

AMERICAN MUSEUM NOVITATES

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CITY OF NEW YORK JANUARY 18, 1949 NUMBER 1392

ON THE IDENTITY OF *ODONTOTERMES* (ISOPTERA, TERMITIDAE)

BY MUZAFFER AHMAD¹

Odontotermes was erected by Holmgren in 1910 with *O. vulgaris* (Haviland) as the generitype (type locality: Natal, Africa). It is a large genus comprising three subgenera, *Odontotermes* Holmgren, *sensu stricto*, *Hypotermes* Holmgren (1912a), and *Euscaiotermes* Silvestri (Silvestri, 1923). It includes about half of the fungus-growing termites belonging to the subfamily Macrotermitinae. Some of the species belonging to *Odontotermes* were formerly included by Holmgren (1912a) in another subgenus, *Cyclotermes*. *Hypotermes* [generitype: *Odontotermes* (*H.*) *xenotermis* (Wasmann) from Burma] and *Euscaiotermes* [generitype: *Odontotermes* (*E.*) *primus* Silvestri from Chilka Lake, India] are easily distinguishable from *Odontotermes*, but *Cyclotermes* [generitype: *Odontotermes* (*O.*) *obesus* (Rambur) from Bombay, India] presents great difficulty in separating its species from those of *Odontotermes*. A detailed study, based upon the material in the collection of the American Museum of Natural History now in the hands of Dr. Alfred E. Emerson, has been made of the exact status of *Cyclotermes*.

The present work was done under the guidance of Dr. Emerson to whom the author wishes to express his great indebtedness.

Holmgren (1912a) distinguished *Cyclotermes* from *Odontotermes* on the basis of the following characters:

¹ Department of Zoology, the University of Chicago.

Cyclotermes

Imago: Postclypeus half as long as wide

Soldier: Left mandible with forwardly pointing tooth. Mandibles relatively small, delicate, and saber shaped. Head distinctly narrower in front

Small species

Odontotermes

Postclypeus not half as long as wide

Left mandibles with a stout but not forwardly pointing tooth in different positions. Mandibles short and thick. Head usually rectangular

Mostly large species

The above characters were studied thoroughly and subjected to statistical analysis wherever necessary.

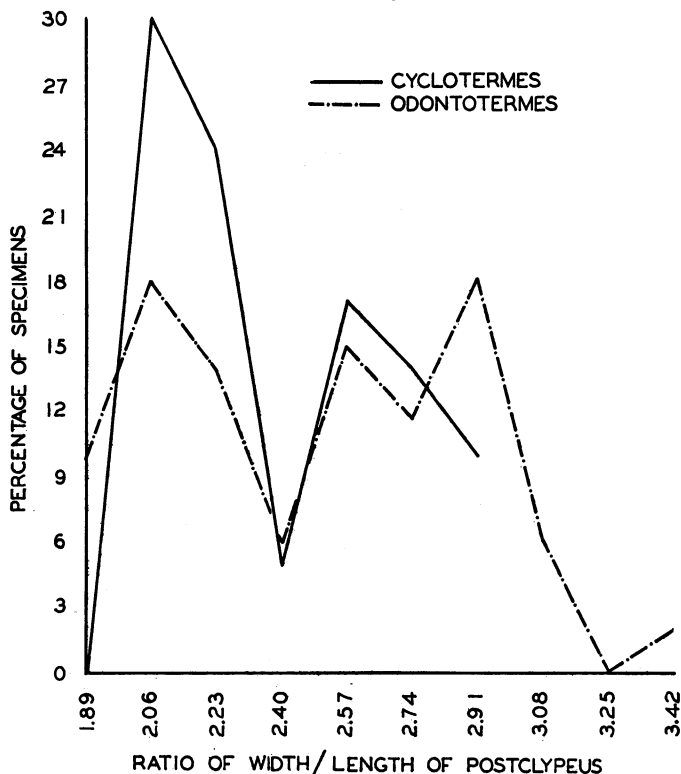


FIG. 1. Frequency distribution of the ratio of width to length of the postclypeus of imago.

