

Data on the occurrence of *Glyptotermes* and *Neotermes* species in Java and Sumatra

by

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One of the main causes which led to the collecting of the data presented in this paper, was the interest taken by American scientists in the intestinal protozoan fauna of certain termite genera. In 1931 Miss Jane COLLIER of Harvard University Medical School paid a flying visit to Java in order to collect material in behalf of Professor L. R. CLEVELAND, whose publications on the function of the protozoa are so well known. As I was engaged at the time in studies of *Neotermes* species living in the trunks of teak trees, I was able to provide colonies of *N. tectonae* and *N. dalbergiae*. Afterwards a dozen vials containing stages of *N. tectonae* taken from young and old colonies and prepared by me with the prescribed fixatives were sent to Boston.

In 1934 it was announced that Dr. Harold KIRBY of Berkeley, California, would visit Java in the course of a world tour for collecting material of termite-protozoa. In order also to have material available from outside Java, I called in the assistance of the Forest Service. In response to this request some suitable infested timber material was obtained, which had been collected in felling areas along the Kateman and Simpang Kiri rivers in the swamp forests of S. Sumatra, as well as a few samples from Banka, the large island situated off the coast of S.E. Sumatra. The visit of Dr. KIRBY was postponed for a year, but in 1935 again similar material was obtained by request from Kateman. Some samples sent from other places did not contain the species wanted. A short search for Kalotermitidae was made by myself in the teak plantations and the original low-land forest near Bandjar, W. Java, VI.1935, and native personnel succeeded in obtaining some more samples afterwards. Parts of trunks of teak and sonokling — *Tectona grandis* and *Dalbergia latifolia* — inhabited by *N. dalbergiae* could be ordered from the same locality, and similar parts of teak, harbouring *N. tectonae* were provided by the field laboratory near Gedangan, district of Semarang, C. Java. During Dr. KIRBY's visit to Bogor in July 1935, we jointly made one-day collection trips to Tapos on the N. slope of Mount Gedé at 800 m, and to Angke in the mangrove belt near Tandjong Priok harbour on the N. coast of W. Java.

In KIRBY's papers, since published before his untimely death, and dealing with the various groups of Flagellates found in the material he had investigated, several samples from Java and Sumatra are mentioned under the host-termites, indicated by collection numbers and localities. As appears from a paper of S. L. LIGHT (1937), the one time specialist on oriental termites, the species collected by Miss COLLIER were identified by him. These identifications and those of the later acquired material have been checked and completed by the eminent termite-specialist Professor A. E. EMERSON of Chicago (see KIRBY 1941, p. 3). Duplicates of some of the original samples are still kept in my collection.

My present notes give some additional data, mainly concerning the host timbers in which the termites were found, and in a few cases, on the size and composition of the original colonies. The notes also contain particulars supplementary to those on *Neotermes dalbergiae* and *N. tectonae* published in my thesis (1930) and those on the Kalotermitidae in KEMNER's „Systematische und Biologische Studien über die Termiten Javas" (1934). In the latter paper the first representatives of the genus *Glyptotermes* met with in Java were described, as well as a new *Neotermes* in addition to the two already known in the country.

The Kalotermitid genera dealt with here include species which apparently may start their colonies in dead parts and wounds of living woody plants — mostly dead branches of standing trees of various kinds — and which often extend their nests eventually into sound wood and bark tissues of the host. Therefore the study of them, besides having some interest from an ecological viewpoint, is also of importance for agriculture as well as forestry, as they may develop into potential pests — or already have done so — of woody crops, fruit trees and forest plantations, and may cause losses to timber production (see in this connection HARRIS "Termites and Forestry", 1955).

A c k n o w l e d g e m e n t s. Dr. W. V. HARRIS has been kind enough to check my identifications of several of my remaining samples, and I am equally grateful to him for the interest he has taken in my preparation of this paper.

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SPECIAL PART

Glyptotermes brevicaudatus Hav. 1898. W. Java: in young teak tree (*Tectona grandis*) broken in a gale at 4 m from its base, the colony being found in the dead stunted top, one meter below the fracture, Bandjar, 19.VII.1930; one colony in a high dead teak-stump and another in a broken top of a teak-tree probably killed by root disease, Bandjar, 12.VI.1935 (the last mentioned under nos 4533 and 4540 in KIRBY 1942a, p. 123 and 1944, p. 196).

KIRBY's mentioning of the species is the first record of its occurrence in Java. HAVILAND collected it in Borneo, and HOLMGREN (1914) listed it from E. and C. Sumatra on account of the collection of alates at light near the coast and at 1200 m altitude.

