

PRESENT STATUS OF OUR KNOWLEDGE OF THE TERMITES OF CHINA

By S. F. LIGHT

Associate Professor of Zoology, University of California

Termites are very much in the public eye in many parts of the world at the present time. We are learning that their serious attacks are by no means confined to the Tropics. In China, termites are widespread. They have been reported from Hainan and Hongkong Island and from Kwangtung, Fukien, Chekiang, Honan, Szechuan, and Hupeh provinces. We have no reports from the three great southwestern provinces, but they will certainly prove to be abundant there. From the northern provinces we have no definite records, but the finding of *Reticulitermes* in Korea (Hozawa, 1915) and numerous unofficial reports make it seem justifiable to expect *Reticulitermes* in these provinces as well.

Our knowledge of the economic importance of the termites in China is as fragmentary as that of their distribution. In Formosa their depredations have been reported by Oshima. In Hongkong and Hainan the author can vouch for their destructiveness. In Fukien the author has found them responsible for considerable damage and the same is true in Jongsí and other provinces along the Yangtse where we have information from Nanchang, Changsha, Hangchow and Shanghai.

In most cases the damage noted has been in connection with foreign buildings and any general increase of such building may be expected to bring to light a very important termite problem. More definite information, therefore, as to the extent and nature of the damage and the species responsible, and especially the habits and distribution of these species, is imperative if very great economic loss is to be avoided.

Among the many other interesting problems presented by Chinese termites is that of the structure and relationship of the Protozoa of the hind intestine of the species of the lower families and the phylogenetic relations of these termite species as brought out by the relations of these Protozoa. In an appendix, I give instructions for making preparations of these Protozoa.

But little attention has been given to the termites of China. Previous to my article (1924) five species had been reported. Two of these are the common, widely ranging species, found also in Formosa, *Coptotermes formosanus* Shiraki and *Termes formosanus* Shiraki. Two others, *Coptotermes hongkongensis* Oshima and *Termes sinensis* Holmgren, I have shown to be synonyms respectively of the two first named species. The fifth is *Reticulitermes chinensis* Snyder (1923).

In my paper (1924), ten species were given as belonging to the Chinese termite fauna. At that time, Dr. Snyder's paper (1923) describing *Reticulitermes chinensis* Snyder was not known to me, and since that time Kemner (1924) has described as new two species taken along the Yangtse, *Odonotermes fontanellus* Kemner, and *Capritermes jantsekiangensis* Kemner, which would seem synonymous respectively with *Termes formosanus* Shiraki and *Capritermes nitobei* Oshima.

Since then, several collections have come to me for study. One of these was made by Miss Katharine L. Schaeffer in Hainan, another in Hongkong by Professor R. W. Barney, formerly of the University of Hong Kong, another in Nanking and vicinity by Prof. E. C. Van Dyke of the Division of Entomology, University of California, and the last was made by the expedition of the departments of Botany and Zoology of the University of Amoy into northern Fukien in the summer of 1924. These collections include one species new to science and several Formosan species not heretofore known from China. They extend the geographical range of other known species and furnish knowledge of castes previously unknown. Had I written this paper two years ago, I would very probably have added several new specific names from the material in these collections instead of the one given here. Careful studies of large series of material involving many individuals and colonies in certain oriental genera have forced upon me the belief that we have greatly underestimated the extent of the range of variation both among individuals of the same colony, *i.e.*, among sibs, and also between different colonies of the same species of termites. This, in turn, has made me extremely doubtful as to the validity of many of our termite species.

Through the kindness of Dr. T. E. Snyder of the Bureau of Entomology, Washington, D.C., I have had the opportunity to study and report here as a Chinese termite, *Cryptotermes piceatus* Snyder, originally described by Dr. Snyder from Hawaii, where it was no doubt introduced, as was *Coptotermes formosanus* Shiraki. The new species described is *Capritermes fuscotibialis*.

The following previously known species are here reported from China for the first time:

Cryptotermes piceatus Snyder.

Nasutitermes parvonasutus Shiraki.

Capritermes nitobei Shiraki.

The following changes in name are made in this paper:

Neotermes sinensis Light for *Kalotermes sinensis* Light.

Procapritermes sowerbyi Light for *Capritermes sowerbyi* Light.

The following castes of termites known from China are here described for the first time:

Cryptotermes campbelli Light, male (dealate).

Procapritermes sowerbyi Light, large soldier.

The following extensions of range are recorded:

Coptotermes formosanus Shiraki, Pakhoi in South Kwangtung, Yenping in North Fukien.

Reticulitermes fukienensis Light, Nanking; Yenping.

