Drywood Termites

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Scientific names of pests—Drywood termites (Isoptera: Kalotermitidae) are represented by six genera: *Neotermes* Holmgren [specifically *N. insularis* (Walker)], *Kalotermes* Hagen [specifically *K. rufinotum* Hill and *K. banksiae* Hill], *Ceratokalotermes* Krishna [specifically *C. spoliator* (Hill)], *Glyptotermes* Froggatt (specifically *G. tuberculatus* Froggatt), *Bifiditermes* Krishna [specifically *B. condonensis* (Hill)], and *Cryptotermes* Banks [specifically *Cryptotermes primus* Hill, *C. brevis* (Walker), *C. domesticus* (Haviland), *C. dudleyi* Banks, and *C. cynocephalus* Light]

Scientific names of hosts—Just about any hardwood or softwood could be infested.

Distribution—*Neotermes insularis* is the only species of this genus in Australia. Its distribution extends from Victoria to Torres Strait and across to Darwin, Northern Territory, and it has been introduced into New Zealand, apparently in shipments of hardwood poles. However, *N. insularis* is not considered to be established in New Zealand. All reports of this species in New Zealand concern imported Australian hardwood poles, some of which have been in service for up to 20 years. No infestations have been found in locally grown (New Zealand) material (Bain and Jenkin 1983). Almost all collections of this species are from forests within 80 km (49.7 miles) of the coast (Gay and Calaby 1970, French 1986). *Kalotermes rufinotum* is distributed from Victoria to southern Queensland. *Kalotermes banksiae* occurs in Victoria, New South Wales, and South Australia, and has also been recorded from New Zealand (Gay and Calaby 1970, Bain and Jenkin 1983, French 1986). *Ceratokalotermes* is a genus that is endemic to Australia. *C. spoliator* is the only species in this genus and occurs in the coastal and adjacent highland areas from new South Wales to northern Queensland (Gay and Calaby 1970). *Glyptotermes tuberculatus* occurs in New South Wales and has been introduced to New Zealand, but is not established there (Gay and Calaby 1970, Bain and Jenkin 1983). *Bifiditermes condonensis* is the only Australian species of this genus. It is distributed in coastal areas from southern Queensland to Western Australia and has been collected from low-rainfall areas [<30 cm (<11.8 in.)/year], an unusual habitat for kalotermitids in Australia (Gay and Calaby 1970). *Cryptotermes primus* is found from northern Queensland to southern New South Wales (Gay and Calaby 1970). *Cryptotermes domesticus*, *C. dudleyi*, and *C. cynocephalus* are found in northern Queensland; *Cryptotermes domesticus* has also been reported from the Australian Capital Territory. *Cryptotermes domesticus* occurs widely throughout the Indo-Malayan Region and in numerous islands and island groups over a wide area of the Pacific, but its exact origin is not known. It has been introduced into Panama and Guam (Gay 1969). *Cryptotermes cynocephalus* is endemic to the Philippine Islands, where it attacks isolated boards in houses, and has recently been reported established in Hawaii (Woodrow and others 1999, Haverty and others 2000). *Cryptotermes brevis* is a cosmopolitan species and has been reported from Queensland and New South Wales and has become established in numerous regions throughout the world (Gay 1969, Weesner 1970, French 1986, Peters and others 1996) and is of significant economic importance in Hawaii and Florida (Bess 1970, Weesner 1970, Su and Scheffrahn 1990).

Summary of natural history and biology of the pest—Of the 2,300 species of termites known to exist in the world, only 183 are known to cause damage to structures, and of these, 83 have a significant economic impact. Drywood termites account for less than 20% of the economically important species, and the genus *Cryptotermes* contains the largest number of economically important species (Gay 1969, Edwards and Mill 1986).

Drywood termites live entirely within wood, do not need to maintain a connection with the ground or soil, and do not absolutely require free water. In fact, some species, such as *C. brevis*, do not survive under conditions of high relative humidity or water content in the wood (Collins 1969). This species produces metabolic water from wood and cannot excrete enough water to survive under high humidity. Most drywood termites are heavily protected from water loss by cuticular hydrocarbons and the cement layer on the cuticle. They adjust their water retention or excretion by absorbing water from their feces. In high humidity they excrete liquid fecal material; under dry conditions water is resorbed in the rectum and fecal material is excreted as a pellet (Collins 1969). Due to their ability to survive in wood with little moisture content, drywood termites can maintain viable colonies or portions of colonies for extended periods and would remain viable during transportation across vast stretches of land or water.

