QUEENSLAND FORESTRY RESEARCH INSTITUTE
timber NOTE 9

SUBTERRANEAN TERMITES IN QUEENSLAND

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Termites (Isoptera) are an ancient order of insects whose origins date back more than 100 million years to the Cretaceous period. Although they are commonly called 'white ants', the resemblance to ants is superficial and they are more closely related to cockroaches (Blattodea).

Australia has a diverse termite fauna. The order is represented by the families Mastotermitidae, Termopsidae, Kalotermitidae, Rhinotermitidae and Termitidae. The five families include about 30 genera with 258 described, and at least 90 undescribed, species. Termites can be grouped into three categories: dampwood, drywood and subterranean. Dampwood termites generally live in damp rotting logs or rot pockets in dead or living trees. Drywood termites obtain water from the wood in which they live and have no contact with the soil, nor with any other source of moisture. Subterranean termites are generally ground-dwelling or require contact with the soil or some constant source of moisture.

Termites play a prominent part in the recycling of plant nutrients through the disintegration and decomposition of dead wood and plant debris. The excavations of termites alter the structure of trees and provide spaces which have become a necessary part of the habitat of many vertebrate species including bats, birds, reptiles and arboreal mammals. Many species of termite feed on materials such as grass. Only a few are of economic importance to timber in the built environment ('timber-in-service'). Termite ingress into buildings (or other structures) and subsequent foraging and consumption of timber, is here called termite infestation ('attack').

The biology, distribution and importance of termites in Queensland are discussed in this publication.

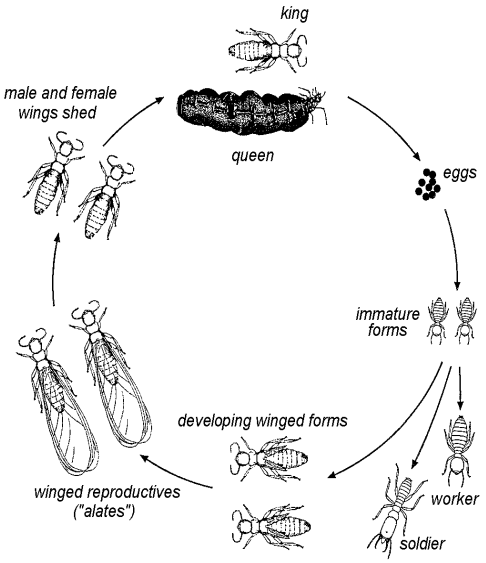

Figure 1. Subterranean termite life cycle

Biology of Termites

The termite colony

Termites are social insects, working and living together in groups (colonies). Each colony contains several types (castes) which differ in body shape and behaviour. Each caste is specialised to perform different tasks. Three principal castes are recognised: workers, soldiers and reproductives (the primary king and queen and sometimes supplementary reproductives).

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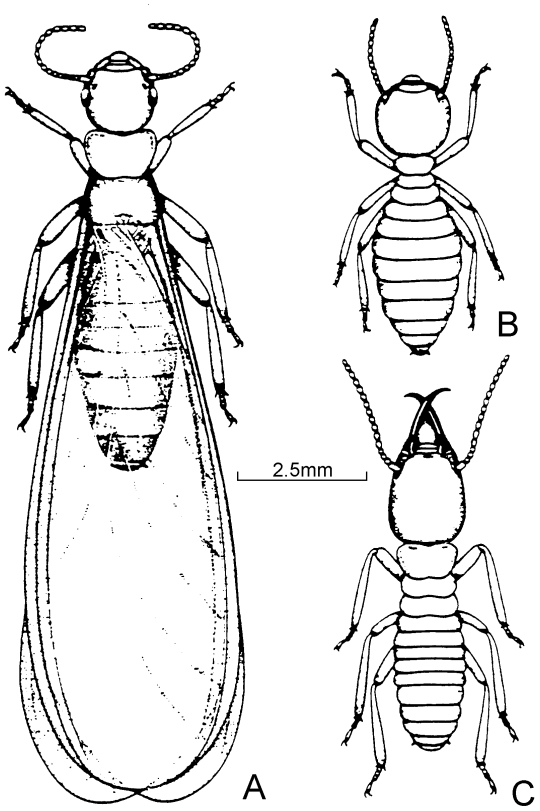

