

THE NEOTROPICAL GENERA *PRO-*  
*CORNITERMES* AND *CORNI-*  
*TERMES* (ISOPTERA,  
TERMITIDAE)

ALFRED E. EMERSON

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## CONTENTS

INTRODUCTION . . . . .	481
History . . . . .	481
Classification of Species Formerly Included in <i>Cornitermes</i> . . . . .	481
Acknowledgments . . . . .	482
Collections. . . . .	482
Terms. . . . .	482
GENUS <i>Procornitermes</i> EMERSON . . . . .	483
Ecological Distribution . . . . .	487
Comparison of the Distributions of <i>Procornitermes</i> and <i>Syntermes</i> . . . . .	487
Nests and Behavior. . . . .	488
Termitophiles . . . . .	489
Key to the Species of <i>Procornitermes</i> . . . . .	490
<i>Procornitermes araujoi</i> , New Species. . . . .	490
<i>Procornitermes triacifer</i> (Silvestri) . . . . .	494
<i>Procornitermes striatus</i> (Hagen). . . . .	495
<i>Procornitermes cornutus</i> (Holmgren) . . . . .	497
<i>Procornitermes romani</i> , New Species. . . . .	498
<i>Procornitermes lespesii</i> (Müller). . . . .	498
GENUS <i>Cornitermes</i> WASMANN . . . . .	502
Ecological Distribution . . . . .	507
Nests and Behavior. . . . .	509
Termitophiles . . . . .	510
Key to the Species of <i>Cornitermes</i> . . . . .	510
<i>Cornitermes cumulans</i> (Kollar) . . . . .	511
<i>Cornitermes similis</i> (Hagen) . . . . .	517
<i>Cornitermes snyderi</i> , New Species . . . . .	519
<i>Cornitermes bolivianus</i> Snyder . . . . .	521
<i>Cornitermes silvestrii</i> Emerson . . . . .	523
<i>Cornitermes acignathus</i> Silvestri . . . . .	524
<i>Cornitermes walkeri</i> Snyder. . . . .	525
<i>Cornitermes pugnax</i> Emerson . . . . .	526
<i>Cornitermes falcatus</i> , New Species . . . . .	530
<i>Cornitermes weberi</i> , New Species . . . . .	530
<i>Cornitermes incisus</i> , New Species . . . . .	531
<i>Cornitermes villosus</i> , New Species . . . . .	532
<i>Cornitermes ovatus</i> , New Species . . . . .	534
<i>Cornitermes bequaerti</i> , New Species . . . . .	535
<i>Cornitermes pilosus</i> Holmgren . . . . .	536
Other Records of <i>Cornitermes</i> . . . . .	537
BIBLIOGRAPHY . . . . .	538





## INTRODUCTION

### HISTORY

THE TAXONOMY of the group of termites formerly included by various authors in the genus *Cornitermes* has been in a confused state since Wasmann (1897) proposed the name *Cornitermes* for a subgenus of *Termes*. Wasmann did not designate a generic type species, and he included species in his proposed subgenus that are placed in two related genera in the following pages. Later authors included a number of other species in *Cornitermes* which was raised to generic rank by Silvestri (1901). Holmgren (1912) proposed the subgenus *Labiatermes* of the genus *Cornitermes*, and Sjöstedt (1926, p. 150) raised *Labiatermes* to generic rank and designated *L. labralis* (Holmgren) as generic type. Holmgren included two African species within his genus *Cornitermes*. These had been assigned by Sjöstedt (1905, pp. 11, 12) to the widely inclusive genus *Eutermes*, a generic name that is untenable. Silvestri (1914) placed these African species in the genus *Ceratitermes*. Sjöstedt (1926) placed these species again in the genus *Labiatermes*, but the characters indicate that the genus *Ceratitermes* definitely belongs to the subfamily Termitinae close to the genus *Apicitermes* and that the generic similarity of the soldiers to *Labiatermes* is convergent and not homologous. Emerson (*in* Snyder, 1949) proposed a new classification of the species formerly assigned to *Cornitermes*, and the substantiating data are included in the following pages.

### CLASSIFICATION OF SPECIES FORMERLY INCLUDED IN *Cornitermes*

The genus *Procornitermes* Emerson, with *Termes striatus* Hagen for the generic type (Emerson *in* Snyder, 1949, p. 260), includes *Cornitermes cornutus* Holmgren (1906), *Termes Lespesii* Müller (1873), *Cornitermes triacifer* Silvestri (1901), and two new species described in this paper (*P. araujo* and *P. romani*). *Cornitermes triacifer* is the generic type of *Triacitermes* Emerson (*in* Snyder, 1949), but the characters do not seem to warrant generic separation from *Procornitermes*.

The genus *Cornitermes* Wasmann, with *Termes cumulans* Kollar (1832) for the generic type (Snyder, 1949, p. 261), also includes

several described species (*C. acignathus*, *C. bolivianus*, *C. pilosus*, *C. pugnax*, *C. silvestrii*, *C. similis*, and *C. walkeri*) and the new species described in this paper (*C. bequaerti*, *C. falcatus*, *C. incisus*, *C. ovatus*, *C. snyderi*, *C. villosus*, and *C. weberi*).

The genus *Paracornitermes* Emerson, with *Cornitermes laticephalus* Silvestri (1901) for generic type (fig. 4), also includes *Cornitermes orthocephalus* Silvestri (1901).

The genus *Labiatermes* Holmgren, with *Cornitermes labralis* Holmgren (1906) for generic type, also includes *L. labralis boreus* Emerson, an undescribed subspecies of *L. labralis*, *Cornitermes longilabius* Silvestri, and a new undescribed species.

The genus *Ceratitermes* Silvestri is confined to Africa and is not closely related to *Cornitermes* or *Labiatermes*. The imago of a new species of *Ceratitermes* has the following generic characters in contrast to those of *Labiatermes*: eyes proportionately small; with less outstanding ocelli; fontanelle round and light colored; antenna with 15 articles; postclypeus about the same in the two genera; left mandible with an angular incision between the first marginal tooth (including the reduced second marginal tooth) and the third marginal tooth; right mandible with the second marginal tooth only slightly smaller than the first marginal tooth; pronotum with a sharper angle between the frontal lobe and the posterior portion in profile; tibial spurs 3:2:2; wing with hairs only on veins and borders and not on the membrane, membrane with minute dots.

The soldier of the new species of *Ceratitermes* has the following generic characters in contrast to those of *Labiatermes*: frontal tube less conspicuous; postmentum without lateral ridges that make it stand out from under part of head; widest portion of postmentum about one-seventh of its length from anterior edge; labrum proportionately shorter, with anterior white portion proportionately smaller and without a conspicuous constriction where the white and yellow portions meet; left mandible with serrations in basal half of cutting edge and an angular notch at the base of the cutting edge; right mandible with a wide-angled junction of the apical and basal portion.

These characters are sufficient to indicate

a wide separation of these two genera. Together with other characters and those of related genera, they validate the classification of *Ceratotermes* among the genera of the Termitinae and *Labiotermes* among the genera of the Nasutitermitinae.

In addition to this proposed generic classification, the species of *Procornitermes* and *Cornitermes* have been redetermined and described from type specimens where available. A surprising amount of error in the correct determination of the species has occurred, largely because of the inadequacy of the early descriptions by Kollar and Hagen. It is hoped that subsequent determinations may be made with greater accuracy following this revision, and that a firm taxonomic basis will allow students of termites to correlate new phylogenetic, geographical, and ecological information more adequately. Interpretations in the following pages suggest many points of biological interest. It is expected that a more thorough taxonomic revision may ultimately be made when all the castes, all the species of these genera, and large series of specimens have been collected.

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During the course of the study, collections were examined in the Scuola Agraria, Portici, Italy; Naturhistorisches Museum, Vienna, Austria; Staatsammlung, Munich, Germany; Museum für Naturkunde, Berlin, Germany; Deutschen Entomologischen Museum, Berlin-Dahlem, Germany; Naturhistoriska Riksmuseum, Stockholm, Sweden; Instituto Biológico, São Paulo, Brazil; Museum of Comparative Zoölogy, Cambridge, Massachusetts; United States National Museum, Washington, D. C.; Chicago Natural History Museum, Chicago, Illinois; and the American Museum of Natural History, New York.

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Information on the classification, phylogeny, and host records of the associated termitophiles were supplied by Dr. Charles Seevers.

Assistance was given in the preparation of some of the drawings by Laura Churchill, A. Anthony, T. Inouye, and R. Wenzel.

#### COLLECTIONS

Unless otherwise stated, the determinations of the listed specimens under each locality were made by the author and conform to the nomenclature used in this paper. The specimens are deposited in the collection of the American Museum of Natural History, unless another repository is given. All numbers are the field numbers of the collectors, unless associated with museum collections or individual collections. The author examined the specimens listed under each locality except for the records from the literature placed at the end of the sections on distribution. The descriptions are based on the examined specimens unless otherwise indicated.

#### TERMS

The taxonomic terms are explained in Emerson (1945, p. 438). Some additional terms of particular use in the present study follow:

The thickness of the head is a measurement from the bottom of the head including the postmentum to a line extending from the tip of the frontal tube to the top of the head in the rear.

The length of the frontal tube is from the ventral angle of the tube with the head to the tip including the white lip around the opening.

The length of the right mandible from the notch is from the angle of the notch to the tip of the mandible.

The width of the pronotum is the greatest width with the sides depressed in their natural position.

The length of the hind tibia is the greatest length of the tibia, but does not include the apical spurs or spines.



## GENUS *PROCORNITERMES* EMERSON

### SYNONYMY:

- <Subgenus *Termes* HAGEN, 1858a, pp. 107, 108.
- <Subgenus *Termes* HAGEN, 1858b, p. 23.
- <Subgenus *Cornitermes* WASMANN, 1897, p. 150.
- <Genus *Cornitermes* SILVESTRI, 1901, p. 4.
- <Genus *Cornitermes* SILVESTRI, 1903, p. 52.
- <Genus *Termes* DESNEUX, 1904, pp. 26, 28.
- <Subgenus *Termes* DESNEUX, 1904, pp. 32, 35.
- <Genus *Cornitermes* HOLMGREN, 1906, p. 549.
- <Genus *Cornitermes* HOLMGREN, 1912, pp. 45, 49.
- <Subgenus *Cornitermes* HOLMGREN, 1912, p. 50.
- <Subgenus *Tubulitermes* HOLMGREN, 1912, pp. 52, 53.
- <Genus *Cornitermes* EMERSON, 1925, p. 363.
- <Subgenus *Cornitermes* EMERSON, 1925, p. 365.
- <Genus *Cornitermes* SNYDER, 1926a, p. 17.
- <Subgenus *Cornitermes* SNYDER, 1926a, p. 17.
- <Subgenus *Cornitermes* EMERSON, 1928, p. 406.
- <Genus *Cornitermes* HARE, 1937, pp. 460, 474.
- >Genus *Procornitermes* EMERSON in Snyder, 1949, pp. 260, 375.
- >Genus *Triacitermes* EMERSON in Snyder, 1949, pp. 263, 376.
- >Genus *Procornitermes* AHMAD, 1950, pp. 46, 58, 59, 61, 82.
- >Genus *Triacitermes* AHMAD, 1950, pp. 46, 58, 59, 61, 82.

**IMAGO:** Color dark brown to yellowish; wings with hyaline or whitish membrane and brown costa and radius. Head and pronotum with scattered bristles; tergites and sternites with moderately thick to thick hair; wing membrane with short hairs and no dark punctations. Size moderate (head width ranges from about 1.29 to 1.97 mm.). Head oval, a blunt ridge running from the front of the eye to the lower base of the mandibles. Top of head between ocelli somewhat convex or nearly straight, but not concave as in some species of *Cornitermes*. Y-suture visible or not. Fontanelle either an oval depressed spot or a slightly raised, convex oval plate. Eye rather small, one-third of its diameter or less from the lower margin of the head (eye diameter ranges from about 0.33 to 0.47 mm.). Ocellus narrower than the antenna socket, its width or more than its width removed from the eye (ocellus length ranges from about 0.13 to 0.21 mm.). Antenna with 13 to 15 articles. Postclypeus strongly arched, about as long

as, or a little longer than, half of its width, median suture visible. Anteclypeus as in *Cornitermes*. Labrum with a white or light anterior lip. Dentition of mandibles close to that of *Cornitermes* (fig. 13), with the apical tooth of each mandible about equal in size to the first marginal tooth. Pronotum long in proportion to width, sides converging towards the rear, hind margin slightly to strongly emarginate. Mesonotum and metanotum as in *Cornitermes*. Tibial spurs either 3:2:2 or 2:2:2. Fore tibia with several spines on inner edge about as long as the spurs but not so numerous as in *Cornitermes*. This character is more distinct in the soldier caste. Tarsi, arolium, wings, cerci, and styli essentially similar to those in *Cornitermes*.

**SOLDIER:** Head, pronotum, and abdomen yellowish. Head with scattered bristles, but without conspicuous short hair; pronotum with scattered bristles, front margin with short hairs; tergites with bristles; sternites with bristles and hairs. Head moderately large (width ranges from 1.35 to 2.00 mm.), sides straight or slightly convex and parallel to, or slightly converging towards, the front; lateral longitudinal ridges on the under side rounded and not so sharp as in *Syntermes*. Frontal tube moderately short, about the same as in *Cornitermes*, overlapping the base of the postclypeus from above but not extending beyond the postclypeus, pointed

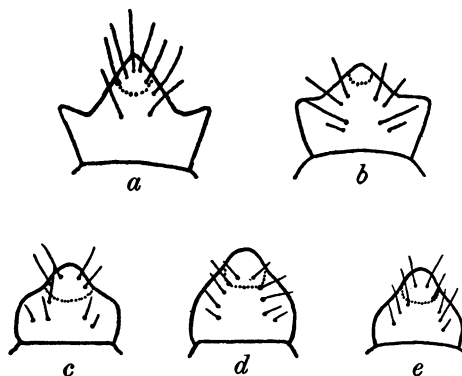


FIG. 1. The labrum of soldiers of *Procornitermes*. A. *P. triacifer* (Silvestri), metatype, Urucum de Corumbá. B. *P. araujoi*, new species, paratype, Congonhas. C. *P. cornutus* (Holmgren), cotype, Tuiche. D. *P. lespesii* (Müller), cotype, Itajá. E. *P. striatus* (Hagen), La Sierra.



FIG. 2. Mandibles of soldiers of *Procornitermes*. A. *P. striatus* (Hagen), La Sierra. B. *P. lespesii* (Müller), Joinville. C. *P. cornutus* (Holmgren), right mandible of cotype, Tuiche.

forward or somewhat upward. Postmentum with the narrowest portion from about one-half to seven-ninths of the width of the widest portion. Antenna with 13 to 15 articles. Postclypeus fused with the front as in *Cornitermes*. Anteclypeus as in *Cornitermes*. Labrum with various shapes in different species (fig. 1) but always with a median, white-tipped point or lobe, sides with or without lateral points that grade from acutely pointed to rounded sides without points. Mandibles (fig. 2) moderately large, each with outer edges fairly strongly curved and each with a distinct notch on the inner edge at the middle or basal half; teeth small; left mandible with a sinuate curve or even curve from the notch to the tip and a few teeth or irregularities between the notch and the base; right mandible with an evenly curved edge from the notch to the tip, the angle of the notch varying from acute to close to a right angle, and small dentations

between the notch and the base. Pronotum with a large, wide, frontal lobe, the front margin emarginate or not. Thoracic nota with rounded sides. Coxa of foreleg with a blunt ridge and no conspicuous projection. Tibial spurs either 3:2:2 or 2:2:2. Fore tibia with four to eight spines on the outer half of the inner edge (fig. 3), each spine about as long as the apical spurs.

WORKER: Same as in *Cornitermes* except that the tibial spurs are either 3:2:2 or 2:2:2, and the fore tibia is similar to that of the soldier caste.

RELATIONSHIPS: The imago-worker mandibles are similar to those of *Syntermes*, *Cornitermes* (fig. 13), *Rhynchotermes*, and the nasute genera related to *Nasutitermes*. In contrast, the imago-worker mandibles of *Paracornitermes*, *Labiotermes*, *Armitermes*, *Curvitermes*, and the nasute genera related to *Subulitermes* indicate a branching of the phylogenetic tree somewhat below the evolutionary level of

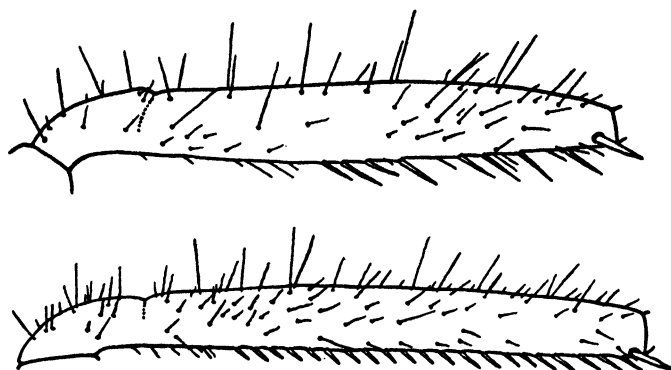


FIG. 3. Above, tibia of left foreleg of soldier of *Procornitermes araujoii*, new species, paratype from type colony, Leme. Below, tibia of left foreleg of soldier of *Cornitermes cumulans* (Kollar), metatype colony, São Paulo, Araujo No. 2326.



*Procornitermes* (Ahmad, 1950), each branch having convergently evolved a nasute soldier from mandibulate ancestry (Allee, *et al.*, 1949, p. 727). The right mandible of the soldier of *Paracornitermes* (fig. 4) has a double-pointed tooth—a character more specialized than in *Syntermes*, *Procornitermes*, *Cornitermes*, or *Labiotermes*. The *Procornitermes* soldier has a longer frontal tube than *Syntermes*, *Paracornitermes* (fig. 4), or *Labio-*

*termes* is placed immediately preceding *Cornitermes* in the linear order for reasons discussed under *Cornitermes*.

The linear arrangement of the species does not represent an exact phylogenetic order. *P. araujo*i is primitive in having a three-pointed labrum (fig. 1B), 15 articles in the antenna of both imago and soldier, and some specimens with tibial spurs 3:2:2. *P. triacifer* is related to *P. araujo*i in the three-pointed

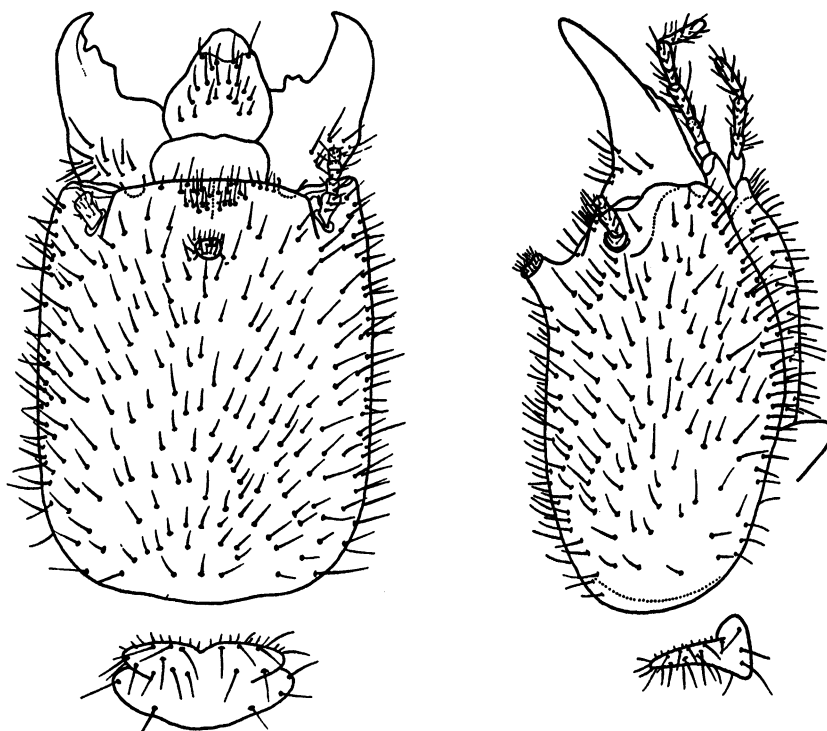


FIG. 4. Dorsal view of head and pronotum and side view of head and pronotum of soldier of *Paracornitermes laticephalus* (Silvestri), metatype, Urucum de Corumbá.

*termes*. The soldier antenna of *Paracornitermes* has 15 articles. The soldier antenna of *Labiotermes* has 15 to 16 articles, and the imago antenna has 16 to 17 articles. *Labiotermes* is more primitive in the number of antennal articles than any other genus of the subfamily except *Syntermes*. Because *Syntermes* shows many characters that indicate that it is the most primitive genus of the subfamily Nasutitermitinae, it should be placed first in the linear order (Emerson, 1945). These primitive characters are discussed later under *Cornitermes*. *Procorni-*

labrum (fig. 1A) but is more advanced in other characters. *P. striatus* is primitive in the tibial spurs 3:2:2 and the 15 articles in the antenna of the imago, but the soldier labrum (fig. 1E) is advanced in the reduction of the lateral points or angles. *P. cornutus* (figs. 1C, 2C), *P. romani* (fig. 10), and *P. lespesii* (figs. 1D, 2B, 11, 12) can hardly be arranged in any significant order with our present knowledge. The labrum of *P. lespesii* (fig. 1D) seems to be a bit more advanced, and the size is smaller than that of *P. romani* (fig. 10).

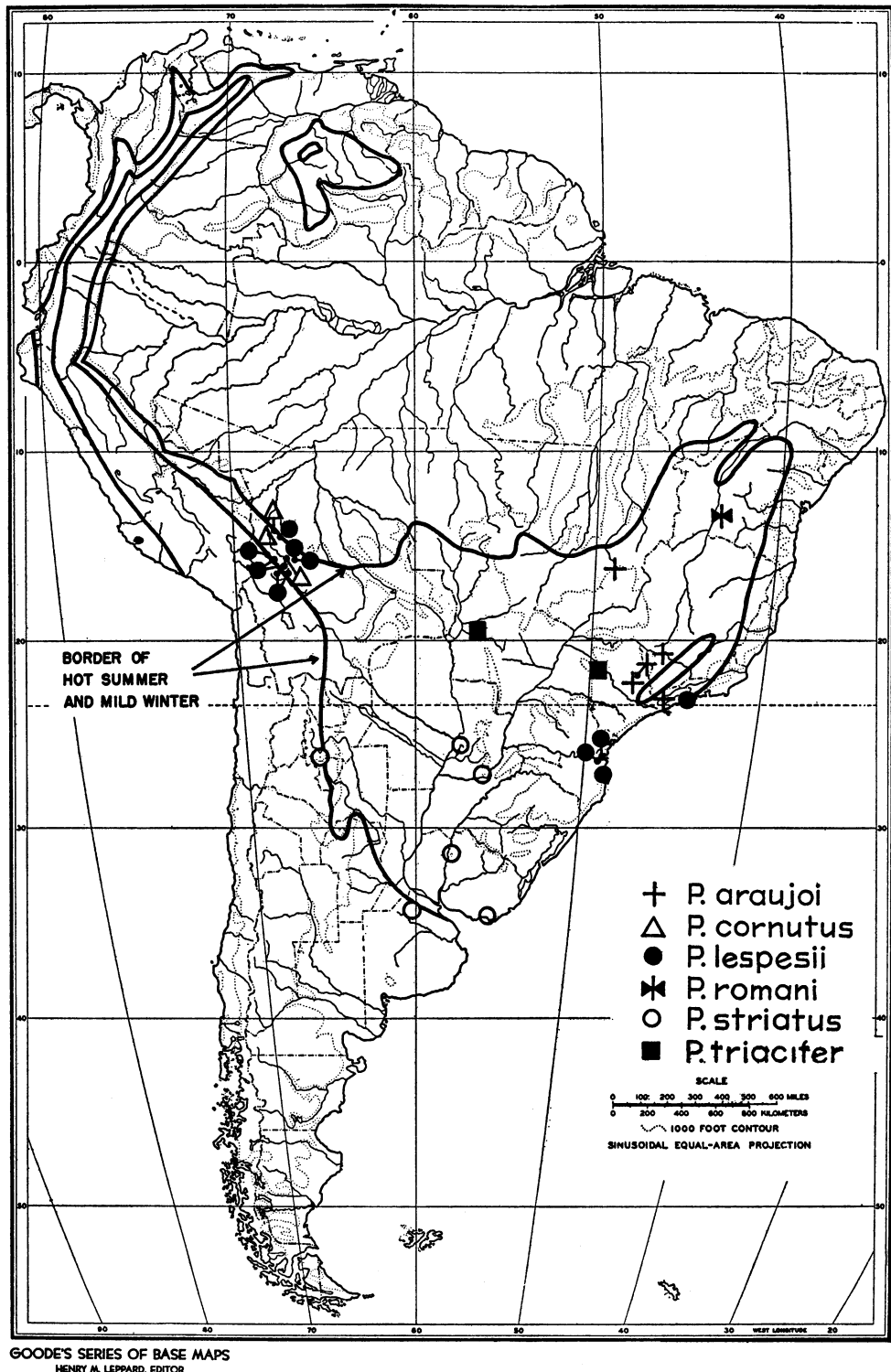


FIG. 5. Distribution of the species of the genus *Procornitermes* showing the approximate border of the region with a hot summer (above 68° F.) and a mild winter (50°–68° F.).

### ECOLOGICAL DISTRIBUTION

The genus as a whole is found in the region south of the Amazonian rain forest (fig. 5) characterized in Goode's "School atlas" as having a hot summer (above 68° F.) and mild winter (50°–68° F.). The annual rainfall of the occupied region varies from 20 to 80 inches. The climate may be characterized as ranging from humid to subhumid and semi-arid. It is possible that narrower rainfall ranges may influence the distribution of the different species. *P. striatus* seems to be confined to a zone with 20 to 60 inches of annual rainfall. This species is found in open fields. *P. triacifer* is in the zone from 40 to 60 inches. *P. lespesii* on the coast is in the 60- to 80-inch zone and in the 40- to 60-inch zone in Bolivia where it occurs with *P. cornutus*. *P. araujo* is in the 60- to 80-inch zone. *P. romani* is recorded in an area with about 40 inches of annual rainfall.

The different vegetation types of the region are referred to as tropical grassland or savanna, warm temperate prairie or savanna, temperate or tropical savanna forest, and scrub woodland. The vegetation in the single locality recorded for *P. romani* is called "catinga jungle" by Dr. A. Roman. There is some overlap of *P. lespesii* with the map outline of the coastal monsoon forest in Brazil, but the data on local distribution are insufficient for the conclusion that this species actually occurs under wet forest conditions.

These climatic and vegetational correlations are only suggestive. The data taken from large maps are not accurate for local conditions. Not only do we need data on local distributions correlated with climatic and vegetational factors, but we also need experimental studies to determine the reaction of the termites to the factors. A few such studies have been made on termites (Williams, 1934; Strickland, 1950), but not nearly enough for more than tentative hypotheses to be drawn. However, with our present information, we may guess that temperature and soil moisture, either separately, in combination, or in correlation with other environmental effects such as carbon dioxide, are important factors governing the distribution of these insects.

Emerson (1951) states that there is a sharp ecological distinction of the species and some

genera inhabiting the grasslands contrasted to the rain forests of the Belgian Congo, while many identical species are found both in the savanna and rain forest of Panama. He postulates a difference in age of the adapted savanna termite faunas in these two countries. The grasslands of Africa and South America probably arose in Miocene times, while the savanna of Panama probably originated in late Pliocene times following the emergence of the isthmus. The termite fauna of Africa has consequently had around 10 million years to adapt itself to the periodic dry conditions of the grasslands, while the termite fauna of Central America has had only one or two million years to evolve such adaptations. Forest species of Africa that might tend to invade the savanna biome seem unable to compete successfully with the adapted grassland species, while the Panamanian forest termites do not meet a similar competition and are able to move into the savannas. Doubtless the social control of moisture in their burrows and nests makes termites less sensitive than most species of plants and animals to variations in soil moisture.

