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Reassessment of lyctine susceptible sapwood

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Reassessment of lyctine susceptible sapwood

Prepared for the

Forest and Wood Products
Research and Development Corporation

by

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EXECUTIVE SUMMARY

Objective

The objective of this study was to examine or re-examine the lyctine susceptibility of 16 timber species or hybrids. Several of the timbers have previously been placed in a 'rarely susceptible' category, but for standards and compliance purposes, such in-between ratings are not acceptable. Timber samples were spot tested for starch content, and exposed to three species of lyctine beetles in an insectary.

Key Results

After bioassay, test specimens were rated NS (not susceptible), S1 (light attack), S2 (moderate attack) or S3 (heavy attack).

- New criteria were developed, and were especially useful for dividing the 'rarely susceptible' species into the susceptible or non-susceptible categories. S1 attack in a minority of specimens was not considered sufficient to name a species susceptible. Also, if the S2 or S3 attack was limited to 6 mm depth (common width of a kerf cut on the outside of a log when sawn), then the timber species was still considered non-susceptible. However, if any S2 or S3 attack occurred to a depth greater than 6 mm, the timber species was considered susceptible.

Lyctine susceptible species were:

- *Erythrophleum chlorostachys* (Cooktown ironwood) with 91% of test specimens susceptible.
- *Eucalyptus delegatensis* (Alpine ash) grown in Tasmania with 52% of test specimens susceptible.
- *Eu. regnans/obliqua* hybrid from Tasmania with 46% of test specimens susceptible.
- *Corymbia nesophila* (Melville Island bloodwood) with 25% of test specimens susceptible.
- *Eu. fibrosa* (Broad-leaved red ironbark) with 17% of test specimens susceptible.
- *Eu. grandis* (Rose gum) with 10% of test specimens susceptible.
- *Eu. crebra* Sydney blue gum Sydney blue gum (Narrow-leaved red ironbark) with 8% of test specimens susceptible.
- *Eu. argophloia* (Western white gum) with 8% of test specimens susceptible.
- *Eu. dunnii* (Dunn's white gum) with 5% (one) of the test specimens susceptible.
- *Eu. regnans* (Mountain ash) from Tasmania with 4% (one) of the test specimens susceptible.
- *Ec. saligna* (Sydney blue gum) with both test specimens examined being susceptible.
- *Eu. grandis/saligna* hybrid, as both parent species are susceptible (conclusion made in the absence of verified hybrid material for testing).

Non-lyctine susceptible species were:

- *Eu. cloeziana* (Gympie messmate).
- *Eu. delegatensis* (Alpine ash) grown in Victoria or NSW.
- *Eu. pilularis* (Blackbutt).
- *Eu. sieberi* (Silvertop ash).
- *Eu. tetradonta* (Darwin stringybark).

Table showing suggested changes to susceptibility ratings:

Timber species	Current AS 5604 rating	Proposed AS 5604 rating
Corymbia nesophila	S	S
Erythrophleum chlorostachys	S	S
Eu. argophloia	Not listed	S
Eu. cloeziana	NS	NS
Eu. crebra[1]	NS	S
Eu. delegatensis Mainland[2]	NS (Vic), S (NSW)	NS
Eu. delegatensis Tasmania	S	S
Eu. dunnii	S	S
Eu. fibrosa[1]	NS	S
Eu. grandis[3]	NS	S
Eu. grandis/saligna hybrid[4]	Not listed	S
Eu. pilularis	NS	NS
Eu. regnans Tasmania[5]	NS	S
Eu regnans/obliqua hybrid, Tasmania	Not listed	S
Eu. saligna	S	S
Eu. sieberi	NS	NS
Eu. tetradonta[6]	S	NS

Notes for suggested changes

1. *Eu. crebra* and *Eu. fibrosa* were also found by CSIRO (1950) and Fairey (1975) to be rarely susceptible.
2. The change suggested for *Eu. delegatensis* is that both NSW and Victorian grown timber have the NS rating, due to botanical similarities and adjacent proximities where genetic exchange would not be limited by state boundaries.

3. *Eu. grandis* was also listed by CSIRO (1950) and Fairey (1975) as rarely susceptible.
4. Authenticated *Eu. grandis/saligna* hybrid was not examined. However, as both parent species are now considered susceptible, a similar rating can also be expected for the hybrid.
5. *Eu. regnans* and the *Eu. regnans/obliqua* hybrid grown in Tasmania are indistinguishable in the field. No change is being suggested for mainland grown *Eu. regnans*.
6. The S listing for *Eu. tetradonta* in AS 5604 arose from an earlier interpretation of the bioassay results reported here, when even rare S1 attack would be sufficient to consider a species susceptible. However, the new criteria take normal sawmilling practices into account.

Starch testing:

- The starch test ratings used were ND (not detected), low, medium or high.
- There were 272 test specimens with medium to high starch contents, but only 42% of these (115) had S2 or S3 attack (irrespective of attacked depth). Also, as 129 specimens had S2 or S3 attack, 14 test specimens had not been identified by this range of colour reaction. Therefore, this starch reaction was 89% accurate at predicting susceptible test specimens.
- There were 572 test specimens with detectable starch, but only 22% of these (126) had S2 or S3 attack. Also, as 129 specimens had S2 or S3 attack, three test specimens had not been identified by the starch test. The starch test was therefore 98% accurate at predicting susceptible test specimens.

Application of Results

The results obtained are suitable for adjusting or adding to the lyctine susceptibility ratings provided in AS 5604 'Timber-Natural durability ratings'. The ability of the starch test to predict lyctine susceptibility has been provided for each timber species, and can be useful for identifying those logs in need of treatment.

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INTRODUCTION

The sapwood of certain hardwoods is susceptible to lyctine beetle attack. The significance of the attack varies according to what proportion of sapwood is present in the timber piece. If the sapwood band is thin, then a small amount of damage in a structural member may be tolerated. However, in NSW and Queensland, where there is a history of using hardwood species with thick sapwood bands, there are constraints under state legislation on the sale of lyctine susceptible timber. Similarly, even minor damage to appearance grade products such as flooring and furniture can be unacceptable, and is not permitted according to AS 2796.2-2006. Susceptible timbers therefore require some form of preservative treatment, or modification, to enable greater sawn recovery and utilisation of the hardwood resource.

Most studies on lyctine susceptibility were conducted in the 1940-70's on mature trees that were more than 80 years old (CSIRO, 1950; Fairey, 1975). Lyctine susceptibility can vary with forest location and age of tree. For example, *Eucalyptus delegatensis* (alpine ash) from Victoria is said to be lyctine resistant (immune), while the same species from Tasmania and NSW has been reported as susceptible (Fairey, 1975). Creffield *et al*. (1995) showed differences in susceptibility between some regrowth and old growth West Australian hardwood species. Recently, Peters *et al.* (2002) produced guidelines on test methodology for determining lyctine susceptibility.

Significant savings can accrue to species or timber sources shown to have non-susceptible sapwood. Treatment costs can be avoided and the timber will be preservative free. The main nutrient for lyctines is starch, which the tree produces as a means of energy storage. Starch content can vary with season. In cool temperate regions, starch usually accumulates over winter, but at other times concentrations may occur at levels below that needed to support the successful development of lyctines.

There are a number of treatment methods, some developed as long ago as the 1930s, available for protecting hardwood sapwood from lyctine attack. In a recent industry review (Cookson *et al.*, 1998), it was found that the majority of sawmills treat green timber with boron using the hot and cold bath method or, more recently, by vacuum pressure impregnation. Pyrethroid treatments are an alternative, with the method of choice dependent upon a number of factors, such as volume of throughput and timber moisture content. As part of this project, a review of current treatment practices being used in Australia was conducted (Cookson, 2004).

The aim of this research was to obtain sapwood-containing timber samples from as wide a geographical range as possible that could be provided by forestry collaborators. The samples were sought during different times of the year, as starch content and susceptibility can be seasonal. Also, regrowth timbers of the 25-50 year age group were sought as being more representative of the future timber supply, although younger trees were also examined when the later age group was not available. The test timbers were exposed to three lyctine beetles maintained in culture by Ensis. These were *Lyctus brunneus*, which is found Australia wide, and the smaller species *L. discedens* and *Minthea rugicollis.*

Some departures from the guidelines provided by Peters *et al*. (2002) were made in the current research, for various reasons. Most timber species to be examined in this trial were in the 'rarely susceptible' category, so were problematic species where some difficulty in obtaining clear guidance from starch and pore diameter readings might be expected. Therefore, rather than assume that susceptibility could be determined by pore size or field starch testing results, the decision was made to bioassay every test specimen. Bioassay is the final arbiter on lyctine susceptibility.

Effort was placed into bioassay rather than pore size readings for additional reasons. Most *Eucalyptus* species have mean pore size diameters greater than the 70 µm limit needed to predict non-susceptibility. For example, 46 out of 50 *Eucalyptus* species examined by Bamber and Erskine (1965) had mean pore diameters greater than 70 µm, and 48 out of 50 had pore size ranges greater than 90 µm.

L. brunneus is the recommended species for use in bioassays. It is one of the larger lyctine species, and requires a minimum pore diameter of 90 µm for oviposition (Cummins and Wilson, 1934). However for this project, the smaller lyctine species (*L. discedens* and *M.. rugicollis*) were included, as the results from one lyctine species may not reflect the level of attack that can occur in the field.

The test for starch in the field was also omitted, as there were many contributors to the supply of timber samples for this project, meaning that consistency of assessment would be difficult to claim. Therefore, all test specimens were starch tested in the one laboratory.

The number of samples and the geographical distribution sought proved difficult to achieve for some species. For example, mature trees of Western white gum (*Eu. argophloia*) are relatively rare, and most occur in national parks, so that the desired level of sampling was not possible. The Victorian alpine fires in early 2003 also rendered some collection sites for *Eu. delegatensis* unsuitable to the trial. It should also be noted that once lyctine susceptibility is demonstrated in a test specimen, further sampling of that timber species is not necessary.

RECOMMENDATIONS AND CONCLUSIONS

The test timbers found to be lyctine susceptible were Cooktown ironwood (*Erythrophleum chlorostachys*), alpine ash (*Eucalyptus delegatensis*) grown in Tasmania, *Eucalyptus regnans/obliqua* hybrid from Tasmania, Melville Island bloodwood (*Corymbia nesophila*), broad-leaved red ironbark (*Eu. fibrosa*), rose gum (*Eu. grandis*), narrow-leaved red ironbark (*Eu. crebra*), western white gum (*Eu. argophloia*), Dunn's white gum (*Eu. dunnii*), mountain ash (*Eu. regnans*) from Tasmania, and Sydney blue gum (*Eu. saligna*). The *Eu. grandis/saligna* hybrid should also be considered lyctine susceptible, until trials of authentic hybrid prove otherwise, as both parent species are now considered to be susceptible.

The test timbers found not to be lyctine susceptible were Gympie messmate (*Eu.cloeziana*), alpine ash (*Eu. delegatensis*) grown in Victoria or NSW, blackbutt (*Eu. pilularis*), silvertop ash (*Eu. sieberi*) and Darwin stringybark (*Eu. tetradonta*).

The results obtained should be used to modify AS 5604 'Timber-Natural durability ratings'.

The iodine starch test was confirmed as being accurate for detecting lyctine susceptible test specimens. However, it was less accurate at detecting non-susceptible test specimens, as many with positive starch reactions were not subsequently attacked.

RESULTS AND DISCUSSION

Criteria for susceptibility

A key aim of this project was to give more detailed information on a number of ‘borderline’ timber species that could more accurately be termed ‘rarely susceptible’. However, because state acts of Queensland (Timber Utilisation and Marketing Act 1987, TUMA) and NSW (Timber Marketing Act 1977, TMA), and AS 5604, can only accept susceptible or non-susceptible divisions (and therefore provide clear guidance on whether to treat with preservatives), more discussion on how to distinguish the two possibilities, especially for borderline species, is still needed.

