Brief Overview of Subterranean Termite Issues in the Southern U.S.

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This paper was given as an introductory presentation to the Formosan subterranean termite technical session at the 2005 American Wood Preservers' Association annual meeting in New Orleans. It provides basic information on current subterranean termite control issues, with particular attention to recent and potential future changes at the Federal and State levels in the regulation of soil applied termiticides.

Basic Biology

Termites are social insects belonging to the order Isoptera. Most are wood-consuming; however several species within the Termitidae (higher termites) are grass-feeding. Termites were the first animals to develop truly social ("eusocial") behavior, in contrast to the more recent aculeate Hymenoptera (ants, bees, and wasps). The order Isoptera is divided into five families, and there are members of four of these families present in the U.S. The fifth family (Mastotermitidae) contains a single primitive species that is known only from the Northern Territory of Australia. The remaining families each have varying numbers of species in the U.S., although not all are considered pest species. For example, while there are a few species of Termitidae in North America, none are considered pests of crops, forests, or structures. The economically important species belong almost entirely to two families, the Kalotermitidae (drywood termites) and the Rhinotermitidae (subterranean termites). Of the two families, the most economically important is the Rhinotermitidae.

Estimates of the costs of preventative measures, controlling active infestations, and repairing damage caused by subterranean termites have been reported as high as $1.5 billion annually in the U.S. alone (Su 1994; Su and Scheffrahn 1998). The termites responsible for this expense belong to three genera, *Heterotermes* Froggatt, *Reticulitermes* Holmgren, and *Coptotermes* Wasmann in order of relative aggressiveness.

The least problematic of the group is *Heterotermes aureus* (Snyder), a common termite pest in the arid Southwest areas of the U.S. However, recent collections of individuals of *Heterotermes* from Florida have been reported (Scheffrahn *et al.* 2003; Szalanski *et al.* 2004), indicating a possible new species to consider in the Southeastern U.S.

The native subterranean termites in the Southeastern U.S. belong to the genus *Reticulitermes*. All species are potential pests in urban areas but are beneficial species in their native forest habitats, providing turnover of nutrients (mainly carbon and nitrogen) found in downed trees. The taxonomy of the genus is somewhat controversial. There are at least three species recognized in the Southeastern U.S.: *R. flavipes* (Kollar), *R. virginicus* (Banks), and *R. hageni* Banks. Two other undescribed species, *R. malletei* Austin and *R. mississippiensis* Austin have been reported from the Southeast. Of these species, the most economically important is *R. flavipes*, and to a lesser extent *R. virginicus*. These species are part of a group of species that account for ~90% of all termite control in the U.S. (Forschler and Lewis 1997). The other species in that group are *R. hesperus* (Banks), *R. tibialis* (Banks) and *Coptotermes formosanus* Shiraki.

The Formosan subterranean termite, *C. formosanus*, is the most destructive termite pest in the U.S. And it is not alone; other members of the genus *Coptotermes* are gaining footholds in the U.S. There have been reports of established colonies of both *C. havilandi* Holmgren in Florida (Scheffrahn *et al.* 2003 and references therein) and *C. vastator* Light in Hawaii (Woodrow *et al.* 2001) in recent years.

Why is the Formosan subterranean termite so much more destructive than the native subterranean termites? There is the obvious answer that like other invasive species, the removal of *C. formosanus* from its native environment has allowed it to escape natural enemies that might otherwise keep it in check. However, this is not a very helpful answer. Some of the answer is based in basic biology of the two genera. For comparative purposes, *Reticulitermes* can be represented by its most well-known species, *R. flavipes*. One of the main reasons for the disparity between *Reticulitermes* and *Coptotermes* is colony size.

Reticulitermes flavipes colonies can contain as many as several hundred thousand worker termites (Grace 1992), while *C. formosanus* colonies can contain as many as a few million worker termites (Grace *et al.* 1996). Another way of estimating the differences between these two groups of termites is to examine their relative energy use, as shown in a recent study of active metabolic rate (walking). Workers, soldiers, and pre-alates (nymphs) of *C. formosanus* used less energy than their *R. flavipes* counterparts (Shelton and Appel 2001). Not only were *C. formosanus* getting better mileage in this study, they were also moving at a faster rate. It is logical to assume that these differences have contributed to their overall success as structural pests.

Regulations

Termites are generally controlled through the use of preventative measures applied to keep termites from entering a structure and causing damage. Traditionally, soil-applied termiticides have been applied beneath and around a slab or conventional foundation prior to construction. Today, these methods are still used to protect homes and other structures from infestation by termites. One of the reasons termites are such an economically important pest is that homes are typically the most important investments we ever make. Maintaining safe and structurally sound buildings is costly. Because of the high levels of investment, and the cost of replacing structures should a treatment fail, the federal government views registration of these products differently than most other insecticides. In a nutshell, termiticides require efficacy tests to ensure that products provide protection for a minimum number of years.

The USDA Forest Service Wood Products Insect Research Unit provides a program for testing termite control products in the laboratory and field, and to date virtually all registered termiticides in the U.S. have gone through this program. The Forest Service provides another service to the pest management industry by publishing the data from active ingredients once they are registered by EPA in the annual "Gulfport report."

The federal agency responsible for the registration of all pesticide products sold in the U.S. is the Environmental Protection Agency. The EPA's primary mission is protecting human health and the environment. Efficacy data is presented to the EPA as part of an overall package for consideration of registration. Once federal registration has been granted, individual states also review the termiticides. Some states have the authority to deny registration of a product for use, or possibly to issue a more restrictive label than the one approved by EPA. Many of these regulatory officials belong to a group known as the Association of State Pest Control Regulatory Officials or ASPCRO. Due to their consumer protection interests, ASPCRO often concerns itself with matters of termiticide efficacy.

