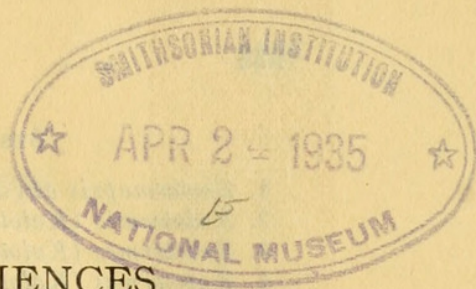


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**THE TEMPLETON CROCKER EXPEDITION OF THE
CALIFORNIA ACADEMY OF SCIENCES, 1932**

No. 20

THE TERMITES

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The termites taken by the Zaca Expedition of the California Academy of Sciences, under Captain Templeton Crocker, represent 44 colonies belonging to 16 species. The most extensive collections were made in the Galapagos Islands but various islands visited and the ports of call on the western coast of Mexico and Costa Rica are represented. Lists of the species in systematic order and by localities are given below. Discussions of the species in systematic order complete the report.

Most of the collections were made by Dr. A. E. Larsen, physician of the expedition. The unusually complete records of locality and habits are due to his interest. Some collections were made by Mr. Templeton Crocker, leader and sponsor of the expedition and some by Mr. M. Willows in charge of entomological collections as noted in the specific discussions.

Types are in the Museum of the California Academy of Sciences, paratypes in the U. S. National Museum and in the author's collection.

April 3, 1935

SYSTEMATIC LIST OF SPECIES WITH LOCALITIES

1. *Zootermopsis angusticollis* (Hagen), Guadalupe Island.
2. *Kalotermes* (*Kalotermes*) *hubbardi* Banks, Socorro Island.
3. *Kalotermes* (*Kalotermes*) *immigrans* Snyder, Galapagos Islands.
4. *Kalotermes* (*Kalotermes*) *jouteli* Banks, Socorro Island.
5. *Kalotermes* (*Kalotermes*) *marginipennis* (Latreille), Socorro Island.
6. *Kalotermes* (*Kalotermes*) *minor* Hagen, Enseñada, Lower California.
7. *Kalotermes* (*Kalotermes*) *pacificus* Banks, Galapagos Islands. (= *K. tabogae* Snyder)
8. *Kalotermes* (*Neotermes*) *larseni* Light, new species, Cocos Islands.
9. *Kalotermes* (*Cryptotermes*) *darwinii* Light, new species, Galapagos Islands.
10. *Kalotermes* (*Cryptotermes*) *fatulus* Light, new name, Galapagos Islands. (New name for *Cryptotermes occidentalis* Light.)
11. *Heterotermes pallidus* Light, new species, Puentarenas, Costa Rica.
12. *Heterotermes orthognathus* Light, Puerto Vallarta and Acapulco, Mexico; Bat Island and Braxilito Bay, Costa Rica; Galapagos Islands.
13. *Nasutitermes* (*Nasutitermes*) *guatemalae* (Holmgren), Maria Madre and Puerto Vallarta, Mexico; Port Parker and Braxilito Bay, Costa Rica.
14. *Mirotermes* (*Mirotermes*) *panamaensis* Snyder, Port Parker, Costa Rica.
15. *Microcerotermes struncki* (Sörensen) (?), Puentarenas, Costa Rica.
16. *Microcerotermes bouveri* (Desneux) (?), Acapulco, Mexico.

LIST BY LOCALITIES

MEXICO

Enseñada, Lower California.

1. *Kalotermes minor* Hagen.

Maria Madre, Tres Marias Islands, State of Nayarit.

1. *Nasutitermes* (*Nasutitermes*) *guatemalae* (Holmgren).

Acapulco.

1. *Heterotermes orthognathus* Light.
2. *Microcerotermes bouveri* (Desneux) (?).

Puerto Vallarta.

1. *Heterotermes orthognathus* Light.
2. *Nasutitermes* (*Nasutitermes*) *guatemalae* (Holmgren).

Guadalupe Island.

1. *Zootermopsis angusticollis* (Hagen).

Socorro Island.

1. *Kalotermes* (*Kalotermes*) *hubbardi* Banks.
2. *Kalotermes* (*Kalotermes*) *jouteli* Banks.
3. *Kalotermes* (*Kalotermes*) *marginipennis* (Latreille).

COSTA RICA

Bat Island.

1. *Heterotermes orthognathus* Light.

Braxilito Bay.

1. *Heterotermes orthognathus* Light.
2. *Nasutitermes* (*Nasutitermes*) *guatemalae* (Holmgren).

Puentarenas.

1. *Heterotermes pallidus* Light, new species.
2. *Microcerotermes struncki* (Sörensen) (?).

Port Parker.

1. *Nasutitermes* (*Nasutitermes*) *guatemalae* (Holmgren).
2. *Mirotermes* (*Mirotermes*) *panamaensis* Snyder.

COCOS ISLAND

1. *Kalotermes* (*Neotermes*) *larseni* Light, new species.

GALAPAGOS ISLANDS

1. *Kalotermes* (*Kalotermes*) *immigrans* Snyder, Chatham, Indefatigable, James, Albemarle, Jarvis, Narborough, South Seymour and Tower Islands.
2. *Kalotermes* (*Kalotermes*) *pacificus* Banks, Albemarle and James Islands.
3. *Kalotermes* (*Cryptotermes*) *darwini* Light, new species, Albemarle, Charles and James Islands.
4. *Kalotermes* (*Cryptotermes*) *fatulus* Light, new name, Albemarle and James Islands.
5. *Heterotermes orthognathus* Light, Indefatigable Island.

Only two species of termites have been reported from the Galapagos Islands (Banks 1901), *Kalotermes pacificus* Banks and *K. galapagoensis* Banks. The descriptions of these two species are exceedingly inadequate, the illustrations of little value, if not actually misleading, and the types which were deposited in the California Academy of Sciences were destroyed in the fire of 1906. *K. galapagoensis*, based on alates only, is reported as having a length of only 9.5 millimeters with the wings, and is smaller by nearly 1.5 millimeters, therefore, than *K. perparvus* Light (1933), the smallest known species of the subgenus. Also, if Banks' drawing has any significance, it indicates a relatively long, narrow pronotum. It seems possible, indeed probable, therefore, that *K. galapagoensis* is not a species of *Kalotermes* s. str., but is based on the alate of the species described below as *K. (Cr.) darwini* n. sp. This seems more probable since the median does run to the tip of the wing in that species which is true of Banks' description and figure.

There remains the possibility that Banks may have had the alates of *K. immigrans* Snyder (see p. 236) but the smallest alates I have seen are considerably larger than Banks' measurements indicate unless this be thought to be due to the use of dried specimens. It seems probable that *K. galapagoensis* will remain a *species inquirenda*, at least until the termite fauna of the Galapagos Islands is very thoroughly known, when, by the process of elimination, it may be possible to determine what species Banks really had.

As brought out in the discussion under that name, Banks' *Kalotermes pacificus* is considered to be the same as *K. tabogae* Snyder from Panama, necessitating the reduction of that species to synonymy.

