

American Museum Novitates

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK 24, N.Y.

NUMBER 1947

JUNE 17, 1959

The African Termite Genera *Firmitermes*, *Hoplognathotermes*, *Acutidentitermes*, *Duplidentitermes*, and *Heimitermes* (Termitidae, Termitinae)¹

BY ALFRED E. EMERSON²

INTRODUCTION

The present paper is the first of a new series of taxonomic papers dealing with the termites of the Belgian Congo (Emerson, 1928, 1951, 1956a). In order to place the fauna of the Belgian Congo in its proper ecological, zoogeographical, and evolutionary perspective, it is necessary to compare the genera and species with termites from other countries and sometimes from other continents. The genera discussed in this article, together with their closest allies, are all confined to tropical Africa in the Ethiopian zoogeographical region. In several respects they are primitive members of the subfamily Termitinae, a large group of about 56 genera found scattered throughout the tropical world (Emerson, 1955). Anatomical and zoogeographical evidence indicate

¹ Financial assistance for the collection and study of these termites was furnished by the John Simon Guggenheim Foundation (Fellow, 1926–1927); the Dr. Wallace C. and Clara A. Abbott Memorial Fund of the University of Chicago; the New York Zoological Society, for study in the Belgian Congo (1948); the Belgian American Educational Foundation (Fellow, 1948); and the National Science Foundation (Grant G-3266, 1957). I am also indebted to the following individuals for assistance and materials: Prof. P.-P. Grassé, Dr. Charles Noirot, Dr. Herbert H. Ross, the late Prof. F. Silvestri, the late Winifred Jelliffe Emerson, and my wife, Eleanor Fish Emerson.

² Research Associate, Department of Insects and Spiders, the American Museum of Natural History, and Professor of Zoology, the University of Chicago.

that the subfamily Termitinae may have originated from the Amitermitinae in tropical Africa during Cretaceous times, but the genera under discussion in this paper may have evolved from more primitive extinct genera during Tertiary times. The existing genera and their close relatives discussed in the following pages have relatively large mandibulate soldiers and are subterranean termites of the steppes, savannas, and rain forests. Some, if not all, are humus feeders. The remarkable intestinal structures of several of these genera are described and discussed by Grassé and Noirot (1954) who also demonstrate correlated behavior as exhibited in their nest constructions. They place a number of these genera in the subfamily "Apicotermitinae." For reasons discussed below, I place this group of related genera within the much larger subfamily Termitinae and do not treat it as a separate subfamily, although I would not oppose tribal status if a thorough revision of all the genera of the Termitinae indicated fairly sharp groups of related genera. The behavior and ecology of these termites have great significance for the understanding of the phylogeny of behavior (Grassé and Noirot, 1954; Schmidt, 1955a, 1955b, 1958; Emerson, 1956b). Here, however, the emphasis is placed on the taxonomy, which must underlie any discussion of the evolution of their structure and behavior.

It is unfortunate that several genera and species are known from unassociated soldiers or imagoes, with consequent provisional generic diagnosis and phylogenetic position. Also the species often seem to be rare and have often been based on unique specimens with meager field data. The known occurrence of some unclassified described and undescribed species of imagoes and workers without associated soldiers indicates that several new genera will ultimately be added to the group. During the writing of this paper, I have often wondered whether much useful information could be gained by detailed studies that resulted only in inconclusive taxonomic decisions, but I have decided to make tentative interpretations available to other students, with the expectation that some will prove to be erroneous. At the same time they will serve as a framework for the gathering of new data.

GENUS *FIRMITERMES* SJÖSTEDT

- = *Firmitermes* SJÖSTEDT, 1926, p. 191.
- = *Firmitermes* EMERSON, 1928, p. 408.
- = *Firmitermes* SNYDER, 1949, p. 152.
- = *Firmitermes* EMERSON, 1953, p. 104.
- = *Firmitermes* GRASSÉ AND NOIROT, 1954, p. 365.
- = *Firmitermes* EMERSON, 1955, p. 511.

TYPE SPECIES: *Firmitermes abyssinicus* (Sjöstedt) (Sjöstedt, 1926, p. 191).

This genus was named by Sjöstedt (1926) who included a single species described earlier (Sjöstedt, 1911) from a unique specimen of a soldier (fig. 1) under the name "*Eutermes abyssinicus*" from Hicka, or Hieka, in central Abyssinia or Ethiopia. No other specimen of the species has been discovered, and virtually nothing is known of its ecology or behavior. The type specimen was damaged, so that some of the generic characters have been misunderstood (Emerson, 1953). Possibly the genus is the most primitive of the Termitinae, so much will be learned from the study of future collections of all castes.

In the following pages, I am tentatively suggesting that a species known from the imago only and originally described as "*Eutermes tripolitanus*" (Sjöstedt, 1912) may belong to *Firmitermes*, but the definite assignment must await the collection of associated castes. Confusion resulted from the mistaken locality of the specimen that Sjöstedt placed in Tripolitana. Capra (1935) reports that the type locality is in Ethiopia. After removal of the species from the nomenclaturally invalid genus "*Eutermes*," it was assigned erroneously to "*Trinervitermes*." Although the questionable placement of "*Eutermes tripolitanus*" in *Firmitermes* is speculative, the only other alternative is to name a new genus for its reception, and such a temporary taxonomic solution seems likely to produce even more confusion. In spite of some corrections of errors in the taxonomy and locality records, our knowledge of *Firmitermes* is meager, and its relations must remain obscure until more material is discovered.

Grassé and Noirot (1954) did not include *Firmitermes* in their subfamily "Apicotermitinae," nor do the generic characters fit their diagnosis of the group. Some of the soldier characters are more primitive than the genera assigned to this category, but there seems to be little doubt that *Firmitermes* is related to the group of genera to which *Apicotermes* belongs. However, because of our inadequate knowledge of the phylogenetic relations, and because of the questionable value of raising small groups of related genera to subfamily rank, in my opinion it seems best for the present to include *Firmitermes* and its relatives in the large subfamily Termitinae. It may be convenient to break up the Termitinae as interpreted by Snyder (1949) and Emerson (1955) into tribes composed of related genera that constitute major branches of the phylogenetic tree (Ahmad, 1950; Weidner, 1956). However, it is my opinion that a revision of the genera of the subfamily throughout the world is necessary before valid and stable tribal categories can be

taxonomically useful. Investigators of regional faunas too often lack perspective on the categories as a whole and on the phylogenetic relationships of the genera involved.

IMAGO: The following generic characters depend on the highly tentative assignment of "*Eutermes*" *tripolitanus* to *Firmitermes*. The apical tooth of both mandibles (fig. 2) is smaller, more slender, and closer to the first marginal tooth than that of the worker mandibles of *Hoplognathotermes* (fig. 4) or *Acutidentitermes* (fig. 6). The angle between the apical and first marginal teeth of the left mandible is sharper in ?*Firmitermes*. The first plus second marginal tooth of the left mandible is about the same actual length in ?*Firmitermes* and *Acutidentitermes*, but the notch in front of the third marginal tooth is not quite so sharp, and the apical edge of the third marginal tooth is longer in ?*Firmitermes*, while it is definitely convex and shorter in *Acutidentitermes*. The third marginal tooth is proportionately much larger than in any known genus of primitive Termitinae or Amitermitinae. There are two small projections below a concave upper ridge between the third marginal tooth and the molar plate, and the edge between the projections is concave. There is only one such projection in *Acutidentitermes* below the basal molar plate. In the right mandible, the first marginal tooth has a weak indication of a reduced accessory tooth near the angle of its junction with the apical tooth. The edges of the second marginal tooth are concave both in front of and behind the point, in contrast to the almost straight edges in front of and behind the blunt convex projection indicating the regressed second marginal tooth in *Acutidentitermes*. The upper edge of the basal plate is less strongly concave than in *Acutidentitermes*. The front tibiae have three spurs each, and the middle and hind tibiae have two spurs each.

SOLDIER (FIG. 1): Head with numerous short hairs and bristles scattered over the front, top, sides, and postmentum in contrast to the very few bristles on the head and the nearly bare postmenta of *Hoplognathotermes subterraneus* (fig. 3) and *Acutidentitermes osborni* (fig. 5). Three or four bristles are seen in the profile of the flatly convex apical portion of the front coxa, and a few bristles and hairs are seen in the profile of the sharply convex basal portion. Also a number of very short hairs are seen on the rounded longitudinal ridge as one turns the coxa from side to side. The general shape of the head (fig. 1A) is not generically different from that in *Hoplognathotermes* (fig. 3A), and both genera have a relatively flat front without conspicuous ridges or protuberances. The fontanelle is small and rather inconspicuous as in *Hoplognathotermes* and *Acutidentitermes*. The postmentum (fig. 1B)

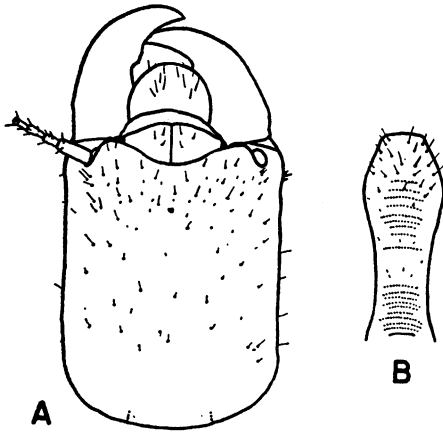


FIG. 1. Holotype soldier of *Firmitermes abyssinicus* (Sjöstedt). A. Head from above. B. Postmentum from below.

is constricted in the middle, with each side fairly concave, a little more concave than in *Hoplognathotermes subterraneus* (fig. 3C), but the postmentum has a series of inconspicuous transverse grooves throughout its length, while such grooves are present only in the rear portion of the postmentum of *H. subterraneus* and are absent in the more bulbous postmentum of *A. osborni* (fig. 5B). The labrum is proportionately wide as in *H. subterraneus* but is more rounded and without the lateral angles or pointed tip of either *H. subterraneus* or *A. osborni*. The postclypeus is distinct, not sufficiently fused with the front to have obliterated the suture, and in these respects is similar to that of *H. subterraneus*. Mandibles proportionately short and thick at the base, with the outer edges fairly strongly convex in comparison to those of *Hoplognathotermes* or *Acutidentitermes*, and there is no angular indentation between the apical and basal portions as may be seen in both mandibles of *H. subterraneus* and to a lesser extent in the mandibles of *A. osborni*. The apical points of the mandibles are shorter, stockier, and the outer edge is more curved, than in either *H. subterraneus* or *A. osborni*. The broken bases of the teeth in the type specimen indicate that each tooth was rather thick at the base and did not seem to have the long cutting edge behind the first marginal tooth of the left mandible that is characteristic of *Hoplognathotermes* and *Acutidentitermes*. It is impossible to state how long or what shape the teeth were in the single damaged type specimen, but the small notch between the apical cutting edge and the tooth of the right mandible indicates an angle similar to that of *H. subterraneus* rather than

the sharper angle of *A. osborni*. The basal portions of the mandibles cannot be seen without injury to the unique type specimen, but a gentle lifting of the labium did not reveal the basal tooth-like projections of *H. subterraneus*, and they are either inconspicuous or absent. The pronotum is smaller and proportionately narrower than that of *H. subterraneus*, but the frontal lobe is similarly large and has an equally small and inconspicuous notch in the front margin. The angle of the profile of the pronotum between the frontal lobe and the basal portion is not so sharp as in *H. subterraneus* and is almost flatly concave at the junction of the frontal lobe and the rear portion. The front coxa is without a projection and has a fairly rounded longitudinal ridge, not so sharp nor so long as that of *H. subterraneus*. The profile of the coxal ridge is flatly convex from the region of the trochanter to the middle, and flatly concave towards the rather sharply convex outer base. The front tibia has three apical spurs, the outer one very short and visible only by careful manipulation. Middle and hind tibia each have two spurs. The tibial spurs are similar to those of *H. subterraneus* which also has a reduced outer spur on the front tibia. The front tibia is slightly but not markedly thicker than the others, in this respect as well as in the pilosity showing fairly close relation to *Hoplognathotermes* and *Acutidentitermes*.