Issues, Issues, Issues

The EPA Office of Prevention, Pesticides and Toxic Substances (OPPTS) issues a guideline for the testing and collecting termiticide efficacy data. Their guideline, OPPTS 810.3600, specifies test and performance standards. It was issued in 1998. The guideline for termiticidal baits, OPPTS 810.3800, was made official in 2004. In 2003, the state of Florida decided to implement rules regarding acceptable efficacy for termiticides sold in Florida. While guidelines are flexible, rules are not. Table 1 compiles the differences among the current federal OPPTS 810.3600 guideline, the Florida rule, and a proposed revision to OPPTS 810.3600 which will be discussed shortly.

The current OPPTS 810.3600 uses penetration of the treated soil as the performance standard of protection. All plots in the test must be free from penetration by termites for ≥ five years for the termiticide to be considered effective at that rate. The Florida rule does not use penetration as the performance standard; instead it uses damage to the wooden test blocks that are "protected" by the termiticide treatment. The Florida rule requires that termiticides must protect wooden blocks from damage greater than ASTM 9 in at least 90% of the plots per rate for each year of the test (Table 1). Note that this means that each rate of a termiticide gets a clean slate at the end of each year, so it is possible to have a single block (of 10 replicates) completely destroyed every year (can be the same or different blocks). In a worst case scenario, the remaining blocks can be rated as ASTM 9.

Earlier this year, the Termiticide Standards Review Committee (TSRC) of ASPCRO proposed changes to OPPTS 810.3600. The details are shown in Table 1. The proposed changes have not been implemented by EPA and would need to undergo a Scientific Advisory Panel prior to approval. Like the

Florida rule this proposal uses damage as the registration standard (e.g., 90% of all test blocks must rate ASTM 9 or better). Unlike the Florida rule, the proposal does not allow each year of the test to be considered independently; rather "failures" (a plot that has a damage rating of greater than ASTM 9) are cumulative over the life of the test. For example, in the standard USFS testing program where 10 replicates per rate are installed at 4 sites, a particular rate of a termiticide would get four failures (damage in a block greater than ASTM 9), but on the fifth failure, the termiticide would not pass the guideline at that rate (although it may still be registered). Thus, if applied as written the proposed revision to OPPTS 810.3600 would be less restrictive than the current guideline, but more restrictive than the Florida rule.

In summary, the issues confronting pest management of subterranean termites are varied, from expansion of the distribution of invasive species such as *C. formosanus* to modifications of regulations regarding the registration of products for control. As human population density increases and housing costs continue to rise, an increase in the cost of protecting and repairing those structures will also continue.

References

Forschler, B.T., and V. Lewis. 1997. Why termites can dodge your treatment. Pest Control 65: 42-53.

Grace, J.K. 1992. Termite distribution, colony size, and potential for damage. Proceedings of the National Conference on Urban Entomology 1: 67-76.

Grace, J.K., C.H.M. Tome, T.G. Shelton, R.J. Oshiro, and J.R. Yates. 1996. Baiting studies and considerations with *Coptotermes formosanus* (Isoptera: Rhinotermitidae) in Hawaii. Sociobiology 28: 511-520.

Scheffrahn, R.H., S.C. Jones, J. Krecek, J.A. Chase, J.R. Mangold, and N.-Y. Su. 2003. Taxonomy, distribution, and notes on the termites (Isoptera: Kalotermitidae, Rhinotermitidae, Termitidae) of Puerto Rico and the U.S. Virgin Islands. Annals of the Entomological Society of America 96: 181-201.

Shelton, T.G., and A.G. Appel. 2001. Carbon dioxide release in *Coptotermes formosanus* Shiraki and *Reticulitermes flavipes* (Kollar): effects of caste, mass and movement. Journal of Insect Physiology 47: 213-224.

Su, N.-Y. 1994. Field evaluation of a hexaflumuron bait for population suppression of subterranean termites (Isoptera: Rhinotermitidae). Journal of Economic Entomology 87: 389-397.

Su, N.-Y., and R.H. Scheffrahn. 1998. A review of subterranean termite control practices and prospects for integrated pest management programmes. Integrated Pest Management Reviews 3: 1-13.

Szalanski, A.L., R.H. Scheffrahn, J.W. Austin, J. Krecek, and N.-Y. Su. 2004. Molecular phylogeny and biogeography of *Heterotermes* (Isoptera: Rhinotermitidae) in the West Indies. Annals of the Entomological Society of America 97: 556-566.

Woodrow, R.J., J.K. Grace, and S.Y. Higa. 2001. Occurrence of *Coptotermes vastator* (Isoptera: Rhinotermitidae) on the island of Oahu, Hawaii. Sociobiology 38: 667-673.

Table 1. Comparison of the current (left) and proposed (right) federal guidelines for measuring termiticide efficacy, and the Florida rule (center).

EPA OPPTS 810.3600	Florida Rule	ASPCRO Revision of 810.3600
No soil penetration in any plot for 5 years	No damage >ASTM 9 in ≥ 90% of plots per year for 5 years	No damage >ASTM 9 in ≥ 90% of plots for 5 years
≥ 3 sites ≥ 10 plots per site	≥ 1 Southeastern site ≥ 10 plots per site	≥ 3 sites ≥ 10 plots per site
Treatments referred to as "barriers"		Treatments referred to as "treated zones"
Test Methods: Concrete slab Ground Board Stake	Test Methods: "Approved method"	Test Methods: Concrete Slab "Approved method"

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