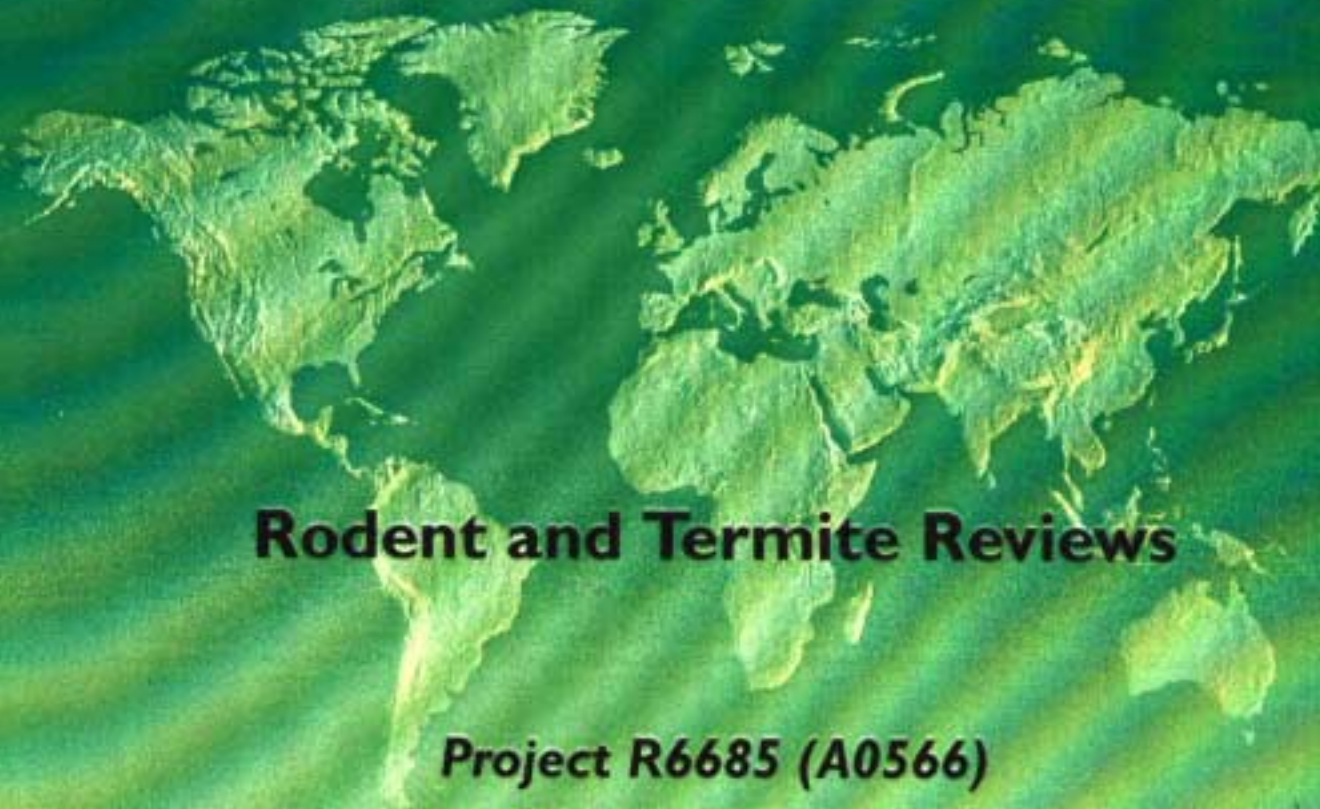


R6685-001

NATURAL RESOURCES INSTITUTE

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Rodent and Termite Reviews

Project R6685 (A0566)

Improved Design of Indigenous Grain Stores

1999



Natural
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Institute

RODENT AND TERMITE REVIEW

CPHP project R6685

Improved Design of Indigenous Grain Stores

(1997)

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NRI Report No. 2446

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EXECUTIVE SUMMARY

This study is part of the ODA-funded Crop Post-Harvest Programme covering both aspects of grain storage practices and grain store design in the Zambezi Valley of Zimbabwe. In particular it reviews the current state of knowledge concerned with the control of rodents and termites in small-scale, farmer-level grain stores of the type examined in the CPHP project R6685 Improved Design of Indigenous Grain Stores.

The review of losses due to rodents revealed few references to small-scale storage. For example, from 166 references to rodents on one database, only six were concerned with post-harvest losses, and only one of these related to small-scale storage. Texts on rodents tend to focus on pre-harvest losses, with post-harvest aspects focusing on large-scale centralised storage. Clearly significant issues such as food contamination with faeces and urine are hardly considered. Losses based on dry weights before and after storage were reported, but these are difficult to assess and may be due to other factors such as household removal or spillage. Harris and Lindblad (1976) suggested that estimates of losses are based on an assessment of the rodent population and their potential food intake. The authors concluded that, if it could be confirmed that rodents are present (and damaging the grain), then this is sufficient justification for a rodent control programme.

A range of questions were raised.

- Have recommended modifications (such as rodent guards) been taken-up elsewhere?
- Do rodents actively seek-out grain or do they come across it by chance?
- Are rodents in stores true field species seeking shelter and food after harvest or are they species normally associated with human habitation?
- To what extent are rodent-borne diseases a problem?

Many of the questions are being addressed by the CPHP funded project "*Development of a methodology for assessing the impact of rodents on rural household food security*" R7372 in Mozambique.

Research into termite damage (ignoring the many entomological and ecological references) concentrated on the protection of modern housing and offices. Termites favour timber structures, but they also thrive in mud-based structures where they can tunnel upwards within a mud wall to attack the thatch and the wooden roof structure (necessitating replacement of the thatch every one to two years). One reference indicated that damage to grain due directly to termite feeding was low, but contamination with moulds as a consequence of their attack is frequent.

Much of the information on the life of storage structures was found to be anecdotal - ranging from two to 10 years. The problem is that a combination of species of termites, levels of infestation, and varying designs of structure, makes comparison between different stores in different locations difficult to assess by discussion.

Destruction of termite hills has been practised to varying degrees of success. Cleanliness (removal of as much plant material from the vicinity of the store) also helps reduce termite activity. Engine oil, wood ash or crushed neem leaves placed in the post-holes are beneficial.

Physical barriers – such as stones, concrete or metal sheets – will prevent termites from tunnelling within the structure. The incorporation of grass into mud mixtures should be avoided in the case of mud-based structures (however this will have a detrimental effect on the strength of these materials).

Termite control measures have relied greatly on the use of chemicals, in particular organochlorines. More recently, control relies on integrated pest management, including the use of physical barriers wherever possible. Soil treatments below stores with chemicals such as chlorpyrifos can provide protection for up to 25 years, depending on the soil type and climate (effectiveness is reduced to 5 years for tropical conditions). Where chemicals are too expensive, wood ash is occasionally mixed with soil. Groundnut shells placed under sacks of grain have been reported to reduce termite damage. Termite soil, hardened by firing and then waterproofed with a bitumen layer, has been used for lining pit stores against termite attack.

The views expressed in this report are not necessarily those of DfID but are those of the authors.

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Part 1

STORAGE LOSSES DUE TO RODENTS

HISTORICAL

Literature reviews of post-harvest losses from the late 1970s and early 1980s showed relatively few references specific to storage losses due to rodents (approximately 20 references compared to around 200 on insect losses). Eight references were classed as 'supported estimates' - where there was some information about how the figures were derived; 5 of these were from the Indian Grain Storage Institute. There were two 'complete estimates' where sufficient information was given to judge the reliability of the figures. Information from Africa was particularly scarce.

In Boxall's (1986) review of methodology for loss assessment, it was reported that there was a wide range of grain losses by rodents, and figures for India ranged from 2.5-5.9% up to 25-30%. However, even when grain loss is considered to be low, there is considerable contamination of grain by urine, faeces and diseases as well as loss from broken grains which further reduces grain quality. It was concluded that the range in loss estimates reflected problems in methodology and could be due to potential variability in rat population densities and behavioural differences among rodent species.

There was considerable debate over the measurement of rodent losses when Harris and Lindblad (1976) prepared their loss assessment manual. Harris and Lindblad (1976) described methods for measuring rodent losses to grain stored on the head or on the cob, and these methods were used in Nepal (Boxall & Gillett, 1982). Figures for rodent losses in threshed grain could be estimated by comparing dry weights at the beginning and end of the storage period while allowing for losses due to insects and agreed removals. However, this method is largely impracticable except under experimental conditions because of the difficulties in measuring all grain movements in and out of store.

Harris and Lindblad (1976) suggested that estimates of loss might be indirectly obtained by combining data from population studies and food consumption studies. For example, adult Norway rats, *R. norvegicus*, eat about 10% of their body weight each day, such that 100 rats would consume more than 1 tonne of grain per year. Therefore 500 rats would result in the loss of enough food to feed 20 people (Jayas *et al.*, 1995). However, these studies can be time consuming and expensive, and up to the present time, only one reference has been made to using this method for farm-level loss assessment in Bangladesh (Mian *et al.*, 1987). This method will tend to underestimate rodent populations and could, therefore, undervalue storage losses.

At the time of Harris and Lindblad's (1976) manual, the need for actual figures for loss caused by rodents was questioned. It was accepted that if it could be established that there was a rodent problem and that this was rated important by the community,

then there was no need for loss figures to justify a control programme. Indeed, losses of food to rodents may be relatively insignificant compared to loss and damage to property, and potential health risks. The joint FAO/WHO (1976) view is that rodent damage and loss to field crops and stored food should not be considered as an isolated agricultural problem as the public health implications associated with rodents may be severe.

A comprehensive search of the relevant databases at NRI revealed no direct references to the magnitude of post-harvest losses due to rodent activity. In the CAB database, for example, there were 166 references to rodents, but of these, only six were concerned with post-harvest aspects, five of which involved rodent problems in large central storage facilities, whereas only one referred to stored food losses in farm households (Mian *et al.*, 1987). The same situation was found with other databases where the number of references to research on post-harvest loss by rodents was low, and these were related to grain in large central stores.