This postulated explanation for the ecological distinctions of the African termite fauna in contrast to the Panama termite fauna can be tested. Corroborative evidence may be collected that would indicate the more recent origin of the Panamanian savanna and the lack of continuity with older savanna areas of South America. A careful study of the distribution of species and genera of the forest and grassland of South America should show distinction of the termite faunas similar to those of Africa if the theory has validity. The existence of genera confined to grasslands in South America would be pertinent, no such grassland genus having been found in Panama. *Procornitermes* indicates by its distribution (fig. 5) that it is a genus absent from the rain forest and typical of periodically drier savanna regions. *Paracornitermes* so far is known only from tropical savanna.

### COMPARISON OF THE DISTRIBUTIONS OF *Procornitermes* AND *Syntermes*

From a comparison with the southern limits of distribution of tropical savanna

outlined on the map of distribution of *Syntermes* (Emerson, 1945, p. 434), it will be noted that *Procornitermes* (fig. 5) conforms except for the four southern and western localities of *P. striatus*. *P. striatus* is probably a species that has become adapted to more temperate conditions than the other species of the genus.

Since the construction of the map of *Syntermes*, some important new localities have been discovered that add to our knowledge of the distribution. These are listed below under each species. All the localities are within the borders of tropical rain forest and savanna except Santa Sofia, Argentina, and Terezopolis, Rio Grande do Sul, Brazil.

- S. dirus* (Burmeister), Terezopolis, Porto Alegre (30°01' S., 51°10' W.), Rio Grande do Sul, Brazil, coll. C. H. Reiniger, 2.I.1940.
- S. grandis* (Rambur), Tres Lagôas (20°45' S., 51°48' W.), Mato Grosso, Brazil; Paramirim Field, Natal (5°32' S., 35°09' W.), Brazil, coll. H. T. Dalmat, 26.III.1945.
- S. hageni* Holmgren, Campinas (16°45' S., 49°15' W.), Goiás, Brazil, coll. Borgmeier and Lopes, I.1936, No. 3.
- S. insidians* Silvestri, Pitangueiras (21°02' S., 48°14' W.), São Paulo, Brazil; Guarani (21°26' S., 48°06' W.), São Paulo, Brazil, coll. J. V. Pinheiro, II.1945, No. 9491.
- S. molestus* (Burmeister), Taubaté (23°02' S., 45°35' W.), São Paulo, Brazil, R. L. Araujo Coll., 4.II.1945, No. 2827; Anápolis (16°12' S., 48°46' W.), Goiás, Brazil, coll. C. R. Gonçalves, No. 6942; Paramirim Field, Natal (5°32' S., 35°09' W.), Brazil, coll. H. T. Dalmat, 26.III.1945; Barcelos (1°01' S., 63°01' W.), Amazonas, Brazil.
- S. praecellens* Silvestri, Jabaquara (23°34' S., 46°36' W.), São Paulo, Brazil; Ipiranga (23°34' S., 46°36' W.), São Paulo, Brazil, coll. C. R. Gonçalves, 11.X.1943, No. 6931.
- S. silvestrii* Holmgren, Santa Sofia (31°01' S., 59°46' W.), Argentina.

#### NESTS AND BEHAVIOR

The nests of *P. striatus* are described and illustrated by Silvestri (1903). They consist of subterranean, dark, dirt, carton structures, averaging about 10 cm. high and about 6 cm. in diameter, which can be removed intact from the cavity in the ground. The carton is reported as consisting of dirt and saliva. The interior of the nest is divided into seven to 10 horizontal chambers about 1 cm.

high, with external surface grooves indicating the position of the floors. A few pillars and oval openings about 4 mm. wide occur between the floors, arranged as a sort of ramp or spiral staircase for the passage of the workers. Exits about 1½ mm. in diameter occur at both ends of the nest. Every colony has about six intercommunicating nests. The royal couple occupies one of these nests. There is no definitive royal cell. The alates fly in May and June. The workers often eat cow and horse manure as well as their usual diet of rich vegetable earth. They are not reported feeding upon wood.

*Procornitermes triacifer* was found by Silvestri (1903) under cattle excrement.

The nests of *P. lespesii* seem to be very similar in type to those of *P. striatus*. Müller (1871, 1873) described several nests from "Itajahy," Santa Catarina, Brazil. The soldiers were first determined by Hagen as *Termes similis* but were later assigned to *Termes lespesii* by Müller. The nests range from about 11 to 20 cm. in height and 5 to 8 cm. in diameter. Following are quotations from Müller (1871):

"These nests . . . are more or less regular cylinders, one span high and two or three inches thick. By horizontal floors they are divided into twelve or fifteen compartments or chambers. The outer surface bulges out so that one can make out the number of chambers by the enlargements of the cylinder. A pillar goes through all the compartments; close to this, or in it, runs an oblique passage from each chamber to the nest. Sometimes all these passages together form a somewhat regular winding stair through all the compartments. For the impregnated female these passages are too narrow, and she can therefore not leave her chamber.

"There are, both in the outer wall and in the horizontal divisions, passages too small to admit the passing of the winged ants; but neither in the outside wall nor in the chambers is there any opening to the outside. In the outside wall the passages run from top to bottom. In the divisions, [they run] from circumference to centre without reaching this latter. In the flat compartments they are not to be detected from the outside; in the circumference they appear as flattened ridges. . . . In undisturbed nests the only entrance



seems to be on the upper surface some inches under ground.

"The nest is not directly connected with the earth, but is surrounded by about a finger's breadth of free space. The nest can, therefore, as soon as the upper is freed from earth, be easily taken out of the ground."

The nests of *P. lespesii* are similar in certain respects to those of the African genus *Apicotermes* described and figured by Desneux (1948). No open ventilation pores characteristic of the nests of most species of *Apicotermes* penetrate the outside wall, but the nests of *P. lespesii* are similar to those of *Apicotermes* in their occurrence in subterranean excavations, in the appearance of the horizontal chambers, in the ramps connecting the stories, in the outer indications of the floors, and in the internal small tunnels or galleries enclosed in the walls, some circular like those of *Apicotermes*, and some vertical unlike those of *Apicotermes*. The similarities are surely the result of convergent evolution, because the two genera belong to the different subfamilies of Nasutitermitinae and Termitinae and are phylogenetically far apart.

The function of the small internal tunnels in the walls is not clear. They may possibly be an insulation device producing a greater temperature stability within the interior of the nest. Most species of *Apicotermes* have ventilation pores that probably function for the exchange of gases between the interior and exterior of the subterranean nests. Two species, *Apicotermes arquieri* (Grassé and Noirot, 1948) and *A. occultus*, usually lack open pores from the outside into circular tunnels or galleries within the wall, and also lack open pores or slits from the circular galleries into the interior chambers, so that the walls have the circular galleries without an open connection to the outside or inside. In the case of *A. arquieri*, the pores typical of the nests of *A. angustatus* can be detected as an external pattern, but usually do not penetrate the wall as they do in the nests of *A. angustatus*. No visible external pores or indications of pores through the wall are found in the nests of *A. occultus*. The nests of *A. arquieri* thus seem to be a most remarkable example of vestigial behavior that has undergone regressive evolution.

The nests of both *A. arquieri* and *A. occultus* occur in relatively dry soils, in contrast to the *Apicotermes* nests with open pores through the walls, all of which occur in the moist soils of rain forests or forest galleries. One may guess that the exchange of gases such as oxygen and carbon dioxide is facilitated by the pores through the nest walls in moist soils, while the pores are unnecessary in dry soils where sufficient diffusion of gases may occur in the soil and through the solid but somewhat porous exterior wall of the nest. The retention of the circular galleries within the wall may possibly function for temperature insulation as suggested for *P. lespesii*.

These speculations on the functions and evolution of the nest structures (Emerson, 1951) of *Procornitermes* and *Apicotermes* can be corrected only by analysis of the microclimate of the nest interiors and the surrounding soil. It is hoped that this important study will be undertaken by biologists living in the areas where the nests are to be found. The study should add highly significant information on the evolution of termite social integration and behavior.

#### TERMITOPHILES

Dr. Charles Seevers, of Roosevelt College, Chicago, has kindly supplied me with data on the staphylinid termitophiles. Specialized physogastric termitophiles occur with *Procornitermes*. *Termituncula gracilipes* Borgmeier (tribe Corotocini, subtribe Timepartheni) is found with *P. araujoii*. This aleocharine is the most generalized of the genera composing the subtribe. Another genus, *Termitozophilus*, occurs with species of *Cornitermes*. *Autuoria elegantula* Silvestri is recorded from the nest of a host species with the manuscript name of *Cornitermes autuorii* Silvestri. Since this has not been described, it is now impossible to guess the species and genus of the host termite until the original collection is reexamined or the termitophile is procured again. However, the subtribe Timepartheni indicates a relationship among the termitophiles conforming to the postulated phylogeny of the host genera.

The tribe Termitonannini is primarily found in the nests of *Anoplotermes*. *Termitonannus domunculi* Silvestri is recorded from the nest of *P. striatus*. Most of the

species of this genus of termitophiles are found with *Anoplotermes*, but one is recorded with *Syntermes* and one with *Subulitermes*. Within the same tribe, a new species of *Termitocomes* has been found with *Labiotermes labralis boreus* Emerson in Trinidad. Also *Macrotrichurus brasiliensis* Silvestri, originally recorded with *Anoplotermes*, has recently been collected with *Cornitermes cumulans*. The classification of these hosts and the recorded termitophiles are not phylogenetically in conformity. *Anoplotermes* belongs to the Amitermitinae and is only remotely related to the Nasutitermitinae (Ahmad, 1950), so that a genus of termitophile occurring with these widely separated hosts must have secondarily invaded new host nests rather than have evolved with the hosts. Also the host record of *Subulitermes* seems somewhat out of place, although this termite genus evolved from the mandibulate Nasutitermitinae. Possibly mistakes have been made in the host records. Several species of termites may occur in close proximity, so that it would be easily possible to collect in the field a termitophile in a vial with the wrong host. *Anoplotermes* workers (the genus lacks soldiers) are often found in vials of *Cornitermes* and *Armitermes* with the conspicuous soldiers of these latter genera, so possibly termitophiles also may be incorrectly assigned to the host. Further collecting should ultimately enable investigators to correct these possible errors.

A new subtribe of the tribe Myrmedoniini contains four genera. *Termitophagus syntermis* Silvestri is recorded from the nest of *Syntermes grandis* (Rambur). *Termitonusa sequax* Borgmeier is found with *Procornitermes araujoi*. Two new genera, one with three new species, are found with *Labiotermes labralis labralis* and *L. labralis boreus*. These termitophiles probably have evolved with the host genera, although it is noteworthy that the subtribe is found with primitive mandibulate genera on both major branches of the phylogenetic tree of the Nasutitermitinae.

#### KEY TO THE SPECIES OF *Procornitermes* IMAGOS

1. Head width 1.79–1.97 mm. . . . .  
     . . . . . *P. araujoi*, new species
- Head width less than 1.75 mm. . . . . 2

2. Length of pronotum 0.77–0.88 mm. Antenna with 15 articles. . . . . *P. striatus* (Hagen)
- Length of pronotum 0.61–0.75 mm. Antenna with 13–14 articles. . . . . *P. lespesii* (Müller)

#### SOLDIERS

1. Labrum conspicuously trilobed with angular points (figs. 1A, B) . . . . . 2
- Labrum without conspicuously angular side projections (fig. 1C–E) . . . . . 3
2. Side points of labrum acute (fig. 1A) . . . . .  
     . . . . . *P. triacifer* (Silvestri)
- Side points of labrum blunt (fig. 1B) . . . . .  
     . . . . . *P. araujoi*, new species
3. Tibial spurs 3:2:2 . . . . . *P. striatus* (Hagen)
- Tibial spurs 2:2:2 . . . . . 4
4. Thickness of head 1.62–1.66 mm. . . . .  
     . . . . . *P. romani*, new species
- Thickness of head less than 1.54 mm. . . . . 5
5. Angle of notch of right mandible close to a right angle (fig. 2B) . . . . . *P. lespesii* (Müller)
- Angle of notch of right mandible wider than a right angle (fig. 2C) . . . . .  
     . . . . . *P. cornutus* (Holmgren)

#### *Procornitermes araujoi*, new species<sup>1</sup>

*Termes similis* HAGEN, 1858a, p. 167 (soldier and worker only), pl. 1, fig. 5 (soldier).

*Termes (Cornitermes) similis* WASMANN, 1897, p. 150 (soldier aspects only).

? *Eutermes* sp. CZERWIŃSKI, 1901, p. 7 (soldier), text fig. 8 (soldier).

*Cornitermes similis* REICHENSPERGER, 1936, p. 230 (termitophiles).

? *Cornitermes similis* WHEELER, 1936, pp. 210, 232 (biology).

IMAGO (FIG. 6): Head, pronotum, and tergites dark brown; clypeus and pronotum somewhat lighter than the head; fontanelle plate dark; pronotum with a series of Y-shaped light marks; sternites lighter than the tergites; wing membrane whitish in specimens and contrasting with the color of the wing scale (specimens probably immature, and the color of the wing membrane in fully mature imagoes may be hyaline); scale, costal border, and radius dark brown; tibia dark except for the ends and contrasting with the yellowish femur and tarsus. Y-suture invisible. Fontanelle plate large, oval, somewhat depressed. Eye rather small, about

<sup>1</sup> This species is named in honor of R. L. Araujo of the Instituto Biológico, São Paulo, Brazil, who has made some important collections of termites in São Paulo and neighboring states and is engaged in a study of the biology and systematics of these insects.

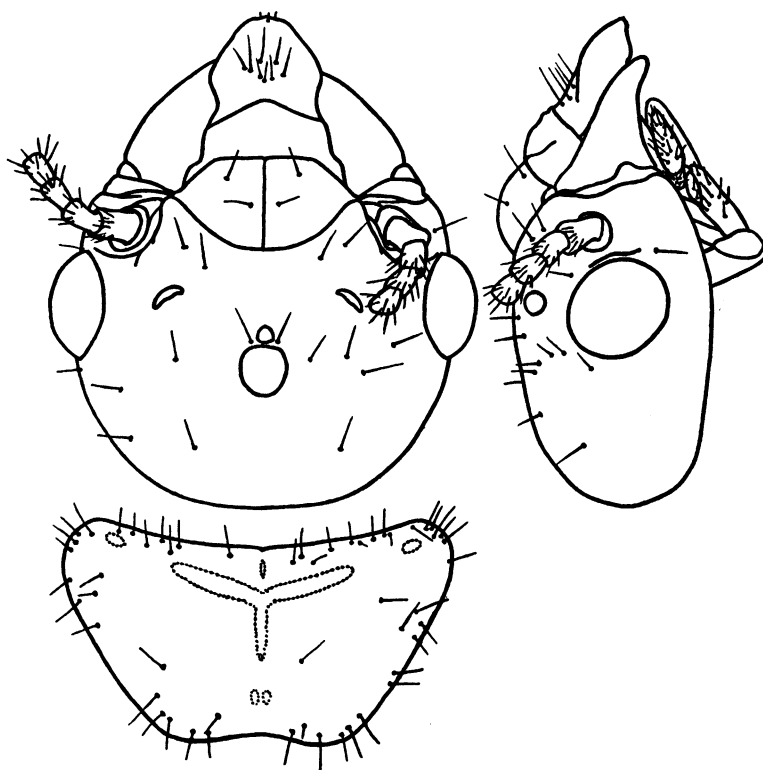


FIG. 6. Dorsal view of head and pronotum and side view of head of imago of *Procornitermes araujoii*, new species, paratype, Anápolis.

TABLE 1

MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Procornitermes araujoii*, NEW SPECIES

	No.	Male Range	Mean	No.	Female Range	Mean
Length of head to tip of labrum	2	2.12	2.12	4	2.06- 2.29	2.19
Length of head to side base of mandibles	2	1.35-1.41	1.38	4	1.59- 1.65	1.63
Width of head	2	1.79-1.85	1.82	4	1.91- 1.97	1.94
Diameter of eye	2	0.45-0.47	0.46	5	0.47	0.47
Eye from lower margin	2	0.13-0.17	0.15	5	0.16- 0.21	0.19
Length of ocellus	2	0.20-0.21	0.20	5	0.14- 0.18	0.17
Width of ocellus	2	0.14-0.15	0.14	5	0.09- 0.13	0.12
Ocellus from eye	2	0.23-0.29	0.26	5	0.23- 0.29	0.25
Ocellus from fontanelle	2	0.44-0.45	0.44	5	0.41- 0.50	0.47
Length of fontanelle	2	0.21-0.24	0.22	5	0.18- 0.23	0.20
Width of fontanelle	2	0.19-0.21	0.20	5	0.17- 0.22	0.20
Length of pronotum	2	0.79-0.82	0.80	4	0.88- 0.93	0.90
Width of pronotum	2	1.52-1.53	1.52	5	1.71- 1.79	1.74
Length of hind tibia	2	2.00-2.02	2.01	4	2.06- 2.07	2.06
Length of anterior wing from suture	1	17.11	17.11	3	18.24-18.42	18.33
Width of anterior wing	2	4.32	4.32	3	4.51- 4.89	4.71

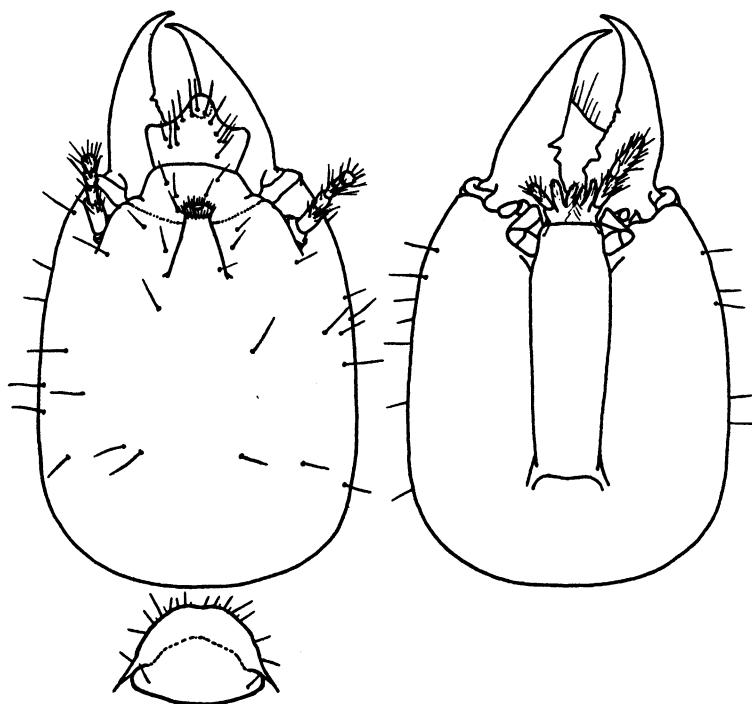


FIG. 7. Dorsal view of head, back view of pronotum, and ventral view of head of soldier of *Procornitermes araujoi*, new species, paratype. Anápolis.

one-third of its width from the lower margin of the head. Ocellus small, smaller than the fontanelle, 0.05 to 0.16 mm. from the eye, in each instance more than its length from the eye. Antenna with 15 articles. Hind margin of pronotum somewhat emarginate. The fore tibia usually has two apical spurs, but in one case a third short spur was present on the upper side of the tip.

COMPARISONS: *Procornitermes striatus* has the tibia a little darker than the femur; width of head is narrower (1.57–1.75 mm.); and width of pronotum is narrower (1.30–1.57 mm.). *P. lespesii* has a yellowish femur and tibia; the width of the head is narrower (1.29–1.45 mm.); and the width of the pronotum is narrower (1.10–1.22 mm.).

SOLDIER (FIGS. 3, 7, 8): Tergites a little paler yellow than the head and pronotum; abdomen often gray from the contents of the intestines. Head, pronotum, and tergites with scattered bristles, rather sparse on the head; a few short, almost invisible, hairs on the head and postmentum. Head rather large, fairly thick, sides somewhat curved or

fairly straight, parallel or converging a little towards the front; hind angles and margin rounded. Frontal tube reaching the base of the postclypeus from above. Narrowest portion of the postmentum seven-ninths of the width of the widest portion (0.50 mm.); with small rugosities on the surface. Antenna with 15 articles. Lateral angles of the labrum distinct and a little sharper than a right angle (fig. 1B). Mandibles as in figure 7. Front margin of the pronotum with a hardly perceptible or very slight emargination.

COMPARISONS: *Procornitermes araujoi* differs from the soldiers of all other species in the genus except *P. triacifer* in the sharp lateral angles of the labrum (fig. 1B). The points are more acute in *P. triacifer* (fig. 1A).

DISTRIBUTION (FIG. 5): Leme (22°12' S., 47°22' W.), Taquarí, São Paulo, Brazil (type locality), imagoes (morphotype and paratypes), soldiers (holotype and paratypes), workers, coll. R. L. Araujo and D. Braz, 14.IX.1944, No. 2435, "nest of uniform structure"; soldiers (paratypes), workers, coll. R. L. Araujo and D. Braz, 16.V. 1945, No. 2873, "hard compact nest."



TABLE 2

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Procornitermes araujo*, NEW SPECIES

	No.	Range	Mean
Length of head with mandibles	6	3.03-3.47	3.26
Length of head to tip of frontal tube	22	1.97-2.44	2.17
Length of head to side base of mandibles	22	2.10-2.59	2.30
Width of head	38	1.67-2.00	1.82
Thickness of head	22	1.32-1.59	1.46
Length of frontal tube	22	0.32-0.43	0.37
Width of labrum	22	0.57-0.69	0.64
Length of left mandible	21	1.14-1.32	1.25
Length of right mandible from notch	15	0.68-0.76	0.73
Length of pronotum	21	0.50-0.59	0.55
Width of pronotum	21	0.76-1.06	0.95
Length of hind tibia	20	1.59-1.88	1.76

Palmeiras (21°49' S., 47°16' W.), São Paulo, Brazil, soldiers (paratypes), workers, coll. D. Braz, 25.I.1945, Araujo Coll. No. 2792; soldiers (paratypes), workers, coll. D. Braz, 26.I.1945, Araujo Coll. No. 2793; soldiers (paratypes), workers, coll. D. Braz, 27.I.1945, Araujo Coll. No. 2794.

Taubaté (23°02' S., 45°35' W.), São Paulo, Brazil, soldiers (paratypes), workers, nymphs, coll. by a farmer, 4.II.1945, Araujo Coll. No. 2828.

Anápolis (16°12' S., 48°46' W.), Goiás, Brazil, queen (paratype), soldier (paratype), workers, coll. Raymundo Gilmore, 2.IX.1936, "Faz. Genipapo," M.C.Z.

Campinas (16°45' S., 49°15' W.), Goiás, Brazil, soldiers (paratypes), workers, coll. Schwarzmair, Borgmeier Coll. No. 1, with *Syntermes molestus* and termitophiles.

Congonhas (20°55' S., 45°42' W.), Minas Gerais, Brazil, soldier (paratype), worker, coll. H. Burmeister, labeled "*T. similis*, Hag. Linn. XII. 170, pl. 1, f. 5," det. H. Hagen, M.C.Z.

Reichensperger (1936, p. 230) records *Cornitermes similis* from Rio Negro, Paraná, Brazil, and Campinas, Goiás, Brazil, with the termitophile *Notocoelis satur* Lewis in the nest, the type of which was found in Paraguay. The specimens of "*C. similis*" from Campinas, Goiás, proved to be *P. araujo* when examined. The other host determination needs verification.

REMARKS: The single soldier (fig. 8) associated with the type imago of *Cornitermes similis* (Hagen) and long considered conspecific with *C. similis* is slightly smaller than any other specimens included in the description, but the differences are too slight

to warrant taxonomic separation. The other characters of the soldier observable in the pinned specimen are identical with the other specimens of *P. araujo*, and there seems to be no doubt that Hagen's soldier belongs to this species. The reasons for believing that the type imago of *C. similis* belongs to *Cornitermes* is discussed under *Cornitermes similis*.

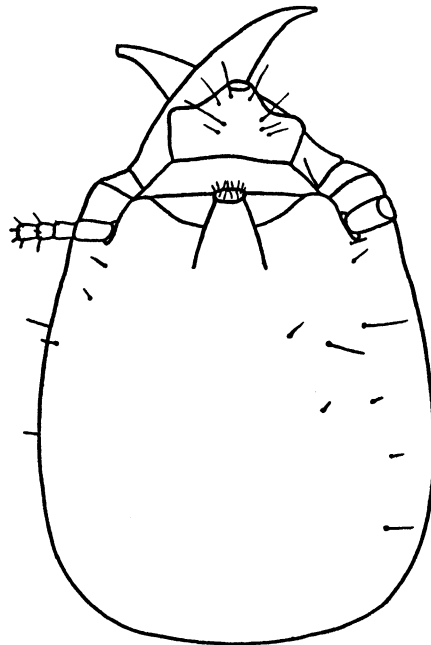


FIG. 8. Dorsal view of head of soldier of *Procornitermes araujo*, new species, "type" (= morphotype) soldier of "*Termes similis*" Hagen, Congonhas.

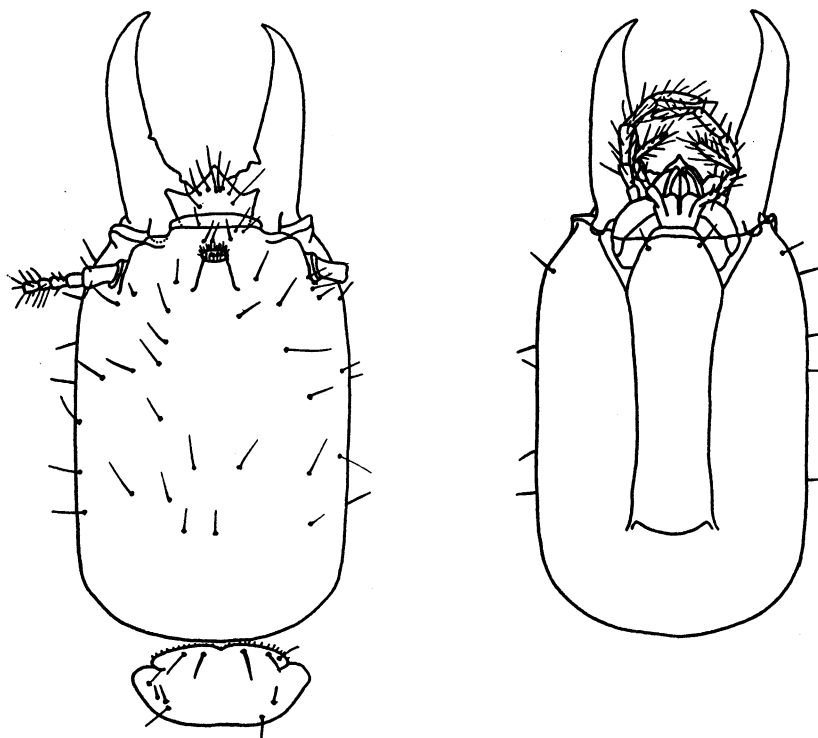


FIG. 9. Dorsal view of head and pronotum and ventral view of head of soldier of *Procornitermes triacifer* (Silvestri), metatype, Urucum de Corumbá.

***Procornitermes triacifer* (Silvestri)**

*Cornitermes triacifer* SILVESTRI, 1901, p. 4 (soldier, worker).

*Cornitermes triacifer* SILVESTRI, 1903, p. 58 (soldier, worker), p. 127 (biology), pl. 3, fig. 102 (soldier).

*Termes (Termes) triacifer* DESNEUX, 1904, p. 38 (synonymy).

*Triacitermes triacifer* SNYDER, 1949, pp. 263, 376 (synonymy).

*Triacitermes triacifer* AHMAD, 1950, pp. 46, 58, 59, 61, 82 (systematics), text fig. 9 (worker mandible).