RELATIONS: As indicated in the characters of the soldier, *Firmitermes* is close to *Hoplognathotermes*. If the imago of "*Eutermes*" *tripolitanus* belongs to *Firmitermes*, the genus gives indications of being more primitive than *Hoplognathotermes*, and I am tentatively placing *Firmitermes* as first in the linear series of the genera of the Termitinae. The small but discernible accessory tooth at the base of the apical margin of the first marginal tooth of the right mandible of the imago of *?Firmitermes tripolitanus* (fig. 2) is a primitive character for the Termitinae. The large third marginal tooth of the left mandible differentiates *?Firmitermes* from any close relative in either the Termitinae or the Amitermitinae. The imago characters of *?Firmitermes tripolitanus* are insufficient for me to assign the genus precisely to either the Termitinae or Amitermitinae. *Firmitermes*, *Hoplognathotermes*, and *Acutidentitermes* are related but more primitive than the series of genera included in the "Apicotermitinae" by Grassé and Noirot (1954). The figures of the imago-worker mandibles in Ahmad (1950, fig. 14) show that all these genera have a reduced second marginal tooth in the right mandible. Ahmad's figure of "*Hoplognathotermes*" is a drawing of the mandibles of "*Hoplognathotermes furcatidens*" (misspelled

furcatus) assigned to the new genus *Duplidentitermes* in the following pages. The apical teeth of the mandibles of ?*Firmitermes*, *Hoplognathotermes*, and *Acutidentitermes* are proportionately smaller than those of *Duplidentitermes*, *Apicotermes*, and allied genera, and in this particular are considered more primitive. However, the reduced second marginal tooth of the right mandible is probably a derivative character, so that *Ceratotermes* is more primitive in this respect and is not included in the same branch of the phylogenetic tree of the Termitinae. It may be postulated that the ancestral genus of these groups of genera had the primitive combination of relatively smaller apical teeth and relatively larger second marginal teeth in the right mandibles. Large body size is often, although not always, a primitive character in phylogenetic sequences of termites, and the large massive heads of the soldiers of this group of genera may be considered to be an example of this rule in the Termitinae. Among the derivative genera, including *Capritermes*, *Pericapritermes*, *Neocapritermes*, and some of their relatives at the top of the phylogenetic sequence within the Termitinae, large body size does not seem to be primitive and is a conspicuous exception to this general rule.

In summary, *Firmitermes*, *Hoplognathotermes*, *Acutidentitermes*, *Duplidentitermes*, *Allognathotermes*, *Apicotermes*, *Trichotermes*, *Coxotermes*, *Heimitermes*, *Jugositermes*, and *Rostrotermes* may be considered to constitute a branch of the Termitinae. The linear order roughly indicates the relative phylogenetic order, but the phylogenetic tree is multidimensional and radiating, so that sometimes one may expect to find primitive characters combined with derivative characters in a genus placed at any position in the linear order. Retention of a primitive character may be accompanied by regression of another character or progressive modification of still another character in the same animal. In polymorphic social animals such as termites, conservative, regressive, and advancing adaptive characters may be somewhat differentially distributed among the castes of the same species. Without discussing the implications of these taxonomic associations of characters here, it may be stated that genetic, developmental, physiological, morphological, and ecological theories based on recent investigations provide a basic understanding of these phylogenetic orders. At the same time, however, much further correlation of taxonomic data with other information will assist us in making corrections of errors and better substantiating hypotheses so that our knowledge and interpretation will improve but will always be far from complete.

Firmitermes abyssinicus (Sjöstedt)

Eutermes abyssinicus SJÖSTEDT, 1911, p. 172 (soldier).

Eutermes abyssinicus SJÖSTEDT, 1922, p. 247 (soldier), pl. It¹, fig. 2 (soldier).

Eutermes abyssinicus HEGH, 1922, pp. 469, 694 (remarks, list).

Firmitermes abyssinicus SJÖSTEDT, 1926, p. 191 (systematics), fig. 39 (soldier).

Firmitermes abyssinicus GHIDINI, 1938, p. 231 (remarks).

Firmitermes abyssinicus SNYDER, 1949, p. 152 (systematics).

SOLDIER (FIG. 1): In addition to the characters considered to be of generic importance described above, the following description is of the species characters. Head yellow brown, a little darker than in *Hoplognathotermes subterraneus*. Pronotum and abdomen lighter than head. Postmentum with a number of bristles on the anterior portion and with a few much shorter bristles in the middle portion in front of the narrowest part of the constriction. Pronotum with long and short bristles, particularly on the sides and on the frontal lobe. Outer edge of the front tibia with about five or six long hairs and a few much shorter hairs about one-fourth to one-fifth of the length of the long hairs. Inner edge of front tibia with numerous spines of varying length that are thicker than the hairs on the outer edge and less thick than the spurs. Middle and hind tibiae similar to the front tibiae, with some difference in the number of long hairs on the outer edges. Tibial hairs and spines similar to those of *H. subterraneus*. Tergites with many short bristles or hairs not sharply distinguishable in the middle, but bristles longer than hairs on the hind tergites and on the sides of the front tergites. Pilosity of sternites similar to that of tergites, with several scattered bristles and contrasting scattered short hairs, the hairs about one-third to one-half of the length of the bristles. Head massive, elongated, somewhat wider behind the mandibles than in the middle or hind portion, hind margin evenly and flatly convex from above, sides fairly straight and somewhat parallel, front in profile flat. Profile of postmentum fairly evenly convex, with a slight depression behind the anterior region and without the rounded bulge in the back portion seen in *Hoplognathotermes subterraneus*. Side margins of postmentum overlapping the lateral sutures behind the maxillary bases, but not particularly overlapping from the constriction to the rear; overlapping side of the postmentum with a fairly distinct sharp lateral ridge behind the base of the maxilla, while in *H. subterraneus* the rounded overlapping portion does not show a sharp ridge but has a more rounded and more bulging postmentum. The antennae are now broken in the type specimen (Sjöstedt, 1922, p. 247, stated that each had 14 articles.) The third article is somewhat longer than the second, with pigmentation

and bristles indicating a partial subdivision; the fourth is a little shorter than the second; the first is much thicker than the second or third and is longer than the third; the middle articles are over twice as long as wide. The postclypeus is distinct, with a longitudinal median line similar in general to that of *H. subterraneus*.

TABLE 1
MEASUREMENTS (IN MILLIMETERS) OF HOLOTYPE SOLDIER OF
Firmitermes abyssinicus (SJÖSTEDT)

Length of head to side base of mandibles	2.88
Width of head behind mandibles	2.02
Thickness of head	1.56
Greatest width of postmentum	0.76
Least width of postmentum	0.49
Length of labrum in middle (about)	0.38
Width of labrum	0.72
Length of left mandible	1.65
Length of pronotum	0.66
Width of pronotum	1.16
Thickness of front femur in the middle	0.24
Length of hind tibia	1.72

LOCALITY AND MATERIAL: Hicka, or Hieka, central Ethiopia (Abyssinia), collector M. de Rothschild, May 31, 1904, one unique holotype soldier, labeled "*Eutermes abyssinicus* Sjöstedt Type," studied in the Laboratoire d'Evolution des Êtres Organisés, Paris, where it was on loan from the Museum National d'Histoire Naturelle, Paris. I have not located Hieka on a map and do not know the latitude and longitude. Sjöstedt (1922) states that the specimen was taken from a subterranean nest of "*Termes anceps*," a species now classified as *Odontotermes anceps* (Sjöstedt).

?*Firmitermes tripolitanus* (Sjöstedt), new combination

Eutermes tripolitanus SJÖSTEDT, 1912, p. 16 (imago).

Eutermes tripolitanus HEGH, 1922, pp. 68, 432, 691 (remarks).

?*Trinervitermes tripolitanus* SJÖSTEDT, 1926, p. 292 (imago), p. 331 (synonymy).

?*Nasutitermes* (*Trinervitermes*) *tripolitanus* EMERSON, 1928, p. 487 (discussion).

Trinervitermes tripolitanus CAPRA, 1935, pp. 44-46 (locality).

Eutermes tripolitanus JUCCI, 1936, pp. 3-4 (remarks).

Trinervitermes tripolitanus CAPRA, 1938, p. 125 (locality).

Trinervitermes tripolitanus GHIDINI, 1938, p. 233 (remarks).

Eutermes tripolitanus SNYDER, 1949, p. 351 (unclassified list).

There has been much confusion in the literature concerning this species, which was poorly described from two specimens of the imago and erroneously recorded from Tripolitana. I am confident of the correct species determination of the specimens described below, but the generic assignment must remain in doubt until all the castes are collected in association. There is a possibility that the imago belongs to *Firmitermes abyssinicus*, known from a unique soldier, but this is only a tentative suggestion and must await future verification.

IMAGO (FIG. 2): Head dark brown, with yellowish areas. Fontanelle brownish yellow, with a small light spot in front in the center close to

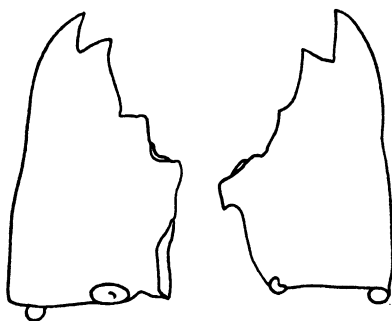


FIG. 2. Mandibles of male imago of ?*Firmitermes tripolitanus* (Sjöstedt), Addis Abeba, Ethiopia, July, 1957.

the fontanelle. Postclypeus yellow-brown, with a light longitudinal line in the center. Pronotum in general yellow-brown, without markedly contrasting color marks but with a discernible T-shaped light mark in the center. Wings smoky brown. Tergites yellow-brown. Sternites yellow. Head, pronotum, and tergites with many long bristles (length about 0.18 mm.) and contrasting short hairs (length about 0.04 to 0.06 mm.), almost dense enough to call a mat. Sternites with longer bristles (0.27 mm.) and hairs than on the tergites, the hairs roughly half of the length of the long bristles. Femora with a few bristles and hairs on the outside and many thin bristles and hairs (about one-fourth to one-half of the length of the bristles) on the inside. Tibiae with hairs and bristles, with the bristles thicker and more abundant on the inside. Middle tibiae without contrasting thick spines on the outer edges. Wing with indistinct microscopic dots on the membrane and numerous short hairs on membrane and veins. Head widely oval, with fairly large eye and proportionately large ocellus. Line between ocelli nearly straight from the rear, without marked ridges near the ocellar margins.

Fontanelle proportionately large, variable in size and shape from oval to round to subtriangular, sometimes wider than long, longer than wide, or approximately circular. Ocellus less than half of its width from the eye, more oval than the basal socket of the antenna but fairly close in general size. Antennae broken in all the specimens before me, but Sjöstedt (1912) states that the antenna has 15 articles. The first article is about equal to the second and third together, the second is equal to or a little longer than the third, and the third is slightly narrower and shorter than the fourth. The postclypeus is a little shorter than half of its width. The pronotum is proportionately short and wide, hind margin weakly or hardly emarginate, front margin very weakly indented in the middle. Hind margin of mesonotum with an indentation forming a central angle of about 120 degrees, with fairly sharply pointed hind lobes each forming an angle greater than a right angle. Hind margin of metanotum similar to that of mesonotum, but with indentation not so deep as that of the mesonotum. Front coxa rounded, without a distinct longitudinal ridge. Tibial spurs 3:2:2, the outer spur of the front tibia about half of the length of the inner spurs.

RELATIONS: No known species is very close, particularly in the characters of the mandibles. The mandibles in many details are transitional

TABLE 2
MEASUREMENTS (IN MILLIMETERS) OF MALE AND FEMALE IMAGOS OF
?Firmitermes tripolitanus (SJÖSTEDT), NEW COMBINATION

	No.	Range
Length of head to side base of mandibles	4	1.06- 1.26
Width of head	20	1.54- 1.80
Length of fontanelle	4	0.15- 0.23
Width of fontanelle	4	0.16- 0.23
Diameter of eye	4	0.48- 0.53
Length of ocellus	5	0.16- 0.26
Width of ocellus	5	0.18- 0.23
Ocellus from eye	4	0.05- 0.08
Ocellus from fontanelle	4	0.34- 0.39
Length of postclypeus	4	0.29- 0.36
Width of postclypeus	4	0.71- 0.77
Length of pronotum	5	0.65- 0.82
Width of pronotum	4	1.21- 1.60
Length of hind tibia	4	1.88- 2.10
Length of front wing from suture	5	18.69-24.25
Width of front wing	4	4.60- 6.10

between those of the primitive genera of both the Amitermitinae and the Termitinae, but I am provisionally placing the imago in *Firmitermes* with a considerable question. If this assignment and its congeneric or conspecific association with the soldier of *F. abyssinicus* are verified, the genus may be considered to be the most primitive member of the Termitinae.