In this work, a species was considered not susceptible when all test specimens lacked larval channeling. Further, timber species where a minor percentage of test specimens rated no more than S1 were considered not susceptible. The S1 rating indicates light attack and no emergence holes, so the individual lyctines within the S1 attacked wood have no ability to spread their attack. The S1 ratings were often only clear under magnification, and would be largely unnoticeable in service. Also note that if a timber species only had S1 attack, then the percentage of test specimens attacked was also small. Timber species where any replicate had S2 (moderate) or S3 (heavy) attack through the majority of the sapwood were considered susceptible, even if only one or a few replicates were involved. A qualification is that if the S2 or S3 attack was confined to the outer 6 mm of sapwood (and the remainder of the sapwood was not attacked or had S1 attack only), the timber was considered not susceptible. During normal sawmilling practice, the outer 6 mm of sapwood at least is lost, due to kerf, and the need to have some wood on either side of the blade to provide greater stability during sawing. For these examples, iodine tests usually confirmed that significant starch was present only in the outer sapwood bands. This finding, that susceptibility in some timber species can vary according to sapwood depth, may account for some of the previous discrepancies between studies on how to rate certain species.

Timber species

The starch test and lyctine susceptibility results for each of the 777 sapwood test specimens examined, representing 772 different trees, are provided in the Appendix. A summary of the results, and discussion for each timber species, follows. Approximate collection sites are marked by red dots on the maps (maps were obtained from the zoomin.com.au website). The graphs show the proportion of specimens with each rating according to the month of timber collection, and as a percentage of the total number of specimens tested irrespective of time. In this way, an indication of the proportion of specimens represented within each month was also obtained. Dry conditions or drought prevailed over much of the time when timber for this trial was collected. It is not known what effect dry weather may have had upon starch contents.

The highly lyctine susceptible species, black bean (*Castanospermum australe*), was included in the bioassays, as a control or check that the lyctine beetles were active. Of the 78 black bean test specimens exposed, one had no attack, nine had slight S1 attack, five had moderate S2 attack and 63 were heavily attacked (S3 rating), confirming the vigour of the lyctine beetles used in the project.

Corymbia nesophila = Melville Island bloodwood

C. nesophila grows naturally in the on the Cape York Peninsula, the Kimberley region of Western Australia, and in the Northern Territory on Melville and Bathurst Islands and the Cobourg Peninsula (Boland *et al.*, 1984). It is being considered as a plantation species for Cape York. It has been listed in AS 5604 as lyctine susceptible.

The material for this study came from several locations in Cape York, which were Weipa, Kendall/Holroyd region, Violet Vale/Morehead region, and Injinoo (Bamaga) (Figure 1). A total of 67 specimens were tested. Results from the iodine spray test showed that starch contents ranged from not detectable to high.

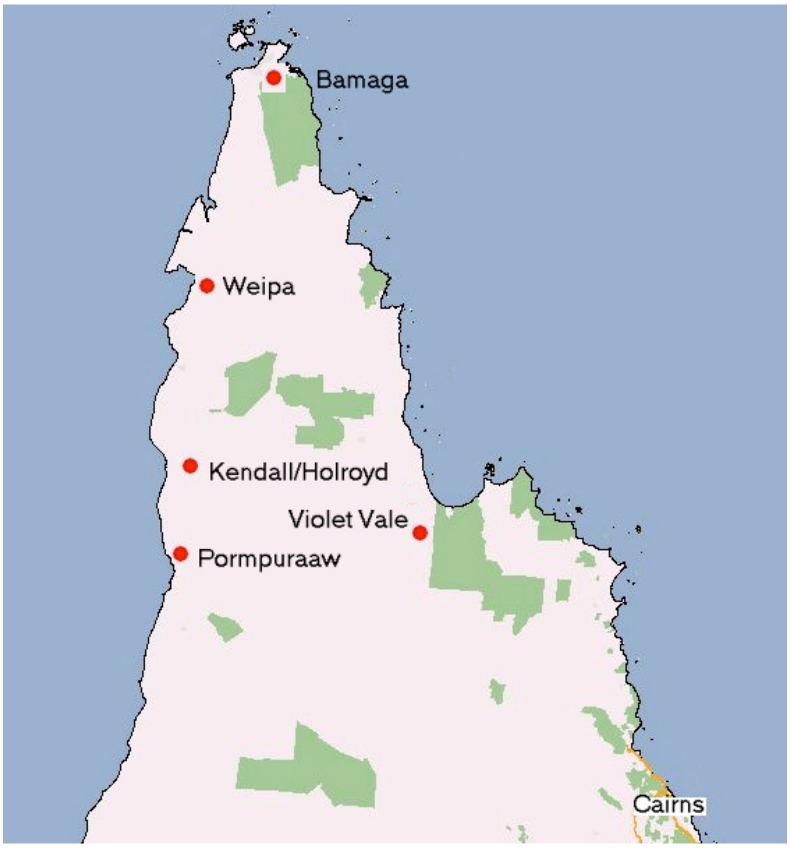

Figure 1: Cape York Peninsula collection sites (approximate).

Almost half (31) of the 67 test specimens were not attacked by lyctines. Sixteen specimens sustained S1 attack (seven samples with more than 6 mm depth of attack), 12 specimens sustained S2 attack (ten with more than 6 mm depth of attack) and eight specimens had S3 attack (seven with more than 6 mm depth of attack). Susceptible samples were collected in each quarter of the year examined, although most susceptible samples were collected in December (Figure 2). Susceptible samples were also collected from each harvesting location. Based upon these results, 25.4% of test specimens had serious attack, and *C. nesophila* should be considered to have lyctine susceptible sapwood.

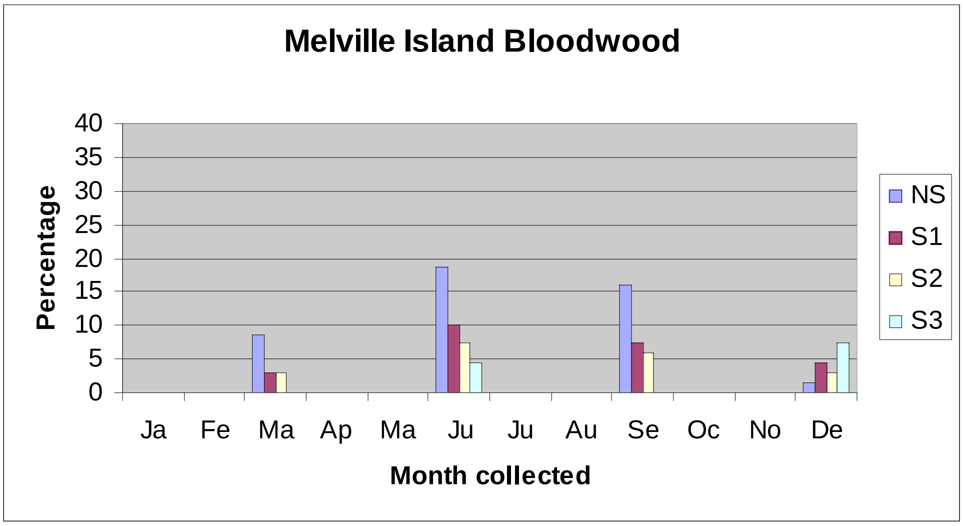

Figure 2: ***C. nesophila*** **(Melville Island bloodwood) lyctine susceptibility results based on month collected.**

Erythrophleum chlorostachys = Cooktown Ironwood

Er. chlorostachys grows naturally in the far north of Queensland, the Northern Territory and Western Australia (Bootle, 2005). It is being considered as a plantation species for Cape York. In AS 5604 it has been listed as lyctine susceptible. Boland *et al.* (1984) also noted that this species is lyctine susceptible.

The material for this study came from several locations in Cape York, which were Weipa, Kendall/Holroyd region, Violet Vale/Morehead region, and Injinoo (Bamaga) (Figure 1). A total of 46 specimens were tested. Starch content was generally medium to high.

All test specimens sustained at least some level of lyctine attack, as none was rated NS. Four specimens had S1 attack, 10 had S2 attack, and the majority at 32 had S3 attack. No clear seasonal trend in susceptibility was found, with collection only occurring twice in June and September, although the September collected material was generally more severely attacked (Figure 3). Further collections were not made as it became clear that the timber was lyctine susceptible. There was also no clear difference in lyctine susceptibility between locations. Depth of lyctine attack was always more than 6 mm, and usually to the full sapwood depth. Based upon these results, 91.3% of test specimens had serious attack, and *Er. chlorostachys* should be considered to have lyctine susceptible sapwood.

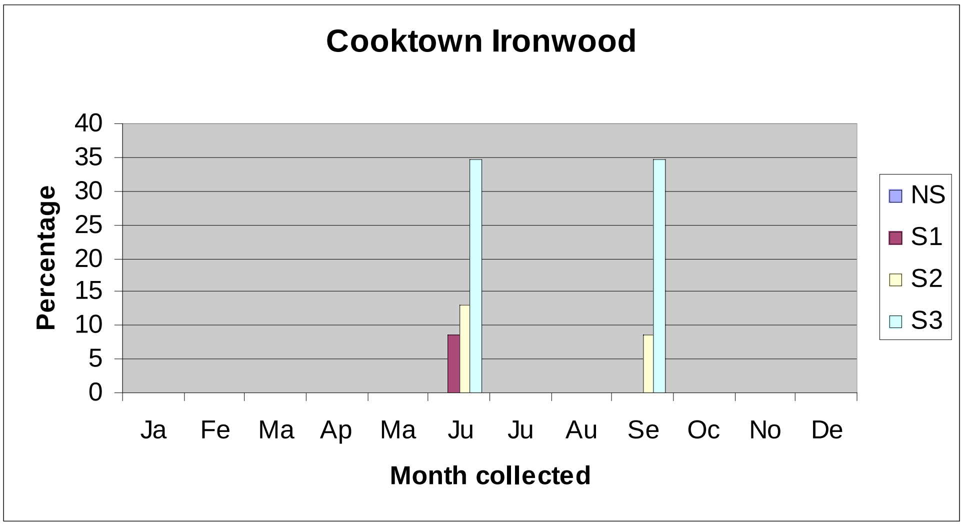

Figure 3: *Er. chlorostachys* (Cooktown ironwood) lyctine susceptibility results based on month collected.

Eucalyptus argophloia = Western white gum or Chinchilla white gum

Eu. argophloia grows naturally in a small area northeast of Chinchilla in south-eastern Queensland, from Burncluith to Burra Burri (Boland *et al*., 1984). It is being considered as a potential plantation species for Queensland and for parts of NSW. It is not listed in AS 5604.

Mature trees for this study came from Biloela, while young plantation trees were from Narayen (12 year old trees) and Dunmore (eight year old trees) (Figure 4). A total of 39 specimens were tested. Starch was not detected in 16 of the 20 specimens from Biloela, while the other four specimens had low starch contents. In comparison, the younger trees generally had higher starch contents. Three of the nine timber specimens from Narayen had medium to high starch contents, while all ten specimens from Dunmore had medium to high starch contents.

Figure 4: Collection sites for *Eu. argophloia* (western white gum).

All specimens from mature trees at Biloela were not lyctine susceptible, which supports the finding from the iodine test that these specimens had starch contents that were low or not detectable. However, many test specimens from young plantation trees had medium or high starch contents, and several proved to be lyctine susceptible. Of the 19 test specimens from young trees collected in May, 13 had no attack, three had S1 attack, two had S2 attack to 16 or 18 mm depths, and one had S3 attack 15 mm deep (Figure 5). Therefore, three test specimens were seriously attacked by lyctine borers. All attacked test specimens had high, or in one case medium, starch content. Based on these results, 7.7% of test specimens had serious lyctine attack, and *Eu. argophloia* should be considered to have lyctine susceptible sapwood. It would be interesting to see if these plantation timbers became non-susceptible upon maturity. It could not be determined from the current study whether susceptibility was influenced by location or month of collection, as differences may have been due to tree age instead. The starch test appears to give reliable results for predicting lyctine susceptibility in *Eu. argophloia.*

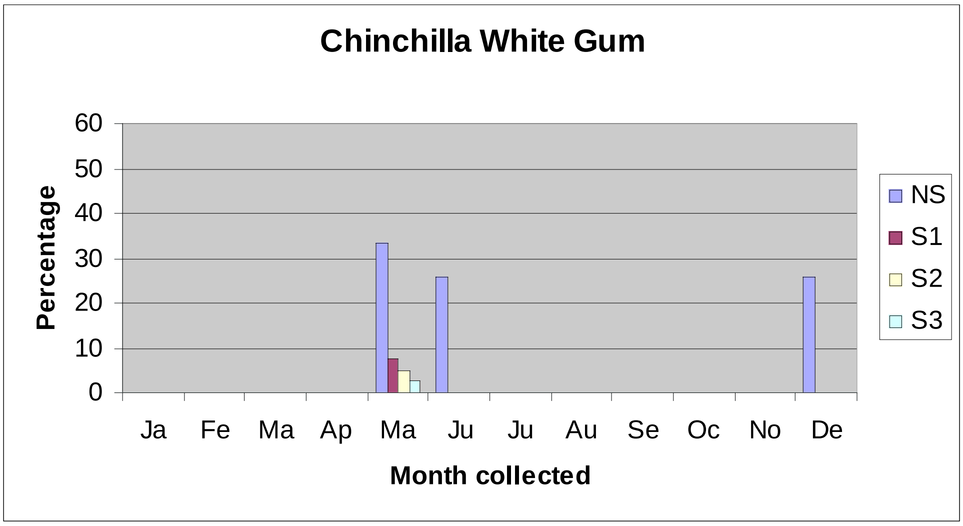

Figure 5: *Eu. argophloia* (western white gum) lyctine susceptibility results based on month collected.