Three of the species taken in the Galapagos occur also on the American mainland, *Kalotermes pacificus* Banks (= *K. tabogae* Snyder) in Panama, *Heterotermes orthognathus* in Mexico and Central America, and *Kalotermes immigrans* in Ecuador. The other two, while new species, are related to American species. *K. immigrans* is

found also in the Marquesas, on Fanning and Jarvis islands and in the Hawaiian Islands. Its presence in the Marquesas and Hawaii may be explained on the basis of distribution by ocean currents but it seems almost certain that it must have been introduced by man on Fanning and Jarvis.

GENUS **ZOOTERMOPSIS** EMERSON 1933

Zootermopsis angusticollis (Hagen)

Termopsis angusticollis Hagen

Material.—Three soldiers from Guadalupe Island collected by Mr. Willows from a fallen dead tree at an elevation of 2,500 ft.

Discussion.—While the posterior enlargement of the head is almost lacking in these soldiers and the head is narrower than in most soldiers of the species from California the head-mandible index is 0.71 and the head index 0.85, well within the range of these values for *Z. angusticollis* (Sumner 1933). Two stout spines are present on the front of the fore tibia as in other *Z. angusticollis* soldiers examined and in contrast to the single spine present in the *Z. nevadensis* soldiers examined.

It seems probable that a reexamination of the earlier collections of the termites of this genus from Guadalupe Island (Light 1933) will show them to agree in the above characters.

GENUS **KALOTERMES** HAGEN, sensu latiore

Subgenus **Kalotermes** sensu strictiore Holmgren

Kalotermes hubbardi Banks

Three collections of this species were made on Socorro Island. Two by Mr. Crocker were from dead trees, one a mile inland and the other only about 100 yards from the shore. The third collection was made by Mr. Larsen only a quarter of a mile from the shore.

This is the first record of this species from Socorro since the original report (Light 1930a) on the basis of a collection by T. T. Craig. It is apparently abundant there as it is on the west coast of Mexico.

Kalotermes immigrans Snyder

Material.—Ten collections from the following eight islands of the Galapagos: Albemarle, Chatham, Narborough, James, Jarvis, Tower, Indefatigable and South Seymour.

K. immigrans was first known from the Hawaiian Islands (Snyder 1924) where it was believed to be an introduced species, hence the specific name. Later it was taken by Kirby on Fanning Island

(Light 1932) and a collection taken from the wood of a wrecked schooner on Jarvis Island was found to be of this species (Light 1932). Still later the Pacific Entomological Survey found it in the Marquesas (Light 1932) and the Zaca Expedition took it as noted above in the Galapagos Islands. Earlier, as material received from Dr. Alfred E. Emerson shows, it was taken by Beebe in the Galapagos. Finally it appears in collections just received from Dr. Wolfgang von Hagen taken on the coast of Ecuador together with my *Metaneotermes athertoni*, a new subgenus (1932) from the Marquesas.

The question therefore of the center of origin of *K. immigrans* and the means whereby it attained so wide a range is a tangled one. Being a wood-dwelling termite it may have been distributed in part by human agencies as seems very probable in the case on Jarvis. Ocean currents may well be invoked in the case of the Marquesas and the Hawaiian Islands but not in that of Fanning which lies in the counter equatorial current.

Kalotermes jouteli Banks

This species was reported from Socorro Island for the first time on the basis of its presence in the collection made by T. T. Craig (Light 1930a). It is represented in the Zaca collection by a single soldier present with the collection of *K. hubbardi* made by Dr. Larsen in a dead tree about a quarter of a mile from the shore of that island.

Kalotermes marginipennis (Latreille), Light 1933

Termes mexicanus Walker.

Kalotermes montanus Snyder.

Kalotermes tuberculifrons Snyder.

not *K. marginipennis* Banks and Snyder.

This species is abundant in the higher altitudes in Mexico (Light 1933) but absent near the coast. It is surprising therefore to find it in Socorro Island. The collection consists of the two queens and a king taken by Mr. Willows at an elevation of 1000 feet in the interior of the island.

Kalotermes minor Hagen

This species is represented by a single collection taken from an unused railroad tie at Enseñada, west coast of Lower California.

Kalotermes pacificus Banks

Kalotermes tabogae Snyder 1924, 1926.

Material.—Two collections both containing numerous soldiers and nymphs, one from a dead branch on a living tree 100 yards inland on James Bay, James Island, Galapagos Island, and one from a similar location at Vilaville, Albemarle Island.

Discussion.—This species has been taken previously only from Panama and was described by Snyder (1924, 1926) as *Kaloterme tabogae*. It becomes necessary to consider *K. tabogae* synonymous with Banks' very poorly described *K. pacificus* for the following reasons. *K. pacificus* is clearly a species of *Kaloterme* s. str. as brought out by Banks' descriptions of both alates and soldiers. It was fairly common as Banks had "a number of specimens from Albermarle Island" "and from Narboro Island." Now the only two species of the subgenus found by the Zaca Expedition were *K. immigrans* and the species here identified with *K. pacificus* and agreeing with *K. tabogae* Snyder. *K. pacificus* Banks must be either *K. immigrans* Snyder or *K. tabogae* Snyder. If no other evidence were available, the smaller size and greater abundance of *K. immigrans* would point to it. Fortunately a collection, supposedly from the Galapagos, and given by Banks to Silvestri, is available for study, due to the kindness of Emerson. This collection contains both an alate and a soldier which rules out *K. galapagoensis* of which only the alates were known to Banks. It is assumed, therefore, that these must be paratypes of *K. pacificus* Banks. The soldier of this collection agrees perfectly with those in the Zaca collections, which in turn agree perfectly with autotypes of *K. tabogae* Snyder from Panama. The alate in Banks' collection also agrees exactly with an autotype alate of *K. tabogae* from Snyder.

The status of the alates associated directly or indirectly with the soldiers of this species in the Zaca collection is less satisfactory. With one collection of soldiers and nymphs are two pale, incompletely pigmented alates. With the other is a dealate male and taken in the same branch were a dealate female and a physogastric, completely apterous (third form) male. Now all of these reproductives agree in size with *K. immigrans* and not with *K. tabogae* as described by Snyder and as exemplified by the Banks' collection and Snyder's autotype from Panama. Further, the color of the two dealates agrees with *K. immigrans* and not with *K. pacificus* (= *K. tabogae*) and no consistent difference has been found. We face the dilemma, therefore, of assuming either that the alates of the two species intergrade or that these reproductives do not belong with the soldiers of *K. pacificus*. These two possibilities will be considered separately.

First of course must be kept in mind the complete agreement of Banks' Galapagos specimen and that of Snyder from Panama. That the specimens are from the Galapagos, although listed with a question mark by Silvestri, seems certain since Banks knew the Panama species and Snyder, who was familiar with Banks' material, described *K. tabogae* much later (1924, 1926) and since the soldier agrees perfectly with soldiers from the Galapagos in the Zaca collection.

