THE TERMITES OF SOUTH AFRICA;

Being a Preliminary Notice.

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The present paper, whilst dealing mainly with the termites of the Union of South Africa also embraces species occurring or reported to occur in Africa south of lat. 22 deg.

It is not proposed to give descriptions of any of the known species, but preliminary statements are made for those regarded as, at present, undescribed.

The keys given are to be regarded as for the everyday use of the field naturalist, and are not designed for the systematist to whom the literature is available.

Some apology is required for the length at which the synonomy of some species is dealt with. I have, however, been unable to offer solutions to the puzzles presented in fewer words.

My species are species in the commonly accepted taxonomic sense. I take the type as having, or in the future being given, a sufficiently elastic description to include the many variations to be met in the asexual castes and also in the antennae and wing venation of the imagos.

The term " variety " has been avoided as a systematic distinction and " form " or " subspecies " used in its place. " Forms " are such as cannot be brought into an elastic description without destroying the biological situation. They would be treated as species by some, but appear to me more in the nature of topographical races.

The term "subspecies" is employed to preserve what also appears to me to be a biological situation. Such as are given might have been ranked as species were it not that by so treating them the distinct relationship they bear to the type would be obscured.

It is not to be inferred that I have any proof that the subspecies recorded are fertile with the type. It is quite possible they are not. On the other hand, the possibilities of " forms " interbreeding among themselves and with the type are so great that such may reasonably be inferred.

As I find no two authorities in agreement upon the fundamental points of a classification, all differing more or less in their view of family relationships, and even the status of genera and subgenera, I have adopted a group system. This may seem to be a retrograde step, but it is the only alternative. The arrangement followed permits of any reshuffling subsequently found desirable, and will be found workable and non-contentious. Moreover, the grouping as here proposed has these immediate, if but local, advantages:—

(a) The characters of the soldiers will, almost always, give a direct clue to the group to which they belong.

(b) The group gives a key to the biology of the species included in it; or, *vice versa*, the natural habit, when known, will indicate what group the species belongs to.

Although the termites of the African continent are estimated to represent at least sixteen groups, it would serve no useful purpose to notice all here and, for this reason, I have confined myself to those of which we have representatives. On this basis there are ten groups and twenty-one genera. These are:

1. CALOTERMES Group.
   - Calotermes.
   - Neotermes.
   - Cryptotermes.
   - Porotermes.
2. HODOTERMES Group
   - Hodotermes.
3. PSAMMOTERMES Group
   - Psammotermes.
4. RHINOTERMES Group
   - Schedorhinotermes.

5. TERMES Group
   - Allodontermes.
   - Macrotermes.
   - Termes.
   - Microtermes.
6. APICOTERMES Group
   - Apicotermes.
   - Hoplognathotermes.
7. NASUTITERMES Group
   - Trinervitermes.
   - Subulitermes.
   - Coactatotermes.
8. HAMITERMES Group
   - Hamitermes.
9. MIROTERMES Group
   - Mirotermes.
   - Cubitermes.
   - Procubitermes.
10. EUTERMES Group
    - Eutermes.
    - (syn. Microcerotermes.)

With regard to the genera enumerated, the following remarks are offered upon the synonomy and status thereof:—

Calotermes: In a preliminary note Hagen (1853) created the genus *Kalotermes*. The elaboration of this note was delayed for the publication of Peter's "Reise nach Mossambique" (1862). In this the same spelling is adopted and *Termes flavicollis* Fabr. is cited as the type for living species, as opposed to fossil species. However, in the interim, Hagen (1858) revised the spelling to *Calotermes*, and in this form it is now thoroughly engrafted upon the literature of termites. It is one of those cases that will, so I think, prove an exception to the rules of nomenclature Except *Porotermes*, the other genera included in this group (and some more not mentioned) are ranked as subgenera of *Calotermes* sens. lat. by Holmgren (1911). Admittedly most of Holmgren's subgenera of *Calotermes* sens. lat. are good independent genera.

Porotermes is included in the *Calotermes* group because the biology of our one species, *P. planiceps* (Sjöst), appears somewhat similar to that of the remaining genera. It is a genus with only four known representatives, one African, two Australian and one South American. The local species was originally described as a *Calotermes*. It was transferred to *Porotermes* by Holmgren (1911) who created a special subgenus, *Planitermes*, for its reception. This is a distinction that seems to me to be superfluous as the genus is so poor in species. *Calotermes amabilis* Sjöstedt is probably the winged form of *P. planiceps*.

Schedorhinotermes was created as an independent genus by Silvestri (1908) and subsequently reduced to a subgenus of *Rhinotermes* sens. lat. by Holmgren (1911). There is much to be said in favour of Holmgren's arrangement but, as the typical *Rhinotermes* are South American, a certain amount of prolixity is avoided by following Silvestri.

Allodontermes was created by Silvestri (1912). In Holmgren's classification (1912) it will be found as a subgenus of *Protermes* s.lat. If *Protermes* stands, it may only do so as a subgenus of *Allodontermes*, the last having admitted priority.

Macrotermes is the name given by Holmgren (1912) for a section or subgenus of his genus *Termes*. I propose to ignore the sub-division made by Holmgren, as it appears unnecessary, and call the genus *Macrotermes*. In creating a genus with *Termes bellicosus* Smeathman as the type, Holmgren (1912) deliberately gave to it the name *Termes*. As I interpret him he says: " I will no doubt be reproached for disregarding the rules of nomenclature in naming the species of this genus *Termes* because the type of *Termes* is *T.capensis* or *T.fatalis*, both of which have been placed by me in the genus *Odontotermes*." On both pages 32 and 40, " Termitenstudien III " he is at pains to point out that he has wittingly suspended the rules of nomenclature and to recommend that his *Odontotermes* should be called *Termes*, and a new name given to *Termes* sensu Holmgren. On this point Banks (1920) makes the following remarks: " *Termes* was used by Linneus in the tenth edition of his Systema Naturae

(p. 609, 1758) for three insects, one termite, and two psocids. The latter have been removed. The one termite was *T. fatale* of India; this then is the type of the genus. Several have credited the genus to Hagen, and Holmgren puts Smeathman as authority for the genus, and several have considered *T. bellicosus* as type." The Linnean type, as types go, is unquestionably *T. fatale* Linn. (1758) since this name is accompanied by both a description and a figure in the Systema Naturae. But *Termes fatale* can only be regarded as a legendary species seeing that it seems to have been based upon an account and drawings supplied to Linneus by Rolander of a termite seen by that traveller in Surinam, not India. On these grounds, coupled with the practical impossibility of connecting *fatale* with a South American termite, Hagen (1858) recommended the suppression of *fatale;* from then onward it has been treated as a *nom. negl.* The Indian insect is *T. fatalis* Köenig (1779) doubtless so named because Köenig, when describing it, thought he was dealing with the Linnean species. There is no evidence to show that Linneus ever saw this insect of Köenig, but we have Sparrman's word (1783) that *Termes capensis* De Geer (1778) was both seen and recognised as a termite by Linneus. *T. capensis* should therefore be regarded as the type or leucotype of the genus. Whilst *Odontotermes* sensu Holmgren falls away, it may be employed for a subgeneric section of Termes, covering species of the *monodon-badius-transvaalensis* group.

Microtermes is a genus to which, subsequently, *Ancistrotermes* will be found attached as a subgenus. *Ancistrotermes* was erected by Silvestri as an independent genus and subsequently Holmgren (1912) reduced it to a synonym of *Microtermes.* Silvestri has objected very strongly to this and maintains the separateness of his genus. Certainly *Ancistrotermes* is sufficiently distinct from *Microtermes* to hold subgeneric rank, but, biologically, it is too closely allied to be treated as an independent genus.

Nasutitermes is the group name for a series of genera or subgenera that were placed by Holmgren (1912) in his *Eutermes* sens. lat. Banks (1920) substituted *Nasutitermes* for Holm-

gren's *Eutermes* s.lat. and s.str. He gives ample evidence to prove that *Eutermes* has long been wrongly applied to those species with nasuti. Banks shows very clearly that the type of the genus *Eutermes*, as erected by Heer (1849), is a termite known as *Microcerotermes debilis*. Consequently *Microcerotermes* disappears and is replaced by *Eutermes*. The three South African sections of this group are herein accorded generic rank tentatively. *Trinervitermes* and *Subulitermes* probably represent subgenera of *Nasutitermes*, but *Coarctotermes* is without doubt independent.