IMAGO: This caste has been separated on one main character only, the relative size of the postclypeus. In order to analyze this character the width and the length of the postclypeus of the species of *Odontotermes* and of those formerly included in *Cyclotermes* were measured and their ratios computed (fig. 1, table 1).

TABLE 1
RATIO OF WIDTH TO LENGTH OF POSTCLYPEUS OF IMAGO

Name of Species	Range	Number	Mean
Species included in the subgenus			
<i>Odontotermes</i> :			
<i>O. badius</i> (Haviland)	2.88-2.91	2	2.89
<i>O. buchholzi</i> (Sjöstedt)	2.65	1	
<i>O. angustatus</i> (Rambur)	2.08-2.60	8	2.37
<i>O. classicus</i> (Sjöstedt)	1.83	2	1.83
<i>O. assmuthi</i> Holmgren	2.44	1	
<i>O. feae</i> (Wasmann)	2.19	1	
<i>O. bogoriensis</i> (Kemner)	1.83	1	
<i>O. ceylonicus</i> (Wasmann)	1.89-2.55	5	2.09
<i>O. horni</i> (Wasmann)	2.00-2.02	4	2.00
<i>O. grandiceps</i> Holmgren	2.57	1	
<i>O. javanicus</i> Holmgren	2.84	1	
<i>O. indrapurensis</i> Holmgren	2.75	1	
<i>O. sundaicus</i> Kemner	2.54	1	
<i>O. taprobanes</i> (Walker)	1.72	1	
<i>O. malabaricus</i> Holmgren	2.00	1	
<i>O. latialatus</i> (Sjöstedt)	2.47	1	
<i>O. ostentans</i> (Silvestri)	2.00-2.50	5	2.26
<i>O. pauperans</i> (Silvestri)	2.55-3.00	7	2.79
<i>O. palmquisti</i> (Sjöstedt)	2.72	1	
<i>O. planiceps</i> (Sjöstedt)	1.77	1	
<i>O. scrutator</i> (Sjöstedt)	2.87	1	
<i>O. schmitzi</i> (Emerson)	2.75-3.42	6	2.95
<i>O. smeathmani</i> (Fuller)	2.00-2.08	2	2.04
<i>O. trögårdhi</i> Holmgren	2.40	1	
<i>O. vulgaris</i> (Haviland)	2.20	2	2.20
Species formerly included in the subgenus <i>Cyclotermes</i> :			
<i>O. orissae</i> (Snyder)	1.95-1.97	2	1.96
<i>O. flavomaculatus</i> Holmgren	1.92	1	
<i>O. latericius</i> (Haviland)	1.96	1	
<i>O. formosanus</i> (Shiraki)	2.30-2.81	12	2.61
<i>O. erodens</i> (Sjöstedt)	2.00	1	
<i>O. aquaticus</i> (Sjöstedt)	1.91-2.44	2	2.17
<i>O. preliminaris</i> (Holmgren)	2.50	2	2.50
<i>O. distans</i> Holmgren	2.16-2.33	2	2.24
<i>O. redemanni</i> (Wasmann)	2.00-2.43	4	2.11
<i>O. bangalorensis</i> Holmgren	2.15-2.20	2	2.17
<i>O. assamensis</i> Holmgren	2.09	1	
<i>O. bellahuniensis</i> Holmgren	2.75	1	
<i>O. almorensis</i> (Snyder)	1.94-2.08	3	2.01
<i>O. obesus</i> (Rambur)	2.00-2.50	8	2.16