Reticulitermes chinensis Snyder, Changsha in Hunan; Yenping.

Macrotermes barneyi Light, Hainan Is.

Termes formosanus Shiraki, Nanking, Yenping.

Procapritermes sowerbyi Light, Yenping.

An increasing knowledge of the termite fauna of the China Coast but emphasizes its affinities with the Formosan fauna on the one hand and its striking differences from the Philippine fauna on the other. Species of eight genera on the coast parallel the same, or very closely related species in Formosa. Of these eight genera, two, *Reticulitermes* and *Procapritermes*, are not known from the Philippines; four, *Cryptotermes*, *Neotermes*, *Coptotermes* and *Nasutitermes*, are represented, but by very distinct species. Unpublished studies of Philippine termites show the same to be the case for *Capritermes*. Unpublished studies of Philippine *Termes* show that there are two distinct species, the most widespread of which is very similar to *Termes formosanus* Shiraki. These last are the only species showing any similarity in the two regions and they have ranges which probably meet in Borneo.

While certain real or apparent differences, probably due to the lack of information, make necessary at present the retention of separate specific names for several of the species of continental China, I am convinced that most of these will prove synonymous with those of Formosa or represent, at the most, subspecies or varieties.

There follows a list of Chinese termites with known distribution and suggestions of the species to which further collection will show certain of them to belong:

1. *Neotermes sinensis* Light, Kwangtung.
Probably is *Neotermes koshunensis* Shiraki.
2. *Cryptotermes campbelli* Light, Hainan Is.; Kwangtung; mainland (?)
Probably is *Cryptotermes kotoensis* Oshima.
3. *Cryptotermes piceatus* Snyder, Hongkong (introduced into Hawaii).
4. *Reticulitermes chinensis* Snyder, Szechuan; Changsha; Yenping (?)
5. *Reticulitermes fukienensis* Light, North Fukien; Nanking (?)
Probably same as above and both possibly but varieties of a single Asiatic species, *R. speratus* Kolbe.
6. *Coptotermes formosanus* Shiraki, from Pakhoi and Hainan Is. in Kwangtung, to as far north as Yenping in North Fukien, and, report has it, as far north as Shanghai.
7. *Macrotermes barneyi* Light, Kuliang near Foochow; Amoy; Hainan Is.
8. *Termes fontanellus* Kemner, Chingkiang, Kiangsu = *Odontotermes fontanellus* Kemner.
Probably is *Termes formosanus* Shiraki.
9. *Termes formosanus* Shiraki, Hainan Is. to Nanking.
10. *Termes hainanensis* Light, Hainan Is.
Possibly a subspecies of *Termes formosanus* Shiraki.
11. *Nasutitermes parvonasutus* Shiraki, Yenping, northern Fukien.

12. *Procapritermes sowerbyi* Light, Yenping and Kuliang, northern Fukien.
Probably same as *P. mushae* Oshima and Maki.
13. *Capritermes nitobei* Shiraki, Hainan Is. to Yenping, northern Fukien and to Kiangsu if the next species is to be considered a synonym, as seems probable.
14. *Capritermes jantsekiangensis* Kemner, Chingkiang, Kiangsu.
Probably same as *C. nitobei* Shiraki.
15. *Capritermes fuscotibialis* sp. nov, Hongkong.

Neotermes Holmgren

Neotermes sinensis Light

Kalotermes sinensis Light, 1924, China Journ. Science and Arts, II, No. 1, pp. 54-57.

A study of the amount of chitinization and the shape of the pronotum in the soldiers of the two genera *Kalotermes* s.s. and *Neotermes* Holmgren has convinced me that we have here generic characters which differentiate the soldiers of the two genera. The pronotum of *Kalotermes* s.s. is characteristically much longer, much more deeply concave in front and with the high antero-lateral corners overhanging the head, while in *Neotermes* the pronotum is short, never deeply concave in front and not strikingly overlapping the posterior corners of the head. A further differentiating character is that the chitinization and pigmentation of the soldier is much more extensive in *Kalotermes* than in *Neotermes*.

On the basis of these characters it seems necessary to place our Chinese species in the genus *Neotermes*, a contingency which I foresaw in my first paper.

Like other Chinese termites of the Fukien region, this species shows very close relationships to its congener in Formosa, *Neotermes koshunensis* Shiraki. It seems very probable, indeed, that more extensive collections will show them to be synonymous. In this regard a comparative study of their intestinal faunas would be of the greatest significance both as to the distinctness of the species and as to the relative stability of isolated protozoan stocks.