The wood which harboured the colony detected in 1930, was slightly rotten and also showed traces of earlier infestation by ambrosia beetles and the larvae of longicorn beetles. The termites were using some of the old Scolytid galleries for passage ways and they had excavated a flat vertical chamber concentrically with the annual rings. The galleries in use were partially filled with a cake of light-brown faecal matter. There were many first instar larvae present. However the colony was not collected completely at the time and only a small sample of it, including one soldier, is now in my collection.

The colony in the teak stump, collected in 1935, had its nest in the lower part of it, while a colony of *Neotermes dalbergiae* was found at a higher level.

Several other teak trees, killed by root disease in the same plantations in Bandjar were searched for *Glyptotermes* colonies in 1935, but no others were detected besides the two listed.

G. caudomunitus Kemn. 1932, 1934. J a v a : two samples from dead bendo (*Artocarpus elastica*) Bandjar, VI.1935; one of these samples being of fair size and including young alates and soldiers (nr. 4566 in KIRBY 1941 p. 39, 1942a p. 121 and 1942b p. 198), the other samples consisting of larvae and nymphae only and therefore identified as "Glyptotermes sp., probably *G. caudomunitus*" (nr. 4560 in KIRBY 1941 p.57, 1942a p. 121, and 1942b p. 198).

The single colony on which KEMNER based his description, was found in an old fallen branch at Depok, probably in the small forest reserve which was often visited by collectors of insects. In this colony there were both large and small soldiers; the Bandjar colony has only soldiers of one size.

Glyptotermes sp.*) Judging from the shape of the soldier frons the species has affinities with *G. dilatatus* Bugn. & Pop. 1910 (see key to the oriental *Glyptotermes* species in HOLMGREN's Termitenstudien IV, 1913, p. 49). In KIRBY's papers it is mentioned as "Glyptotermes n.sp.". W. J a v a : three samples collected in the Bandjar forests, one of them in a dead lamè tree (*Alstonia scholaris*), the hosts of the other two not being noted, VI.1935 (nrs. 4559, 4567 and 4571 in KIRBY 1941 p. 33 and 66, and 1942b p. 191).

Sample nr. 4571 originally consisted of one of the parents, 37 soldiers, 17 neotenic individuals and a large number of larvae and nymphs.

G. dilatatus was first found living in the frame of termite-infested tea bushes in Ceylon, and since has been mentioned in several reports on this damage.

Glyptotermes sp.*), related to the preceding species. S. S u m a t r a : parts of three colonies found in some billets in a large consignment from the felling area Kateman and mainly harbouring colonies of *Neotermes tectonae* (see below), VIII.1934; two colonies collected from similar material and same locality, VII.1935 (mentioned as "Glyptotermes sp.", nrs. 4538 and 4562 in KIRBY 1941 p. 39 and 1942b p. 191).

G. niger Kemn. 1934. W. J a v a : two colonies, one of them with young alates, found in dead branches of old *Ficus elastica* trees, at Tapos, 21.VII.1935 (nr. 4543 and 4545 in KIRBY 1941 p. 48 and 1942b p. 212).

KEMNER found his type-colony in a rotten trunk and gives a few details about the nest (1934 p. 181).

G. montanus Kemn. 1934. W. J a v a : to the localities mentioned by KEMNER — Mount Salak at 700 m and Tjibodas on Mount Gedé at 1400 m — has been added Telaga Warna, a small forest-bordered lake on Mount Gedé at some 1200 m, on the same N. slope as the Tjibodas Gardens (nr. t. 324 COLLIER in KIRBY 1938 p. 16, 1942a p. 116, 1942b p. 185, 204).

*) The descriptions of both these new species of *Glyptotermes* will appear, I am informed, in a forthcoming paper of A. E. EMMERSON and KUMAR KRISHNA.

KEMNER found one of his colonies in a tree, part of which was still alive and he mentions a few details on the nest (1934 p. 181).

Neotermes dalbergiae (Kalsh.) 1930. Particulars about this species published in my thesis almost exclusively concern its taxonomy and give very few other details. These data may be supplemented here.

New material. W. Java: two colonies found in living teak trees in 10-year old plantations, Bandjar, VII.1930; samples of three colonies from teak in similar plantations, Bandjar, VI.1935 (two of them mentioned under nrs. 4532 and 4570 in KIRBY 1942a p. 108 and 1942b p. 191); one colony from nangka tree (*Artocarpus integra*) and one from bendo tree (*A. elastica*), Bandjar, VI.1935 (mentioned under nrs. 4541 and 4568 in KIRBY 1941 p. 47 and 1942a p. 108); one alate taken at light, 27.V.1934, and one colony found in a dead limb of a *Ficus elastica* tree, VII.1935, both at Tapos.