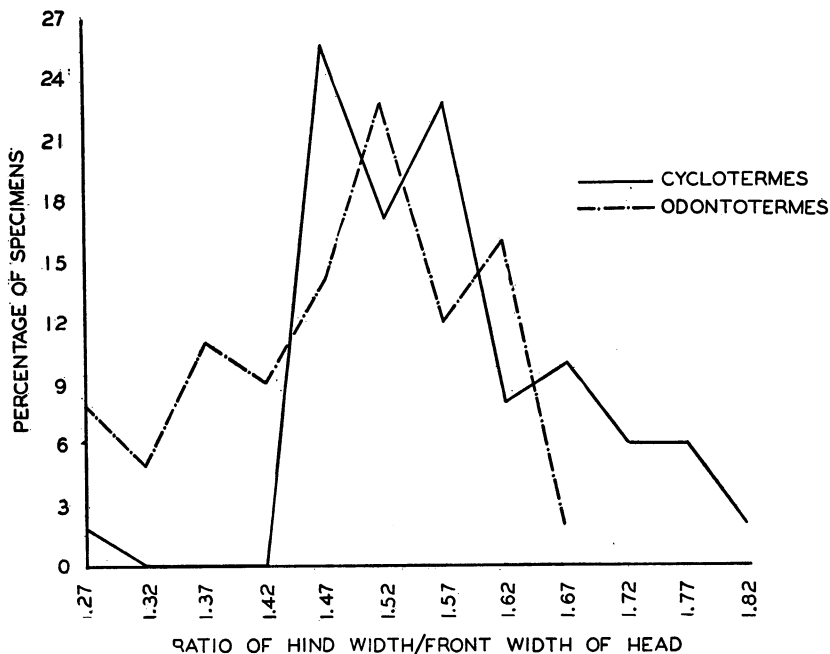
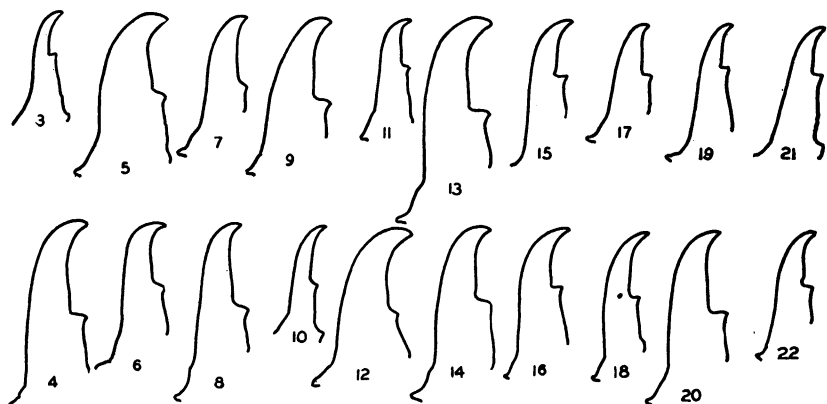


FIG. 2. Frequency distribution of the ratio of hind width to front width of the head of soldier.

A glance at the figure shows almost a complete overlap between the two graphs, and consequently *Odontotermes*, *sensu stricto*, and *Cyclotermes* are not distinguishable. One striking point, however, is that both the graphs indicate bimodality. If the two categories on either side of W/L ratio of 2.40 are lumped together and their frequency distribution is determined they might be considered to be two distinct entities. This would involve a transfer of some species formerly included in *Cyclotermes* to *Odontotermes* and *vice versa*. Thus all the specimens showing W/L ratio 2.40 or less might be regarded as *Cyclotermes* and the rest above 2.40 as *Odontotermes* according to definition. The possibility exists that there might have been some former misidentifications which could be corrected by this means. That this is not true will become evident by taking a few examples. *Odontotermes* (*O.*) *bogoriensis* with a W/L ratio of 1.83 would be classified under *Cyclotermes* according to this scheme, but if we look at the mandibles of its soldier caste (fig. 42) we find that it is an *Odontotermes* type (according to Holmgren's description of *Odontotermes*). *O.*



FIGS. 3-22. Left mandibles of *Odontotermes*. 3. *angustatus*. 4. *badius*, major soldier. 5. *badius*, minor soldier. 6. *amanicus*. 7. *anceps*. 8. *bequaerti*. 9. *culturarum*. 10. *classicus*. 11. *fulleri*. 12. *fidens*. 13. *monodon*. 14. *kibarensis*. 15. *malelaensis*. 16. *mukimbunginis* Sjöstedt. 17. *nolaënsis*. 18. *ostentans*. 19. *nilensis*. 20. *patruus*. 21. *planiceps*. 22. *pauperans*.

horni with an average ratio of 2.00 might also be classified under *Cyclotermes*, but if one examines its soldier mandibles (fig. 44) one would identify it as a species of *Odontotermes*. *O. formosanus* with an average W/L ratio of 2.61 was formerly included in *Cyclotermes*. Moreover the variation within a species (e.g., *O. angustatus* with a range of 2.08-2.60) is so great that it is not possible to use this character in subgeneric identification.

