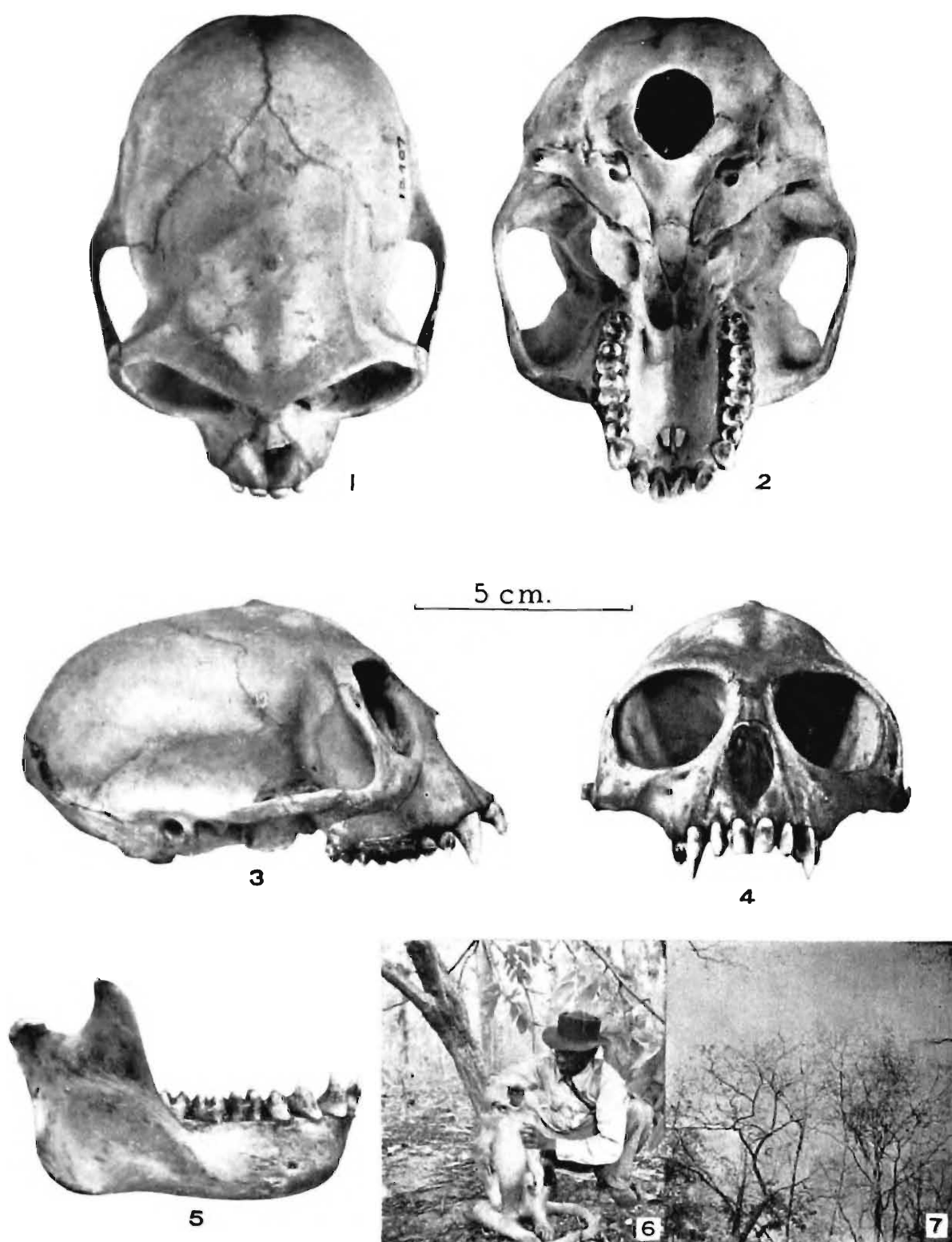
Note.—The scale given on the plate does not apply to Figs. 6 and 7.

Figs. 1—4.—Dorsal, ventral, lateral and front views of the skull of the holotype of *Presbytis geei*.

Fig. 5.—Lower jaw of *Presbytis geei*.

Fig. 6.—A freshly killed specimen of *Presbytis geei* in its original environment.

Fig. 7.—The habitat of *Presbytis geei* in April.



Skull, lower jaw, etc., of *Presbytis geeli*.

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34, Chittaranjan Avenue,
Calcutta-12.

Officers and Scientific & Technical Sections as on 30th June, 1960.