Eucalyptus cloeziana = Gympie messmate

Eu. cloeziana grows naturally in coastal Queensland from Gympie to near Cooktown (Boland *et al*., 1984). It is being considered as a plantation species in Queensland, and to a lesser extent, in NSW. It has been listed in AS 5604 as not susceptible to lyctines.

The material for this study came from two locations, with trees of mature regrowth from Ringtail State Forest, and nine year old plantation trees from Pomona, both in the Noosa hinterland (Figure 6). There was difficulty in finding mature regrowth for the trial, so that young saplings were also tested. A total of 25 specimens were tested. Starch content was not detectable for 22 of the specimens, while two samples had low starch content and one medium starch content.

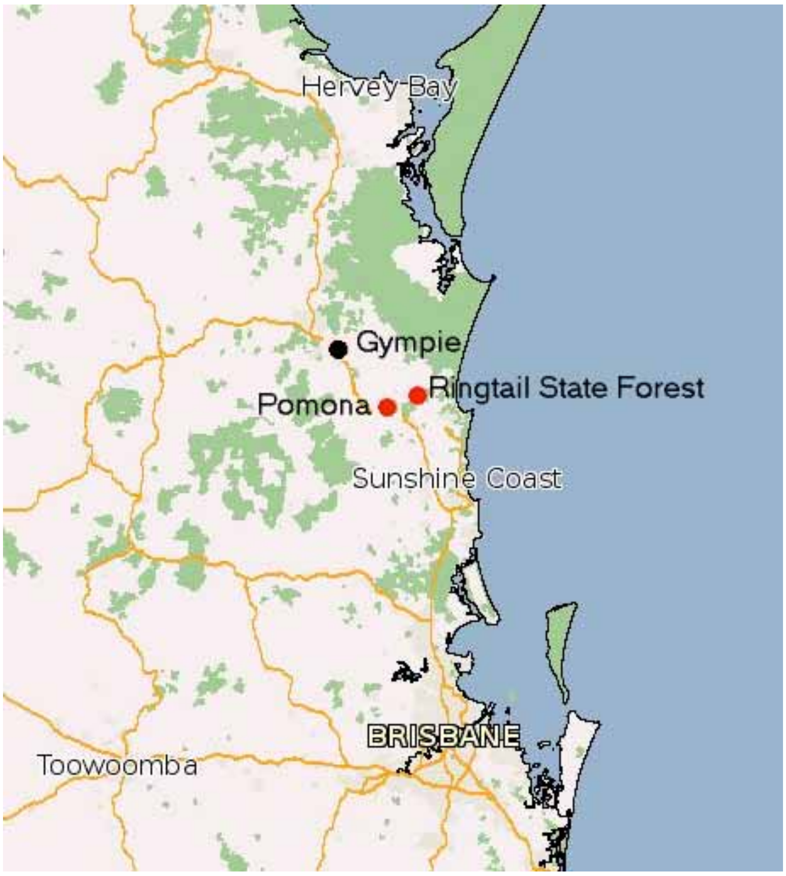

Figure 6: Collection sites for *Eu. cloeziana* (Gympie messmate).

In the bioassays, no lyctine attack of *Eu. cloeziana* occurred (Figure 7). Therefore, there were no seasonal trends or location effects to note (Figure 7). Earlier trials by CSIRO (1950) suggested that *Eu. cloeziana* was rarely susceptible. This earlier research did not differentiate the depth to which the rare examples of attack occurred within the sapwood. Based upon the current research, *Eu. cloeziana* should remain listed as a species that is non-susceptible to lyctine borers.

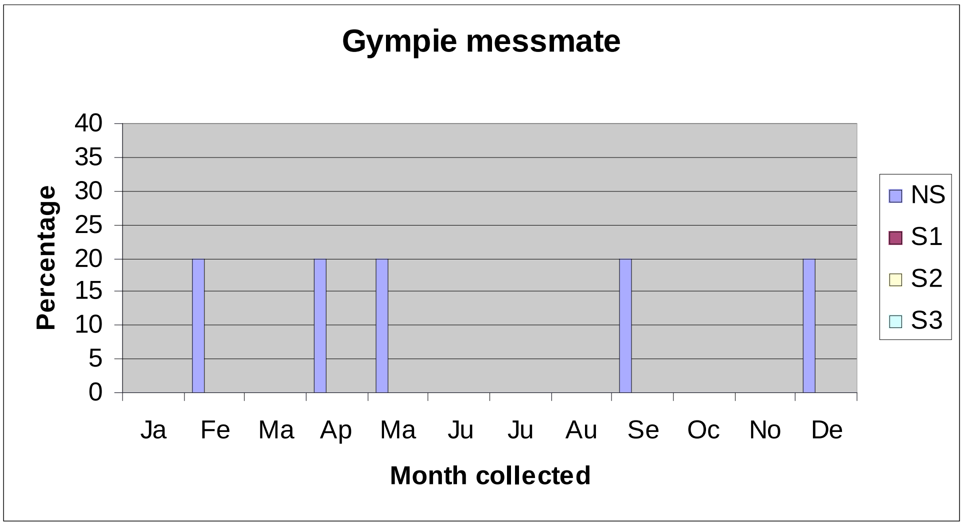

Figure 7: *Eu. cloeziana* (Gympie messmate) lyctine susceptibility results based on month collected.

Eucalyptus crebra = Narrow-leaved red ironbark

Eu. crebra is a variable species in appearance (Boland *et al*., 1984), and grows naturally along the east coast from Sydney to Cairns, and the higher rainfall areas of the western slopes and plains of NSW (Bootle, 2005). It has been listed in AS 5604 as not susceptible to lyctines.

The material for this study came from one main location at Corrabare (39 trees sampled) near Paxton west of Newcastle, and one tree that was collected at Girard State Forest near Tenterfield in NSW (Figure 8). A total of 40 specimens were tested. Starch was not detectable in six of the specimens, low starch content was detected in 14 specimens, medium starch content was detected in 13 specimens, and seven specimens had high starch content.

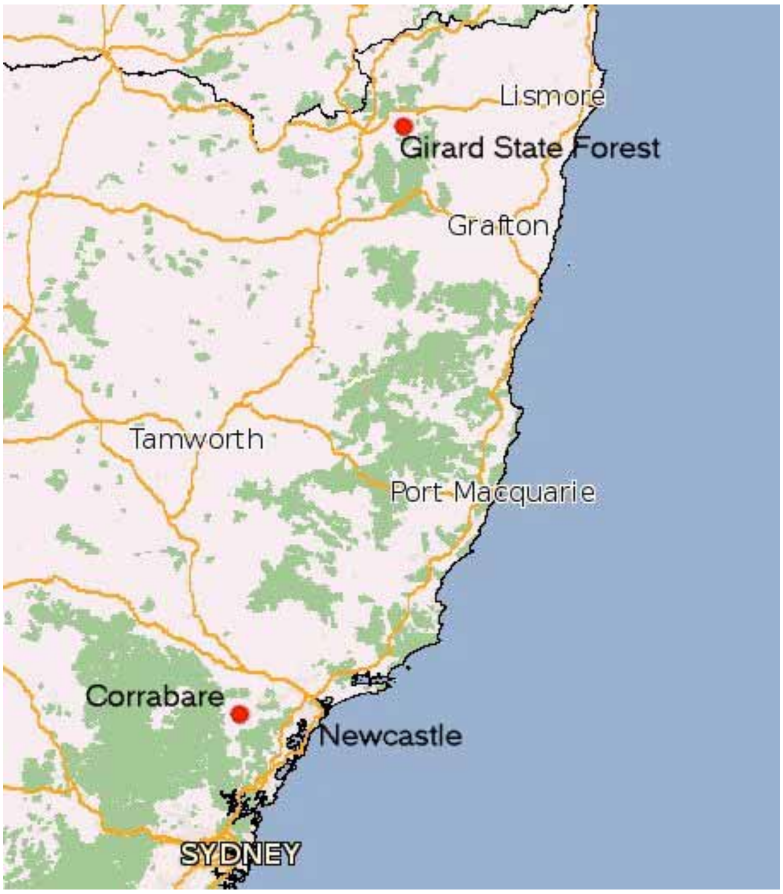

Figure 8: Collection sites for *Eu. crebra* (narrow-leaved red ironbark).

In the bioassays, heaviest lyctine attack occurred in medium to high starch containing samples. Lyctine attack was absent in 18 test specimens, while 14 had S1 attack, one had S2 attack and seven had S3 attack (Figure 9). There were three samples rating S2 or S3, which had the attack occurring deeper than 6 mm into the sapwood. A seasonal trend was noticed whereby these three seriously attacked specimens had been harvested during November in two consecutive years (Figure 9). Insufficient material was collected elsewhere to determine if growth location affected lyctine susceptibility. This research confirms that *Eu. crebra* is occasionally lyctine susceptible, where the attack is usually light or shallow and therefore insignificant. However, there is sufficient variability with some specimens being seriously attacked, to suggest that the conservative approach would be to consider the species lyctine susceptible. There appears to be some potential for avoiding lyctine susceptible sapwood in this species by choosing time of harvest, although the reliability of this factor, and how it is affected by other locations, would need to be investigated in more detail. Based upon the current research, 7.5% of test specimens had serious attack, and *Eu. crebra* should be considered lyctine susceptible.

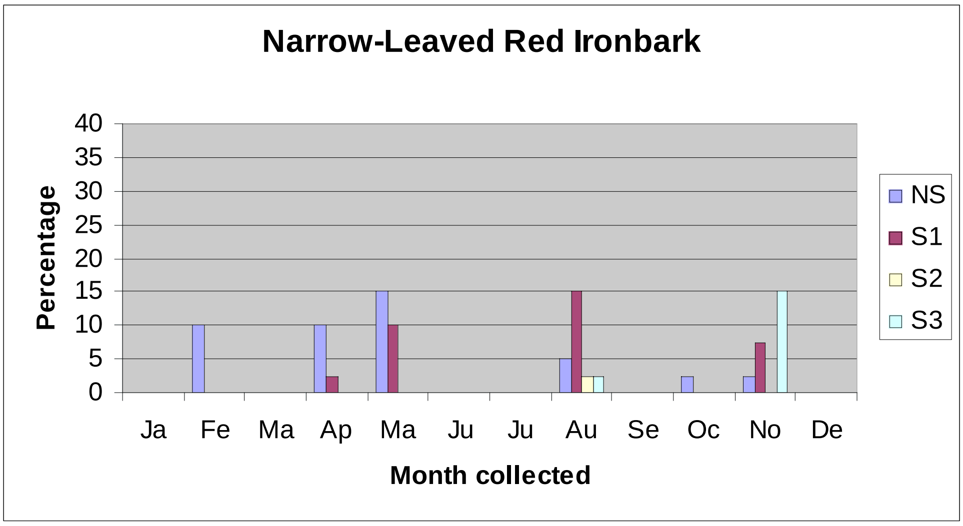

Figure 9: *Eu. crebra* (narrow-leaved red ironbark) lyctine susceptibility results based on month collected.