It is apparent, therefore, that relatively little research into losses of stored products due to rodents has been conducted. The majority of post-harvest investigations relate to rice storage and have been conducted in Southeast Asia (Benigno & Sanchez, 1984), particularly in the Philippines and Bangladesh. This may be because much of the pre-harvest research on rodent damage to growing crops has been in rice fields. No data relating to research on pre- or post-harvest losses due to rodents or on rodent control were found from Africa or South America.

Extension books published by FAO (1980) and GTZ (Gwinner *et al.*, 1996), which include farm-level grain storage, make frequent reference to problems caused by rodents and to 'heavy' or 'significant' damage to stored grain. However, the GTZ booklet which has a chapter on rodents, does not refer at all to the problem at farm-level or to control measures that may be used at this level.

Publications on storage technology generally make only a passing reference to storage losses caused by rodents. Textbooks on rodents, such as that by Meehan (1984), concentrate on problems caused by rodents in plantation crops, post-harvest aspects cover only central storage. Prakash (1988) contains some reference to rodent damage to stored crops in Africa and Asia and states that, due to inadequate methodology on loss assessment, the values for post-harvest losses due to rodents are 'guesstimates'. Some loss values are given for countries in Asia, but there is no clear distinction between losses at farm or central storage level.

A further reason given for the lack of programmes to investigate strategies against rodents in developing countries is that strategies in most countries are based on the use of rodenticides. This concept is supported by Macdonald and Fenn (1994) who suggest that most of the population research on rodents in developing countries arises from studies on the efficacy of rodenticides. They are of the opinion that such studies contribute little to understanding the factors that regulate or limit field populations, or cause population outbreaks of rodents.

Fiedler (in Prakash, 1988) reports research indicating that damage to stored crops increased after field crops had been harvested, because the removal of food and shelter

caused rodents to move closer to villages. However, Prakash and Mathur, (also in Prakash, 1988), suggest that true field rodents do not normally extend their range into houses and stores, although if these species become established in such situations, they gradually replace the existing species. According to these authors the main damage to stored crops from true field rodent species occurs when stores are built in the vicinity of crop fields.

Macdonald and Fenn (1994) report studies on UK lowland farms which show that the potential for reinfestation of farm buildings increases following harvest when rodents are more mobile. They suggest that a knowledge of the population dynamics of any stored product pest is vital in planning a management programme, and that the social structure and behaviour of the local rodent population must be known in order to design a successful pest management system.

QUESTIONS FOR THE FUTURE

Current recommendations for control of rodents at farm-level storage focus on store and homestead hygiene, proofing, trapping and, perhaps as a last resort, the use of rodenticides. How far are these recommendations taken up, and if rodents become a serious problem, do people take action? It seems that rat guards are routinely fitted only when assistance is provided through a project, e.g. Sasakawa Global 2000. In Ghana, cribs built under the direction of extension agents were fitted with rat guards, yet farmers 'copying' the new design of crib did not bother with guards. At a USAID-funded storage project in the Central African Republic, all stores in some villages had been 'rodent-proofed' using thorn twigs, whilst stores in neighbouring villages had no such treatment.

Rodents are highly mobile - if they are excluded from a store (by rat guards) do they just move on to the next non-proofed store? Do rodents actively seek out stored grain or do they find it by accident? How serious are storage losses by rodents? Are these losses caused by rats or mice, or both? Feeding habits suggest that mice may be more of a problem as they feed regularly on site; rats are more likely to remove grain. In farm surveys, farmers frequently report losses due to rodents, but how reliable is this information? Is there a real loss or is it just that the occasional rat is more visible than insect damage when the store is visited or opened?

The risks to health caused by rodents, as well as the potential food loss, are often stressed when recommending rat guards. Are there any reports of rodent-related health problems arising from consumption of farm-stored grain?

Are the rodents that damage crops in farm stores true field species that seek shelter and food after harvest or species that are normally associated with human habitation, such as *R. rattus* and *R. norvegicus* which might not be expected to spend most of their time attacking field crops? Are rodents more of a problem in villages and around stores in the period following harvest or are they a constant problem?

Farmers are often not prepared to undertake rodent control measures because rodents from adjacent stores with no control measures are a constant source of reinfestation.

Any campaign against rodents damaging stored crops should be on a village-wide basis. How easy will it be to introduce this concept?

How do the local health and agriculture departments in any country view the problem of rodents? Is there any collaboration or do each regard it as the other department's responsibility?

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Part 2

STORAGE LOSSES DUE TO TERMITES

An intensive literature search through a variety of electronic and manual systems revealed that much of the research into termite damage (ignoring the many entomological and ecological references) concentrated on the protection of modern housing and offices. No scientific research papers were found which specifically examined aspects of termite damage to small-scale structures (storage or otherwise). Examples of the types of references found are listed in Appendix 1. However, snippets of relevant information appeared in a number of either more general references or those that concentrated on other aspects of termite damage, ecology or control. The two key references found were Pearce (1997) and GTZ (no date of publication).

Obviously termites favour timber structures, but they also thrive in mud-based structures where they can tunnel upwards within a mud wall to attack the thatch and the wooden roof structure (necessitating replacement of the thatch every one to two years) (Pearce, 1997). Wooden poles or bamboo incorporated (for added strength) into wooden, mudded or cement walls provide termites with easy access to the remainder of the structure. Termites can also burrow through mortar between bricks or blocks. Construction materials should be carefully examined to ensure they do not have a resident infestation. Areas of vegetation close to inhabitation, such as the mangrove swamps in parts of Kenya, can act as sources of re-infestation.

Much of the information on the life of structures was found to be anecdotal - ranging from two to 10 years. The problem is that a combination of species of termites, levels of infestation, and varying designs of structure, makes comparison between different stores in different locations difficult to assess. Pearce (1997) indicated that damage to grain due directly to termite feeding was low, but contamination with moulds as a consequence of their attack is frequent.

Termite activity in buildings is greatly influenced by air temperature and humidity.

Termite control measures have relied greatly on the use of chemicals, in particular organochlorines. More recently, control relies on integrated pest management, including the use of physical barriers wherever possible.

CHEMICAL TREATMENTS

Soil treatments below stores with chemicals such as chlorpyrifos can provide protection for up to 25 years, depending on the soil type and climate (effectiveness may be reduced to as little as 5 years under tropical conditions) (GTZ). Other active ingredients include cypermethrin, fenvalerate, isofenphos, oftanol, permethrin, phoxim, and pyrimiphos-methyl. Although borate-based chemicals are less toxic they still give good protection against termites. Effectiveness of treated timber walls

however can be further reduced due to weathering (Pearce, 1997). Dipping of timber in coal tar, petrol, or creosote will reduce termite damage but these are toxic, have strong often unpleasant odours (possibly making them unsuitable for food stores), and discolour the timber. A wide range of chemical preservatives have been used in the past but many are either no longer used due to concerns over their high toxicity or are not suitable for small-scale structures due to their high cost.

Fumigation has been successfully used in many situations, especially where the building is gas-tight or where it can be covered in gas-proof sheeting. A wide range of fumigants appear to have been used – including methyl bromide, phosphine, sulphuryl fluoride, and carbonyl sulphide. Of these, methyl bromide and phosphine are probably the only ones available to farmers in certain countries (depending on the local regulations). Whether or not fumigants are available to farmers, due to the potential dangers of performing fumigations by un-trained farmers, the use of fumigation by small-scale farmers cannot be recommended.

Baiting, where toxic baits are placed near termite colonies, can be effective but the type of bait must be matched to the type of termite, and there is a relatively high managerial requirement in order to successfully use baits. Baiting is therefore a more specialist technique and so is probably best performed by an agency such as the local ministry or perhaps by specialist pest control companies.

Where man-made chemicals are too expensive, alternative methods must be devised. Engine oil or wood ash placed in the post-holes are beneficial (GTZ). Many farmers use plants or plant extracts (such as bark, leaves, seeds, and oil extracts) to either deter termites from entering an area or that are toxic to termites. Plants can also be used to attract termites away from crops or buildings – *Leucaena* is one example (Pearce, 1997).

PHYSICAL BARRIERS

Physical barriers (GTZ) – such as stones, concrete or metal sheets – will prevent termites from tunnelling within the structure. A solid concrete floor will prevent termite access (providing the cement content has not been reduced for some reason) - any joints in concrete floors or access points for cables and pipes should be sealed carefully with bitumen. Aluminium or galvanised metal sheets incorporated into the structure, with protruding edges of at least 10 cm and bent downwards at approximately 45°, provides some protection against both tunnelling within the structure and crawling up the outside (GTZ). Similar plates may be placed on top of supporting columns under floors and walls – in this case the corners of the sheets are soldered to form effectively an up-turned metal tray (Harris, 1971). (If nothing else such plates can make termite runways more visible, Pearce 1997). A cement sill around the warehouse with a groove on the underside also prevents termites from climbing the outer walls. Hollow block walls should not be used as these provide easy access for termites within the structure.

Careful selection of materials for use in construction is important – where termites are a problem avoid timber wherever possible for example by using metal door and

window frames. Ventilation openings should be covered by fine mesh screens to prevent termite access into the building.

The incorporation of grass into mud mixtures should be avoided in the case of mud-based structures (however this will have a detrimental effect on the strength of these materials). Sand, basalt, granite, glass splinters and coral of specific sizes can act as very effective barriers – particles must be too big for the termites to move but the gaps between the particles too small for termites to pass through (Pearce, 1999). Wood ash is occasionally mixed with soil either below the store, in the post-holes, or in the mud mix for mud-based structures (termites dislike tunnelling through ash). Groundnut shells placed under sacks of grain have been reported to reduce termite damage (Pearce, 1997). Termite soil, hardened by firing and then waterproofed with a bitumen layer, has been used for lining pit stores against termite attack.

OTHER FACTORS

Good managerial practices can significantly reduce termite activity within the store (GTZ). Good field hygiene, including the removal of dead plant materials (stalks, leaves, etc.) and harvesting at the correct stage of maturity (termites often attack grain left in the field after maturity) reduces the carry-over of termites into store. Destruction of termite hills has been practised to varying degrees of success. Cleanliness (removal of as much plant material from the vicinity of the store) also helps reduce termite activity (Pearce, 1997). Regular inspection of stores and their contents helps identify problems before they have had chance to develop. The keeping of fowls (chickens for example) around stores helps kill-off termites.