Distribution in Java. Frequency of occurrence. This species was found for the first time in the districts of Kedu and Banyumas in the southern part of Central Java in 1926, in teak trees (*Tectona grandis*) as well as in trees of the not less valuable sonokling or angsono timber. (*Dalbergia latifolia*) and in a single instance in nangka (*Artocarpus integra*). As additional reports about the damage were received a survey was made of its occurrence in some wide-spread plots of cultivations in the forest range of Banyumas, and this was carried out, at my instigation, by the Forest Entomological Assistant, F. VERBEEK, in May 1927. From his report it became evident that traces of infestation, part of them old, some fresh, could be found all over the area, affecting a varying number of trees in teak stands of 20—60 years. The percentage was estimated at 5—35 in different parts of plots of 25—40 years, and up to 60% in one plot, 60 years old. The cavities caused by the termites were frequently found in the various assortments of hewn and sawn timber in the timber yards. There were only a few stands of sonokling, and here the infestation as far as could be observed, was also often found, sporadically or up to some 15%. The new injurious *Neotermes* sp. was mentioned in a few lines in an official annual report for 1927 (ANONYMOUS 1928).

During an inspection in 1930 of teak plantations, suspected to be infested, in the Bandjar area — situated in the plains of the East Priangan District, and bordering Banyumas on the West side — a moderate infestation was found in an isolated 30 year old plot of teak and in 10—14 year old plantations forming the first planted compartments of a series, started on newly cleared terrain, originally covered with natural mixed forest.

A further extension of the known area of distribution resulted from the discovery of the species at Tapos on Mount Gedé in 1934/1935.

Observations on the nests. The presence of a nest of *dalbergiae* could be detected by the uneven and swollen places on the trunks of the trees in a similar way as in *tectonae*, but the rough places and the cracks in the bark were much less marked than those found in teak trees inhabited by the latter species. In the *Dalbergia* trunks particularly the affected parts were scarcely bulging.

In a few nests which could be investigated superficially after the felling of

the trees, the colonies appeared to have their largest concentrations just below the thickened part. Narrow passages — deceptively like the tunnels of the shot-hole borer *Xyleborus destruens* — were found leading upwards for considerable distances.

In the infested part of a *Dalbergia* trunk a few horizontal passages were noticed right under the bark, cutting through the outer layer of sapwood. There was also a short row of holes piercing the bark and connecting one of the galleries with the open air. Similar holes have been described for the nests of *tectonae* (KALSHOVEN 1930, 1959). Flat chambers were found excavated under a portion of the trunk where the bark was dry, presumably a result of the tunnelling activities of the termites. A part of these superficial cavities was filled with dry kino, the red-coloured liquid which is produced by the sapwood of *Dalbergia* trees as reaction to wounds.

A 14-year old teak tree in the Bandjar plantations had broken at a height of 7 meter, just where the trunk appeared to be badly damaged by a colony of *dalbergiae*. Many galleries were to be seen under the bark, and the course of woodvessels in the cambial zone showed that the trunk had been trying to bridge the interruptions in the sap-stream. This breaking of teak trees at the place where the cavities made by a *Neoterмес* nest are, is a feature rather often met with in the plantations infested by *N. tectonae* in C. Java.

Composition of the colonies. Very few observations are available about the size of the colonies and the number of individuals in various stages. A large colony collected from a *Dalbergia* trunk in Banyumas, May 1926, but not fully complete, included 496 larvae of the 5th instar, 84 nymphs with small wing pads and 7 with large wing pads, 3 soldier nymphs, 3 soldiers and 2 young alates, therefore some 600 individuals in total. A note on the numbers collected from infested teak in Bandjar, in 1935, mentions 1035 larvae and nymphs, 19 soldiers and 6 imagines, apparently the populations of three colonies combined. These few figures and the amplitude of the nests indicate that *dalbergiae* colonies probably reach sizes similar to those of *tectonae*.

Notes on the alates. In the field young alates were found to be already present in numbers at the end of May in a colony collected from a teak tree in Banyumas, therefore rather early in the season as compared with *tectonae*.

In the laboratory at Bogor a billet of *Dalbergia*, containing *Neoterмес* and cut in Banyumas in March 1927, was kept in a cage under moist conditions. From this billet small numbers of alates appeared mainly in the period 30 October/15 January. In all some 80 specimens were counted; out of these 23 in November, 33 in December and 13 in January, with some stragglers making their appearance at an even later date. These alates could be trapped with small pieces of dry branches provided with a slit leading to a hole made in the surface and covered with celluloid. The alates would enter these chambers most cautiously, soon shedding their wings and after some time beginning to enlarge the hole by removing small bits of wood, which were pushed outside in part through the entrance hole.