The next question is as to the distinguishing characters of the soldiers of the two species, if any. It must be said that the two species are very close together as to soldier characters. They agree as

to the shape of the gula, length, shape and size of mandibles, number and location of teeth, number and size of antennal segments, shape and location of eye, details of sculpture in region of the rim of the antennal foveolae and anterior margin of head capsule. A prolonged and careful comparison of all soldiers of both species from all regions represented brings out, however, the following slight but consistent differences:

1. Pigmentation of *K. tabogae* is always lighter than in *K. immigrans* and usually much lighter.
2. The eye is white in *K. tabogae* even when the head is darkly pigmented while it is typically blackish in *K. immigrans* (one small individual from Hawaii is an exception).
3. The teeth of *K. tabogae*, especially the anterior two of the left mandible, project more strongly, the first being directed more anteriorly and the second being pointed and medially directed.
4. The anterior margin of the pronotum of *K. tabogae* is only faintly biconvex and the antero-lateral corners are sharp and projecting, forming the most anterior portion of the pronotum, while in *K. immigrans* the anterior margin is strongly biconvex and the corners strongly rounded, the most anterior part being some distance mediad to them.
5. The sides of the pronotum are strongly convergent in *K. tabogae* with broadly rounded postero-lateral corners and shallowly but definitely emarginate posterior margin, while in *K. immigrans* the sides are much less strongly receding, the postero-lateral corners *squarely* rounded and the posterior margin very faintly emarginate if not straight.

For these reasons it seems impossible to consider these variants of one species. On the other hand the presence of *K. immigrans* reproductives in close association with *K. tabogae* soldiers and nymphs does not seem an unlikely situation since *K. immigrans* was very abundant and particularly since incipient colonies were abundant. For example, one vial of *K. immigrans* soldiers and nymphs contains a number of reproductives evidently representing several incipient colonies. It seems reasonable to suppose, therefore, that the collection before me contains no *K. pacificus* reproductives.

Subgenus *Neotermes* Holmgren

Kalotermes (*Neotermes*) *larseni* Light, new species

Figs. 1-4 and Plate 9, fig. 3.

Material.—A single collection including alates, soldiers and nymphs collected by Mr. Crocker on June 26 in a dead fallen tree one-half mile from the shore of Wafer Bay, Cocos Island.

DIAGNOSIS

Alate.—Generally brown, wings and ventral surface pale; eyes about 0.5 mm. in diameter, separated from ventral margin by about 0.30 mm.; ocelli large, touching the eye; Y suture fine but visible; a pale gamma-shaped spot on frons; antennae of

17/18 segments; pronotum more than twice as wide as long; radius sector with three long and four or five very short anterior branches.

Soldier.—Head relatively broad (head index 0.70) and high (ratio of height to width 0.82); antennae of 16 segments; 3rd as thick as 1st, longer than 2nd or 4th; pronotum much less than one-half as long as wide, deeply but roundly concave in front; gula twice as wide in front as behind, sides converging gradually from anterior end.

DESCRIPTIONS

Alate.—Generally brown above, head and sternites darkest, pronotum lighter; ventral sclerites, legs, antennae and costal veins of wings light brown; central areas of meso- and meta-nota whitish.

Head (fig. 2) squarish, bulging slightly behind eyes and converging in front. Y suture narrow but distinct; a faint additional Y marking on the frons.

Eyes truncated in front, longer than high, not strongly projecting, separated from lower margin of head by slightly more than half their vertical diameter and from posterior margin by one and one-half this diameter.

Ocelli large, about same size as antennal foveolae, touching eye below, oval, with long axis directed forward and upward at an angle of about 45° , slightly drawn out at point of juncture with Y suture.

Antennae of 17 or 18 segments; 3rd about as long as 2nd when 17 segments; 4th shortest, very short when 18 segments.

Pronotum (fig. 2) wider than head, broadly concave in front, roundly emarginate in the center behind; sides strongly convex, receding into biconvex posterior margin; antero-lateral corners rounded.

Head, pronotum, legs, and abdominal sclerites with prominent reddish-yellow hairs.

Wing membrane pale, transparent: median vein (fig. 1) separated from radial sector by same distance as separates radial sector from radius; transverse branches of median weak; radius joining costa near middle of wing near level of origin of first anterior branch of radius sector; radius sector with 3 or 4 long oblique anterior branches.

Measurements in millimeters of alates of *Kaloterms* (*Neoterms*) *larseni* Light, new species.

Length with wings.....	14.	-16.
Length without wings.....	8.	
Length of head to tip of labrum.....	1.92	
Length of head capsule.....	1.50-	1.59
Width of head through eyes.....	1.70	
Width of head capsule.....	1.53	
Maximum diameter of eye.....	0.50-	0.60
Minimum diameter of eye.....	0.48	
Length of ocellus.....	0.21	
Maximum length of pronotum.....	1.06-	1.08
Minimum length of pronotum.....	0.93-	0.96
Width of pronotum.....	1.95	
Length of fore wing with scale.....	13.	
Length of fore wing scale.....	1.44-	1.56
Width of fore wing.....	3.3	
Pronotal index.....	0.55	

Soldier.—Head shading from light yellow-brown behind through light reddish brown to dark reddish brown on front margins, pronotum pale with darker margins; body and legs pale to light yellow; antennae dark reddish brown near base, pale distally.

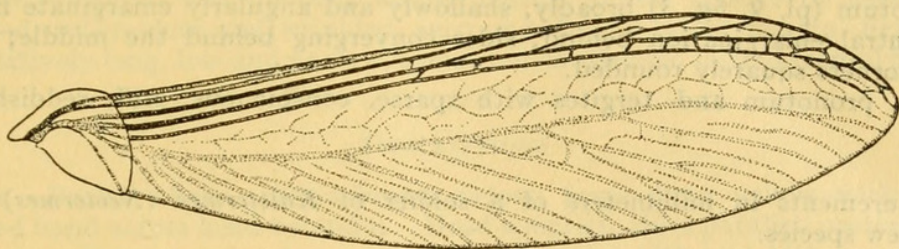


Fig. 1

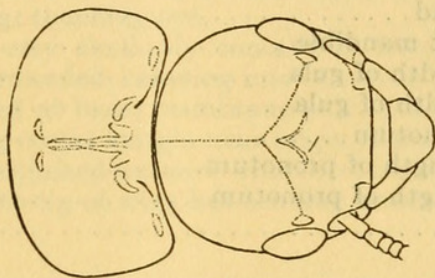


Fig. 2

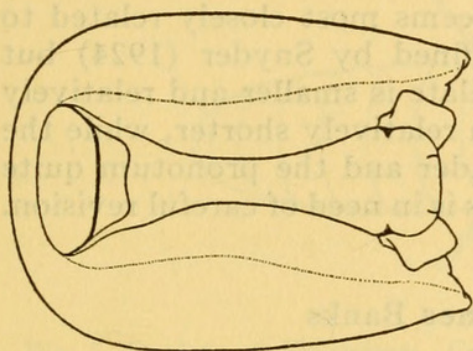


Fig. 3

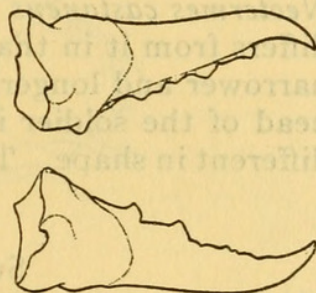


Fig. 4

Figs. 1-4. Camera lucida drawings of *Kaloterмес (Neoterмес) larseni* Light, new species.