The only outstanding differences encountered in a brief comparison of the type and only specimen of *N. sinensis* and three collections of *N. koshunensis* Shiraki, all from Babel-

Tobago Island off the southern end of Formosa, for two of which I have to thank Dr. M. Oshima, and for the other, Dr. S. Hozawa, were found in the gula. These consist in the greater length of the gula as a whole, especially of the posterior narrow portion, and in the shape of the enlarged anterior area.

From *N. malatensis* Oshima, the common *Neotermes* species of the Philippines, the difference is striking, as would be expected and is most clearly seen in the proportionately much shorter and broader head (see indices in table below) and in the much shorter and heavier mandibles.

In table 1 are given a few measurements and tentative indices. These will be very considerably changed when a sufficient amount of material is studied to include the very wide range of variation which occurs in the soldiers of the species of the family Kalotermitidae. They serve, however, to show the close relationship of *N. sinensis* and *N. koshunensis* and their distinctness from *N. malatensis*.

"Antennal breadth" is used to indicate breadth between the posterior borders of the margins of the antennal foveolae. "Head index," "contraction index" and "minimum breadth index" are used as previously defined (Light, 1927) to mean respectively maximum head breadth divided by head length, maximum gular breadth divided by minimum breadth, and gular length divided by minimum breadth. "Breadth index" is used to indicate maximum head breadth divided by "antennal breadth."

The type of *Neotermes sinensis* was collected by Dr. Barney near Ting Wu Shan Monastery on the West River, Kwangtung, in a piece of fallen wood which contained four species of termites representing as many genera. This gives some idea of the returns to be expected from collecting in this region. It is very desirable to have extensive collections of this species to determine definitely its relations to the Formosan species. When found, smears should be made from the intestinal contents to allow for a comparison of the Protozoa with those found in *N. malatensis*, material for the study of which is available. For methods of making such smears, see the appendix to this paper.

Cryptotermes Banks

Cryptotermes campbelli Light

New Material Examined: 465 Ca, a single dealate male from Kachek, Hainan, collected by Miss K. L. Schaeffer.

The present specimen was collected from the type-locality of *Cr. campbelli* Light and since it agrees very well with

TABLE I
 COMPARATIVE MEASUREMENTS AND INDICES OF NEOTERMES SINENSIS,
 N. KOSEUNENSIS AND N. MALATENSIS

SPECIES	Head Measurements				Head Indices		Gular Measurements			Gular Indices	
	Length	Max. Breadth	Antennal Breadth	Head Index	Breadth Index	Length	Max. Breadth	Min. Breadth	Contraction Index	Min. Breadth Index	
<i>N. sinensis</i> Light	3.37	2.28	1.96	0.677	0.858	2.39	.76	.33	0.428	7.33	
<i>N. koseunensis</i> Shiraki...	3.29	2.37	2.00	0.719	0.845	2.15	.76	.33	0.428	6.58	
<i>N. malatensis</i> Oshima ...	3.26	2.04	1.88	0.625	0.920	2.28	.79	.27	0.344	8.40	

Cr. kotoensis Oshima, which the soldiers of *Cr. campbelli* resemble, I feel justified in considering it the adult of *Cr. campbelli* Light even though it was not taken with the other castes of that species.

Brief Description of Dealate Male of Cr. campbelli Light

The head and nota are light yellow brown, the terga darker brown, the ventral surface, antennae and legs, yellow. In shape of head, etc., it agrees well with descriptions of *Cr. kotoensis* Oshima except that the pronotum seems narrower. In color it seems much darker than *Cr. kotoensis* Oshima.

Measurements in Millimeters

¹ Length without wings	5.25
Head length	1.15
Head length, to labrum	1.05
Head width	0.975
Diameter of eye	0.21
Pronotum length	0.625
Pronotum width	0.975

As suggested in my former paper, it seems quite possible that a comparative study of more complete collections may show *Cr. campbelli* Light to be synonymous with *Cr. kotoensis* Oshima.

Cryptotermes piceatus Snyder

Cr. piceatus Snyder, 1922, Proc. U. S. Nat. Museum, 61, pp. 14-16, pl. 5, figs. 18-19.

This species known to be damaging woodwork in Honolulu since 1904 (Fulloway, 1920) was referred to *Cr. brevis* Walker until 1922 when Snyder correctly described it as a new species. Since then it has twice been intercepted (kindness of Snyder) by quarantine officials in Honolulu in wooden materials from Hongkong, and there seems no reason to doubt that *Cr. piceatus* is of Chinese origin.

While this is true, it is very distinct from the other known oriental species of *Cryptotermes*: *Cr. kotoensis* Oshima, *Cr. campbelli* Light, *Cr. domesticus* Haviland and particularly *Cr. cynocephalus* Light, as well as from *Cr. hermsi* Kirby from Fanning Island. From these all it differs among other points in the larger size of the alate, and in the great extent of the rugosity of the dorsal surface of the head of the soldier.