Hamitermes is the spelling adopted by European authorities. The genus was erected by Silvestri (1901) under the name *Amitermes*. Subsequently Silvestri altered the spelling to *Hamitermes*. As the change may be authorised under Article 19 of the Rules of Nomenclature, Silvestri's revised spelling has been followed.

Mirotermes s.lat. is a genus in which Holmgren (1912) included those here given (and a number of others) as subgenera. So far as the South African kinds are concerned I find it convenient to accept the distinctions as generic.

SYNOPSIS OF GENERA.

I.—*WINGED IMAGOS.**

I. STUMP OF FOREWING PLAINLY DIFFERENT FROM AND DECIDEDLY LARGER THAN THAT OF HINDWING.

A. Radius well separated from Costa with a number of oblique offsets to Costa; Radius without strong sector-like branches to inner margin of wing.

(1) Media reaching to wing-tip; (yellowish insects).

a. Media faintly chitinised; half way between R. and Cu. or nearer to Cu. than R.

(i) With Ocelli, these touching eyes. *Calotermes*

(ii) Ocelli missing. *Porotermes*.

b. Media densely chitinised, close to and parallel with Radius. With ocelli touching eyes. *Neotermes*

(2) Media not reaching wing tip. Small brownish insects. M. joined to R. at half wing-length so forming an elongated cell between R. and M. *Cryptotermes*.

*In this synopsis Radius is equivalent to Sub-costa of Hagen and Sjöstedt, Radial Sector of Holmgren and Comstock and Radius of Desneux.

B. Radius quite close to and parallel with Costa; simple; reaching to wing-tip; both Costa and Radius of equal development. *Schedorhinotermes.*

II. STUMP OF FOREWING PLAINLY LIKE THAT OF HIND-WING, ABOUT THE SAME SIZE OR BUT SLIGHTLY LARGER.

A. Radius well separated from Costa, with a number of oblique offsets to Costa, and WITH SEVERAL STRONG SECTOR-LIKE BRANCHES TO INNER MARGIN OF WING. *Hodotermes.*

B. Radius quite close to and parallel with Costa; both C. and R. of equal development. R. simple, reaching to wing-tip.

(1) Media missing as a rule; weakly developed when present. Cubitus highly developed. Small brownish insects; span 15 mm. *Psammotermes.*

(2) Media always present; well developed but not strongly chitinised, reaching to apex of wing.

a. Head parallel sided, somewhat elongate. Small black insects; males decidedly smaller than females. *Eutermes.*

b. Head never parallel sided; (rounded or broadly oval.)

(i) Costa and Radius, yellow or orange coloured; colour contrasting with more or less smoky membrane of wing. Fontanelle plainly triangular. Antennæ XV to XVII jointed. Insects medium sized; body 10 mm. Span 38 to 45 mm. *Trinervitermes.*

(ii) Costa and Radius concolorous with wing, or, if contrasting, wings clear hyaline, not smoky or brownish.

aa. Antennæ XIX jointed.

1. Largest kinds; Body 16 to 20 mm. Span 54 to 88 mm. Body brown and relatively smooth. Wings hyaline, never smoky. *Macrotermes.*

2. Large kinds: Body 12 to 15 mm. Span 38 to 56 mm. Body usually hairy (exception *T. caffrariae*). Bodies brown or black; wings hyaline, brown, smoky or black. *Termes.*

3. Medium sized: Body 10 mm. Span about 40 mm. Bodies smooth, yellowish brown. Wings hyaline *Allodontermes.*

bb. Antennæ XV to XVIII jointed. Medium sized. Body 10 mm. Span about 30 mm. Bodies smooth, pale yellow to yellowish brown. Wings hyaline. (Compare with *Allodontermes*, which it much resembles.) *Microtermes.*

cc. Antennæ XV to XVII jointed.
Relatively small insects with dark bodies and dark wings.
1. Larger kinds: Body 6 to 8 mm. Span 23 to 27 mm. Wings usually smoky or blackish. Antennæ XV, XVI, XVII. *Cubitermes* and *Mirotermes*.
2. Smaller kinds: Body 5 to 6 mm. Span 19 to 24 mm. Wings usually brownish. Antennæ XV. *Hamitermes*.

II. *SOLDIERS.*

I. NASUTI WITH MANDIBLES REDUCED TO MICROSCOPIC PLATES. HEADS, SEEN FROM ABOVE, PEAR-SHAPED WITH A LONG TUBULAR SNOUT.

A. Head regularly pear-shaped. Body brownish.
(1) Head yellowish or reddish; snout usually darker. *Trinervitermes*.
(2) Head brownish. *Subulitermes*.
B. Head irregularly pear-shaped; sides plainly constricted; wine-coloured. Body black. *Coarctotermes*.

II. HEADS ABNORMAL; MANDIBLES AS LONG OR LONGER THAN HEAD, BLADE-LIKE OR ROD-LIKE. HEADS SHORT AND THICK; SEEN FROM THE SIDE DISTINCTLY TRUNCATE OR DECIDEDLY SLOPING IN FRONT AND ALWAYS WITH A LARGE FRINGED PORE (Fontanelle) ON FRONT.

A. Head not plainly longer than wide, four sided; mandibles blade-like.
(1) Labrum deeply forked; basal joint of antenna smooth. *Cubitermes*.
(2) Labrum with sinuate indented tip but not deeply forked; basal joint of antenna rough. *Procubitermes*.
B. Head longer than wide, four-sided, frontal ridge with a pinched up, pointed protuberance; mandibles rod-like. *Mirotermes*.

III. HEADS NORMAL: CYLINDRICAL SUBCYLINDRICAL OR LENTICULAR.

A. Head long cylindrical (roller-like) about twice as long as wide; eyes missing. Mandibles fairly strong; inbent at tips; cutting margin finely serrate. Small insects. *Eutermes*.
B. Head sub-cylindrical; somewhat flattened; facetted eyes present; mandibles toothed; pronotum flat or introse never plainly sellate.
(1) Mandibles plainly down bent, short, massive; eyes distinct. *Porotermes*.

(2) Tips of mandibles plainly up bent.

a. Head shorter than body; mandibles prominent, teeth large; labrum short, wide, appears rounded; eyes large, concolorous with head. *Calotermes.*

b. Head almost as long as body, very characteristic; in front decidedly truncate and with a distinct frontal cavity; cavity overhung by a sculptured ridge; mandibles short, triangular with small teeth; labrum triangular; eyes small, usually indistinct. *Cryptotermes.*

C. Heads lenticular, flatly arched, oval or sub-oval in dorsal outline; without facetted eyes.

(1) Labrum characteristic.

a. Labrum with a deep median groove and fimbrinate tip; fontanelle large; mandibles short and with acute teeth. *Schedorhinotermes.*

b. Labrum not grooved, triangular, with a distinct cordate, fleshy tip. *Macrotermes.*
[Labrum forked like prongs of catapult; head abnormal. *Cubitermes*, et ante.]

(2) Labrum excluded, except as a secondary character.

a. Mandibles sickle-shaped (characteristic); both alike; both furnished with one strong tooth, the point of which is directed backwards. *Hamitermes.*

b. Mandibles without teeth on cutting margin. Mandibles strong, sword-shaped, tips inbent and upcurved.

(i) Large insects: soldiers of two sizes; labrum with cordate fleshy tip. Smallest soldiers as large or larger than largest workers. *Macrotermes* (et ante).

(ii) Small insects: soldiers about one size; labrum triangular, tip not fleshy. Soldiers not larger than largest workers. *Microtermes.*
[Small insects: head abnormal; mandibles blade-like. *Cubitermes* and *Procubitermes.*]
[Mandibles rod-like. *Mirotermes.*]

c. Left mandible only with one strong tooth (like a step) on cutting margin. Tooth placed at half length. Right mandible may exhibit a faint tooth opposite that on left. In most species, soldiers only a little larger than largest workers. *Termes* (*Termes*).

d. Both mandibles dentate.

(i) Soldiers with facetted eyes.

aa. Head broadly oval or round, slightly arched; mandibles massive, with large sharp triangular teeth; eyes black and conspicuous. Pronotum distinctly sellate. *Hodotermes.*

bb. Head elongate; pronotum not sellate.
1. Mandibles up bent. *Calotermes* (et ante).
2. Mandibles down bent. *Porotermes* (et ante).
3. Mandibles triangular, teeth small. *Cryptotermes* (et ante).