Figure 2. Castes of *Coptotermes acinaciformis* (Froggatt)
A. winged reproductive or alate
B. worker
C. soldier

(Illustration courtesy of CSIRO Division of Entomology and Melbourne University Press)

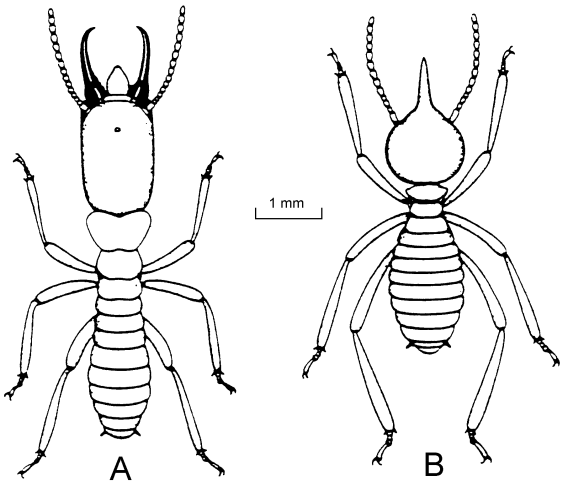

Figure 3. The soldier caste
A. a mandibulate soldier
B. a nasute soldier

(Illustration courtesy of CSIRO Division of Entomology and Melbourne University Press)

The **worker** caste numerically dominates the colony population and is wingless, sterile and blind. The workers are aptly named because they build the nest and galleries, tend the eggs and young, gather food, and feed other castes incapable of feeding themselves (Figure 2). Older workers may predominate in activities outside the nest. Primitive termite families (Mastotermitidae, Termopsidae and Kalotermitidae) lack a worker caste. Instead, the tasks of workers are performed by a 'worker-like caste' (pseudergates), which may develop to form the other castes.

The **soldiers** are distinguished from other castes by their heads which are heavily armoured and pigmented. Like the workers they are wingless, sterile and blind. Two types of soldiers occur: 'mandibulate', with prominent jaws, and 'nasute', with a pronounced snout (Figure 3). Because their mandibles are so modified or specialised, soldiers must be fed by the workers. The primary function of the soldiers is to defend the colony against predators such as ants. In the family Kalotermitidae, *Cryptotermes* spp. soldiers have strongly built heads which may be used as plugs to seal the nest from predators. The soldier caste is the most distinctive and the easiest from which to identify the species.

The **alate** caste, the potential kings and queens of new colonies, possesses eyes, functional reproductive systems and wings (Figure 2A). They usually swarm (leave the colony) in spring to early summer or late summer to early autumn, often through specially constructed exits. Alates do not fly strongly and, unless assisted by winds, their dispersal is limited. They normally swarm at dusk and may be attracted to lights at night.

Following swarming, alates shed their wings and each mated pair seeks out a suitable place to establish a new colony. The king alters little in shape, but the queen's abdomen may become enormously distended with eggs until she is little more than a large, immobile egg laying machine. Mature termite colonies may number up to two million individuals. Some subterranean termite queens are capable of producing 2000 eggs per day. Termite colonies may exist for as long as 50 years.

Nests

Termites build various types of nest. The simplest nest is constructed by the Kalotermitidae and Termopsidae. The entire colony lives in a gallery system, consisting of chambers connected by tunnels in moist or dry wood. Some termites have a completely underground existence, apparently without a central nest. Examples include some species of *Amitermes.* Others build a central nest in the soil, or in dead or living trees. Many economically-important termites build nests of this type, notably *Mastotermes darwiniensis* Froggatt and species of *Coptotermes* and *Schedorhinotermes*. Still other species, for example in the genera *Microcerotermes* (Figure 4) and *Nasutitermes* (Figure 5), attach their nest to a tree but maintain a soil connection via galleries running down the surface of the trunk. A termite mound is the most familiar form of termite nest. Mounds are often of very distinctive form, and their size and shape vary from hardened flat areas to the tall, columnar structures of *Nasutitermes triodiae* (Froggatt) which may be more than 7 m high. Typically,

each species builds a characteristic mound (Figure 6), although there may be geographical variation in the size and shape of the mound within species. In the mounds of *Coptotermes* the outer wall is hard and built of soil and the inner region is generally composed of woody faecal material (carton) and soil.