Eucalyptus delegatensis = Alpine ash

Eu. delegatensis grows in the colder regions of Tasmania, Victoria and south-eastern NSW (Bootle, 2005). In NSW, *Eu. delegatensis* is confined to the southern tablelands, and grows best around Batlow and Tumbarumba (Bootle, 1971). Tasmanian *Eu. delegatensis* has some differences in physical appearance to the mainland population in terms of bark, leaves and fruit (Boland *et al.*, 1984), and population differences appear to extend further into the lyctine susceptibility ratings.

Most of the mainland specimens for test came from 3-4 locations in Victoria, at Rawson, Alexandra, Mitta Mitta and Diggers Hole East (Figure 10). One collection of five trees also occurred in NSW near Thredbo at Ingebirah State Forest (Figure 10). Note that the major alpine fires in Victoria of early 2003 rendered some locations unsuitable for sampling. A total of 55 trees were examined from mainland Australia. Starch was not detected in 24 samples, low starch was detected in 20 samples, nine samples had medium starch content and one sample had high starch content. It should be noted that the starch reaction within sapwood was usually strongest and confined to the outer sapwood, and that detectable starch deeper in the sapwood was usually absent.

Figure 10: Collection sites for *Eu. delegatensis* from the mainland (alpine ash).

The bioassays found that 46 mainland test specimens were not susceptible to lyctines (Figure 11). Seven test specimens had S1 attack, and all of this attack was confined to the outer 6 mm or less of sapwood. Two specimens had S2 lyctine attack, with attack depths reaching just 3 or 5 mm depth (Appendix). Therefore, as these attacked regions are almost invariably lost during sawmilling, mainland grown *Eu. delegatensis* should be considered not susceptible to lyctines. The trees sampled during February and March had the lowest proportions of test specimens with lyctine damage (3% of 30 test specimens), while the highest percentage of damage (60% of five test specimens) occurred in trees sampled in September (Figure 11). With such limited attack in *Eu. delegatensis* test specimens, conclusions about seasonal effects on lyctine susceptibility could not be made. In susceptible timber species, a common seasonal variation is that starch content and susceptibility in temperate regions peaks during late winter and summer (Brimblecombe, 1961; Peters *et al*., 2002).

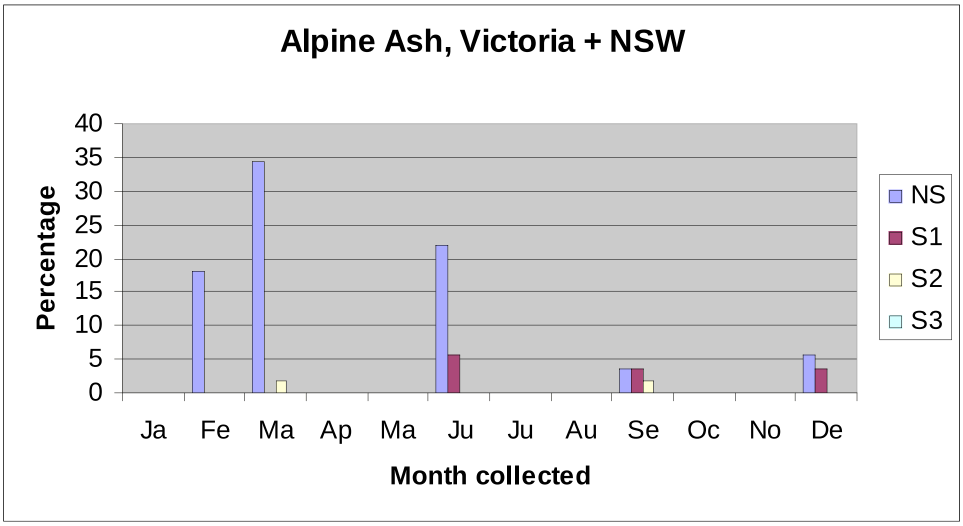

Figure 11: *Eu. delegatensis* (alpine ash) from Victoria and NSW, with lyctine susceptibility results based on month collected.

These results compare to *Eu. delegatensis* grown in Tasmania. Test material was collected from two locations in close proximity to each other, at Waterloo and Geeveston in the Huon Valley region of southern Tasmania (Figure 12). Test material was collected from 40 trees in this region. Only two specimens had no detectable starch, and 11 specimens had low starch. Eight specimens had medium and 19 specimens had high starch contents. As might be expected from the starch testing results, many test specimens (52%) incurred significant lyctine attack (Figure 13), and to depths greater than 6 mm. These results suggest that Tasmanian grown *Eu. delegatensis* should be considered lyctine susceptible.

Figure 12: Collection sites for *Eu. delegatensis* from Tasmania (alpine ash).

CSIRO (1950) listed alpine ash (*Eu. gigantea = Eu. delegatensis*) as rarely susceptible. The source of the trees for that study was not provided. In further research, Fairey (1975) noted that *Eu. delegatensis* grown in Victoria was not susceptible, that trees from NSW were rarely susceptible, and that Tasmanian grown material was susceptible. The current research suggests that Victorian grown *Eu. delegatensis* could also be considered rarely susceptible, unless depth of attack into the sapwood is taken into account (effectively making it non-susceptible). As the NSW and Victorian grown *Eu. delegatensis* have similar appearance and are in genetic proximity not inhibited by artificial state boundaries, results between the two populations are thought to be interchangeable. Also, as the depth of attack into sapwood was not included in the assessments by CSIRO (1950) or Fairey (1975) for the NSW material, and the five trees examined from NSW were not susceptible, it is our recommendation that mainland grown *Eu. delegatensis* be considered not susceptible, while Tasmanian grown *Eu delegatensis* is susceptible.

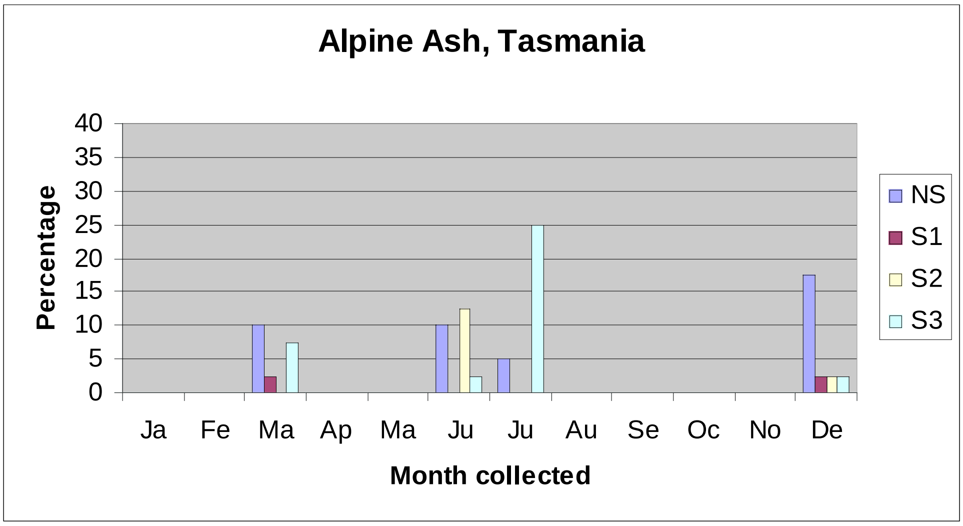

Figure 13: *Eu. delegatensis* (alpine ash) from Tasmania, with lyctine susceptibility results based on month collected.

Eucalyptus dunnii = Dunn's white gum

Eu. dunnii grows naturally in an area near Coffs Harbour in NSW, and also near Warwick in Queensland (Boland *et al.*, 1984). The species is being developed as an important plantation species for NSW and Queensland. Previous research by CSIRO (1950) listed *Eu. dunnii* as highly susceptible to lyctines, while Fairey (1975) also listed this timber species as susceptible. *Eu. dunnii* is listed in AS 5604 as lyctine susceptible.

The material for the current study came from a 3.5 year old plantation in the Anamoor State Forest near Gympie in Queensland, and nine year old trees in the Boambee State Forest near Coffs Harbour in NSW (Figure 14). A total of 21 specimens were tested. The five specimens from Boambee, collected in January 2004, all had starch contents that were low or not detectable. In comparison, those specimens collected in May 2005 from Amamoor State Forest had the full range of reactions from non-detectable starch to high starch content. Specifically, starch content was not detectable in two of the specimens from Amamoor, six specimens had low starch, seven had medium starch, and one specimen had high starch content.

Only young trees were available for the project. Of the 21 test specimens examined, 12 were non-susceptible, and eight had S1 attack where five of the test specimens had damage further than the 6 mm threshold depth. The remaining test specimen had S2 attack to a depth of 12 mm, even though the starch test suggested that it had low starch content. Indeed, the starch test appeared to be less accurate for *Eu. dunnii* than for most other species, as some of those specimens with S1 attack had starch readings of low or not detectable. There were insufficient specimens to determine if there was any seasonal or tree location influences in the results. This research found that 4.8% of test specimens examined (one specimen) had serious lyctine attack, and confirms the findings of CSIRO (1950) and Fairey (1975) that *Eu. dunnii* should be considered to have lyctine susceptible sapwood. Nevertheless, the susceptibility found in the test specimens examined here, from young trees, appears to be less than previously published.

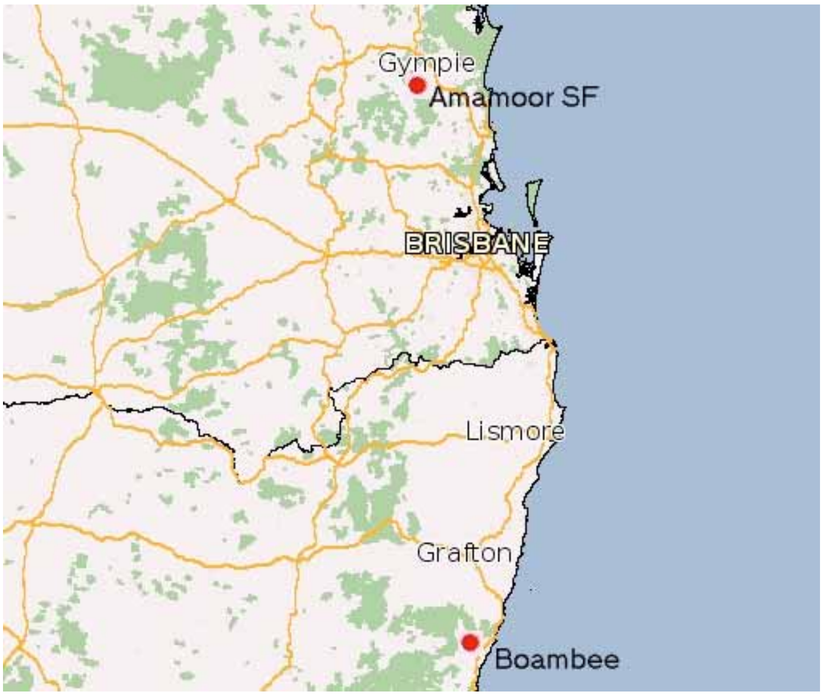

Figure 14: Collection sites for *Eu. dunnii* (Dunn's white gum).

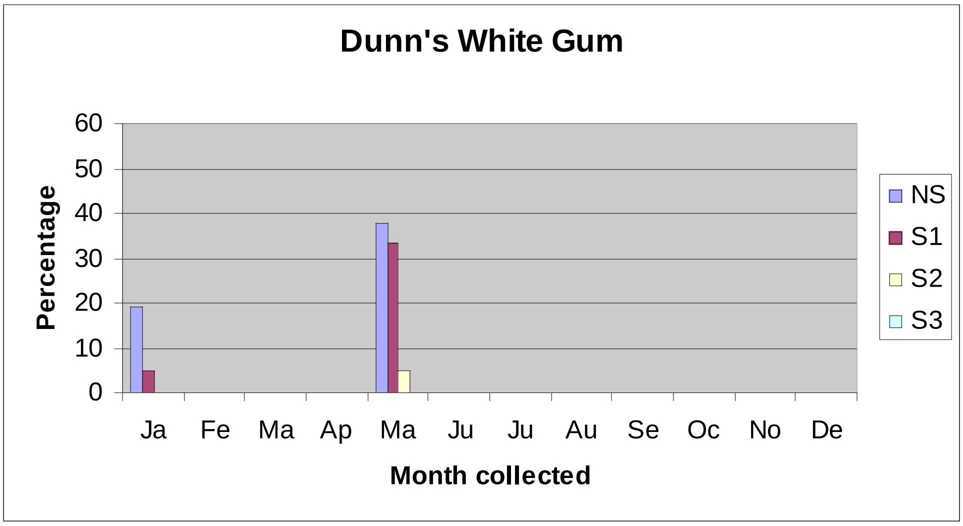

Figure 15: ***Eu. dunnii*** **(Dunn's white gum) lyctine susceptibility results based on month collected.**

Eucalyptus fibrosa = Broad-leaved red ironbark

Eu. fibrosa grows naturally from Bodalla on the south coast of NSW to north of Rockhampton in Queensland (Boland *et al*., 1984). Previous research by CSIRO (1950) listed *Eu. fibrosa* (formerly *Eu. siderophloia*) as rarely susceptible, which is the same rating provided by Fairey (1975). AS 5604 currently lists *Eu. fibrosa* as not susceptible to lyctines.