1. Right fore wing. $\times 6$.
2. Head and pronotum of alate. $\times 13$. Posterior emargination not indicated.
3. Head capsule of soldier in ventral view to show gula. $\times 14$.
4. Mandibles of soldier. $\times 14$.

Head (pl. 9, fig. 3) relatively short, head index 0.70; sides of head weakly convex especially at level of ocelli, converging from ocelli forward; postero-lateral corners rounding into straight posterior margin. Head high, head height index 0.82.

Frons with declivity of about 45° ; with broad, shallow median groove narrowing posteriorly and extending back to about middle of head: Median suture of head white, conspicuous; lateral sutures visible; eyespot large, white; ocellus spot distinct (pl. 9, fig. 3).

Gulamentum (fig. 3) about twice as wide near anterior end as at narrowest point, sides converging gradually from near anterior end. Antennae of 16 segments (pl. 9, fig. 3); 3rd segment chitinized, as thick as 1st, longer than 2nd or 4th.

Mandibles as in figure 4.

Pronotum (pl. 9, fig. 3) broadly, shallowly and angularly emarginate in front, with central emargination behind; sides converging behind the middle; antero-lateral corners squarely rounded.

Head, pronotum and tergites with sparse, conspicuous, stiff, reddish-brown hairs.

Measurements in millimeters of a soldier of *Kalotermes* (*Neotermes*) *larseni* Light, new species.

	mm.
Length of head capsule.....	3.6
Width of head.....	2.52
Height of head.....	2.07
Length of left mandible.....	1.92
Maximum width of gula.....	.83
Minimum width of gula.....	.36
Width of pronotum.....	2.65
Maximum length of pronotum.....	1.32
Minimum length of pronotum.....	1.08
Head index.....	0.70

Type.—C. A. S. Ent. No. 3912.

Systematic Affinities.—This species seems most closely related to *Neotermes castaneus* (Burmeister) as defined by Snyder (1924) but differs from it in that the head of the alate is smaller and relatively narrower and longer and the pronotum relatively shorter, while the head of the soldier is shorter and broader and the pronotum quite different in shape. This group of species is in need of careful revision.

Subgenus *Cryptotermes* Banks

Kalotermes (*Cryptotermes*) *darwini* Light, new species

Plate 9, figs. 1 and 2; figs. 7 and 8.

Material.—Seven collections of this species by the Zaca Expedition are all from the Galapagos Islands, four from Albemarle Island, two from Charles Island and one from Sullivan Island. In addition I am able to report a collection of soldiers made by Dr. Beebe on Gardner Island available through the kindness of Dr. Alfred Emerson and Dr. Harold Kirby, Jr. Several of the colonies were in standing dead trees, others in fallen branches. One colony contained alates on May 25th and dealates were taken in other collections.

DIAGNOSIS

Alate.—Generally brown with pale, faintly brown wings: a dark V-shaped band across head behind frons, head parallel-sided; antennae of 15 segments; eyes and ocelli large for genus; eyes separated from lower margin of head by slightly less than their own short diameter; ocelli about half as wide as eyes; median vein not bent up to join radius sector but sending several branches to it beyond middle of wing. Ratio length of pronotum to length of fore wing scale about 0.6.

Soldier.—Frontal rim bilobed, widely flaring; dorsal surface of head black, excavated, tuberculate and wrinkled, surrounded by a raised margin, flat above; head relatively long, low and narrow, somewhat constricted behind frontal rim.

DESCRIPTIONS

Alate.—Brown above, yellow-brown below; frons dirty yellow with a dark V-shaped band across head behind it. Head squarish, sides parallel, postero-lateral corners, broadly rounded. Antennae of 15 segments, 13th and 14th longest, each twice as long as 3rd which is about as long as 2nd and 8th and longer than 4th, 5th, 6th, or 7th. Eye large for genus, separated from lower margin by somewhat less than its own short diameter; ocellus large, about as high as half the short diameter of eye; nearly as high as long; touching eye.

Pronotum widely but very shallowly concave in front and faintly but widely emarginate behind, sides rounded, receding into biconvex posterior border.

Wing strongly narrowed at base; membrane pale, delicate, with very fine ornamentations; radius joining costal margin near origin of first branch of radius sector; radius sector with four chitinized anterior branches; median closer to cubitus than to radius sector; running to tip of wing but sending several vertical branches to the radius sector.

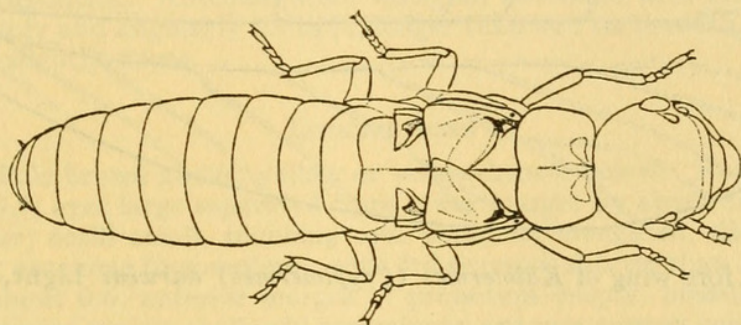


Fig. 7. Dealate of *Kaloterme (Cryptoterme) darwini* Light, new species. $\times 13$.

Soldier.—Back and lower sides of head, cervical sclerites and anterior margin of pronotum yellowish brown; frons, top and upper sides of head black; antennae white, abdomen pale brownish; in life "a bright yellow thoracic area separates the deep black head from the pale brownish abdomen" (Larsen in lit.).

Blackened areas of head (pl. 9, figs. 1 and 2) rugose, tuberculated. Head with widely flaring bilobed frontal rim, followed by an irregular lateral constriction behind which the sides swell out again, minimum width being found at about the anterior third and maximum width at about the posterior third behind which the margins round into the flatly convex posterior margin.

Dorsal concavity (pl. 9, figs. 1 and 2) roughly quadrangular, anteriorly somewhat indented by median notch in frontal rim, bounded laterally by upraised longitudinal ridges, which end anteriorly in the frontal rim, and are connected posteriorly by a somewhat convex transverse ridge. Head relatively long and narrow for the genus, greatest width about two-thirds of greatest length. Frontal rim elevated and projecting, frons making less than a right angle with the horizontal plane of head; frontal cavity deep and regular, separated by an inconspicuous median ridge running down from the notch; frontal rim thickened above the antennae (pl. 9, fig 2) which lie in a longitudinal groove in the outer lower portion of this thickening. Antennae (pl. 9, fig. 2) of 13 or 14 segments; 3rd narrowest, clavate, somewhat chitinized, often incompletely separated from 4th.