LOCALITIES AND MATERIAL: One headless cotype imago, in the Museo Civico di Storia Naturale, Genoa, Italy, labeled "Berek, VIII.1887." Another cotype specimen is listed by Sjöstedt (1912, 1926) in the collection of the Naturhistoriska Riksmuseum in Stockholm, Sweden, but a thorough search in September, 1957, failed to locate this specimen, and it may be presumed to be lost or mislaid. The type locality was erroneously placed in Tripolitana by Sjöstedt, but Capra (1935, 1938, and personal communication) has clear evidence that the type locality is Monti Berrek near Ancover, Antoto Nuova, and Alio Amba, south of Let Marefia, about 15 kilometers northeast of Addis Abeba (latitude $9^{\circ} 2' N.$, longitude $38^{\circ} 49' E.$) in Ethiopia. The above description is based primarily on 20 imagoes of both sexes (with overlapping measurements) from Addis Abada (= Addis Abeba), Ethiopia, July, 1957, collector P. Rice, at a porch light. These specimens were sent to me through the courtesy of Dr. H. Ross and are now deposited in the collection of the American Museum of Natural History and also exchanged with other termite specialists. These recently collected specimens not only agree with the few characters of the pronotum, legs, and wings described during my studies in Genoa in 1957, but they agree perfectly with the characters included in the meager original description by Sjöstedt (1912).

GENUS *HOPLOGNATHOTERMES* SILVESTRI

- <*Hoplognathotermes* SILVESTRI, 1914a, p. 25.
- <*Hoplognathotermes* SILVESTRI, 1914b, p. 497.
- ?*Hoplognathotermes* FULLER, 1921, pp. 23, 25.
- ?*Hoplognathotermes* FULLER, 1922, p. 106.
- <*Hoplognathotermes* SJÖSTEDT, 1926, p. 157.
- <*Hoplognathotermes* EMERSON, 1928, pp. 408, 420.
- <*Hoplognathotermes* SNYDER, 1949, p. 151.
- <*Hoplognathotermes* EMERSON, 1953, p. 104.
- <*Hoplognathotermes* EMERSON, 1955, pp. 468, 485, 511.

TYPE SPECIES: *Hoplognathotermes subterraneus* Silvestri (Silvestri, 1914a, p. 25).

This genus was originally described by Silvestri, with *H. subterraneus* as "Typus" known from the nymph, soldier, major worker, and

minor worker and recorded from Conakry, Camayenne, and Kakoulima in French Guinea. A variety, *H. subterraneus* var. *superior*, known from the worker only, was recorded by Silvestri from Mamou, French Guinea. A direct comparison of workers from the original colonies shows only a size difference that is not considered to be of taxonomic importance by me. Another species, "*H.*" *submissus*, known only from the major and minor workers, was described by Silvestri (1914a, p. 28) from Victoria, Cameroon, and is here placed among the unclassified species. Fuller (1921, 1922) refers to an undescribed species known only from callow soldiers recorded from Vryburg, Cape Province, Union of South Africa. I have been unable to locate the Fuller specimens and am very doubtful of the generic assignment. Sjöstedt (1926) included his species, "*H.*" *furcatidens*, described in 1924 from Nola (Bania), French Congo, in the genus. After 1924, all references to the genus include "*H.*" *furcatidens*. Ahmad (1950, pp. 68, 69, 83) and Grassé and Noirot (1954) discuss the genus in terms of the characters of "*H.*" *furcatidens* only.

In the present revision of the genus, "*H.*" *submissus* Silvestri (1914a, p. 28) is removed from *Hoplognathotermes* because of the characters of the worker mandibles, but is not reassigned to any known genus; *H. subterraneus* var. *superior* is placed in synonymy with *H. subterraneus*; Fuller's record from South Africa is included with considerable doubt because of the locality and inadequate description; and "*H.*" *furcatidens* Sjöstedt is made the type species of a new genus, *Duplidentitermes*, described in the following pages.

Hoplognathotermes is reconstituted as a monotypic genus, with the single species *H. subterraneus*, and is considered in general to be a primitive genus of the subfamily Termitinae. As revised, the genus does not fit exactly into the subfamily "Apicotermitinae" as described by Grassé and Noirot (1954). I agree with these authors that the genera that they include under this subfamily category are related to one another in external, internal, and behavioral characters. However, I consider *Firmitermes*, *Hoplognathotermes*, and *Acutidentitermes* to be relatives, although they do not fit into the "Apicotermitinae" in all particulars.

The imago of *Hoplognathotermes* is unknown. When discovered, it will add some characters for phylogenetic interpretation.

SOLDIER (FIG. 3): Head with a very small number of rather short scattered bristles near the frontal gland opening. Front coxa without strong spines and with only a few thin bristles, not forming a special pattern. First four tergites with short hairs or bristles, and additional

short hairs on the posterior tergites and sternites. Head large, with straight parallel sides. Profile of the head flat or slightly concave in the region of the frontal gland. Postmentum large, with a moderate constriction; profile somewhat convex. Antenna with 15 articles. Postclypeus distinct and slightly arched. Labrum with rounded lateral margins, straight parallel sides behind the lateral angles, and tip rounded and blunt. Each mandible has a conspicuous, large, forward-pointing marginal tooth in front of the middle. Tooth of left mandible with a long, basal, cutting edge in contrast to that of *Firmitermes*. Anterior lobe of pronotum fairly large, with a shallow, rather indistinct indentation in the middle of the front margin. Legs long compared to those of *Duplidentitermes*. Front coxa long compared to those of *Duplidentitermes*, simple, with a blunt, unmodified, longitudinal ridge, fairly straight or flatly convex in profile, and extending from the apex to about one-third to one-half of the length of the coxa; portion between ridge and inner margin convex. Femora slender, with middle portions of nearly equal thickness. Tibial spurs 3:2:2, without any dark outer spines on the middle tibia. Emerson (1953, p. 104) gave the tibial spur formula as 2:2:2. This error resulted from reference to Silvestri's description and possibly from the inclusion of *Duplidentitermes furcatidens*, with its reduced outer spur of the front tibia, in *Hoplognathotermes*.

WORKER (FIG. 4): Silvestri (1914a, p. 27) figured the worn worker mandibles of *H. subterraneus*. Somewhat less worn cotype specimens are here described and figured (fig. 4). They agree in generic characters with *Acutidentitermes osborni* (fig. 6) in the following particulars: The apical tooth of both mandibles is only a little larger than the first marginal tooth, and the cutting edge of the first plus second marginal tooth of the left mandible is long and less undulating compared to that of *Duplidentitermes* (fig. 9) and other related genera of Termitinae. There is a distinct notch between the fused first plus second marginal tooth and the third marginal tooth of the left mandible. *Acutidentitermes* (fig. 6) has more forward-pointing first marginal teeth in both mandibles, sharper angles between the apical and first marginal teeth, and a proportionately slightly longer cutting edge of the fused first plus second marginal teeth of the left mandible.

RELATIONS: The closest genus in the soldier characters is *Firmitermes* (fig. 1). *Acutidentitermes* (fig. 5) is derivative in the less distinct postclypeus, more bulbous postmentum, and longer front lobe of the pronotum. *Duplidentitermes* (figs. 7, 8) is considered derivative, particularly in its double-pointed marginal teeth, antenna with 13 to 14

articles, constriction of the postmentum behind the rather bulbous anterior five-sixths of its middle length, comparatively shorter legs, and the front coxa (fig. 7C) with a sharp, convexly rounded, longitudinal ridge with several strong bristles on its edge. The left mandible (fig. 6) of the imago-worker is more primitive than in any known genus of Termitinae with biting mandibles in the soldier caste except *?Firmitermes*. Imago-worker mandibles of *Neocapritermes* and *Pericapritermes* appear primitive in the size of the apical teeth and in the dentition of the right mandible, but the specialized soldiers indicate a derivative secondary return to a seemingly generalized dentition. The right mandible (fig. 4) of *Hoplognathotermes* is primitive in having a comparatively small apical tooth, but is derivative in the reduction of the second marginal tooth of the right mandible to a flatly convex hump on the margin. Other related genera with the reduced second marginal tooth of the right mandible are *Acutidentitermes*, *Duplidentitermes*, and *Allognathotermes*. Other genera of Termitinae with a more reduced second marginal tooth on the right mandible have a much larger apical tooth (*Jugositermes*, *Euchilotermes*, *Ophiotermes*, *Tuberculitermes*, *Spinitermes*, *Crepititermes*, and *Cavitermes*). These latter genera in some cases probably evolved their larger apical teeth and their reduced third marginal tooth of the left mandible by means of parallel or convergent evolution.

I now consider *Hoplognathotermes* worker mandibles to be primitive among the Termitinae in some important characters, with only the questionably assigned *?Firmitermes tripolitanus* being more primitive. The comparatively small apical tooth that is only a little larger than the first marginal tooth of each mandible, and the distinct notch between the relatively long fused first plus second marginal teeth and the third marginal teeth of the left mandibles, are considered primitive characters. The reduced second marginal tooth of the right mandible is not a primitive character, and it may be presumed that the most primitive genera of the subfamily combined the primitive characters of the left mandible with a large second marginal tooth in the right mandible now found in such genera as *Ceratotermes*, *Proboscitermes*, and *Promirotermes*. For some time, I shared the view of Ahmad (1950, p. 68) that *Neocapritermes* and *Planicapritermes* possessed the most primitive imago-worker mandibles in the Termitinae, but in view of the obviously derivative soldier, with asymmetrical snapping mandibles and the relatively small apical teeth of *Pericapritermes*, I now interpret the sharp angle between the first and second marginal teeth of the right mandible of *Neocapritermes* and *Planicapritermes* to be derivative,

even though this character may be primitive in some other groups, particularly in the Rhinotermitidae which presumably gave rise to the Termitidae. The most primitive Termitidae were probably close to *Protohamitermes* placed at the base of the Amitermitinae. *Protohamitermes* is the only genus of Termitidae with separate first and second marginal teeth of the left mandible, a subsidiary reduced tooth on the first marginal tooth of the right mandible (except ?*Firmitermes*), and a large second marginal tooth on the right mandible with a wide angle between the first and second marginal teeth (Ahmad, 1950, pp. 64, 65, fig. 12). The sharp angle between the first and second marginal teeth of the right mandible in some advanced Amitermitinae seems to be derivative.

Hoplognathotermes subterraneus Silvestri

Hoplognathotermes subterraneus SILVESTRI, 1914a, p. 26 (nymph, soldier, major worker, minor worker), fig. 12 (soldier), fig. 13 (soldier, worker).

Hoplognathotermes subterraneus var. *superior* SILVESTRI, 1914a, p. 28 (worker, biology).

Hoplognathotermes subterraneus SILVESTRI, 1914b, p. 498 (nymph, soldier, major worker, minor worker), fig. 12 (soldier), fig. 13 (soldier, worker).

Hoplognathotermes subterraneus var. *superior* SILVESTRI, 1914b, p. 500 (worker, biology).

Hoplognathotermes subterraneus HEGH, 1922, p. 497 (biology), p. 696 (locality), fig. 353D (soldier).

Hoplognathotermes subterraneus var. *superior* HEGH, 1922, p. 497 (biology), p. 696 (locality).

Hoplognathotermes subterraneus SJÖSTEDT, 1926, p. 158 (soldier, biology), fig. 34 (soldier).

Hoplognathotermes subterraneus var. *superior* SJÖSTEDT, 1926, p. 158 (systematics).

Hoplognathotermes subterraneus SNYDER, 1949, p. 151 (synonymy).

Hoplognathotermes subterraneus var. *superior* SNYDER, 1949, p. 151 (synonymy).

