XVI. Termites *in captivity in England*. By George D. Haviland, M.A., and David Sharp, M.A., F.R.S., etc.

[Read October 21st, 1896.]

It will be recollected that at the meeting of the Society on June 5th, 1895, I exhibited on behalf of Mr. G. D. Haviland, who had brought them to England from Singapore, two societies of Termites in glass tubes. These small associations survived for a considerable period—very different in the case of the two species, however; and as there are some points of interest in connection with them, Mr. Haviland has kindly put together notes of his observations. The association of *Calotermes domesticus* was, however, in my charge during most of the time it existed. [D. S.]

Calotermes artocarporum [n. sp.].

* "The specimens were found by a native collector in Sarawak in the dead stump of a Champadak or Jack-fruit tree (*Artocarpus integrifolia*). He brought back a log of wood full of them about the middle of September, 1894. Some individuals were mounted and sent to Dr. Sharp.

"September 23rd the log of wood was split open and a search made for the queen; neither the queen nor any winged forms were discovered, but a king was found. Many of the individuals, including two or three soldiers, were put in a pudding dish with plenty of wood, and the dish was covered with glass. At first they were kept damp with moist cotton wool, but a peculiar fly became plentiful under the glass, so the damping of the cotton wool was given up. They were also at first protected from ants by placing their dish in water, but this protection was found unnecessary and was given up. They united the pieces of wood together by earthen walls derived from proctodeal discharges, thus protecting themselves from dry air and light. Generally, however,

* The parts in inverted commas are furnished by Mr. Haviland.—D.S.

they passed solid oval frass like the furniture Termite (*Calotermes domesticus*). If picked up they discharged a drop of muddy fluid from the anus, which under the microscope was found to be literally crammed with infusoria.

"About December 16th some of these Termites were taken and placed in glass tubes plugged at the mouth with cotton wool and kept in a closed box in the dark. In some of the tubes 12 individuals and in others 24 were put. In a few days it was noticed that in two or three of the tubes there were Termites without the posterior end of their abdomen, they looked as if the posterior half had been snipped off. They were alive and on the wood. There was no evidence to support the idea that they had been bitten. It is probable, however, that the condition was in some way the consequence of insufficient food and moisture; for the wood that they were on was too hard for them.

"Many of the specimens preserved in spirit at this time, or earlier, have compound eyes, are yellowish in colour, and clearly are incipient neoteinic forms, unfortunately the exact dates at which the specimens were put into spirit are not recorded on the tubes.

"On January 2nd the following record of the tubes was made:—

"*Tube* 1. 19 individuals, without trace of wings, but varying in size; one is brown with brown compound eyes; another is yellowish white, uniform in colour except for the dark streak of the cardiac vessel, it is of smaller size than the first, and its compound eyes are not pigmented; the other 17 have no compound eyes, and are white except where the brown colour of the intestines shows through the cuticle.

"*Tube* 2. 16 are alive and two are dead at the bottom of the tube. They all seem to be in a bad way, and to be starving, the wood appears to be too hard for them. None of them have signs of compound eyes.

"*Tube* 3. 18 individuals, none are yellowish or have compound eyes. Their wood seems hard, but they are healthy.

"*Tube* 4. 11 individuals, healthy, none appear to have compound eyes.

"*Tube* 5. 7 individuals healthy, none appear to have compound eyes.

"*Tube* 6. 7 individuals, some small and dwarf looking, none appear to have compound eyes.

"On February 21st the following observations were made at sea off Aden :—

"*Tube* 1. 4 individuals ; one of them is brown with compound eyes ; the other three are white and one of them is very short.

"*Tube* 2. 3 individuals, small and of starved appearance.

"*Tube* 3? 4 individuals, one large and one very short.

"*Tube* 4. 11 healthy individuals, one a well developed brown form with compound eyes.

"*Tube* 5 ? 2 miserable individuals.

"*Tube* 6. All dead.

"March 13th in the English Channel. The Termites seemed to stand the cold till the thermometer went down to 55 degrees, but yesterday the thermometer went lower and they were nearly dead, lying on their backs, just able to move a leg when breathed on. I have taken them down to the engine room where the majority at once recovered.

"March 30th. Almost all these Termites now have eyes and some of them are growing wings. In the dish are 56 still alive, all the soldiers are dead and there are no substitution forms ; added 5 from a tube, making in all 61. In one of the tubes there is a substitution form.