**SOLDIER (FIG. 9):** Tergites a little paler yellow than head. Head, pronotum, and tergites with scattered bristles, rather sparse on head; a few short, almost invisible, hairs on head and pronotum; front margin and face of pronotum with short hairs. Head rather large, thick, and elongate, sides fairly straight and parallel, hind margin and angles rounded. Frontal tube proportionately rather small, barely reaching the base of the postclypeus from above (suture of post-

clypeus and front indistinct). Postmentum narrowest in the middle or in the basal third, sides slightly concave. Antenna with 13 to 14 articles, third with signs of dividing in some specimens. Lateral angles of labrum sharp (fig. 1A), forming an angle of about 50 to 60 degrees, tip sharper than a right angle. Mandibles as in figure 9. Front margin of pronotum slightly emarginate. Tibial spurs 2:2:2.

**COMPARISONS:** Differs from all other described species of this genus in the three sharply pointed projections of the labrum (fig. 1A). Closest to *P. araujoii*, from which it differs in the sharper side points of the labrum, the straighter and more parallel sides of the head, the somewhat more concave sides of the postmentum, and the proportionately shorter hind tibia.

**DISTRIBUTION (FIG. 5):** Corumbá (19°07' S., 57°38' W.), Mato Grosso, Brazil (type locality), soldiers (cotypes), workers, coll. and det. F. Silvestri as *Cornitermes triacifer*, 14.VIII.1900, Silvestri Coll., Portici, Italy.

TABLE 3  
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Procornitermes triacifer* (SILVESTRI)

	No.	Range	Mean
Length of head with mandibles	9	3.09-3.23	3.15
Length of head to tip of frontal tube	9	2.00-2.19	2.11
Length of head to side base of mandibles	10	2.07-2.29	2.18
Width of head	10	1.45-1.59	1.53
Thickness of head	10	1.23-1.41	1.31
Length of frontal tube	10	0.21-0.27	0.23
Width of labrum	9	0.47-0.53	0.52
Length of left mandible	10	1.12-1.23	1.16
Length of right mandible from notch	8	0.65-0.77	0.70
Widest width of postmentum	10	0.50-0.56	0.53
Narrowest width of postmentum	10	0.35-0.45	0.38
Length of pronotum	8	0.50-0.56	0.54
Width of pronotum	9	0.93-1.06	0.98
Length of hind tibia	9	1.12-1.24	1.20

Urucum de Corumbá (19°00' S., 57°43' W.), Mato Grosso, Brazil, soldiers (metatypes), workers, coll. K. P. Schmidt, 14.VIII.1926, A.M.N.H., C.N.H.M.

Lins (21°40' S., 49°45' W.), São Paulo, Brazil, soldiers, workers, coll. R. L. Araujo, 24.XI.1944, No. 2654, "attacking roots of rice and corn."

***Procornitermes striatus* (Hagen)**

*Termes striatus* HAGEN, 1858a, p. 171 (imago).

*Termes striatus* HAGEN, 1858b, p. 23 (imago).

*Cornitermes striatus* SILVESTRI, 1901, p. 4.

*Cornitermes striatus* SILVESTRI, 1903, p. 57 (imago, soldier, worker), p. 122 (nests, biology),

text fig. 12 (wings), text figs. 42, 43, 44, 45 (nests), pl. 3, fig. 99 (imago), figs. 100, 101 (soldier).

*Cornitermes (C.) striatus* HOLMGREN, 1912, p. 51, pl. 2, figs. 10, 13 (soldier).

*Procornitermes striatus* SNYDER, 1949, pp. 261, 375 (synonymy).

IMAGO: Head brown; clypeus a little lighter than the head; fontanelle plate, if present, dark brown or yellowish; pronotum margins as dark as the head but with lighter parts in the center; tibia a little darker than the femur; wings hyaline, with brown costa

TABLE 4  
MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Procornitermes striatus* (HAGEN)

	No.	Range	Mean
Length of head to tip of labrum	4	1.77- 1.91	1.84
Length of head to side base of mandibles	3	1.15- 1.18	1.17
Width of head	7	1.57- 1.75	1.65
Diameter of eye	6	0.37- 0.47	0.41
Eye from lower margin	4	0.09- 0.11	0.10
Ocellus from eye	6	0.12- 0.16	0.14
Length of ocellus	4	0.13- 0.20	0.16
Width of ocellus	4	0.10- 0.13	0.12
Length of fontanelle	4	0.08- 0.23	0.13
Width of fontanelle	4	0.06- 0.19	0.11
Fontanelle from ocellus	4	0.47- 0.48	0.47
Length of pronotum	7	0.77- 0.88	0.82
Width of pronotum	7	1.30- 1.57	1.42
Length of hind tibia	5	1.65- 1.91	1.77
Length of anterior wing from suture	5	16.40-16.92	16.68
Width of anterior wing	5	4.04- 4.79	4.40

and radius; tergites and sternites lighter than the head. Tergites and sternites with thick hair. Y-suture visible. Fontanelle depressed spot or a small oval plate either smaller or larger than the ocellus. Head with small eyes two-fifths to one-fourth of their diameter from the lower margin. Ocellus small, its width or a little more than its width removed from the eye. Postclypeus a little longer than one-half of its width. Antenna with 15 articles. Pronotum with an emarginate hind margin, proportionately long compared to its width. Fore tibia with three apical spurs, the upper spur short.

COMPARISONS: This species seems to be the only one (except for one specimen of *P. araujoii*) with three apical spurs on the fore tibia of both imago and soldier. This is a primitive character compared to the 2:2:2 arrangement in all the other species (one exception already noted). *P. striatus* is also the only species with 15 articles in the antenna of the imago and 14 articles in the antenna of the soldier. The other species conform in the imago and soldier antennal articles so far as is known. The species closest in the imago caste seems to be *P. araujoii* (fig. 6) which differs particularly in size. *P. lespesii* (figs. 11, 12) is smaller and has shorter hind tibiae.

SOLDIER: Top of head with a few long bristles and no short hairs, under side without bristles or hairs; postmentum with a few microscopical hairs and about two bristles on the anterior end; pronotum with short hairs

on the anterior surface. Head with sides only slightly curved and almost straight and parallel. Frontal tube large and thick at the base, extending almost to the base of the anteclypeus from above, not upturned above the top of the head. Postmentum narrowest part about three-fifths of the width of the widest part (0.29:0.50 mm.). Antenna with 14 articles, the second larger than the third, the third larger than the fourth. Labrum with curved sides and no side angles, sides slightly concave behind the proportionately wider white median lobe (fig. 1E). Mandibles as in figure 2A. Front margin of pronotum without or with very slight emargination. Fore tibia with three apical spurs, the outer spur short; other tibiae with two apical spurs (3:2:2).

COMPARISONS: *Procornitermes araujoii* and *P. triacifer* have sharp side angles on the labrum (figs. 1B, 1A). *P. lespesii*, *P. romani*, and *P. cornutus* have a tibial spur arrangement of 2:2:2. *P. lespesii* has a wider labrum (fig. 1D) and usually has a longer tibia. *P. romani* is larger in almost all measurements, and the sides of the head are more straight and parallel (fig. 10). *P. cornutus* has somewhat angular sides of head, the notch of the right mandible is wider than a right angle (fig. 2C), and the measurements are almost always larger. The closest species would seem to be *P. lespesii*.

DISTRIBUTION (FIG. 5): Brazil (type locality), 2 imagoes, det. H. Hagen as *Termes striatus*, M.C.Z., Berlin Mus.

TABLE 5  
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Procornitermes striatus* (HAGEN)

	No.	Range	Mean
Length of head with mandibles	2	2.94-3.00	2.97
Length of head to tip of frontal tube	3	2.10-2.23	2.19
Length of head to side base of mandibles	2	2.12-2.13	2.12
Width of head	3	1.44-1.53	1.48
Thickness of head	2	1.29-1.33	1.31
Length of frontal tube	2	0.36-0.42	0.39
Width of labrum	1	0.44	0.44
Length of left mandible	3	1.07-1.27	1.15
Length of right mandible from notch	1	0.54	0.54
Length of pronotum	2	0.53-0.54	0.53
Width of pronotum	3	0.85-0.87	0.86
Length of hind tibia	3	1.06-1.22	1.16



TABLE 6

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Procornitermes cornutus* (HOLMGREN)

	No.	Range	Mean
Length of head with mandibles	2	3.23-3.29	3.26
Length of head to tip of frontal tube	3	2.35-2.41	2.38
Length of head to side base of mandibles	3	2.26-2.53	2.42
Width of head (includes Holmgren's measurements)	4	1.60-1.73	1.69
Thickness of head	2	1.42-1.44	1.43
Length of frontal tube	3	0.35-0.41	0.39
Width of labrum	3	0.52-0.56	0.54
Left of left mandible	2	1.24-1.27	1.25
Length of right mandible from notch	2	0.59-0.68	0.63
Length of pronotum	3	0.63-0.65	0.64
Width of pronotum	3	0.94	0.94
Length of hind tibia	2	1.48-1.50	1.49

La Sierra (34°40' S., 55°20' W.), Uruguay, imago, soldiers, workers, coll. and det. F. Silvestri as *Cornitermes striatus*, V.1899, Silvestri Coll., Portici, Italy, A.M.N.H.

Salta (24°48' S., 65°25' W.), Argentina, imagoes, det. N. Holmgren as *Cornitermes striatus*, coll. Steinbach, 21.II.1905, Berlin Mus., A.M.N.H.

The species is also recorded from San Pedro de Colalao (26°14' S., 65°33' W.), Tucuman, Argentina, Silvestri (1903); from Villa Incarnacion (27°36' S., 55°52' W.), Paraguay, Silvestri (1903); and from Paraguari (25°33' S., 57°09' W.), Paraguay, Silvestri (1903).

#### *Procornitermes cornutus* (Holmgren)

*Cornitermes cornutus* HOLMGREN, 1906, p. 549 (soldier, worker), text fig. J (soldier), text fig. K (worker mandibles).

*Cornitermes* (C.) *striatus* SNYDER, 1926a, p. 20 (soldier, part only).

*Procornitermes cornutus* SNYDER, 1949, p. 261 (synonymy).

**SOLDIER:** Head dark yellowish, pronotum yellowish. Head with a few scattered bristles and no short hair. Head subrectangular, widest region just behind the base of the frontal tube, sides fairly straight and converging somewhat both in front and behind the widest part. Frontal tube somewhat conical, the tip only about half of the width of the base from above, overlapping the base of the postclypeus from above. Postmentum with the narrowest part about three-fifths of the width of the widest part (0.15:0.25 mm.). Antenna with 14 articles, the second, third,

and fourth subequal. Labrum with curved lateral margins behind the base of the white median lobe with only a suggestion of angularity (fig. 1C). Left mandible (specimens from Covendo and Tumupasa, Bolivia) with a tooth immediately posterior to the notch, and another flat, curved, tooth-like projection longer than the first marginal tooth between the first marginal tooth and the basal portion, the basal portion with two tooth-like serrations. Right mandible (fig. 2C) short, with a slight evenly concave curve from the notch to the tip, notch wider than a right angle. Pronotum with a rather long frontal lobe, front margin either emarginate or not. Tibial spurs 2:2:2.

**COMPARISONS:** *Procornitermes romani* (fig. 10) close, with mandibles very similar except that the notch of the right mandible is close to a right angle, the widest part of the postmentum is wider, the head is longer, with straighter sides, and the frontal tube is thicker at the base. *P. araujo* has distinct lateral angles on the labrum (fig. 1B), and the antenna has 15 articles. *P. lespesii* has the angle of the notch of the right mandible close to a right angle (fig. 2B). *P. striatus* has the tibial spurs 3:2:2 and is smaller.

**DISTRIBUTION** (FIG. 5): Tuiche (14°15'-14°40' S., 67°30'-69°00' W.), prov. Caupolicán, Bolivia (type locality), damaged soldier (cotype), workers, coll. and det. N. Holmgren as *Cornitermes cornutus*.

Covendo (15°40' S., 67°05' W.), Bolivia, soldier, coll. W. M. Mann, det. T. E. Snyder (1926a, p. 20) as *Cornitermes striatus*, U.S.N.M.

Tumupasa (14°09' S., 67°48' W.), Bolivia, soldier, coll. W. M. Mann, det. T. E. Snyder (1926a, p. 20) as *Cornitermes striatus*, U.S.N.M.

***Procornitermes romani*, new species<sup>1</sup>**

**SOLDIER (FIG. 10):** Head, pronotum, legs, and abdomen dark yellow. Head sparsely covered on the top and sides with bristles and with few or no contrasting short hairs;

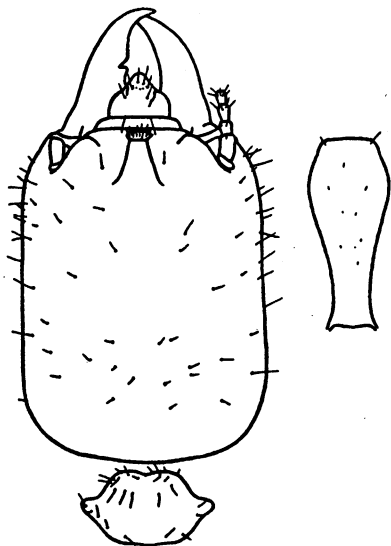


FIG. 10. Dorsal view of head and pronotum and ventral view of postmentum of soldier of *Procornitermes romani*, new species, holotype.

under side of head with few or no bristles; postmentum with two anterior bristles and a few inconspicuous microscopic hairs in the middle. Head somewhat rectangular, the sides fairly straight and parallel. Frontal tube proportionately long, reaching the front of the postclypeus from above. Postmentum with the narrow portion about half the width of the widest portion (0.28–0.30:0.58–0.63 mm.). Antenna with 13 to 14 articles, the third sometimes showing signs of dividing in the antennae with both 13 and 14 articles. Labrum with rounded lateral angles, the margins behind the base of the white median lobe slightly concave or nearly straight.

This species is named in honor of Dr. A. Roman of the Naturhistoriska Riksmuseum, Stockholm, Sweden, a specialist on the Hymenoptera, who took time on his expedition to Amazonas and Bahia to make an important collection of the termites of the region.

Mandibles as in figure 10, the angle of the notch of the right mandible about equal to a right angle, with an evenly curved cutting edge from the notch to the tip. Pronotum with a distinctly emarginate front margin. Tibial spurs 2:2:2.

**COMPARISONS:** The closest species is *P. cornutus* which has a narrower postmentum at the widest part, and the frontal tube is not so thick at the base.

**DISTRIBUTION (FIG. 5):** Iguassú (possibly 13°24' S., 43°10' W.), Bahia, Brazil (type locality), soldiers (holotype, paratype), workers, coll. A. Roman, 5.VII.1924, "in dead tree in catinga jungle"; soldier (paratype), workers, coll. A. Roman, 14.VIII.1924.

***Procornitermes lespesii* (Müller)**

*Termes striatus* MÜLLER, 1871, pp. 205, 206 (biology, nest).

? *Termes similis* MÜLLER, 1871, p. 206 (nest).

*Termes Lespesii* MÜLLER, 1873, p. 349 (imago, soldier, biology), text figs. 3–11 (biology, nests).

*Termes lespesi* BERG, 1880.

? *Termes Mülleri* VON IHERING, 1887, p. 3 (soldier, nest).

*Termes (Cornitermes) Lespesii* WASMANN, 1897, p. 150 (taxonomy).

? *Eutermes mülleri* CZERWIŃSKI, 1901, p. 7 (soldier), text fig. 7 (soldier).

*Cornitermes Lespesii* placed in synonymy with *C. striatus*, SILVESTRI, 1903, p. 57.

*Cornitermes Lespesii* placed in synonymy with *C. striatus*, DESNEUX, 1904, p. 38.

*Cornitermes (C.) Lespesi* HOLMGREN, 1912, p. 51 (taxonomy), text fig. 23 (soldier mandibles).

*Cornitermes (Cornitermes) lespesi* SNYDER, 1926a, p. 20 (soldier).

*Cornitermes (Cornitermes) striatus* SNYDER, 1926a, p. 20 (soldier from Asunto, Canamina, and Espia, Bolivia, only).

*Procornitermes lespesii* SNYDER, 1949, p. 261 (synonymy).

**IMAGO:** Head brown, with yellowish streaks; fontanelle plate same color as head or a little lighter; postclypeus yellow-brown; pronotum yellowish or yellow-brown; tibia and femur yellowish; wing membrane hyaline, with brownish costa and radius; tergites as light as the lightest part of the pronotum; sternites lighter than tergites. Pronotum with numerous bristles and a few short hairs; tergites with bristles in the middle and contrasting short hairs on the sides and posterior margins; sternites with bristles and

TABLE 7

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Procornitermes romani*, NEW SPECIES

	No.	Range	Mean
Length of head with mandibles	3	3.32-3.65	3.52
Length of head to tip of frontal tube	3	2.33-2.65	2.52
Length of head to side base of mandibles	3	2.41-2.74	2.62
Width of head	3	1.72-1.94	1.86
Thickness of head	3	1.62-1.66	1.63
Length of frontal tube	3	0.41-0.46	0.44
Width of labrum	3	0.52-0.56	0.53
Length of left mandible	3	1.26-1.32	1.29
Length of right mandible from notch	3	0.62-0.66	0.64
Length of pronotum	3	0.57-0.60	0.59
Width of pronotum	3	0.99-1.06	1.04
Length of hind tibia	3	1.47-1.53	1.50

hairs. Y-suture visible. Fontanelle plate projecting slightly from the head surface, a little smaller than, or about the same size as, the ocellus. Eye proportionately small, about one-third of its diameter from the lower margin. Ocellus small, a little shorter and much narrower than the antenna socket, upper side somewhat projecting, with about one-fourth of the width of the ocellus visible from above, about its width and less than its length from the eye. Postclypeus about as long as half its width (0.28-0.33:0.54-0.69

mm.). Antenna with 13 to 14 articles. Pronotum proportionately long, sides converging somewhat towards the rear, hind margin slightly to strongly emarginate. Tibial spurs 2:2:2.

COMPARISONS: *Procornitermes araujo*i has a dark middle portion of the tibia that contrasts with the yellowish femur and tarsus, and the size is larger. *P. striatus* has 15 articles in the antenna, the tibial spurs are 3:2:2, and the size is larger.

SOLDIER (FIGS. 11, 12): Head with a num-

TABLE 8

MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Procornitermes lespesii* (MÜLLER)

	No.	Male Range	Mean	No.	Female Range	Mean
Length of head to tip of labrum	4	1.48-1.57	1.51	5	1.56-1.66	1.59
Length of head to side base of mandibles	4	0.94-1.00	0.97	5	1.06-1.12	1.08
Width of head	4	1.29-1.32	1.30	5	1.40-1.45	1.42
Diameter of eye	4	0.33-0.34	0.34	5	0.35-0.38	0.36
Eye from lower margin	4	0.08-0.12	0.10	5	0.08-0.12	0.09
Length of ocellus	4	0.15-0.18	0.17	5	0.17-0.18	0.18
Width of ocellus	4	0.11-0.12	0.12	5	0.11-0.12	0.12
Ocellus from eye	4	0.11-0.14	0.12	5	0.11-0.14	0.13
Ocellus from fontanelle	4	0.32-0.41	0.36	5	0.32-0.38	0.35
Length of fontanelle	4	0.10-0.18	0.15	5	0.12-0.22	0.17
Width of fontanelle	4	0.08-0.14	0.12	5	0.10-0.12	0.11
Length of pronotum	4	0.61-0.70	0.65	5	0.65-0.75	0.70
Width of pronotum	4	1.10-1.12	1.11	5	1.18-1.22	1.21
Length of hind tibia	3	1.56-1.60	1.58	5	1.53-1.59	1.57
Length of anterior wing from suture	4	12.34-12.87	12.53	4	13.44-13.72	13.58
Width of anterior wing	4	3.29-3.66	3.46	4	3.57-3.76	3.68

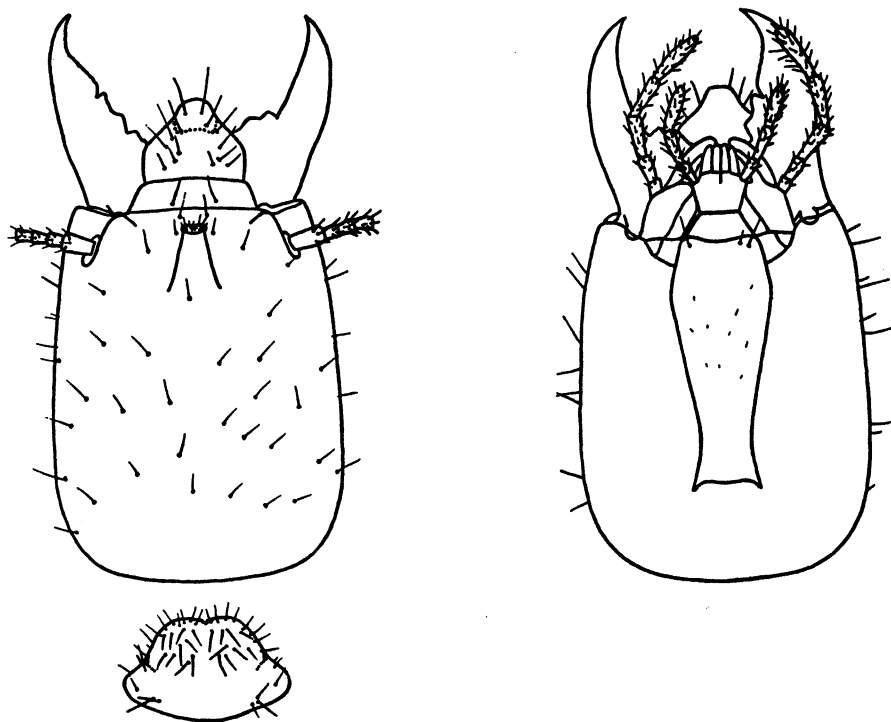


FIG. 11. Dorsal view of head and pronotum and ventral view of head of soldier of *Procornitermes lespesii* (Müller), Espia.

ber of sparsely scattered bristles on the top and none on the under side near the postmentum; postmentum with a few bristles on the anterior end and a few very minute hairs over the surface. Head subrectangular or somewhat oval, sides slightly to markedly curved, subparallel or converging a little

towards the front. Frontal tube rather long, extending well beyond the base of the postclypeus from above. Postmentum somewhat bulging and curved in profile, narrowest part from a little more than one-half to about two-thirds of the width of the widest part. Antenna with 14 articles. Lateral margins of the labrum behind the base of the median white lobe evenly curved without or with a slight suggestion of angularity (fig. 1D). Mandibles as in figures 2B and 11. Pronotum with front margin either emarginate or not. Tibial spurs 2:2:2.

COMPARISONS: *Procornitermes cornutus* has the angle of the notch of the right mandible greater than a right angle (fig. 2C), and the sides of the head are more angular. *P. romani* has the sides of the head straighter and more parallel (fig. 10), and the head is thicker (1.62–1.66 mm.). *P. striatus* has the tibial spurs 3:2:2, the length of the right mandible (fig. 2A) from the notch is shorter (about 0.54 mm.), and the hind tibia is usually shorter (1.06–1.22 mm.). *P. triacifer* and *P. araujoii* have sharp lateral angles of the labrum (fig. 1A, B).

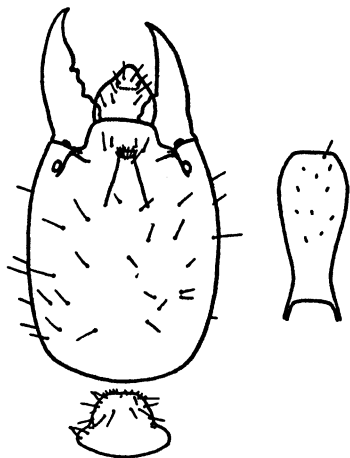


FIG. 12. Dorsal view of head and pronotum and ventral view of postmentum of soldier of *Procornitermes lespesii* (Müller), Canamina.

TABLE 9  
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Procornitermes lespesii* (MÜLLER)

	No.	Range	Mean
Length of head with mandibles	28	2.41-3.38	3.05
Length of head to tip of frontal tube	50	1.82-2.35	2.14
Length of head to side base of mandibles	50	1.70-2.44	2.14
Width of head	49	1.35-1.71	1.58
Thickness of head	50	1.22-1.53	1.40
Length of frontal tube	50	0.31-0.53	0.41
Width of labrum	49	0.45-0.54	0.51
Length of left mandible	48	1.04-1.26	1.19
Length of right mandible from notch	36	0.57-0.67	0.62
Length of pronotum	50	0.44-0.68	0.60
Width of pronotum	48	0.73-0.94	0.87
Length of hind tibia	37	1.18-1.48	1.40

Von Ihering (1887) distinguishes *T. mülleri* from *T. lespesii* by the incised pronotum. The variation within the species in this character is considerable, and I am placing *T. mülleri* in synonymy until type specimens can be studied. Czerwiński (1901) records "*Eutermes mülleri*" from "Rio Grande."

DISTRIBUTION (FIG. 5): Itajaí (27°10' S., 48°48' W.), Santa Catarina, Brazil (type locality), imago (?cotype), soldiers (?cotypes), workers, ? coll. Fr. Müller, ? det. Fr. Müller as *Termes Lespesii*, det. N. Holmgren as *Cornitermes lespesii*, from Holmgren Coll., without locality or name of Müller on the label but probably original type specimens; soldiers (cotypes), workers, coll. and det. Fr. Müller as *Termes Lespesii*, from Munich Mus.

Joinville (26°22' S., 48°53' W.), Humboldt District, Santa Catarina, Brazil, imagoes, soldier, coll. W. Ehrhardt, 1913; soldiers, workers, det. N. Holmgren as *Cornitermes striatus* from Holmgren Coll., locality label with only district but probably from Joinville.

São Paulo (23°33' S., 46°38' W.), São Paulo, Brazil, soldiers, workers, coll. J. V. Pupo Nogueira, 16.XI.1944, Araujo Coll. No. 2551, A.M.N.H.

Ilha Grande (22°59'-23°07' S., 44°07'-44°26' W.), Rio de Janeiro, Brazil, king, queen, soldier, coll. H. Muth and H. Sick, 19.II.1943, No. 200; king, queen, workers, nymphs, coll. H. Muth and H. Sick, 10.V.1943, No. 213; imagoes, worker, coll. H. Muth and H. Sick, 16.VI.1943, No. 225; king, queen, soldiers, worker, coll. H. Muth and H. Sick, 10.VII.1943, No. 231; dealate male, soldiers, workers, nymphs, coll. H. Muth and H. Sick, II.1944; king, queen, soldiers, workers, nymphs, coll. H. Muth and H. Sick, III.1944;

imagoes, worker, nymphs, coll. H. Muth and H. Sick, 22.VII.1944.

Cajuata (16°38' S., 67°40' W.), Bolivia, soldiers, workers, coll. W. M. Mann, 1921, det. T. E. Snyder (1926a, p. 20), as *Cornitermes lespesi*, U.S.N.M., A.M.N.H.

San Fernando Rapids (15°50' S., 67°18' W.), Bolivia, soldiers, workers, coll. W. M. Mann, 1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes lespesi*, U.S.N.M., A.M.N.H.

Rosario (13°58' S., 66°52' W.), Bolivia, king, queen, soldiers, workers, coll. W. M. Mann, XI.1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes lespesi*, U.S.N.M., A.M.N.H.

Espia (16°30' S., 67°21' W.), Bolivia, soldiers, workers, coll. W. M. Mann, 1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes lespesi*, U.S.N.M., A.M.N.H.; soldier, workers, coll. W. M. Mann, 1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes striatus*, U.S.N.M.

Rurrenabaque (14°28' S., 67°27' W.), Bolivia, soldiers, workers, coll. W. M. Mann, X.1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes lespesi*, U.S.N.M., A.M.N.H.

Huachi (15°36' S., 67°12' W.), Bolivia, soldiers, workers, coll. W. M. Mann, IX.1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes lespesi*, U.S.N.M., A.M.N.H.

St. Helena on Huachi (about 15°40' S., 66°41' W.), Bolivia, soldiers, workers, coll. W. M. Mann, VIII.1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes lespesi*, U.S.N.M., A.M.N.H.