¹ Specimen strongly contracted.

Cr. piceatus may be expected to be a "house termite" in China as in Honolulu, attacking furniture and the timbers of buildings. Its presence will be indicated as that of other species of the genus by the tiny faecal pellets resembling fine, regular sawdust, extruded from the workings.

Careful search should be made for *Cryptotermes* material. If found, smears should by all means be made from the intestines of nymphs according to the methods outlined in the appendix, and soldiers and reproductives should be preserved in alcohol. Such material will be of the greatest value in determining the actual systematic relationships of the compact group of termite species which includes *Cr. kotoensis*, *Cr. ogasawaraensis*, *Cr. campbelli* and *Cr. hermsi*. The Protozoa of *Cr. piceatus* are being investigated by Dr. Kirby and those of *Cr. hermsi* have been described by him (1926).

Reticulitermes Holmgren

Four species of *Reticulitermes* have been described from Japan and China. Of these, two are from China: *R. chinensis* Snyder and *R. fukienensis* Light; one from Formosa, *R. flaviceps* Oshima, and one from Japan proper and Korea, *R. speratus* (Kolbe). These four species form a very compact group. Hozawa (1915) believes that *R. flaviceps* Oshima is a synonym of *R. speratus* (Kolbe). *R. fukienensis* seems most closely related to *R. flaviceps* Oshima, as described, in its soldier characters, and with both *R. flaviceps* Oshima and *R. speratus* (Kolbe) in that the adult has a light-colored pronotum while the adult of *R. chinensis* Snyder is characterized by the black color of the pronotum. The key given below will serve to differentiate these four species as at present known.

I. KEY TO THE ADULTS OF ASIATIC SPECIES OF RETICULITERMES HOLMGREN

- A. Generally black or dark brownish black, pronotum black or very dark *R. chinensis* Snyder.
- AA. Generally somewhat lighter, pronotum yellow or yellow with scattered pigmented areas.
 - B. Pronotum yellow, without pigmented areas.
 - C. In Japan *R. speratus* (Kolbe).
 - CC. In Formosa *R. flaviceps* Oshima.
 - BB. Pronotum yellow but with scattered pigment spots
..... *R. fukienensis* Light.

II. KEY TO THE SOLDIERS OF THE ASIATIC
SPECIES OF RETICULITERMES HOLMGREN

- A. Head index (*i.e.* maximum breadth by length), 0.64 or more *R. speratus* (Kolbe).
- AA. Head index less than 0.64.
- B. Small, head 1.75 mm. long or less and 1.06 mm. or less in width.
- C. Very light in color, smaller, head usually 1 mm. or less in width, pronotum usually less than 0.42 mm. in width. In China *R. fukienensis* Light.
- CC. Yellower, somewhat larger, head usually more than 1 mm. in width, pronotum usually more than 0.42 mm. wide. In Formosa *R. flaviceps* Oshima.
- BB. Larger, head 1.85 mm. or more in length, and 1.1 mm. or more in width *R. chinensis* Snyder.

Reticulitermes chinensis Snyder

R. chinensis Snyder, 1923, Journ. of Washington Acad. Science, 13, No. 6, pp. 107-109, fig. 1.

New Material Examined: 406 *Ca*, paratypes (alates) of *R. chinensis* Snyder, collected by Graham at Suifu, Szechuan, May 1922 (kindness of Dr. Snyder); 563 *Ca* (dried alates) collected at Changsha, in May 1924, and sent me through the kindness of Mr. A. K. W. Chiu, librarian of University of Amoy; 510 *Ca* and 518 *Ca* (soldiers and workers) collected at Yenping, Northern Fukien, August 11, 1924 by T'ang Wangwang.

This very appropriately named species of Dr. Snyder's was unfortunately unknown to me when I was writing my former paper on Chinese termites. The alates from Changsha, although dried and hence not available for detailed study, show the black pronotum, and hence I have placed them in this species.

The two collections made at Yenping, North Fukien by the collecting expedition from the departments of Botany and Zoology of the University of Amoy contain soldiers with heads considerably larger than those seen by Snyder, but they seem best placed here as yet. Extensive collections from all parts of China are very desirable, as comparative studies of such series will be necessary before any final conclusions can be reached as to the species of this genus.

Reticulitermes fukienensis Light

R. fukienensis Light, 1924, China Journal of Science and Arts, Vol. 2, No. 2, p. 142.

New Material Examined: 564 Ca, soldiers collected at Yenping, August 11, 1924 by T'ang Wangwang.