The material for this study came from the McDonald State Forest, Girard State Forest (one tree), Taree State Forest, Mogo State Forest and Glenugie State Forest (Figure 16). The two test specimens from Glenugie State Forest provided by J. Notaras & Sons Pty. Ltd sawmills, were confirmed as *Eu fibrosa* by Mr Jugo Ilic. A total of 18 specimens were tested. Starch content was not detectable in one test specimen, low starch was in six specimens, medium starch was detected in six specimens, and five specimens had high starch content.

Figure 16: Collection sites for *Eu. fibrosa* (broad-leaved red ironbark).

In the bioassays, seven of the test specimens resisted lyctine attack and were rated NS (Figure 17). Six *Eu. fibrosa* specimens had light S1 lyctine attack, although in each case the depth of attack was less than 6 mm. Five specimens had S2 attack, where the attack was limited to less than 6 mm depth in two of the specimens, but was greater in the remaining three specimens. The deepest S2 attack was to 20 mm in the sapwood, another had 7 mm depth of attack, and the third test specimen with serious attack had S2 damage to a depth of 6 mm, and then lighter S1 attack from 6 to 9 mm depth. No clear seasonal trend in lyctine susceptibility was evident from the limited material supplied, with S2 attack occurring in samples collected from each collection time, except October when only one sample was collected (Figure 17). The location of sample collection did not appear to be an important factor, as samples from nearly all locations had some specimens with S2 attack. This research confirms that *Eu. fibrosa* is occasionally lyctine susceptible, where the attack is usually light or shallow and therefore insignificant. However, there is sufficient variability with some specimens being seriously attacked, to suggest that the conservative approach would be to consider the species lyctine susceptible. Based upon the current research, 16.7% of test specimens were seriously attacked, and *Eu. fibrosa* should be considered lyctine susceptible.

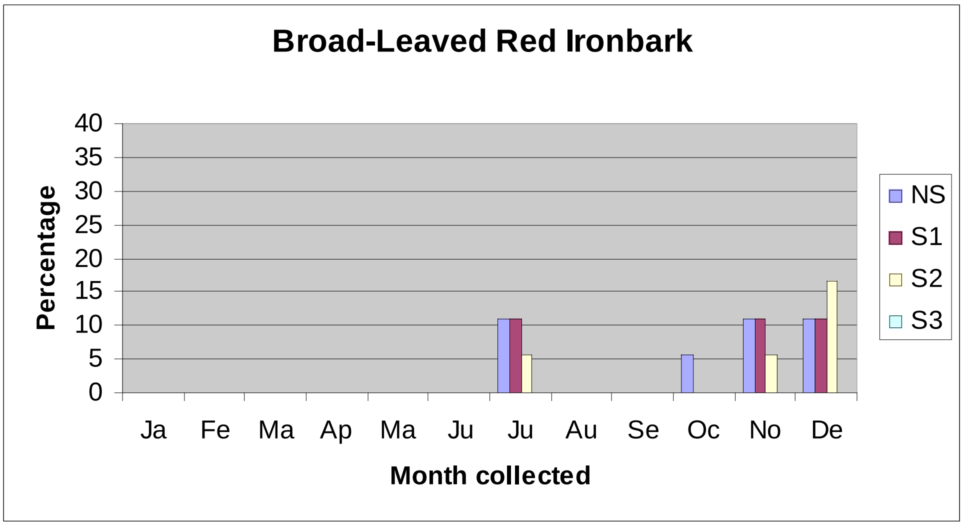

Figure 17: *Eu. fibrosa* (broad-leaved red ironbark) lyctine susceptibility results based on month collected.

Eucalyptus grandis = Rose gum or flooded gum

Eu. grandis grows naturally along the east coast of NSW from the Hunter River to northern Queensland (Bootle, 2005). It has been listed in AS 5604 as not susceptible to lyctines. CSIRO (1950) considered that *Eu. grandis* was rarely susceptible, as did Fairey (1975).

The material for this study came from one location in Queensland, the Ringtail State Forest in the Noosa hinterland (21 trees sampled), and six locations in NSW (31 trees sampled) that were all in the Coffs Harbour-Bellingen region (Figure 18). The NSW sites were Tuckers Nob State Forest, Wedding Bells State Forest, Orara East State Forest, Newry State Forest, Wild Cattle Creek State Forest, and Pine Creek State Forest. A total of 52 specimens were tested. Starch content was not detectable for 13 of the specimens, while 21 specimens had low starch content, 16 specimens had medium starch, and two specimens had high starch content.

In the bioassays, heaviest lyctine attack occurred mostly (not always) in medium to high starch containing specimens. Lyctine attack was absent in 33 specimens, while 12 had S1 attack, four had S2 attack and three had S3 attack (Figure 19). Most of the S1 attack was less than 6 mm deep, although three specimens had attack to 7 mm depth and another to 13 mm depth. Three of the four specimens with S2 attack had this attack penetrating more deeply than 6 mm into the sapwood (9, 10 and 17 mm depths). The fourth specimens had S2 attack to 5 mm depth, followed by S1 attack from the 5 to 18 mm depth. The three S3 specimens came from Ringtail State Forest, and two had attack to the significant depths of 7 and 10 mm. The highest proportion of susceptible specimens was harvested in September, although some level of susceptibility continued for the remaining months and into February (Figure 19). There appeared to be little difference in lyctine susceptibility between the Queensland and NSW populations, as both included a low percentage of trees that suffered significant lyctine attack.

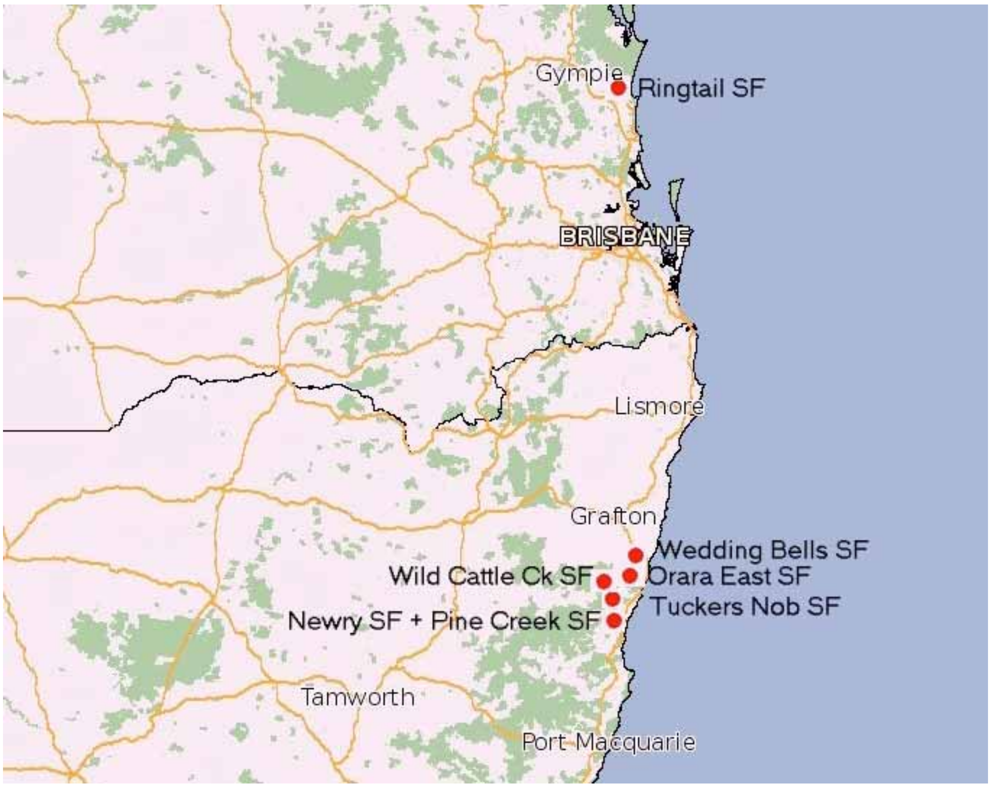

Figure 18: Collection sites for *Eu. grandis* (rose gum).

Even though there was a low percentage of trees suffering significant attack (five out of 52 specimens or 9.6% of the population), this would be enough to suggest that *Eu. grandis* should be considered lyctine susceptible. There appears to be some potential for avoiding lyctine susceptible sapwood in this species by selecting the time of harvest (Figure 19). Humphreys and Humphreys (1966) also found that the starch content of *Eu grandis* peaked in spring and early summer.

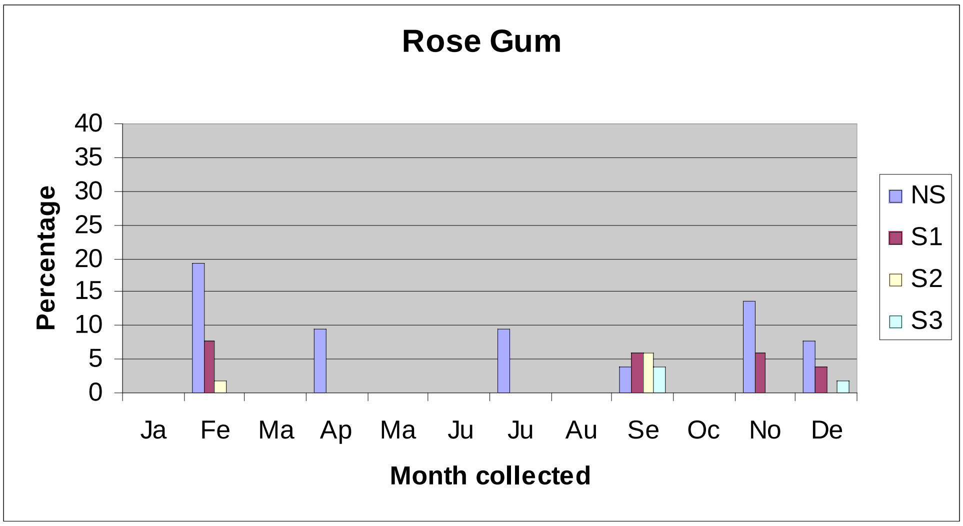

Figure 19: *Eu. grandis* (rose gum) lyctine susceptibility results based on month collected.

Eucalyptus grandis/saligna hybrid

Eu. grandis and *Eu. saligna* are known to produce hybrids, and plantations of the hybrids are being grown in NSW. However, several attempts to obtain verified hybrid material were unsuccessful. One collection from five trees, possibly of hybrid, was obtained in March from Tuckers Knob State Forest near Coffs Harbour (Figure 18). These trees had starch contents that were not detectable or low. All five test specimens proved to be lyctine resistant. However, the collection was at a time when starch content in trees is often low. For example, all five *Eu. grandis* test specimens collected in April were not susceptible. Collections of hybrid during September may be more informative.

In the absence of further research, our recommendation is to consider that the *Eu. grandis/saligna* hybrid is lyctine susceptible. That is based upon the lyctine susceptibility of the parent species, where *Eu. saligna* has long been recognized as susceptible (CSIRO 1950, Fairey 1975), and the current research also suggests that *Eu. grandis* should be considered lyctine susceptible.

Eucalyptus pilularis = Blackbutt

Eu. pilularis grows naturally along the east coast from Bega in NSW to Maryborough in Queensland (Bootle, 2005). It has been listed in AS 5604 as not susceptible to lyctine attack. CSIRO (1950) listed *Eu. pilularis* as rarely susceptible, while Fairey (1975) considered it to be non-susceptible.