Asunto (16°06' S., 67°20' W.), Bolivia, soldiers, workers, coll. W. M. Mann, VIII.1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes striatus*, U.S.N.M., A.M.N.H.

Canamina (16°37' S., 67°15' W.), Bolivia, soldiers, workers, coll. W. M. Mann, 1921, det. T. E. Snyder (1926a, p. 20) as *Cornitermes striatus*, U.S.N.M., A.M.N.H.



## GENUS *CORNITERMES* WASMANN

### SYNONYMY:

- <Subgenus *Termes* HAGEN, 1858a, pp. 107, 108.
- <Subgenus *Termes* HAGEN, 1858b, p. 23.
- <Subgenus *Cornitermes* WASMANN, 1897, p. 150.
- <Genus *Cornitermes* SILVESTRI, 1901, p. 4.
- <Genus *Cornitermes* SILVESTRI, 1903, p. 52.
- <Genus *Termes* DESNEUX, 1904, pp. 26, 28.
- <Subgenus *Termes* DESNEUX, 1904, pp. 32, 35.
- <Genus *Cornitermes* HOLMGREN, 1906, p. 549.
- <Genus *Cornitermes* HOLMGREN, 1912, pp. 45, 49.
- <Subgenus *Cornitermes* HOLMGREN, 1912, p. 50.
- <Subgenus *Tubulitermes* HOLMGREN, 1912, pp. 52, 53.
- <Genus *Cornitermes* EMERSON, 1925, p. 363.
- <Subgenus *Cornitermes* EMERSON, 1925, p. 365.
- <Genus *Cornitermes* SNYDER, 1926a, p. 17.
- <Subgenus *Cornitermes* SNYDER, 1926a, p. 17.
- <Subgenus *Cornitermes* EMERSON, 1928, p. 406.
- <Genus *Cornitermes* HARE, 1937, pp. 460, 474.
- = Genus *Cornitermes* SNYDER, 1949, p. 261
- = Genus *Cornitermes* AHMAD, 1950, pp. 46, 58, 59, 82.

**IMAGO:** Color yellowish or reddish brown to dark brown; wing membrane hyaline or smoky brown. Head, pronotum, wing scales, tergites, and sternites with fairly long, scattered bristles; contrasting short hairs on front margin of pronotum, sternites, and white sides of abdomen, sometimes on the tergites, wing scales, and occasionally a few on other parts of the body; wing membrane and veins with short hairs and no chitinous punctations except occasionally between the costal border and the radius near the wing suture. Size moderately large (head width ranges from about 1.77 to 2.50 mm.). Head oval or round, a blunt ridge running diagonally from the front of the eye to the lower base of the mandible. Side arms of the Y-suture invisible or inconspicuous, the bases near the fontanelle sometimes visible, the median suture visible. Fontanelle usually conspicuous, oval or round, small to large (length ranges from about 0.09 to 0.63 mm.), either a convex or somewhat convex plate, or a light somewhat concave depression, with a small light muscle insertion immediately in front of the fontanelle. Eye of moderate size or large (eye diameter ranges from about 0.51

to 0.77 mm.). Ocellus of moderate size or large (ocellar length ranges from about 0.18 to 0.38 mm.), the top margin of the ocellus strongly or a little raised above the general level of the head, and the bottom margin in a depression, the position of the base of the ocellus vertical or fairly vertical, with only a portion of the surface of the ocellus visible from above; ocellus about twice its length to four-ninths of its length removed from the eye. Antenna with 15 to 16 articles. Post-

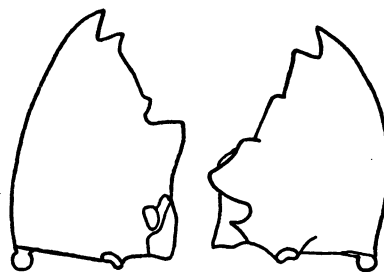


FIG. 13. Mandibles of imago of *Cornitermes cumulans* (Kollar), São Paulo, Araujo No. 2380.

clypeus moderately to strongly arched, from distinctly less than, to about half as long as, wide, median suture visible. Anteclypeus white, with a V-shaped darker sclerotized mark in the middle, the arms curving towards the front lateral margin. Labrum with a thin white anterior lip. The left mandible (fig. 13) with the apical and first marginal tooth roughly similar in size; a long, continuous, even, slightly curved, or nearly straight cutting edge between the first (plus the reduced second) marginal tooth and the small third marginal tooth; and a blunt notch posterior to the third marginal tooth.<sup>1</sup> The right mandible (fig. 13), with the apical tooth nearly the same size as the first marginal tooth and the second marginal tooth smaller than the first marginal tooth, notch at base of apical tooth sharper than a right angle,

<sup>1</sup> The above homologies of the teeth seem to be a fair assumption from a comparison with the mandibles of the Macrotermitinae which have an acute notch between the first plus second and the third marginal teeth. The reduction of the second marginal tooth is assumed from the trend of the evolution from the Rhinotermitidae to the Termitidae, including *Protohamitermes*. See Ahmad (1950).

notches at bases of first and second marginal teeth slightly sharper or greater than a right angle. Pronotum somewhat flat or slightly saddle shaped, narrower than the head, side angles rounded, and hind margin emarginate or not emarginate. Hind margin of mesonotum widely concave or somewhat angular; two fairly sharp or rounded points on the sides of the posterior margin, the points close to, or a little wider than, a right angle, and the concavity or emargination distinctly wider than a right angle. Hind margin of metanotum widely concave, with fairly sharp lateral or rounded angles wider than a right

freely a little beyond the suture.  $R_{4+5}$  runs singly to near the tip of the wing, where it joins the costal border; sometimes with an inferior weak branch or branches near the tip and also with numerous weak branches or reticulations from the media joining  $R_{4+5}$  on the inner side. M weak, running fairly close and parallel to Cu, with two to 10 branches reaching the borders in the outer half of the wing; M joined to  $R_{4+5}$  in the hind wing just beyond the suture. Cu weak, with nine to 20 branches reaching the border. Cerci short, with two articles. Male and female without styli.

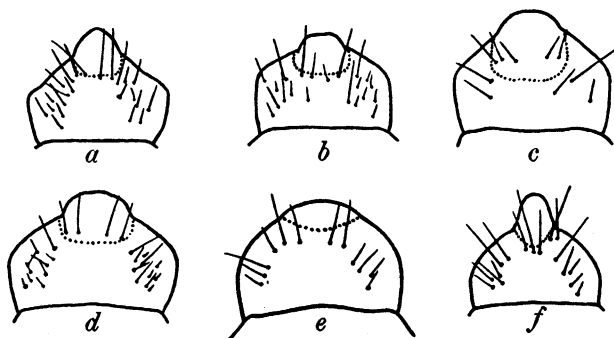


FIG. 14. The labrum of soldiers of *Cornitermes*. A. *C. cumulans* (Kollar), Santo Amaro. B. *C. pilosus* Holmgren, cotype, Chaquimayo. C. *C. walkeri* Snyder, paratype, Rio Tapia. D. *C. pugnax* Emerson, paratype, Kartabo. E. *C. acignathus* Silvestri, Rio Casacay. F. *C. bolivianus* Snyder, cotype, Lago Rogagua.

angle. All tibiae with two apical spurs or spines near the apex (2:2:2). A row of more than 10 spines on the inner edge of the fore tibia suggestive of the more distinct comb-like row found in the same position in the soldier and worker castes. Tarsi with four articles. Arolium absent. Scales of wings not overlapping the posterior border of the notum. Wing suture nearly straight, with small undulations. Shape of wings elongate, with slightly curved costal and inner margins that are nearly straight in the center of the wing. Slight reticulations sometimes between the costal border and the radius near the tip. Forewings and hind wings with a short  $R_1$  extending a little beyond the wing suture and ending freely between the costal border and the radius or occasionally joining the costal border. In some forewings and hind wings a short  $R_{2+3}$  is also visible, ending

**SOLDIER:** Color of head deep to dull yellow, thorax and abdomen pale yellow. Head with many or few bristles; short hair abundant or nearly absent. Head moderately large (width ranges from 1.40 to 3.25 mm.), sides straight or curved, parallel or converging somewhat towards the front; lateral longitudinal ridges on the under side rounded, not so sharp as in *Syntermes*. Frontal tube moderately short, about the same as in *Procornitermes*, longer than in *Syntermes*, *Paracornitermes* (fig. 4), and *Labiatermes*, shorter than in *Rhynchotermes* and *Armitermes*, overlapping the base of the postclypeus but not extending beyond the postclypeus from above, pointed forward or somewhat upturned. Postmentum with narrowest portion from about two-fifths to three-fourths of the width of the widest portion. Antenna with 15 articles. Postclypeus fused with the front, the suture still

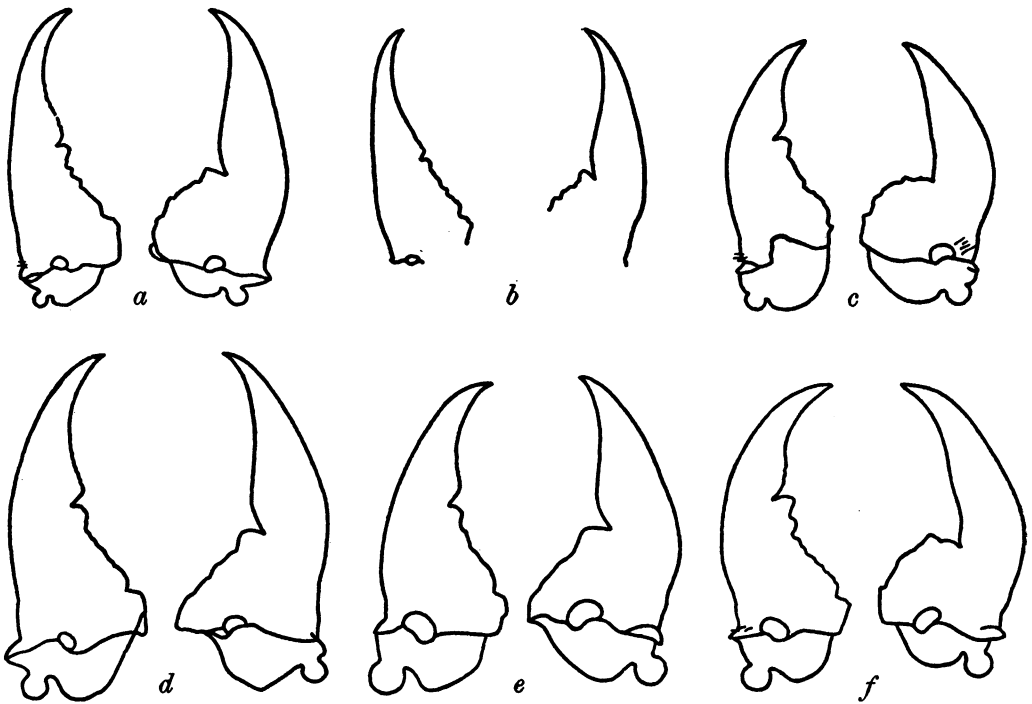


FIG. 15. Mandibles of soldiers of *Cornitermes*. A. *C. cumulans* (Kollar), Santa Amaro, coll. Melzer. B. *C. bolivianus* Snyder, cotype, Lago Rogagua. C. *C. pilosus* Holmgren, cotype, Chaquimayo. D. *C. acignathus* Silvestri, Rio Casacay. E. *C. walkeri* Snyder, paratype, Rio Tapia. F. *C. pugnax* Emerson, paratype, Kartabo, June 29,\* 1919.

visible in a favorable light. Anteclypeus less than half as long as wide, with two diagonal sclerotized portions converging towards the rear and joining in the center to form a thickened V-shaped mark. Labrum of various shapes (fig. 14), with a median, white, rounded lobe in front, often with obtusely pointed lateral angles or with roundly angular or evenly curved margins. Mandibles (fig. 15) moderately large, each with outer edges fairly strongly curved and each with a distinct notch on the inner edge at the base of the apical portion; teeth rather small. Pronotum with a large, wide, frontal lobe, the front margin either emarginate or rounded. Thoracic nota with rounded sides. Coxa of foreleg with a blunt ridge and no conspicuous projection. All tibiae with two apical spurs (2:2:2). Fore tibia with a comb-like series of more than 10 spines (usually 16–21) on the inner edge (fig. 3), each shorter than the apical spurs.

**WORKER:** Head yellowish. Numerous bristles on head; tergites with bristles and sometimes with a few short hairs; sternites

with bristles and short hairs. Fontanelle oval or round, white, a little smaller than the antennal socket. Y-suture present. Antenna with 14 to 15 articles. Postclypeus, anteclypeus, labrum, and mandibles as in the imago. Pronotum with a large frontal lobe. Sides of thoracic nota rounded. All tibiae with two apical spurs (2:2:2). Fore tibia with a comb-like series of more than 10 spines (usually 16–21) on the inner edge, each shorter than the apical spurs.

**RELATIONSHIPS:** *Cornitermes* is most closely related to *Procornitermes*, the two groups having long been included together within the same genus or subgenus. The most obvious distinction of *Cornitermes* from related genera is the presence of a row of more than 10 spines (usually 16–21) on the inner edge of the fore tibia of the soldier (fig. 3) and the worker, each spine shorter than the apical spurs. The character is also discernible in the imago, but the comb-like row of spines is not so easily distinguishable as it is on the sterile castes. *Procornitermes* has four to eight spines on the inner edge of the fore tibia of the

soldier and worker, each spine about as long as the apical spurs (fig. 3), and the imago also indicates the presence of the character, although again it is more distinct in the sterile castes. All the other genera of Nasutitermitinae with mandibulate soldiers lack this comb-like series of spines, so it would appear that it evolved with *Cornitermes* and that the more advanced genera probably evolved from a group similar in this respect to *Procornitermes*.

The tibial spurs are 2:2:2 in *Cornitermes*, while the spurs are 3:2:2 in *Procornitermes striatus*, occasionally 3:2:2 but usually 2:2:2 in *P. araujoi*, and always 2:2:2 in *P. cornutus*, *P. romani*, and *P. lespesii*. The larger number of spurs is a primitive character, so *Cornitermes* is more advanced in this respect than are some species of *Procornitermes*. *Syntermes* has 3:2:2 apical spurs and is considered the most primitive genus of the Nasutitermitinae.

The imago of *Cornitermes* has 15 to 16 articles in the antenna, while *Procornitermes* has 13 to 15 articles. *Syntermes* has 19 to 21 articles. The imago and soldier of *Rhynchotermes* have 14 articles. The larger number of antennal articles is considered the more primitive character. *Cornitermes* usually has 15 articles, with only an occasional specimen with 16, and some species of *Procornitermes* have 15 (the imago of *P. striatus* and the imago and soldier of *P. araujoi*), while the other species have 13 or 14. In this respect *Procornitermes* may be considered somewhat more advanced than *Cornitermes*, but the character overlaps in the two genera and should not be given undue importance.

*Syntermes* soldiers have lateral thoracic spines or pointed sides (Emerson, 1945) which are lacking in *Procornitermes* and *Cornitermes*. This indicates a more advanced phylogenetic position for the latter two genera.

Larger size is often an indication of a more primitive type, and in this respect *Syntermes* is definitely more primitive, *Cornitermes* is the next more advanced, and *Procornitermes* has the smallest soldiers of the three. However, there is an overlap between *Procornitermes* and *Cornitermes*, and it is also by no means sure that the evolutionary trend is always towards a decreased size.

The soldier labrum of *Syntermes*, with its fairly sharp lateral angles, may be considered

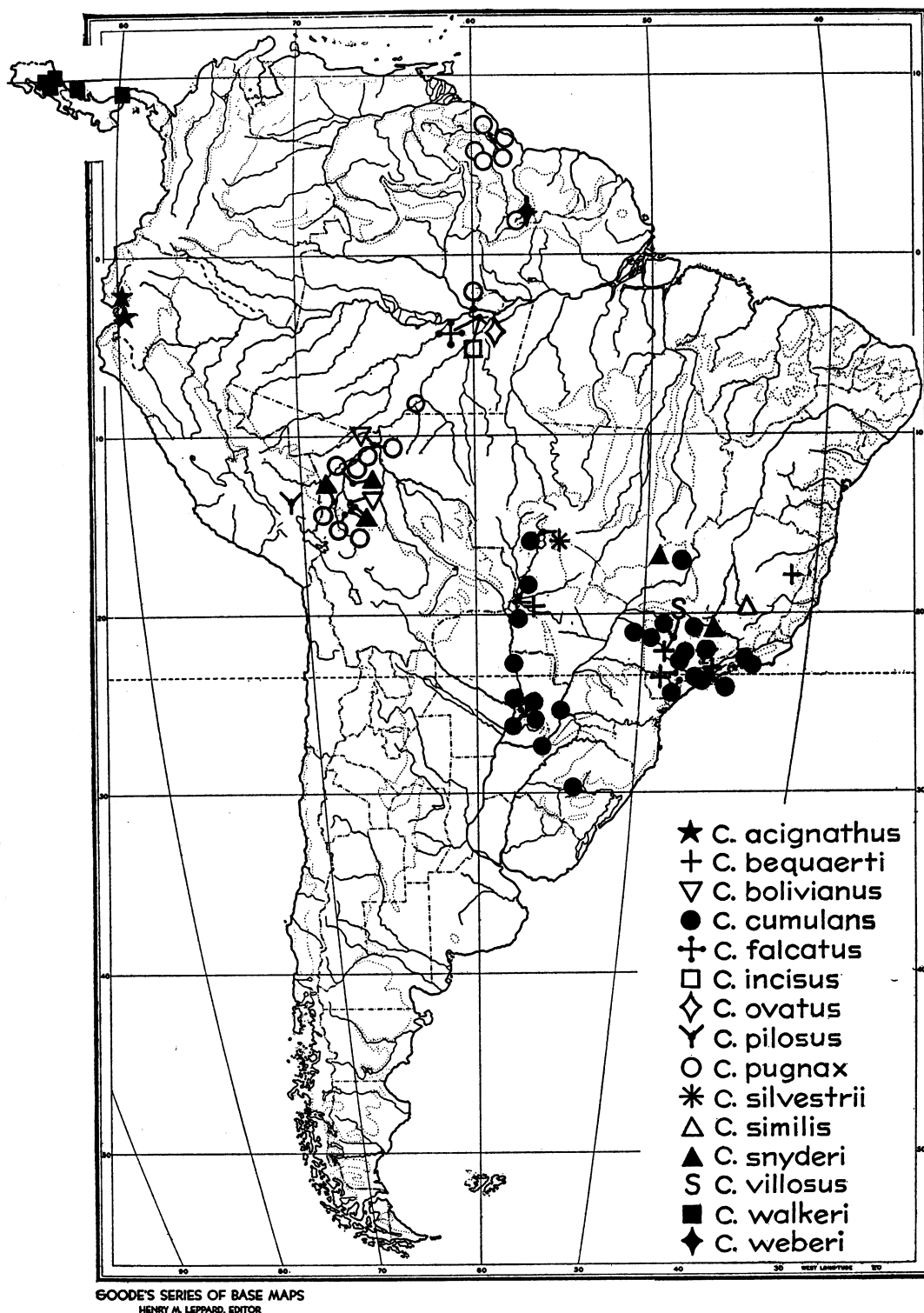
the most primitive in this subfamily. Both *Procornitermes* and *Cornitermes* have species with sharp lateral angles (*P. triacifer*, *P. araujoi*, and *C. weberi*) and both genera possess species showing various degrees of reduction of the lateral projections (figs. 1, 14), so that in this respect the two genera cannot be arranged in a phylogenetic sequence.

The mandibles of the imago and worker of *Syntermes*, *Procornitermes*, *Cornitermes* (fig. 13), *Rhynchotermes*, and *Nasutitermes* are essentially similar (Ahmad, 1950), and this character indicates a phylogenetic relationship of these genera setting them apart from *Paracornitermes*, *Labiatermes*, *Armitermes*, *Curvitermes*, and *Subulitermes* (Allee, et al., 1949, p. 727). This series from *Paracornitermes* (fig. 4) to *Subulitermes* and related nasute genera is characterized by imago-worker mandibles with a relatively large apical tooth in comparison to the smaller first marginal tooth of the left mandible, and the cutting edge of the left mandible between the first (plus reduced second) and third marginal tooth is undulating rather than evenly curved or nearly straight as in the genera from *Syntermes* to *Nasutitermes* and related nasute genera. The mandible characters indicate a split of two main branches of the subfamily among the primitive genera with mandibulate soldiers. The branching probably occurred from a primitive extinct genus between *Syntermes* and *Procornitermes*.

The large teeth in the mandibles of the soldiers of *Syntermes*, the dental specialization of *Paracornitermes* (fig. 4), and the reduction of the teeth in *Procornitermes* (fig. 2) and *Cornitermes* (fig. 15) indicate a phylogenetic trend, but it is difficult to detect generic differences of phylogenetic importance between the last two genera.

The small frontal tube of *Syntermes* soldiers and the increasing proportional size of the tube in genera of both major branches surely indicate a phylogenetic series. The soldier mandibles become convergently reduced gradually to functionless basal portions as the frontal tube increases. There is no phylogenetic distinction between *Procornitermes* and *Cornitermes* in this character.

The postclypeus is flat and less than half as long as wide in the imago of *Syntermes* and also in the imago of *Cornitermes pugnax*

FIG. 16. Distribution of the species of the genus *Cornitermes*.

and *walkeri*, while the postclypeus is arched and about as long as half of its width in the other species of *Cornitermes* and in *Procornitermes* and *Rhynchotermes*. What phylogenetic significance this character has is as yet not clear. One would guess that the postclypeus of *Procornitermes* is the more primitive and that the shortening occurred convergently in *Syntermes* and a few species of *Cornitermes*.

Summing up these data, one may postulate that an extinct group between *Syntermes* and *Procornitermes* gave rise to *Procornitermes* and *Cornitermes*. *Procornitermes* is more closely related to this extinct group, particularly in the character of the tibial spines. *Rhynchotermes* probably arose either from this extinct group or directly from *Procornitermes*. The sharp coxal spine of the *Rhynchotermes* soldier and the sharp coxal ridge of the *Rhynchotermes* imago are specializations without any precursors in the more primitive genera. The *Paracornitermes-Subulitermes* branch probably arose from this extinct group, as indicated by the modification of the imago-worker mandible, and ultimately gave rise to a convergent nasute soldier that is strikingly similar to that on the *Nasutitermes* branch.

There is considerable biological significance in the fact that the imago-worker mandibles are conservative and relatively constant, while the soldier mandibles have undergone a convergent evolutionary regression in negative correlation with the increase in the size of the frontal tube. There is strong evidence that caste differences within the same colony of termites are not determined by differences in the genetic constitution of each caste. Here is a clear demonstration that gene patterns may indicate evolutionary change under certain physiological conditions, and under other physiological conditions these same gene patterns will indicate no evolution. The detected evolution in the soldier caste is obviously adaptive, but the soldier caste is sterile and cannot pass on its adjustments to the next generation directly. Natural selection must therefore act upon the colony as a whole, including the adapted sterile castes as well as the conservative reproductive castes. If one conceives of the social system as an integrated supraorganism, with

some biological and evolutionary attributes of an individual organism, the relations of these facts become clear. The sterile castes are significant analogues of the somatic tissues of the individual organism. There is also a convergent evolution of sterility in the somatic cells and in the sterile castes of social insects. Both the individual organism and the social supraorganism are analogous unit systems on which natural selection may act.

The linear arrangement of the species does not represent an exact phylogenetic order. A few characters indicate a gradation from the primitive to the complex. The pilosity that most closely resembles that of *Procornitermes* is considered the more primitive. The species that show a diminution of bristles on the soldier head are placed after those with abundant bristles, and the species with a mat of short hair are considered more specialized than those without short hair. The angular side lobes of the labrum (figs. 14, 28) indicate a more primitive condition than rounded side lobes. The mandibles of the soldier of *Cornitermes cumulans* (fig. 15A) are considered the more primitive, while the mandibles of *C. pilosus* (fig. 15C) are considered more specialized. Larger size indicates a more primitive condition than small size in most instances. The postclypeus of the imago of *C. cumulans* is thought to be more primitive than that of *C. pugnax* or *C. walkeri*. The combination of these characters indicates a radiation of species rather than a linear phylogenetic order within the genus.

#### ECOLOGICAL DISTRIBUTION

As reconstituted, *Cornitermes* is essentially a tropical forest and savanna genus. The conspicuous exception is the record of *C. cumulans* from Santa Maria, Rio Grande do Sul, Brazil. The recorded distribution (fig. 16) is similar to that of *Syntermes* (Emerson, 1945, p. 434), with a few records south of the border of the tropical forest and savanna, and a notable extension into Panama and Costa Rica in contrast to the strictly South American distribution of *Syntermes*.

*Procornitermes striatus* extends farther south into temperate prairies (fig. 5) than there is any record of *Cornitermes*. Otherwise the two genera overlap in the southern tropical savanna region. Some species of *Corni-*



*termes*, however, are adjusted to rain forest conditions, while those of *Procornitermes* are not.

The northwestern records of *Cornitermes walkeri* (fig. 16) are within the climatic and vegetational zones of the genus but do not follow these zones to the north into Central America. Historical events and biotic barriers may give an explanation. The theory that seems credible is that the primitive genera of Nasutitermitinae with mandibulate soldiers arose in South America in early Cretaceous times. They did not follow their nasute descendants, *Nasutitermes* and genera related to *Subulitermes* into the Old World in the Cretaceous dispersion over the tropical Bering or Aleutian land bridge (Emerson, 1952), possibly because of the relatively poor protection against predatory enemies in comparison to the good protection of the nasute genera. During the long Tertiary isolation of South America, the mandibulate genera speciated in response to geographical and ecological conditions. When the Pliocene connection with Central America was established, a few genera were dispersed as far as Costa Rica but were unable to follow favorable climatic conditions north into Central America, possibly because of the biotic barrier (Allee, *et al.*, 1949, pp. 723, 726) imposed by the long-established community adaptive integration of Central America. Numerous termite genera show a northwestern limit of distribution resembling that of *Cornitermes*. These are *Rugitermes* (also found in the Marquesas and Cook Islands), *Dolichorhinotermes*, *Rhynchotermes*, *Velocitermes* (also found in the West Indies), *Convexitermes*, *Cylindrotermes*, *Neocapritermes*, and *Orthognathotermes*.

While it is postulated that the Costa Rican limit to the dispersion of otherwise essentially South American genera is a biotic barrier originating in the late Pliocene, other genera did not move beyond the Andes of Colombia. This mountain barrier is probably the result of physical ecological conditions and a very narrow coastal highway of dispersal. Genera that are limited to the tropical and subtropical regions east of the Andean barrier are *Rhinotermes* (also in the West Indies), *Syntermes*, *Procornitermes*, *Diversitermes* (south of the Amazonian rain forest), *Constrictotermes*, *Labiatermes*, *Curvi-*

*termes*, *Planicapritermes*, *Spinitermes*, and *Cavitermes*. Certain monotypic genera are also east of the Andes but may never have reached this barrier. These are *Eucryptotermes*, *Glossotermes*, *Acorhinotermes*, *Angularitermes*, *Genuitermes*, *Dentispicotermes*, *Spicotermes*, *Crepititermes*, *Cornicapritermes*, and *Serritermes*. Except for the fact that it includes two species, *Paracornitermes* (south of the Amazonian rain forest) belongs with these monotypic genera.

The genera that may have originated in Central America and could not penetrate far against the biotic barrier of the integrated community in South America were *Tenuirostritermes*, with an undescribed Venezuelan species, *Hoplotermes* (known from a single Mexican species), and *Calcaritermes*, which occurs in northern South America to British Guiana. An undescribed species of *Calcaritermes* from Ilha Grande, Rio de Janeiro, Brazil, may make this hypothesis untenable for this genus. *Gnathamitermes* is a Mexican and southwestern United States genus confined to arid habitats, and it probably never reached the biotic barrier of South America.