Pronotum with broadly but very shallowly convex posterior margin; postero-lateral corners rounded; sides convex, strongly contracted anteriorly; anterior margin deeply, roundly, and broadly, concave; antero-lateral corners sharp, projecting forward over head, set off from lateral margins by a notch.

Measurements in millimeters of soldier of *Kaloterme* (*Cryptoterme*) *darwini* Light, new species.

Length over all.....	5.40
Length of head to center of frons.....	1.25
Length of head to side of frons.....	1.44
Minimum width of head.....	0.97
Maximum width behind middle.....	1.14
Width of head across center of frons.....	1.10
Maximum height of head.....	0.86
Minimum height of head.....	0.81
Width of pronotum.....	1.20
Maximum length of pronotum.....	0.88
Minimum length of pronotum.....	0.63

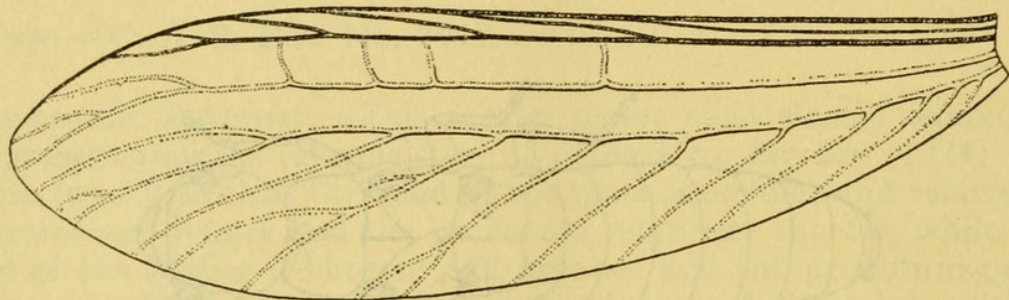


Fig. 8. Left fore wing of *Kaloterme* (*Cryptoterme*) *darwini* Light, new species. $\times 13$.

Type.—C. A. S. Ent. No. 3913.

Systematic Position.—This species is closely related to *Cryptoterme brevis* Walker and *Cr. piceatus* Snyder. The reproductives, however, are considerably smaller in every way, and differ in relative size of eyes, pronotum, etc., while the soldiers differ in that the head is decidedly lower and narrower, and is more constricted behind the frons, while the frons flares much more widely, and the dorsal surface is flattened.

Biology.—The frontal cavities of the heads of most of the soldiers in the collections were filled with a mass of granular material which also covered the mouth parts and lower side of the head in most cases. Dr. Larsen reports that when disturbed they threw out this yellowish material from the head region and would be found with the head lying in a pool of the yellowish liquid. The liquid is almost certainly regurgitated food which issuing from between the mouth parts would seem to come from the neck. It seems probable that this is a defensive mechanism against ants. It is interesting as being a new departure in termite economy.

Kalotermes (**Cryptoterme**s) **fatulus** Light, new name

Plate 9, fig. 4; fig. 6.

*Kaloterme*s (*Cryptoterme*s) *occidentalis* Light 1933 [preoccupied by *K. (Rugiterme*s) *rugosus* var. *occidentalis* Silvestri 1903].*Cryptoterme*s sp. ? Light (1930).

Material.—Two collections, one of king and queen and a soldier from James Island, Galapagos, and one of soldiers only, from Albe-marle Island, the first in the dead branch of a living tree, the other in a small dead bush.

DIAGNOSIS

Dealate.—Small and delicate; eye separated from lower margin by about two-thirds its short diameter; ocellus small; pronotum long, more than half as long as wide; ratio of length of pronotum to length of fore wing scale 0.87.

Soldier.—Small, head (pl. 9, fig. 4) short and broad, nearly as broad as long; low behind, high in front; frons making slightly less than a right angle with horizontal plane of head; frontal rim flaring, deeply notched; dorsal surface with a median longitudinal groove which runs back onto posterior third; head and frons with no conspicuous rugosities. Antennal scale vestigial; antennae with eleven segments; pronotum deeply and angularly concave, longer than half its breadth, antero-lateral corners only slightly acute.

DESCRIPTIONS

Dealate.—Pale brown above, yellow or yellow-brown below. Head broad, head index about 0.9; eyes large separated from lower margin by about two-thirds their short diameter; ocelli small, touching eye, obliquely elongated, directed forward and upwards; antennae (incomplete), with 3rd segment shorter than 2nd; pronotum long, index about 0.6; anterior margin of pronotum deeply, broadly, and evenly excavate; posterior margin shallowly emarginate, anterior corners squarely rounded, sides rounded, receding posteriorly into posterior margin.

Measurements in millimeters of dealates of *K. (Cryptoterme*s) *fatulus* Light, new name, from the Galapagos Islands.

	Female	Male
Length without wings.....	4.41	4.56
Length of fore wing scale.....	.78	.90
Length of head to tip of labrum.....	1.04	1.07
Length of head capsule.....	.84	.83
Width of head capsule.....	.78	.76
Width of head with eyes.....	.87	.87
Long diameter of eye.....	.25	.27
Short diameter of eye.....	.20	.22
Short diameter of ocellus.....	.06	.08
Long diameter of ocellus.....	.12	.12
Width of pronotum.....	.81	.87
Maximum length of pronotum.....	.59	.61
Minimum length of pronotum.....	.53	.57
Length of hind tibia.....	.66	.66

Soldier.—Frons and anterior half of head black, posterior half mahogany to light brown; mandibles dark reddish black; anterior margin of pronotum dark brown; irregular areas just behind the anterior margin of the pronotum, the cervical

sclerites, and the tips of the maxillary palpi, brown; other parts very pale yellow to whitish.

Blackened portions of head (pl. 9, fig. 4) not rugose or wrinkled but with very fine tuberculations or very fine wrinkles. Frontal rim somewhat flaring, with conspicuous median notch, and followed somewhat posteriorly by a shallow constriction behind which the sides of the head are somewhat swollen; postero-lateral corners rounding shortly into nearly straight posterior margin.

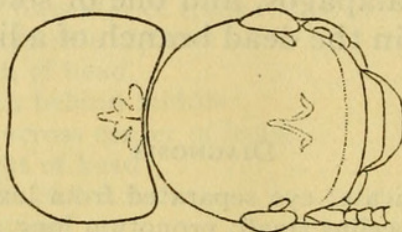


Fig. 6. Head and pronotum of alate of *Kaloterme (Cryptoterme) fatulus* Light, new name. $\times 24$.

Head small, short and broad, about 1.0 mm. long and 0.96 mm. wide; head low behind and high in front due to uplifted frons; dorsal surface of head marked by broad sunken area behind the frons which is lower than frontal rim or the posterior third of head and a narrow median groove extending back onto the posterior third; anteriorly this groove begins at the posterior end of a ridge running back from the frontal rim. Frons making just about, or slightly more than, right angle with the horizontal plane of head; frontal concavity regular, relatively shallow and without any marked protuberances; antennal scale vestigial.