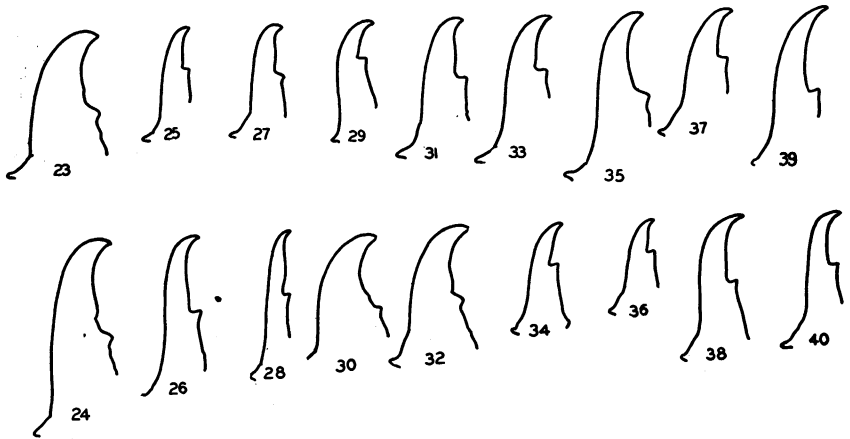
Thus it follows that if Holmgren's classification is adopted the same species would be put under *Odontotermes* or *Cyclotermes* depending upon what caste is examined. Holmgren (1912b) himself does not seem to be very clear about the correct identity of this group. In his monograph of the oriental termites he includes *O. ceylonicus*, *O. horni*, and *O. feae* under category A of his key to *Odontotermes* species which he defines as including species with "postclypeus quite strongly arched, as long as half its width or only a little shorter" These are the characters of *Cyclotermes* as given in his earlier paper (1912a).

A list of the species with localities of *Odontotermes* whose imagoes are known but not included in the present study follows:

Ethiopian species:

agilis (Sjöstedt), Liberia

angustipennis (Sjöstedt), Belgian Congo



FIGS. 23-40. Left mandibles of *Odontotermes*. 23. *stanleyvillensis* (Emerson). 24. *schmitzi*. 25. *scrutor*. 26. *somaliensis* (Sjöstedt). 27. *stercorivorus* (Sjöstedt). 28. *sjöstedti* (Emerson). 29. *snyderi* (Emerson). 30. *robustus* Sjöstedt. 31. *sudanensis* Sjöstedt. 32. *rectanguloides* Sjöstedt. 33. *transvaalensis*. 34. *vulgaris*. 35. *trågårdhi*. 36. *assmuthi*. 37. *butteli*. 38. *ceylonicus*. 39. *dives*. 40. *anamallensis*.

apollo (Sjöstedt), British East Africa
aurora (Sjöstedt), Zanzibar
bottegoanus (Sjöstedt), northeast Africa
cafrariae (Sjöstedt), Natal
capensis (DeGeer), Kapland
culturarum Sjöstedt, Tanganyika
diana (Sjöstedt), Belgian Congo
ebeni (Sjöstedt), Abyssinia
egregius Sjöstedt, British East Africa
fidens (Sjöstedt), Gold Coast
interveniens Sjöstedt, Belgian Congo
iratus (Sjöstedt), Gabun
kibarensis (Fuller), Uganda
lautus (Sjöstedt), Transvaal
microps (Sjöstedt), Tanganyika
*nilensis*¹ Emerson (MS), Sudan
nolaënsis Sjöstedt, Cameroon
ramulosus (Sjöstedt), German East Africa
rehobothensis (Sjöstedt), German South West Africa
rothschildianus (Sjöstedt), Abyssinia
salebrifrons (Sjöstedt), northeast Africa
silvestrii Sjöstedt, Kongo
terricola (Sjöstedt), Cameroon
transvaalensis (Sjöstedt), Transvaal

¹ The credit for authorship of this species should be given to Emerson.