Feeding habits and behaviour

Cellulose is the basic food requirement of all termites, and all types of plant material are damaged. Most termite species eat grass and other surface vegetation and have an important role in maintaining soil fertility. They recycle nutrients, in particular nitrogen which is essential for healthy plant growth. When termite mounds erode, the soil particles rich in nutrients such as calcium, magnesium and potassium are washed into the soil from the mound to become available for plant growth. Termite galleries improve soil structure, and water entry and storage in soil; surface rainwater runoff and subsequent soil erosion are thereby reduced by the galleries.

Other termite species infest timber and particularly timber which is in an early state of decay by wood rotting fungi (Figure 7).

Figure 4. Arboreal nest of *Microcerotermes* sp.

Figure 5. Arboreal nest of *Nasutitermes* sp.

Figure 6. *Coptotermes acinaciformis* constructs a mound north of the Tropic of Capricorn.

Figure 7. *Microcerotermes* sp. attacking painted timber decayed by the fungus *Pycnoporus coccineus*.

Species of timber are resistant to termites, but none is entirely 'termite proof'. Termites will often damage materials they cannot digest, for example, plastics, rubber, metal or mortar. Primarily, this damage occurs when the indigestible items are encountered in the termites' search for food.

Cellulose is digested by intestinal protozoa in many species of termites, or by bacteria in species in the family Termitidae. The plant tissues upon which termites feed contain very little protein and, therefore, little nitrogen. However, the protozoa and bacteria do contain nitrogen, and often termites dispose of excess, dead and diseased members of the colony by cannibalism, thereby conserving nitrogen. Some termites are capable of fixing atmospheric nitrogen using gut bacteria.

Some termites forage for food by means of subterranean galleries or covered runways which extend from the central nest to food sources above or below ground. The gallery system of a single colony may exploit food sources over as much as one hectare, with individual galleries extending up to 50 m in length. In the case of the giant northern termite *M. darwiniensis*, individual galleries may extend as far as 100-200 m. Apart from grass-eating species which forage in the open, all termites remain within a closed system of galleries, devoid of light. The only exceptions are during a swarming flight, or when repair or new construction is occurring. The advantages to the termites of this closed system are twofold. They are protected from natural

enemies such as ants, and they gain a measure of protection from temperature and humidity extremes. Termites have a thin integument and have relatively little resistance to drying out.

Natural enemies

The most important natural enemies of termites are predators of various kinds, especially ants. Winged reproductives emerging on their colonising flight are eaten in large numbers by lizards, snakes, frogs, insectivorous and omnivorous birds, ants and other predatory insects, especially dragonflies. Workers and soldiers of a wide range of species form an important part of the diet of the echidna *Tachyglossus aculeatus* (Shaw) which has strong, long-clawed feet with which it attacks mounds and subterranean galleries.

Distribution and Importance

There are about 15 species of subterranean termite which commonly attack timber-in-service throughout Australia and 10 of these occur in Queensland. Our most serious pest species are *Coptotermes acinaciformis* and the giant termite *Mastotermes darwiniensis*. The former occurs throughout the State while *Mastotermes* is confined to the tropical northern region. Other species which commonly damage timber are *Schedorhinotermes actuosus*, *S. breinli*, *S. intermedius* and *S. seclusus* and *Nasutitermes exitiosus*. *Coptotermes frenchi* and *C. lacteus* also occur in southern Queensland. The latter constructs mounds usually associated with stumps, and primarily feeds on decayed wood.

Soil type appears to have an important influence on termite distribution in Queensland. For example, *Mastotermes darwiniensis* does not occur in rainforest soils or in the extensive bauxite soils of Cape York Peninsula. However, other termite species which damage timber may occur in these areas. The physical characteristics of the heavy soils, for example, the black earths of inland Queensland which crack deeply and widely in dry conditions and become waterlogged after rain, do not favour termite survival.

Although, the coastal belt and northern parts of the State are generally regarded as high hazard areas for subterranean termite attack, species which attack timber-in-service occur throughout the State. In practice, any structure containing wood is exposed to possible subterranean termite invasion whether in the business heart of a city, in the suburbs or out in the country, unless protective measures are taken.

Source of information:
Peters, B.C., King, J. & Wylie, F.R. 1996. "Pests of Timber in Queensland". (Queensland Forestry Research Institute, Department of Primary Industries, Brisbane), 175pp.

Further information can be obtained by contacting:

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