SOLDIER (FIG. 3): Head uniform brown, somewhat lighter at the sides of the postmentum. Labrum almost as dark as the postclypeus. Base of mandibles same color as the head, with outer portions black-brown. Pronotum much lighter than the head. Abdomen yellowish, lighter than pronotum. Very few bristles scattered over the head, and no hairs near the fontanelle. Postmentum (fig. 3C) without bristles or hairs except for a few at the sides of the anterior portion. Pronotum with a few bristles near the margins and short hairs in front. Legs without conspicuously thick bristles. Tergites with a row of bristles and a few short hairs. Sternites with hairs almost as long as the bristles.

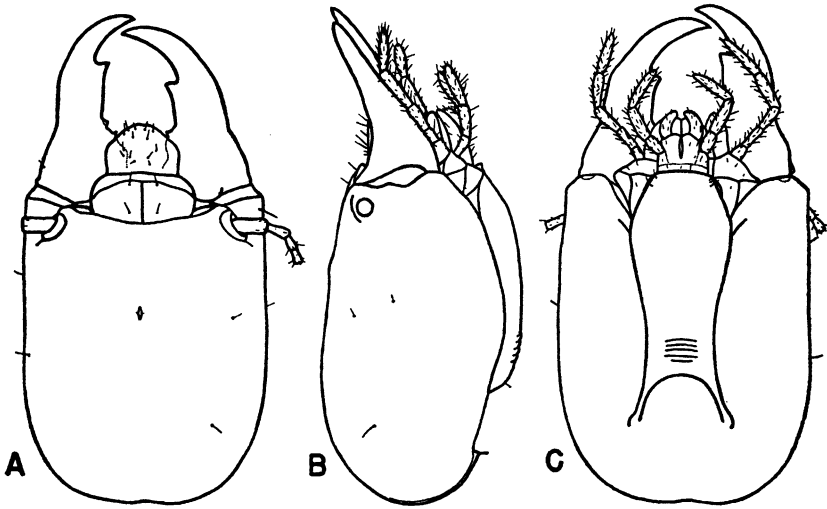


FIG. 3. Cotype soldier of *Hoplognathotermes subterraneus* Silvestri. A. Head from above. B. Head from the side. C. Head from below.

Head (fig. 3A) wide, rectangular, with fairly straight parallel sides and hind margin rounded except for a slight longitudinal furrow; ridges near the base of the antennae not prominent; two slight projections between the fontanelle and the bases of the antenna visible in profile (fig. 3B); profile rather flat, with the postclypeus and front in line with the vertex. Fontanelle inconspicuous, about one-third of the length of the head from the base of the postclypeus. Postmentum (fig. 3C) constricted behind; profile arched; with about four small transverse ridges near the rear. Antennae with 15 articles, the third article shorter than the second. Postclypeus fairly distinct, with a median line. Labrum with sides somewhat angulate and tip somewhat rounded. Each mandible with a conspicuous tooth in the apical third and several small projections near the base; bases not conspicuously bulging; outer edge of apex more curved and teeth not so large as in *Acutidentitermes osborni* (fig. 5), and the angle between the apical and first marginal teeth of each mandible not so sharp. Pronotum strongly saddle-shaped, with a conspicuously emarginate front margin; frontal lobe large, forming an angle with the posterior region of about 125 degrees in profile; sides rounded and converging towards the rear; hind margin not emarginate. Front coxa with a longitudinal ridge that is not particularly sharp and lacks a projection. Front femora not swollen.

WORKER (FIG. 4): The front coxal ridge has a few scattered stiff hairs

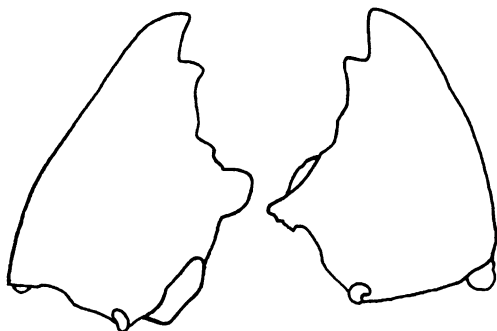


FIG. 4. Mandibles of worker (somewhat worn) from cotype colony of *Hoplognathotermes subterraneus* Silvestri, Conakry, French Guinea.

but lacks conspicuous spines. The front tibia, femur, and trochanter have long stiff hairs but lack the conspicuous spines found in many other related genera. Mandibles (fig. 4) close to the worker mandibles of *Acutidentitermes osborni* (fig. 6), but the angle between the apical and first marginal teeth of each mandible is not so sharp, the cutting edge of the first plus second marginal tooth of the left mandible is proportionately slightly shorter and slightly more undulating, while the apical teeth of both mandibles are close in proportional size. The upper edge of the molar region of the right mandible of *H. subter-*

TABLE 3
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF
Hoplognathotermes subterraneus SILVESTRI

	Range
Length of head to side base of mandibles	3.17-3.23
Width of head	2.38-2.44
Thickness of head	1.94-2.06
Greatest width of postmentum	1.00-1.04
Least width of postmentum	0.68-0.74
Length of labrum	0.48-0.56
Width of labrum	0.70-0.74
Length of left mandible	2.29
Length of left mandible from tip to tip of tooth	0.64-0.73
Width of left mandible at tooth	0.42-0.47
Length of pronotum	0.86
Width of pronotum	1.47-1.50
Length of hind tibia	2.65-2.74

raneus is more evenly and less sharply and deeply concave in outline from above than in *A. osborni*. The front margin of the pronotum is evenly and smoothly convex, with no indentation in the middle, and the anterior lobe is rather large but not so large proportionately as in *A. osborni*. The ridge of the front coxa is not sharp, but is blunt and rounded. The front tibia is not swollen and stocky as in some related genera and has three spurs, the outer spur short but distinct.

LOCALITIES AND MATERIAL: The description and figure 3 of the soldier are taken from two soldiers, one together with one nymph and workers in the Silvestri Collection, Portici, Italy, labeled "*Hoplognathotermes subterraneus* Silv. Cotypi. Guinea francese: Camayenne. F. Silvestri—16 Ott. 1912" (latitude 9° 25' N., longitude 13° 20' W.), and another cotype soldier with workers from the same colony in the Emerson Collection, the American Museum of Natural History. Vials from Conakry (latitude 9° 27' N., longitude 13° 50' W.) and Kakoulima (latitude 9° 40' N., longitude 13° 25' W.), French Guinea, in the Silvestri Collection in Portici are also labeled "Cotypi." The worker was described and the mandibles were drawn (fig. 4) from a specimen in the Emerson Collection labeled "*Hoplognathotermes subterraneus*, det. and coll. F. Silvestri, Conakry, French Guinea, VIII.1912."

(?Genus) "*Hoplognathotermes*" *submissus* Silvestri

Hoplognathotermes submissus SILVESTRI, 1914a, p. 28 (major worker, minor worker, biology), fig. 14 (worker mandibles).

Hoplognathotermes submissus SILVESTRI, 1914b, p. 500 (major worker, minor worker, biology), fig. 14 (worker mandibles).

Hoplognathotermes submissus HEGH, 1922, p. 498 (biology), p. 696 (locality).

Hoplognathotermes submissus SJÖSTEDT, 1926, p. 158 (synonymy).

Hoplognathotermes submissus SNYDER, 1949, p. 151 (systematics).

WORKER: The hairs on the coxa are not quite so long as in *H. subterraneus*. The postclypeus is less strongly arched than in *H. subterraneus*. The mandibles are conspicuously different from those of *H. subterraneus*. The left mandible has a shorter cutting edge of the first plus second marginal tooth, and the right mandible has a much more prominent second marginal tooth. The pronotum is narrower but is generally similar to that of *H. subterraneus*. The proportions of the tibia, femur, and coxa of the front leg are similar to those of *H. subterraneus*. The tibial spurs are 2:2:2. The width of the worker head is 1.32 mm.

RELATIONS: Because of the mandibular differences in particular, I think this species surely belongs to a different genus from *Hoplognathotermes*.

termes, but the workers show relationship, at least at the subfamily level. The characters do not fit any known genus. In view of the lack of the imago or soldier caste, it seems best to place this species among those unclassified to genus, without attempting to interpret its precise relationships. It may be possible to retain the specific name when other castes are collected in association with workers. At the same time, even a distinctive worker is best not named without other castes. Not only is there taxonomic difficulty, but there is little biological information that can be correlated with the name.

LOCALITY AND MATERIAL: One worker cotype determined and collected by F. Silvestri, Victoria, Cameroon (latitude 4° 3' N., longitude 9° 16' E.), January, 1913; in the American Museum of Natural History.

ACUTIDENTITERMES, NEW GENUS

TYPE SPECIES: *Acutidentitermes osborni*, new species.

There is little question that this genus is closely related to *Hoplognathotermes*, and, during its study and description, I attempted to expand the concept of the genus *Hoplognathotermes* to include this new species. I am naturally hesitant to name new monotypic genera, especially when the species is known only from few specimens and without one of the important castes. However, in this case, the distinctions of the species *Hoplognathotermes subterraneus* and *Acutidentitermes osborni* are of generic importance when all closely related genera are considered. In order to be consistent with the generic separations as now understood by numerous students of termites, it is necessary to establish a new genus for the reception of *A. osborni*.

Little is known of the ecology and range of the genus and species. The single locality is in the Ituri rain forest near the Epulu River in the Belgian Congo. The single soldier, together with its associated workers, is a sample of a subterranean colony. All the known related genera are subterranean, without surface indications of their nests.

SOLDIER (FIG. 5): The genus resembles *Hoplognathotermes* (fig. 3) in the small number of rather short bristles on the head and none near the fontanelle. The postmentum lacks hairs or bristles completely. The first four tergites have fairly long bristles, with few or no hairs, but additional short hairs occur on the posterior tergites and sternites. The head (fig. 5A) is massive, the sides of the head are slightly convex and fairly parallel, and the fontanelle is rather small. The postmentum (fig. 5B) is more bulbous than that of *Hoplognathotermes* and has overlapping lateral margins that obscure the lateral sutures except near the posterior margin when viewed from below. Rear portion of post-

mentum without transverse ridges. The antenna of both genera have 15 articles each. The suture between the postclypeus and the front is much less distinct than in *Hoplognathotermes*. Labrum with fairly sharp lateral and medial points. Both genera have conspicuous forward-pointing teeth on the left and right mandibles, but the teeth are longer, sharper, and more forward-pointing in *Acutidentitermes* than in *Hoplognathotermes*. The outer curve of the mandibles near the tip is less convex than in *Hoplognathotermes*, and the notch in the sides of each mandible at the junction of the apical and basal portions is somewhat less marked. The frontal lobe of the pronotum (fig. 5A) is larger and longer than in *Hoplognathotermes*, the median notch on the front margin is more marked and wider, and the hind margin of the pronotum is more concave. The front coxa (fig. 5C) in both genera is simple, with a rather blunt, very moderately sharp, longitudinal ridge that is fairly straight or slightly convex in profile and without thick spines. The femora of the front legs are relatively long and comparatively thin in contrast to those of *Duplidentitermes* and its related genera. Tibial spurs are 3:2:2.

WORKER (FIG. 6): The worker mandibles of *Acutidentitermes* (fig. 6) differ from those of *Hoplognathotermes* (fig. 4) in having a sharper angle between the apical and first marginal teeth in both mandibles; in having a proportionately slightly longer cutting edge of the fused first and second marginal teeth of the left mandible; and in having a sharper and more deeply concave edge of the upper ridge of the molar area in the right mandible.

RELATIONS: It is my opinion that the characters of the soldiers indicate that *Firmitermes*, *Hoplognathotermes*, and *Acutidentitermes* are a related group of primitive genera of the Termitinae. The worker mandibles of *Acutidentitermes* (fig. 6) seem to be somewhat derivative from the *Hoplognathotermes* type mandible (fig. 4), and these two genera are much more closely related to each other than either is to *Firmitermes tripolitanus* (fig. 2).