TERMITE REFERENCES

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APPENDIX 1 EXAMPLES OF REFERENCES FOUND CONCERNING TERMITES AND SMALL-SCALE STRUCTURES

TITLE: Subterranean termite *Reticulitermes* spp. (Isoptera: Rhinotermitidae) baiting and control in historical public buildings in Italy.

AUTHOR(S): Ferrari-R; Marini-M; Robinson-WH (ed.); Rettich-F (ed.); Rambo-GW

SOURCE (BIBLIOGRAPHIC CITATION): Proceedings of the 3rd International Conference on Urban Pests. Czech University of Agriculture, Prague, Czech Republic, 19-22 July 1999. 1999, 357-365; 22 ref.

PUBLISHER INFORMATION: Graficke zavody Hronov; Czech Republic

LANGUAGE OF TEXT: English

ABSTRACT: Many historical sites in Italy suffer severe damage to wooden structures, works of art and ancient books caused by well-established subterranean termite populations (*Reticulitermes* sp., *R. lucifugus lucifugus* and *R. lucifugus corsicus*). In 6 field tests, termite colonies were treated with a baiting procedure based on the delivery of cellulose matrix impregnated with hexaflumuron, a slow acting chitin synthesis inhibitor. Six different large structures in ancient towns were chosen for their high historical value: a church, a museum, a monastery, a library, a cellar and a school. Treatments took place between 1995 and 1998, by means of baiting in underground and above-ground stations. Operating density was 3-4 monitoring-baiting devices/100 m² for large buildings, increased to 5-10/100 m² for smaller surfaces. Different problems in contacting colonies, implementing networks of bait stations, finding effective concentrations of hexaflumuron and managing reinfestations were overcome. Different decreasing trends were observed, depending on the features of specific colonies. In all sites total elimination of *Reticulitermes* spp. activity was reached in a period of between 3 and 12 months, delivering minimal quantities of hexaflumuron (0.3-3.4 g) to the colonies.

PUBLICATION TYPE: Conference-paper

INTERNATIONAL STANDARD BOOK NUMBER: 80-238-4257-9

ACCESSION NUMBER: 19991109449

TITLE: Termite resistant construction and building materials.

AUTHOR(S): Grace-JK; Yates-JR; Robinson-WH (ed.); Rettich-F (ed.); Rambo-GW

SOURCE (BIBLIOGRAPHIC CITATION): Proceedings of the 3rd International Conference on Urban Pests. Czech University of Agriculture, Prague, Czech Republic, 19-22 July 1999. 1999, 399-406; 41 ref.

PUBLISHER INFORMATION: Graficke zavody Hronov; Czech Republic

LANGUAGE OF TEXT: English

ABSTRACT: Prevention of termite [Isoptera] attack is preferable to remedial control. This can be accomplished through good architectural design, use of termite-resistant building materials, installation of physical or chemical barriers to prevent subterranean termite penetration and possibly also installation of termite bait/monitoring stations. Current developments and trends in each of these areas contributing to the construction of termite resistant buildings are reviewed, particularly with respect to control of the Formosan subterranean termite, *Coptotermes formosanus*.

PUBLICATION TYPE: Conference-paper

INTERNATIONAL STANDARD BOOK NUMBER: 80-238-4257-9

ACCESSION NUMBER: 19991109455

TITLE: Termite durability classification of building materials by formosan termite, *Coptotermes formosanus*.

AUTHOR(S): Suzuki-K; Hagio-K; Walford-GB (ed.); Gaunt-DJ

SOURCE (BIBLIOGRAPHIC CITATION): Proceedings of Pacific Timber Engineering conference, 14-18 March 1999, Rotorua, New Zealand. Volume 2. Forest-Research-Bulletin. 1999, No. 212, 258-263.

PUBLISHER INFORMATION: Forest Research; Rotorua; New Zealand

LANGUAGE OF TEXT: English

ABSTRACT: Building materials, including heartwood samples of 3 Japanese domestic species, 13 imported softwoods and 17 imported hardwoods were placed on a laboratory colony of *Coptotermes formosanus*, together with akamatsu (*Pinus densiflora*) sapwood blocks as controls. Termite resistance of the materials was graded by mass loss and visual means. Heartwood samples of 7 wood species [*Chamaecyparis obtusa*, *Thujopsis dolabrata*, *Chamaecyparis nootkatensis*, *Thuja plicata*, *Callitris* sp., *Dryobalanops* sp., and *Swietenia macrophylla*] were graded as 'highly resistant'. Plywood made from tropical hardwood species, inorganic board materials and medium density fibreboard made from *Pinus radiata* were also highly resistant. Other board materials, most commercial softwood plywoods, and OSB were graded as 'low resistant'. Common thermal insulating foams were severely attacked by termites. Of the fire-protection materials tested, expanded concrete was resistant to *C. formosanus*.

PUBLICATION TYPE: Conference-paper; Journal-article

ACCESSION NUMBER: 19990609675

TITLE: Reproductive dynamics and colony structure of subterranean termites of the genus *Reticulitermes* (Isoptera Rhinotermitidae): a review of the evidence from behavioral, ecological, and genetic studies.

AUTHOR(S): Thorne-BL; Traniello-JFA; Adams-ES; Bulmer-M

SOURCE (BIBLIOGRAPHIC CITATION): *Ethology, Ecology and Evolution*. 1999, 11: 2, 149-169; 4 pp of ref.

LANGUAGE OF TEXT: English

ABSTRACT: In subterranean termites of the genus *Reticulitermes*, colonies are difficult to delineate because physical nest structures are concealed or amorphous, and colony boundaries are difficult to define. The ambiguity of colony architecture and the cryptic nesting and feeding habits of these ecologically and economically important termites hinder understanding of their population biology. Current information on *Reticulitermes* life history, reproduction, and genetics is reviewed to develop an understanding of colony and population structure, and possible modes of reproductive organization. To infer colony structure, several breeding systems that might be found in *Reticulitermes* were simulated and the *F* statistics and relatedness coefficients expected for groups of workers drawn from the simulated populations were determined. Available field data on the distribution of worker genotypes within and among colonies were then used to distinguish between alternate hypotheses regarding population and breeding structure in *Reticulitermes*. Comparisons suggest that *Reticulitermes* colony structure ranges from simple families with monogamous, alate-derived parents to complex, interconnected nests containing numerous inbreeding

neotenic reproductives. Patterns of colony organization may vary considerably depending upon species, colony size, habitat, and population. Inbreeding and complex colony structures have also been documented in other termites and in some social Hymenoptera.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 19991108474

TITLE: Characterization of surface structures covering termite flagellates of the family Oxymonadidae and ultrastructure of two oxymonad species, *Microrhopalodina multinucleata* and *Oxymonas* sp.

AUTHOR(S): Rother-A; Radek-R; Hausmann-K

SOURCE (BIBLIOGRAPHIC CITATION): *European-Journal-of-Protistology*. 1999, 35: 1, 1-16; 46 ref.

LANGUAGE OF TEXT: English

ABSTRACT: The surface structures of different Oxymonadidae were investigated by light and electron microscopy with respect to their morphology, chemical nature and distribution in the different oxymonad genera. Two species, *Microrhopalodina multinucleata* and *Oxymonas* sp. were focused on and, since ultrastructural reports of oxymonads are scarce, some attention was also paid to their morphology. The cell surface of both species is totally covered with extracellular surface structures (ESS) to which bacteria are attached. The ESS are not detectable by light microscopy, but by scanning electron microscopy a continuous cover composed of circular structures is visible. They are found in indentations of the plasma membrane and consist of a cylindrical, hollow basis on top of which lies a circular lid. Digestion experiments and labelling with lectins and Ruthenium red indicated that they mainly consist of carbohydrates and not protein. The presence of ESS seemed to be a principal feature of termite flagellates belonging to the genera *Microrhopalodina* and *Oxymonas*. The morphology of *M. multinucleata* and *Oxymonas* sp. resembles that of other oxymonad species. Their karyomastigonts include an axostyle, a preaxostyle, and 2 pairs of basal bodies/nucleus. In addition to the axostyles, a further microtubular rod extends into the rostellum. The numerous large vacuoles with "fluffy" contents are considered to be final stages of digestion vacuoles rather than sites for production of the ESS.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 990802615

TITLE: Water supply during building activities in the subterranean termite *Reticulitermes santonensis* De Feytaud (Isoptera, Rhinotermitidae).

AUTHOR(S): Grube-S; Rudolph-D

SOURCE (BIBLIOGRAPHIC CITATION): *Insectes-Sociaux*. 1999, 46: 2, 192-193; 10 ref.

LANGUAGE OF TEXT: English

ABSTRACT: *Reticulitermes santonensis* uses its labial gland reservoirs as a storage and transport organ for imbibed water. Therefore the reservoirs can be entitled as 'water sacs'. During building activities, pseudergates of *R. santonensis* moistened the building material with the contents of their water sacs.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 991106664

TITLE: The contribution of termites to the microgranular structure of soils on the Uasin Gishu Plateau, Kenya.

AUTHOR(S): Jungerius-PD; Ancker-JAM-van-den; Mucher-HJ; van-den-Ancker-JAM

SOURCE (BIBLIOGRAPHIC CITATION): Catena. 1999, 34: 3-4, 349-363; 29 ref.

LANGUAGE OF TEXT: English

ABSTRACT: A termite mound was selected on pedologically unaffected, clayey weathering material derived from phonolite. The fate of microaggregates produced by termites was followed through the various stages of mound building. Field evidence was supplemented with microscopic analysis. Development of the mound begins when lumps of soil are detached from the subsoil by termites and carried as microaggregates to the surface. In the next stage the microaggregates are cemented to form the nest. Breakdown begins when the nest is abandoned and disintegrates by splash and runoff producing colluvium, or is demolished by ants. In the final stage this material is integrated in the soil of the mound. Soil aggregates produced by splash, ants and soil-forming processes have different size characteristics, but the original microaggregates produced by the termites are preserved in the matrix throughout. It is assumed that they owe their stability to impregnation with saliva or other body fluid excreted by the termites. Termites produce also microaggregates in the form of faecal pellets, but these appear to be unstable and are found only in the voids of the soil developed during the last stage.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 991903711

TITLE: Results on termite resistance of building materials against *Coptotermes formosanus* by choice test.