Director	Dr. M. L. Roonwal
Deputy Directors	Dr. M. S. Mani
	Dr. A. P. Kapur
Administrative Officer	Shri D. G. Mookerjee

Scientific Divisions and Sections

I. Invertebrate Division

	(Superintending Zoologist	Dr. B. S. Chauhan)
1. Protozoology Section	Zoologist : Vacant	Dr. B. S. Chauhan (Officer-in-Charge)
2. Helminthology Section	Zoologist : Vacant	
	Asstt. Zoologist : Shri S. Biswas*	
3. General Non-Chordata Section	Zoologist : Vacant	Shri K. S. Pradhan (Officer-in-Charge)
	Asstt. Zoologist : Shri T. D. Soota	
4. Crustacea Section	Zoologist : Vacant	Dr. K. K. Tiwari (Officer-in-Charge)
	Asstt. Zoologist : Shri G. Ramakrishna	
5. Mollusca Section	Zoologist : Dr. H. C. Ray	Dr. H. C. Ray (Officer-in-Charge)
	Asstt. Zoologist : Shri A. S. Rajagopalaingar*	

II. Entomology Division

	(Superintending Zoologist	Vacant)
1. Insect Section	Zoologist : Shri K. S. Pradhan	Dr. A. P. Kapur (Officer-in-Charge)
	Zoologist : Vacant	
	Asstt. Zoologist : Shri G. Mathai	
	Asstt. Zoologist : Shri T. G. Vazirani*	
	Asstt. Zoologist : Vacant	
2. Arachnida Section	Asstt. Zoologist : Shri B. K. Tikader	

* Indicates Officers transferred to Regional Stations.

- 3. Termite Research Unit** Jr. Research Officer : Shri
O. B. Chhotani

III. Lower Chordata Division

(Superintending Zoologist .		Vacant)
1. Marine Fish Section	Zoologist : Dr. A. G. K. Menon	Dr. A. G. K. Menon (Officer-in-Charge)
2. Freshwater Fish Section.	Zoologist : Vacant	
	Asstt. Zoologist : Shri M. A. S. Menon	
3. Protochordata & Amphibia Section	Zoologist : Vacant	Shri M. N. Acharji (Officer-in-Charge)

IV. Higher Chordata Division

(Superintending Zoologist		Dr. K. K. Tiwari)
1. Reptilia Section	Zoologist : Shri M. N. Acharji	Shri M. N. Acharji (Officer-in-Charge)
	Asstt. Zoologist : Km. M. B. Kripalani	
2. Bird Section	Zoologist : Dr. B. Biswas	Dr. B. Biswas (Officer-in-Charge)
3. Mammal & Osteology Section	Zoologist : Vacant	
	Asstt. Zoologist : Vacant.	
	Asstt. Zoologist : Shri H. Khajuria*	
4. Prehistoric Zoology Section	Vertebrate Zoologist : Shri Bhola Nath	Shri Bhola Nath (Officer-in-Charge)

V. Other Scientific & Technical Branches

1. Taxidermy & Museum Section	Curator : Shri B. S. Lamba	Shri B. S. Lamba (Officer-in-Charge)
	Asstt. Curators : Shri A. K. Mukherjee, Shri Syed Mohammad Ali	
2. Marine Survey Unit	Zoologist : Dr. A. Daniel	Dr. A. Daniel (Officer-in-Charge)
	Asstt. Zoologist : Vacant .	
3. Animal Population Studies Unit	Zoologist : Vacant	
	Asstt. Zoologist : Vacant	
4. Documentation Unit	Documentation Officer : Vacant	

* Indicates Officers transferred to Regional Stations.

VI. Regional Stations of the Zoological Survey of India

**1. Eastern Regional Station,
Z. S. I., Shillong**

Zoologist : Vacant

Asstt. Zoologist : Shri T.
G. Vazirani (on transfer
from Headquarters)

Shri T. G. Vazirani
(Officer-in-Charge)

**2. Western Regional Station,
Z. S. I., Poona**

Zoologist : Vacant

Asstt. Zoologist : Shri A.
S. Rajagopalaingar (on
transfer from Headquar-
ters)

Shri A. S. Rajagopalaingar
(Officer-in-Charge)

**3. Central Regional Station,
Z. S. I., Jabalpur**

Zoologist : Shri H. Kha-
juria (on transfer from
Headquarters.)

Shri H. Khajuria
(Officer-in-Charge)

**4. Desert & Gangetic Plains
Regional Station, Z. S.
I., Jodhpur.**

Zoologist : Vacant

Asstt. Zoologist : Shri S.
Biswas (on transfer from
Headquarters.)

Shri S. Biswas
(Officer-in-Charge)