Acutidentitermes osborni, new species

SOLDIER (FIG. 5): Head and pronotum brown, posterior portion of the head and postclypeus brownish yellow, and antennae and labrum yellowish. Pilosity of head sparse. Pronotum with a few small hairs on the margins only. Middle tibia without thick outer spines. Anterior tergites with a row of bristles and no short hairs; posterior tergites and sternites with bristles, and hairs about half of the length of the bristles. Head (fig. 5A) with somewhat convex parallel sides, profile slightly

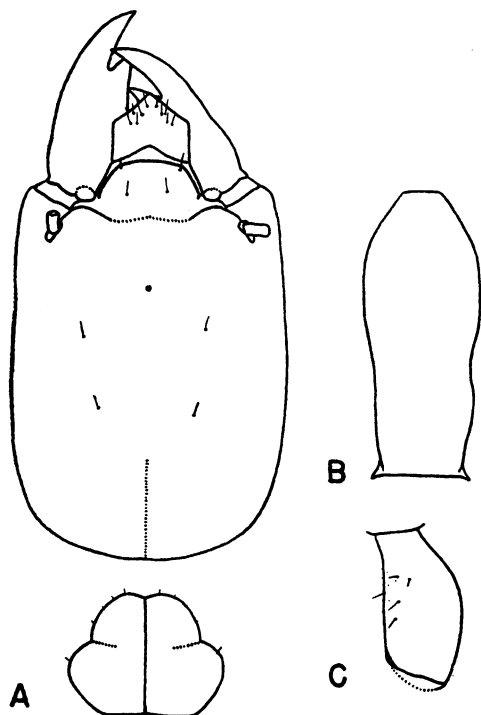


FIG. 5. Holotype soldier of *Acutidentitermes osborni*, new genus, new species. A. Head and pronotum from above. B. Postmentum from below. C. Front coxa from inner side.

concave in the vicinity of the fontanelle. Postmentum as in figure 5B; profile strongly and evenly convex, with a small constriction about three-fifths of the middle length from the front; posterior portion wider than in *Hoplognathotermes subterraneus* (fig. 3C). Antenna with 15 articles, the third article a little narrower and about as long as the fourth, the fourth equal to the fifth and shorter than the second. Labrum pointed, forming an angle slightly less than a right angle (the labrum is pointed somewhat downward in fig. 5A and consequently does not show the tip so sharp nor the sides between the tip and the lateral angles so concave as they actually are). Each mandible has a large, forward-pointing, acutely sharp, marginal tooth, nearly as sharp and thick as the apical tooth but not so long. The angle between the inner margin of the apical tooth and the first marginal tooth is about 30 degrees. Each mandible has a small, rather blunt tooth on the margin near the junction with the basal portion. Maxillary palps extend

TABLE 4
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF
Acutidentitermes osborni, NEW SPECIES

Length of head with mandibles	5.12
Length of head to side base of mandibles	3.47
Width of head	2.65
Length of postmentum	2.65
Greatest width of postmentum	1.15
Least width of postmentum near hind margin	0.79
Length of labrum in middle	0.52
Width of labrum	0.72
Length of left mandible	2.12
Length of left mandible from tip to tip of tooth	0.52
Length of pronotum	1.10
Width of pronotum	1.47
Length of hind tibia	3.00

out to about the tip of the first marginal tooth of the extended mandibles. Pronotum (fig. 5A) with a comparatively large frontal lobe; front margin widely and shallowly indented; angle at base of frontal lobe in profile about 135 degrees. Front coxa (fig. 5C) with a short, blunt, unmodified, longitudinal ridge. Front femur from the side only about twice as thick as the front tibia in the middle. Tibial spurs 3:2:2, the outer spur on the front tibia rather short.

WORKER (FIG. 6): Head brownish yellow. Head with a very few long and short hairs. Pronotum with a few hairs around the margins. Middle tibia without outer conspicuous spines. Anterior tergites with two rows of bristles and no hairs. Posterior tergites and sternites with bristles



FIG. 6. Mandibles of worker of *Acutidentitermes osborni*, new genus, new species.

TABLE 5
MEASUREMENTS (IN MILLIMETERS) OF THE WORKER OF
Acutidentitermes osborni, NEW SPECIES

Width of head	1.65
Length of postclypeus	0.35
Length of pronotum	0.64
Width of pronotum	1.07
Length of hind tibia	2.54

and hairs. Antenna with 15 articles. Postclypeus strongly arched; length less than half of width. Mandibles as in figure 6, the angle between the apical and first marginal tooth in each mandible sharper than in *Hoplognathotermes subterraneus* (fig. 4). Pronotum with large anterior lobe with a barely perceptible indentation in the front margin; profile with angle at the base of the front lobe a little greater than a right angle. Front coxa similar to that of the soldier. Tibial spurs 3:2:2.

LOCALITY AND MATERIALS: The description is taken from a single holotype soldier and seven workers determined and collected by A. Emerson, Pygmy Camp, 4 kilometers north of Camp Putnam (latitude 1° 24' N., longitude 28° 36' E.), Epulu River, Belgian Congo, May 21, 1948, in galleries below the surface of the soil in the rain forest; in the American Museum of Natural History.

The species is named in honor of my friend, President Fairfield Osborn of the New York Zoological Society, who made both financial and official arrangements for my studies in the Belgian Congo in 1948, and who has greatly stimulated the conservation of wild life throughout the world. Earlier in my professional studies, I named several species of termites in honor of his father, Henry Fairfield Osborn, one-time President of the American Museum of Natural History, who preceded his son as President of the New York Zoological Society.

DUPLIDENTITERMES, NEW GENUS

- <*Hoplognathotermes* SJÖSTEDT, 1926, p. 157.
- <*Hoplognathotermes* EMERSON, 1928, pp. 408, 420.
- <*Hoplognathotermes* SNYDER, 1949, p. 151.
- <*Hoplognathotermes* AHMAD, 1950, pp. 68, 69, 83.
- <*Hoplognathotermes* EMERSON, 1953, p. 104.
- <*Hoplognathotermes* GRASSÉ AND NOIROT, 1954, pp. 357, 359, 370, 373.
- =*Duplidentitermes* MS EMERSON, 1955, p. 511 (without description).

TYPE SPECIES: *Duplidentitermes furcatidens* (Sjöstedt) (= *Hoplognathotermes furcatidens* Sjöstedt).

This genus is proposed for the species described by Sjöstedt (1924) under the name "*Hoplognathotermes furcatidens*" and for two additional new species described in the following pages. The known geographical range includes several localities in French Equatorial Africa and in the Belgian Congo. All the species of *Duplidentitermes* are subterranean, as are their close generic relatives. The nest constructions are described by Grassé and Noirot (1954).

IMAGO: Outline of front coxa with a number of short hairs and long and short bristles. Middle tibia without outer contrasting spines. The fontanelle of the imago is white, triangular, and only slightly smaller than the ocellus. Imago mandibles (Ahmad, 1950, pp. 69, 83, fig. 14, "*Hoplognathotermes*") similar in general to the worker mandibles of *D. jurioni* (fig. 9). The apical tooth is proportionately larger than in *Hoplognathotermes* (fig. 4). The distance from the apical tip to the tip of the first marginal tooth is greater than the distance from the tip of the first marginal tooth to the tip of the third marginal tooth of the left mandible. The cutting edge of the first plus second marginal tooth of the left mandible undulates as in figure 9. The second marginal tooth of the right mandible is reduced to a small hump as in *Allognathotermes*. The hind margins of the mesonotum and metanotum are deeply indented with points sharper than right angles. The front coxa has a sharp longitudinal ridge which is flatly convex in profile, with the peak of the hump towards the basal end and not in the middle of the ridge. Tibial spurs 3:2:2; outer spur of front tibia short and markedly reduced. Both wings with a short *Sc* immediately apical to the basal suture and joining the costal margin close to the suture.

SOLDIER (FIGS. 7, 8): There seems little doubt that *Hoplognathotermes* (fig. 3), *Duplidentitermes*, and *Allognathotermes* (Emerson, 1956b, p. 24, fig. 7) are related genera. The soldiers are similar in the lack of a clump of hairs near the frontal gland opening and in the scattered bristles at the front end of the large labrum (not bunched as in *Apicotermes*). Several (nine to 11) conspicuous bristles are in a row along the sharp ridge of the front coxa (fig. 7C) and extend in a curve towards the inner edge and recurve towards the apex to enclose a somewhat oval, flat area inside the apical half of the coxa. Front tibia with several inner spines not showing great specialization. The middle tibia lacks outer contrasting spines. Head (fig. 7A) massive, with a rather flat front, in general somewhat similar to that of *Hoplognathotermes* (fig. 3) and *Allognathotermes*. Postmentum (fig. 7B, D, E) with a proportionately larger front portion than in related genera, with the minimum width nearer to the hind margin (above five-sixths to six-sevenths

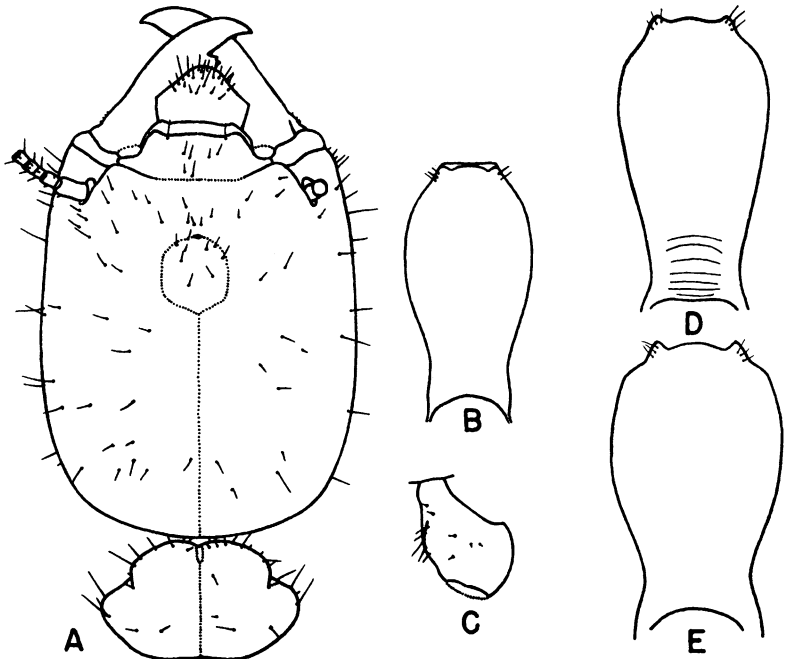


FIG. 7. A. Head and pronotum from above of holotype soldier of *Duplidentitermes jurioni*, new species. B. Postmentum of paratype soldier of *Duplidentitermes jurioni*, new species. C. Front coxa from inner side of holotype soldier of *Duplidentitermes jurioni*, new species. D. Postmentum of paratype soldier of *Duplidentitermes furcatidens* (Sjöstedt). E. Postmentum of holotype soldier of *Duplidentitermes latimentonis*, new species.

of the middle length from the front). The lateral sutures of the postmentum are visible for its entire length. Antennae with 13 to 14 articles and similar to those of *Allognathotermes*. *Firmitermes* is reported to have antennae with 14 articles, while those of *Hoplognathotermes* and *Acutidentitermes* have 15 articles. Suture between postclypeus and front of head visible but not so distinct as in *Firmitermes* and *Hoplognathotermes*. *Duplidentitermes* has a labrum (fig. 7A) with the greatest width at the distinct lateral angles, while *Firmitermes* (fig. 1) has convex lateral margins of the labrum, *Hoplognathotermes* (fig. 3A) has parallel sides with blunt lateral angles, *Acutidentitermes* (fig. 5A) has parallel and slightly concave sides, with sharper points, and *Allognathotermes* has more rounded sides at the region of greatest width. *Duplidentitermes* differs conspicuously from its related genera in the large, double-pointed tooth in both the right and left mandibles (fig.

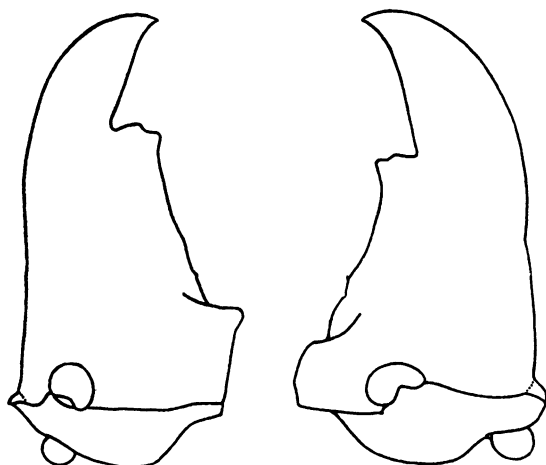


FIG. 8. Mandibles of paratype soldier of *Duplidentitermes jurioni*, new species.