All species of drywood termites are social insects and live in colonies. They do not live in discrete nest structures. They live in a diffuse gallery system entirely within one or more pieces of wood. Individuals within this gallery system, including the reproductives, are mobile and can move within this system to areas with the most suitable environmental conditions. Generally there are five types of individuals in a colony: immatures or larvae, workers, soldiers, reproductives, and nymphs (Miller 1969). Nymphs will eventually metamorphose into adults with wings (alates) that serve to disperse and establish new colonies a significant distance [100 m (328 ft)] from the natal colony. Colonies contain a large proportion of workers and nymphs whose role is the care of the immatures, feeding and foraging, and cleaning, whereas the soldiers defend the colony from predators. The workers and younger nymphs are the individuals that damage the wood. Flights of the future reproductives (alates) can occur anytime during the year in tropical environments.

Mature colonies can contain up to several thousand individuals, but even mature colonies never reach the size of mature subterranean termite colonies (Mampe 1990, Thorne 1998). Colonies as young as 4 years old can produce alates that fly off to establish new colonies. Incipient colonies can reinfest the same piece of wood occupied by the natal colony or other suitable wood nearby. To initiate a new colony, alates need only find a gap or hole big enough for them to enter, seal off, and begin to excavate. Most drywood species in Australia establish colonies in dead wood on trees, within branch stubs, or in wounds or scars in the bark. Occasionally, the exit holes of wood-boring beetles are utilized to establish an incipient colony site. Colonies can be established low on the bole or high into the canopy of trees (Gay and Calaby 1970). Wood species is not a critical factor for pest species of drywood termites. Many drywood species utilize seasoned wood as host material (Mampe 1990, Peters and others 1996). Workers and nymphs are capable of becoming replacement (neotenic) reproductives and assuming the reproductive role if the reproductives die or a portion of the colony is permanently separated from the main colony. It is this capacity for establishing new colonies from partial colonies or subcolonies that makes drywood termites a threat for introduction into nonendemic sites.

Specific information relating to risk elements

A. Likelihood of introduction

1. Pest with host-commodity at origin potential:
   Logs—*High* (RC) (Applicable risk criteria, from Ch. 1: a, c, d, e, f, g, h)
   Chips—*Low* (RC) (Applicable risk criteria, from Ch. 1: none)

   Any of the commercial *Eucalyptus* species could supply harborage for drywood termites. The likelihood of association of drywood termites with freshly cut logs is greater in older trees in natural forests or in plantations in which silvicultural practices include pruning and use of prescribed fire. The damage done by these termites may not be easily detected in logs. Termite colonies or subcolonies would not survive the chipping process.

2. Entry potential:
   Logs—*High* (RC) (Applicable risk criteria, from Ch. 1: a, b, c, d)
   Chips—*Low* (RC) (Applicable risk criteria, from Ch. 1: none)

   Drywood termites could survive quite well during transit and may not be detected if they are within the wood. The most likely indication of the presence of drywood termites would be piles of characteristic fecal pellets on horizontal surfaces, but these pellets are usually not discharged until colonies are well established in the wood. The greatest danger exists if items are shipped from plantations in Australia with these species present and remain in storage at the import site, in a suitable habitat such as Hawaii or Puerto Rico, for extended periods of time. Wood chips are not likely to harbor viable groups of termites.

3. Colonization potential: *High* (RC) (Applicable risk riteria from Ch. 1: a, b, c, d, e)

   Even partial colonies can contain many individuals capable of differentiating into a reproductive caste. If a colony contains alates and they were to fly after arriving in the United States, incipient colonies could easily be established. Because these drywood termites can infest numerous tree species and wood in service, the presence of an acceptable host is not the critical factor. Rather, a suitable environment with an adequate supply of wood and appropriate temperature and moisture conditions are the key factors. The initiation of a colony is a slow process, but dry wood in structures and suitable trees with scars or wounds at ports and storage facilities might provide an infestation site. The adults (alates) fly only about 100 m (328 ft) but are capable of moving up to 1 km (0.62 miles), depending on wind conditions and weather. Long-range [>10 km (>6.2 miles)] establishment of colonies from alates has a very low probability. Colonization potential is greatest at ports with warm, moist conditions similar to those in Hawaii, southern California, the Gulf Coast, and the southern Atlantic coast.

4. Spread potential: *High* (RC) (Applicable risk criteria, from Ch. 1: a, b, c, d, e, g)

   Termites spread slowly [15 to 300 m (49 to 984 ft) per year], and less than 1% of the alates eventually establish a new colony. However, an important factor concerning drywood termites is that infested wood, moved by humans in commerce, spreads termites at a much faster rate than their natural spread. Also, once established at the receiving seaport or inland destinations, drywood termites are often not detected because of their cryptic habits; colonies can be large before the first evidence of their activities (piles of characteristic fecal pellets) is apparent. By this time multiple colonies will already be established adjacent to the invading colony and additional wood or trees could become infested and distributed within the continental United States or its territories and possessions. Furthermore, drywood termites could be misdiagnosed or confused with endemic species.