"April 6th. Put all the Termites from the tubes into the dish, there is amongst them a good neoteinic individual.

"On December 5th, 1895, all the Termites except the neoteinic individual, which was a king, were dead. On December 7th he died also."

Calotermes domesticus [n. sp.].

"From the beginning of November to the 9th of December, 1894, a good number of individuals were kept in a tube under observation, but as no neoteinic individual could be seen spirit was added and some fresh tubes started. The exact dates of the starting of these tubes was not recorded, but none were started after January, 1895.

"On March, 17th, 1895, they reached England and were sometimes exposed for brief intervals to cold, once to below 45 degrees F., when they were quite helpless, but soon recovered; generally they were kept warm artificially.

"On March 30th there was only one tube of them left, but that had a good number of individuals in it. It had frequently produced winged individuals and continued to do so at intervals, till there were but few left; these imagos could not escape through the plug of cotton wool, and did not seem to live many days after they had got their wings. So far there was no neoteinic individual recognized.

"On December 5th, 1895, Dr. Sharp, who then had charge of them, wrote: 'The colony is producing winged forms and eggs: where the eggs came from I have not ascertained, they are of comparatively large size; the Termites lift them in their mouths and carry them about as ants do.'"

The specimens of this species under my charge were all contained in a test tube 6 inches long, $\frac{5}{8}$-inch in diameter. The tube contained a large splinter of the wood the *Calotermes* eats, and was closed by a plug of cotton wool; the Termites never attempted to interfere with this plug, but kept away from it; occasionally it was taken out and a minute quantity of water was added to make the atmosphere damp. The intra-tubal arrangements of the Termites were interfered with in no other way; the tube was placed in a small card-box, packed with cotton wool to keep it steady, so that the Termites were not exposed to light; during the winter the box was placed in a corner of one of the apartments of the new museums at Cambridge (the Bird-room), under the hot-water pipes, but, notwithstanding this, it was exposed to great vicissitudes of temperature. The Termites, on the whole, did well, and had there been more of them to start with, it is, I think, probable that the association might have been maintained for a long time, instead of becoming extinct in October, 1896, after nearly two years of this highly artificial kind of existence. At first the colony produced numerous winged individuals, and this process continued for about a year; none of the winged individuals were taken out of the tube, and I think they all soon died. As a result, at the beginning of the

present year the number of individuals in the tube was reduced to about twenty; for some time eggs in very small number were to be seen, I doubt whether more than four or five were produced; and they did not hatch. The number of individuals of the association continued to diminish throughout the summer, and as the autumn set in they languished more and more so that on the 17th October only a single individual was to be seen, and this was evidently dying. On that date I opened the tube and took out the fragment of wood, and splitting it up I discovered, concealed in a cavity, another individual, a neoteinic one, that doubtless had produced the eggs. As this cavity had been the centre of activity during the egg-laying period of the colony, I was not surprised at finding this queen in it. Although left quite alone, this specimen seemed in good health (though one of her feet had been amputated at some time). I removed her and placed her in the small glass tube in which I exhibit her this evening. The night of the 19–20th was cold, and on the morning of the 20th the queen was torpid, but revived on the tube being placed in a pocket of my waistcoat. The chief point of importance is that though this colony had abundant opportunities of using adult individuals for the purposes of reproduction they did not do so, but established a neoteinic queen. I have no reason to suppose that there was a male present, and this may have been the reason that none of the eggs hatched.

Very little trouble has been taken with this colony; indeed, it has often not been looked at for several weeks, and, as the result of this experiment, I feel sure that observations on living Termites may be carried on in this country with very little trouble. If an artificial termitarium such as that recently designed for ants by Mr. Ch. Janet, and described in the Ann. Soc. Ent. France, 1893, p. 467, were used, and care taken that the temperature never fell below 60 or 65 degrees Fahr., I believe very little difficulty would be experienced in keeping the creatures in good health and in making valuable observations. *Calotermes domesticus* seems specially suitable for the purpose; it is a very abundant and destructive insect at Singapore, but there is not the slightest danger of its doing any damage in this country. Indeed, I may remark, that all the evidence goes to show that Termites

can nowhere be destructive until after they have been established for some considerable time in any given locality. Their increase can be carried on at a good rate only after a certain complexness of conditions has been established. Finally, I may remark that I am inclined to believe that the posterior parts of the bodies of individuals of this species may have been eaten by their associates, but I never saw the act.

18th December, 1896.

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