8). *Allognathotermes* (Emerson, 1956b, p. 24, fig. 7) has less prominent teeth than *Hoplognathotermes* or *Duplidentitermes*, but it has two more separated teeth that seem to be homologous with the double-pointed tooth of *Duplidentitermes* in the left mandible. Front coxa (fig. 7C) with a conspicuous, sharp, longitudinal ridge, with a flat, evenly convex profile extending from the apex for about half of the length of the coxa. The front coxal ridge is more arched and prominent than in *Hoplognathotermes*, but is very similar to that of *Allognathotermes*, differing only in being a little more distinct owing to a slight curved extension towards the inner surface. Front femur short and robust in *Duplidentitermes* and *Allognathotermes* and markedly different from the long and slender front femur of *Firmitermes*, *Hoplognathotermes*, and *Acutidentitermes*. Front femur with parallel sides and equal thickness in the middle portion. Front tibia somewhat swollen. Tibial spurs 3:2:2, with the outer spur of the front tibia proportionately short as in *Hoplognathotermes*.

WORKER (FIG. 9): The characters of the mandibles are similar to those described in the imago. The front coxal ridge is more arched and prominent than in the worker of *Hoplognathotermes*.

RELATIONS: *Duplidentitermes furcatidens* has long been included in the related but more primitive genus *Hoplognathotermes*, the imago of which is unknown. The imago-worker mandibles (figs. 4, 9) are generically distinct. *Duplidentitermes* is also related to *Allognathotermes*.

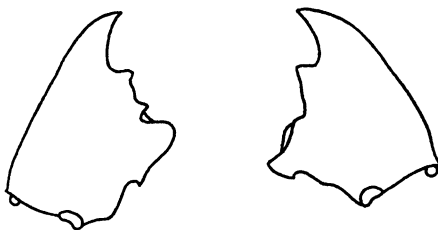


FIG. 9. Mandibles of worker of *Duplidentitermes jurioni*, new species.

In some respects *Duplidentitermes* is more primitive than *Allognathotermes* (Grassé and Noirot, 1954, p. 378, figs. 6D, 11, 13B, 14C, 15, 18G; Emerson, 1956b, p. 24, fig. 7). Grassé and Noirot (1954) discuss and illustrate the behavior of these and related genera. A female imago of *Allognathotermes hypogeus* Silvestri (determined and collected by P.-P. Grassé at Adiopodoumé near Abidjan, Ivory Coast) is similar to that of *Duplidentitermes furcatidens* (Sjöstedt) in color, pilosity, size, relation of eye to ocellus, basal articles of the antenna, postclypeus, proportions of pronotum, and shape of the seventh sternite. The fontanelle of *A. hypogeus* is similar in color and shape, but is about two-thirds as long and about half as wide as that of *D. furcatidens*. *Allognathotermes* has a slightly smaller apical tooth in both mandibles of the imago. In the left mandible, the distance from the apical point to the tip of the first marginal tooth compared to the distance between the tips of the first and third marginal teeth is 0.22/0.19 mm. in *Allognathotermes* and 0.22/0.18 mm. in *Duplidentitermes*. The pronotum of *A. hypogeus* has a dark, longitudinal, median line with a more marked depression in both the middle and the branches of the T-shaped mark than in *D. furcatidens*; the anterior edge of the pronotum is a little more raised; and the hind margin is a little more sharply indented than in *D. furcatidens*. The front coxa of *A. hypogeus* has a little more prominent longitudinal sharp ridge and is also a little more convex in profile than in *D. furcatidens*. The outer spur on the front tibia of *A. hypogeus* is only a little smaller than the inside spurs and is not reduced as in *D. furcatidens*. The first eight tergites of *A. hypogeus* are conspicuously notched at the sides near the spiracles, while in *D. furcatidens* only the first tergite shows such a conspicuous notch, and the second tergite has only a suggestion of such a notch.

Although in most respects the imagoes, soldiers, and workers of *Duplidentitermes* indicate a more primitive set of characters than do those of *Allognathotermes*, in a few respects *Allognathotermes* may

be considered more primitive. The valvular structures of the hind intestine of the two genera are close (Grassé and Noirot, 1954, figs. 9C, 10, 11, pl. 5).

Duplidentitermes furcatidens (Sjöstedt), new combination

Hoplognathotermes furcatidens SJÖSTEDT, 1924, p. 496 (soldier).

Hoplognathotermes furcatidens SJÖSTEDT, 1926, p. 158 (imago, soldier, worker, biology), pl. 6, figs. C1-C3 (soldier), fig. C4 (worker).

Hoplognathotermes furcatidens SNYDER, 1949, p. 151 (systematics).

Hoplognathotermes furcatus (mistake in spelling) AHMAD, 1950, pp. 68, 83 (systematics), fig. 14 (imago mandibles).

Hoplognathotermes furcatidens GRASSÉ AND NOIROT, 1954, pp. 357, 359 (nest constructions), pp. 370, 373 (intestine), figs. 9, 10 (intestine), fig. 13H (soldier coxa), fig. 18E (worker mandibles), pl. 5, figs. 9, 10 (enteric valve).

IMAGO: Head fairly dark brown. Postclypeus yellow-brown, lighter than dark parts of the head. Pronotum same color as head. Tergites and sternites yellow-brown, sternites at anterior end of abdomen with a little light patch on the front center of each. Wings yellow-brown, membrane covered with minute dots when viewed under a binocular microscope. Head and pronotum covered with many scattered bristles and short hairs about one-third of the length of the bristles. Outline of front coxa with a number of bristles of variable length and also with short hairs. Middle tibiae without outer contrasting spines. Tergites and sternites with many bristles and hairs, the bristles scattered and not marginal, the hairs about one-third to one-half of the length of the bristles but not contrasting sharply with the bristles in outline. Borders of wings with short hairs and a few along the veins but not on the membrane. Head roundly oval, with prominent medium-sized eyes about one-fourth to two-sevenths of their diameter from the lower margin. Line between the ocelli from the rear very flatly convex, with a very slight elevation at the top of each ocellus. Fontanelle white, conspicuously triangular, and only slightly smaller than the ocellus. Eye relatively small. Ocellus somewhat smaller than the antennal socket, less than its length but slightly more than its width removed from the eye. Antenna with 17 articles, third article shorter than the fourth, fourth equal to the fifth, and fifth shorter than the second. Length of postclypeus distinctly less than half of its width, moderately convex or arched in profile, and with a longitudinal median dark line. Mandibles similar to those of the worker of *D. jurioni* (fig. 9). Pronotum a little longer than half of its width, with a small, shallow, posterior indentation; T-shaped depression a little darker than the rest of the

pronotum and with a short stem; two small, dot-like depressions in front of the posterior margin, one on each side of the median line and close together. Mesonotum and metanotum with deeply indented hind margins, with the points of the projections sharper than right angles; angle of indentation of mesonotum from the points to the center near to a right angle or slightly sharper; angle of indentation of metanotum a little less than a right angle. Front coxa with a sharp longitudinal ridge, flatly convex in profile, and with a longer margin towards the trochanter and a somewhat steeper basal margin. Tibial spurs 3:2:2, the outer spur of the front tibia very much reduced and short. Hind margin of the enlarged seventh sternite of the female straight or very slightly concave in the middle and with slightly concave converging sides.

SOLDIER: (FIG. 7D): Head yellowish, outer half of mandibles red-brown, and thorax and abdomen paler than head. Head and pronotum with numerous sparsely scattered bristles without contrasting short hairs on the head; many scattered bristles on the front half of the labrum. In a single specimen, the postmentum (fig. 7D) is bare except

TABLE 6
MEASUREMENTS (IN MILLIMETERS) OF THE IMAGOS OF
Duplidentitermes furcatidens (SJÖSTEDT), NEW COMBINATION

	Male	Female
Length of head to tip of labrum	1.76	1.88
Length of head to front of postclypeus	1.22	1.32
Length of head to side base of mandibles	1.09	1.22
Width of head	1.53	1.61
Length of fontanelle	0.12	0.15
Width of fontanelle	0.15	0.16
Diameter of eye	0.36	0.34
Eye from lower margin	0.09	0.10
Length of ocellus	0.17	0.18
Width of ocellus	0.12	0.14
Ocellus from eye	0.13	0.15
Length of postclypeus	0.29	0.32
Width of postclypeus	0.70	0.73
Length of pronotum	0.70	0.79
Width of pronotum	1.29	1.47
Length of hind tibia	1.69	1.74
Length of forewing from costal suture	13.91	15.98
Width of forewing	3.69	4.23

for three bristles on each side of the anterior portion near the margin. Front coxa with several stiff bristles on the projecting longitudinal ridge and with a few short bristles on the area inside the ridge. Tergites with bristles near the posterior margins and scattered hairs about half as long as the bristles. Sternites with many scattered bristles without contrasting short hairs. Head elongate, with fairly straight sides converging slightly towards the front. Frontal gland fontanelle in a depression in the front portion of the head with two grooves diverging from it to the lateral base of the postclypeus. Profile of head with a depressed front with a somewhat concave outline from the base of the mandibles to the vertex and top somewhat convex; a rounded ridge from the side base of the mandible to the rear of the antenna socket. Postmentum (fig. 7D) with a rounded bulbous anterior six-sevenths, and concave sides at a constriction about one-seventh, of the length from the middle hind margin, and with about six small transverse grooves on the posterior fourth. Profile of postmentum convex in front and slightly concave at the rear fourth. Antenna with 14 articles, the third article shorter than the fourth, the fourth shorter than the fifth, and the fifth shorter than the second. Postclypeus fused with the front, but with an indistinct suture visible in a favorable light. Labrum somewhat pentagonal in shape, with a rounded broad whitish tip and bluntly angular sides, all angles greater than right angles; lateral sides of front margin slightly concave and posterior sides straight and converging somewhat towards the clypeus. Mandibles robust, each with a conspicuous, large, double-pointed tooth, the tooth about one-fourth of the total length from the tip of the left mandible, and about one-third of the total length from the tip of the right mandible; margins of mandibles posterior to the teeth irregular, without large teeth. Right mandible with a very short sharp tooth about two-fifths of the total length from the basal condyle. Pronotum with a strongly indented front margin forming an angle of about 90 degrees with the rounded front side lobes; a median longitudinal groove in the rear half; sides rounded in outline; profile of middle with an angle of about 160 degrees between the front and hind portions. Front coxa with a sharp longitudinal ridge, with a flat convex projection in outline; area inside edge of projection somewhat convex. Middle tibia without conspicuous outer spines near the tip. Tibial spurs 3:2:2, the outer spur of the front tibia much reduced and hardly visible.

LOCALITY AND MATERIAL: Imagoes and one soldier, paratypes from type colony, labeled "*Hoplognathotermes furcatidens*," determined by Y. Sjöstedt, Nola (latitude 3° 32' N., longitude 16° 3' E.), Bania,

TABLE 7
MEASUREMENTS (IN MILLIMETERS) OF SOLDIERS OF THREE SPECIES OF
Duplidentitermes

	<i>D. furcatidens</i> Paratype	<i>D. jurioni</i> Holotype	<i>D. latimentonis</i> Holotype
Length of head to side base of mandibles	2.66	2.40	2.74
Width of head	2.07	1.87	2.11
Thickness of head	1.64	1.44	1.62
Length of postmentum	1.64	1.32	1.52
Greatest width of postmentum	0.80	0.76	0.89
Least width of postmentum	0.45	0.49	0.54
Width of labrum	0.67	0.61	0.71
Length of left mandible	1.47	1.31	1.47
Length of left mandible from apex to inside tip of first marginal tooth	0.38	0.29	—
Length of right mandible from apex to in- side tip of first marginal tooth	0.50	0.38	—
Length of pronotum	0.78	0.72	0.79
Width of pronotum	1.36	1.18	1.44
Length of hind tibia	1.71	1.45	1.65

French Congo, collected by G. Eriksson, 1924; in the American Museum of Natural History.