(ii) Soldiers without facetted eyes.
aa. Pronotum flat, semi-lunar, deeply incurvate in front. Head longer than wide, with a large pore in middle, sides parallel. Antennæ stiff, joints with apex swollen. Legs short and stout. *Psammotermes.*
bb. Pronotum not flat, somewhat sellate.
1. Left mandible with several small broad teeth; right with one. Labrum pointed, on the tip a boss. *Apicotermes.*
2. Both mandibles with a decided tooth.
a. Tooth on left step-like, on right triangular. Head oval. Labrum tongue-shaped. *Termes* (*Odontotermes*).
b. On both step-like. Head short rectangular. Labrum as wide as long, sub-trapezoid in front. *Hoplognathotermes.*
3. Left mandible with a wide apical point, below this a distinct notch. Right mandible with a decided tooth (step-like) at half its length. Labrum roundly triangular with a small hyaline tip. *Allodontermes.*
4. Both mandibles alike, both finely serrate. Heads cylindrical. *Eutermes* (et ante).

SYNOPSIS OF HABITS AND FIELD KEY.

I. Living and nesting in trees.
A. Nests in form of simple cells and galleries gnawed out for food and accommodation; almost always located in dead stubs where limbs have broken away. Seldom any external evidence. Abdomen of queens elongated not greatly distended; queens moving freely in nest. No workers present; relatively few soldiers; colony composed of many nymphæ in all stages of development. No earth in nest.
(1) Soldiers fairly large; mandibles large and strongly toothed. Distribution: Natal, Cape, (East and S.E. Coasts). *Calotermes* (2 spp.). *Neotermes* (1 sp).

(2) Soldiers small, very few in colony; mandibles short; head hardly longer than body. Distribution: Natal, Cape (East Coast). *Cryptotermes* (2 spp).

B. Living in dead wood; so far only found in mountainous parts of southern Cape Province. Soldiers with strong toothed mandibles; mandibles plainly downbent; facetted eyes large; accompanied by workers. Biology not well understood. *Porotermes* (1 sp).

C. Making nests of carton in hollows, that are due to decay, in trunks and limbs of standing trees. Soldiers and workers found below long individual galleries of carton extending up and down trunk and branches. Workers boring for food in dead limbs. Soldiers of two very distinct castes, both castes exhibiting a very distinct labrum which is deeply grooved and possesses a fimbrinate tip. Distribution: Coast of Natal and Zululand. *Schedorhinotermes* (1 sp.)

II. Nesting in soil.

A. Nests independent; capable of being lifted out bodily, unless, as sometimes happens, attached to dead roots or stumps. Nests made of a black or black-brown carton like substance. Nests ranging in size from that of the egg of a goose to that of an ostrich, rarely larger. Soldiers small; heads cylindrical, both mandibles alike, both finely serrate. Distribution: General. *Eutermes* spp.

B. Nests never independent.

(1) With little or no surface indication of nest-site.

a. Harvesters. Workers large with brown or black heads and large facetted eyes; to be seen dragging or carrying short grass-lengths into openings in soil. Soldiers large, yellow headed with black eyes and strongly toothed mandibles. Workers may often be found making loose piles of earth like mole-hills, each pile with a clay, tubular core. Nests are large globular cavities in soil; cavities filled with closely set shelving made of a very fragile carton. (Exception, *H. Thomseni*. This species builds a large, hard, clay cone over nest in De Ghoup of the Karroo.) Distribution: General. *Hodotermes*, spp.

b. Fungus growers. Workers feeding on dead grass, wood, and dung, always constructing a canopy of clay. Sometimes found feeding on dead bark and fencing poles.

(i) Nests as large globular cavities with clay brackets and a large fungus garden. Soldiers about as large as largest workers, with one large tooth on left mandible.

aa. Only known from Humansdorp, Cape, S.E. *Termes capensis*.

bb. Distribution: General, except Karroo and Cape, S.W. (Exceptions: making a small mound in the district of George; making a bare patch more or less circular in outline over nest-site in Transkei). *Termes angustatus*, s. lat.

(ii) Nests as very fine tunnels, diameter 2 mm., ramifying in soil; with small adjacent cavities, each containing a small fungus garden.

aa. Fungus gardens like the kernel of a walnut, from one to three inches in diameter. Soldiers not larger than workers with short, toothless, sword-shaped mandibles. Distribution: General, except Karroo and Cape S.W. *Microtermes* spp.

bb. Fungus gardens from 3 to 5 inches in diameter; sub-circular; flat below, arched above, plainly rosette shaped; laminæ radiating from centre. Soldiers but faintly larger than workers; mandibles toothed, left with a decided notch one-third from the apex. Distribution: Northern half of Transvaal and Kalahari. *Allodontermes* (1 sp).

c. Biology unknown.

(i) Reported from Zululand. *Apicotermes* (1 sp.)

(ii) Found at Vryburg. *Hoplognathotermes* (1 sp.)

(2) With marked and often characteristic indications of nest-site.

SECTION I. FUNGUS GROWERS.

a. Nest below a broad flattish and characterless mound or below an assembly of moundlets, each moundlet about 4 inches high and made of firmly cemented earth; nests usually associated with trees or shrubs. Nest cavity large, quite filled with sponge-like fungus garden. Queens largest found; imprisoned in large shapeless cell of clay. Workers often found in great numbers feeding on bark or trees and on posts under sheet-like canopy of clay; commonly found attacking wood work of houses; often found destroying lawns under wide canopies of clay. Soldiers larger than workers with a very distinct step-like tooth on left mandible. Distribution: Natal, Transvaal, Orange Free State and Transkei. *Termes badius* s. lat.

b. Nest-site always indicated by several pits in soil, flat or covered by a raised mound; mouths of pits surrounded with clay pipes; queens large, imprisoned in cells.

(i) Pipes thin walled, tenuous and tapering, sometimes 6 feet high.
Distribution: Transvaal Bush Veld, Kalahari and Vaal River Valley (West).
Termes transvaalensis.

(ii) Pipes thick walled, turret-like, three inches to two feet high.
Distribution: General for Natal and Transvaal. *Termes latericius* s. lat.

c. Nest site covered by mound of loose soil, not unlike that of new grave; usually amongst trees; infrequently becoming compact and hard by weathering; usually with mole-hill like moundlets on or next to main mound. Soldiers large and aggressive with sword-shaped mandibles; queens imprisoned in clay cells.
Distribution: Transvaal, Waterberg area.
Macrotermes waterbergi.

d. Nests in or below hard mounds of cemented earth.

(i) Nests as large cavities, down to 4 feet below soil level. Queens large, imprisoned in clay cells. Mounds fairly characteristic when not grass-grown.

aa. Mound roughly dome-shaped, covered with large knobs or moundlets of hard texture shaped like warts. Soldiers large; aggressive; with sword-shaped mandibles. A destructive species.
Distribution: Foothills of Drakensberg in Eastern low veld of Transvaal and Swaziland. *Macrotermes swaziae.*

bb. Mounds conical.

1. Tall mounds, 10 feet and upwards; may be very large and grass-grown, then often with a clay column at apex. Soldiers with sword-shaped mandibles.

a. Very destructive, found in Damaraland; Ovomboland; Valley of Limpopo; Portuguese East Africa; west of Lebombo Mountains.
Macrotermes bellicosus s. lat.

b. Very destructive, found in Transvaal Eastern low veld.
Macrotermes natalensis f. intermedius.

2. Mounds not tall; 3 to 4 feet or, rarely, 6 feet high.

a. Soldiers with sword-shaped mandibles. Very destructive, found in Natal, Transvaal, Griqualand West, Kalahari.
Macrotermes natalensis s. str. and s. lat.

b. Soldiers with large step-like tooth on left mandible. Mounds low and more often grass covered than bare. Distribution: Natal.
Termes vulgaris.

SECTION II. NOT FUNGUS GROWERS.

(ii) Nests within cellular mounds; nest superficial, never penetrating soil to any great depth.

aa. Mounds usually hemispherical (like a Zulu hut) or roughly conical. In Kalahari sometimes columnar and 6 feet high; elsewhere, seldom more than 2 high and 3 feet in diameter. Surface of mound hard; interior relatively soft and very cellular; cells intercommunicating openly and forming a labyrinth, always more or less filled with short grass lengths. Cellular part never carried down into soil more than 18 to 20 inches.