Most genera found both in Central America north of Costa Rica and in South America are also found in the Old World. These were presumably dispersed before the early Tertiary isolation of South America. The genera belonging to this category are *Neotermes*, *Procryptotermes*, *Cryptotermes*, *Glyptotermes*, *Coptotermes*, *Heterotermes*, *Nasutitermes*, *Amitermes*, *Anoplotermes*, *Microcerotermes*, and *Termes*. *Subulitermes* (not recorded north of Costa Rica in Central America) and *Speculitermes* (not recorded north of Panama in Central America) are recorded both in South America and in the Old World. A projected revision of the species currently placed in *Subulitermes* will divide this group into numerous related genera.

Other Neotropical genera that do not fit into any of the above categories and require special interpretation not deemed appropriate to the present inquiry are *Porotermes*, *Kalotermes*, *Prorhinotermes*, *Rotunditermes*, *Parvitermes*, *Obtusitermes*, and *Synhamitermes*. The reported South American species of *Synhamitermes* probably does not belong to this genus.

Temperature, humidity, and competition

seem to be the determining factors limiting the ranges of the species of *Cornitermes*. The species found in the region of hot summers (above 68° F.) and mild winters (50°–68° F.) are *C. cumulans*, *C. bequaerti*, *C. villosus*, *C. similis*, *C. silvestrii*, and probably *C. pilosus*. Species found in regions that are always hot (above 68° F.) are *C. pugnax*, *C. acignathus*, *C. walkeri*, *C. weberi*, *C. incisus*, *C. falcatus*, *C. bolivianus*, and *C. ovatus*. *C. snyderi* is found in both of the above climatic regions. All species of *Cornitermes* occur in areas with an annual rainfall of more than 40 inches, and, with the exception of *C. acignathus*, all the species occur within or near the border of the areas with more than 60 inches of rainfall. Species known only from tropical rain forests are *C. walkeri*, *C. pugnax*, *C. weberi*, *C. falcatus*, *C. incisus*, *C. ovatus*, and *C. bolivianus*. *C. acignathus* is associated with vegetation characterized as broad-leaf deciduous low shrub with grass. *C. silvestrii* and *C. similis* occur in tropical savanna with patches of trees. Silvestri (1903) describes the habitat of *C. silvestrii* under the name of *C. cumulans* as dry with little or low aboreal vegetation. *C. bequaerti* and *C. villosus* are associated with semideciduous, broad-leaved trees. *C. bequaerti* is also found in pasture land in an original forested region at Taubaté (personal communication from R. L. Araujo). Probably *C. pilosus* is associated with grass and patches of deciduous shrubs. *C. snyderi* occurs in the last two vegetational types and also possibly in rain forest. *C. cumulans* is found in both savanna and among semideciduous, broad-leaved trees. Silvestri (1903) states that *C. cumulans* (=his *C. similis*) always lives in dry places.

#### NESTS AND BEHAVIOR

The nests of *Cornitermes cumulans* are discussed by Silvestri (1903) under the name of *C. similis*. The mounds are more or less conical, around 2 meters in height and 1 meter in diameter at the base, and are brown in color, with a hard surface. The interior is divided into two parts—the outer portion of earth with small irregular galleries, and the central part black in color with large galleries separated by thin walls. Dry grass and finely divided detritus are stored in the central portion. The colonizing flight is from

August to October and occurs at night. During the winter there is a concentration of workers and soldiers in the portion of the nest exposed to the sun's rays. The natives remove one side and the center of some nests for use as ovens.

The nests of *C. silvestrii* are discussed by Silvestri (1903) under the name of *C. cumulans*. The mounds are common near Coxipó. They are irregularly conical in shape and about 1 meter high and 1 meter in basal diameter. Roundish apertures about 4 to 5 cm. in diameter occur on the upper surface. The interior of the mound is divided into two portions—the outer part from 6 to 10 cm. thick, and a central part with a different texture. The surface lining of the cells is smooth and of a chocolate color. Storage of food was not observed. The colonizing flight takes place in August or a little later.

Weber found *Cornitermes weberi* nesting between the small buttresses of a tree in yellow clay soil which was heaped 15 inches or so above the ground level. Tunnels led down among the roots. When the nest chambers were exposed, the soldiers boiled out. One bit him in the finger tip and drew blood from a cut 1.5 mm. long. The soldiers were very aggressive. The reproductive nymphs were very active and elusive (from field notes by N. A. Weber, No. 616, 30.VII.1936).

*Cornitermes pugnax* is a fairly common species in the rain forest of Kartabo, British Guiana, where it was studied by the author. It is commonly found in soft or hard logs, bamboo clumps (introduced), and standing dead trees or stumps. One nest was under an old stump of very hard wood that had to be uprooted in order to reach the center of the nest. Workers and soldiers were often found under the ties of an abandoned railroad. The largest colony observed was in a small mound that was evidently built around a small stump that had been almost entirely eaten. The mound was soft on the outside and was constructed of a gray moist earth. The inside around the royal cell was very hard and dry. The eggs and nymphs were mainly confined to the softer parts of the nest around the hard center. Alates were found in nests at Kamakusa, British Guiana, by Herbert Lang on October 25,



- Top of head covered with a thick mat of short hair . . . . . 8
2. Top of head with bristles . . . . . 3  
Top of head without bristles or hair; under side, postmentum, and area around bases of antennae with bristles and contrasting short hair (fig. 27) . . . . .
3. Apical inside cutting edge of the right mandible distinctly sinuous; general angle of notch much less than a right angle (40°–60°) . . . . . 4  
Apical inside cutting edge of the right mandible not distinctly sinuous (fig. 15F); general angle of notch close to a right angle (about 80°) . . . . . *C. pugnax* Emerson
4. Lateral angles of labrum obtuse but distinct . . . . . 5  
Lateral angles of labrum curved or with rounded indistinct angles . . . . . 6
5. Width of head 1.50–1.85 mm., labrum with somewhat blunt lateral angles (fig. 24) . . . . .  
Width of head 1.85–2.62 mm.; labrum with distinctly pointed lateral angles (fig. 14A) . . . . . *C. cumulans* (Kollar)
6. Width of head 1.40–1.46 mm. (fig. 25) . . . . .  
Width of head 1.78–2.12 mm. . . . . *C. silvestrii* Emerson  
Width of head more than 2.60 mm. . . . . 7
7. Apical portion of mandible proportionately long (fig. 15D); length of right mandible from notch to tip 0.85–0.91 mm. . . . .  
Apical portion of mandible proportionately short (fig. 15E); length of right mandible from notch to tip 0.75–0.83 mm. . . . . *C. acignathus* Silvestri
8. Lateral angles of labrum distinctly and fairly sharply pointed, angles close to, or a little greater than, a right angle (fig. 28) . . . . .  
Lateral angles of labrum without very distinct points, rounded or roundly angular, angles much greater than a right angle (fig. 14) . . . . . 9
9. Head width over 2.85 mm. . . . . 10  
Head width under 2.85 mm. . . . . 11
10. Angle of notch of right mandible about 60°–70° (fig. 29) . . . . . *C. incisus*, new species  
Angle of notch of right mandible about 90° (fig. 31) . . . . . *C. ovatus*, new species
11. Front margin of pronotum distinctly emarginate . . . . . 12  
Front margin of pronotum not or very weakly emarginate (fig. 32) . . . . .  
Front margin of pronotum not or very weakly emarginate (fig. 32) . . . . . *C. bequaerti*, new species
12. Angle of notch of right mandible (fig. 15C) close to a right angle (75°–90°); width of

head 2.00–2.20 mm. . . . . *C. pilosus* Holmgren  
Angle of notch of right mandible distinctly less than a right angle (about 50°); width of head 2.29–2.71 mm. (fig. 30) . . . . .  
head 2.00–2.20 mm. . . . . *C. villosus*, new species

#### *Cornitermes cumulans* (Kollar)

Figure without name, PERTY, 1830, pl. 25, fig. 14 (soldier).

*Termes cumulans* KOLLAR, 1832, p. 13 (imago), p. 111 (imago), fig. 9 (imago).

? *Termes americanus* RENGGER, 1835, pp. 266–274. Placed in synonymy with *T. cumulans* by HAGEN, 1858a, p. 165; placed in synonymy with *T. similis* by SILVESTRI, 1903, p. 53.

*Termes dubius* RAMBUR, 1842, p. 309 (soldier).  
*Termes cumulans* HAGEN, 1858a, p. 165 (imago, soldier), pl. 2, fig. 11 (wing), pl. 3, fig. 20 (imago), Ypanema specimens only.

*Termes cumulans* HAGEN, 1858b, p. 23 (imago).  
*Termes Christersonii* SÖRENSEN, 1884, pp. 3, 20 (imago, soldier, worker), pl. 1, figs. 1–12 (imago, soldier).

*Termes (Cornitermes) cumulans* WASMANN, 1897, p. 150 (synonymy).

*Cornitermes similis* SILVESTRI, 1901, p. 4.

*Cornitermes similis* SILVESTRI, 1903, p. 53 (imago, soldier, worker), p. 117 (biology), text fig. 11 (wing), text figs. 37–39 (nest), pl. 2, figs. 89–91 (imago), figs. 92–93 (soldier), pl. 3, fig. 94 (soldier).

*Cornitermes (C.) similis* HOLMGREN, 1912, p. 51, text fig. 25 (soldier), pl. 2, fig. 9 (imago).

*Termes cumulans* DESNEUX, 1915, p. 9.

? *Cornitermes similis* STRELNİKOV, 1920, p. 217 (biology).

? *Cornitermes similis* JOHN, 1920, p. 227 (localities).

*Cornitermes cumulans* WHEELER, 1936, p. 210 (biology).

*Cornitermes cumulans* SNYDER, 1949, p. 262 (synonymy).

*Cornitermes cumulans* AHMAD, 1950, p. 82 (systematics), text fig. 9 (imago mandibles).

IMAGO (FIGS. 13, 17, 18): Head light to dark brown, lighter around the base of the antenna; fontanelle light; postclypeus yellowish; margin of the pronotum the same color as the head, center lighter; tibia and femur yellowish; wing hyaline except for the yellow-brown costal border and radius; tergites same color as the pronotum; sternites light brown at sides and yellowish in the center. Head with a number of bristles and a few short hairs, particularly in front of the eyes; tergites with numerous bristles. Head broadly oval, line between the ocelli concave.

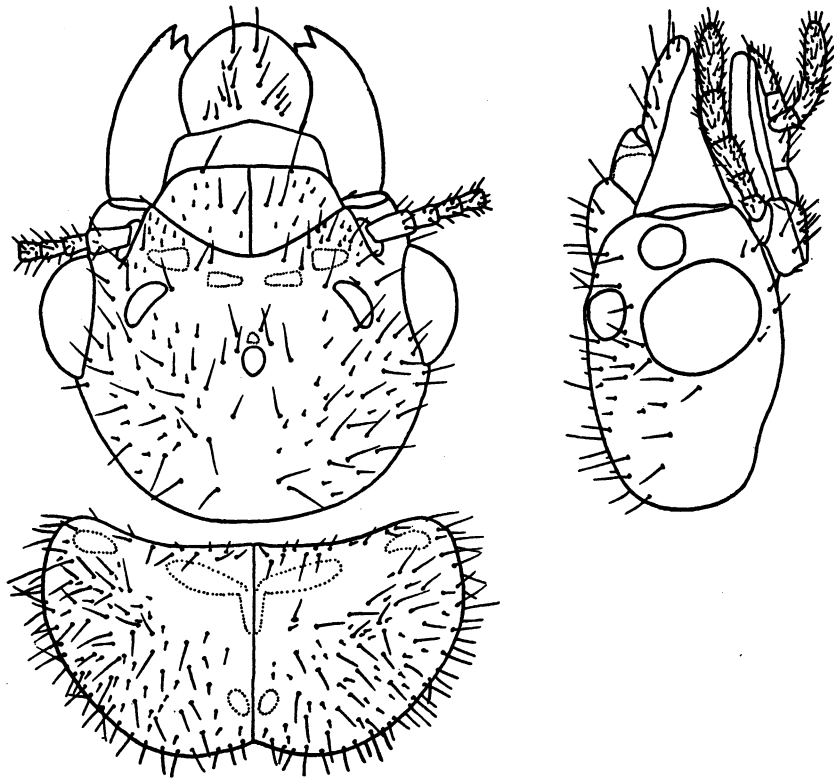


FIG. 17. Dorsal view of head and pronotum and side view of head of imago of *Cornitermes cumulans* (Kollar), Mendes.

Fontanelle smaller than either the antennal base or the ocellus, oval, depressed, in one case not very conspicuous. Eye prominent, about one-fifth to one-tenth of its diameter from the lower margin. Ocellus large and prominent, nearly vertical in position, slightly more than its width to less than half of its width from the eye, about the same size or a little larger than the antennal socket. Postclypeus about twice as wide as long. Antenna with 15 to 16 articles, the third about equal to, or a little longer than, the second, the second about equal to the fourth. Pronotum with a broadly concave front margin, sides rounded and converging towards the rear, hind margin distinctly emarginate, a pear-shaped depression on each side near the anterior angles. Mesonotum and metanotum emarginate with an angle of about 135 degrees.

COMPARISONS: *Cornitermes snyderi* is smaller, and less of the ocellus shows from above (fig. 23). *C. similis* is very close, the only difference of significance being the

large, plate-like fontanelle in *C. similis* (0.39–0.63 mm. long, 0.32–0.51 mm. wide). As the fontanelle may vary considerably in certain species (*Syntermes molestus*, Emerson, 1945, pp. 467, 468), it seems quite possible that *C. similis* is conspecific with *C. cumulans*.

SOLDIER (FIGS. 3, 19–22): Head yellowish, the pronotum a little lighter than the head; tergites a little lighter than the pronotum; intestinal contents often producing a dirt color. Head sparsely covered with bristles and numerous fairly long hairs about half of the length of the bristles not, however, forming a contrasting mat of short hair; postmentum with many short hairs and a few anterior bristles; pronotum with numerous bristles and front margin with short hair; tergites with bristles; sternites with bristles and hairs. Head somewhat variable in shape and size, rectangular or subrectangular, with somewhat curved sides that are either nearly parallel or converge slightly towards the front, posterior angles and margin rounded;

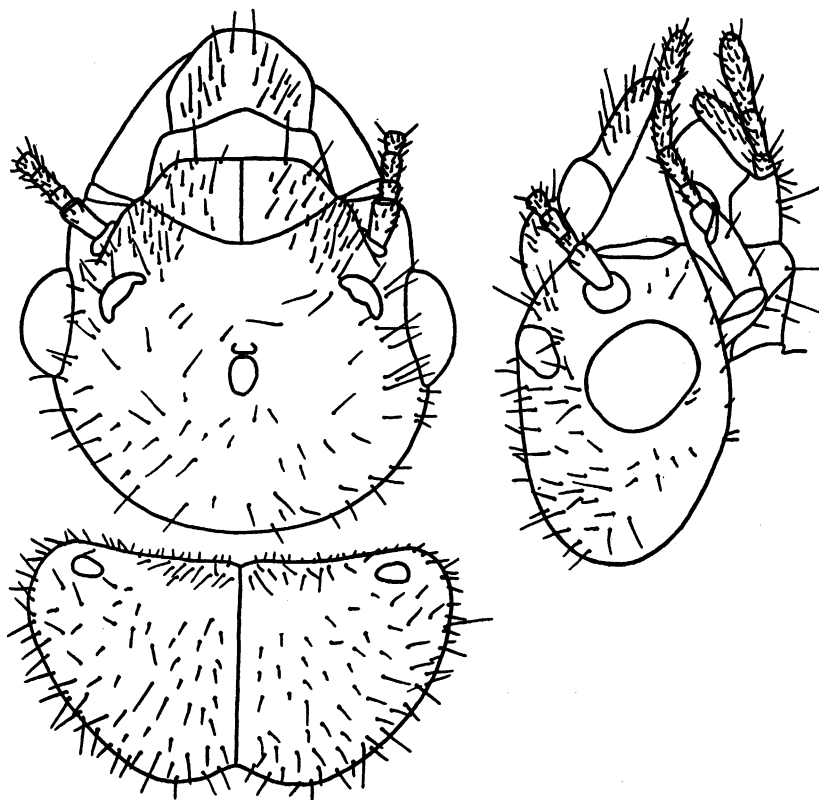


FIG. 18. Dorsal view of head and pronotum and side view of head of imago of *Cornitermes cumulans* (Kollar), Posadas.

TABLE 10  
MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Cornitermes cumulans* (KOLLAR)

	No.	Male Range	Mean	No.	Female Range	Mean
Length with wings	1	25.25	25.25	7	24.18-29.81	26.62
Length of head to tip of labrum	15	2.00- 2.33	2.20	20	2.29- 2.79	2.53
Length of head to side base of mandibles	15	1.41- 1.76	1.53	20	1.65- 2.06	1.82
Width of head	21	1.94- 2.29	2.14	24	2.23- 2.47	2.35
Diameter of eye	17	0.61- 0.73	0.65	25	0.62- 0.73	0.66
Eye from lower margin	19	0.05- 0.14	0.08	22	0.09- 0.18	0.12
Length of ocellus	21	0.26- 0.33	0.30	25	0.26- 0.37	0.32
Width of ocellus	19	0.18- 0.24	0.21	22	0.18- 0.24	0.22
Ocellus from eye	17	0.09- 0.23	0.17	25	0.14- 0.26	0.22
Ocellus from fontanelle	15	0.47- 0.58	0.53	21	0.49- 0.63	0.56
Length of fontanelle	19	0.09- 0.23	0.16	21	0.14- 0.31	0.19
Width of fontanelle	19	0.04- 0.17	0.11	21	0.09- 0.20	0.14
Length of pronotum	20	0.88- 1.09	0.99	26	0.90- 1.15	1.05
Width of pronotum	20	1.88- 2.16	1.98	26	1.97- 2.35	2.12
Length of hind tibia	15	2.29- 2.56	2.41	22	2.41- 2.88	2.55
Length of anterior wing from su- ture	10	19.74-23.12	21.45	19	20.77-25.57	23.98
Width of anterior wing	13	5.73- 6.39	6.01	22	5.61- 6.87	6.29



TABLE 11

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes cumulans* (KOLLAR)

	No.	Range	Mean
Length of head with mandibles	83	3.29-4.31	3.82
Length of head to tip of frontal tube	81	2.12-3.00	2.49
Length of head to side base of mandibles	77	2.35-3.29	2.68
Width of head	95	1.85-2.62	2.14
Thickness of head	78	1.37-1.88	1.59
Length of frontal tube	76	0.29-0.53	0.42
Width of labrum	80	0.62-0.85	0.73
Length of left mandible	94	1.23-1.63	1.44
Length of right mandible from notch	74	0.61-0.87	0.76
Length of pronotum	86	0.58-0.82	0.68
Width of pronotum	91	0.96-1.40	1.12
Length of hind tibia	84	1.57-2.18	1.87

frontal tube proportionately fairly large, upturned, overlapping the base of the postclypeus from above. Narrowest portion of the postmentum about four-sevenths to seven-tenths of the width of the widest portion. Antenna with 15 to 16 articles. Labrum with distinct side angles greater than a right angle (fig. 14A). Mandibles as in figure 15A. Front margin of the pronotum not emarginate or with a shallow emargination.

COMPARISONS: Colonies often show a dif-

ference in the mean measurements of the soldiers that may be environmental or genetic. It is also possible that geographical trends in size and slight proportional differences may be detected with further collecting which may warrant the recognition of subspecies. For example, the few soldiers examined from Argentina, Rio Grande do Sul, and Paraguay are larger than the average size of the soldiers from more northern localities, although the smallest southern

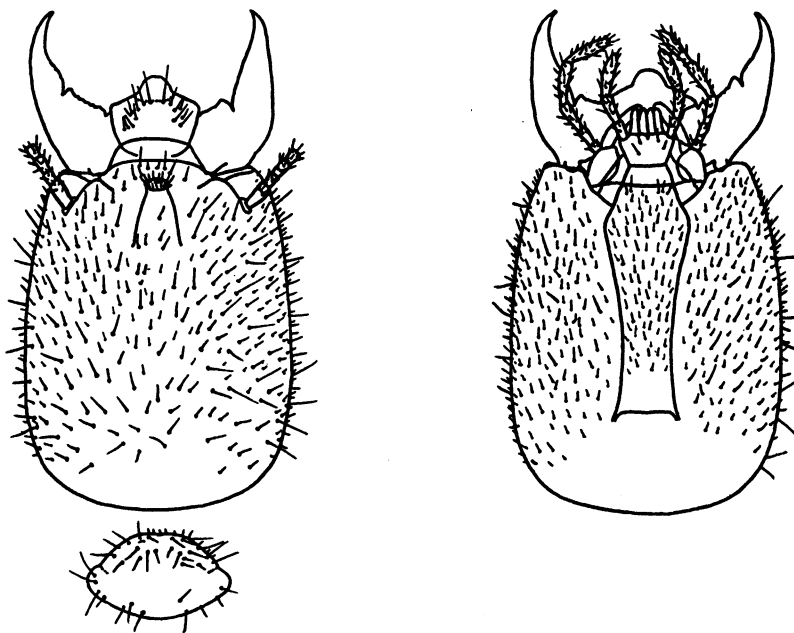


FIG. 19. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes cumulans* (Kollar), Mendes.

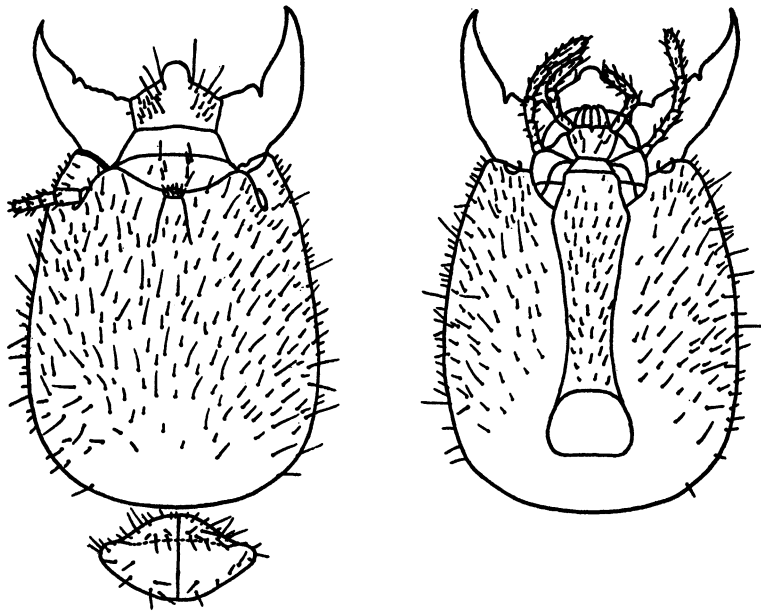


FIG. 20. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes cumulans* (Kollar), Urucum de Corumbá.

forms are smaller than the largest northern forms. At the present time, these differences do not seem to demand taxonomic distinction.

*Cornitermes silvestrii* soldiers (fig. 25) have rounder sides of the labrum and more parallel sides of the postmentum. *C. snyderi* soldiers (fig. 24) have proportionately deeper

notches in both mandibles and straighter sides of the postmentum behind the widest portion.

DISTRIBUTION (FIG. 16): Ipanema (23°48' S., 47°36' W.), São Paulo, Brazil (type locality), imago (probably a cotype), coll. Natterer, det. H. Hagen as *Termes cumulans*, from Vienna Museum.

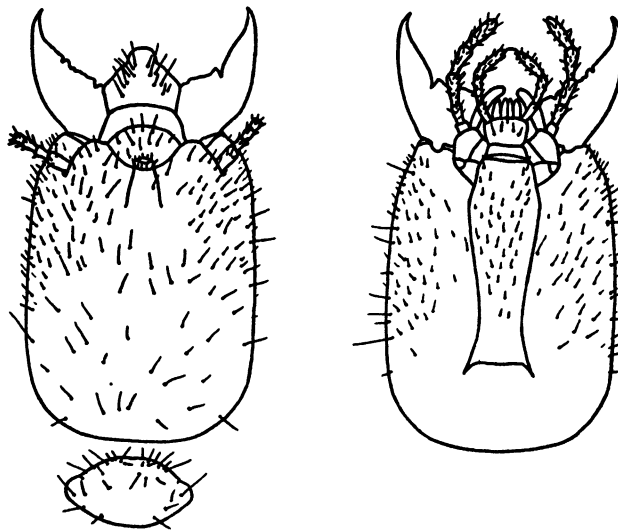


FIG. 21. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes cumulans* (Kollar), Araçatuba.

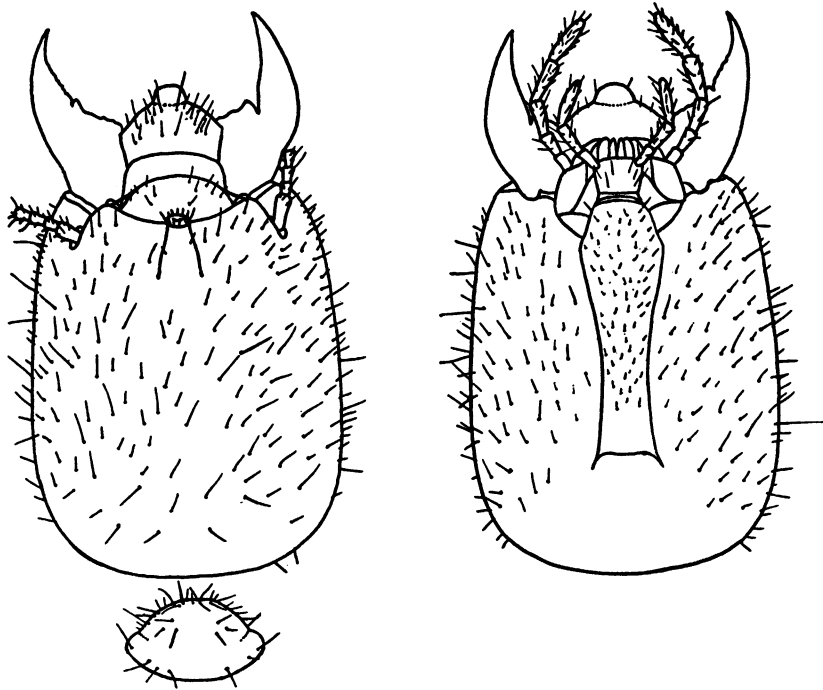


FIG. 22. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes cumulans* (Kollar), Posadas.

Santo Amaro (23°39' S., 46°43' W.), São Paulo, Brazil, queen, soldiers, workers, coll. Melzer, 29.VII.1923, from Deutsches Ent. Mus.; soldiers, workers, coll. R. L. Araujo, 6.I.1945, No. 2708.

Leme (22°12' S., 47°22' W.), Taquarí, São Paulo, Brazil, soldiers, workers, coll. R. L. Araujo and D. Braz, 14.IX.1944, No. 2428, "semi-subterranean mound-like nest with a soft central part"; imagoes, soldiers, workers, coll. R. L. Araujo and D. Braz, 13.IX.1944, No. 2430; soldiers, workers, coll. R. L. Araujo and D. Braz, 15.V.1945, No. 2865, "clay nest on stub of old fence"; soldier, worker, coll. R. L. Araujo and D. Braz, 15.V.1945, No. 2866, "hard clay nest"; queen, soldiers, workers, coll. R. L. Araujo and D. Braz, 16.V.1945, No. 2871, "hard clay nest"; imagoes, soldiers, workers, coll. R. L. Araujo and D. Braz, 16.V.1945, No. 2877, "hard clay nest."

São Paulo (23°33' S., 46°38' W.), São Paulo, Brazil, soldiers, workers, coll. R. L. Araujo, 7.VIII.1944, No. 2305, "most of nest underground with soft central part and hard thick earthen envelope"; soldiers, workers, coll. R. L. Araujo, 7.VIII.1944, No. 2306, with termitophiles, "nest like that of No. 2305"; soldiers, workers, coll. R. L. Araujo, 7.VIII.1944, No. 2307, "nest like that of No. 2305"; soldiers, workers, nymphs, coll. R. L. Araujo, 9.VIII.1944, No. 2315, with termitophiles, "nest like that of No. 2305"; soldiers, workers, nymphs, coll. R. L. Araujo, 9.VIII.1944, No.

