

Nematodes Associated With Termites in Hawaii, Borneo and Celebes

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During investigations of natural enemies of the sugar cane borer, *Rhabdocnemis obscura* (Boisduval) in the East Indian Archipelago, 1926-1927, opportunity was had to examine termite communities for parasites in Celebes and North Borneo. Certain nematodes were often found abundantly present within termites collected on both islands, and subsequently in Hawaii also; but only in small numbers. As nematodes have in some cases been recorded as fatally parasitic on certain insects, including termites, the following information is given for what interest it may have.

In North Celebes nema were found within the mouth-cavity of *Neotermes*, *Coptotermes*, *Microcerotermes* and *Termes* species. About one-quarter of the individuals examined were infested. The nema were not abundant. Rarely more than ten were found within a head. These were more commonly found within the heads of workers. No nema were found in species of *Nasutitermes* and *Cryptotermes*. An abdominal nematode lying outside the intestine occurred in small workers of one species of *Termes*; usually from 1 to 4 individuals per termite. About one-third of the small workers of this species were infested.

In North Borneo head-inhabiting nematodes were commonly found in the mouth-cavity of 2 species of *Coptotermes*; 3 species of *Capritermes*; 2 species of *Microcerotermes*; 2 species of *Termes*; 3 species of *Rhinotermes*; 1 species of *Neotermes*; 1 species of *Macrotermes* and 3 species of an undetermined genus. They were not found in 1 species of *Cryptotermes*; 1 species of *Hospitalitermes* and 3 species of *Nasutitermes*. In the case of the large, mound-building species of *Macrotermes*, the head-infesting nema were not numerous, but in all of the others, where found, they were often abundant; there sometimes being 20 nema to a head. No abdominal nema were found in Borneo.

The nema occurring in termite-heads, both in Celebes and Borneo, were always immature. Their average length was about .25 mm. Maturity appears to follow the death of the termite; for full-grown individuals were only found in dead termites. Dr. G.

Henderson of the Experiment Station, H. S. P. A., has examined these and determined them as a species of *Rhabditis*.

Nema were especially numerous in the workers of all species of *Capritermes*. Mounds of these were frequently found completely vacated. Being otherwise undisturbed in the forest, it seemed possible that such colonies had been wiped out by accumulations of nema. Nema-infested *Capritermes* were brought to Honolulu from North Borneo. The termites all died en route within 2 weeks. The nema survived and were found numerous within the heads of the dead termites.

It is probable that wet conditions favor these nema. Examinations in Celebes were made at the close of the annual 6 months' dry season, while the Borneo studies were made at the height of the wet season.

Dissections of *Neotermes connexus* Snyder, a supposedly Hawaiian termite, revealed nematodes in the heads of workers. They are uncommon, however. Rarely more than one nematode per head occurred in the examinations, while the percentage infested is low. Dr. Henderson finds this to be a species of *Rhabditis* also.

Examinations of *Coptotermes formosanus* Shiraki and *Cryptotermes piceatus* Snyder, collected in Honolulu showed no nematode infestation.

The presence of nematodes within heads of termites has been observed by others. Of particular interest are the observations of Merrill and Ford¹ who found head-inhabiting nema in *Leucotermes lucifugus* Rossi in Kansas. This nematode was described by Cobb as *Diplogaster labiata* n. sp. They found that where infestation was heavy the termites often died and under culture nema infestation could in 12 days time become so heavy as to kill all termites under observation.

On October 25, 1926, termites bearing the abdominal nematode were shipped from Macassar, Celebes. The nema reached Honolulu alive some six weeks later. Mr. Muir and Dr. Henderson were able to breed this in quantity in culture. Large numbers of them were placed in soil infested with *Coptotermes formosanus* in one spot in Honolulu. A quantity was also placed with *Coptotermes* in soil in a large glass jar containing wood. During April,

¹Merrill and Ford, *Journal of Agricultural Research*, Department of Agriculture, Washington, D. C. Vol. VI, No. 3, April, 1916.

1927, the writer has dissected open many termites from both places; but in no single instance has a termite been found containing nema.

Attempts to inoculate *Coptotermes* in Honolulu with the head-inhabiting nematodes from Borneo have so far given negative results also.