1. Soldiers nasute. Soldiers with yellow or reddish heads. Distribution: General for Union.
Trinervitermes spp.

2. Soldiers with brown heads. Distribution: Bushmanland.
Subulitermes sp.

bb. Mounds sometimes hemispherical, more often flatly dome-shaped; of hard texture; cells small and cell-walls thick. No provisions stored in nest. Cellular part not carried deep into soil. Soldiers with barbed and sickle-shaped mandibles. Distribution: General, except Natal. *Hamitermes* spp.

cc. Mounds quite small; very hard, usually like a piece of sandstone set in soil; never more than a few inches high and 12 inches in diameter. Soldiers with short thick heads. Often built amongst stones.

1. Soldiers with a forked labrum. Distribution: General. *Cubitermes* spp.

2. Soldiers with basal joint of antenna roughened. Distribution: Transvaal.
Procubitermes sp.

1.—CALOTERMES GROUP.

Genus CALOTERMES Hagen.

Calotermes durbanensis Haviland.
= *Calotermes madagascarensis* Wasmann, Sjöstedt (in part, 1900).

This species belongs to the *C.flavicollis* group. No complete description of the imago has been given, the species being erected by Haviland on the soldier caste only. The imago is well known to me, and I believe the species to be distinct from the insular *madagascarensis*. There appears to be much in which the two are alike, and it is to be remembered that Sjöstedt reduced *durbanensis* to a synonym of Wasmann's species on a comparison of soldiers only. Unfortunately Wasmann's description does not go far enough. However, he describes the pronotum of the winged *madagascarensis* as short, broad and semilunar, a description that does not fit the pronotum of *durbanesis*, which is sub-quadrangular. Similarly, Wasmann's description of the pronotum of the soldier does not apply.

The soldiers of *durbanensis* differ from those of *flavicollis* in not having the prominent third tooth (not counting the apical) shown in Hagen's figure of the left mandible. Judging by the same figure, the soldier pronotum of *durbanensis* appears more like that of *flavicollis* than *madagascarensis* except that the hind margin is rounded, not incurvate in the middle as appears to be the case with both *flavicollis* and *madagascarensis*.

Calotermes braunsi n.sp.

Through the kindness of Dr. Hans Brauns, I have from " The Wilderness " on the Cape South Coast soldiers and nymphs of a *Calotermes*. These I regard as representing an undescribed species. The soldier is readily distinguished from that of *durbanensis* by having three distinct teeth below the apical, as figured for *flavicollis* by Hagen. It differs from both *flavicollis* and

durbanensis in having the front margin of the pronotum angularly indented in the middle. The labrum is longer than that of *durbanensis*, always covering more of the base of the mandibles.

Genus NEOTERMES Holmgren (1911).

Neotermes zuluensis Holmgren.

Holmgren has described a species under this name from material collected by Ivor Trägardh at Lake Sibayi, Zululand. The species is founded on the soldier form, the imago being unknown. The published description is very imperfect, and as far as it goes might relate to *durbanensis*. The imagos of *Neotermes* differ strikingly from those of *Calotermes* inasmuch as the Media runs close to and parallel with the Radius whilst in *Calotermes* it lies about half way between the Radius and Cubitus. I have not met with any imagos or soldiers of *Neotermes* up to the present.

Genus CRYPTOTERMES Banks.

Cryptotermes merwei sp.n.

This termite is to be found at a number of points along the Natal coast. The nests are always in the dead stubs left where limbs have broken away from living trees. Although intermingling with *Calotermes durbanensis* it favours more the flora of the sand dunes behind the sea beaches. However, I have received imagos that cannot be separated from the Natal form from the Albany Museum. These were obtained from the Brak Valley, Grahamstown.

The imago of *merwei* answers well to the description given by Sjöstedt for *C.Havilandi* from Senegal, etc. It is, however, a little smaller and may differ in features not touched upon in Sjöstedt's description. The soldiers are very different from those of *havilandi* as described by Silvestri. The frontal ridge of the head is very slightly incurvate, almost straight. In this it differs from *havilandi*, *senegalensis* and *pseudobrevis*. The clypeo-apical is short, wide, and the front margin distinctly incurvate. The labrum is wide, somewhat heart-shaped in outline; the tip

finely pointed. I have much pleasure in naming this insect after my colleague, Mr. C. P. van der Merwe, as a small return for the many observations he has made for me.

Cryptotermes pseudobrevis sp.n.

Colonies of this species are known to have inhabited the woodwork of certain compositors' desks in the printing works of the "Natal Mercury," at Durban, for a number of years past. Because it has not been found elsewhere and is localised in the centre of that part of the town which has longest been the most closely built over, one is inclined to look upon it as an exotic species.

The heads of the soldiers, in a lateral inspection, agree wholly with the excellent figure of the West Indian *Cryptotermes brevis* Walker published by Nathan Banks (1920). Unfortunately, there appears to be no description of this caste of *brevis*, the species having been erected on the imago. The head of *pseudobrevis* is, as with that of *brevis*, tuberculate in front and smooth behind. There is also a deep cavity in front. Viewed from above *pseudobrevis* exhibits a strikingly bilobed frontal ridge; this is more deeply indented than is the case with *havilandi* and *senegalensis*. Behind the frontal ridge there is a median groove extending back to nearly half the length of the head. From this aspect the sides of the head are so sinuate that the outline resembles that of a squat ewer. The pronotum is cream coloured except for the erected, front corners and thereabouts, where it is brown.

The front corners are well within the boundaries of the sides so that the pronotum may be said to narrow strikingly; they are triangular and flap-like, and so erected that each is marked off from the rest of the pronotum by a distinct groove. The sides and hind margin merge roundly into one another The figure of *brevis* given by Banks does not indicate any striking peculiarity of the pronotum such as that here described for *pseudobrevis*..

The winged imagos before me were killed in the nest before they had become chitinised. They are pale yellow with black

eyes. With them are two breeding males and one female; these are brown. None of the specimens have antennæ.

Hagen's description of the imago of *brevis* might be applied to these except they are larger.

The measurements of the imagos of the several *Cryptotermes* discussed are contrasted below in millimetres.

	merwei	havilandi	brevis	pseudobrevis
Body with wings	8.5	9.0	9.0	11.0
Body without wings . .	5 to 5.9	5.0	4.0	5 to 5.5
F.Wing with stumps . .	7.0	—	—	9.5
F.Wing without stumps	6.2	7.3	—	8.5
Span	15.0	17.0	16.0	20.0

Genus POROTERMES Hagen (1858).

Porotermes planiceps (Sjöstedt.)

= *Calotermes planiceps* Sjöstedt (1904).

= *Porotermes* (*Planitermes*) *planiceps* (Sjöst.) Holmgren 1911).

? = *Calotermes amabilis* Sjöstedt (1911).

This species was described from soldiers and workers found in a dead stick by Dr. L. Perinquey, at Ceres, Cape Province. I understand from Dr. Perinquey that he has also seen the species at Stellenbosch and on Table Mountain. Part of the original type series is in the South African Museum at Cape Town. These specimens I have examined.

I have also a good series of soldiers and workers found by Dr. Hans Brauns in the Montagu Pass, where he kindly made a special search for the species on my behalf. They were found in a fallen piece of dead wood.

The imago of *planiceps* is as yet unknown. Sjöstedt has, however, described and named a winged termite from "Kapland" under the name *Calotermes amabilis*. This exhibits no ocelli, and the absence of these organs coupled with other features leads one to infer that *amabilis* is a *Porotermes* and, probably, the winged form of *planiceps*.

GROUP II.—HODOTERMES.

Genus HODOTERMES Hagen.

Sub-genus *Hodotermes* s.str.
Type *Termes viator* Latrielle (1805) a worker.
Sub-genus *Macrohodotermes* sg. nov.
Type *Hodotermes mossambicus* Hagen.
Sub-genus *Anacanthotermes* Jac.
Type *Hodotermes ochraceus Hagen* (from Persia.)

Hodotermes was created by Hagen (1853) with *T. viator* Latr. as the type. Later (1858) the genus was subdivided by him into two sections; one containing *ochraceus* and *vagans*, the other *mossambicus* and *viator*. Neither section was given subgeneric rank. Jacobson (1904) erected the subgenus *Anacanthotermes* for *H. ochraceus* Burm. This sub-genus was suppressed by Desneux and reconstituted by Holmgren.
The revision here submitted is:

A. Tibiae of imagos without lateral spurs *Anacanthotermes* Jac.

B. Tibiae of imagos with lateral spurs.

a. Styli elongate cylindrical, first wing rib without branchlets to costa. Basal half of gula noticeably chitinized, brown or yellow; left mandible of soldier somewhat straight with first and second teeth short, wide and blunt, not triangular; gula of worker as with imago. *Hodotermes* s. str.

b. Styli atrophied or missing; first wing rib with one or more short oblique branchlets to costa.
Basal half of gula not noticeably chitinised, pallid or mottled with grey or black; left mandible of soldier arcuate, with first and second teeth pointed and triangular; gula of worker as with imago.
Macrohodotermes, sg.n.