The material for this study came from one location in Queensland, the Ringtail State Forest in the Noosa hinterland (21 trees sampled) (Figure 18), and seven locations in NSW (Figure 20), with 19 samples from northern coastal NSW, 39 samples from the Newcastle region at Olney, and 10 samples from southern coastal NSW. A total of 89 specimens were tested. Starch content was not detectable for 24 of the specimens, while 40 specimens had low starch content, 22 specimens had medium starch content, and three specimens had high starch content.

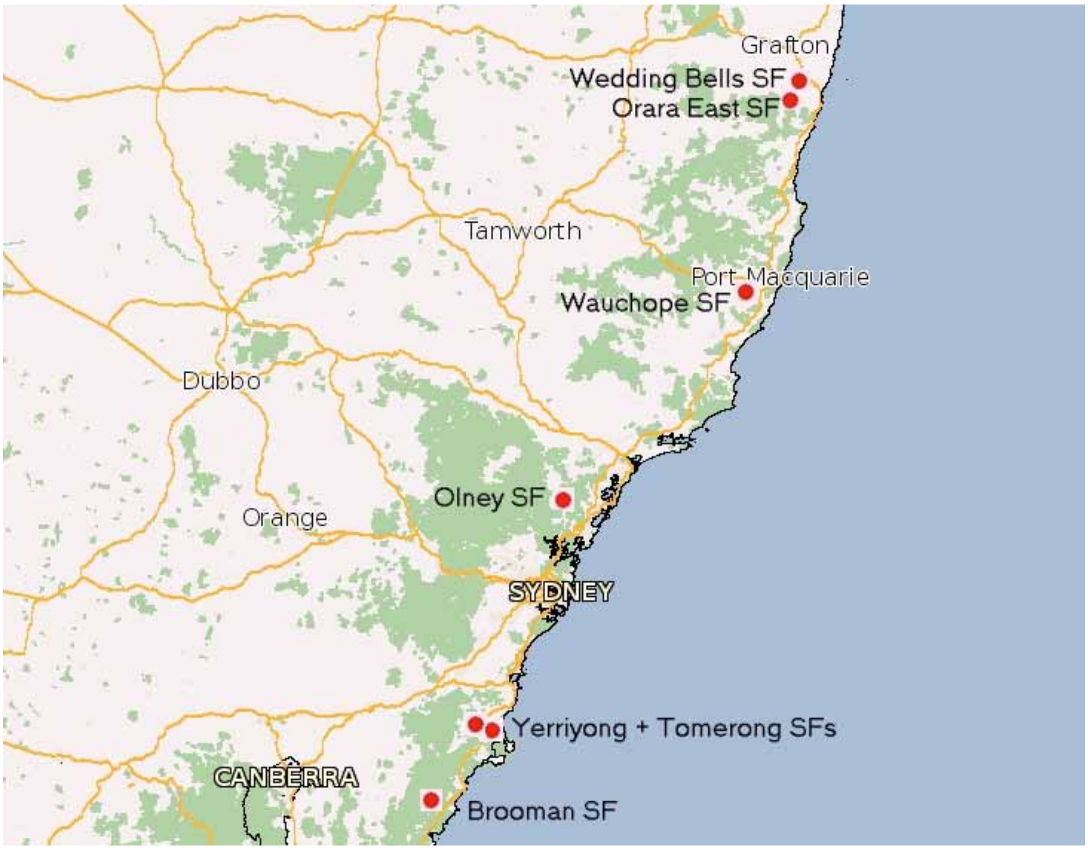

Figure 20: Collection sites for *Eu. pilularis* from NSW (blackbutt).

In the bioassays, only ten of the 89 specimens had lyctine attack (Figure 21), and for nine of these the rating was S1 and the depth of attack was mostly less than 6 mm, although two were attacked to 8 mm and another to 12 mm depths. Only one specimen had the more serious level of attack with an S2 rating; however, this attack penetrated to a depth of only 5 mm. The starch test did not appear to be a good indicator of whether lyctine attack would occur, as specimens with low to high starch contents were included in those attacked, while many specimens with high or medium starch contents were not attacked. No clear seasonal trend in susceptibility was found, although the S2 attack occurred in a November collection (Figure 21). Also, with so few specimens having attack, no clear evidence of variation according to location was found. However, it should be noted that no specimen from Queensland (Ringtail State Forest) was attacked, and that seven of the 10 specimens with attack were from Olney. Of the remaining NSW attacked specimens, two came from southern NSW, and one from northern NSW. The results confirm that *Eu. pilularis* should be considered to have sapwood that is non-susceptible to lyctine borers.

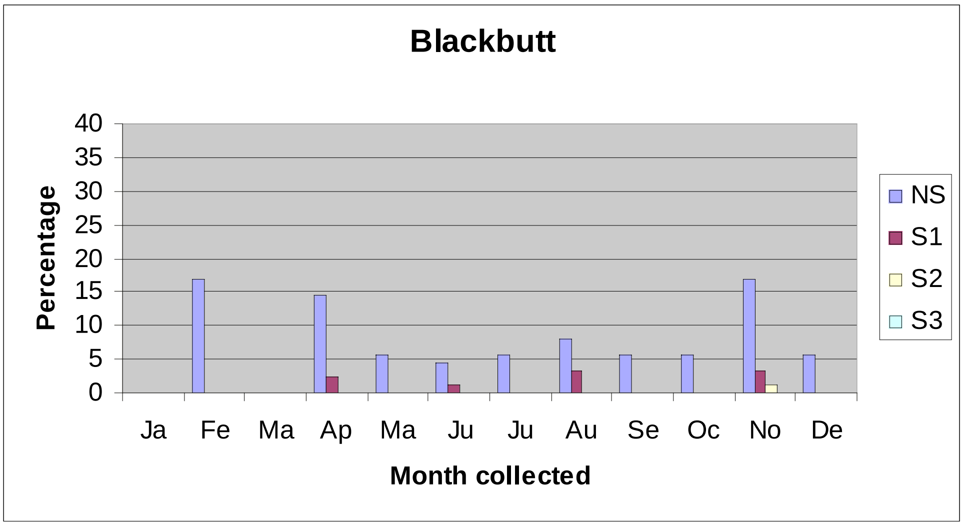

Figure 21: *Eu. pilularis* (blackbutt) lyctine susceptibility results based on month collected.

Eucalyptus regnans = Mountain ash

Eu. regnans grows naturally in the mountainous regions of Tasmania and eastern Victoria (Bootle, 2005). It is considered to be immune to lyctine beetles by CSIRO (1950), Fairey (1975) and AS 5604. While there was no reason to consider that this rating for *Eu. regnans* grown on the mainland should change, a re-evaluation of Tasmanian grown *Eu. regnans* was included in the current trial.

The material for this study came from four locations in Tasmania, near Dunrobin, Tyenna, and Hartz and Edwards spurs near Geeveston (Figure 22). A total of 24 specimens were tested. Starch content was quite variable in the test specimens. Starch was not detectable in two of the specimens, while eight had low starch content, 12 had medium starch content, and two had high starch content.

Figure 22: Collection sites for *Eu. regnans* (mountain ash) and *Eu. regnans/obliqua* hybrid from Tasmania.

The lyctine bioassays demonstrated that the majority of *Eu. regnans* from Tasmania was non-susceptible. Twenty of the 24 test specimens had no attack, while three specimens collected in February had S1 attack (Figure 23). However, one test specimen collected from Hartz Spur in February had S3 attack to a depth of 17 mm into the sapwood. This specimen was amongst several with medium starch content. The S1 and S3 attack occurred only in the material collected in February near Geeveston, with the only other collection being in July from Dunrobin and Tyenna. It is therefore unclear whether this apparent difference in lyctine susceptibility is due to location or month of collection. The *Eu. regnans* from Tasmania had only one specimen (4.2% of those collected) with serious lyctine attack, which is sufficient to consider this source of timber lyctine susceptible. Given the great difficulty in distinguishing *Eu. regnans* from

Eu. regnans/obliqua hybrid in the field in Tasmania, and that the hybrid is susceptible, such a listing for *Eu. regnans* from Tasmania may be prudent as well. Greater study of the differences in appearance in the field between *Eu. regnans* and hybrid, and in corresponding lyctine susceptibility, seems warranted. In practice however, it may be necessary to treat all Tasmanian Oak when it contains sapwood, or separate susceptible and non-susceptible *Eu. regnans* and hybrid on the basis of the starch test. All test specimens from either group that had serious lyctine attack also had medium to high starch content, while those with low or non-detectable starch proved to be immune.

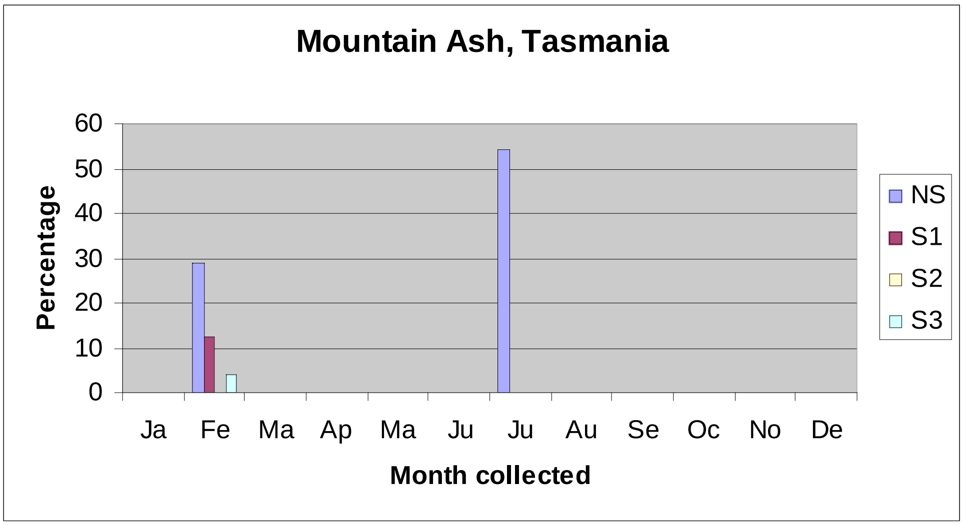

Figure 23: *Eu. regnans* (mountain ash) from Tasmania, with lyctine susceptibility results based on month collected.

Eucalyptus regnans/obliqua hybrid

Eu. regnans grows naturally in the mountainous regions of Tasmania and eastern Victoria (Bootle, 2005), while *Eu. obliqua* (messmate) also grows in Tasmania, Victoria and the tableland districts of NSW and southern Queensland (Bootle, 2005). *Eu. obliqua* is known to be a lyctine susceptible species (AS 5604). The hybrid came from Tasmania, where the appearance of the tree closely resembles *Eu. regnans* (P. Bennett pers. comm.), while anatomically the timber looks more like *Eu. obliqua* (J. Ilic pers. comm..). Boland *et al.* (1984) noted that 'in southern Victoria and parts of Tasmania gum-topped forms intermediate between *Eu. regnans* and *Eu. obliqua* are not uncommon.'

The material for this study came from Glen Huon and Geeveston in Tasmania (Figure 22). A total of 28 specimens were tested. Starch content was not detectable in 4 of the specimens, while five specimens had low starch content, six had medium starch content, and 13 had high starch content. Season of tree collection had a clear effect on starch content, with trees in December having low or non-detectable starch, while those collected in March and June had medium to high starch contents.

The starch test gave a good indication of whether the test specimens would be lyctine susceptible. All ten test specimens collected in December, with low or non-detectable starch, proved to be immune to lyctine attack (Figure 24). In comparison, for the 18 test specimens with medium to high starch contents collected in March and June, 13 had S2 or S3 attack, and to depths greater than 6 mm. There was no difference in performance between the two tree collection sites. Figure 24 shows the clear effect of season on lyctine susceptibility for the *Eu. regnans/obliqua* hybrid. Based on these results, 46.4% of test specimens had serious lyctine attack, and the *Eu. regnans/obliqua* hybrid should be considered lyctine susceptible. This result could present some challenges in the forest, where by appearance it is difficult to distinguish *Eu. regnans* from hybrid. The method used to collect *Eu. regnans* rather than hybrid for the current study, was to collect the material from higher altitudes where *Eu. obliqua* did not occur, in areas regenerated after wildfire without supplementation by aerial sowing (P. Bennett pers. comm.). The starch test alone did not sufficiently distinguish the timbers, as *Eu. regnans* at times gave medium to high starch content, even though it proved most often to be non-susceptible. A conservative approach would be to starch test logs and treat all those giving medium to high starch content, even though some logs may be *Eu. regnans* and not susceptible.