Oriental species:

brunneus (Hagen), India
dehraduni (Snyder), India
dives (Hagen), Philippines
hageni Holmgren, Borneo
*holmgreni*¹ Snyder and Emerson (MS), Celebes
incisus Holmgren, Sumatra
koenigi (Desneux), Ceylon
latissimus (Kemner), Sumatra
makassarensis Kemner, Celebes
proximus Holmgren, Malacca
wallonensis (Wasmann), India

SOLDIER: As in the case of the postclypeus of the imago, the width of head in front and behind was measured and the ratios of these widths were obtained (fig. 2, table 2).

TABLE 2
 RATIO OF HIND WIDTH TO FRONT WIDTH OF SOLDIER HEAD

Name of Species	Range	Number	Mean
Species included in the subgenus			
<i>Odontotermes</i> :			
<i>O. assmuthi</i>	1.35-1.44	4	1.40
<i>O. feae</i>	1.52-1.67	4	1.59
<i>O. bogoriensis</i>	1.52-1.54	2	1.53
<i>O. anamallensis</i> Holmgren	1.58	1	
<i>O. ceylonicus</i>	1.33-1.40	10	1.36
<i>O. butteli</i> Holmgren	1.22	2	1.22
<i>O. dives</i>	1.22-1.47	2	1.34
<i>O. feaeoides</i> Holmgren	1.39	1	
<i>O. grandiceps</i>	1.50-1.61	8	1.55
<i>O. horni</i>	1.45-1.51	3	1.47
<i>O. longignathus</i> Holmgren	1.45-1.60	5	1.53
<i>O. karnyi</i> Kemner	1.51-1.54	2	1.52
<i>O. javanicus</i>	1.49-1.66	9	1.58
<i>O. makassarensis</i>	1.54-1.60	2	1.57
<i>O. malaccensis</i> Holmgren	1.59-1.62	4	1.60
<i>O. sundaicus</i>	1.55-1.62	2	1.58
<i>O. oblongatus</i> Holmgren	1.25-1.27	3	1.25
<i>O. praevalens</i> John	1.51-1.62	2	1.56
<i>O. parvidens</i> Holmgren	1.50-1.55	3	1.52
<i>O. mirganjensis</i> Holmgren	1.48	1	
<i>O. malabaricus</i>	1.36	1	
<i>O. amanicus</i> Sjöstedt	1.38-1.43	2	1.40
<i>O. anceps</i> (Sjöstedt)	1.24-1.60	3	1.44
<i>O. bequaerti</i> (Emerson)	1.52-1.59	4	1.55

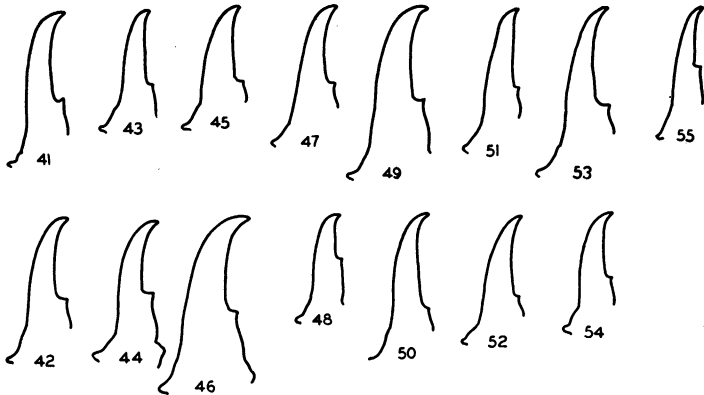
¹ The credit for authorship of this species should be given to Snyder and Emerson.