Sub-genus HODOTERMES, s.str.

Hodotermes viator (Latr.)
= *H. aurivillii* Sjöstedt (1900).

The synonomy of *Hodotermes viator* (Latr.) is somewhat involved; but from an examination of the type, I have been able to decide that the form hitherto known as *H. aurivillii* Sjöstedt (1900) represents Latrielle's species. In a previous paper of the writer's (1915), wherein a description of the soldier and worker caste of *viator* was set out, the announcement was made that *aurivillii* was quite a distinct species.

It is only recently, however, that I have had the opportunity of inspecting Latrielle's type, this being submitted to me, from the Brussels Museum, through the kindly offices of Dr. L. Peringuey, Director of the South African Museum. It is especially interesting that after a period of over 115 years this specimen should again return, if but temporarily, to South Africa and be sufficiently unique to set at rest what might otherwise have remained debatable.

The type has a recorded headwidth of 4 mm. (Hagen,, Sjöstedt) but a careful measurement shows it to be 3.8 mm. The head is a clear red brown in colour with the pseudo ocelli very distinct, quite sharply defined and bright yellow. The flagelli of both antennae are missing so that only the two basal joints of each organ remain. The mandibles are closely clenched and cannot be examined. The frons exhibits a shallow but distinct transverse depression almost oblong in outline, the hind margin being broken in the middle by a short keel, a projection of the vertex into the depression. The body, as a whole, is an opaque, orange yellow, there being a noticeable and dark band in the transverse furrow of the pronotum. The legs are a pale sordid yellow, but two are present, and from one, a tarsus is missing. Apart from the labels showing it to be Latrielle's type, there are two older labels which I have failed to decipher.

The type is characterized mainly by its unusually large head and it is mainly upon this feature I have connected *aurivillii* with *viator*.

Widely distributed as *Hodotermes* s.s. is throughout the Union south of the Orange River and ample as are my series from certain points, those points are comparatively few and widely separated as may be seen from the accompanying list:

N. W. area: Springbok, Steinkopf, Prieska (Sodium) Van Rhynsdorp.

S.W. area: Malmesbury, Stellenbosch, Elsenberg, Simondium, Groot Drakenstein.

Middle area: Victoria West, Nobelsfontein, Three Sisters, Beaufort West, Krantsvogelkuil, Montagu, Willowmore.

S.E. area: Peddie, Alicedale, Coeney.

Upon the whole each series is fairly representative of the average condition of the particular community each illustrates. This being so it is remarkable that in the Malmesbury series only are there workers that attain the full dimensions given by Sjöstedt for *H. aurivillii*. Quite a number of these workers have a head width of 3.8 mm. In only a few of the remaining series is there an occasional worker with a head width of 3.5 mm. Apart from their wide heads the workers from the Malmesbury district are also more in agreement with Latrielle's type as regards the colour of the head and the striking distinctness of the pseudo ocelli. So much is this the case that one feels sure the type locality of *viator* must be that neighbourhood or somewhere in the country intervening between there and Cape Town of a similar, sandy treeless, nature.

The points upon which Sjöstedt distinguished *aurivillii* from *viator* may be tabulated as follows:

viator.	*aurivillii.*
(a) Mandibles somewhat straight.	somewhat curved.
(b) Left mandible of soldier with third tooth small.	with third tooth very distinct.
(c) Front and hind lobe about equally long in the middle	Front lobe more strongly outcurved than *viator*, front angles more broadly rounded.
(d) Hind margin of pronotum circular (kreisformig).	not so strongly curved. Broad incurved (eingebuchtet) in the middle.
(e) Workers: The workers stand between the larger and the smaller of *aurivillii*, otherwise hardly distinguished.	
Headwidth of worker 4.0 mm. Length 8 mm.	Headwidth 2 to 3.8 mm. Length 7 to 11 mm.

There are three differences here which, taken together, go to show the strong possibility that the soldier, in the Schoenherr collection, identified as *viator* by Hagen was not *viator*. Upon the several points I would like to offer the following remarks.

(a) The mandibles of the largest soldiers in the Malmesbury series are plainly more incurved than are those of the medium sized and smallest. The mandibles of the smaller are as straight as of soldiers of equal size found elsewhere in the Cape S.W.

(b) By comparing camera lucida drawings of the mandibles of the soldiers of this sub-genus, one is able to detect differences in the prominence and orientation of the third tooth of the left mandible as between soldiers of the same series and as between species. Thus the third tooth is more prominent in some soldiers of the Malmesbury series than in others. As between species, so far as my examination goes this tooth is least produced and blunter in *viator* (e.g. *aurivillii*) than in others, especially *H. perinqueyi* and *H. thomseni.*

(c) The difference cited for the anterior lobes and angles of the pronotum furnishes my principal reason for thinking the insect in the Schoenherr collection was wrongly determined as *viator* by Hagen.

(d) The hind margin of the pronotum of all soldiers of *Hodotermes* s. lat. is incurved in the middle. There are differences in the degree of incurvature, but with the exception of one abnormal specimen, I have seen no soldier of which the hind margin of the pronotum could be described as " kreisformig ". This abnormal specimen is one of the Malmesbury series!

(e) The only dimension of any value in comparing the variation of size of workers of *Hodotermes* s. lat. is the headwidth. On this Sjöstedt's statement that the workers of *viator* stand " between " the larger and smaller of *aurivillii* collapses.

Latrielle's description (1805) is quite brief and may be quoted in full:

TERMES VOYAGEURS — *Termes viator.**

> Je n'en connais que la larve qui est d'un brun clair, avec la tête grosse, brune; les yeux noirs, a facettes trés distinctes, placés sur les côtes, a peu de distance des mandibles; deux points jaunatres á la place des petits yeux lisse. Du Cap. d. Bon. Esp.

Burmeister (1839) described certain imagos from South Africa (vorbirge du G. Hoff.) as those of *viator.* How much guesswork there was about this determination cannot now be told, but it

*It is evident from the title here bestowed that Latrielle was to some extent acquainted with the characteristic habit of this species; that of moving freely over the surface of the ground.

must have been a conjecture. Burmeister speaks of the head being dark coloured, mouth, antennae and legs paler. He adds that the species inhabits sandy treeless parts where the cone-shaped mounds appear from a distance like the huts of the inhabitants.*

Hagen (1858) furnished a more elaborate description of *viator* comparing it with *H. mossambicus*. That part of the description which applies to the imagos was drawn up from several dried males and females, the types of Burmeister. The account of the worker clearly relates to Latrielle's type, but mention is made of five " younger " forms of paler colour. The description of the soldier was based upon two specimens, both of which Hagen for some reason regarded as dwarfed—(nicht ganz ausgewachsens).

One of these two soldiers belonged to Schoenherr's collection in the Stockholm Museum (e.g. that used by Sjöstedt for his diagnosis); the imagos were collected by Krebs and Mund. Hagen says that the relationship of imago with worker and soldier is based only upon a conjecture although confirmed by the specimens in the Berlin Museum belonging to one collection. From this it may be gathered that a soldier and five workers accompanied Krebes' and Mund's imagos. Unfortunately, here, as with the type, it is not nowadays possible to place precisely the locality where the specimens were obtained.

In his description of the imago Hagen says: " Dark brown, head and thorax black brown; the mouth, the antennae, the front margin of the pronotum, the tips of the tibiae and tarsi yellowish". It can only be inferred that the unmentioned parts of the limbs were dark brown; although this is not supported by either the older description of Burmeister (1839) or the newer of Sjöstedt (1900). However that the rest of the legs are dark may be gathered from the fact that Sjöstedt found an imago from Hex River to agree with the types; this could only have had dark legs

*The mounds referred to could only have been those of *Trinervitermes sp.* At Malmesbury Mr. W. R. Birch, of the Division of Entomology, has found a colony of *H. viator* nesting in a deserted mound of *Trinervitermes*. The interior of the mound being converted into a typical *Hodotermes* nest. The description of the country applies to the environment of *aurivillii*.

of which part of each tibia and the whole of each tarsus was yellowish.*

Silvestri (1908) with specimens before him from Namaqualand (Luderitzbucht and Steinkopf) reduced *aurivillii* to a synonym of *viator* stating that it was clear from the description and the analytical table of Sjöstedt, that the difference was one of size only. The writer has not seen any repudiation by Silvestri of his determination. But, as a footnote by no means germane to the discussion it appends, Sjöstedt (1911) briefly states that in a private letter to him Silvestri admits that he was wrong in reducing *aurivillii* to a synonym of *viator*. However, the Namaqualand form which Silvestri had before him is distinct from *viator*. It is referred to later as *H. silvestrii*.