The adult of this species is known only from the king and queen taken by me (500 Ca) and made the types of the species. If the characters of this royal pair hold true in the adults of the species, it is differentiated from *R. chinensis* Snyder by the prevailing yellow color of the pronotum and from the two Japanese species *R. speratus* (Kolbe) and *R. flaviceps* Oshima, by a somewhat smaller size, by a smaller, shorter, more hairy head and particularly by the fact that the pronotum shows irregular pigmented areas and that the pigmentation in general shows a tendency to be irregular. The finding of a first form king and queen with the second colony of *Reticulitermes* collected in Fukien and the third known to science from China is indeed remarkable. Of the 253 collections reported on by Hozawa in his splendid Revision of the Japanese Termites (1915) only three contain first form reproductives, one from Formosa, another from Hondo (Tokyo), and one from Amami-Oshima. No first form king or queen of *R. lucifugus*, the European representative of this genus, has yet been found in a developed colony. In the United States, physogastric first form reproductives have been taken but very rarely, although kings and queens of incipient colonies are often found.

Studies based on measurements of extensive series of all these so-called species of *Reticulitermes* of the Asiatic portion of the Palaearctic Region, while not complete as yet, point to the possibility of their representing a single variable species, *R. speratus* (Kolbe) or two species, one a Chinese and Formosan species, *R. flaviceps* Oshima, and a Japanese species, *R. speratus* (Kolbe), or three species, *R. speratus* of Japan, *R. flaviceps* of Formosa and Southern China and *R. chinensis* Snyder of Northern and Western China.

Coptotermes Wasmann**Coptotermes formosanus** Shiraki

Common name "Oriental Termite."

New Material Examined: 507 and 508 Ca, (soldiers and workers) collected by Mr. Sharpless at Pakhoi, Kwangtung, presented by Mr. R. de Rautenfeld; 516 Ca and 519 Ca (soldiers and workers), 522 Ca (alates, workers and soldiers), collected by T'ang Wangwang at Yenping, August 1924.

TABLE 2
 MEASUREMENTS OF SOLDIERS OF VARIOUS COLLECTIONS OF ASIATIC
 SPECIES OF REVICULITERMES

COLLECTIONS	Head Length	Head Width	Head Index	Pronotum Width	Pronotum Length
<i>R. fukienensis</i> Light (Types, Baek Liang) ...	1.57 — 1.68	0.97 — 1.05	0.61 — 0.62	0.71 — 0.8	0.4
<i>R. chinensis</i> Snyder (540 Ca, Nanking)	1.63 — 1.72	1.0 — 1.06	0.61	0.78 — 0.8	0.405
<i>R. chinensis</i> Snyder (564 Ca, Nanking)	1.78	1.05 — 1.07	0.59	0.79	0.42
<i>R. flaviceps</i> Oshima (25 J, Formosa)	1.68 — 1.80	1.011 — 1.06	0.60 — 0.61	0.75 — 0.83	0.4 — 0.42
<i>R. speratus</i> (Kolbe) (15 J. and 264 J.)	1.68 — 1.8	1.22 — 1.24	0.68 — 0.72	0.79 — 0.84	0.42 — 0.47
<i>R. chinensis</i> Snyder (Snyder, paratype)	1.85 — 1.90	1.1 — 1.2	0.59 — 0.63	0.85	
<i>R. chinensis</i> Snyder (518 Ca, Yenping)	2.02 — 2.2	1.15 — 1.36	0.57 — 0.62	0.79 — 1.02	0.42 — 0.53
<i>R. chinensis</i> Snyder (510 Ca, Yenping)	2.1 — 2.2	1.21 — 1.42	0.60 — 0.64	1.0 — 1.05	0.53

The collections made by Mr. Sharpless, Commissioner of Customs at Pakhoi, Kwangtung Province, and kindly presented to me by Mr. P. de Rautenfeld, Commissioner of Customs, Kiungchow, Hainan Island, considerably extend the known southern continental range of this important economic species which had been taken from Hainan Island, but no farther south than Canton on the mainland. The soldiers of the Pakhoi collections have heads noticeably wider than is common for the species, some as wide as 1.32 mm. but this is equalled in collections made elsewhere.

This is by far the most destructive species in the regions where collections were made by me, *i.e.*, from Foochow to Canton on the mainland including Hongkong, in Formosa, and in Hainan Island. In Formosa, Hongkong and Hainan it was found to be doing very great damage. In the warmer regions its habit of building covered ways over impenetrable foundation materials and making its way to the roof beams made it a most harmful form. In Fukien, while very troublesome, the damage observed was of a less important character. In Fukien, this termite attacks the wood of coffins, often making its nest there. On one occasion a human skull was brought me which had been penetrated at many points and in which the termites evidently had their headquarters.