TABLE 2—*Continued*

Name of Species	Range	Number	Mean
<i>O. badius</i>	1.55–1.61	3	1.57
<i>O. angustatus</i>	1.45–1.55	10	1.49
<i>O. fulleri</i> (Emerson)	1.28–1.34	9	1.30
<i>O. classicus</i>	1.40	2	1.40
<i>O. malelaensis</i> (Emerson)	1.51–1.60	3	1.56
<i>O. kibarensis</i>	1.51–1.59	3	1.55
<i>O. monodon</i> (Gerstächer)	1.53	1	
<i>O. ostentans</i>	1.40–1.54	4	1.49
<i>O. nilensis</i>	1.41–1.47	9	1.44
<i>O. patruus</i> Sjöstedt	1.35–1.43	4	1.40
<i>O. planiceps</i>	1.23–1.26	4	1.23
<i>O. nolaensis</i>	1.28–1.36	4	1.32
<i>O. pauperans</i>	1.36–1.48	5	1.43
<i>O. vulgaris</i>	1.42–1.54	7	1.48
<i>O. trögårdhi</i>	1.47	1	
<i>O. transvaalensis</i>	1.42–1.46	4	1.45
Species formerly included in the subgenus <i>Cyclotermes</i> :			
<i>O. flammifrons</i> (Sjöstedt)	1.64–1.78	7	1.71
<i>O. zulu Natalensis</i> Sjöstedt	1.62	1	
<i>O. bomaensis</i> Sjöstedt	1.45	2	1.45
<i>O. latericius</i>	1.57–1.59	5	1.57
<i>O. brunneus</i>	1.43–1.49	6	1.45
<i>O. denticulatus</i> Holmgren	1.63–1.75	7	1.64
<i>O. bangalorensis</i>	1.48–1.62	3	1.57
<i>O. escherichi</i> (Holmgren)	1.43–1.47	3	1.45
<i>O. assamensis</i>	1.50	1	
<i>O. latigula</i> (Snyder)	1.55–1.61	2	1.58
<i>O. orissae</i>	1.44	1	
<i>O. hainanensis</i> (Light)	1.43–1.57	2	1.50
<i>O. formosanus</i>	1.45–1.58	9	1.51
<i>O. redemanni</i> (Wasmann)	1.52–1.69	7	1.60
<i>O. wallonensis</i>	1.45–1.50	6	1.48
<i>O. paradenticulatus</i> Ahmad	1.55	2	1.55
<i>O. sarawakensis</i> Holmgren	1.25	1	

With these measurements also there is an overlap but without an indication of bimodality as occurred for the measurements of the postclypeus. It shows that there is no sharp distinction between the two groups on the basis of the shape of the head.

As regards the relative position and the shape of the tooth on the left mandible it appears that this character is highly variable (figs. 3–75) and as such it should not be used as a criterion for separating the two species groups. Some of the species formerly



FIGS. 41-55. Left mandibles of *Odontotermes*. 41. *feae*. 42. *bogoriensis*. 43. *grandiceps*. 44. *horni*. 45. *javanicus*. 46. *lignathus*. 47. *karnyi*. 48. *oblongatus*. 49. *praevalens*. 50. *parvidens*. 51. *makassarensis*. 52. *sundaicus*. 53. *mirganjensis*. 54. *malabaricus*. 55. *malaccensis*.

assigned to the subgenus *Odontotermes*, e.g., *O. scrutor* (fig. 25) and *O. vulgaris* (fig. 34), have the left mandible similar to that of many species included in *Cyclotermes*.