B. Consequences of introduction

5. Economic damage potential: *Moderate* (VC) (Applicable risk criteria, from Ch. 1: a, c)

   Termites will attack untreated wood. Their damage to wooden houses can be severe if not detected at an early stage. Once they are in a structure, spread of drywood termites to other parts of the structure can be rapid. Most species of *Cryptotermes* probably would not do well in extremely cold climates but could be a problem in moist, warm climates along the western, southern, and southeastern coasts of the continental United States. Drywood termites cause a small portion of the economic losses due to wood-destroying insects in the United States. However, where they are abundant (southern Florida, southern California, and Hawaii), the cost for control and repair of their damage rivals that of subterranean termites. Potential economic losses caused by all species of *Cryptotermes* could be comparable with those currently caused by the exotic *C. brevis* and the endemic *Incisitermes minor* (Hagen). If *C. primus or C. domesticus* were to be as aggressive as *C. brevis* and *I. minor*, it could cause an additional $100 million in damage and control costs within 30 years. Control methods for termites are available but can be expensive.

6. Environmental damage potential: *Low* (MC) (Applicable risk criterion from Ch. 1: none)

   These termites would not likely cause large outbreaks or kill an excessive number of trees. Drywood termites would most likely feed on dead wood in live trees or dead wood on the ground. Control efforts could be a risk to environmental quality through increased pesticide use.

7. Social and political considerations: *Moderate* (RC) (Applicable risk criterion from Ch. 1: a)

   Drywood termites do not cause aesthetic damage in forests. They can infest live trees by attacking pruning and fire scars. This could degrade the value of timber species grown where drywood termites live. Damage to wood in use would cause the consumer the greatest concern, adding to concerns about other termite species. Control methods for termites are available but can be expensive. Spot treatments do not eliminate the problem, and fumigant gases stop the infestation but provide no residual protection.

   Any species of *Cryptotermes* becoming successfully established in the United States or in one of its protectorates or possessions would probably be as damaging as *C. brevis* or *I. minor*.

C. Pest risk potential:
Logs—*High* (Likelihood of introduction = *High*; Consequences of introduction = *Moderate*)
Chips—*Low* (Likelihood of introduction = *Low*; Consequences of introduction = *Moderate*)

Termite colonies or subcolonies would not survive the chipping process.

Selected bibliography

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Reviewers' comments—"Distribution. It is probably worth noting that although *Neotermes insularis* has been 'introduced' into New Zealand (in fact it was described from there) it is not considered to be established there [Bain, J.; Jenkin, M.J., 1983: *Kalotermes banksiae*, *Glyptotermes brevicornis*, and other termites (Isoptera) in New Zealand. New Zealand Entomologist 7: 365–371.]. Apart from the original description, which was based on alates, all records of this species in NZ concern imported Australian hardwood poles (some of which have been in service up to 20 years). No infestations have been found in locally grown material." (Bain)

"Distribution. *Kalotermes banksiae* also occurs in New South Wales and South Australia [Bain & Jenkin 1983]. The species of *Kalotermes* on the Kermadec Islands (and on Lord Howe Island and Norfolk Island) has been referred to a discrete species, *Kalotermes cognatus* Gay [Gay, F.J., 1976: Isoptera of the Kermadec Islands. New Zealand Entomologist 6 (2): 149–153.]." (Bain)

"Distribution. *Glyptotermes tuberculatus*. This species is not considered to be established in New Zealand. All records of it from New Zealand have been in imported Australian hardwood material [Bain & Jenkin 1983]." (Bain)

"Entry potential, last line. Is the statement that 'Wood chips are not likely to harbor viable groups of termites' supported by references?" (Cameron)

"The IPRA for drywood termites discusses the economic costs associated with pesticide controls for this type of pest. However, under environmental damage potential, no mention is made of the possible adverse environmental effects of those same control measures. Why? This same thing happens in the IPRA for subterranean termites." (Osterbauer and Johnson)

Response to comments—The information about and reference on *N. insularis* was added. The distribution information was expanded and the reference to Kermadec Islands was dropped. The reference to *Glyptotermes tuberculatus* was kept, but a disclaimer about establishment was added. It has been introduced, but no claim of establishment was made.

The team is not aware of any literature that documents termites in shipments of chips. The statement above was made from empirical observations of the chipping of logs at mills in Australia, the transportation of the chips from the mill to the chip pile, and subsequent transportation to the ship (see trip report). The assumption was made that the chips would be similarly handled from the ship to the port and then to the vehicles that would take them to the paper plant. The statement in question has been modified to reflect these empirical observations.

The team felt that the direct environmental impact of the establishment of drywood termites would be negligible. Control efforts would be limited to structures and would involve spot treatments or fumigation of entire structures, but would have limited impact on general environmental quality.