AUTHOR(S): Suzuki-K; Hagio-K

SOURCE (BIBLIOGRAPHIC CITATION): Document -International-Research-Group-on-Wood-Preservation. 1998, No. IRG-WP-98-10275, 7 pp.; Paper prepared for the 29th Annual Meeting of the IRG, Maastricht, Netherlands, 14-19 June, 1998. 2 ref.

PUBLISHER INFORMATION: IRG Secretariat; Stockholm; Sweden

LANGUAGE OF TEXT: English

ABSTRACT: Various building materials, including 73 wood species, wooden board materials, thermal insulation materials and fire-protection materials, were tested for grading of termite resistance against *Coptotermes formosanus*. The dimensions of most specimens were 2X2X2 cm. Ten repeats were prepared. The specimens were put between Akamatsu [*Pinus densiflora*] sapwood control specimens on a laboratory cultured mound colony of *Coptotermes formosanus*. After 1 month of attack by termites, the specimens were removed from the mound colony and cleaned up. Then their final masses were determined. The grading of termite resistance was initially estimated by mass loss of specimens. This grading was corrected by visual observation. Three Japanese domestic species as well as cypress pine [*Pinus* sp.], Alaska-cedar [*Chamaecyparis nootkatensis*], kapur [*Dryobalanops* sp.] and mahogany [*Swietenia* sp.] indicated rather high termite resistance. In the case of Siberian red pine and Gmelina, the value of termite resistance was shown to be variable. Tropical species plywood, inorganic board and radiata pine MDF, showed rather high termite resistance. Other board materials showed rather less termite resistance. Most of the

commercial softwood plywood and OSB were very sensitive to termite attack. Most common thermal insulation materials in Japan were estimated to be very sensitive to attack. In the case of fire protection materials, expanded concrete was rather resistant but plaster board was very sensitive to attack.

PUBLICATION TYPE: Conference-paper; Journal-article

ACCESSION NUMBER: 990601928

TITLE: A novel chemical barrier system, Kordon R TMB, for the protection of buildings against subterranean termites using a synthetic matrix as carrier for the chemical.

AUTHOR(S): Lenz-M; Morrow-P; Runko-S

SOURCE (BIBLIOGRAPHIC CITATION): Document -International-Research-Group-on-Wood-Preservation. 1998, No. IRG\WP\98-10264, 8 pp.; 29th Annual Meeting, Maastricht, Netherlands, 14-19 June 1998. 12 ref.

PUBLISHER INFORMATION: IRG Secretariat; Stockholm; Sweden

LANGUAGE OF TEXT: English

ABSTRACT: Kordon TMB is a new chemical barrier system for installation beneath concrete slab-on-ground constructions using a matrix other than soil as carrier for the termiticide. The product consists of a synthetic foraminous web (blanket) carrying the synthetic pyrethroid deltamethrin. The blanket is laminated on the upper side to a standard 0.2 mm thick moisture vapour membrane of low density polyethylene (LDPE) and on the other side to a sheet of black 0.05 mm UV-stabilised LDPE. Installation of the barrier follows existing building practice of setting down and sealing the vapour barrier, as required, during site preparation for building. Results of the evaluation of component materials and key features of the Kordon TMB system, which has been ongoing for the past eight years, are briefly discussed in this paper. Experiments simulated the use of treated webbing with or without LDPE under concrete slabs at sites near Griffith (New South Wales) in a semi-arid part of eastern Australia and near Darwin (Northern Territory) in the wet/dry tropics of northern Australia. In these trials timber has been protected from subterranean termite attack (*Coptotermes* and *Mastotermes*) for more than seven to eight years at rates of 0.25-2.50 g/m² deltamethrin. In another series of studies, samples of wood protected by the webbing with LDPE were exposed to termites using a below-ground exposure method. To date, these trials have demonstrated successful protection of timber from termite attack for periods of six months to two years for rates from 0.01-1.00 g/m² deltamethrin. Laboratory studies have been conducted to simulate the Kordon TMB seals around service penetrations through the concrete slab. The first trial was conducted at incubation temperatures optimal to termite requirements, while a second series investigated the effectiveness of seals at lower temperatures more closely resembling conditions under a concrete slab.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 990602652

TITLE: Disturbance by the mound-building termite, *Trinervitermes trinervoides*, and vegetation patch dynamics in a semi-arid, southern African grassland.

AUTHOR(S): Smith-FR; Yeaton-RI

SOURCE (BIBLIOGRAPHIC CITATION): Plant-Ecology. 1998, 137: 1, 41-53; 30 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Changes in the composition and abundance of grasses and shrubs, soil fertility, and the productivity and nutrition of the grass *Themeda triandra*, were examined along an age gradient of *Trinervitermes trinervoides* mounds occurring in a semi-arid grassland of the Free State, South Africa. The pioneer grass, *Tragus koelerioides*, and the climax grass, *Themeda triandra*, dominated around active mounds. As the mounds became inactive and eroded away, these two grass species were replaced by the subclimax grass, *Eragrostis lehmanniana*, along with an increase in the cover of the unpalatable shrub, *Walafriida saxatilis*. Mound soils, in contrast, were sparsely vegetated and only changed in composition, and the population abundance of *T. triandra*, on old active mounds compared to earlier or older mound age states. Soils on eroded mounds were more acidic, and contained higher concentrations of Mg, Ca, N, P, and total exchangeable cations (T.E.C.) than soils occurring 0.5 m from the margins of eroded, inactive and active mounds. A plant bioassay, using *Lolium perenne*, confirmed the higher soil fertility on eroded mounds but also showed significant increases in soil fertility alongside inactive and eroded mounds. Pot experiments showed an increase in the production of *T. triandra* plants grown on soils from eroded mounds, and those occurring alongside inactive and eroded mounds. Foliar protein and nitrogen increased when these plants were grown on soils from eroded mounds. Mounds of *T. trinervoides* were foci of biotic disturbance because they alter soil resources, and the population abundance and composition of grasses and shrubs in the first metre around their margins. Increases in soil fertility alongside inactive and eroded mounds, and the accompanying increase in the productivity of *T. triandra*, along with signs of its foliar nutrient enrichment, suggest the removal of this species through preferential grazing by animals as the mounds become inactive and erode away.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 980709323

TITLE: Evaluating chemicals for eco-friendly pest management-I: terpenoids and fatty acids for building termites.

AUTHOR(S): Sharma-RN; Raina-RM

SOURCE (BIBLIOGRAPHIC CITATION): *Journal-of-Scientific-and-Industrial-Research*. 1998, 57: 6, 306-309; 11 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Some selected terpenoids and fatty acids were screened for toxicity and repellency against the termite *Odontotermes brunneus*. In toxicity tests, LD50 doses were calculated using log-probit analysis. Among the compounds screened, linalool, citronellal and carvone showed promising toxicity (LD50 = 16.63 µg/cm², 22.9 µg/cm² and 22.51 µg/cm², respectively), while eucalyptol, terpinene and limonene did not show much activity (LD50 > 350 µg/cm²). Limonene exhibited maximum persistence. Terpinene, farnesol and carvone prevented 50% of the population from crossing over the treated barrier for up to 24 h. It is concluded that the more active of these chemicals can be deployed in suitable application strategies for eco-friendly termite management.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981108469

TITLE: Reproductive strategies and community structure of New Guinean arboreal nesting termites.

AUTHOR(S): Leponce-M

SOURCE (BIBLIOGRAPHIC CITATION): Bulletin-and-Annales-de-la-Societe-Royale-Belge-d'Entomologie. 1997, 133: 2, 283-289; 16 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Colonies of *Microcerotermes biroi*, an arboreal nesting termite, generally headed by a pair of dealated imagos (84% of colonies in coconut plantations), spread by large nuptial flights which allow a fast colonization of new habitats. Replacement reproductives, which are nymph-derived and transitorily worker-derived, were found in 16% of the colonies in Papua New Guinea and presumably differentiated in response to the death of the primary reproductives or to the isolation of a satellite nest from a parent nest (budding). The reproductive strategy of *M. biroi* allows it to preempt the habitat with many small colonies and to be the most common species in coconut plantations, despite the fighting superiority of the main competitor, *Nasutitermes princeps*, which exhibited a propensity to build very large nests and to propagate by budding. Differences in each species reproductive strategy was one of the major factors explaining the observed community structure.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981109630

TITLE: The mound-building termite *Macrotermes michaelsoni* as an ecosystem engineer.

AUTHOR(S): Dangerfield-JM; McCarthy-TS; Ellery-WN

SOURCE (BIBLIOGRAPHIC CITATION): Journal-of-Tropical-Ecology. 1998, 14: 4, 507-520; 4 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Many organisms create or alter resource flows that affect the composition and spatial arrangement of current and future organismal diversity. The phenomenon called ecosystem engineering is considered with a case study of the mound building termite *Macrotermes michaelsoni*. It is argued that this species acts as an ecosystem engineer across a range of spatial scales, from alteration of local infiltration rates to the creation of landscape mosaics, and that its impacts accrue because of the initiation of biophysical processes that often include feedback mechanisms. These changes to resource flows are likely to persist for long periods and constrain the biological structure of the habitat. The value of ecosystem engineering is discussed as a holistic way of understanding the complexity of tropical ecology.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981109779

TITLE: Termite-induced change in soil structure after mulching degraded (crusted) soil in the Sahel.

AUTHOR(S): Mando-A; Miedema-R

SOURCE (BIBLIOGRAPHIC CITATION): Applied-Soil-Ecology. 1997, 6: 3, 241-249; 29 ref.