Mandible short, sharply incurved, antennae of 11 segments; 1st and 2nd large and chitinized, 3rd short, clavate, 3rd and 4th smallest, subequal.

Pronotum deeply and somewhat angularly concave in front; antero-lateral corners somewhat acute; sides rounded, rounding and receding into faintly emarginate posterior margin; anterior margin roughened.

Measurements of soldier of *Kaloterme (Cryptoterme) fatulus* Light, new name.

	James Island	Albemarle Island
Length over all.	4.26	
Length of head to center of frons.	0.9	0.93
Length of head to side of frons.	0.98	1.02
Minimum width of head.	0.94	0.96
Maximum width behind middle.	0.96	0.96
Width of head across center of frons.	1.00	1.02
Maximum height of head.	0.75	0.84
Minimum height of head.	0.67	0.75
Width of pronotum.	0.89	0.9
Maximum length of pronotum.	0.59	0.6
Minimum length of pronotum.	0.48	0.53

Systematic Position.—In 1930 I reported a single dried dealate *Cryptoterme* collected from Socorro Island by T. T. Craig. In 1933 I gave the name *K. (Cryptoterme) occidentalis* to a new species represented by pinned alates in the collection of the California Academy of Sciences. The collection by Larsen from James Island

contains a king and queen and a soldier which seem to represent the same species although the condition of the Socorro and Mexican material makes the comparison difficult.

Since the name *occidentalis* is preoccupied by Silvestri's *Kalotermea rugosus* var. *occidentalis* (1903) the species is given the new name *K. (Cr.) fatulus*.

The presence of soldiers has made possible the description of that hitherto unknown caste.

GENUS **HETEROTERMES** FROGGATT

(= *Leucotermes* Silvestri)

Heterotermes pallidus Light, new species.

Figure 5

Seven dealate reproductives of this species with one first instar nymph were taken from an old log lying high on the beach at Puentarenas, Costa Rica. These evidently represented incipient colonies and were located so near to soldiers and workers of *Microcerotermes struncki* (Sörenson) as to have been included with them.

It is interesting to find the incipient colonies of this species of *Heterotermes* in wood as is often the case with *Reticulitermes*. This is in contrast to observations made on *H. aureus* in the Colorado Desert which show it to start its colonies in the soil rather than in wood.

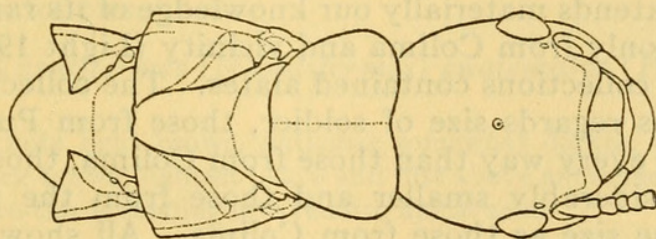


Fig. 5 Dealate of *Heterotermes pallidus* Light, new species. $\times 24$.

DIAGNOSIS

Alate.—Small, head 0.85 mm. wide through eye; generally pale in color; nota convex, mesonotum longer than wing scale and not covered by it; eye large, sharply truncate in front; ocellus vestigial, anterior wing scales short, 0.64 mm. long.

DESCRIPTION

Alate.—Generally pale brown to yellow, head especially pale with a white area just back of fontanelle (as in *H. maculatus* Light). Eye relatively large, separated from lower margin of head by a little less than its short diameter, sharply truncate in front. Ocellus very small, vestigial. Pronotum with broadly rounded corners,

posterior margin with only faint suggestion of emargination. Nota strongly convex, mesonotum extending beyond anterior wing scales.

Soldier unknown.

Measurements in millimeters of Dealate of *Heterotermes pallidus* Light, new species.

Length of head to tip of labrum.....	1.20
Length of head capsule.....	0.81
Width of head through eyes.....	0.85
Maximum diameter of eye.....	0.20
Minimum diameter of eye.....	0.17
Maximum length of pronotum.....	0.52
Minimum length of pronotum.....	0.49
Width of pronotum.....	0.65
Length of anterior wings scale.....	0.64

Type.—C. A. S. Ent. 3937.

Systematic Position.—Its very short wing scales, convex nota, small size and pale color serve to separate the species from all the other described American species of the genus. It seem probable that it is the alate of *H. orthognathus* Light but in the absence of a collection including both soldiers and alates it must be considered a separate species.

***Heterotermes orthognathus* Light**

Five collections from the following localities have been determined as belonging to this species: Acapulco, Mexico; Puerto Vallarta, Mexico; Braxilito Bay, Costa Rica; and Indefatigable Island, Galapagos. This extends materially our knowledge of its range, it having been reported only from Colima and vicinity (Light 1933).

None of the collections contained alates. The collections fall into three groups as regards size of soldier, those from Puerto Vallarta being larger in every way than those from Colima, those from Braxilito Bay, considerably smaller and those from the Galapagos of about the same size as those from Colima. All showed a remarkable agreement in proportions as brought out below.

Measurement in millimeters of soldiers of *Heterotermes orthognathus* Light.

	Galapagos	Puerto Vallarta	Braxilito Bay
Length of head.....	1.50	1.62	1.26
Width of head.....	0.90	0.92-1.02	0.78
Length of left mandible, ..	1.05	1.15	0.99
Width of pronotum.....	0.69	0.78	0.61
Head index.....	0.60	0.61	0.64
Head mandible index....	0.70	0.70	0.71
Head pronotum index... ..	0.77	0.77	0.76
Maximum width of gula.		0.41-0.42	
Minimum width of gula..		0.18-0.20	
Gular index.....		0.43-0.50	

Nasutitermes (*Nasutitermes*) *guatemalae* (Holmgren)

Material.—One colony from Maria Madre Island, Tres Marias Islands, Mexico; one from Braxilito Bay, Costa Rica; and two from Port Parker, Costa Rica.

Discussion.—The black headed nasutes of the subgenus *Nasutitermes* present a very difficult taxonomic problem which will only be settled by a careful comparative study using great numbers of extensive colony collections taken over large areas. It will be necessary to determine the nature and extent of intracolony variation, which undoubtedly is great, the intercolony variation within given localities and the geographical variation within a species. At present identifications must be considered tentative and be based when possible upon both alate and soldier characters.

The collections here considered to belong to *N. guatemalae* show considerable variation in characters of the nasutes. The alates present in the collection from Tres Marias (June 25) and those from Port Parker (July 5) agree perfectly with alates from Guerrero collected by von Hagen and identified as *N. guatemalae* by Emerson (in lit.) after comparison with type alate material.

These alates differ from *N. (N.) nigriceps* (Haldeman) (Light 1933) in the much larger eye and the close approach of the ocellus to the eye. The nasutes are characterized by darker color, generally larger heads, which are relatively broader and with shorter rostra.

Since this nasute has not been described a brief diagnosis with measurements follows.

Nasute of *Nasutitermes* (*Nasutitermes*) *guatemalae* (Holmgren)

Tergites and nota light brown, antennae somewhat darker, sternites and legs lighter, head black-brown, lightest below and just above antennae. Rostrum dense black in basal two-thirds shading into reddish apical zone.

