Termite Attractant from Fungus-Infected Wood

Abstract. Field observations suggested that subterranean termites might follow a concentration gradient of attractive material to find decaying wood. Laboratory cultures of the brown rot fungus, *Lenzites trabea* Pers. ex. Fr., on pine blocks formed a material attractive to the eastern subterranean termites, *Reticulitermes flavipes* (Kol.) and *R. virginicus* Banks, and a Costa Rican termite, *Nasutitermes columbicus* (Holmgren). Such a potent termite attractant may be useful in termite surveys and control.

The diet of subterranean termites consists primarily of wood infected by fungi. Such fungi may be either beneficial or detrimental to the growth of the insects (*1*). Observations of the eastern subterranean termite, *Reticulitermes flavipes* (Kol.), suggested that a fungus or fungal product might also help the termites locate decaying wood. Shelter tubes built by this termite were found on buildings and trees in Sheboygan, Wis. Such tubes on the bark of living trees invariably led directly to a dead, decaying branch stub. The possibility that the termites followed a concentration gradient of attractive material to find the decaying wood led to laboratory studies on the relationship of termite to fungus.

Eight species of fungi associated with wood decay or termites (*2*) were cultured, and the attractancy of the products to *R. flavipes* was assayed. Culturing was accomplished with soil bottles containing a thin strip of wood called the feeder block. The bottles were inoculated with fungi and then incubated at 80°F at 70 percent relative humidity until the feeder blocks were covered with mycelium (*3*). Autoclaved (15 lbs, 15 min) blocks (¾ by ¾ by 2¾ in.) of western pine sapwood, *Pinus monticola* Dougl., were inserted in the bottles on top of the feeder blocks, and the cultures were incubated an additional 15 or 20 days. Next the test blocks were removed and marked at the upper limit of mycelial growth. Some of the blocks could be demarcated into three regions as follows: (i) a basal region covered by older woolly mycelium, (ii) a mid-region covered by cottony mycelium, and (iii) a top region with no visible mycelium. The mycelium was then brushed off, and each block was cut into sections according to the marked regions.

The blocks (either subsections from fungus-infected wood or control blocks from soil bottles not inoculated with fungi) were placed on moist sand in a large plastic container. Termites (250 of mixed castes excluding macropterous forms) were scattered over the sand in this multiple-choice situation. Within 2 minutes the termites clustered primarily around the basal portion, or woolly mycelium region, of blocks infected with *Lenzites trabea* in each of three replicated containers. Smaller groups of insects gathered around the basal portions of a few of the other blocks infected with other species of fungi. However, the basal portion from blocks infected with *L. trabea* was much more attractive than portions of the other blocks were. After 1 hour the greatest congregation of termites in the three boxes still occurred around the basal portion of the blocks infected with *L. trabea.*

For further studies a more refined bioassay technique for the attractive material was developed. Small paper pads as used in antibiotic assay (12.7 mm in diameter) were placed in a dish 5.3 cm in diameter. The basal portion of the block infected with *L. trabea* was macerated in distilled water to obtain an aqueous extract. A 0.03-ml portion of the extract was placed on one pad, and 0.03 ml of water was placed on another pad in the dish. When 20 termites were introduced they congregated within 30 sec on the pad containing the extract of wood infected with *L. trabea.* This response occurred despite the fact that the termites were in the light and exposed to desiccation. Neither water nor organic solvent extracts of sound wood or of *L. trabea* mycelium grown on malt agar medium elicited any response similar to comparable extracts from the infected wood. Further studies showed that the aqueous extract from 1 g of dry wood could be diluted to 6 liters with distilled water, and 0.03 ml was still adequate for attraction of the termites. Partial purification of the attractive material has been effected. The attractant was extracted from the aqueous material with ether. The ether-soluble materials were then chromatographed on Florisil columns with a benzene-ether elution gradient. The attractant eluted at about a 95:5 benzene-ether mixture. At this stage in the purification, the termites respond to 0.1 μg of the resulting colorless oil.

The aqueous extract from wood infected with *L. trabea* was also found to be highly attractive to other earth-dwelling termites, such as mixed castes, excluding macropterous forms, of *R. virginicus* Banks, and for nasute and worker forms of a Costa Rican termite, *Nasutitermes columbicus* (Holmgren).

The potential uses of such an attractant in survey, control, and research have been considered in a recent review on the general subject of insect attractants (*4*). Similar uses might be made of this termite attractant from fungus-infected wood (*5*).

G. R. Esenther, T. C. Allen,
J. E. Casida, R. D. Shenefelt
Department of Entomology,
University of Wisconsin, Madison,
and *Forest Products Laboratory,*
U.S. Department of Agriculture
Forest Service, Madison

References and Notes

1. E. C. Hendee, in *Termites and Termite Control*, C. A. Kofoid, Ed. (Univ. of California Press, Berkeley, 1934), pp. 100–107; A. E. Lund, *Forest Prods. J.* **9**, 320 (1959); *Pest Control* **28**, 26, 40 (1960).
2. Forest Products Laboratory cultures: (534) *Lentinus lepideus* Fr.; (617) *Lenzites trabea* Pers. ex Fr.; (697) *Polyporous versicolor* L. ex Fr.; (698) *Poria monticola* Murr.; and (71316) *Polyporous gilvus* Schw. ex Fr. *Penicillium* sp., *Aspergillus* sp., and *Spicaria* sp. were repeatedly isolated from termites.
3. This technique was described by the American Society for Testing Materials, "Tentative method for testing wood preservatives by laboratory soil-block cultures" (1956), ASTM Designation: D1413-56T.
4. N. Green, M. Beroza, S. A. Hall, *Advances in Pest Control Research* **3**, 129 (1960).
5. This report was approved for publication by the director of the Wisconsin Agricultural Experiment Station. This project involved the cooperation of and support by the department of entomology of the University of Wisconsin, the city of Sheboygan, and the Forest Products Laboratory of the U.S. Department of Agriculture Forest Service, Madison, Wis. This work was supported in part by the research committee of the Graduate School from funds made available by the Wisconsin Alumni Research Foundation.

16 March 1961

Initiation of Flower Buds in Rhododendron after Application of Growth Retardants

Abstract. Vegetative terminals of azalea (*Rhododendron* spp.) plants of varying ages initiated flower buds promptly after application of the chemical growth retardants, tributyl-2,4-dichlorobenzylphosphonium chloride (phosfon) and (2-chloroethyl) trimethylammonium chloride (CCC), as soil drenches. This response occurred under environmental conditions which prevented or limited flower bud initiation in untreated plants. Normal flowering followed exposure of the treated plants to dormancy-breaking cool storage.

Application of the growth retardants phosfon (tributyl-2,4-dichlorobenzylphosphonium chloride) and CCC [(2-chloroethyl) trimethylammonium chloride] caused suppression of vegetative growth and prompt initiation of flower buds in azalea, *Rhododendron* spp. These responses did not depend on