LANGUAGE OF TEXT: English

ABSTRACT: A morphological approach was used to study the influence of termite activity on crusted soil. The structure of the top layer (0-10 cm) of these soils is

degraded (no functional voids and no aggregates). Composite mulch (woody material + straw) was applied at the rate of 4 mg ha⁻¹ to trigger the activity of termites. Termite-induced features in soil structure were described and quantified by means of field observations, observation with polarizing microscope and computerized image analysis using Quantimet 970. The termite activity after the application of the mulch resulted in a change from a compact grain structure (original structure) to a chamber and channel structure. The channels and chambers accounted for over 60% of the macroporosity in the 0-10 cm layer. Unmulched plots (i.e. bare plots) mostly had packing voids, very few macropores, no voids with equivalent circle diameter (ECD) greater than 2 mm and one-third the number of voids with ECD > 100 µm compared with the plots with termite activity in the 0-10 cm layer. In the mulched plots the sealed surface was perforated by termites, resulting in many visible open voids. These plots were covered by sheetings that consisted of fine soil material transported to the soil surface and linked up by termites. In the deeper layers, termite-induced change of soil structure after mulching was difficult to confirm since both on mulched and bare plots there are many termite-mediated features from previous termite activity. These features are numerous voids, open or infilled, generally with crumbs. The latter are the only type of aggregate found in these soils, suggesting that termites play an important role in soil aggregation in such environments. This study provides information about the influence of termites in the improvement of a sealed/crusted topsoil structure. It shows that soil surface management such as mulching which enhances termite activity is an option to consider when improving degraded soil structure.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981912999

TITLE: Monitoring/baiting station to detect and eliminate foraging populations of subterranean termites (Isoptera: Rhinotermitidae) near structures.

AUTHOR(S): Su-NanYao; Thoms-EM; Ban-PM; Scheffrahn-RH; Su-NY

SOURCE (BIBLIOGRAPHIC CITATION): Journal-of-Economic-Entomology. 1995, 88: 4, 932-936; 6 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Commercial prototype monitoring/baiting stations were used to detect, bait and eliminate field populations of *Coptotermes formosanus* and *Reticulitermes flavipes* near structures in Florida. Because of the durable plastic housing, the station can be used by pest control professionals for ongoing monitoring and baiting programmes to provide continuous protection of structures from subterranean termites.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 951113264

TITLE: Isolation and primary structures of neuropeptides of the AKH/RPCH family from various termite species.

AUTHOR(S): Liebrich-W; Kellner-R; Gade-G

SOURCE (BIBLIOGRAPHIC CITATION): Peptides. 1995, 16: 4, 559-564; 30 ref.

LANGUAGE OF TEXT: English

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 951113840

TITLE: Evaluation of insecticides for the control of mound-building termite, *Cornitermes cumulans* (Kollar) (Isoptera: Termitidae) in pasture.

ORIGINAL NON-ENGLISH TITLE: Avaliacao de inseticidas no controle do cupim de monticulo, *Cornitermes cumulans* (Kollar) (Isoptera: Termitidae) em pastagens.

AUTHOR(S): Valerio-JR; Buainain-Alves-CM; Oliveira-MCM

SOURCE (BIBLIOGRAPHIC CITATION): Anais-da-Sociedade-Entomologica-do-Brasil. 1994, 23: 1, 19-24; 10 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: Five insecticides were tested for the control of *Cornitermes cumulans* in pasture in Mato Grosso do Sul, Brazil. Fenthion (Lebaycid 50% EC), chlorpyrifos (Dursban 24% EC), abamectin (Vermitec 1.8% EC), pirimiphos (Actellic 50% EC) [pirimiphos-methyl] and malathion (Nitrotion 50% EC) were tested. Mortality 30 days after application was 80 and 100% for fenthion at 5 and 10 ml/litre water, resp., 40 and 90% for chlorpyrifos at 5 and 10 ml/litre water, 100% for abamectin at both 3.3 and 6.6 ml/litre water, 30 and 40% for pirimiphos at 10 and 15 ml/litre water and 10% for malathion at both 5 and 10 ml/litre water. Further assays were conducted to determine the lowest dosage of abamectin capable of providing 100% control. Mortality was 100, 100, 100, 100, 100, 70 and 20% with 1.6, 0.8, 0.4, 0.2, 0.15, 0.1 and 0.05 ml/litre water, resp. The majority of termites, mainly workers, were dead after 3 days, but soldiers and young alates remained active for a few days after the death of workers.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 951115528

TITLE: Termiticide leachate from building foundation drains.

AUTHOR(S): Peyton-RL; Anderson-SH; Gantzer-CJ

SOURCE (BIBLIOGRAPHIC CITATION): Journal-of-Irrigation-and-Drainage-Engineering. 1995, 121: 5, 322-326; 19 ref.

LANGUAGE OF TEXT: English

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 951911434

TITLE: Termite physical barriers: current status of retrofitting Granitgard around 'mock-up' buildings.

AUTHOR(S): Ahmed-B; French-JRJ

SOURCE (BIBLIOGRAPHIC CITATION): Document -International-Research-Group-on-Wood-Preservation. 1994, No. IRG-WP-94-10057, 5 pp.; Paper presented at the 25th annual meeting, Bali, Indonesia, May29-June3, 1994.; 7 ref.

PUBLISHER INFORMATION: IRG Secretariat; Stockholm; Sweden

LANGUAGE OF TEXT: English

ABSTRACT: The results are presented after 2 years of a field experiment, in a semi-arid region of Victoria, Australia, to test the effectiveness of Granitgard physical barriers against attack by termites. After 23 months, no foraging by *Coptotermes*

species has occurred.

PUBLICATION TYPE: Miscellaneous

ACCESSION NUMBER: 950607439

TITLE: Foraging habits and nest structure of *Macrotermes estherae* Desneux (Isoptera: Termitidae) [in Karnataka, India].

AUTHOR(S): Sudhakar-K; Veeresh-GK

SOURCE (BIBLIOGRAPHIC CITATION): *Journal-of-the-Bombay-Natural-History-Society*. 1992, 89: 2, 180-183; 6 ref.

LANGUAGE OF TEXT: English

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 951104502

TITLE: Distribution of humic compounds in mounds of some soil-feeding termite species of tropical rainforests: its influence on soil structure stability.

AUTHOR(S): Garnier-Sillam-E; Harry-M

SOURCE (BIBLIOGRAPHIC CITATION): *Insectes-Sociaux*. 1995, 42: 2, 167-185; 43 ref.

LANGUAGE OF TEXT: English

ABSTRACT: A comparison was made of some physicochemical characteristics of epigeous termitaries (nest walls and surrounding horizons) of 4 species of soil-feeding termites living in tropical rainforest in Congo. The structural ability of soil was correlated with organic matter, cations and the relative proportion of mineral elements. Of these parameters, the content of organic matter was the most significant factor effecting the stability of termite building materials. Analysis of humic compound distribution revealed that fulvic and humic acids, owing to their electrochemical properties, were highly involved. Also, the organic matter in termitaries was more polymerized than that of humiferous control horizons, leading to FA/HA ratios close to 1. The stability of nest walls and topsoils differed between the species. Generally, 3 species including *Thoracotermes macrothorax* and *Cubitermes fungifaber* built nests that were enriched with organic matter and exchangeable cations, resulting in high structural stability. In contrast, materials worked by *Crenetermes albotarsalis* were not enriched with organic matter or cations and did not differ in stability from the control soils. It is concluded that any generalization on the overall influence of soil-feeding termites on soil fertility might be misleading. Only species which enrich their materials with organic matter, especially stabilized humic acids, contribute to soil conservation and hence fertility. Once the termitary is dead, its organic matter is again available to the soil ecosystem.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 951107246

TITLE: Synthetic studies of sesquiterpenes with a cis-fused decalin system, 5. A synthetic approach to the study of structure-activity relationships of the termiticidal norsesquiterpenoids, chamaecynone and related compounds.

AUTHOR(S): Ando-M; Kikuchi-K; Isogai-K; Ishiwatari-T; Hirata-N; Yamazaki-H

SOURCE (BIBLIOGRAPHIC CITATION): *Journal-of-Natural-Products*. 1994, 57: 7, 924-933; 5 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Various analogues of chamaecynone, an acetylenic norsequiterpenoid in the essential oil of *Chamaecyparis formosensis* (Benihi wood), were prepared from alpha-santonin (the methodology of which is described and figured) and the termiticidal activity of these compounds was examined. All compounds possessing a 5betaH-13-noreudesmane skeleton with a ethynyl group at C-7 showed significant termiticidal activity. Changes in the structure of the A-ring of these compounds also influenced the potency of this termiticidal activity.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 951101070

TITLE: Mechanical control of the mound-building termite *Cornitermes cumulans* (Kollar) with a mound-drill.

ORIGINAL NON-ENGLISH TITLE: Controle mecanico do cupim de monticulo, *Cornitermes cumulans* (Kollar), com a 'broca-cupinzeira'.

AUTHOR(S): Avila-CJ; Goulart-JA; Rumiatto-M

SOURCE (BIBLIOGRAPHIC CITATION): *Anais-da-Sociedade-Entomologica-do-Brasil*. 1994, 23: 2, 351-354; 2 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: The effectiveness of a mound-drill was compared with that of fenthion at 1.5 g a.i./mound for the control of *Cornitermes cumulans* in pastures in Mato Grosso Sul, Brazil, in 1991. The drill destroyed mounds above and below ground level. Worker activity was evaluated 113 days after treatment. Of the 13 mounds destroyed by the drill, 2 had worker activity, giving a mortality index of 85%, and one had another mound being built. No worker activity was observed up to 113 days after insecticide treatment (100% mortality), compared with activity and no mortality in all untreated mounds.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 951102777

TITLE: Population genetic structure of the Neotropical termite *Nasutitermes nigriceps* (Isoptera: Termitidae).

AUTHOR(S): Thompson-GJ; Hebert-PDN

SOURCE (BIBLIOGRAPHIC CITATION): *Heredity*. 1998, 80: 1, 48-55; 43 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Monogamy and inbreeding are often thought to characterize the breeding system of termite societies. However, few studies have employed genetic markers to ascertain either the genetic structure of single colonies or the extent of local inbreeding. Allozyme analysis was used to investigate the breeding system of *Nasutitermes nigriceps* with respect to the number of reproductives contributing to single colonies, and the level of inbreeding within and among local colonies. The majority of the 136 nests examined from three study sites in Jamaica showed patterns of protein polymorphism consistent with their origin from a single mated pair,

establishing that monogamy is indeed the predominant mode of reproduction. A small proportion of colonies (N = 7) had genotypic frequencies suggesting that offspring were not all full-siblings. The genetic composition of all colonies appeared stable through a one-year interval, suggesting that the observed genetic attributes represent relatively persistent reproductive associations. Wright's (1978) F-statistics showed moderate differentiation among study sites, indicative of restricted gene flow and the occurrence of inbreeding at a regional scale. However, mating appeared to be random at single sites as the inferred genotypic frequencies of colony progenitors did not deviate from Hardy-Weinberg expectations, indicating little inbreeding in the study populations.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981104260

TITLE: Comparison of nest structure and caste parameters of sympatric species of *Odontotermes* (Termitidae, Macrotermitinae) in Kenya.

