FIELD MICROTESTS OF MATERIALS AGAINST SUBTERRANEAN TERMITE ATTACK

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INTRODUCTION: The testing of materials against termite attack is an important aspect of preventive control. Insecticidal, repellent or physically durable materials have hitherto been tested against subterranean termites by large scale field tests or small scale laboratory tests. Field microtests were devised to combine the advantages and eliminate the disadvantages of both methods. Successful trials were carried out during the writer's secondment to the Building and Road Research Institute, Kumasi, Ghana, 1968-70. The assistance and cooperation of the Director, Dr. J. W. S. de Graft-Johnson, and the staff of the Institute is gratefully acknowledged.

Laboratory tests use a selected termite species in a well controlled situation. The tests are precise, can be monitored throughout, started or stopped at short notice. However, a test is only reliable if the termite is living under conditions in which it will breed. Some Reticulitermes and Heterotermes species can be cultured easily, and though a few Termitidae have been cultured (Becker 1969) the important Macrotermitinae, fungus growers, have never been bred successfully. Thus the test termite is rarely the same genus as any to which the material will be exposed in practice, and the laboratory test is only a screening test. If a material shows no resistance it can be assumed that it would be damaged by most termites, but if it shows any degree of resistance it must be tested further in the field.

Field tests usually use one or more termites species to which the material will be exposed in practice, but it is often difficult to determine which samples were attacked by a particular species and when each was contacted. Sometimes the most important termites are not present in the test area. A field test is harder and more expensive to lay down and take up than a laboratory test, is less precise and cannot be monitored at all easily during its progress.

MICROTEST METHODS The principle is to set up a small test using samples of laboratory-test size, with either bait wood or glass below and a glass sheet above for observation. The test is presented to a colony of a selected termite species beneath a shade of hollow bricks or roofing felt. The shade can be gently lifted for observation, several times a day if desired. Buried strips of wood may be used to draw termites foraging nearby into the test.

MATERIAL IN BLOCK FORM Four microtests of an 'insect proof' plywood were prepared by placing a group of six 2.5 x 2.5 x 0.6 cm. blocks on a 20 x 20 x 1 cm. obeche (Triplochiton scleroxylon) bait board. Each block was surrounded by further obeche bait wood.

Test 1 was placed in an area dominated by Pseudacanthotermes militaris. It was recessed in the ground so that the cover glass was a little below ground level, as shown in Fig. 1. This prevented disturbance

of the test when the hollow brick shade was lifted for observation. The test was contacted by P. militaris within a day. Intermittent attack is usual in this species, and after six months the plywood blocks had received a total of about one month of contact, the obeche bait wood having been some $\frac{2}{3}$ destroyed. The blocks were undamaged except for slight nibbling and grooving along the edges of some of them.

Test 2 was similarly placed in an area dominated by a colony of Odontotermes pauperans. It was contacted within a day and received fairly constant attack for six weeks, by which time the bait wood was almost wholly destroyed. The plywood blocks were little damaged.

Test 3 was similarly placed near a Macrotermes bellicosus mound. It was attacked by that species after several weeks, and the blocks were contacted but remained undamaged. The M. bellicosus were then ousted by P. militaris and the course of the test was much as 1 and 2.

Test 4 was placed on a brick support with one edge recessed in an Amitermes evuncifer mound. The termites sealed off the test at first, but attacked it after several months. No blocks showed any detectable signs of attack after two weeks of contact.

This successful series of tests demonstrated that the plywood was very resistant to all these termites, though not repellent to contact. Test 4 also demonstrated the versatility of the method. A conventional large scale field test laid down in this Macrotermitinae dominated area would have had little chance of sustained attack by A. evuncifer.

MATERIAL IN SHEET FORM Three microtests of a synthetic air filter material were carries out. The material resembled a sheet of coarse and matted cotton wool about 5 mm. thick when uncompressed. Tests 1 and 2 were prepared by placing a 15 x 15 cm. sheet of the material on a 20 x 20 x 1 cm. obeche bait board. A 15 x 7.5 x 0.2 cm. obeche slip was placed over one half of the material. If the material was resistant the slip would be attacked with little damage to the material. If it was not resistant and not attractive, it would be greatly damaged beneath the slip but not elsewhere. If attractive it would be well attacked all over.

Test 1 was placed where attack could be expected by Pseudacanthotermes militaris. The termites attacked the test and contacted the material after several days. The material was wholly destroyed within one day. Clearly it was very attractive to this termite.