In a few cases observed the entrance of a specimen was first resisted by the one already occupying the room, but later tolerated.

The successful rearing of initial colonies was not achieved as in the case of *N. tectonae* under the same laboratory conditions (KALSHOVEN 1930).

Hosts. From the data presented it follows that 5 hosts of *dalbergiae* have become known so far, three of which have already been mentioned before (KALSHOVEN 1930 p. 37). This is still far less than the number of hosts observed for *tectonae* (see below).

N. sonneratae Kemn. 1932/1934. Java: single colonies in dead specimens of kapok (*Ceiba pentandra*) (nr. 4575 in KIRBY 1941 p. 47), in kapidada (*Sonneratia acida*) (nr. 4574 in KIRBY 1942b p. 183, 192) and in kendaka (according to the botanical works the vernacular name of *Avicennia officinalis* but the timber did not show the rings and was very hard in contrast to what appears to be characteristic of this species), a young colony in a dead limb of buta-buta (*Excoecaria agallocha* or *Cerbera manghas*), all in the mangrove swamps of Angke, VII.1935.

KEMNER found the species in a still living tree of *Sonneratia acida* and gives *Hibiscus tiliaceus* as another probable host.

N. tectonae Damm. 1913. New material. E. and C. Java: colony apparently taken from teak, at Djember, district of Besuki, VIII.1931 (nr. t. 311 COLLIER in KIRBY 1942a p. 105); in teak tree at Bentjuluk in the forest range of Banyuwangi, collected by a forest ranger, VIII.1934; colonies in infested billets of teak trunks sent from the field station Gedangan near Telawa, VI.1935 (nr. 4542 in KIRBY 1942a p. 105, 1942b p. 192). W. Java: parts of colonies in two branches of teak, collected by a senior forest ranger in a plantation near Tangerang, VIII.1935. S. Sumatra: 10 colonies in dead branches taken by personnel of the Forest Service from trees of punah (*Tetrameristra glabra*), meranti (*Shorea leprosula*) and geronggang (*Cratoxylon cuneatum* or *glaucum*), in felling area near Kateman, VIII.1934; four colonies collected from similar timbers in the same locality, V.1935 (two of them mentioned under nrs. 4528 and 4529 in KIRBY 1942a p. 105; his number 4561, according to my notes, however, originating from Telawa, C. Java and not from Kateman). Banka: in unidentified sample of wood, collected in Koba and submitted by the Forest Service, VIII.1934.

Distribution. When I prepared my thesis on the bionomics of *N. tectonae* (published in 1930) the species was already known from the main area of teak forests, reaching from Krawang in West Java to Bodjonegoro in the eastern part. The additional records now show that the species also occurs in still more western localities as well as in the most eastern districts of Java, facing the coast of Bali. Most likely it will be found therefore all over the plains and low hills of those parts of the long-stretched island which have a comparatively dry climate, but it has not been met with so far in the southern half of W. and C. Java, which is characterized by a higher rain-fall and which has been found to be the habitat of *N. dalbergiae*.

The occurrence of the species in Sumatra, already suspected in 1930, has now been confirmed. Among the Kateman material there were two exceptionally large colonies of 2265 and 2690 individuals respectively, the others being of very different sizes from a score of specimens to some 750.

The identity of the specimens from Banka has still to be substantiated, as the soldiers in the single proper sample at hand have a rather elongated head. But this appears to be a doubtful characteristic for separating species, as the ratio between the length and width of the soldier's head shows considerable variation in different colonies all from the same host — teak — in the main area of distribution in Java (KALSHOVEN 1930). The Banka colony in question consisted of some 1100 specimens originally.

Hosts. During the investigations in Java before 1930, well established colonies of *tectonae* were found in a dozen host trees of different botanical affinities, in addition to teak, and small or initial colonies in another dozen hosts. It is not surprising therefore that in Sumatra some further hosts have been observed which appear to be suitable for a full development of the colonies. The occurrence of the teak trunk termite in *Tetrameristra* was mentioned in an annual plant pests report (KALSHOVEN 1936).

It may be expected that further investigations will disclose still more host timbers of the species.

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Formica exsecta Nyl. Bij Wierden in het Vossenbos werd door mij op 9 juni 1959 een nest van *F. exsecta* gevonden. Dit is de eerste vondst van deze boreo-alpine soort in het subcentreuropische district.

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Verzoek. Zo spoedig mogelijk opgaven van afwijkende data van Lasiocampidae, Drepanidae, Cymatophoridae en Nolidae en alle U bekende vindplaatsen van *Habrosyne pyritoides* Hufn., *Thyatira batis* L. en *Tethea* or Schiff. Bij voorbaat dank.

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