AUTHOR(S): Darlington-JPEC

SOURCE (BIBLIOGRAPHIC CITATION): *Insectes-Sociaux*. 1997, 44: 4, 393-408; 17 ref.

LANGUAGE OF TEXT: English

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981104529

TITLE: Chemical and mechanical control of mound-building termite species (*Isoptera*: *Termitidae*) in pastures.

ORIGINAL NON-ENGLISH TITLE: Controle quimico e mecanico de cupins de monticulo (*Isoptera*: *Termitidae*) em pastagens.

AUTHOR(S): Valerio-JR; Santos-AV; Souza-AP; Maciel-CAM; Oliveira-MCM

SOURCE (BIBLIOGRAPHIC CITATION): *Anais-da-Sociedade-Entomologica-do-Brasil*. 1998, 27: 1, 125-131; 11 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: Studies were conducted aimed at the control of mound-building termite species in pastures. Six insecticides were tested against the termite *Cornitermes cumulans*. The active ingredients (a.i.) and respective dosages (quantity of a.i. per termite mound) are given as follows: A - sulfluramid (ant granular bait 0.30%): A1=60 mg, A2=120 mg and A3=180 mg; B - chlorpyrifos (ant granular bait 0.125%): B1=25 mg, B2=50 mg and B3=75 mg; C - dodecachlor [mirex] (ant granular bait 0.45%): 90 mg; D - abamectin (EC 1.8%): 3.6 mg; E - deltamethrin (DP 0.2%): E1=10 mg and E2=20 mg; F - fipronil (G 2%): F1=25 mg, F2=50 mg and F3=100 mg. Thirty days after insecticide application percent mortalities were: A1, A2, B1, E2=0; A3, B2, B3, E1=10%; C=90%, D, F1, F2, F3=100%. In a 2nd test, the insecticide fipronil was tested against three species of mound building termites, *C. cumulans*, *C. bequaerti* and *Syntermes* sp., at 100 mg of a.i./mound in the case of the first two species, or per m² of mound for *Syntermes* sp. The percent mortalities after 30 days were: 100% for *C. cumulans* and *C. bequaerti* and 50% for *Syntermes* sp. In a 3rd test, mechanical and chemical control were compared against *C. cumulans*. Mechanical control was performed using a special drill (which operates attached to a tractor) that completely destroys the termite mound. For the chemical treatment, the

insecticide abamectin (EC 1.8%; 3.6 mg a.i./mound) was used. Both treatments provided 90 to 100% control.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981105117

TITLE: Efficiency of fipronil in the control of the mound-building termite, *Nasutitermes* sp. (Isoptera: Termitidae) in sugarcane.

ORIGINAL NON-ENGLISH TITLE: Eficiencia do fipronil no controle do cupim de monticulo, *Nasutitermes* sp. (Isoptera: Termitidae) em cana-de-acucar.

AUTHOR(S): Melo-RM; Veiga-AF-de-SL

SOURCE (BIBLIOGRAPHIC CITATION): *Anais-da-Sociedade-Entomologica-do-Brasil*. 1998, 27: 1, 149-152; 6 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: The efficiency of fipronil was evaluated in field conditions at different dosages and two formulations, against *Nasutitermes* sp. in sugarcane in Rio Grande do Norte, Brazil. Termite mounds were identified, measured and drilled into as far as the cellulosic chamber to allow insecticide application. Nine treatments were tested with ten replications in a completely randomized design and each termite mound was considered as an experimental unit. After 50 days, the termite mounds were opened and the mortality evaluated. The most efficient treatments were fipronil (800 WG) at 0.32 g a.i./mound and fipronil (20 G) at 0.20 g a.i./mound, both treatments causing 100% mortality.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981105120

TITLE: Small-scale population structure of the termite *Schedorhinotermes lamanianus*: aggression modulated by genetic and environmental factors.

AUTHOR(S): Husseneder-C; Kaib-M; Epplen-C; Epplen-JT; Brandl-R

SOURCE (BIBLIOGRAPHIC CITATION): *Proceedings of the German Society for General and Applied Entomology, Bayreuth, Germany, 18-22 March 1997.*

Mitteilungen-der-Deutschen-Gesellschaft-fur-Allgemeine-und-Angewandte-Entomologie. 1997, 11: 1-6, 183-187; 12 ref.

LANGUAGE OF TEXT: English

LANGUAGE OF SUMMARIES: German

ABSTRACT: The small-scale population structure of *Schedorhinotermes lamanianus* was studied using aggression tests and multilocus DNA fingerprinting. The 2 techniques gave similar results regarding arrangement of galleries in various colonies. Aggression within colonies could not be ascribed to environmental factors, although they may have some influence; genetic factors were shown to play an important role in recognition of nestmates. Genetically determined aggression between colonies is of considerable importance in intraspecific competition for limited resources.

PUBLICATION TYPE: Conference-paper; Journal-article

ACCESSION NUMBER: 981105438

TITLE: Effect of insecticides in solid and liquid formulations for the control of the mound-building termite, *Nasutitermes* sp. (Isoptera, Termitidae) in sugarcane.

ORIGINAL NON-ENGLISH TITLE: Efeito de inseticidas em formulacoes solidas e

liquidas no controle do cupim de monticulo, *Nasutitermes* sp, (Isoptera, Termitidae) em cana-de-acucar.

AUTHOR(S): Melo-Filho-R-de-M; Veiga-AF-de-SL; De-MM-Filho-R; De-SL-Veiga-AF

SOURCE (BIBLIOGRAPHIC CITATION): Revista-de-Agricultura-Piracicaba. 1997, 72: 1, 53-61; 18 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: Different insecticides in solid and liquid formulations were evaluated in Rio Grande do Norte, Brazil, for controlling the mound-building-termite *Nasutitermes* sp. in sugarcane. The products were applied into two canals drilled in each mound, and were evaluated after 30 days. The results obtained showed that the most efficient treatment was dodecachlor (0.22 g active ingredient per mound) with 100% mortality of the termite colony.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981105768

TITLE: Environment friendly approaches to termite management in buildings.

AUTHOR(S): Sen-Sarma-PK

SOURCE (BIBLIOGRAPHIC CITATION): Wood-News. 1997, 7: 3, 16-19; 30 ref.

LANGUAGE OF TEXT: English

ABSTRACT: The principle options for controlling termites in buildings in India are discussed, namely soil chemical barriers, physical barriers, poison baits and dust toxicants. The effects of these methods on the environment are discussed and an integrated approach is recommended.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 980603778

TITLE: Structure and dynamics of the arboreal termite community in New Guinean coconut plantations.

AUTHOR(S): Leponce-M; Roisin-Y; Pasteels-JM

SOURCE (BIBLIOGRAPHIC CITATION): Biotropica. 1997, 29: 2, 193-203; 39 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Whereas ant mosaics have been widely recognized and described in tropical ecosystems, data on space partitioning among arboreal termite colonies are rudimentary. During a long term field study in New Guinea, the distribution of arboreal termite species in coconut plantations as well as the extent and dynamics of competition between them were investigated. The three dominant species, *Microcerotermes biroi*, *Nasutitermes princeps* and *N. novarumhebridarum*, feed on the same items but never exploit the same tree. The resulting distribution pattern is a mosaic with two peculiarities. First, some extended areas around *N. princeps* colonies appear unexploited, as this species practices interference competition on a wide scale, defending large territories inter- and intra-specifically. Second, interspecific relations are asymmetrical. In some plantations, large colonies of *N. princeps* expand their territory by destroying colonies of *M. biroi*, but when the pressure of *N. princeps* is relaxed, dense populations of colonies of *M. biroi* can recolonize the trees in a few years' time. Territorial boundaries may thus change relatively fast. *N. novarumhebridarum* often colonizes dead trees and interferes less with the other

species. These facts are consistent with each species' reproductive investment strategy. Hypotheses are proposed to explain how the dominant species can coexist, even in long established plantations.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981102050

TITLE: Control of the mound-building termite *Cornitermes cumulans* with liquid formulations of chlorpyrifos and endosulfan.

ORIGINAL NON-ENGLISH TITLE: Controle do cupim-de-monte *Cornitermes cumulans* (Kollar, 1832) com formulações líquidas de clorpirifos e endossulfan.

AUTHOR(S): Mariconi-FAM; Pacheco-P; Ciniglio-Neto-F; Passos-HR; Campos-Neto-HM

SOURCE (BIBLIOGRAPHIC CITATION): Scientia-Agricola. 1996, 53: 2-3, 293-295; 7 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: In order to control the mound-building termite, *Cornitermes cumulans*, considered to be the most important termite in natural pastures in the State of Sao Paulo, Brazil, an experimental field test with chemical insecticides was carried out. The test consisted of 8 treatments with 10 replications each: A1 and A2 chlorpyrifos (600 ml, 22.4% EC); B1 and B2 chlorpyrifos (1000 ml, 22.4% EC); C1 and C2 endosulfan (600 ml, 35% EC); D1 and D2 endosulfan (1000 ml, 35% EC). The values in parentheses are the quantities of the trade mark Dursban (chlorpyrifos) and Thiodan (endosulfan) in 100 litres of water (one litre of water/mound). In the treatments A1, B1, C1 and D1, evaluations were made 120 days after application, and in A2, B2, C2 and D2, after 253 days. There was no significant difference among treatments: all were effective.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 981102764

TITLE: Efficacy of phosphine for the control of mound-building termite, *Nasutitermes* sp. (Isoptera: Termitidae) in sugarcane.

ORIGINAL NON-ENGLISH TITLE: Eficiência da fosfina no controle do cupim de montículo, *Nasutitermes* sp. (Isoptera: Termitidae) em cana-de-acucar.

