ABSTRACTS (MASTER THESIS)

X-ray Computer Tomographic Analysis of Breeding Chambers and Gallery Systems in Wood Created by a Drywood Termite, *Incisitermes minor* (Hagen)

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Introduction

The western drywood termite, *Incisitermes minor* (Hagen) (Kalotermitidae), is considered to be the most destructive drywood termite in the western United States (USA). Today, more than half of the prefectures in Japan are also listed as infested areas. Despite it being an economically important pest, the nesting biology of *I. minor* is poorly understood. To date, there are no published data available regarding *in situ* nest-gallery development of *I. minor*. In the present study, two commercial timbers, Sitka spruce (*Picea sitchensis* Bong. Carriere) and Sugi (*Cryptomeria japonica* D. Don), were used to evaluate nest-site selection and nest-founding activity in *I. minor*.

Materials and Methods

Forty Sugi and 60 Spruce timbers were prepared; sample dimensions were 50 mm (R) x 50 mm (T) x 1000 mm (L), and each included sapwood and heartwood portions. All timbers were placed in highly infested attic areas at four different houses in the Wakayama Pref., Japan. CT-scan analysis of samples was carried out with a large-scale X-ray CT apparatus (YXLON International GmBH Germany) at the Kyushu National Museum, and the data were reconstructed into three dimensional (3-D) images, 2-D section images, and series of virtual cuts using volume graphics software (VGStudio MAX 2.1, Volume Graphics GmbH Germany: digital data thickness 1 mm, 1024 x 1024 pixels, 3.17 2-D image slice per mm).

Result and Discussion

The results indicated that *I. minor* showed a preference for the spruce timbers over the Sugi timbers in establishing the first royal cells. To observe the breeding chambers and nest-gallery development, three spruce timbers were selected for bi-annual analyses by X-ray CT. Two timbers were infested by five pairs of reproductives from nuptial flight. Other timber was infested by the outside foraging of a group of individuals that emerged from the natal nest. CT images revealed that *I. minor* reproductives showed anatomical selectivity in both nest-founding activity and nest-development. The structure of the initial chambers varied to follow to the anatomical texture of the wood; resembled either a pear-shape or cashew nut-shape. The first six-month CT analyses indicated two kinds of strategies to initiate a new colony. In the first, two of the reproductive pairs expended energy in brooding, while simultaneously curtailing foraging; the other three pairs concentrated on foraging. The reproductive pairs showed no hibernation period and continuously excavated the galleries during the first six months. The nest-gallery was excavated cavernously in a particular annual growth ring where the breeding chamber was established. All the chambers showed significant accretion in volume and structure. After one year, one reproductive pair had exhibited no brooding activity, while the other four had 2 - 5 new colony members.

The infestation by a group of individuals demonstrated the different pattern of nest-development to that of the nuptial flight. The group established the first chamber, which was transversely excavated across several growth rings. After one year, the nest-gallery systems had been established consisting of seven chambers with extensive galleries across both sapwood and heartwood. Young colony members were observed, which indicated the emergence of the replacement reproductives. Although drywood termites have been classified as having the most primitive nesting behavior, the current results indicated that nest excavation of a one-piece nester involves quite intricate environmental responses.

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