This species, introduced into the Hawaiian Islands presumably from China and Japan, and there formerly erroneously known as "The Philippine Termite" and now as the "Oriental Termite" is spreading through the Islands and doing very considerable damage, particularly in Honolulu.

A well established colony with thousands of workers was recently discovered in a vessel in San Francisco harbor and there seems every reason to believe that it will be introduced into the United States in time.

Family **TERMITIDAE**

Macrotermes Holmgren

Macrotermes barneyi Light

New Material Examined: 469 *Ca* and 470 *Ca* (large and small soldiers and workers) collected by Miss K. L. Schaeffer in the southern part of Hainan Is.

These two collections made by Miss Katharine L. Schaeffer of the Presbyterian Mission in Hainan extend the known range of the species to that island. I wish to take this opportunity to express my appreciation of the interest which Miss Schaeffer has shown in making several collections of Hainan termites.

Macrotermes gilvus Hagen, a closely related species, builds conspicuous mounds in the Philippines and East Indian Islands. No such mounds have been reported from China as yet. They may be expected in the more southern portions of the range of the species.

Termes Linnaeus s.s.

(= *Odontotermes* Holmgren)

Termes formosanus Shiraki

New Material Examined: 541 Ca, (soldiers and workers) collected by Dr. E. C. Van Dyke, at Nanking, Spring of 1924; 511 Ca, 515 Ca, 517 Ca, 520 Ca, 521 Ca, (soldiers and workers) collected by T'ang Wangwang at Yenping, August 1924.

The collection made by Dr. Van Dyke in Nanking and kindly shared with me increases very greatly the known northern range of this species which has previously been known from no locality north of Foochow.

Dr. Van Dyke tells me that this is the termite commonly found attacking graves. In this respect they would seem to take the place in the North of *Coptotermes formosanus* Shiraki in the south which is very commonly found in graves of the Amoy region. *Termes formosanus* Shiraki is also found attacking the wood of coffins in the graves in Amoy but much less frequently than is *Coptotermes*.

Termes formosanus is by far the commonest termite of southern China. It is a fungus grower as is *Macrotermes barneyi*. Its large, brain-shaped fungus gardens are frequently encountered in excavations from eighteen inches to two feet or more under ground.

The very large, dark brown alates of this species swarm synchronously in great numbers over large areas due to similar meteorological conditions. In Amoy and vicinity this occurs during late May about dusk on a rainy evening and Prof. R. W. Barney, formerly of Hongkong University, reports enormous swarming there on June 1, 1923.

Termes hainanensis Light

No new collections have been made since my previous note.

This may prove to be a nanitic subspecies of *T. formosanus* but as yet must be considered distinct.

Termes fontanellus Kemner

Odontotermes fontanellus Kemner, 1924, Arkiv f. Zool., 17, No. 28.

This species, based on the character of the fontanel of the workers of a collection from Chingkiang, Kiangsu, would seem to be synonymous with *T. formosanus* Shiraki. Definite decision must await a study of the type material.

Nasutitermes Banks

This genus represents the subgenus *Eutermes* of Holmgren and others. It is here reported from continental China for the first time.

Nasutitermes parvonasutus Shiraki

Material Examined: 509 Ca, numerous soldiers and workers collected by T'ang Wangwang at Yenping, North Fukien, August 1924.

Certain apparent differences in size would easily have led to the separation of this as a new species but I feel certain that examination of a sufficiently large series will show this to be the same as the Formosan species.

Procapritermes Holmgren

This genus was made by Holmgren to receive those *Capritermes*-like species whose soldiers were characterized by longer, more slender, and straighter mandibles. Here belongs the species which I described as *Capritermes sowerbyi* (1924). A single, very large soldier of this species collected at Yenping indicates a decided dimorphism among the soldiers.

Procapritermes sowerbyi Light

Capritermes sowerbyi Light, 1924 China Journal of Science and Arts, No. 4, pp. 354-357.

New Material Examined: 514 Ca, a single large soldier collected by T'ang Wangwang from "a crack in a rock" at Yenping, August 24, 1924.

For descriptions of dealate female and small soldier see above reference.

Large Soldier: Head light yellow-brown, mandibles reddish-black, antennae and basal two segments of maxillary palpi light brown, distal joints of maxillary palpi, base of labrum and the anteclypeus white, labrum and other parts of body light yellowish to white.