AUTHOR(S): Melo-Filho-RM; Veiga-AFSL

SOURCE (BIBLIOGRAPHIC CITATION): Anais-da-Sociedade-Entomologica-do-Brasil. 1997, 26: 1, 21-25; 11 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: The efficacy of phosphine for the control of *Nasutitermes* sp. in sugarcane was evaluated in the field in Ipojuca, Pernambuco, Brazil. Eight treatments were tested: 5 tablets containing 0.6 g Gastoxin in 5 holes; 3 tablets in 3 holes; 1 tablet in 1 hole; 5 tablets in 1 hole; 3 tablets in 1 hole; endosulfan; control (water); control (intact mound). Each mound was considered an experimental unit with mean height of 24.9 cm; and basal and apical diameters of 30.8 and 24.7 cm, respectively. A dosage of 5 tablets in 5 holes was the most efficient, with 75% mortality.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 971108905

TITLE: Remedial baiting with hexaflumuron in above-ground stations to control structure-infesting populations of the Formosan subterranean termite (Isoptera: Rhinotermitidae).

AUTHOR(S): Su-Nan Yao; Ban-PM; Scheffrahn-RH; Su-NY

SOURCE (BIBLIOGRAPHIC CITATION): Journal-of-Economic-Entomology. 1997, 90: 3, 809-817; 10 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Above-ground bait stations composed of reclosable plastic bags containing spruce (*Picea* sp.) sawdust bait matrices impregnated with hexaflumuron (at 0, 1000, 3000 or 5000 ppm (wt a.i./dry wt sawdust)) were placed directly over active infestations of *Coptotermes formosanus* [in 1994-96 in Florida, USA]. Of the 5 colonies tested, 2 each of aerial colonies and ground-based colonies were eliminated. The population of 1 ground-based colony was reduced from >2 000 000 to 155 000 foragers. The results demonstrated the feasibility of introducing baits into active areas of infestation of subterranean termites. In addition to the in-ground baiting system, the above-ground bait station may offer another option for bait delivery to affect the structure-infesting populations of subterranean termites.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 970502986

TITLE: Morphology, fine structure, and functional aspects of the labial gland reservoirs of the subterranean termite *Reticulitermes santonensis* de Feytaud (Isoptera: Rhinotermitidae).

AUTHOR(S): Grube-S; Rudolph-D; Zerbst-Boroffka-I

SOURCE (BIBLIOGRAPHIC CITATION): International-Journal-of-Insect-Morphology-and-Embryology. 1997, 26: 1, 49-53; 14 ref.

LANGUAGE OF TEXT: English

ABSTRACT: The morphology and fine structure of the labial gland reservoirs in *Reticulitermes santonensis* was studied by light and transmission electron microscopy. The reservoir wall consisted of a single epithelial cell layer and a cuticular intima. The reservoir ducts were formed by a flat epithelial matrix with cuticular ridges lining the duct lumen. Measurements of the ionic concentrations of reservoir fluids and haemolymph showed that the osmolality of reservoir fluid ranged from 7 to 28 mosmol/kg; the haemolymph osmotic pressure was 201 ± 31 mosmol/kg. The reservoir lumen was effectively separated from the haemolymph compartment; a net water flow through the reservoir wall could not be induced in physiological experiments. Moreover, typical epithelial structures associated with a fluid transport against an osmotic gradient were lacking. Thus, these fine structural and physiological data support the view that a water transfer from the haemolymph through the reservoir wall into the reservoir lumen does not occur.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 971106787

TITLE: Mound structure of the fungus-growing termite *Macrotermes gilvus* in Thailand.

AUTHOR(S): Inoue-T; Vijarnsorn-P; Abe-T

SOURCE (BIBLIOGRAPHIC CITATION): Journal-of-Tropical-Ecology. 1997, 13:

1, 115-124; 34 ref.

LANGUAGE OF TEXT: English

ABSTRACT: The change of mound structure of the fungus growing termite, *Macrotermes gilvus*, which has no clear air passage system in the mound, was examined in relation to the mound growth in a rubber plantation of southern Thailand. The nest proper consisted of the hive with a royal chamber and nursery, and diffused chambers with fungus combs. The location of the hive became higher with the growth of the mound. Therefore, colonies with a very large mound utilize only the upper mound part and this may be due to the lack of air passage systems in this species. A colony with a very large mound is not in reality commensurately large in colony size and this may be the reason why the density of huge mounds of *M. gilvus* in Thailand is much higher than that of *Macrotermes* in Africa.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 971107122

TITLE: Termite physical barriers: update on retrofitting Granitgard around 'mock-up' buildings after four years.

AUTHOR(S): Ahmed-B; French-JRJ

SOURCE (BIBLIOGRAPHIC CITATION): Document -International-Research-Group-on-Wood-Preservation. 1996, No. IRG-WP-96-10140, 6 pp.; Paper prepared for the 27th Annual Meeting, Guadeloupe, French West Indies, 20-24 May, 1996.; 5 ref.

PUBLISHER INFORMATION: IRG Secretariat; Stockholm; Sweden

LANGUAGE OF TEXT: English

ABSTRACT: The field experiment described was installed four years previously (March 1992) to evaluate the effectiveness of graded crushed granite stone, commercially marketed under the name Granitgard as a physical termite barrier when retrofitted around 'mock-up' buildings. The field site was located at Walpeup in the semiarid mallee region of NW Victoria (360 km from Melbourne), and there were 8 common indigenous subterranean termite species at the site. This paper describes the results of the field evaluation after four years. No termites penetrated the Granitgard barriers, with or without chlorpyrifos treatments. These findings are discussed together with their implications in the protection of timber structures in areas in which there are naturally foraging populations of subterranean termites.

PUBLICATION TYPE: Conference-proceedings

ACCESSION NUMBER: 970603113

TITLE: Mound-building termites and soil microbial biomass: an interaction influencing termite abundance.

AUTHOR(S): Holt-JA

SOURCE (BIBLIOGRAPHIC CITATION): *Insectes-Sociaux*. 1996, 43: 4, 427-434; 17 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Termites [Isoptera] are more abundant in the warmer lower latitudinal regions of the earth. Within these broad geographic regions, however, the precise nature of the factors influencing termite abundance is poorly understood. The abundance was examined of detritivorous, mound-building termites and certain aspects of the climate, soils and vegetation at 14 sites in tropical northeastern

Queensland, Australia. No relationship between termite mound density and the particle-size characteristics of surface soil horizons, plant available phosphorus or rainfall was found. Microbial biomass carbon level of the surface soil was found to have a strong negative relationship with termite mound numbers. The negative interaction between the soil microbial population and termites may be due to the limiting effect of the organic matter processing capacity of the soil microbial population on the success of termites in occupying the decomposer niche in any particular area. Microbial biomass may therefore be a major factor influencing termite abundance in tropical Australian landscapes and elsewhere.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 971102979

TITLE: Heat tolerance of structure-infesting drywood termites (Isoptera: Kalotermitidae) of Florida.

AUTHOR(S): Scheffrahn-RH; Wheeler-GS; Su-NanYao; Su-NY

SOURCE (BIBLIOGRAPHIC CITATION): Sociobiology. 1997, 29: 3, 237-245; 13 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Heat tolerance studies were conducted against *Cryptotermes brevis* and *Incisitermes snyderi* pseudergates to determine temperature and heating time requirements at target sites for controlling structural infestations. Complete mortality of *C. brevis* was obtained following exposure times of 4 and 10 min at 50 and 48°C, respectively, while *I. snyderi* required a minimum 15 min exposure at 50°C. Relative humidities (RH, ca. 10, 50, and 90%) did not significantly influence the heat tolerance of *C. brevis*. Mortality was similar in termites exposed to these RH levels within exposure times (25, 35, and 45 min) when termites were heated to 45°C indicating that the amount of water vapour in the air had no effect on heat tolerance of this species. The rate at which the temperature was increased significantly affected *C. brevis* mortality only at 50°C with a 1 min hold time. Pseudergates treated with the slowest temperature increase (0.5°C/min) had the highest mortality compared with the more rapid increases (1.0 and 3.0°C/min). Gradual acclimation of *C. brevis* pseudergates at 35°C for 10 d had no significant effect on heat tolerance. The recommended commercial exposure of 54.4°C internal wood temperature for 60 min will achieve control of economically important drywood termites in Florida and could be substantially reduced if temperatures of all target sites can be monitored.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 971104379

TITLE: Evaluation of six techniques for control of the western drywood termite (Isoptera: Kalotermitidae) in structures.

AUTHOR(S): Lewis-VR; Haverty-MI

SOURCE (BIBLIOGRAPHIC CITATION): Journal-of-Economic-Entomology. 1996, 89: 4, 922-934; 40 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Chemical and nonchemical methods for control of the drywood termite *Incisitermes minor* were evaluated under conditions that simulated infestations in structures. The efficacy of excessive heat or cold, electrocution, microwaves and 2 fumigants (sulfuryl fluoride and methyl bromide) was evaluated. Termite mortality in

artificially-infested boards was 100% at 3 days after treatment for both fumigant gases. Heating the whole structure or spot-applications using microwaves resulted in 96 and 90% mortality, resp., 3 days after treatment. Mortality levels 4 weeks after treatment increased to 98% for heat and 92% for microwaves. Spot-applications of liquid nitrogen at 381.8 kg/m³ achieved 100% mortality 3 days after treatment. However, for 122.7 and 57.3 kg/m³, mortality levels 4 weeks after treatment were 99 and 87%, resp. Mortality by spot-applications of electricity was 44% 3 days after treatment in the 1st test. Four weeks after treatment, mortality increased to 81%. In a 2nd electrocution test, using spot-application techniques infrequently used in structures, mortality levels increased to 93% at 3 days and 99% at 4 weeks after treatment. The distribution of termite survivors within the test building and test boards varied for some treatment techniques. For naturally-infested boards, both fumigants exceeded 99% mortality. Use of heat and microwaves resulted in 100 and 99% mortality levels, resp., 4 weeks after treatment. Applications of liquid nitrogen resulted in mortality 99.8% at 381.8 and 122.7 kg/m³; however, mortality for 57.3 kg/m³ was significantly lower (74%). Mortality levels from electrocution were 89 and 95% 4 weeks after treatment, resp., in the 2 tests. Damage to test boards and the test building did occur. Six test boards were scorched during microwave treatment, 80% of test boards were damaged during electrocution and visible signs of damage to the test building were noted for whole-structure heating. This study provided information for the evaluation of the relative efficacy of fumigation and nonchemical alternatives for the control of drywood termite infestations in structures.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 961108592

TITLE: Field tests for control of the mound-building termite *Cornitermes cumulans* (Kollar, 1832) (Isoptera, termitidae).