Head very broadly ovate in dorsal view; minimum width (anterior) more than half of maximum width; contraction index 0.62. Dorsal profile of head flat in general but with a distinct median convexity set off by two narrow concavities. Rostrum short, not at all uplifted.

Measurements in millimeters of Nasute of *Nasutitermes* (*Nasutitermes*) *guatemalae*.

Length of head with rostrum.....	1.68
Length of head.....	1.20
Length of rostrum.....	0.48
Head rostrum index.....	0.48
Width of head.....	1.02
Head index.....	0.93
Minimum width of head.....	0.66
Contraction index.....	0.65

GENUS **MICROCEROTERMES** SILVESTRI

Six nearctic species of this genus have been reported: *M. exiguus* (Hagen), *M. struncki* (Sørensen), *M. bouveri* (Desneux), *M. arboreus* Emerson, *M. septentrionalis* Light and *M. gracilis* Light. The first three species are very imperfectly described, especially *M. exiguus*, which must be considered a *species inquirenda*.

Two species are represented in the material under consideration, each by a single collection and each by soldiers and workers only. These I have identified as *M. struncki* and *M. bouveri* in the absence of alates or of authentic soldier types with which to make comparisons. Such identifications are difficult and must be considered tentative. The species in question are clearly very different from *M. septentrionalis* and *M. gracilis*. From *M. arboreus* they differ in that the head is not largest just behind the antennae. *M. exiguus* cannot be definitely identified. They must therefore be considered to be either *M. struncki* and *M. bouveri* respectively or new species. The agreement is close but not entirely satisfactory in certain regard as is brought out in the discussion of the species. Diagnostic characters, measurements and illustrations are given to enable future workers to check the identifications.

Microcerotermes struncki (Sørensen) (?)

Figure 9.

A single collection from a log, lying high on the beach at Puentarenas, Costa Rica, has been identified as belonging to this species. Sørensen's (1884) description is inadequate. The agreement with Silvestri's (1903) figure is excellent, however. Holmgren's (1910) figure is evidently not this species, the head being much shorter and wider and the characteristic narrowing of the head anteriorly, as shown in Silvestri's figure and in these soldiers from Costa Rica, is lacking.

The proportion of the head (fig. 9) agrees exactly with those given by Silvestri (head index 0.62) but the mandibles are relatively longer. Otherwise the agreement is excellent.

The great distance between Costa Rica and southern Brazil where Sørensen's and Silvestri's collections were made adds to the uncertainty of this identification.

Measurements in millimeters of a soldier of *Microcerotermes struncki* (Sörensen) (?) from Puentarenas, Costa Rica.

Length.....	3.96
Length of head without mandibles.....	1.46
Length of mandibles.....	.85
Width of head.....	.89
Width of head at antennae.....	.69
Width of pronotum.....	.54
Maximum width of gula.....	.32
Minimum width of gula.....	.21

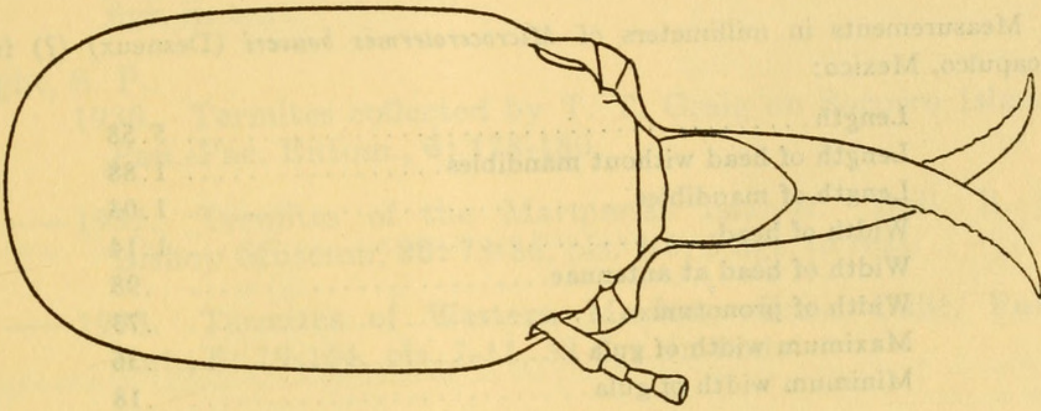


Fig. 9

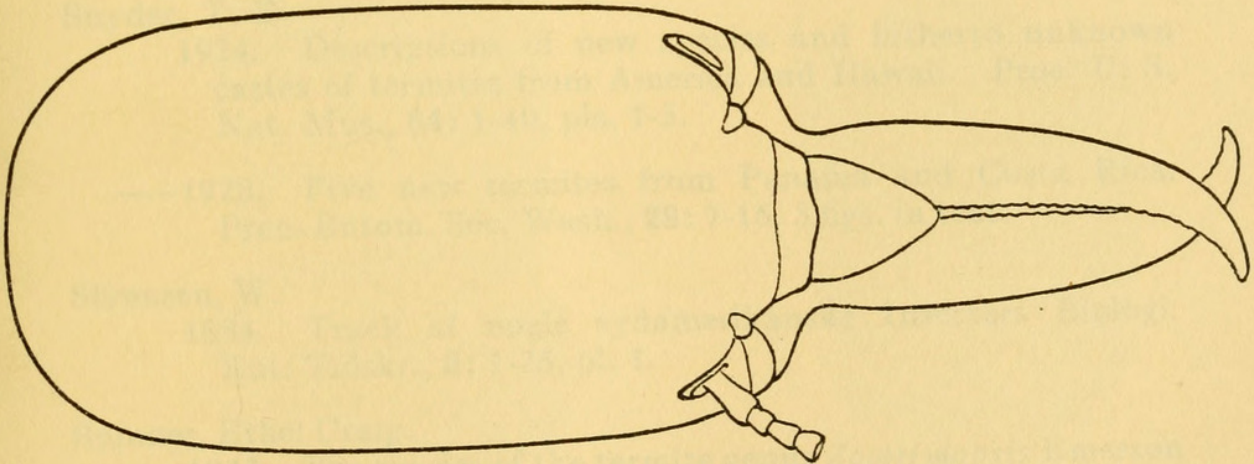


Fig. 10

Figs. 9-10. Head of soldiers of *Microcerotermes*.

9. *Microcerotermes struncki* (Sörensen) (?). $\times 29$.

10. *Microcerotermes bouveri* (Desneux) (?). $\times 29$.

Microcerotermes bouveri (Desneux) (?)