Head with fairly numerous large hairs, a conspicuous cluster, anteriorly directed, marking ventral antero-lateral angle of

head, clusters of varying length, more or less radiating and anteriorly directed on the very narrow postclypeus and behind the mandibular articulations.

Head rectangular, sides parallel, converging somewhat at either end; posterior margin flatly convex, postero-lateral corners nearly square; anterior head region distorted due to asymmetrical position of the mandibular articulations; dorsal surface nearly flat, rising slightly from the rounded posterior end to the region of the fontanel from which it slopes down to the level of the mandibular articulations; ventral margin nearly straight in posterior one-half, bulging strongly in anterior one-half and rounding up to mandibular articulations.

Gula much contracted in center, very wide behind.

Both mandibles apparently rotated toward the upper mid-line carrying the antennae and antennal parts with them and leaving a white, unchitinized area between inner mandibular articulations and antennal pits. The right antennal pit lies far forward and at the extreme right margin, above outer margin, opening anteriorly and dorsally instead of laterally. The margins of pit are heavily chitinized. The antennae are entirely gone in the only specimen. The left antennal pit is considerably farther from the head margin, much less heavily chitinized and directed antero-laterally.

The labrum is swollen, more than twice as long as broad, bifurcated distally and distinctly asymmetrical in position and shape. It is turned toward the right, the distal points lying on either side of the right mandible when the mandibles are crossed. The right tip is larger and longer than the left one. The labrum is more than twice as long as broad, broadest at posterior end, gradually converging toward anterior end, tips directed antero-laterally. The right side is nearly straight while the left has a marked convexity near the base. Anteclypeus very short. Postclypeus not clearly demarcated.

Fontanel opening just below a projecting shelf whose anterior margin is darkened and faintly notched in the mid-line. The fontanel duct is marked in light brown.

Longitudinal suture a very distinct dark brown line to middle of head in a groove which runs back over the posterior surface making a faint notch in posterior margin.

Antenna (left with only 8 segments, right entirely gone) with very large cylindrical segment I. II shortest, most heavily chitinized, longer than, or subequal to II; III longer than II or IV, about as long as V, VI, VII, and VIII.

Right mandible about as long as head, flattened, nearly straight in dorsal view, distinctly curved in side view, inner margin higher than outer. Rising in inner two-thirds continuously with curve of ventral surface of head to a level with surface of head curved downward in outer one-third. Left mandible displaced toward the mid-line so that its base lies under the labrum except for a narrow lateral area which curves downward more or less continuously with the downcurve of the upper surface of head. It is narrower than the right, flattened vertically in its distal one-half, with a slight sinuous inward curve in basal one-half, then curving more sharply outward in inner half of distal one-half and then more sharply inward to near the tip which bears a distal finger-like prolongation arising from the upper margin of tip of band-like portion and projecting almost directly anteriorly. When the mandibles are crossed, the left mandible lies almost entirely below the right in dorsal view.

Pronotum small, anterior uplifted portion making a right angle with remainder of sclerite, anterior margin notched.

Measurements in Millimeters of Large Soldier of

Procapritermes sowerbyi Light

Length	6.93
Body length	2.73
Head with mandibles	4.62
Head without mandibles	2.62
Right mandible	2.34
Head width	1.75
Gula length	1.58
Gula, maximum width	{ post. 0.43
	{ ant. 0.53
Gula, minimum width	0.21
Labrum, maximum breadth	0.43
Labrum, length of right tip	0.21
Labrum, width at base of projections ...	0.26
Labrum, length on right side from post- clypeus to end of tip	0.53
Pronotum length	0.42
Pronotum width	0.92

Oshima and Maki (1919, Zoological Magazine, 31) have described *Procapritermes mushae* from Formosa, evidently from the small soldiers. The measurements differ widely from those

of either type of soldier as known for *P. sowerbyi*, yet so great is the variation in size within termite species that even here I expect large series from Formosa and the mainland to show them to belong to the same species.

Capritermes Wasmann

The soldiers of this genus are distinguished by their asymmetrically crumpled, band-shaped mandibles. They are readily distinguished from the soldiers of *Procapritermes*, with which they have been found closely associated in China, among other characters, by the much broader, more massive and more strongly curved mandibles.

Capritermes nitobei Shiraki

Material: 467 *Ca* (alate) and 468 *Ca* (dealate), collected by Miss Schaeffer in Hainan; 503 *Ca* (1 soldier), collected at Baekliang in mountains of North Fukien by Light, 504 *Ca* (1 soldier and workers), under stone in same locality by Prof. C. R. Kellogg of Fukien Christian University, 513 *Ca* (soldiers and workers), by T'ang Wangwang at Yenping, August 1924 (with *Procapritermes* large soldier).