2316, "nest like that of No. 2305"; imagoes, soldiers, workers, nymphs, coll. R. L. Araujo, 8.VIII.1944, No. 2326; imagoes, soldiers, workers, coll. R. L. Araujo, 30.VIII.1944, No. 2380; soldiers, workers, nymphs, coll. R. L. Araujo, 8.VIII.1944, No. 2687; soldiers, workers, coll. R. L. Araujo, 9.VIII.1944, No. 2688; soldiers, workers, coll. R. L. Araujo, 9.VIII.1944, No. 2689; soldiers, workers, nymphs, coll. R. L. Araujo, 15.III.1945, No. 2846, with termitophiles; soldiers, workers, nymphs, coll. R. L. Araujo, 15.III.1945, No. 2847, with termitophiles; soldiers, workers, coll. R. L. Araujo, VII.1946, No. 2994, with termitophiles, "clay nest in *Atta* nest"; imagoes, soldiers, workers, nymphs, coll. H. L. Parker, No. 510A.

Jarinú (23°07' S., 46°44' W.), São Paulo, Brazil, soldiers, workers, nymphs, coll. V. Autuori, 23.II.1945, Araujo Coll. No. 2831; soldiers, workers, coll. V. Autuori, 26.II.1945, Araujo Coll. No. 2835; soldiers, workers, nymphs, coll. V. Autuori, 3.III.1945, Araujo Coll. No. 2841; soldiers, workers, coll. V. Autuori, 3.III.1945, Araujo Coll. No. 2842.

Campinas (22°53' S., 47°05' W.), São Paulo, Brazil, soldiers, workers, coll. R. L. Araujo, 17.I.1945, No. 2715; soldiers, workers, coll. R. L. Araujo, 26.VI.1945, No. 2878.

Tatuí (23°21' S., 47°51' W.), São Paulo, Brazil, soldiers, workers, coll. R. L. Araujo, 5.II.1945, No. 2797, under cattle dung.

Atibáia (23°06' S., 46°33' W.), São Paulo, Brazil, soldiers, workers, coll. R. L. Araujo, 19.III.1946, No. 2936, with termitophile, "clay nest."

Piracaia (23°03' S., 46°21' W.), São Paulo, Brazil, soldiers, workers, coll. D. Braz, Araujo Coll. No. 2517, "attacking corn and rice."

Araçatuba (21°04' S., 50°31' W.), São Paulo, Brazil, soldiers, workers, coll. K. P. Schmidt, 19.VII.1926.

Novo Horizonte (21°28' S., 49°13' W.), São Paulo, Brazil, soldiers, workers, coll. R. L. Araujo, 22-24.XI.1944, No. 2657.

Guaraní (21°26' S., 48°06' W.), São Paulo, Brazil, soldier, coll. A. da Costa Lima; imagoes, 23.X.1945, A. da Costa Lima Coll. No. 9693, with soldiers of *C. bequaerti*.

São Sebastião do Paraíso (20°54' S., 46°59' W.), Minas Gerais, Brazil, soldiers, workers, coll. R. L. Araujo, 22.II.1945, No. 2818, "under and inside rotten wood."

Passa Quatro (16°53'-17°11' S., 48°36'-48°44' W.), Sul de Minas, Minas Gerais, Brazil, soldier, worker, Qu 12, 15, Seevers Coll. No. R-31; soldier, worker, No. 18, Seevers Coll. No. R-35; soldiers, workers, Seevers Coll. No. R-42.

Mendes (22°32' S., 43°43' W.), Rio de Janeiro, Brazil, imagoes, soldiers, workers, nymphs, coll. H. A. Eidmann, 21.IX.1933, No. 7, "large solid cement nest in grassland."

San José dos Campos (21°43' S., 41°49' W.), Rio de Janeiro, Brazil, soldiers, coll. d'Azevedo Sampaio, 1898, det. J. Desneux as *Termes similis*.

Rio de Janeiro (23°18' S., 43°18' W.), Rio de Janeiro, Brazil, soldier, worker, det. N. Holmgren as *C. similis*.

Piraputanga (20°25' S., 55°28' W.), Mato Grosso, Brazil, soldiers, workers, nymphs, coll. K. P. Schmidt, 22.VII.1926.

Urucum de Corumbá (19°00' S., 57°43' W.), Mato Grosso, Brazil, soldiers, workers, nymphs, coll. K. P. Schmidt, 14.VIII.1926, "under log."

Santa Maria (29°40' S., 53°50' W.), Rio Grande do Sul, Brazil, soldier, workers, coll. T. White, M.C.Z.

Paraguay, imagoes, Light Coll. No. S.A.180, labeled "*Cornitermes similis*," A.M.N.H.

San Bernardino (25°19' S., 57°16' W.), Paraguay, imagoes, coll. K. Fiebrig.

Puerto Max (22°37' S., 57°50' W.), northern Paraguay, soldier, det. N. Holmgren as *C. similis*.

Villarica (25°55' S., 56°27' W.), Paraguay, soldiers, workers, IX.1927, from G. C. Crampton Coll.

Posadas (27°25' S., 55°52' W.), Argentina, imagoes, soldiers, workers, coll. F. Silvestri, VI-VII.1900, det. F. Silvestri (1903, p. 53) as *C. similis*.

Cierva Petiso (not located on map), Chaco,

Argentina, imago, soldiers, workers, coll. J. A. Vellard, 18.XI.1945.

The following records from the literature probably belong to this species, although the author has not examined the specimens: Coxipó (15°30' S., 56°00' W.), Cuiabá, Mato Grosso, Brazil; Pirapitanga (20°25' S., 55°28' W.), Mato Grosso, Brazil; São Domingos (19°15' S., 57°25' W.), Mato Grosso, Brazil; Paraguari (25°33' S., 57°09' W.), Paraguay; Tacuru Pucu (25°27' S., 54°42' W.), Paraguay; Santa Ana (27°20' S., 55°35' W.), Misiones, Argentina; Gran Chaco, Argentina.

#### *Cornitermes similis* (Hagen)

*Termes similis* HAGEN, 1858a, p. 167 (imago only), pl. 3, fig. 21 (imago).

*Termes similis* HAGEN, 1858b, p. 23 (imago).

*Termes (Cornitermes) similis* WASMANN, 1897, p. 150 (taxonomy).

IMAGO: Head brown, fontanelle yellowish; margins of pronotum as dark as the head; tibia and femur yellowish; wing membrane hyaline, costa and radius yellow-brown; sternites lighter in the middle than on the sides. Fontanelle forming a large plate raised above the surface of the head, con-

TABLE 12

MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Cornitermes similis* (HAGEN)

	Berlin Mus. Specimen	M.C.Z. Type
Length of head to tip of labrum	—	2.59
Length of head to side base of mandibles	—	1.76
Width of head	—	2.33
Diameter of eye	0.69	0.70
Eye from lower margin	—	0.10
Length of ocellus	0.29	0.35
Width of ocellus	0.19	0.21
Ocellus from eye	0.19	0.20
Ocellus from fontanelle	0.46	0.35
Length of fontanelle	0.39	0.63
Width of fontanelle	0.32	0.51
Length of pronotum	1.00	1.01
Width of pronotum	ca. 1.82	2.03
Length of hind tibia	—	2.59
Length of anterior wing from suture	ca. 21.18	24.25
Width of anterior wing	ca. 5.63	ca. 6.58

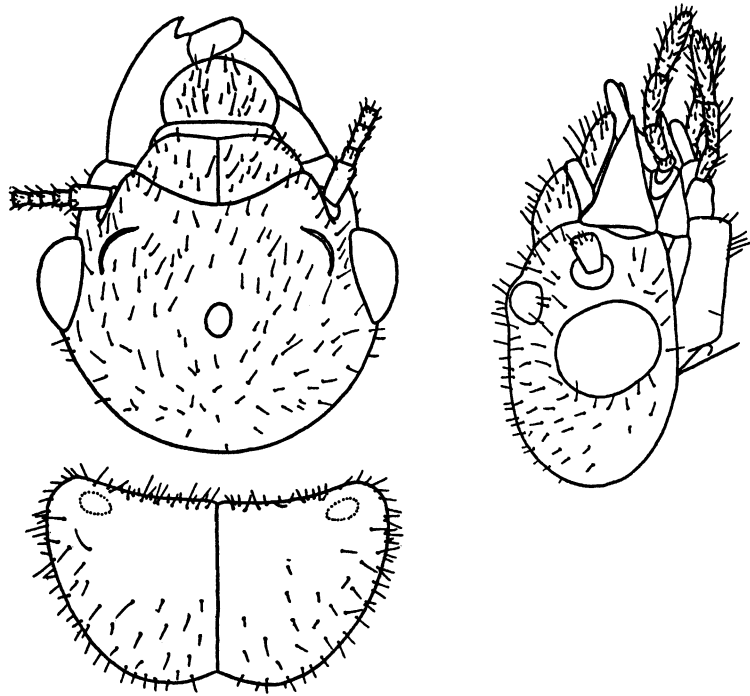


FIG. 23. Dorsal view of head and pronotum and side view of head of imago of *Cornitermes snyderi*, new species, paratype from type colony.

spicuously larger than the ocellus. [It is possible that the fontanelle may vary considerably in the same species, for example, in *Syntermes molestus* (Burmeister), Emerson, 1945, pp. 467, 468.] Eye of medium size, about two-sevenths of its long diameter from the lower margin of the head. Ocellus rather large, about its width from the eye, the upper margin of the ocellus projecting and the lower margin depressed so that the general angle of front curvature is fairly vertical (curvature at bottom of eye is vertical). Antenna with 15 articles. Length of postclypeus about half of its width (0.47:0.97 mm.). Hind margin of pronotum emarginate, with a widely concave edge, angles rounded. Inner edge of fore tibia with a comb-like series of spines similar to those of *C. cumulans*. Tibial spurs 2:2:2.  $R_{2+3}$  absent.

COMPARISONS: The two imagoes determined by Hagen in the Berlin museum and in the Museum of Comparative Zoölogy are so close to *C. cumulans* (figs. 17, 18) in every respect, except for the large fontanelle plate, that it seems quite probable that *C. similis* belongs in synonymy with *C. cumulans*. As already pointed out, the fontanelle sometimes

varies considerably within the same species, and the Berlin specimen has a much smaller fontanelle than the specimen in the Museum of Comparative Zoölogy. However, until sufficient material is studied to bridge the gap between the descriptions of these two species, it seems best to keep them separated.

The eye of *C. bolivianus* is smaller. The eye of *C. walkeri* is larger. The wing membrane of *C. pugnax* is smoky brown. *C. snyderi* is in general smaller, and the ocellus is more vertical in position (fig. 23).

DISTRIBUTION (FIG. 16): Congonhas (20°55' S., 45°42' W.), Minas Gerais, Brazil (type locality), imago (type), det. H. Hagen (1858a, p. 167, pl. 3, fig. 21), M.C.Z. Type No. 420; imago, det. H. Hagen, Museum für Naturkunde, Berlin, No. 2767.

A specimen from Lagôa Santa (19° 41' S., 43°57' W.), Minas Gerais, Brazil, is recorded by Hagen (1858a) and probably is in the Hall Museum. Although this locality is mentioned first by Hagen, it seems best to make Congonhas the type locality because the specimens on which the new description is based are both from Congonhas.

TABLE 13  
MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Cornitermes snyderi*, NEW SPECIES

	No.	Male Range	Mean	No.	Female Range	Mean
Length of head to tip of labrum	10	1.82- 2.13	1.97	10	1.92- 2.41	2.15
Length of head to side base of mandibles	10	1.41- 1.62	1.49	10	1.39- 1.62	1.52
Width of head	9	1.82- 1.94	1.89	10	1.82- 2.06	1.91
Diameter of eye	10	0.58- 0.63	0.60	10	0.58- 0.65	0.59
Eye from lower margin	10	0.08- 0.11	0.09	10	0.09- 0.12	0.10
Length of ocellus	10	0.22- 0.30	0.27	10	0.21- 0.28	0.25
Width of ocellus	10	0.14- 0.22	0.19	10	0.15- 0.22	0.20
Ocellus from eye	10	0.09- 0.17	0.14	10	0.12- 0.21	0.16
Ocellus from fontanelle	10	0.47- 0.53	0.51	10	0.47- 0.56	0.53
Length of fontanelle	10	0.15- 0.22	0.18	10	0.17- 0.24	0.20
Width of fontanelle	10	0.12- 0.18	0.16	10	0.15- 0.21	0.19
Length of pronotum	10	0.82- 0.89	0.87	10	0.84- 0.97	0.88
Width of pronotum	10	1.65- 1.85	1.78	10	1.68- 1.91	1.77
Length of hind tibia	9	1.94- 2.21	2.09	9	2.09- 2.29	2.17
Length of anterior wing from suture	11	14.38-18.05	16.50	6	16.45-18.42	17.04
Width of anterior wing	11	4.76- 5.23	4.94	6	4.70- 5.01	4.86

Another dealate imago from "Para" in the Berlin museum probably does not belong to this species. All other locality records in the literature either belong to other species or need verification.

REMARKS: Because of the spines on the inner edge of the fore tibia, the imago described by Hagen belongs to *Cornitermes*, while the soldier (Hagen, 1858a, p. 167, pl. 1, fig. 5) belongs to a different genus and species described under the name of *Procornitermes araujo*, new species (fig. 8). The species referred to as *Termes similis* by Müller (1870, p. 206) needs redetermination. Likewise, the species referred to as *Cornitermes similis* by Reichensperger (1936, p. 230) from Rio Negro, Paraná, Brazil, and by Wheeler (1936, pp. 210, 232) from southern Brazil need verification.

***Cornitermes snyderi*, new species<sup>1</sup>**

*Cornitermes* (*Cornitermes*) *cumulans* SNYDER, 1926a, p. 19 (locality).

<sup>1</sup> This species is named in honor of Dr. T. E. Snyder of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, whose taxonomic, ecological, and economic studies of termites of the New World and of the Orient have contributed enormously to our knowledge of these insects and their control.

*Cornitermes snyderi* EMERSON in Snyder, 1949, p. 263 (synonymy).

IMAGO (FIG. 23): Head light reddish brown, fontanelle plate yellowish; labrum light yellow; postclypeus yellowish; pronotum lighter than the head, about the same color as the labrum; tibia and femur same color; wing membrane hyaline, costal margin and radius brown or yellow. Head sparsely or abundantly clothed with moderately long bristles; pronotum with bristles and a few short hairs; tergites with marginal bristles and some short hairs on the disc. Head broadly oval. Fontanelle plate oval or round, fairly large, not so long as the ocellus, surface convex but not raised much above the level of the surrounding head. Eye fairly large, about one-sixth to one-seventh of its diameter from the lower margin. Ocellus rather broadly oval, less than its width from the eye, upper margin raised above the general level of the head and under margin depressed so that the general angle of the surface of the ocellus is vertical and little of the white ocellus shows from above. Antenna with 15 or 16 articles. Postclypeus about as long as half its width. Anterior margin of the pronotum broadly concave, angles rounded, sides curved and converging towards the rear, hind margin

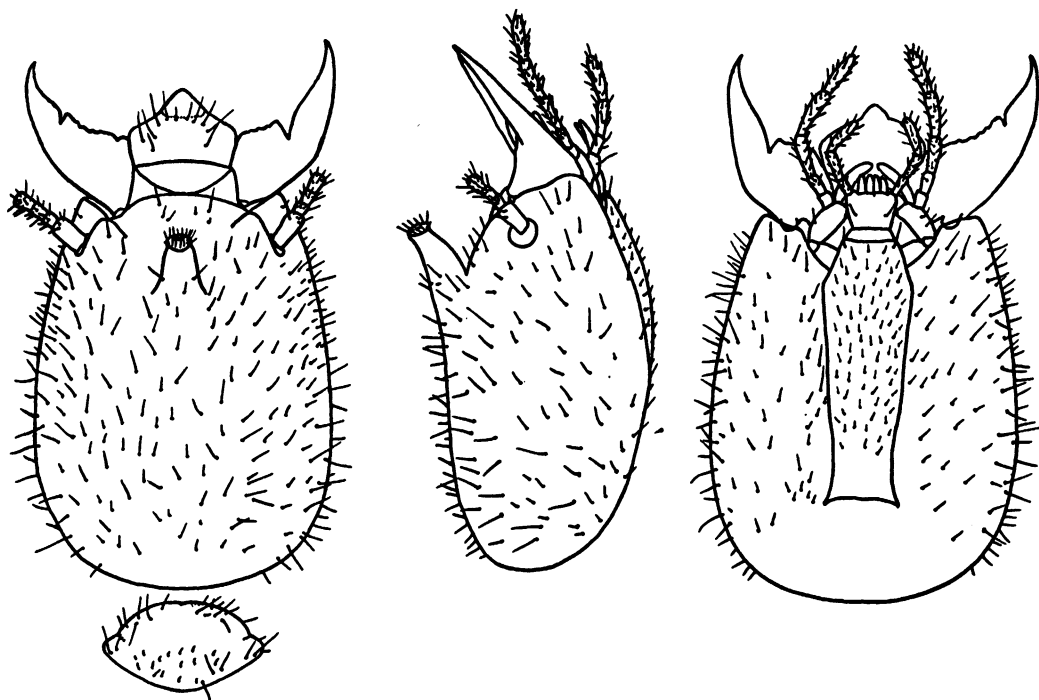


FIG. 24. Dorsal view of head and pronotum, side view of head, and ventral view of head of soldier of *Cornitermes snyderi*, new species, paratype from type colony.

distinctly emarginate in the middle, a distinct oval depression near the anterior side angle.

COMPARISONS: *Cornitermes snyderi* differs from other described imagoes in the genus in the vertical position of the ocellus and the small white portion of the ocellus visible from above.

SOLDIER (FIG. 24): Head dark yellow; labrum with a tinge of pale brown; pronotum yellow; legs light yellow; abdomen yellowish. Head with numerous bristles and some shorter hairs but not forming a mat of contrasting short hair; postmentum with short hair and about two anterior bristles; pronotum with a number of bristles and a few short hairs on the posterior half; tergites with a row of bristles in the middle and another near the posterior margin; sternites with bristles and sparse short hair. Head subrectangular, with somewhat curved sides converging a little towards the front, posterior angles and hind margin rounded. Frontal tube rather large, overlapping the base of the postclypeus. Narrowest portion of the post-

mentum about seven-ninths to seven-tenths of the width of the widest portion (0.35–0.38:0.50 mm.). Antenna with 15 articles. Labrum with lateral angles distinct but somewhat rounded, each greater than a right angle, margins between the lateral angles and the base of the median white tip slightly concave or nearly straight. Mandibles as in figure 24. Front margin of the pronotum distinctly or indistinctly emarginate.

COMPARISONS: *Cornitermes cumulans* has somewhat more angular sides of the labrum (fig. 14A) and the postmentum is proportionately narrower in the middle (figs. 19–22). *C. silvestrii* has less angular sides of the labrum, sides of head more straight and parallel, and the sides of the postmentum more parallel (fig. 25). *C. bolivianus* has evenly rounded lateral margins of the labrum with no angles (fig. 14F), and the length of the right mandible from the angle of the notch to the tip is 0.67–0.76 mm.

DISTRIBUTION (FIG. 16): Rosario (13°58' S., 66°52' W.), Bolivia (type locality), imagoes (morphotype and paratypes), queen (paratype),



TABLE 14  
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes snyderi*, NEW SPECIES

	No.	Range	Mean
Length of head with mandibles	25	2.74-3.47	2.98
Length of head to tip of frontal tube	25	1.88-2.29	2.00
Length of head to side base of mandibles	25	1.91-2.59	2.18
Width of head	25	1.50-1.85	1.64
Thickness of head	25	1.15-1.47	1.26
Length of frontal tube	25	0.34-0.41	0.37
Width of labrum	25	0.51-0.63	0.56
Length of left mandible	25	1.04-1.17	1.10
Length of right mandible from notch	25	0.56-0.65	0.60
Length of pronotum	25	0.47-0.59	0.52
Width of pronotum	25	0.81-1.00	0.87
Length of hind tibia	18	1.37-1.65	1.47

soldiers (holotype and paratypes), workers, coll. W. M. Mann, XI.1921, No. 3, det. T. E. Snyder (1926a, p. 19) as *C. cumulans*, A.M.N.H., U.S.N.M.; soldiers (paratypes), workers, coll. W. M. Mann, XI.1921, det. T. E. Snyder (1926a, p. 19) as *C. cumulans*, U.S.N.M., A.M.N.H.

Cavinas (12°32' S., 66°54' W.), Bolivia, soldiers (paratypes), workers, coll. W. M. Mann, II.1922, det. T. E. Snyder (1926a, p. 19) as *C. cumulans*, U.S.N.M., A.M.N.H.

Ixiarnas (13°45' S., 68°08' W.), Bolivia, queens (paratypes from three colonies), soldiers (paratypes), workers, coll. W. M. Mann, XII.1921, det. T. E. Snyder (1926a, p. 19) as *C. cumulans*, U.S.N.M., A.M.N.H.

Reyes (14°22' S., 67°13' W.), Bolivia, soldiers (paratypes), workers, coll. W. M. Mann, X.1921, det. T. E. Snyder (1926a, p. 19) as *C. cumulans*, U.S.N.M., A.M.N.H.

Anápolis (16°12' S., 48°46' W.), Goiás, Brazil, queen (paratype), M.C.Z.

Campinas (16°45' S., 49°15' W.), Goiás, Brazil, imago (paratype), soldiers (paratypes), coll. Lopes, I.1936, Borgmeier Coll. No. 66, Esc. Nac. Agr., A.M.N.H.; imagoes (paratypes), soldier (paratype), worker, coll. Schwarzmaier, Borgmeier Coll. No. 2, A.M.N.H.

#### *Cornitermes bolivianus* Snyder

*Cornitermes (Cornitermes) bolivianus* SNYDER, 1926a, p. 17 (imago, soldier), pl. 1, fig. 4 (soldier mandibles).

*Cornitermes bolivianus* SNYDER, 1949, p. 262 (synonymy).

IMAGO: Head and pronotum dark brown, pronotum with light T-shaped marks; clypeus and tergites yellowish brown; sternites

lighter than tergites; wing hyaline except for the yellow-brown costal border and radius; femur and tibia yellow brown. Fontanelle large, white, depressed, about the size of, or a little smaller than, the antennal socket. Eye proportionately large, about one-fourth of its diameter from the lower margin. Ocellus fairly large, its length or a little less than its length from the eye, its face rather vertical but not so much so as in *C. snyderi* which shows less white portion of the ocellus from above. Antenna with 15 articles, the second equal to the third, the fourth a little shorter than the third. Postclypeus twice as wide as long. Pronotum with sides somewhat converging towards the rear; hind margin not emarginate or with only a very weak emargination.

COMPARISONS: *Cornitermes snyderi* has the white portion of the ocellus nearly covered by the head projection from above.

SOLDIER: Head and pronotum yellowish. Head and pronotum with a number of scattered bristles and no short hair; postmentum without hair and with only about two bristles at the anterior end; tergites with bristles; sternites with hair and bristles. Head small, sides curved and converging only slightly towards the front; hind margin evenly curved; head thick in the middle; profile of postmentum curved. Frontal tube proportionately rather large, overlapping the base of the postclypeus from above, level with the head or somewhat upturned. Narrowest portion of the postmentum about

TABLE 15  
MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Cornitermes bolivianus* SNYDER

	No.	Range	Mean
Length of head to tip of labrum	4	1.74- 2.12	1.97
Length of head to side base of mandibles	6	1.29- 1.65	1.51
Width of head	5	1.77- 2.00	1.88
Diameter of eye	7	0.51- 0.59	0.55
Eye from lower margin	6	0.11- 0.15	0.12
Length of ocellus	7	0.18- 0.23	0.20
Width of ocellus	7	0.13- 0.16	0.15
Ocellus from eye	6	0.15- 0.22	0.19
Ocellus from fontanelle	6	0.46- 0.51	0.48
Length of fontanelle	6	0.22- 0.25	0.23
Width of fontanelle	6	0.19- 0.22	0.20
Length of pronotum	4	0.88- 0.94	0.89
Width of pronotum	6	1.56- 1.74	1.65
Length of hind tibia	3	2.29- 2.35	2.32
Length of anterior wing from suture	5	16.36-16.73	16.59
Width of anterior wing	7	3.88- 4.51	4.26

two-thirds of the width of the widest portion, sides fairly straight and parallel in the middle. Antenna with 15 articles. Sides of sclerotized portion of the labrum evenly rounded behind the base of the median white tip (fig. 14F). Mandibles as in figure 15B. Front margin of pronotum distinctly or slightly emarginate.

COMPARISONS: The soldiers from the type colony from Lago Rogagua have a more bulging postmentum in profile, and the frontal tube is not so curved on the under side as in the paratype soldiers from Cachuela

Esperanza. Also the soldiers from Lago Rogagua have a more emarginate front margin of the pronotum and a somewhat longer hind tibia. On the basis of specimens from two colonies only, it is impossible to ascertain the significance of these differences. There is a possibility that these colonies represent different subspecies, but more extensive collecting is necessary before a decision can be made.

*Cornitermes silvestrii* is smaller, and the length of the right mandible from the notch is proportionately shorter.

TABLE 16  
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes bolivianus* SNYDER

	Lago Rogagua			Cachuela Esperanza		
	No.	Range	Mean	No.	Range	Mean
Length of head with mandibles	8	3.17-3.66	3.45	4	3.17-3.41	3.25
Length of head to tip of frontal tube	10	2.06-2.32	2.21	10	2.09-2.29	2.20
Length of head to side base of mandibles	10	2.07-2.59	2.42	10	2.27-2.47	2.35
Width of head	10	1.78-2.12	1.97	10	1.94-2.05	1.98
Thickness of head	10	1.41-1.59	1.52	10	1.35-1.50	1.44
Length of frontal tube	10	0.35-0.41	0.36	10	0.39-0.47	0.42
Width of labrum	10	0.58-0.65	0.61	10	0.54-0.60	0.59
Length of left mandible	10	1.29-1.39	1.34	10	1.26-1.35	1.31
Length of right mandible from notch	8	0.67-0.75	0.72	10	0.71-0.76	0.74
Length of pronotum	8	0.55-0.66	0.61	12	0.58-0.65	0.63
Width of pronotum	10	0.90-1.03	0.97	10	0.94-1.04	0.99
Length of hind tibia	7	1.76-1.94	1.84	12	1.59-1.76	1.69

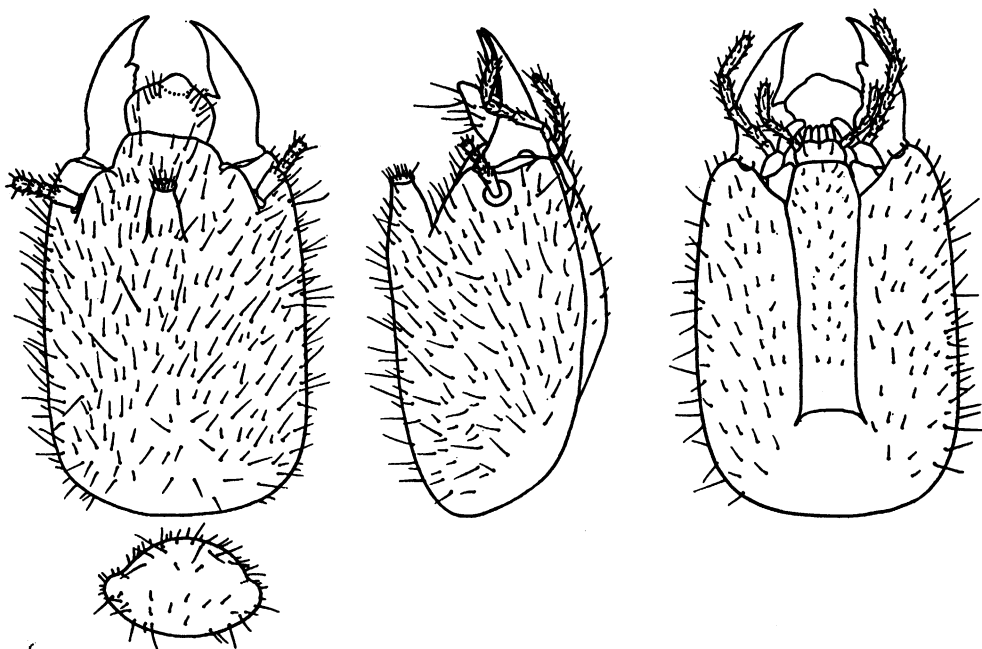


FIG. 25. Dorsal view of head, side view of head, and ventral view of head of soldier of *Cornitermes silvestrii* Emerson, holotype.