The description of *viator* given by the writer (1915) applies to the form usually met with in the neighbourhood of Paarl and Stellenbosch. The soldiers and workers from this district seem to be regularly smaller in stature than those found at Malmesbury but the mandibles of the soldiers are not relatively straighter. The imagos from the two centres do not differ.

As relatively large soldiers and workers have been collected at Groot Drakenstein which intergrade between this smaller (Stellenbosch, Paarl) and the larger (Malmesbury) it is not wise to separate the smaller although it might be considered, tentatively, as *H. viator* f. *hageni*.

In conclusion, I take as *Hodotermes viator* (Latr.) that species found in the S.W. Cape to which the descriptions cited all apply fairly well. It is a species that can only be satisfactorily recognised by the following characters of the imago.

Males often decidedly smaller than females.

Above dark red-brown; below abdomen pallid, often a sordid brownish yellow, always sharply contrasting with the dark coloured legs. Pronotum not quite so dark as

*Hagen states that nothing is known of the habits of *viator* and questions the remarks of Burmeister. He presumes *viator* to be the species referred to by Lichtenstein as working underground in the vicinity of the Seacow River, a southern tributary of the Orange River. The insect seen by Lichtenstein was no doubt a *Macrohodotermes*.

the head, the anterior lobe often mottled with yellow, often with a dark median line. (In dried material the anterior lobe noticeably pale yellow).

Abdomen above brown or yellow brown, always less dark than the head or the thorax, always dark in contrast with the underside. Legs brown or red brown except that the tarsi, the tips of the tibiae and the tips of the femora are yellow. (The apical half of the tibia or less may be yellow). The outline of the pronotum is characteristic in that the margin of the front lobe bends into the front margin of the anterior lateral corners without being there angularly indented and in that the curve of the margin of the front lobe is somewhat acute.

The range of this termite is not defined but it may be described as a S.W. species common to the districts of the Cape, Stellenbosch, Paarl and Malmesbury.

Hodotermes peringueyi sp.n.

The imago of this species is readily distinguished from that of *H. viator* by the uniform pale yellow colour of the legs, only the sides of the coxae being brown; by the wide, short pronotum in which the margin of the front lobe meets the anterior corners at a sharp angle and by the golden yellow colour of the tergites of the abdomen. The third tooth of the left mandible of the soldier is more produced and acute than in viator.

This is essentially a S.E. termite of indefinite range but known to inhabit the districts of Albany, Peddie and Alexandria.

Hodotermes thomseni sp.n.

The imagos of this species differ from any others in their small size, the largest females attaining the dimensions of the smallest males of *viator*, *peringueyi* and *silvestrii*. The pronotum is somewhat like that of *H. peringueyi*, but relatively longer. The legs and abdomen are coloured as are those parts of *viator*, but are uniformly paler. The third tooth of the left mandible of the soldier is as in *peringueyi;* the dentation of the mandibles

and the sculpture is more sharply defined in this caste than in other species; this difference is plainly discernible when the soldiers of *thomseni* are compared with those of other species.

This termite inhabits that portion of the Great Karroo known as De Ghoup where it builds, over its nest sites, extremely hard conical mounds, remarkable for their symmetry. Many of these mounds attain a height of between three and four feet. It is the only *Hodotermes* building a mound over its nest site. Similar mounds have been seen in the Karroo in the northern part of the Ceres district where the environment is like that of De Ghoup.

Hodotermes silvestrii sp.n.
= *H. viator* sens. Silvestri (1908).

The imagos of this species are much in agreement with *H. viator*. They differ in having the tergites of the abdomen golden yellow like *H. peringueyi*, except that first tergite has a wide, brown band extending across the anterior half and that the pronotum is parti-coloured; it may be described as being somewhat cream-coloured with a wide transverse brown band. The outline of the pronotum closely approaches that of *viator*, but the margin of the front lobe bends into that of the anterior lateral corners at a more definite angle.

The mandibles of the soldiers agree closely with those of *viator* as regards the third tooth of the left.

This is essentially the Namaqualand-Bushmanland *Hodotermes* s.s. and ranges from van Rhynsdorp to the Orange River. Imagos have also been taken at Victoria West.

Hodotermes faurei sp.n.

The imagos of this species are structurally in agreement with *H. silvestrii*. Otherwise they approximate those of *H. viator* but are darker, especially below, the abdominal sternites being brown except that the first two or three may be yellowish in the middle. The mandibles are brown, not yellow and only the tips of the tibiae and the tarsi are pale, being pale brown. Only dealate imagos known. This may prove to be a dark form of *H. silvestrii*. Locality Victoria West.

Sub-genus MACROHODOTERMES sg.n.

The definition of species in this sub-genus is fraught with many difficulties, and it seems to me that the wide variety of forms scattered over Southern Africa represent but very few species. Having examined soldiers, workers and imagos from many parts I have decided to recognise only three species. These are *Macrohodotermes mossambicus* (Hagen) sensu latus, *Macrohodotermes karrooensis* mihi and *Macrohodotermes pallidus* sp.n. Each different terrain seems to give rise to its own peculiar " form " or topographical race. Especially is this the case in the *mossambicus* series, wherein from the largest (*transvaalensis* mihi) to the smallest (*pulcher* Sjöstedt) I have a series of intergrading imagos.

Here I may say that the published measurements of *pulcher* are somewhat conflicting; this is especially noticeable when comparing the " wing-lengths " and the " span ", seeing that in the latter no allowance is made by Sjöstedt for the width of the pronotum between the wing roots. According to Sjöstedt's basis of measurements, in his Monograph, the length of the wing does not include the stump. In the case of *pulcher* he gives the wings as 21 to 23 mm., and the span 42 to 46 mm. or just twice the length of the wing. The body length is given as 10 to 13 mm. and I can only think these measurements refer to shrunken insects with the heads in a vertical position. A type of *pulcher* in the British Museum has, with the head bent down, a length of 13 mm.; this with the head outstretched would be about 15 mm. The wings of two types in the British Museum, including the stump, measure respectively 20 and 23 mm., and the span of these should be 41.5 and 47.5 respectively.

In the subjoined table are given certain measurements in millimetres of six series of imagos. The range of each includes males and females, the larger dimension is that of the largest female the smaller that of the smallest male. All the material is preserved in alcohol. The body is measured with the head outstretched. The wing-length is that of the forewing without the stump.

	P.	P.R.	J.	L.	K.	pulcher *a*	pulcher *b*
Body & wings	34-31.5	32-27	31-30	30.5-29	29-25	—	25-23
Body	18-17	18-15.5	17-15	17-16.5	16-13	14	13-10
Fore-wing	28-25.5	25.5-20	24.5-22	24-23	22-19.7	23-20	23-21
Span	62-57	56-45	55-49	52-51	51-42	47.5-41.5	46-42
Head-width	3.5-3.1	3.3-3.0	3.3-3.0	3.4-3.2	3.1-2.7	—	—

P = Pretoria; P.R. = Pienaars River: J = Johannesburg; L = Lovat; K = Knapdaar; pulcher *a* = measurements of types in British Museum; pulcher *b* = Sjöstedt's published measurements.

Macrohodotermes mossambicus (Hagen) sens. str. (1853, 1862)
= *Hodotermes mossambicus* Hagen (1853, 1862).
= *Hodotermes mossambicus* Hagen (1858 in part, nec. soldier).

In the strict sense *mossambicus* is a species only known, even today, by the imagos and workers. No soldiers have ever been obtained from the type locality.

There are no less than five records of the occurrence of the species in South Africa, but no one of these can be regarded as technically valid.

Hagen (1858) gave the first record and this calls for some explanation. In 1853 he published a preliminary note on the Termites of Mossambique in which he named certain imagos *Hodotermes mossambicus*. The amplification of this note had a delayed publication and appeared in Peter's "Reise nach Mossambique" published in 1862. The amplification refers only to imagos and workers.