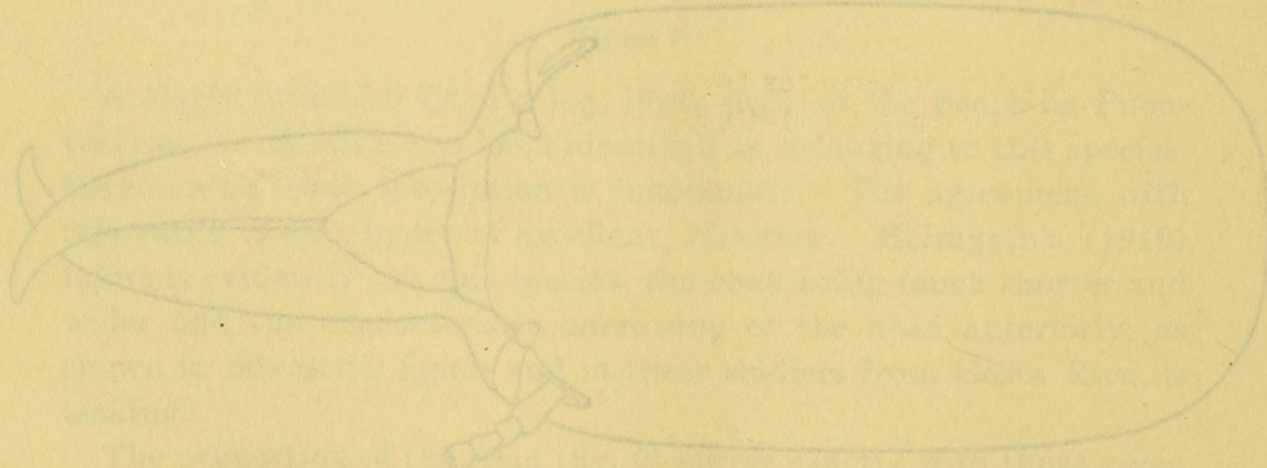
Figure 10.

A single collection from Acapulco taken from a beehive-like mound which extended a foot above the ground and a foot below it around the root of a dead shrub has been determined as belonging to this species.

Desneux's (1904) description is scanty and without illustrations but there are no outstanding differences. The 10 degrees separating the two localities, Acapulco in Mexico and Mariquita in Colombia, makes the identification questionable.

Measurements in millimeters of *Microcerotermes bouveri* (Desneux) (?) from Acapulco, Mexico:

Length.....	5.58
Length of head without mandibles.....	1.88
Length of mandibles.....	1.03
Width of head.....	1.14
Width of head at antennae.....	.98
Width of pronotum.....	.73
Maximum width of gula.....	.36
Minimum width of gula.....	.18



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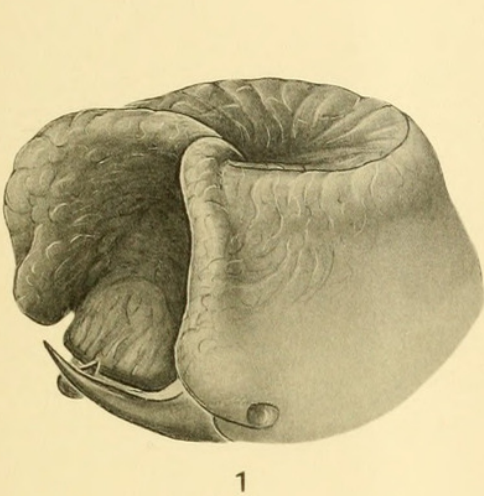
PLATE 9.

Fig. 1. Head of soldier of *Kaloterme* (*Cryptoterme*) *darwini* Light, new species, in oblique lateral view. $\times 22$.

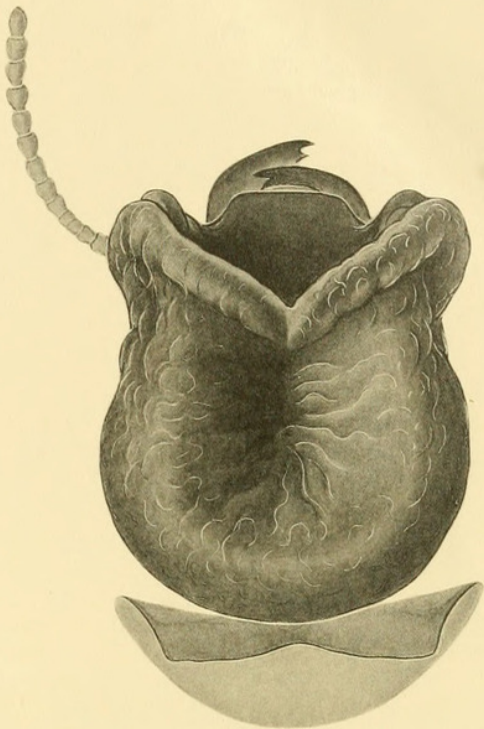
Fig. 2. Same in dorsal view. $\times 22$.

Fig. 3. Head and pronotum of soldier of *Kaloterme* (*Neoterme*) *larseni* Light, new species, in dorsal view. $\times 9$.

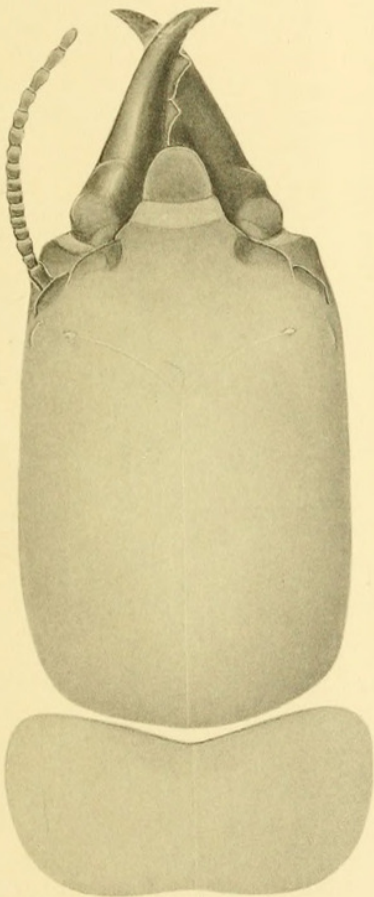
Fig. 4. Head of soldier of *Kaloterme* (*Cryptoterme*) *fatulus* Light, new name, in dorsal view but with head uplifted in front to show frons. $\times 22$.



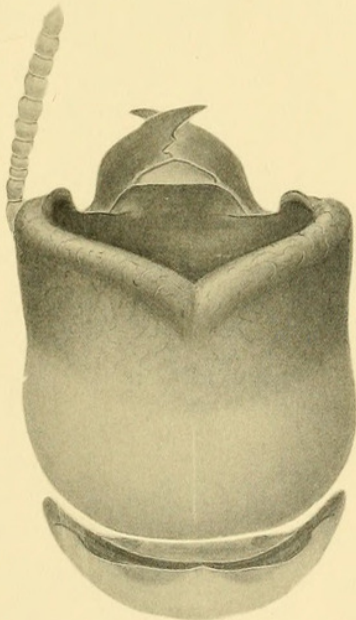
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PLATE 10.

Photographs of work of *Nasutitermes* (*Nasutitermes*) *guatemalae* (Holmgren)
taken by Dr. A. E. Larsen at Port Parker, Costa Rica.

Fig. 1. Carton nest.

Fig. 2. Runways on tree.



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