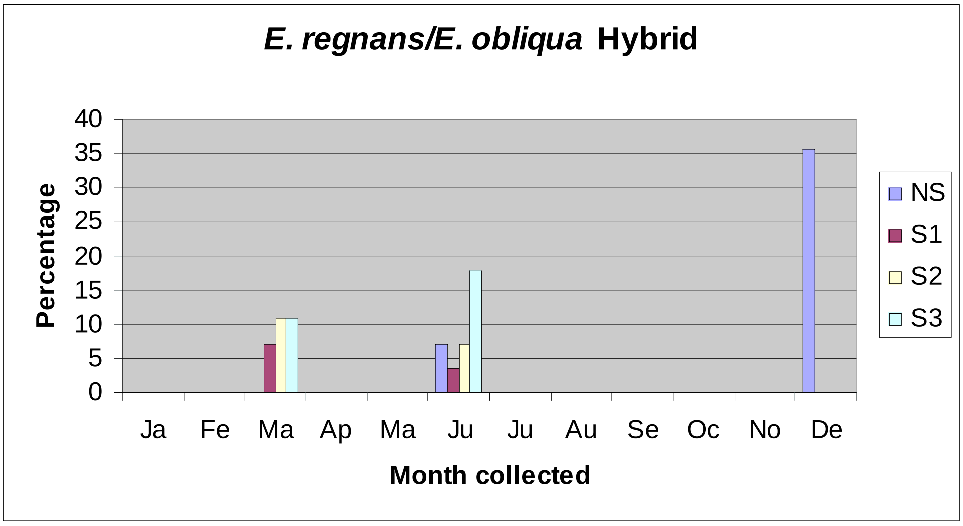

Figure 24: *Eu. regnans/obliqua* hybrid (mountain ash/messmate) from Tasmania, with lyctine susceptibility results based on month collected.

Eucalyptus saligna = Sydney blue gum

Eu. saligna grows naturally along the east coast from Batemans Bay in NSW to around Maryborough in southern Queensland (Boland *et al*. 1984). *Eu. saligna* is currently listed in AS 5604 as lyctine susceptible. This result was confirmed in specimens from two trees from the Kangaroo River State Forest north west of Coffs Harbour near Glenreach in NSW. Both test specimens had low starch contents, but nevertheless, were rated S2 for attack by lyctines. This attack occurred to a depth of 10 mm. Therefore, the lyctine susceptibility of *Eu. saligna* was confirmed by these limited examples.

Eucalyptus sieberi = Silvertop ash

Eu. sieberi grows naturally on the southern and central coast and tablelands of NSW, eastern Victoria and north-eastern Tasmania (Bootle, 2005). It has been listed in AS 5604 as not susceptible to lyctine attack. CSIRO (1950) also listed *Eu. sieberi* (as *Eu. sieberiana*) as immune to lyctines, while according to Fairey (1975) it is rarely susceptible.

The material for this study came from three locations in East Gippsland, Victoria. The locations were Stoney Peak, Tonghi and Purgagoolah (Figure 25). A total of 91 specimens were tested. Starch content was not detectable for 15 of the specimens, while 43 specimens had low starch content, 24 had medium starch content, and nine had high starch content.

Figure 25: Collection sites for *Eu. sieberi* (silvertop ash) from Gippsland Victoria.

In the bioassays, only seven of the 91 specimens had lyctine attack, and in four of these the rating was S1 (Figure 26) and the depth of attack was less than 6 mm. Three specimens had the more serious S2 level of attack; however, these attacks penetrated to only 2, 3 and 6 mm depths. The starch test did not appear to be a good indicator of whether lyctine attack would occur, as specimens with low to high starch contents were included within those that were attacked, while many specimens with medium or high starch content were not attacked. No clear seasonal trend in susceptibility was found (Figure 26). Also, with so few specimens having attack, no clear evidence of variation according to location within East Gippsland was found. The results confirm that *Eu. sieberi* should be considered to have sapwood that is non-susceptible to lyctine borers.

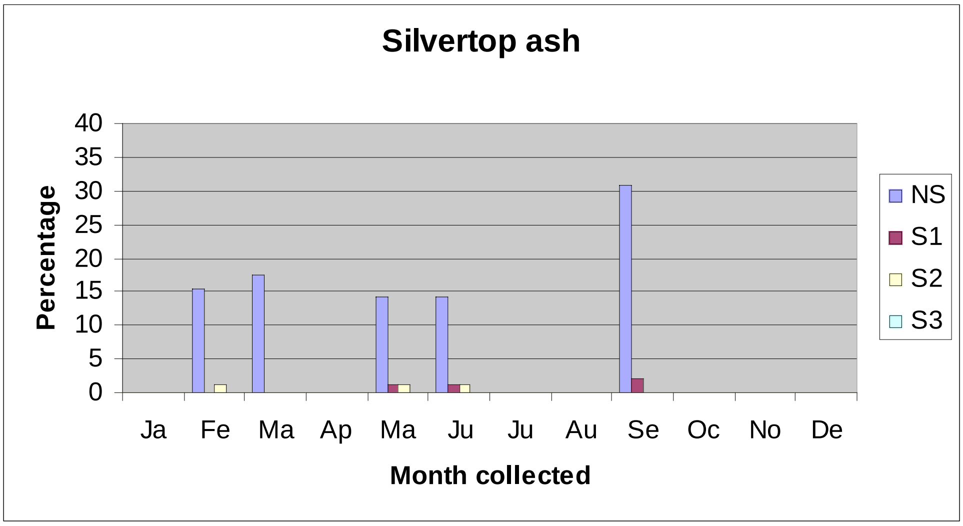

Figure 26: ***Eu. sieberi*** **(silvertop ash) lyctine susceptibility results based on month collected.**

Eucalyptus tetradonta = Darwin stringybark

Eu. tetradonta grows naturally in the northern and northern coastal regions of the Northern Territory, the Kimberley region of Western Australia, and Cape York Peninsula (Bootle, 2005). Most of this distribution is north of 17°S latitude (Boland *et al*., 1984). It is being considered as a plantation species for Cape York. While AS 5604 lists *Eu tetradonta* as lyctine susceptible, it should be noted that this rating arose from an earlier interpretation of the current results, where it was assumed that even limited S1 attack could be used to classify a timber as susceptible.

The material for this study came from several locations in Cape York, which were Weipa, Kendall/Holroyd region and Violet Vale/Morehead region (Figure 1). Other collections were from Injinoo (Bamaga) and Pormpuraaw. A total of 135 specimens were tested, and *Eu. tetradonta* was therefore the species most extensively studied in this project. Starch content was generally low (85 specimens) or not detectable (46 specimens), with only four specimens having medium starch content.

In the bioassays, only four of the 135 specimens (3.0% of specimens) had lyctine attack, and each of these was given an S1 rating. No clear seasonal trend in susceptibility was found, as two specimens collected during the dry season (June 2003 and May 2005 collection) and two from the wet season (October 2004 and December 2003) had attack (Figure 27). Also, with so few specimens having attack, no clear evidence of variation according to location was found, as two attacked specimens came from Violet Vale/Morehead and two were from Kendall/Holroyd. Further, the S1 attack in the specimens reached maximum depths of 2 and 3 mm in three specimens, and was therefore within the outer 6 mm of sapwood likely to be removed during sawmilling. The fourth specimen had S1 attack to a depth of 10 mm. *Eu. tetradonta* should be considered to have sapwood that is non-susceptible to lyctine borers.

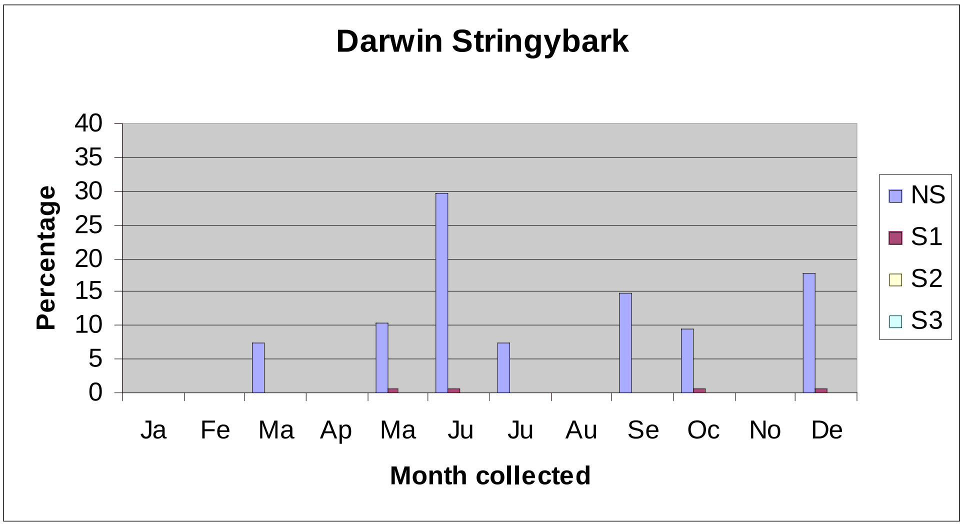

Figure 27: *Eu. tetradonta* (Darwin stringybark) lyctine susceptibility results based on month collected.

Accuracy of starch testing

A total of 777 test specimens were put through the bioassays against lyctine beetles (Table 1). Of these, 129 had S2 or S3 attack to any depth (irrespective of the 6 mm threshold). All test specimens were tested for starch prior to bioassay. Two groups of starch test results are examined here, those with more than low starch content (i.e. medium or high, Table 1), or those with any detectable starch (i.e. excluding non-detectable starch but including low and higher starch ratings, Table 2).

Of the 129 test specimens with S2 or S3 attack, 115 or 89% had been given starch test ratings of medium or high prior to bioassay (Table 1). Further, 126 test specimens with S2 or S3 attack had been shown by the starch test to have detectable starch (low or higher) (Table 2). Therefore, only three test specimens that were S2 or S3 attacked had non-detectable starch prior to bioassay. These may be examples that demonstrate that starch distribution within sapwood can be patchy for some species, so that a spot test on one cut surface may not always represent starch that may be present deeper within a test specimen. Also, some other nutrients such as protein, can contribute to the lyctine diet. Bioassay remains the most accurate method for determining susceptibility, and was applied to all test specimens in this project, irrespective of their starch test result. The group of ratings encompassing ‘detectable starch’ had correctly identified 98% of the S2 and S3 attacked test specimens.

There were 272 test specimens that gave a medium or high starch reaction, and 115 (42%) of these proved to have S2 or S3 lyctine susceptibility (Table 1). Therefore, if a quality control program was to operate where all medium to high starch containing logs were treated against lyctine borers, then around 58% of the logs would be treated unnecessarily. Conversely, there were 572 test specimens that had detectable starch (Table 2), and 126 (22%) of these proved to have S2 or S3 lyctine susceptibility. Therefore, if a quality control program was to operate where all logs with detectable starch were treated against lyctine borers, then around 78% of the logs would probably be treated unnecessarily.

An examination of Tables 1 and 2 will also give the level of accuracy from the starch test, and the level of ‘wastage’, for each test timber separately. Obviously, greater accuracy can be placed in those timber species with the higher numbers of test specimens examined.

Hardwoods with pore diameters less than 90 μm are considered to be immune to *L. brunneus* (Cummins and Wilson, 1934). The influence of pore size diameter on the starch testing results was not examined here, but may have minor influence. Bamber and Erskine (1965) examined pore diameter in a range of hardwoods, including six of the species examined here. The mean and range (calculated from four or more of their measurements for each species) was 97 μm (50-160 μm) for *E. crebra*, 143 μm (50-230 μm) for *E. delegatensis*, 123 μm (50-200 μm) for *E. grandis*, 142 μm (40-230 μm) for *E. pilularis*, 154 μm (50-230 μm) for *E. regnans* and 129 μm (50-250 μm) for *E. saligna*.

Table 1: Accuracy of starch tests for predicting S2 and S3 lyctine susceptibility, based upon starch contents that were medium or high.