In the interim, Hagen (1858) published his Monograph and into the description of *H. mossambicus*, therein given, he inserted a description of the soldier caste. This description was based upon a single, dry and imperfect specimen collected by Dorhn at Pniel Mission Station in Griqualand West. The type locality of this soldier is, therefore, the valley of the Orange River between Kimberley and Barkly West.

Although it is not known with any degree of certainty whereabouts in Portuguese East Africa Peters obtained his imagos, the probability is that it was in the valley of the Zambesi River, or quite a thousand miles away from where the soldier came from.

Sjöstedt (1900) recorded the species from the Cape, the specimens being collected by Meyer at " Orlog River." This probably refers to the Oorlog Kloof Rivier in Calvinia, but may refer to the Oorlog Poort Rivier in Aliwal North. The imagos exhibited much larger measurements than the type, and these, being included in the description, have led to some misconceptions. Sjöstedt (1900) is also responsible for reducing *havilandi* to a synonym of *mossambicus*. Silvestri (1908) recorded *mossambicus* from the Kalahari and Damaraland. His determination seems to have been based on Sjöstedt's " hold all " description.

Holmgren (1913) determined specimens of soldiers from Zululand as *mossambicus*. He follows Sjöstedt; the record relates more properly to *havilandi*.

The writer (1915) recorded *mossambicus* from Marico (Transvaal), Kimberley (Griqualand West) and Somkele (Zululand). The last record relates to *havilandi*, the two former to *transvaalensis*.

Macrohodotermes mossambicus sub sp. *havilandi*.
= *Hodotermes havilandi*. Sharp and Haviland.

It is customary to credit Sharp with the description of *havilandi*. He appears to have selected the name for it, but it was described by Haviland. It is regarded by Sjöstedt and Holmgren as *mossambicus*. The species is only known by the soldier caste; the imagos await discovery. In the biological sense it is distinct from any in the rest of the Union and occupies a separate terrain. The soldiers differ from any others I have examined in having the pronotum narrower than the meso- and metanota and the labrum less acute.

Localities: Zululand; Swaziland; Natal, in the valley of the Tugela River only.

Macrohodotermes mossambicus sub.sp. *pulcher.*
= *Hodotermes pulcher* Sjost. (1905).

Although, as I have shown, *pulcher* imagos intergrade with those of other forms, here linked up under the subspecific name *transvaalensis*, it is sufficiently removed therefrom and from *mossambicus* s.str., to hold subspecific rank. According to Sjöstedt the types were obtained in the Orange Free State. I place with *pulcher* a series of imagos captured at Knapdaar in the Cape Province. The following are measurements from the Knapdaar series:

	males.	females.
Body, with wings	25 to 26 mm.	28 to 29 mm.
Body, without wings	13 to 14	15 to 26
Forewing, with stumps	21	23 to 24
Forewing, without stumps	19.7	21.5 to 22
Span	42	48 to 51
Head-width	3.1	2.7

Macrohodotermes mossambicus sub.sp. *transvaalensis.*
= *Hodotermes transvaalensis* Fuller (1915).
= ,, *pretoriensis* ,, ,,
= ,, *warreni* ,, ,,
= ,, *braini* ,, ,,
= ,, *mossambicus* Hagen, Silvestri (1908).
= ,, ,, Hagen (1858) (in part, soldier nec imago).

Under the one subspecific name *transvaalensis* I propose to bring together a number of series which, in the broad characters of the imagos so far found, agree with *mossambicus* s.str. but vary in their size and wing measurements so that their dimensions are both greater and smaller than those of *mossambicus* s.str.

As with the imagos so with the soldiers there is much variation, but the more this is studied the more the soldiers from one locality merge into those from another. However, all seem to agree as regards the general nature of the thorax and in the features of this to differ from the sub-species *havilandi* and from *karrooensis* mihi.

The pronotum is as wide or wider than the meso- and metanotum, as it is with *karrooensis* soldiers, but it is relatively longer and not so deeply incurvate. The hind margin of the mesonotum is broadly curvate, not produced as in *karrooensis* but agreeing with this feature in *havilandi*. The hind margin of the metanotum is produced as is the case with both *havilandi* and *karrooensis*.

Judging from specimens of soldiers from Kimberley and Barkly West, the soldier described by Hagen (1858) belongs here.

H. pretoriensis mihi, founded on soldiers, should rank as a *form* of the subspecies.

H. warreni mihi, of which the measurements of the imago are given under L in the foregoing table, should also rank as a *form*.

H. braini mihi is given as a synonym in the belief that the soldiers on which the species was based were members of an immature colony of *transvaalensis*, the peculiar character of their mandibles being due to nanism.

Macrohodotermes karrooensis (Fuller).

= *Hodotermes karrooensis* Fuller (1915).

This species is readily recognised by its imagos which differ from all others in their uniform yellow colour, only the wing-stumps being brown. The wings are a pale brown and exhibit a more generalized scheme of venation than do those of any others I have examined. Including the stumps, the forewings measure 31 to 32 mm. and the span is, approximately, 66 to 67 mm.

The largest soldiers are characterised by a distinct mound in the frons depression. The pronotum is short, decidedly incurvate behind and always as wide or wider than the meso- and metanotum. Both meso- and metanotum are produced behind and the margin of the produced part is slightly incurved.

Localities: Middelburg (Cape); Victoria West; Montagu.

Macrohodotermes pallidus sp.n.

The imagos of this species may be recognised by their pallid legs and the presence of two yellow patches on the frons. These patches rest on the clypeo-frontal suture and extend back to the ocellus spots (pseudo ocelli). In size the species approximates *pulcher*.

	Females.	Males.
Body with wings	28-30	24-26
Body	16	13.5-14
Forewing and stump	22.5	19-21.5
Forewing, without stump	21.5	20-20.5
Span	48-50	42-45
Head-width	3.1	2.6-2.7

The soldiers of *pallidus* have not been obtained, but there is much possibility that this is the termite referred to by Lichenstein.

Locality: Olivewood, Cape Province.

III. PSAMMOTERMES GROUP.

Psammotermes allocerus Silvestri (1908).

This is probably synonymous with *P.hyberstoma* Desneux (1902) in which case *P.fuscofemoralis* Sjöstedt (1904) and *P.assuanensis* Sjöstedt (1912) will almost certainly fall to *P.hybostoma.* I can, however, only indicate a possible synonomy arising out of my examination of lengthy series of imagos, soldiers and workers from Namaqualand and Ovomboland.

The following is a synopsis of the examinations referred to:—

(*a*) The imagos from Namaqualand and Ovomboland agree entirely with the description given by Sjöstedt for *fuscofemoralis* (1904). The antennæ of all examined are composed of XVI joints except one of XV joints. The type *fuscofemoralis* is stated to have antennæ of XVII joints but, subsequently (1912), Sjöstedt announced that the majority had XVI-jointed organs. I find the fontanelle larger and brighter in the females than in the males, turbinate in outline, the narrowed apex directed forward. The wing venation I have already dealt with (1920).

(b) The soldiers intergrade very regularly from very small to very large; the majority being of medium size. A series of measurements specially taken for this paper show the ranges to be as follows:*

*In my "Studies upon the Post-embryonic Development of the Antennæ of Termites," Annals, Natal Mus. IX, 2, 1920, p. 291, I have recorded a series of head widths for *P. allocerus.* In error only half the width of the heads measured is given so that it is necessary to double the figures to get the correct range. Thus treated the measurements will not be found to be at variance with the present statement.

Total length	4.1	to	11 mm.
Head width	0.88	to	1.9 mm.
Head and mandibles . .	2.2	to	3.7 mm.

There is a regular increase of about 0.10 mm. in the head width as from 0.88 to 1.4 mm.; there is then a break of 0.20 mm., the largest ranging in head width from 1.6 to 1.9 mm. It is only these few odd large soldiers of 9 to 11 mm. long that could possibly be regarded as majors. I have found the right mandible to be regularly as long as the head is wide, but the head length is variable as may be seen by the following contrasts:

	mm.	mm.	mm.	mm.
H.W. . .	1.0	1.2	1.3	1.4
H.+M. . .	2.0—2.5	2.2—2.7	2.3—3.0	2.7—3.1

It is readily seen from this that some heads are visibly more elongate-rectangular than others. To this it may be added that the largest soldiers have the heads more regularly rectangular than the lesser, and the sides straighter, some even faintly incurved.