Test 2 was similarly placed where attack by Odontotermes pauperans could be expected. It was attacked after $2\frac{1}{2}$ months and the bait wood virtually destroyed in seven weeks thereafter. The material was destroyed where it had lain beneath the obeche slip, but not elsewhere. It was thus not resistant to this termite, but had no attraction.

Test 3 was carried out with Microcerotermes brachygnathus. Six strips of the material 7.5 x 1.25 cm. alternating with six strips of cotton wool were placed beneath a glass sheet in contact with an opened runway in the angle of a concrete step. The cotton wool was eaten when it became mouldy, but the air filter material was only slightly damaged

to allow passage of the termites. Again it was not resistant but was not attractive.

A laboratory test with Reticulitermes flavipes santonensis suggested that the air filter was resistant. Thus this interesting material ranged from being attractive to being resistant when tested with four different termites.

MATCHED TREATMENT TESTS Many resistance tests involve comparisons between different timber species, preservatives or strengths of a preservative. Statistical analysis of laboratory tests have sometimes been carried out, but this has not been done in field testing, presumably because of difficulty in getting the necessary precision. This was overcome in the four microtests described below.

Each test included six treatments of 2 x 2 x 1 cm. timber blocks replicated six times. They were fixed on a 20 x 20 cm. glass sheet in a 6 x 6 latin square. Termite damage was measured by dry weight loss as in laboratory tests such as those of Becker (1961). The full methods are discussed and results analysed statistically elsewhere (Williams, in press). Here only the baiting and presentation methods are important.

The first experiment tested the relative susceptibility of six samples of Triplochiton scleroxylon heartwood to attack by Coptotermes intermedius. The test was floored with a paper bait on a glass sheet and the sides were sealed with aluminium foil. A slit in the foil was placed against an opened runway of C. intermedius in a garage. The termites rapidly occupied the test after the runway and slit were damped. This first microtest successfully demonstrated that there could be wide variations in the susceptibility to attack of different samples of this negligibly resistant timber.

The other three tests were of the resistance of fourteen timber species to Pseudacanthotermes militaris. Each included Triplochiton scleroxylon and Chlorophora excelsa together with four other timbers.

Test 1 used a baiting and presentation method similar to that described for large scale field tests by Fougerousse (1969). The test was placed on a hollow brick with the blocks resting on a cotton wool bait, which was connected with the ground by obeche bait blocks. The method is shown in Fig. 2. The test was attacked within a few days, but the cotton wool was carried away so rapidly that only part of the test remained infested. It was taken up and rebaited more densely, and the termites were induced to return within a day or two by damping the obeche baits. The test blocks had received a satisfactory degree of damage after about a week of continuous infestation. The great advantage of this method is that the test remains dry and free from fungus attack whereas the ground beneath, and the baits at the sides can be damped to attract the termites, without damping the test.

Tests 2 and 3 were placed on the ground over bait sheets of Antiaris africana veneer and cotton wool respectively. The sides were loosely closed with wood strips and obeche bait blocks laid along them. Both tests were very intermittently attacked. After five months test 2 had been satisfactorily attacked but test 3 only very poorly and unevenly. These tests remained dry and free from fungus attack before infestation, only because the shaded area had been allowed to dry out beforehand. The obeche baits could not be

damped to encourage attack without damping the tests.

DISCUSSION AND CONCLUSIONS Field microtests are not intended to replace large scale field tests for materials in simulated use. Their great value is for tests of substances rather than structures, for example timber resistance, wood preservatives, physical durability of plastics, metal foils etc.