DISTRIBUTION (FIG. 16): Lago Rogagua (13°49' S., 66°50' W.), Bolivia, imagoes, soldiers, workers (type colony), coll. M. R. Lopes, XI.1921, Mulford Expedition, U.S.N.M., A.M.N.H.

Cachuela Esperanza (10°33' S., 65°36' W.), Bolivia, soldiers (paratypes), workers, coll. W. M. Mann, III.1922, Mulford Expedition, U.S.N.M., A.M.N.H.

#### *Cornitermes silvestrii* Emerson<sup>1</sup>

*Cornitermes cumulans* SILVESTRI, 1901, p. 4 (locality).

*Cornitermes cumulans* SILVESTRI, 1903, p. 56 (imago, soldier, worker), p. 120 (biology), text figs. 40, 41 (nests), pl. 3, figs. 96-98 (imago, soldier).

*Cornitermes silvestrii* EMERSON in Snyder, 1949, p. 263 (synonymy).

IMAGO: Described by Silvestri, but not available for study by the author.

SOLDIER (FIG. 25): Head, pronotum, and abdomen yellowish. Upper surface of head sparsely covered with numerous long bristles and somewhat shorter hairs, not, however,

with a mat of contrasting short hair; postmentum with numerous short hairs; pronotum with bristles and front margin with short hairs; tergites with bristles; sternites with bristles and hairs. Head subrectangular, with slightly curved, somewhat parallel sides, posterior angles rounded, hind margin curved; frontal tube proportionately fairly large. Postmentum rather wide, with sides nearly parallel, narrowest portion about three-fourths of the width of the widest portion. Antenna with 15 articles. Labrum with rounded sides and white tip projecting slightly. Mandibles as in figure 25, the left mandible with a sharp notch and a small tooth posterior to the notch, with small serrations posterior to the tooth and no conspicuous serrations anterior to the notch; right mandible with a deep notch forming an angle less than a right angle. Front margin of the pronotum not or very faintly emarginate.

COMPARISONS: *Cornitermes snyderi* (fig. 24) with sides of head more curved, sides of labrum more angular, and anterior portion of right mandible longer. *C. cumulans* with sides of labrum distinctly more angular (fig. 14A), and postmentum proportionately narrower in the middle (figs. 19-22).

<sup>1</sup> This species is named in honor of the late Prof. F. Silvestri, director of the Scuola Agraria, Portici, Italy, whose taxonomic, morphological, and ecological studies of the termites of the world have long been models for accuracy and clarity.

TABLE 17

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes silvestrii* EMERSON

	No.	Range	Mean
Length of head with mandibles	2	2.60-2.70	2.65
Length of head to tip of frontal tube	3	1.83-1.94	1.90
Length of head to side base of mandibles	2	2.00-2.07	2.03
Width of head	3	1.40-1.46	1.43
Thickness of head	2	1.09-1.12	1.10
Length of frontal tube	2	0.33-0.36	0.34
Width of labrum	2	0.51-0.53	0.52
Length of left mandible	3	0.96-1.00	0.97
Length of right mandible from notch	2	0.50-0.53	0.51
Length of pronotum	2	0.49-0.50	0.49
Width of pronotum	3	0.76-0.81	0.79
Length of hind tibia	3	1.27-1.41	1.34

DISTRIBUTION (FIG. 16): Coxipó (15°30' S., 56°00' W.), Cuiabá, Mato Grosso, Brazil (type locality), soldiers (holotype and paratypes), workers, coll. F. Silvestri, VIII-IX.1900, det. F. Silvestri (1903, p. 56) as *C. cumulans*, U.S.N.M., A.M.N.H.

***Cornitermes acignathus* Silvestri**

*Cornitermes acignathus* SILVESTRI, 1901, p. 4 (soldier, worker).

*Cornitermes acignathus* SILVESTRI, 1903, p. 55 (soldier, worker), pl. 3, fig. 95 (soldier).

*Termes acignathus* DESNEUX, 1904, p. 35 (synonymy).

*Cornitermes* (*C.*) *acignathus* SNYDER, 1929, pp. 83, 86 (soldier).

*Cornitermes acignathus* SNYDER, 1949, p. 262 (synonymy).

SOLDIER: Head, pronotum, and abdomen

yellowish; pronotum a little paler than head; abdomen with grayish appearance from gut contents. Head sparsely covered with bristles, no short hair visible; postmentum with a few bristles at the anterior end and covered with minute, almost invisible short hair; pronotum with bristles and front margin with short hair; tergites with bristles; sternites with bristles and short hair. Head large and thick, sides somewhat curved and converging towards the front, hind margin rounded. Frontal tube short and conical, not reaching the base of the clypeus. Narrowest portion of the postmentum about two-thirds of width of widest portion. Antenna with 15 articles. Labrum (fig. 14E) with evenly curved sides of the sclerotized portion and a projecting white tip. Mandibles as in figure

TABLE 18

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes acignathus* SILVESTRI

	No.	Range	Mean
Length of head with mandibles	6	4.51-4.85	4.68
Length of head to tip of frontal tube	10	2.80-3.05	2.93
Length of head to side base of mandibles	11	3.23-3.66	3.41
Width of head	32	2.93-3.17	3.04
Thickness of head	9	2.11-2.19	2.16
Length of frontal tube	10	0.37-0.48	0.42
Width of labrum	10	0.79-0.86	0.84
Length of left mandible	11	1.65-1.82	1.74
Length of right mandible from notch	6	0.85-0.91	0.88
Length of pronotum	6	0.79-0.86	0.84
Width of pronotum	11	1.34-1.46	1.40
Length of hind tibia	10	2.38-2.52	2.64

15D. Pronotum with a distinctly emarginate front margin.

COMPARISONS: *Cornitermes walkeri* is smaller; the frontal tube reaches the base of the clypeus, thus giving a different proportion from above; the postmentum is proportionately narrower at the widest portion; and the outer portions of the mandibles are shorter (fig. 15E). *C. pugnax* is smaller, the head is not so thick proportionately, and the right mandible has a notch with a wider angle (fig. 15F).

DISTRIBUTION (FIG. 16): Guayaquil (2°16' S., 79°53' W.), Ecuador (type locality), soldiers (co-types), workers, coll. V. Ortoneda, XI.1899, det. F. Silvestri, Silvestri Coll., Portici, Italy.

Rio Casacay (3°21'–3°27' S., 79°39'–79°43' W.), tributary of Rio Jubones, Ecuador, soldiers, workers, coll. W. von Hagen, 10.V.1935, No. 118.

#### *Cornitermes walkeri* Snyder

*Cornitermes acignathus* BANKS, 1918, p. 662 (imago from Panama only).

*Cornitermes acignathus* DIETZ AND SNYDER, 1923, p. 281 (locality).

*Cornitermes acignathus* SNYDER, 1924, p. 187 (imago).

*Cornitermes* (*Cornitermes*) *acignathus* SNYDER, 1925, p. 162 (locality).

*Cornitermes acignathus* SNYDER, 1926b, p. 28 (locality).

*Cornitermes* (*C.*) *acignathus*, subsp. *walkeri* SNYDER, 1929, pp. 83–86 (soldier), text fig. 1 (soldier mandibles).

*Cornitermes* (*C.*) *acignathus*, subsp. *costaricensis* SNYDER, 1929, pp. 83–86 (soldier), text fig. 2 (soldier mandibles).

*Cornitermes* (*Cornitermes*) *acignathus* HARE, 1937, p. 468 (soldier, worker), fig. 29 (worker and soldier mandibles).

*Cornitermes* (*C.*) *acignathus walkeri* PARK, 1946, p. 449 (termiticolous pselaphid).

*Cornitermes walkeri* SNYDER, 1949, p. 263 (synonymy).

IMAGO: Head dark brown; postclypeus a little lighter than the head; pronotum in part as dark as the head, in Y-shaped central part lighter than the postclypeus; tibia slightly darker than the femur; tergites the same color as the postclypeus; sternites on the sides as dark as the postclypeus and yellow in the center. Head with a few scattered bristles; pronotum with numerous bristles and a few scattered short hairs,

particularly on the front margin; tergites with bristles; sternites with bristles and hairs. Fontanelle large, not so long as, but wider than, the ocellus, convex, with thin light chitin. Eye large, one-eleventh of its diameter from the lower margin. Ocellus large, smaller than the antennal socket, less than its width from the eye, upper margin projecting a little from the general level of the head. Antenna with 15 articles. Postclypeus distinctly shorter than half its width (0.37:0.88 mm.), not strongly arched. Pronotum with rounded sides converging towards the rear, hind margin somewhat emarginate.

TABLE 19

MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Cornitermes walkeri* SNYDER

Length of head to tip of labrum	2.30
Length of head to side base of mandibles	1.70
Width of head	2.31
Diameter of eye	0.76
Eye from lower margin	0.07
Length of ocellus	0.37
Width of ocellus	0.24
Ocellus from eye	0.17
Ocellus from fontanelle	0.41
Length of fontanelle	0.32
Width of fontanelle	0.27
Length of pronotum	1.00
Width of pronotum	1.94
Length of hind tibia	2.60

COMPARISONS: The short postclypeus indicates that *C. walkeri* and *C. pugnax* are closely related. *C. walkeri* has the largest eye of any described species in the genus.

SOLDIER: Head, pronotum, and abdomen yellowish. Head with a few bristles on top, more abundant on the front half, none on the under side; postmentum with about two bristles on the anterior end and with inconspicuous microscopical hairs in the middle portion; pronotum with a few bristles, short hairs on the front margin; tergites with bristles; sternites with short hairs and bristles. Head with fairly straight sides converging somewhat towards the front. Frontal tube somewhat upturned, base rather thick, tip overlapping the postclypeus from above. Narrowest portion of the postmentum about

TABLE 20  
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes walkeri* SNYDER

	No.	Range	Mean
Length of head with mandibles	25	4.15-4.90	4.48
Length of head to tip of frontal tube	26	2.71-3.21	2.99
Length of head to side base of mandibles	27	2.93-3.54	3.29
Width of head	27	2.64-3.07	2.85
Thickness of head	26	1.94-2.26	2.09
Length of frontal tube	26	0.52-0.60	0.56
Width of labrum	27	0.74-0.84	0.78
Length of left mandible	26	1.50-1.68	1.61
Length of right mandible from notch	25	0.75-0.83	0.79
Length of pronotum	27	0.76-0.92	0.82
Width of pronotum	27	1.25-1.47	1.34
Length of hind tibia	24	2.18-2.50	2.31

three-fifths of the width of the widest portion (0.42:0.70 mm.). Antenna with 15 articles, the second, third, and fourth about equal. Labrum (fig. 14C) with blunt lateral angles. Mandibles as in figure 15E. Front margin of the pronotum either distinctly or not emarginate.

COMPARISONS: Although the cotype soldiers of *C. acignathus*, subsp. *costaricensis* Snyder, from Hamburg Farm, Costa Rica, are somewhat larger than the soldiers from numerous colonies of *C. walkeri* from Panama and one colony from Estrella, Costa Rica, the differences are insufficient in the author's opinion to warrant the separation of two subspecies.

*Cornitermes walkeri* is close to *C. acignathus* (figs. 14E, 15D) and to *C. pugnax* (figs. 14D, 15F), but differs in the sharper lateral angles of the labrum (fig. 14C) and in the character of the mandibles (fig. 15E).

DISTRIBUTION (FIG. 16): Rio Tapia (9°02'-9°08' N., 79°24'-79°27' W.), Republic of Panama (type locality), soldiers (paratypes), worker, coll. 25.II.1924, and det. T. E. Snyder as *Cornitermes* (*C.*) *acignathus* Silvestri, subsp. *walkeri* Snyder, U.S.N.M., A.M.N.H.

Barro Colorado Island (9°08'-9°11' N., 79°49'-79°52' W.), Canal Zone, Panama, queen, soldiers, workers, coll. A. Emerson, 8.VI.1935, No. 108; soldiers, workers, coll. A. Emerson, 13.IV.1935; soldiers, workers, coll. A. Emerson, 4.V.1935.

Almirante (9°21' N., 82°23' W.), Republic of Panama, soldiers, workers, coll. A. Emerson, 15.IX.1935.

Estrella (9°48' N., 83°54' W.), Costa Rica,

soldiers, workers, coll. H. Kirby, 27.VIII.1925, No. T-183.

Hamburg Farm near San José (9°56' N., 84°05' W.), Costa Rica, soldiers, workers, coll. F. Nevermann, 26.XI.1925, det. T. E. Snyder as *C. acignathus*, subsp. *costaricensis* (cotypes), U.S.N.M., A.M.N.H.

The species has also been collected from Cabima (9°07'-9°10' N., 79°32'-79°34' W.), Panama (Banks, 1918, p. 662); Rio Chinilla (9°14' N. 79°48' W.), Canal Zone, Panama (Snyder, 1924, p. 187); Rio Chilibre, 4 miles above Juan Mina (9°10' N. 79°39' W.), Canal Zone, Panama, 26.II.1923, collector J. Zetek, determined by T. E. Snyder; Quipo (9°00' N., 80°05' W.), Panama, 19.V.1923, collector J. Zetek, determined by T. E. Snyder; headwaters of Rio Aojeta near headwaters of Rio Chinilla (9°14' N., 79°48' W.), Canal Zone, Panama, 19.VIII.1923, collector J. Zetek, determined by T. E. Snyder; Colombiana (10°08' N., 83°34' W.), Costa Rica (Snyder, 1925, p. 162); Santa Anna (probably near 10°52' N., 74°10' W.), Colombia (Snyder, 1926b, p. 28).

#### *Cornitermes pugnax* Emerson

*Cornitermes acignathus* BANKS, 1918, p. 666 (locality).

*Cornitermes pugnax* EMERSON, 1925, p. 294 (synonymy), p. 311 (soldier), p. 365 (imago, soldier), text fig. 48 (imago, soldier).

*Cornitermes* (*Cornitermes*) *similis* SNYDER, 1926a, p. 20 (soldier).

*Cornitermes pugnax* SNYDER, 1949, p. 262 (synonymy).

TABLE 21  
MEASUREMENTS (IN MILLIMETERS) OF THE IMAGO OF *Cornitermes pugnax* EMERSON

	No.	Range	Mean
Length of head to tip of labrum	24	2.00- 3.09	2.46
Length of head to side base of mandibles	24	1.35- 2.23	1.75
Width of head	24	1.97- 2.50	2.19
Diameter of eye	24	0.53- 0.66	0.58
Eye from lower margin	24	0.11- 0.23	0.16
Length of ocellus	24	0.16- 0.25	0.22
Width of ocellus	24	0.12- 0.17	0.15
Ocellus from eye	24	0.21- 0.41	0.31
Ocellus from fontanelle	24	0.35- 0.52	0.44
Length of fontanelle	24	0.22- 0.31	0.25
Width of fontanelle	24	0.13- 0.22	0.18
Length of pronotum	24	0.90- 1.10	0.99
Width of pronotum	24	1.62- 2.18	1.84
Length of hind tibia	21	2.26- 2.82	2.55
Length of anterior wing from suture	21	13.25-16.63	14.82
Width of anterior wing	21	3.80- 4.70	4.15

IMAGO: Head, pronotum, and tergites dark brown to brown; postclypeus same color as head; fontanelle plate same color as head; center of pronotum somewhat lighter than margins; tibia a little darker than the femur; wing scales dark brown; membrane of the wing dark smoky brown, costa and radius dark brown; sternites lighter in the center than on the sides. Head with a few bristles, pronotum and wing scales with bristles more numerous than on the head; tergites with bristles and very few short hairs; sternites with bristles and hairs. Fontanelle plate large, oval, dark, raised slightly above the surface of the head, convex. Eye proportionately of medium size, about one-third to one-fifth of its diameter from the lower margin of the head. Ocellus the same size or smaller than the fontanelle plate, about its length to almost twice its length from the eye, upper margin projecting above the general surface of the head. Antenna with 15 articles, the third sometimes partially divided. Postclypeus length much less than half its width. Pronotum with sides converging strongly towards the rear, hind margin emarginate.

COMPARISONS: The males from the same colony are usually smaller than the females. However, the males from Kamakusa are about the same size as the females from Kartabo.

The combination of the dark, smoky wings, the width of the head, the diameter of the eye, the size of the ocellus, and the length of the hind tibia distinguishes this species from all other described imagoes in the genus. The postclypeus is similar to that of *C. walkeri*.

SOLDIER (FIG. 26): Head, pronotum, and abdomen yellowish, the head and labrum darker than the abdomen. Head sparsely covered with bristles on top and a few short hairs on the under side; postmentum with a few short hairs in the middle and about two long bristles at the anterior end; pronotum with a few bristles and short hairs on the front margin; tergites with bristles; sternites with bristles and short hairs. Head with sides somewhat curved and converging towards the front. Frontal tube comparatively short and upturned, barely reaching the base of the postclypeus from above, the Bolivian specimens with a wider base of the frontal tube than in the Brazilian and Guiana specimens. Narrowest part of the postmentum about two-fifths of the width of the widest part. Antenna with 15 articles. Labrum with the side angles blunt and rounded, with a convex margin between the base of the white median lobe and the side angle (fig. 14D). Mandibles as in figures 15F and 26. Front margin of the pronotum weakly to conspicuously emarginate.



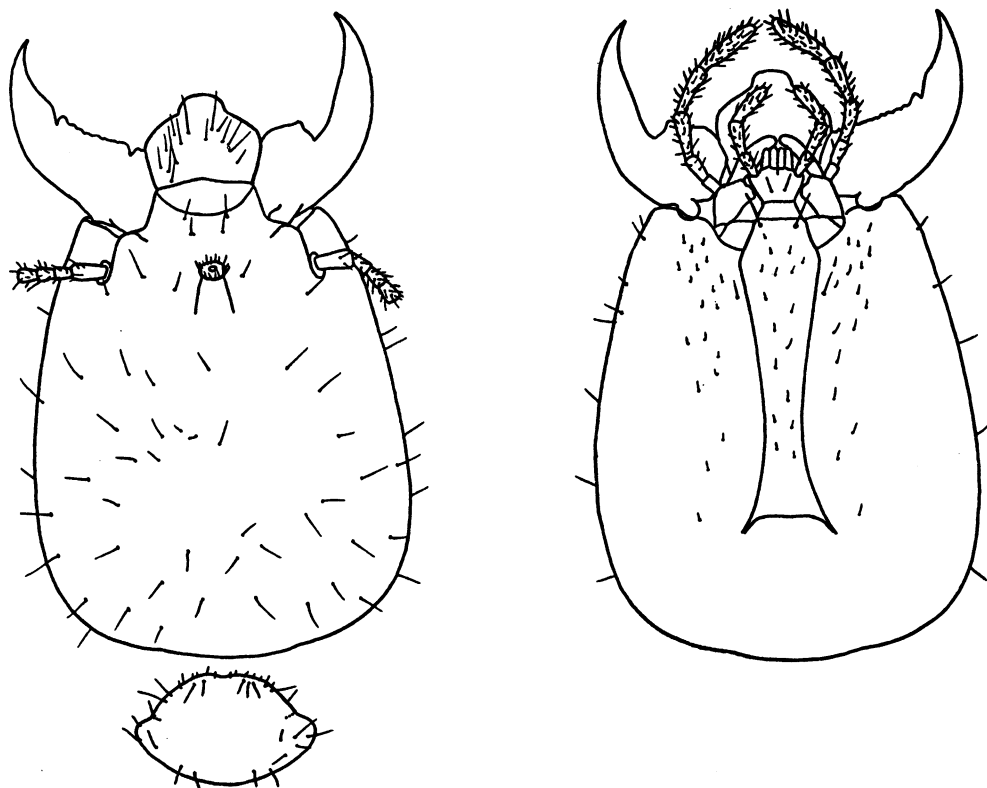


FIG. 26. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes pugnax* Emerson, metatype, Lago Poraquêquare.

COMPARISONS: There is a considerable variation in the mean size of the soldiers from different colonies. For example, the head width of 35 specimens from various Guiana localities (except Itabu Creek) averaged 2.59 mm., 23 specimens from Itabu

Creek, British Guiana, averaged 3.07 mm., six specimens from Lago Poraquêquare, Manaus, Brazil, averaged 3.12 mm., five specimens from Cachuela Esperanza, Bolivia, averaged 2.85 mm., and seven specimens from a number of other Bolivian localities

TABLE 22

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes pugnax* EMERSON

	No.	Range	Mean
Length of head with mandibles	41	3.84-5.24	4.53
Length of head to tip of frontal tube	55	2.41-3.33	2.91
Length of head to side base of mandibles	54	2.56-3.94	3.33
Width of head	76	2.05-3.25	2.80
Thickness of head	54	1.54-2.15	1.89
Length of frontal tube	56	0.31-0.50	0.40
Width of labrum	58	0.71-1.00	0.87
Length of left mandible	65	1.47-2.01	1.74
Length of right mandible from notch	47	0.77-1.07	0.95
Length of pronotum	56	0.65-0.87	0.76
Width of pronotum	55	1.14-1.62	1.38
Length of hind tibia	50	2.00-2.74	2.31

and Boa Hora, Brazil, averaged 2.63 mm. It is possible that these variations may indicate subspeciation, but with the available material it seems to be premature to subdivide the species.

*Cornitermes acignathus*, *C. walkeri*, and *C. pugnax* seem to be a group of related species, the soldiers of which differ from one another in characters of the labrum (fig. 14) and mandibles (fig. 15) in particular.

**DISTRIBUTION (FIG. 16):** Kartabo (6°23' N., 58°42' W.), British Guiana (type locality), queen (morphotype), soldiers (holotype, paratypes), workers, coll. A. Emerson, 29.VII.1920, No. 164; queen (paratype), coll. A. Emerson, 15.VIII.1919; king, queen (paratypes), soldiers (paratypes), workers, coll. A. Emerson, 29.VI.1919; imagoes, soldiers, workers, coll. A. Emerson, 17.IV.1924, No. 24.113h.

Okó River (6°28' N., 58°50' W.), tributary of the Cayuni River about 37 miles from its mouth, British Guiana, soldiers, workers, coll. N. Weber, 19.VI.1936, No. 481.1.

Kamakusa (5°56' N., 59°54' W.), British Guiana, imagoes, soldiers, workers, coll. H. Lang, 25.X.1922, No. 29; soldiers, workers, coll. H. Lang, 3.XI.1922, No. 37.

New River (mouth 3°26' N., 57°26' W.), British Guiana, soldiers, coll. N. Weber, 17.VII.1936, No. 574.

Itabu Creek (1°42' N., 57°55' W.), tributary of upper New River, Acary Mts., British Guiana, soldiers, coll. E. R. Blake, X.1938.

Surinam, soldier, coll. A. Reyne, No. 3.

Lago Paraquêquare, Manaus (3°06' S., 60°00' W.), Amazonas, Brazil, soldiers, workers, coll. A. Roman, 13.V.1915.

Boa Hora (8°11' S., 63°19' W.), Rio Madeira, Brazil, soldier, workers, coll. W. M. Mann, III.1922, det. T. E. Snyder (1926a, p. 20) as *C. similis*.

Ivon (11°10' S., 66°09' W.), Bolivia, soldiers, workers, coll. W. M. Mann, III. 1922, det. T. E. Snyder (1926a, p. 20) as *C. similis*.

Cachuela Esperanza (10°33' S., 65°36' W.), Beni River, Bolivia, soldiers, workers, coll. W. M. Mann, III.1922, det. T. E. Snyder (1926a, p. 20) as *C. similis*.

Cavinas (12°32' S., 66°54' W.), Bolivia, soldiers, workers, coll. W. M. Mann, II.1922, det. T. E. Snyder (1926a, p. 20) as *C. similis*.

Blanca Flor (11°50' S., 66°42' W.), Beni River, Bolivia, soldiers, workers, coll. W. M. Mann, I.1922, det. T. E. Snyder (1926a, p. 20) as *C. similis*.

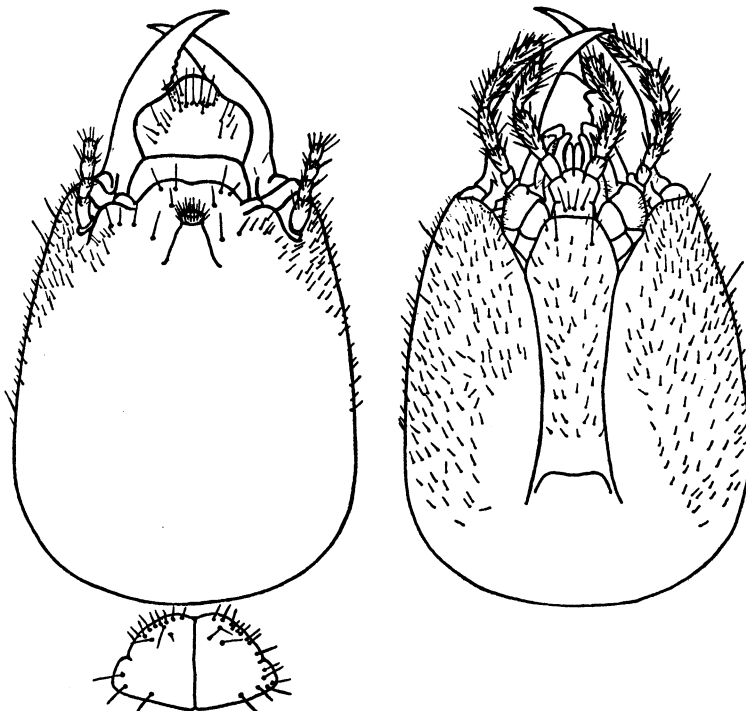


FIG. 27. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes falcatus*, new species, holotype.

Ixiamas (13°45' S., 68°08' W.), Bolivia, soldiers, workers, coll. W. M. Mann, XII.1921, det. T. E. Snyder (1926a, p. 20) as *C. similis*.

Rurrenabaque (14°28' S., 67°27' W.), Bolivia, soldiers, workers, coll. W. M. Mann, XI.1921, det. T. E. Snyder (1926a, p. 20) as *C. similis*.

St. Helena (near 15°40' S., 66°41' W.), Bolivia, soldier, workers, coll. W. M. Mann, 1921, det. T. E. Snyder (1926a, p. 20) as *C. similis*.

The species is also recorded from Tukeit (5°13' N., 59°25' W.), British Guiana, determined by N. Banks (1918), as *C. acignathus*, Dunoon (6°25' N., 58°18' W.), British Guiana (Emerson, 1925).

#### ***Cornitermes falcatus*, new species**

**SOLDIER (FIG. 27):** Head and pronotum yellowish. Sides of head, region of antennal base, and under side clothed with short hairs and a few longer bristles; top and back part of head behind the frontal tube without hairs or bristles; pronotum with numerous bristles but without contrasting short hairs; tergites with bristles on the posterior half. Head with somewhat curved sides converging towards the front. Frontal tube of medium size, projecting beyond the base of the postclypeus from above. Postmentum with the narrowest portion a little wider than three-fifths the width of the widest portion (15:23). Antenna broken in specimen, the third article a little longer than the second, the fourth equal to, or a little shorter than, the third and a little longer than the second. Labrum with curved sides and a

median white tip giving a three-lobed appearance. Left mandible with a rather long tip and numerous conspicuous serrations in front of the notch and coarser serrations behind notch. Right mandible with a nearly evenly curved edge in front of the notch (not sigmoid), the angle of the notch a little less than a right angle, and with a fairly sharp projecting tooth (see dotted line in fig. 27 in the ventral view of the head). Pronotum with a distinctly emarginate front margin.