Duplidentitermes jurioni, new species

SOLDIER (FIGS. 7, 8): Compared directly to a paratype soldier of *D. furcatidens* (Sjöstedt), the holotype of *D. jurioni* is similar in color and pilosity and is smaller in size. The profile of the head of *D. jurioni* has a sharper concavity above and behind the base of the antenna, but has less of a projection at the upper base of the mandible. The profile of the postmentum has a fairly straight hind portion without so much of an abrupt separation from the convex front portion, and without so much of a concave outline of the hind portion. Postmentum (fig. 7B) lacking transverse ridges or grooves in the hind portion, but showing a somewhat more marked constriction and a more bulbous anterior region. Antenna with 13 articles, the third article probably consisting of two fused articles and a little longer than the second, the fourth shorter than the second, and the fifth equal to or slightly shorter than the second. Mandibles (fig. 8) shorter but quite similar to those of *D. furcatidens*. Pronotum (fig. 7A) with less sharp indentation of front margin; angle a little greater than a right angle. Front coxa (fig. 7C)

with a flattened area inside the sharp ridge a little more marked and with a few more conspicuous dark bristles. Middle tibia without conspicuous outer spines. Tibial spurs 3:2:2, but the outer spur of the front tibia is so reduced as to be hardly visible.

Seven other soldiers from the same colony conform to the above description of the holotype except that the antenna on one side only in one specimen is similar to that described for *D. furcatidens*.

The measurements of the holotype soldier are given in table 7.

LOCALITY AND MATERIAL: Holotype soldier and seven paratype soldiers with workers, determined and collected by A. Emerson, Yangambi (latitude 0° 47' N., longitude 24° 23' E.), Belgian Congo, May 30, 1948, from the surface of a mound 6 feet high at the base of a tree, *Pteryapodium oxyphyllum* Harms; in the American Museum of Natural History; Silvestri Collection, Portici; Congo Museum, Tervuren; Wasmann Collection, Maastrichter Museum; Entomologiska Institutet, Lund; Naturhistoriska Riksmuseum, Stockholm.

The species is named in honor of M. Fl. Jurion, Directeur General de l'Institut National pour l'Etude Agronomique du Congo Belge at Yangambi at the time of my visit and who greatly facilitated my field studies of termites in the Belgian Congo.

Duplidentitermes latimentonis, new species

SOLDIER (FIG. 7E): Compared directly to a paratype soldier of *D. furcatidens* (Sjöstedt), *D. latimentonis* is close in color and pilosity. The front of the head at the upper base of the mandibles and in front of the antennal base is a little less protruding, and the outline in profile is a little more flat and less concave. The concavity of the front of the head in outline is not so sharp as in *D. jurioni*. Postmentum (fig. 7E) is wider in both the widest and narrowest portion than in either *D. furcatidens* (fig. 7D) or *D. jurioni* (fig. 7B). Profile of postmentum a little less convex in the middle than in *D. furcatidens* and without transverse ridges or grooves in the posterior region. The constriction of the postmentum is distinctly more marked than in *D. jurioni*. Antennae broken; the first five articles with the same proportions as those in *D. furcatidens*. Mandibles a little thicker at the base than in *D. furcatidens*, but the dentition is similar. The tips of the mandibles of the unique specimen are broken. Pronotum close to that of *D. furcatidens* and with a slightly sharper indentation in front than in *D. jurioni*. Front coxa similar to that of *D. jurioni* (fig. 7C) in both shape and pilosity. Tibial spurs and spines similar to those of the other two species.

The measurements of the holotype soldier are given in table 7.

LOCALITY AND MATERIAL: Unique holotype soldier without workers, determined and collected by A. Emerson, Pygmy Camp, 4 kilometers north of Camp Putnam (latitude $1^{\circ} 24' N.$, longitude $28^{\circ} 36' E.$), Epulu River, Belgian Congo, May 20, 1948, in ground galleries; in the American Museum of Natural History.

GENUS *HEIMITERMES* GRASSÉ AND NOIROT

= *Heimitermes* GRASSÉ AND NOIROT, 1954, pp. 370, 384.

= *Pugnitermes* MS EMERSON, 1955, p. 511 (not described).

TYPE SPECIES: *Heimitermes laticeps* Grassé and Noirot (Grassé and Noirot, 1954, p. 385).

This genus was proposed for the single species *H. laticeps*, to which a new species, *H. moorei*, is now added. The manuscript name of *Pugnitermes* in a table of distribution (Emerson, 1955, p. 511) is synonymous with *Heimitermes*, but has no nomenclatural validity. The known geographical range of the genus is the Middle Congo, French Equatorial Africa, and the Ituri Forest of the Belgian Congo. The species seem to live in subterranean galleries and nests.

SOLDIER (FIGS. 10, 11): Head with a number of scattered bristles, most

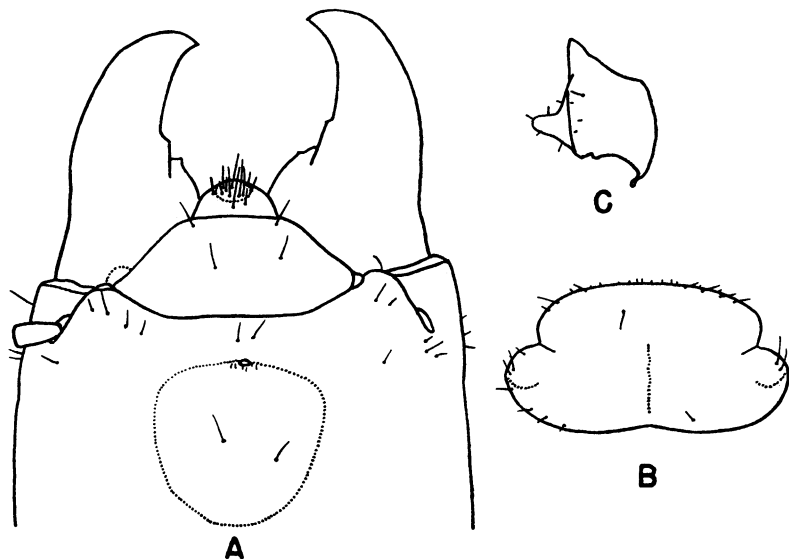


FIG. 10. Holotype soldier of *Heimitermes moorei*, new species. A. Front of head from above. B. Pronotum from above (scale different from other figures). C. Front coxa inner side.

abundant on the front, top, and sides. A few short hairs near the fontanelle. Postmentum (fig. 11B) with a few bristles on the sides near the front and at the base of the maxilla. Labrum (fig. 10A) with numerous long bristles. Front coxa (fig. 10C) with a few bristles and short hairs on the longitudinal ridge, projection, and area inside the ridge. Front tibia with spines on the inner edge of the apical half. Middle tibia with no modified outer spines. Head thick and massive, with somewhat straight parallel or flatly convex sides; a distinct and fairly deep depression in the middle between the base of the postclypeus and the opening of the frontal gland; profile (fig. 11A) curved in the region of the frontal gland, with a slightly bulbous shape near the vertex. Postmentum (fig. 11B) widest behind the bases of the maxillae; the rounded sides at the widest region become more straight as they converge towards the rear, where there is a small constriction just anterior to the concave posterior margin. Lateral sutures of the postmentum visible for their entire length except in the anterior portion. Postclypeus (fig. 10A) distinct and widely hexagonal in shape, with a well-differentiated suture separating it from the front of the head. Labrum (fig. 10A) with a whitish apical region, somewhat larger than that of *Coxotermes*, the tip slightly differentiated from the sides at the front edge, and the sides rounded and not so angular as in *Allognatho-*

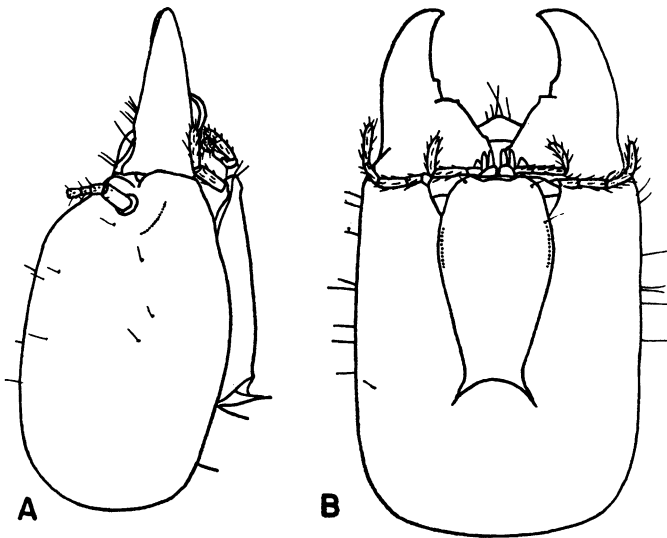


FIG. 11. Holotype soldier of *Heimitermes moorei*, new species. A. Head from the side. B. Head from below.

termes. Sides of labrum at the base approximately parallel. The labrum is usually bent downward, is distinctly shorter than the postclypeus, and is about one-third of the width of the postclypeus. The mandibles (figs. 10A, 11B) are short and massive, with slightly hooked apical points, each mandible with a small but more or less distinct tooth somewhat anterior to the middle of the total length, and each mandible also with a small but distinct tooth at the front of a ventrally protruding thick basal portion not continuous with the cutting edge extending from the apex to the rear of the median tooth, but the tooth is on a protruding ventral portion that forms a somewhat separate, blunt, cutting edge in front of the small molar plate. The pronotum (fig. 10B) is somewhat flared out at the sides and rear; the anterior margin is wide and is slightly and evenly convex, without any distinct emargination or indentation; side margins rounded and hind margin indented and depressed in the middle. The sharp longitudinal ridge of the front coxa has a very conspicuous, long, nipple-like projection with a rounded tip (fig. 10C), more robust and less elongated than in *Coxotermes*, and with a more concave surface at the base of the projection. Front femur is equally thick in the middle portion as in *Coxotermes*. The tibial spurs are 2:2:2. Each front tibia has a whitish circular mark on the upper outer surface that may be the base of the reduced outer apical spur.

WORKER (FIG. 12): The worker mandibles of *Heimitermes laticeps* as described and figured by Grassé and Noirot (1954, fig. 18F) seem identical to those of *H. moorei* (this paper, fig. 12), except that the posterior cutting edge of the first plus second marginal tooth of the left mandible of *H. moorei* is a little more undulating in outline. The major generic characters are the large apical tooth in contrast to the first marginal tooth, the distinct notch between the first plus second marginal tooth and the third marginal tooth of the left mandible, and the small second marginal tooth of the right mandible. The worker mandibles of *H. moorei* (fig. 12) and of *Coxotermes boukokoensis* (Grassé and Noirot, 1954, fig. 18C) are very similar. *Duplidentitermes* (fig. 9), *Allognathotermes*, *Apicotermes*, and *Trichotermes* (Ahmad, 1950, fig. 14; Grassé and Noirot, 1954, fig. 18) are also allied to *Heimitermes* and *Coxotermes*. The front coxa of the worker of *Heimitermes* has a conspicuous triangular projection from the longitudinal sharp ridge, but the projection is not so tooth-like as in the soldier.

RELATIONS: The soldier and worker castes of *Heimitermes* indicate that *Coxotermes* is the most closely related genus. These two genera are somewhat similar in the soldier and worker castes in the shape of

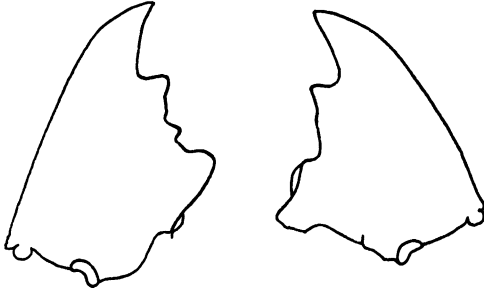


FIG. 12. Mandibles of worker of *Heimitermes moorei*, new species.

the head, the postmentum, the antennae with 14 articles, the labrum, the mandibles, the front coxal projection, the tibial spurs, and (according to Grassé and Noirot, 1954) the enteric valves. The major distinction is in the soldier mandibles, which are more curved in *Coxotermes* and less differentiated into a thick basal portion. The front coxal projection of *Coxotermes* is more extremely elongated. It may be presumed that *Coxotermes* has somewhat more primitive soldier mandibles and that the markedly thickened basal portions of the mandibles of *Heimitermes* are derivative. These two genera are more closely related to each other than either is to any other genus. They seem to have arisen from a more primitive genus related to *Duplidentitermes* or *Allognathotermes*. *Trichotermes* soldiers have a conspicuous angular frontal projection, the mandibles lack the ventral basal protuberance of *Heimitermes*, the sides of the postmentum are straighter and more gradually converging towards the constriction in the posterior third, the pronotum is sharply indented in front and not so indented behind, the front coxal ridge lacks a tooth-like projection but is rounded, and the tibial spurs are 3:2:2. *Heimitermes* and *Trichotermes* are related, but are not very close to each other. *Allognathotermes* has a flat front between the postclypeus and the frontal gland opening, has a somewhat more primitive dentition of the mandibles than *Heimitermes*, lacks the ventral basal modifications of the mandibles, has a more angular labrum, and the frontal coxal projection is not so prominent. I interpret *Allognathotermes* to be a related genus, but it is more primitive on the whole than *Heimitermes* and is not very close.