ORIGINAL NON-ENGLISH TITLE: Ensaio de combate ao cupim de monte *Cornitermes cumulans* (Kollar, 1832) (Isoptera, Termitidae).

AUTHOR(S): Mariconi-FAM; Galan-VB; Rocha-MT; Maule-RF; Passos-HR; Silva-RAA

SOURCE (BIBLIOGRAPHIC CITATION): *Scientia-Agricola*. 1994, 51: 3, 505-508; 10 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: Two field tests were carried out to evaluate the effectiveness of several insecticides for the control of the pasture pest *Cornitermes cumulans* in Sao Paulo, Brazil. The most effective compounds tested were granular fipronil (2%) at 10 or 15 g/nest and granular imidacloprid (70%) at 0.15 or 0.30 g/nest.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 961109555

TITLE: Application technology for phosphine (aluminium phosphide) for the control of mound-building termite, *Nasutitermes* sp. (Isoptera, Termitidae), in sugarcane.

ORIGINAL NON-ENGLISH TITLE: Tecnologia de aplicacao da fosfina (fosfeto de aluminio) no controle do cupim de monticulo, *Nasutitermes* sp. (Isoptera, Termitidae), em cana-de-Acucar.

AUTHOR(S): M-Melo-Filho-R-de; S-Leao-Veiga-AF-de; De-M-Melo-Filho-R; De-

S-Leao-Veiga-AF

SOURCE (BIBLIOGRAPHIC CITATION): *Revista-de-Agricultura-Piracicaba*. 1996, 71: 2, 263-271; 16 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: Different methods of applying phosphine for the control of *Nasutitermes* sp. on sugarcane were studied in Pernambuco, Brazil. The influence of the depth of holes on the efficiency of phosphine was tested. Five basal holes, 2 basal holes plus 3 apical holes, and 2 basal holes, 1 median hole and 2 apical holes, were the most efficient treatments with 100% colony mortality.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 961109813

TITLE: Occurrence, nature and structure of the mounds of the termite *Odontotermes brunneus* Hagen (Isoptera: Termitidae) from Belgaum District, Karnataka, India.

AUTHOR(S): Patil-DS; Basalingappa-S

SOURCE (BIBLIOGRAPHIC CITATION): *Journal-of-Ecobiology*. 1994, 6: 1, 17-26; 25 ref.

LANGUAGE OF TEXT: English

ABSTRACT: The occurrence and structure of mounds of *O. brunneus* were studied. The mounds were normally associated with vegetation and were either conical, cylindrical, or dome shaped. The height of the mounds was 0.12-2.4 m. The mounds had hard and compact outer walls beneath which were ventilation shafts and several interconnected vaults housing the fungus gardens. The royal chamber was usually situated centrally in the mound. There were a number of small entrance and exit holes in the floor and roof of the royal chamber for the entrance and exit of workers and soldiers.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 961907509

TITLE: Mound dimensions, internal structure and potential colony size in the fungus growing termite *Macrotermes michaelseni* (Isoptera: Macrotermitinae).

AUTHOR(S): Schuurman-G; Dangerfield-JM

SOURCE (BIBLIOGRAPHIC CITATION): *Sociobiology*. 1996, 27: 1, 29-38; 23 ref.

LANGUAGE OF TEXT: English

ABSTRACT: The external dimensions of mounds built by the fungus growing termite *Macrotermes michaelseni* were measured in periodically inundated grassland and flood plain woodland in the north of Botswana during the wet seasons of 1993-94 and 1994-95. The internal structure and dimensions of selected mounds were also assessed. Overall mound height differed within and between habitats and pediment width was greater in the grassland habitat but mean turret height did not differ significantly between habitats. Grassland mounds had broader but shallower fungus gardens and in all mounds a discrete nursery area was absent. These results are compared with similar data for *M. michaelseni* in Kenya. Reasons for the differences between the populations and their evolutionary consequences are discussed.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 961102873

TITLE: An above-ground station for monitoring structure-infesting populations of the Formosan subterranean termite (Isoptera: Rhinotermitidae).

AUTHOR(S): Su-Nan Yao; Ban-PM; Scheffrahn-RH; Su-NY

SOURCE (BIBLIOGRAPHIC CITATION): Sociobiology. 1996, 27: 1, 39-45; 19 ref.

LANGUAGE OF TEXT: English

ABSTRACT: An above-ground termite monitoring station composed of a plastic box containing a wooden block and covered by foam insulation is described. The station was installed directly over active infestations of *Coptotermes formosanus* in both structures and trees in Florida during June-December 1994. Aerial and soil-borne populations of the termite were monitored using these devices. Catches from the monitoring stations ranged from 30 to 4845 termites/station, with >1000 termites being collected from the majority of active monitoring stations. The proportion of soldiers ranged from 4 to 10%.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 961102874

TITLE: Termiticidal potentiality of inorganic wood preservatives for the control of mound-building and subterranean termites.

AUTHOR(S): Roomi-MW; Shah-AH; Qureshi-SA

SOURCE (BIBLIOGRAPHIC CITATION): Sarhad-Journal-of-Agriculture. 1992, 8: 6, 665-670; 8 ref.

LANGUAGE OF TEXT: English

ABSTRACT: Wooden pickets of fir (*Abies pindrow*), measuring 20X4X2 inches, coated with 2% mercuric oxide, 15% zinc oxide, or 2% mercuric chloride in gelatine based solutions containing 15% calcium carbonate were found to be resistant to mound-building and subterranean termites in soil for a period of 3, 4 1/2 and 5 yr respectively in field tests in Pakistan. Also, pickets coated with Solignum-white, used as a standard termiticide treatment, remained unattacked for up to 5 yr. Wooden pickets treated with 1% sodium dichromate, 3% sodium arsenate, 5% sodium fluoride or 5% zinc chloride (in gelatine based solutions containing 15% calcium carbonate) were heavily infested by termites within 2 yr. Control, untreated, wooden pickets were severely damaged by mound-building and subterranean termites within 6 months. The most prevalent termite was *Odontotermes obesus*. *Amitermes parudentatus* and *Heterotermes indicola* were also present.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 940600552

TITLE: Termite attack of wood in buildings and their distribution in the National Capital District.

AUTHOR(S): Konabe-C; Rokova-M

SOURCE (BIBLIOGRAPHIC CITATION): Klinkii. 1993, 5: 1, 19-24; 6 ref.

LANGUAGE OF TEXT: English

ABSTRACT: A brief report is given of a survey started in 1983 of the occurrence of drywood and subterranean termites in the National Capital District (the main administrative and commercial centre of Papua New Guinea) indicating species found, damage caused and means of prevention/control.

PUBLICATION TYPE: Journal-article
ACCESSION NUMBER: 940603902

TITLE: Numbers and biomass of mound-building termites (Isoptera) in a semi-arid tropical woodland near Charters Towers, North Queensland, Australia.

AUTHOR(S): Holt-JA; Easey-JF

SOURCE (BIBLIOGRAPHIC CITATION): Sociobiology. 1993, 21: 3, 281-286; 17 ref.

LANGUAGE OF TEXT: English

ABSTRACT: The numbers and biomass of the 4 dominant mound-building termite species (*Amitermes* *vtiosus*, *Tumulitermes* *pastinator*, *Drepanotermes* *perniger*, *D. rubriceps*) on red and yellow earth soils in a semi-arid tropical woodland in northern Queensland were estimated using a mark-recapture method and mound density data. The density of mound-building termites was similar on both soils, 13-14 X 108/ha. *A. vtiosus* accounted for >90% of the mound-building termite population on the red earth soil, and >70% on the yellow earth soil. The estimated total mound-building termite biomass was about 47 and 50 kg/ha on the 2 soils, resp.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 941105029

TITLE: Efficiency of insecticides to control the mound-building termite, *Cornitermes cumulans* (Kollar) (Isoptera: Termitidae) in pastures.

ORIGINAL NON-ENGLISH TITLE: Eficiencia de inseticidas no controle do cupim de monticulo, *Cornitermes cumulans* (Kollar) (Isoptera: Termitidae) em pastagens.

AUTHOR(S): Buainain-Alves-CM; Valerio-JR; Oliveira-MCM

SOURCE (BIBLIOGRAPHIC CITATION): Anais-da-Sociedade-Entomologica-do-Brasil. 1993, 22: 3, 521-525; 16 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: Field tests were carried out in Mato Grosso do Sul, Brazil, to evaluate the efficiency of insecticides to control *Cornitermes cumulans* in pastures of *Brachiaria decumbens*. The most efficient treatments were mirex at 20 and 40 g/termite mound and carbaryl at 5 g/litre of water per mound.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 941108029

TITLE: Nest structure and aeration system of *Cornitermes cumulans* (Kollar, 1832) (Isoptera: Termitidae).

ORIGINAL NON-ENGLISH TITLE: Estrutura e sistema de aeracao do cupinzeiro de *Cornitermes cumulans* (Kollar, 1832) (Isoptera: Termitidae).

AUTHOR(S): Sanchez-G; Filho-OP; Salvador-JR; Nakano-O

SOURCE (BIBLIOGRAPHIC CITATION): Pesquisa-Agropecuaria-Brasileira. 1989, 24: 8, 941-943; 3 ref.

LANGUAGE OF TEXT: Portuguese

LANGUAGE OF SUMMARIES: English

ABSTRACT: The structure and aeration system of nests of *Cornitermes cumulans* were studied in Sao Paulo, Brazil, during 1985. Powder injection did not provide sufficient information on the structures involved in aeration. Fog produced by

thermonebulizator was more efficient and demonstrated the importance of the cavity surrounding the nest base for aeration.

PUBLICATION TYPE: Journal-article

ACCESSION NUMBER: 931169324



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