**COMPARISONS:** The arrangement of the bristles and hairs on the head distinguishes this species from all others in the genus.

**DISTRIBUTION (FIG. 16):** Santa Amélia (within 3°20'–5°00' S., 58°45'–62°00' W.), Amazonas, Brazil (type locality), soldier (holotype), coll. A. Roman, VIII–IX.1914.

#### ***Cornitermes weberi*, new species<sup>1</sup>**

**SOLDIER (FIG. 28):** Head, pronotum, and abdomen yellowish. Both the upper and under side of the head covered with numerous bristles and a dense mat of short hair; postmentum with a mat of short hair and a few anterior bristles; pronotum with numerous bristles and a number of short hairs both on the lateral portions and on the front margin; tergites with many bristles and some microscopical hairs; sternites with bristles and hairs. Head subrectangular, sides nearly straight and parallel or slightly converging towards the front. Frontal tube thick at the base, slightly upturned in profile. Narrowest portion of the postmentum a little more than half of the width of the widest portion (0.35:0.66 mm.). Antenna with 15 articles, the second, third, and fourth about equal, or the second a little shorter than the third. Labrum with conspicuous lateral angles, each close to a right angle or a little greater than a right angle, margin from the base of the white median lobe to the lateral angle slightly concave. Mandibles as in figure 28. Front margin of the pronotum weakly emarginate.

**COMPARISONS:** The lateral angles of the labrum are sharper in *C. weberi* than in any

TABLE 23  
MEASUREMENTS (IN MILLIMETERS) OF THE  
SOLDIER OF *Cornitermes falcatus*,  
NEW SPECIES

Length of head with mandibles (estimated)	4.23
Length of head to tip of frontal tube	2.82
Length of head to side base of mandibles	3.03
Width of head	2.33
Thickness of head	1.67
Length of frontal tube	0.38
Width of labrum	0.80
Length of left mandible	1.59
Length of right mandible from notch	0.89
Length of pronotum	0.78
Width of pronotum	1.23
Length of hind tibia	2.15

<sup>1</sup> This species is named in honor of Dr. Neal A. Weber of Swarthmore College, who has studied the ants of Africa and the New World extensively and has made important collections of termites on his expeditions.

TABLE 24  
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes weberi*, NEW SPECIES

	No.	Range	Mean
Length of head with mandibles	25	4.08-4.57	4.33
Length of head to tip of frontal tube	25	2.72-3.06	2.90
Length of head to side base of mandibles	25	2.80-3.27	3.10
Width of head	25	2.12-2.37	2.24
Thickness of head	25	1.59-1.76	1.68
Length of frontal tube	25	0.39-0.47	0.42
Width of labrum	25	0.75-0.83	0.79
Length of left mandible	25	1.49-1.60	1.55
Length of right mandible from notch	25	0.79-0.86	0.82
Length of pronotum	25	0.66-0.75	0.71
Width of pronotum	25	1.12-1.31	1.24
Length of hind tibia	25	1.85-2.06	1.99

other described soldier with a dense mat of short hair on the head. *C. ovatus* differs in the larger size, proportionately wider head with the sides more curved and converging towards the front (fig. 31).

DISTRIBUTION (FIG. 16): Oronoque River (2°02'-2°43' N., 57°18'-57°26' W.), British Guiana (type locality), soldiers (holotype and paratypes), nymphs, coll. N. A. Weber, 30.VII.1936, No. 616.

*Cornitermes incisus*, new species

SOLDIER (FIG. 29): Head, pronotum, and abdomen yellowish. Head with numerous bristles and covered with a mat of short hair; postmentum with a few bristles at the anterior end and covered with short hair; pronotum with numerous bristles and a few short hairs on the front margin; tergites with bristles; sternites with hair and bristles. Head

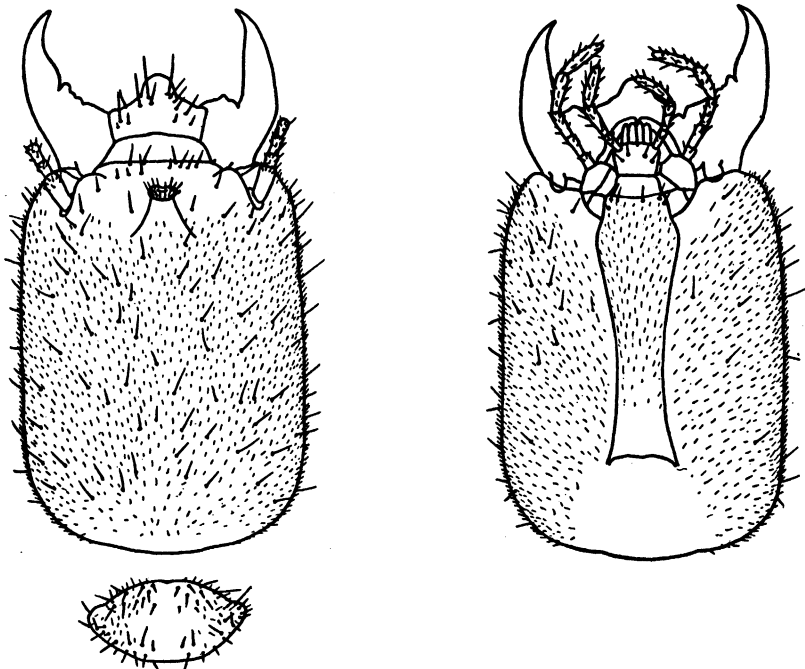


FIG. 28. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes weberi*, new species, holotype.

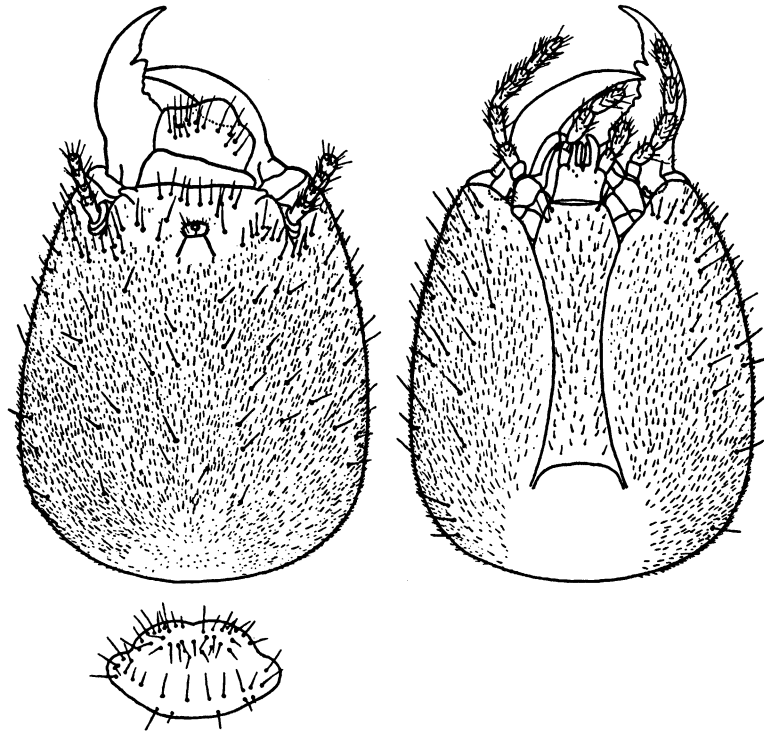


FIG. 29. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes incisus*, new species, holotype.

with curved sides converging towards the front. Frontal tube short, with the tip overlapping the base of the postclypeus from above. Postmentum with the narrowest portion a little wider than half of the width of the widest portion (15:26). Antenna with 15 articles, the second, third, and fourth about

equal. Labrum with the sides slightly angular and with a broad, rounded, white tip. Left mandible with a rather elongated apical portion, slightly serrate anterior to the notch, notch fairly deeply incised, with a conspicuous tooth and coarse serrations posterior to the tooth. Right mandible with an evenly curved anterior edge (not sigmoid) and the angle of the notch about 60 to 70 degrees. Pronotum with a conspicuously emarginate front margin.

COMPARISONS: All other species of the genus with a mat of short hair covering the head have straighter and more parallel sides of the head, with a sharper curve joining the sides and the hind margin.

DISTRIBUTION (FIG. 16): Santa Amélia (within 3°20'–5°00' S., 58°45'–62°00' W.), Amazonas, Brazil (type locality), soldier (holotype), workers, coll. A. Roman, VIII–IX.1914.

***Cornitermes villosus*, new species**

SOLDIER (FIG. 30): Head, pronotum, and abdomen yellowish. Top of head covered with many bristles and a thick mat of short hair,

TABLE 25

MEASUREMENTS (IN MILLIMETERS) OF THE  
SOLDIER OF *Cornitermes incisus*,  
NEW SPECIES

Length of head with mandibles	5.12
Length of head to tip of frontal tube	3.38
Length of head to side base of mandibles	3.47
Width of head	3.12
Thickness of head	2.03
Length of frontal tube	0.34
Width of labrum	0.87
Length of left mandible	1.78
Length of right mandible from notch	0.96
Length of pronotum	0.85
Width of pronotum	1.53
Length of hind tibia	2.41

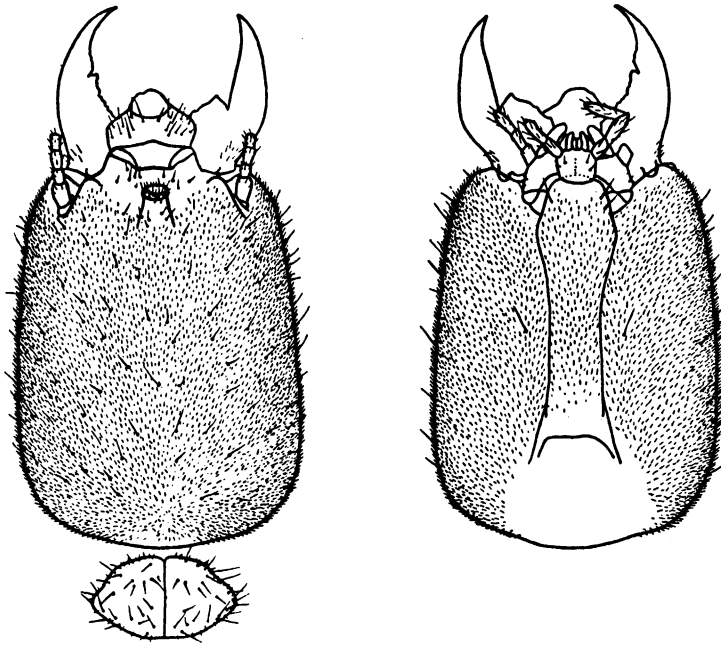


FIG. 30. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes villosus*, new species, holotype.

under side with one or two bristles and a mat of short hair; postmentum with a few anterior bristles and covered with a mat of short hair; pronotum with numerous bristles and a few short hairs; tergites with bristles and many short hairs; sternites with bristles and hairs. Head subrectangular, sides slightly curved and converging a little towards the front. Frontal tube short and slightly up-turned, the tip below the top of the head in

profile, overlapping the base of the postclypeus from above. Narrowest portion of the postmentum a little wider than one-half to two-thirds of the width of the widest portion (0.39–0.47:0.69–0.71 mm.). Antenna with 15 articles, the second, third, and fourth about equal or the third a little longer than the second. Labrum with rounded side angles and the margin between the side angle and the base of the median white lobe slightly convex.

TABLE 26

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes villosus*, NEW SPECIES

	No.	Range	Mean
Length of head with mandibles	3	4.63–4.69	4.65
Length of head to tip of frontal tube	18	2.97–3.29	3.12
Length of head to side base of mandibles	18	3.01–3.53	3.28
Width of head	18	2.29–2.71	2.52
Thickness of head	18	1.56–1.82	1.73
Length of frontal tube	19	0.35–0.46	0.40
Width of labrum	17	0.76–0.83	0.79
Length of left mandible	10	1.53–1.60	1.56
Length of right mandible from notch	5	0.75–0.86	0.81
Length of pronotum	19	0.64–0.74	0.69
Width of pronotum	19	1.26–1.39	1.34
Length of hind tibia	17	1.94–2.15	2.06

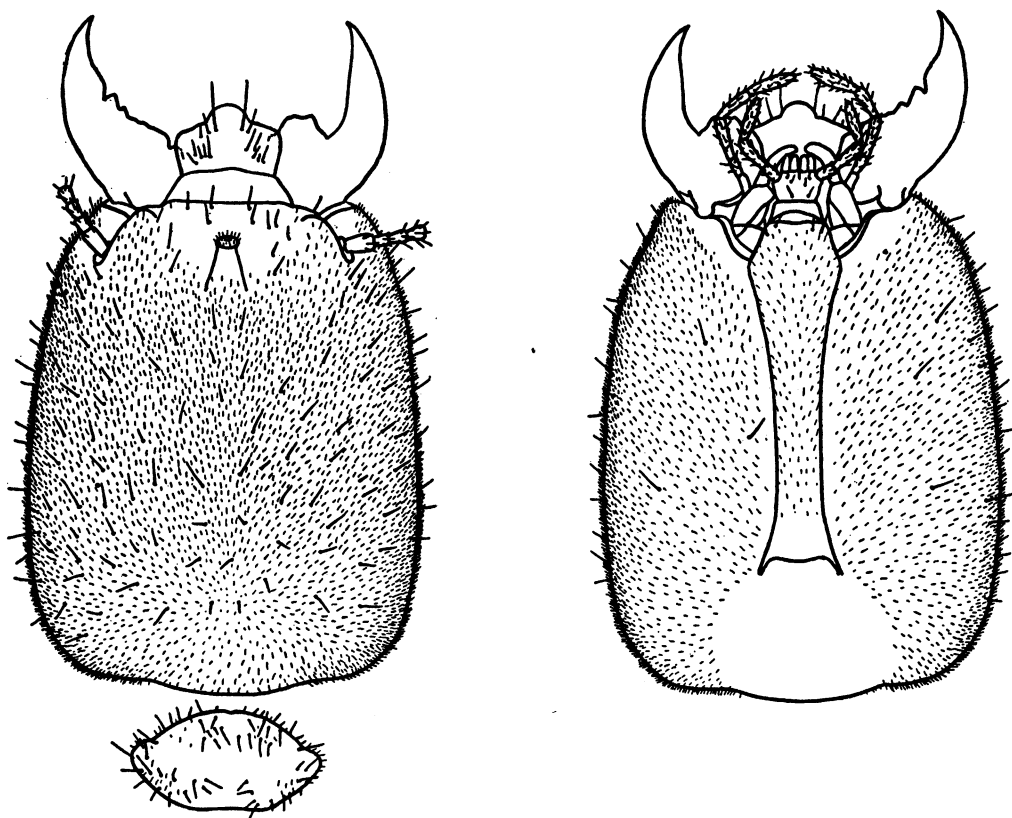


FIG. 31. Dorsal view of head and pronotum and ventral view of head of soldier of *Cornitermes ovatus*, new species, holotype.

Mandibles as in figure 30. Front margin of the pronotum distinctly emarginate.

COMPARISONS: Close to *C. bequaerti* (fig. 32), but *C. villosus* has a more dense mat of short hair on the head, the sides of the head converge more towards the front, and the front margin of the pronotum is more distinctly emarginate.

DISTRIBUTION (FIG. 16): Guaraní (21°26' S., 48°06' W.), São Paulo, Brazil (type locality), soldiers (holotype and paratypes), worker, coll. Jayme V. Pinheiro, II.1943.

***Cornitermes ovatus*, new species**

SOLDIER (FIG. 31): Head light reddish brown or dark yellow, pronotum and abdomen yellowish. Head with numerous bristles on top and a few underneath, and with a mat of contrasting short hair; pronotum with numerous bristles and a few short hairs; tergites with sparse bristles on the posterior half and with a few short hairs on the lateral mar-

gins; sternites with bristles and hairs. Head subrectangular, sides somewhat curved and converging a little towards the front; the hind margin with a shallow median lobe and the hind angles rounded but fairly distinct at the junction of the hind margin and sides. Frontal tube proportionately short, barely overlapping the base of the postclypeus from above. Postmentum proportionately narrow in relation to the width of the head, the narrowest portion slightly more than half of the width of the widest portion (0.37:0.71 mm.). Antenna with 15 articles. Labrum with the sides obtusely pointed or with rounded angles, the angles at the junction of the white median lobe distinct. Mandibles as in figure 31. Pronotum with the front margin slightly or not emarginate.

COMPARISONS: *Cornitermes incisus* (fig. 29) is close, but the sides and hind angles of the head are rounder, the pronotum is more deeply emarginate in front, the frontal tube is

TABLE 27

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes ovatus*, NEW SPECIES

	No.	Range	Mean
Length of head with mandibles	4	5.08-5.30	5.20
Length of head to tip of frontal tube	11	3.41-3.68	3.57
Length of head to side base of mandibles	11	3.66-4.03	3.84
Width of head	10	2.98-3.20	3.08
Thickness of head	10	1.90-2.07	2.00
Length of frontal tube	11	0.32-0.42	0.37
Width of labrum	11	0.82-0.88	0.86
Length of left mandible	10	1.68-1.86	1.81
Length of right mandible from notch	4	0.87-0.94	0.90
Length of pronotum	10	0.78-0.86	0.82
Width of pronotum	10	1.40-1.59	1.50
Length of hind tibia	10	2.15-2.42	2.30

thicker at the base, and the notch of the left mandible is closer to the tip of the mandible. *C. weberi* (fig. 28) is smaller, with proportionately narrower head and straighter, more parallel, sides. The lateral angles of the labrum are sharper in *C. weberi*.

**DISTRIBUTION** (FIG. 16): Cururuzinho (within 3°20'-5°00' S., 58°45'-62°00' W.), Rio Autaz, Amazonas, Brazil (type locality), soldiers (holotype and paratypes), coll. A. Roman, 9.X.1914.

Rio Autaz (3°25'-5°00' S., 58°45'-60°00' W.), Amazonas, Brazil, soldiers (paratypes), coll. A. Roman.

***Cornitermes bequaerti*, new species<sup>1</sup>**

**SOLDIER** (FIG. 32): Head and pronotum yellowish, abdomen pale yellow. Top of head covered with numerous bristles and densely covered with short hair; postmentum with a few anterior bristles and covered with short hair; pronotum with bristles and a few short hairs; tergites with bristles only and no short hairs; sternites with hair and bristles. Head of medium thickness, sides straight or slightly curved and almost parallel, hind margin with two slight indentations on either side of the middle in large specimens. Frontal tube conical, barely reaching beyond the base of the postclypeus from above, in profile the upper margin almost continuous with the top of the head. Narrowest part of postmentum about

one-half to two-thirds of the width of the widest part (0.35-0.43:0.62-0.71 mm.). Antenna with 15 articles. Labrum with sides evenly curved or bluntly rounded posterior to the base of the median white tip. Mandibles as in figure 32, the notch in the right mandible usually a little less than a right angle, but in one large specimen the notch is wider than in the figure and forms a right angle. Front margin of pronotum not emarginate or with a barely perceptible indentation.

**COMPARISONS:** A single colony from Piraputanga, Mato Grosso, Brazil, contained one soldier of normal size and a number of markedly smaller soldiers. About a third of the measurements in table 28 were taken from these small soldiers, so that the averages are less than would otherwise have been the case.

*Cornitermes villosus* (fig. 30) has sides of head more curved, the mat of short hair is more dense, and the front margin of the pronotum is distinctly more emarginate.

**DISTRIBUTION** (FIG. 16): Tatuí (23°21' S., 47°51' W.), São Paulo, Brazil (type locality), soldiers (holotype and paratypes), workers, coll. R. L. Araujo, 6.II.1945, No. 2805, "nest with soft central part."

Guaraní (21°26' S., 48°06' W.), São Paulo, Brazil, soldiers (paratypes), workers, A. da Costa Lima Coll. No. 9693, with imagoes of *C. cumulans*.

Taubaté (23°02' S., 45°35' W.), São Paulo, Brazil, soldiers (paratypes), workers, coll. by a farmer, 4.II.1945, Araujo Coll. No. 2829.

Near "Philadelphia" (17°53' S., 41°19' W.), Brazil, soldiers (paratypes), coll. Hartt and Copeland, Thayer Expedition, M.C.Z.

Piraputanga (20°25' S., 55°28' W.), Mato

<sup>1</sup> This species is named in honor of Dr. Joseph Bequaert, Curator of Entomology at the Museum of Comparative Zoölogy, Cambridge, Massachusetts, whose notes and collections of termites from Africa and South America have added much to our knowledge of these insects.



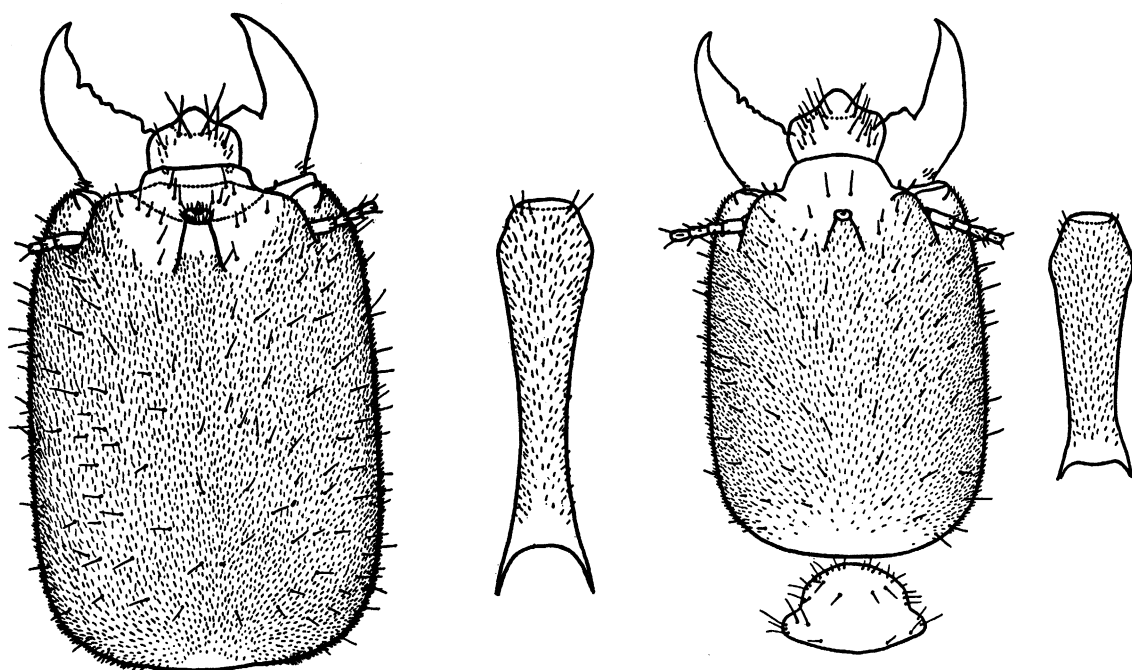


FIG. 32. Dorsal view of head and ventral view of postmentum of soldier of *Cornitermes bequaerti*, new species, paratype from type colony, Tatui; dorsal view of head and pronotum and ventral view of postmentum of small soldier of *Cornitermes bequaerti*, new species, paratype, Piraputanga.

Grosso, Brazil, soldiers (paratypes), workers, coll. K. P. Schmidt, 22.VII.1926.

***Cornitermes pilosus* Holmgren**

*Cornitermes pilosus* HOLMGREN, 1906, p. 551 (soldier, worker), text figs. L, M (soldier, worker).

*Cornitermes (C.) pilosus* HOLMGREN, 1912, p. 51 (taxonomy), text fig. 24 (soldier mandibles).

*Cornitermes pilosus* SNYDER, 1949, p. 262 (synonymy).

**SOLDIER:** Head, pronotum, and abdomen yellowish, cotype soldier somewhat dark, probably due to preservation. Head with numerous long bristles on the upper side and a dense contrasting mat of short hairs on the upper and under sides; postmentum covered with short hair, a few bristles only at the anterior end; pronotum with numerous bristles and some short hairs on both the front margin

TABLE 28

MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes bequaerti*, NEW SPECIES

	No.	Range	Mean
Length of head with mandibles	20	4.00-5.00	4.51
Length of head to tip of frontal tube	35	2.53-3.54	3.07
Length of head to side base of mandibles	35	2.79-3.78	3.36
Width of head	35	2.06-2.76	2.45
Thickness of head	35	1.48-1.85	1.73
Length of frontal tube	30	0.23-0.44	0.33
Width of labrum	35	0.71-0.85	0.80
Length of left mandible	33	1.44-1.68	1.56
Length of right mandible from notch	21	0.76-0.86	0.80
Length of pronotum	33	0.63-0.77	0.69
Width of pronotum	33	1.12-1.41	1.30
Length of hind tibia	32	1.76-2.18	1.98

TABLE 29  
MEASUREMENTS (IN MILLIMETERS) OF THE SOLDIER OF *Cornitermes pilosus* HOLMGREN

	No.	Range	Mean
Length of head with mandibles (estimated)	1	4.06	4.06
Length of head to tip of frontal tube	2	2.79-2.88	2.83
Length of head to side base of mandibles	2	2.94-2.95	2.94
Width of head	4	2.00-2.20	2.12
Thickness of head	2	1.46-1.47	1.46
Length of frontal tube	3	0.29-0.31	0.30
Width of labrum	2	0.71-0.76	0.73
Length of left mandible	2	1.39-1.47	1.43
Length of right mandible from notch	2	0.71-0.76	0.73
Length of pronotum	3	0.50-0.61	0.57
Width of pronotum	3	1.10-1.18	1.14
Length of hind tibia	1	1.67	1.67

and the rest of the surface; tergites and sternites with both bristles and hairs, the hairs somewhat longer on the sternites. Head with the sides slightly curved and subparallel. Frontal tube fairly short, depressed in profile, the tip not rising above the level of the hind part of the head, the base of the under side fitting into a depression in the head. Postmentum proportionately narrow in relation to the head, narrowest portion about one-half of the width of the widest portion or somewhat wider (0.32:0.64 mm. in a cotype; 0.39:0.64 mm. in an autotype). Antenna with 15 articles, the second, third, and fourth about equal. Labrum with rounded, bluntly pointed, lateral angles, the margins from the base of the median white lobe to the lateral angles straight (fig. 14B). Mandibles as in figure 15C. Angle of notch of right mandible 75 to 90 degrees. Front margin of pronotum distinctly emarginate.

The measurements in table 29 are from three soldiers in the author's collection to which have been added the measurements given by Holmgren (1906).

COMPARISONS: Closest to *C. villosus* from which it differs in the wider angle of the notch of the right mandible, and in the smaller size.

DISTRIBUTION (FIG. 16): Chaquimayo (13°25' S., 70°27' W.), Peru (type locality), soldier (cotype from type colony), worker, coll. and det. N. Holmgren.

Llínquipata (13°49' S., 70°38' W.), Peru, soldier (autotype), worker, coll. and det. N. Holmgren, 2.XII.1904.

Peru, soldier (autotype), workers, coll. and det. N. Holmgren.

#### OTHER RECORDS OF *Cornitermes*

Silvestri (1940, p. 344) records a termitophilous scarabaeid from a nest of *Cornitermes persimilis*, a species of termite that has not been described. The locality given is Rio de los Coros, São Paulo, Brazil. It is impossible for the author to assign this species to either the genus *Procornitermes* or *Cornitermes* without examining the specimens.

Silvestri (1946, pp. 310, 312) records a termitophilous staphylinid (*Autuoria elegantula*) from a nest of *Cornitermes autuorii*, a species of termite that has not been described. The locality given is Jabaquara (23°34' S., 46°36' W.), São Paulo, Brazil. Without specimens available for study by the author, this species remains unassigned to either genus or species.

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