(c) An examination of many soldier mandibles shows considerable differences. In the larger soldiers these organs are broader and coarser than in the smaller. Apart from this all mandibles differ extremely, both left and right, as regards the dental armature. Generally speaking, the teeth of the mandibles of the smaller soldiers are more acute and more antrose than those of the larger soldiers, but this does not hold good for all. The right mandible always exhibits a large step-like tooth below its arcuate, apical point; below this tooth there may be 2 or 3 quite distinct subtriangular teeth, or there may be an irregular series of knob-like teeth; any one of these may have a simple rounded apex or a notched apex. In one mandible I have noted three pointed teeth, and below these two knobbed teeth, giving six teeth to the right mandible. A suggestion of an extra tooth is often to be found on the cutting edge of the apical point. Scarcely two right mandibles are to be found that are quite alike.

There is more superficial regularity with the left mandible, but here also an extra tooth often occurs at half the length of the apical point. Leaving this out of consideration, left mandibles that are more or less regularly serrate usually exhibit 7, 8 or 9 teeth; the more inferior of the series may be rounded knobs and not triangular. Exceptional left mandibles are also to be met with which exhibit only 3 or 4 teeth.

(d) Throughout the series the pro-, meso- and metanota of the soldier are subject to slight variations of contour. With the pronotum the sides of some tend to be more oblique than of others, and to vary from being straight to faintly curvate or incurvate. The front margin is always decidedly, angularly indented, but in the larger soldiers the two margins meeting at the median notch are more arcuate than in the case with smaller soldiers. The hind margin is always faintly incurvate. The mesonotum is relatively large and usually rounded behind, the metanotum is usually shorter and has a more or less roundly truncate hind margin.

The head of every soldier exhibits a dorsal fuscous band extending forward to and widest at the clypeal suture, where it terminates. This has the appearance of being the visible sign of a duct below the cuticle. However, there is never a superficial groove upon the frontal area.

(e) The clypeus of the soldier is short and incrassate, the anterior margin broadly curvate; it can be described as a weal-like elevation with distinct hollows on each side.

(f) With the largest soldiers the labrum is decidedly inflated and darker than the head (somewhat alizarine) except that the pointed extension is white, and that this colour narrowly margins the tapering edges of the inflated part. With large and small soldiers the labrum narrows toward its base.

(g) With all soldiers the fontanelle is more or less distinct and has fuscous edges

(h) The soldier antennae range from X to XVI joints; very rarely are those of the smallest soldiers clearly moniliform.

(i) With the largest soldiers the head is plainly depressed in the middle.

Silvestri in his remarks upon *allocerus* states that it is quite distinct from *P.hybostoma* Desneux inasmuch as the major soldiers are smaller and have antennae with a maximum of XIII joints. The second contention falls away. The difference in size appears considerable, e.g. maximum length 11 against 10 to 15 mm., head-width 1.9 against 2.5 mm. It is, however, quite possible for *hybostoma* to be a large locality form or race just as is the worker type of *Hodotermes viator* Latr.

Sjöstedt's soldier of *P.fuscofemoralis* must be, from the description, quite agreeable with the small soldiers of *allocerus*. As between his *fuscofemoralis* and *assuanensis* the only differences are size, the number of teeth to the left mandible and the hollows on either side of the clypeus (epistome). All these are features of the soldiers of *allocerus*. It is true that for both these insects Sjöstedt describes a channel (Rinne) running forward from the fontanelle, but this reference is conceivably to the duct which is exhibited by the soldiers of *allocerus*.

To these remarks it may be added that Silvestri (1914) has determined the *Psammotermes* found by him in Senegal as *fuscofemoralis* and Holmgren (1913) determined as this species that from Zululand.

If future studies show the synonomy to be as here set out, then we have a variable and remarkable species almost encircling the African continent. That this should be the case is all the more interesting because it is contrary to my experience with South African species in general, most of which have a limited range, and then tend to vary more or less decidedly according to one environmental factor or another.

The insect now under reference as *P.allocerus* certainly extends from van Rhynsdorp, on the south, to Angololand, and may be classed as one peculiar to the Namib veld. It is, however, known to exist in the valley of the Orange River to at least one hundred miles from the sea. The part of Zululand from which Holmgren reported *fuscofemoralis* I have never visited, but I know it to be of a sandy nature. There the conditions are tropical and peculiar.

Sjöstedt has thrown out the suggestion that, since he found a preserved soldier with a piece of grass stem in its jaws, *Psammotermes* harvests as does *Hodotermes*. This is not so and, further, one never sees a soldier of the sub-genus *Macrohodotermes* outside of a burrow.

Although I have never had the opportunity of studying the biology of *Psammotermes* my correspondents on the Orange River have been very good in trying to clear up this matter for me and my colleague, Mr. F. Thomsen, endeavoured to locate the nest definitely when in Little Namaqualand. The species feeds upon dry grass haulms and upon wood. On the grass it feeds under a canopy of clay and attacks wood just as do fungus growers. It fills up the parts removed with sand-particles firmly cemented together. It has been taken injuring the wood of houses, vineyards, and fencing posts, being particularly destructive to the last mentioned. Pieces of damaged posts are before me, and it is clear that in the parts replaced by termite cement nest conditions obtain, the cells in the cement being found crowded with imagos, soldiers, workers and half-grown forms.

IV. RHINOTERMES GROUP.

Schedorhinotermes putorius (Sjöst.) sub species *australis* subsp.n.

I have hitherto regarded as *Rhinotermes putorius* Sjöst. those representatives of the genus coming under my notice at Beira (Portuguese East Africa) and Durban (Natal). These determinations (1915, 1919 and 1920) related to soldiers, workers and dealate imagos. I have since obtained one winged imago from Durban.

Sjöstedt has described two other species, *lamanianus* (1911) and *bequertianus* (1913) both from Congo; from this region he has also reported *putorius*. However, *putorius* has been recorded from quite a number of places. Sjöstedt gives the following localities; Cameron, Fernando Po; Gabun, Congo (1900); Sierre Leone (1904); Congo (1905); Usambara (1906). Holmgren (1913) determined material from several parts of Zululand as *putorius*, and Silvestri (1914) reports the species from French Guinea, Cameroon, and Gold Coast. Wasmann (1911) treats his material from the Upper and Lower Congo as *putorius*.

The imago of *bequertianus* is unknown.

According to Sjöstedt, *lamanianus* differs from *putorius* in the following features:

(a) The imago is distinctly larger; joint III of its antennae is clavate and much larger than joint II; the wings are much longer, 12 mm. as against 9 to 10 mm.

(b) The major soldier has a more rectangular head, less narrowed in front; the hind margins of the pronotum and mesonotum are distinctly incurvate; the abdomen is almost quite smooth.

As to whether these features are sufficient to establish the biological independence of *lamanianus* from *putorius* I am not able to say. Our South African insect is certainly more agreeable with the description of *lamanianus* than with that of *putorius*. However, I prefer to treat it as a sub-species of *putorius*. The imagos

are not longer in the body than *putorius*, but the wings are longer and agreeable with the measurements of those of *lamanianus*. The soldiers have the hind margins of the pronotum and mesonotum incurvate as with *lamanianus*, but the heads are not at all rectangular. The following is a table of comparisons:

	putorius.	*lamanianus*.	*putorius-australis*.
IMAGO			
Antennæ	XX joints	—	XX (or, rarely, XXI) joints.
Joint III	distinctly longer than II.	clavate, longer than adjoining	clavate, as long as IV + V.
Span	21-22 mm.	29 mm.	29.2 mm.
Forewing, length	9-10 mm.	12 mm.	with stumps 14.1 mm. without 12.7 mm.
Forewing, width	3 mm.	3.3 mm.	4 mm.
Total length	8-9 mm.	9 mm.	8 to 9 mm.
Body & wings	12-13 mm.	16 mm.	15.7-16.7 mm.
Head length	—	—	1.5-1.6 mm.
Head width	—	—	1.7-1.8 mm.
MAJOR SOLDIER			
Antennæ	XVI	XVII	XVI-XVIII
Total length	5-5.5 mm.	6 mm.	7-8.5 mm.
Head & Mands.	2.2 mm.	2.7-2.9 mm.	2.5-2.6 mm.
Head width	—	1.7 mm.	1.7-2 mm.
WORKER			
Total length	5-6 mm.	—	4.8-6.6 mm.
Head width	1.3 mm.	—	1.2-1.6 mm.
Antennæ	XVI, XVII	—	XVI-XVIII.

To be continued.