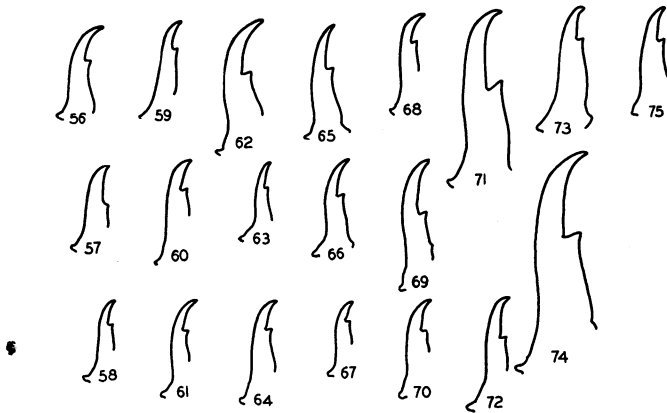
Below is the list of *Odontotermes* species whose soldier caste is known but is not sketched here:

Ethiopian species:

- akengeensis* (Emerson), Belgian Congo
- cafrariae*, Natal
- fallax* Sjöstedt, British East Africa
- fockianus* (Sjöstedt), German South West Africa
- interveniens*, Belgian Congo
- lobintactus* (Sjöstedt), Belgian Congo
- mediocris* (Sjöstedt), Abyssinia
- okahandjae* (Fuller), Dammerland
- pretoriensis* Sjöstedt, Pretoria
- tanganicus* Sjöstedt, Tanganyika
- terricola*, Cameroon
- zambesiensis* (Sjöstedt), Zambesi

Oriental species:

- bellahuniensis*, India
- billitoni* Holmgren, East Indies
- boetonensis* Kemner, east Celebes
- celebensis* Oshima, Celebes
- djampeensis* Kemner, southwest of Celebes
- feaeoides*, India
- flavomaculatus*, India
- fontanellus* Kemner, China
- gravelyi* Silvestri, lower Burma



FIGS. 56-75. Left mandibles of *Odontotermes* (formerly included in the subgenus *Cyclotermes*). 56. *bangalorensis*. 57. *denticulatus*. 58. *escherichi*. 59. *assamensis*. 60. *formosanus*. 61. *orissae*. 62. *brunneus*. 63. *hainanensis*. 64. *latigula*. 65. *obesus* form *gurdaspurensis* Holmgren. 66. *obesus*. 67. *sarawakensis*. 68. *redemanni*. 69. *wallonensis*. 70. *paradenticulatus*. 71. *flammifrons*. 72. *bomaënsis*. 73. *zulunatalensis*. 74. *simplicidens* (Sjöstedt). 75. *latericius*.

holmgreni, Celebes
karawajevi John, Java
maximus, Sumatra
simalurensis Oshima, Simalur
sinabangensis Kemner, Simalur

On the basis of these data it seems best not to separate *Cyclotermes* from *Odontotermes*, *sensu stricto*. If *Cyclotermes* has arisen from *Odontotermes* or *vice versa* there should be some degree of consistency in characters showing phylogenetic relationship as evidenced by morphology, zoogeography, nest building behavior, termitophiles, etc. But we do not find any distinctive character which helps us to distinguish *Cyclotermes* from *Odontotermes*. The geographical distribution of these groups shows some features of possible significance—coastal distribution of *Cyclotermes* as contrasted to more hinterland distribution of *Odontotermes*, and the relative number of their species in the Ethiopian and the Oriental regions. The geographical distribution, however, fits the concept of the polyphyletic origin of *Cyclotermes*.

It is proposed that *Cyclotermes* be placed in synonymy with *Odontotermes*. A large and more inclusive category presents greater difficulties in species determination, but mere conven-

ience of identification should not warrant subgeneric status with its phylogenetic implications. The characters discussed above may be used in keys for practical identification.

REFERENCES

HOLMGREN, NILS

- 1910. Das System der Termiten. Zool. Anz., vol. 35, pp. 284-286.
- 1912a. Termitenstudien. III. Systematik der Termiten. Die Familie Metatermitidae. K. Svenska Vetensk.-Akad. Handl., vol. 48, no. 4, 166 pp.
- 1912b. Termitenstudien IV. Versuch einer systematischen Monographie der Termiten der orientalischen Region. *Ibid.*, vol. 50, no. 2, 276 pp.

SILVESTRI, FILIPPO

- 1923. The termites of Barkuda Island (The fauna of an island in the Chilka Lake). Rec. Indian Mus., vol. 25, no. 2, pp. 221-232.