This is the first record of a *Capritermes* from South China and aside from Kemner's species listed below, which is probably the same, the first from China.

Capritermes yangtsekiangensis Kemner

Capritermes yangtsekiangensis Kemner, 1924, Arkiv. f. Zool., 17, No. 28.

This species reported by Kemner from Chiangkiang is probably the same as the above.

Capritermes fuscotibialis sp. nov.

Material: 450 *Ca* (a single alate male) collected by Prof. R. W. Barney, formerly of Hongkong University, on June 1, 1923, amidst a heavy flight of *Termes formosanus* alates.

This single specimen differs so distinctly from *Capritermes nitobei* in color, in size and position of ocellus, in size and position of fontanel, and in shape of pronotum that it seems necessary to consider it as representing a different species, and since it does not agree with any other described species, I have felt it necessary to consider it a new species in spite of the fact that only the single specimen is available.

Description

Alate: Postclypeus somewhat lighter than frons but distinctly brown, general color of chitinized regions a dark brown; compound eyes small, strongly projecting; ocellus small, narrow, elongated, directed inward and somewhat forward, more than twice as long as broad; separated from eye by nearly its long diameter; antennae dark brown, of fourteen segments, III very short, IV and V equal, II longer than IV or VI, equal to VII; head highest at level of the ocelli, low in front and behind; fontanel somewhat elevated, white, behind center of head; anteclypeus white; postclypeus brown; much shorter than $\frac{1}{2}$ its width, labrum very flat, yellow, seed-shaped; pronotum with straight anterior border unlifted in middle, convex sides receding posteriorly into the biconcave posterior margin; a broad, very shallow Y-marking present, but not conspicuous; anterior region of mesonotum and metanotum yellow, median region very light smoky brown, posterior bifurcated areas each with a dark smoky patch, the tip lighter; tibiae darker than femora or tarsus (hence the name); wings brown, closely papillate, with numerous hairs on anterior margin and a single line of hairs on posterior margin; costal margin thick, basally dark, distally lighter, space between costal and radius-sector light, radius sector thicker and darker, bordered by very narrow clear area separating it anteriorly from a very narrow dark line and posteriorly from a somewhat broader yellow "costalstripe;" other veins narrow, darker brown, median lying near cubitus with one distal branch in forewing and two in hind; cubitus with about eight branches to margin, proximal three or four thickened. All parts thickly haired save wing membranes.

Measurements

Length with wings	11.5
Length without wings	5.7
Head length over all	1.35
Head length to postclypeus	0.81
Head with eyes	1.15
Head without eyes	0.88
Pronotum width	0.95
Pronotum length	0.62
Fontanel length	0.095
Fontanel width	0.068
Ocellus length	0.0135
Ocellus width	0.0054
Projection from head level	0.013
Postclypeus, width	0.54
Postclypeus, length	0.174

APPENDIX**Instructions for Preparation of Protozoa of
Termites for Study**

Many termites, particularly those which live in wood without any ground connection and whose workers are grub-like in appearance, contain large numbers of Protozoa in the hind intestine. These are of the utmost interest both for themselves and because of their use in studying the phylogeny and relationships of the termites. These may be studied from smears, so-called, made and fixed as follows:

Have ready a thin (No. 1) cover glass on which has been placed a very thin film of egg albumen by placing on it a tiny drop and then wiping off all excess by means of a finger. Place on this an extremely tiny drop of dilute salt solution (0.5% commercial salt). Place one of the nymphs or workers on a flat surface and holding it by a probe placed on the thorax, seize the extreme tip of the abdomen with the points of fine, curved forceps. Then by pulling gently the alimentary tract may be removed from the body. It should be placed in the drop of the salt solution on the cover slip and teased open by means of two dissecting needles. It should then be moved over the cover slip in a spiral path, leaving behind the contents of the intestine. Actual drying should never occur. On the other hand, if put too soon into the fixative, the organisms will be lost. A little experience will indicate the amount of evaporation of liquid most advantageous. When this stage is reached, the cover slips should be placed in the fixing fluid. Bouin's Picoformol-acetic is the most satisfactory for field work, since it may also be used as a preservative. Cover slips should be kept separated by paper washers and if numbers are put on the washers corresponding to the numbers placed in the vials containing specimens of the termites used, identification will be facilitated. It would seem best to have a vial of clean cover slips, another vial containing paper washers and a third vial containing Bouin's fluid. The smears as made can be placed in the Bouin's fluid, protected from other slips by the rings and kept from moving about in the vial by means of cotton.

Similar methods may be followed in making smears on the slide. They may be stained in haematoxylin by the Heidenhain method.