***Heimitermes moorei*, new species**

SOLDIER (FIGS. 10, 11): Head and hard portions of thorax and abdomen brownish yellow. Head with scattered, fairly long bristles and a

few microscopical hairs around the gland opening. Pronotum and tergites with scattered long bristles and a few short hairs. Inside convex surface and projection of front coxa (fig. 10C) with a few scattered bristles. Sternites with many long bristles and some short hairs. Head (fig. 11B) subrectangular, thick, and robust. Sides of head slightly convex, hind margin rounded, profile (fig. 11A) thick, with a fairly straight dorsal outline and a rounded posterior margin. Antennal socket in a small lateral depression with no sharp ridges in the vicinity. Frontal gland (fig. 10A) distinct and easily visible under the surface of the head capsule; opening of gland small but showing a distinct pore. Postmentum (fig. 11B) with sides a little flattened near the edge of the widest portion and the profile fairly evenly and rather flatly convex but not bulbous. Antenna with 14 articles, the third article shorter than the fourth, the fourth shorter than the second. Mandibles as in generic description and in figures 10A, 11B. Pronotum (fig. 10B) with a deep indentation at the lateral edge between the front margin and side margin; front margin evenly convex, without a median notch. The front coxa (fig. 10C) has a concave area inside the ridge near the tooth grading into an inner convex surface.

TABLE 8
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Heimitermes moorei*,
NEW SPECIES

	Holotype	Paratype
Length of head with extended mandibles	4.76	—
Length of head to side base of mandibles	3.26	3.17
Width of head	2.59	2.67
Thickness of head with postmentum	2.12	2.14
Length of postmentum	1.82	—
Greatest width of postmentum	1.02	0.98
Least width of postmentum	0.56	0.59
Length of postclypeus	0.59	0.61
Width of postclypeus	1.29	1.23
Width of labrum	0.48	0.47
Length of left mandible	1.74	1.71
Length of left mandible from apex to tip of tooth	0.59	—
Length of pronotum	0.90	0.88
Width of pronotum	1.77	1.73
Width of front coxa to top of projection	0.80	0.74
Length of hind tibia	1.85	1.88

WORKER (FIG. 12): Head with scattered long bristles and short hairs. Antenna with 14 articles. Mandibles (fig. 12) virtually identical with those of *H. laticeps*. Front margin of pronotum without an indication of an indentation. Front coxa described under the genus.

RELATIONS: *Heimitermes moorei* has been compared directly by me to *H. laticeps* Grassé and Noirot type specimens in the Laboratoire d'Evolution, Paris, from a palm grove in Edbana near Etoumbi (latitude 0°, longitude 15° 0' E.) in French Equatorial Africa, and from metatype specimens determined and collected by C. Noirot, 50 kilometers east of Makokou (latitude 0° 33' N., longitude 12° 47' E.), Gabon, January 14, 1957. The distinctions are not striking, and it is possible that further collecting will show only subspecific variation or a wide variation within the species population. In view of the present data, however, it seems best to treat the collections under two species names. These species are similar in pilosity of the soldier, in the shapes of the labrum and pronotum of the soldier, and in the tibial spurs of both soldiers and workers. The head of the soldier of *H. moorei* is slightly larger in size than that of *H. laticeps* in nearly all measurements. The sides of the head of the soldier are more convex and less straight than in one of the type specimens of *H. laticeps*. The profile of the postmentum is flatter in *H. moorei*, and this character is possibly the best distinction between the two species. The narrowest width of the postmentum is less in proportion to the greatest width in *H. laticeps*, and the constriction at the rear is less sharp, with longer concave lateral margins. The mandibles of *H. moorei* are more massive and somewhat less curved than in *H. laticeps*. The dentition and basal portion of the mandibles of the soldier of *H. moorei* are sharper, more massive, and more distinct than those of *H. laticeps*. The projection on the front coxal ridge of the soldier is similar, but shows some variation in specimens from the same colony.

LOCALITY AND MATERIAL: Two soldiers and two workers collected by A. Emerson, temporary Pygmy Camp, 4 kilometers north of Camp Putnam (latitude 1° 24' N., longitude 28° 36' E.), Epulu River, Belgian Congo, May 20, 1948, in ground galleries; in the American Museum of Natural History.

I have named this interesting species in honor of the late Dr. Carl R. Moore, former chairman of the Department of Zoology at the University of Chicago, whose administrative policy and leadership greatly assisted my researches on termites, particularly my field studies in the Belgian Congo in 1948.

SUMMARY

The tropical African termite genera *Firmitermes* Sjöstedt, *Hoplognathotermes* Silvestri, *Acutidentitermes*, new genus, *Duplidentitermes*, new genus, and *Heimitermes* Grassé and Noirot, are described, and their phylogenetic relations are discussed. Four described species are redescribed and figured, and four new species are described and figured. All exhibit relatively primitive characters within the subfamily Termitinae of the family Termitidae.

The genus *Firmitermes* and its type species, *F. abyssinicus*, known only from a unique holotype soldier from Ethiopia, is redescribed and figured. *?Firmitermes tripolitanus* (Sjöstedt), known only from the imago caste from Ethiopia, is redescribed from one cotype and a number of recently collected specimens. This species was formerly included in "*Eutermes*" and "*Trinervitermes*," but is now assigned to *?Firmitermes* with considerable doubt.

The genus *Hoplognathotermes* is revised, and a cotype soldier and worker of the type species, *H. subterraneus* Silvestri from French Guinea, are redescribed and figured. A species described from the worker only under the name "*Hoplognathotermes submissus* Silvestri" is removed from *Hoplognathotermes* and is placed among the species listed under unclassified genera.

Acutidentitermes, new genus, and *A. osborni*, new species, are described and figured from a soldier and workers from the Belgian Congo.

Duplidentitermes, new genus, and the type species, *D. furcatidens* (Sjöstedt), formerly placed in *Hoplognathotermes* and known from imagoes, soldiers, and workers from the French Congo, French Equatorial Africa, are described and figured. *Duplidentitermes jurioni*, new species, and *D. latimentonis*, new species, both known from soldiers from the Belgian Congo, are described and figured.

The genus *Heimitermes* is redescribed. *Heimitermes moorei*, new species, is described and figured from soldiers and workers from the Belgian Congo. *Heimitermes laticeps* Grassé and Noirot, known from soldiers and workers from French Equatorial Africa and Gabon, is compared to *H. moorei*.

BIBLIOGRAPHY

AHMAD, M.

1950. The phylogeny of termite genera based on imago-worker mandibles. Bull. Amer. Mus. Nat. Hist., vol. 95, pp. 37-86.

CAPRA, F.

1935. La vera patria del *Trinervitermes tripolitanus* (Sjöstedt) e note su alcuni termiti della Libia. Boll. Soc. Ent. Italiana, vol. 67, pp. 44-46.
1938. Sulla presenza in Libia di *Trinervitermes tripolitanus* Sjöstedt e *trinervius* (Rambur). *Ibid.*, vol. 70, pp. 125-128.

EMERSON, A. E.

1928. Termites of the Belgian Congo and the Cameroon. Bull. Amer. Mus. Nat. Hist., vol. 57, pp. 401-574.
1951. Termite studies in the Belgian Congo. Deuxième Rapport Ann. 1949, Inst. Recher. Sci. Afrique Centrale, pp. 149-160.
1953. The African genus *Apicotermes* (Isoptera: Termitidae). Ann. Mus. Roy. Congo Belge, ser. 8°, Sci. Zool., vol. 17, pp. 99-121.
1955. Geographical origins and dispersions of termite genera. Fieldiana, Zool., vol. 37, pp. 449-505.
- 1956a. Regenerative behavior and social homeostasis of termites. Ecology, vol. 37, pp. 248-258.
- 1956b. Ethospecies, ethotypes, taxonomy, and evolution of *Apicotermes* and *Allognathotermes* (Isoptera, Termitidae). Amer. Mus. Novitates, no. 1771, pp. 1-31.

FULLER, C.

1921. The termites of South Africa; being a preliminary notice. South African Jour. Nat. Hist., vol. 3, pp. 14-52.
1922. The termites of South Africa. *Ibid.*, vol. 3, pp. 70-131.

GHIDINI, G. M.

1938. Le termiti dell' Africa orientale Italiana e loro importanza economica. Riv. Biol. Coloniale, vol. 1, pp. 221-235.

GRASSÉ, P.-P., AND NOIROT, C.

1954. *Apicotermes arquieri* (Isoptère): ses constructions, sa biologie. Considérations générales sur la sousfamille des Apicotermatinae nov. Ann. Sci. Nat., Zool., sér. 11, vol. 16, pp. 345-388.

HEGH, E.

1922. Les termites. Brussels, Imp. Industrielle et Financière, 756 pp.

JUCCI, C.

1936. Le termiti nelle nostre colonie africane. Atti XXV Riunione Soc. Italiana Prog. Sci., vol. 4, pp. 300-313 (1-9).

SCHMIDT, R.

- 1955a. The evolution of nest-building behavior in *Apicotermes* (Isoptera). Evolution, vol. 9, pp. 157-181.
- 1955b. Termite (*Apicotermes*) nests—important ethological material. Behaviour, vol. 8, pp. 344-356.
1958. The nest of *Apicotermes trågårdhi* (Isoptera). New evidence on the evolution of nest-building. *Ibid.*, vol. 12, pp. 76-94.

SILVESTRI, F.

- 1914a. Contribuzione alla conoscenza dei termitidi e termitofili dell' Africa occidentale. I. Termitidi. Boll. Lab. Zool. Gen. Agr., Portici, vol. 9, pp. 1-146.
- 1914b. Contribuzione alla conoscenza dei termitidi e termitofili dell' Africa occidentale. I. Termitidi. Ann. R. Scuola Sup. Agr., Portici, vol. 12, pp. 475-616.

SJÖSTEDT, Y.

- 1911. Termitidae novae a Cl. Dom. Maurice de Rothschild ex Aethiopia reportatae. Ent. Tidskr., vol. 32, pp. 171–172.
- 1912. Neue Termiten aus Tripolis, Ober-Ägypten, Abessinien, Erithrea, dem Galla- und Somalilande. Arkiv Zool., vol. 7, no. 27, pp. 1–17.
- 1922. Termites. Extrait du Voyage de M. le Baron Maurice de Rothschild en Ethiopie et en Afrique orientale Anglaise (1904–1905). Paris, pp. 241–247.
- 1924. Weitere Neuheiten von der afrikanischen Termitenfauna. Rev. Zool. Africaine, vol. 12, pp. 495–497.
- 1926. Revision der Termiten Afrikas 3. Monogr. K. Svenska Vetenskaps-akad. Handl., ser. 3, vol. 3, pp. 1–419.

SNYDER, T. E.

- 1949. Catalog of the termites (Isoptera) of the world. Smithsonian Misc. Coll., vol. 112, pp. 1–490.

WEIDNER, H.

- 1956. Beiträge zur Kenntnis der Termiten Angolas, hauptsächlich auf Grund der Sammlungen und Beobachtungen von A. de Barros Machado (I. Beitrag). Publ. Cult. Compan. Diamantes Angola, no. 29, pp. 55–106.