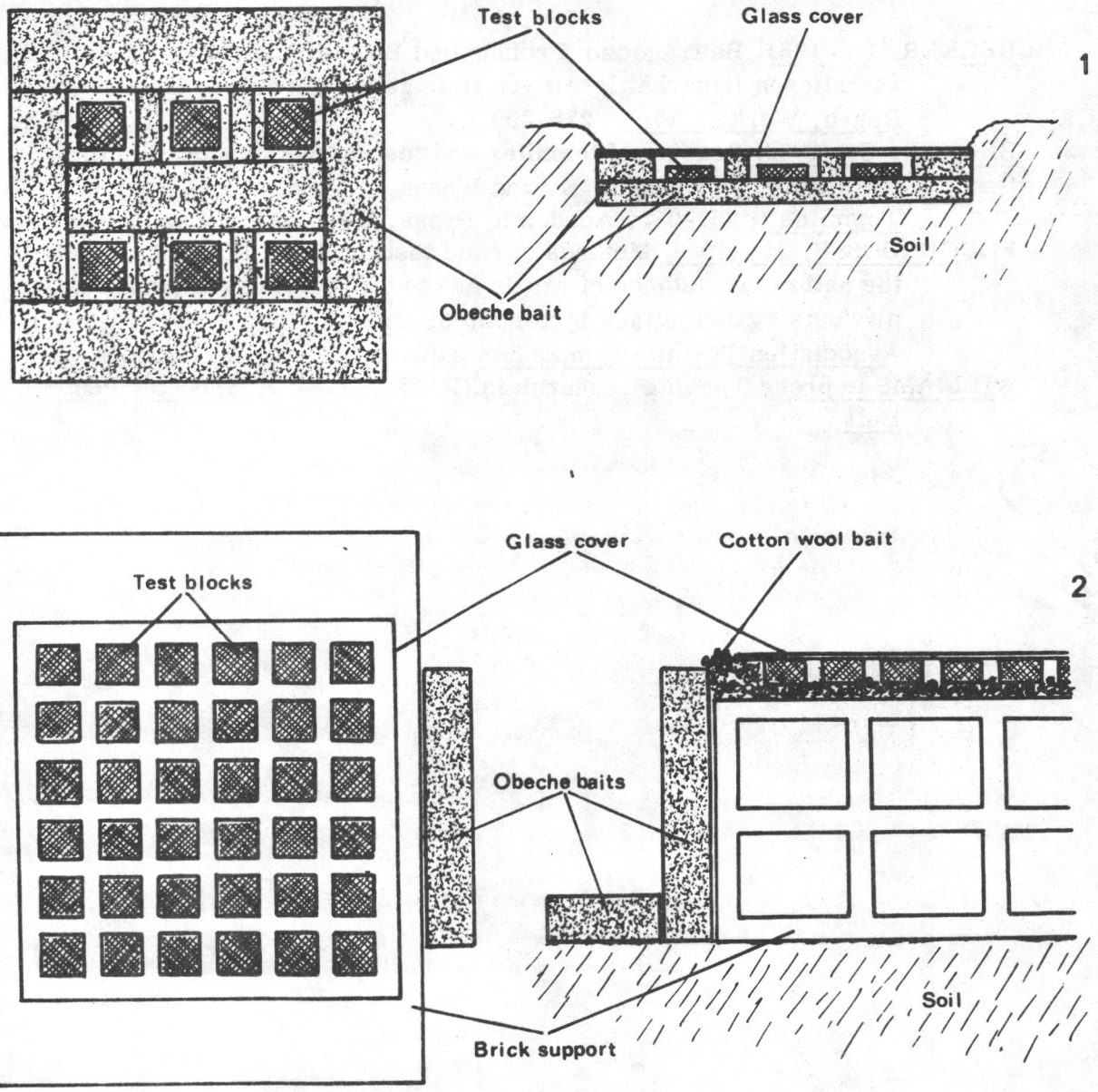
Their most important advantage is that tests can be carried out with any chosen subterranean termits. In a conventional large scale field test the relative contribution of several termite species may be uncertain, and the dominant or most damaging species may be unrecognised. A material can be microtested against each of the most relevant species separately and any variation in response noted.

A microtest can be presented wherever a termite species occurs. The important building damager Coptotermes intermedius is rare in open areas at at Kumasi and can only be used in a micro- or laboratory test.

Microtests are prepared by senior staff and technicians with laboratory precision, and can be laid down quickly and easily by one person. The elaborate arrangements for laying down a large scale field test, the use of unskilled labour and many experimental errors are avoided.

The progress of a microtest can be followed to a degree which would be impractical for a large scale test. Deterioration of samples and other undesired events can be observed and faults quickly rectified. The test can be taken up immediately it is satisfactorily completed.

There are still prolems of selective presentation and baiting for particular termite species, which need to be solved before microtests develop their maximum utility. However, with a little experience of termite behaviour and reasonable care they offer an accuracy of information which cannot be matched in any large scale testing method.



Field microtests against subterranean termite attack, in plan and elevation view: 1. Test of 2.5 x 2.5 x 0.6 cm. 'insect proof' plywood blocks; 2. Latin square timber resistance test of 2 x 2 x 1 cm. blocks.

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