Test timber	No. of test specimens	No. had ≥med starch	No. with S2/S3 any depth	No. of S2/S3 had ≥med starch	% of S2/S3 had ≥med starch	% ≥med starch with S2/S3 any depth
C. nesophila	67	23	20	15	75%	65%
Er.chlorystacys	46	44	42	41	98%	93%
Eu. argophloia	39	13	3	3	100%	23%
Eu. cloeziana	25	1	0	NA	NA	NA
Eu. crebra	40	20	8	8	100%	40%
Eu. delegatensis Vic+NSW	55	11	2	1	50%	9%
Eu. delegatensis Tasmania	40	27	21	19	90%	70%
Eu. dunnii	21	8	1	0	0%	0%
Eu. fibrosa	18	11	5	5	100%	45%
Eu. grandis	52	18	7	6	86%	33%
Eu. grandis/saligna	5	0	0	NA	NA	NA
Eu. saligna	2	0	2	0	0%	NA
Eu. pilularis	89	25	1	1	100%	4%
Eu. regnans Tasmania	24	14	1	1	100%	7%
Eu. regnans/obliqua	28	20	13	13	100%	65%
Eu. sieberi	91	33	3	2	67%	6%
Eu. tetradonta	135	4	0	NA	NA	NA
Total	777	272	129	115	89%	42%

Table 2: Accuracy of starch tests for predicting S2 and S3 lyctine susceptibility, based upon detectable starch (low or higher).

Test timber	No. specimens	No. had detected starch	No. with S2/S3 any depth	No. of S2/S3 had detected starch	% of S2/S3 had detected starch	% detected starch with S2/S3 any depth
C. nesophila	67	47	20	20	100%	43%
Er.chlorystacys	46	46	42	42	100%	91%
Eu. argophloia	39	21	3	3	100%	14%
Eu. cloeziana	25	3	0	NA	NA	NA
Eu. crebra	40	34	8	34	100%	24%
Eu. delegatensis Vic+NSW	55	31	2	1	50%	3%
Eu. delegatensis Tasmania	40	38	21	21	100%	55%
Eu. dunnii	21	16	1	1	100%	6%
Eu. fibrosa	18	17	5	5	100%	29%
Eu. grandis	52	39	7	7	100%	18%
Eu. grandis/saligna	5	2	0	NA	NA	NA
Eu. saligna	2	2	2	2	100%	100%
Eu. pilularis	89	65	1	1	100%	2%
Eu. regnans Tasmania	24	22	1	1	100%	5%
Eu. regnans/obliqua	28	24	13	13	100%	54%
Eu. sieberi	91	76	3	3	100%	4%
Eu. tetradonta	135	89	0	NA	NA	NA
Total	777	579	129	126	98%	22%

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MATERIALS AND METHODS

Timber sources

The timber samples examined were:

Corymbia nesophila (Melville Island bloodwood) from Cape York
Erythrophleum chlorostachys (Cooktown ironwood) from Cape York
Eucalyptus argophloia (western white gum) from Queensland
Eu. cloeziana (Gympie messmate) from Queensland
Eu. crebra (narrow-leaved red ironbark) from NSW
Eu. delegatensis (alpine ash) from Tasmania, Victoria and one collection from NSW
Eu. dunnii (Dunn's white gum) from NSW and Queensland
Eu. fibrosa (broad-leaved red ironbark) from NSW
Eu. grandis (rose gum) from NSW
Eu. pilularis (blackbutt) from NSW
Eu. regnans (mountain ash) from Tasmania
Eu. regnans/obliqua hybrid from Tasmania
Eu. saligna (Sydney blue gum) from NSW
Eu. sieberi (silvertop ash) from Victoria
Eu. tetradonta (Darwin stringybark) from Cape York

Efforts to obtain authentic *Eu. grandis/saligna* hybrid were largely unsuccessful.

The initial plan was for forestry collaborators to supply sapwood containing samples at three monthly intervals for up to two years unless there was early demonstration of lyctine susceptibility. At each sampling, five trees were to be sampled from three to four regions throughout the natural distribution of regrowth or plantation for each timber species. The actual timing of timber collections and the numbers of test specimens provided for each species can be found in the Appendix. Ideally, the trees were to be sampled in the age group of 25-50 years. However, if suitable sources of trees were limited, then other age groups were used as indicated in the Appendix. A total of 777 test specimens were examined, representing 772 different trees. Five trees of *Eu. argophloia* had two test specimens cut from each, at 1.3 or 2.0 m heights.

Sapwood samples, with heartwood attached, were cut at breast height from trees, as a disc from felled trees (within 48 hours of felling). Bark was removed immediately in the field from the sapwood piece, and the sapwood sample forwarded to Ensis for air drying. Timber was stored indoors but without covering, to avoid mould growth.

At Ensis, timber samples were placed on racks and left to air dry. Prior to bioassay, sapwood was spot tested for starch using an iodine indicator as described in Australian Standard 1604.1. They were then cut to obtain heartwood-sapwood test specimens that contained the full sapwood depth, with dimensions greater than 100 mm long x 25 mm wide x full sapwood depth. Test specimens were cut using a tungsten-tipped saw blade, to prevent burring and the blocking of vessels (which would inhibit lyctine oviposition). All test specimens, regardless of starch test result, were subjected to lyctine bioassay.

With each round of bioassay, jars containing untreated black bean (*Castanospermum australe*) sapwood samples were also prepared, as a check on lyctine borer activity and bioassay success.

Lyctine bioassays

Test specimens were heated at 60^oC overnight, to kill any mites that might be present on the received timber samples. They were then equilibrated in a conditioned insectary at 26^oC and 70% relative humidity for seven days prior to inoculation with test insects. Each test specimen was exposed to not less than 20 unsexed adult beetles of each species of lyctine (*Lyctus brunneus, L. discedens* and *Minthea rugicollis*). Inoculation with the lyctine species occurred consecutively, with each lyctine species inoculation separated by two weeks or more. For each lyctine species, three weeks after the first inoculation, a second inoculation of 20 unsexed adult beetles was made. Therefore, test specimens were inoculated on six different occasions. The test durations were for a minimum of three months from the time of the latest inoculation.

The test specimens were assessed by splitting longitudinally and examining for evidence of larval channelling using the following subjective rating system (Creffield *et al*., 1995).
NS – non-susceptible – no channelling
S1 – slightly susceptible – small amount of larval channelling, sometimes only 10 mm in length along the vessel. Emergence holes absent.
S2 – moderately susceptible – moderate amount of larval channelling
S3 – highly susceptible – high amount of larval channelling. Broad frass-packed larval galleries.

APPENDIX. Lyctine susceptibility results and details for each test specimen.

Starch test results were ND (not detected), Low, Med (Medium) or High.
Ratings for lyctine attack were NS (not susceptible), S1 (slightly susceptible), S2 (moderately susceptible) or S3 (highly susceptible).

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Corymbia nesophila* = Melville Island bloodwood**					
MW111	Weipa	26/6/03	Low	NS	
MW112	Weipa	26/6/03	Low	NS	
MW121	Weipa	26/6/03	ND	S1	2
MW122	Weipa	26/6/03	ND	S1	2
MW131	Weipa	27/6/03	Low	NS	
MW132	Weipa	27/6/03	Low	NS	
MW141	Weipa	27/6/03	Med	S2	>5 mm
MW142	Weipa	27/6/03	Med	S2	>10 mm
MW151	Weipa	27/6/03	High	S3	>12 mm
MW152	Weipa	27/6/03	High	S3	>7 mm
MK111	Kendall / Holroyd	30/6/03	ND	NS	
MK112	Kendall / Holroyd	30/6/03	Low	NS	
MK121	Kendall / Holroyd	30/6/03	ND	S1	5 mm
MK122	Kendall / Holroyd	30/6/03	Med	NS	
MK131	Kendall / Holroyd	30/6/03	Med	S1	6 mm
MK132	Kendall / Holroyd	30/6/03	Med	S2	>12 mm
MK141	Kendall / Holroyd	30/6/03	Med	NS	
MK142	Kendall / Holroyd	30/6/03	Med	NS	
MK151	Kendall / Holroyd	30/6/03	Low	NS	
MK152	Kendall / Holroyd	30/6/03	Med	S2	>7 mm
MV111	Violet Vale / Morehead	1/7/03	Med	S1	4
MV112	Violet Vale / Morehead	1/7/03	Med	S1	5
MV121	Violet Vale / Morehead	1/7/03	Low	NS	
MV122	Violet Vale / Morehead	1/7/03	Low	NS	
MV13	Violet Vale / Morehead	17/7/03	Low	NS	
MV14	Violet Vale / Morehead	17/7/03	Med	S3	5
MV15	Violet Vale / Morehead	17/7/03	Low	S2	>12
MW21	Weipa	11/9/03	ND	NS	
MW22	Weipa	11/9/03	ND	S1	16
MW23	Weipa	11/9/03	Low	S2	>6
MW24	Weipa	11/9/03	ND	NS	
MW25	Weipa	11/9/03	ND	NS	
MK21	Kendall / Holroyd	22/9/03	Low	S1	6
MK22	Kendall / Holroyd	22/9/03	ND	NS	
MK23	Kendall / Holroyd	22/9/03	ND	S1	6
MK24	Kendall / Holroyd	22/9/03	ND	NS	
MK25	Kendall / Holroyd	22/9/03	Low	S2	11

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Corymbia nesophila* = Melville Island bloodwood (continued)**					
MV21	Violet Vale / Morehead	22/9/03	Low	S2	10
MV22	Violet Vale / Morehead	22/9/03	ND	NS	
MV23	Violet Vale / Morehead	22/9/03	Low	S1	7
MV24	Violet Vale / Morehead	22/9/03	Low	NS	
MV25	Violet Vale / Morehead	22/9/03	ND	NS	
MJ11	Injinoo (Bamaga)	22/9/03	Low	NS	
MJ12	Injinoo (Bamaga)	22/9/03	ND	NS	
MJ13	Injinoo (Bamaga)	22/9/03	Low	NS	
MJ14	Injinoo (Bamaga)	22/9/03	Low	S2	10
MJ15	Injinoo (Bamaga)	22/9/03	ND	S1	12
MW31	Weipa	6/12/03	Med	S3	>8mm
MW32	Weipa	6/12/03	High	S3	>6mm
MW33	Weipa	6/12/03	High	S3	>8mm
MW34	Weipa	6/12/03	Low	NS	
MW35	Weipa	6/12/03	High	S3	>7mm
MV31	Violet Vale / Morehead	10/12/03	High	S3	>6mm
MV32	Violet Vale / Morehead	10/12/03	Med	S2	>7mm
MV33	Violet Vale / Morehead	10/12/03	Med	S1	7 mm
MV34	Violet Vale / Morehead	10/12/03	Low	S1	7 mm
MV35	Violet Vale / Morehead	10/12/03	Low	S1	9 mm
MW41	Weipa	4/3/04	Low	S1	4
MW42	Weipa	4/3/04	ND	NS	
MW43	Weipa	4/3/04	ND	NS	
MW44	Weipa	4/3/04	ND	NS	
MW45	Weipa	4/3/04	ND	NS	
MV41	Violet Vale / Morehead	24/3/04	Med	S2	4
MV42	Violet Vale / Morehead	24/3/04	High	S2	6
MV43	Violet Vale / Morehead	24/3/04	Med	S1	10
MV44	Violet Vale / Morehead	24/3/04	Low	NS	
MV45	Violet Vale / Morehead	24/3/04	ND	NS	
***Erythrophleum chlorostachys* = Cooktown ironwood**					
CW111	Weipa	26/6/03	High	S3	>10 mm
CW112	Weipa	26/6/03	High	S3	>11 mm
CW121	Weipa	26/6/03	High	S3	>7 mm
CW122	Weipa	26/6/03	High	S3	>10 mm
CW131	Weipa	27/6/03	Low	S1	>4 mm
CW132	Weipa	27/6/03	Med	S1	>5 mm
CW141	Weipa	27/6/03	Med	S3	>10 mm
CW142	Weipa	27/6/03	Med	S3	>9 mm
CW151	Weipa	27/6/03	High	S1	>4 mm
CW152	Weipa	27/6/03	High	S2	>8 mm

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
Erythrphleum chlorystacys **= Cooktown ironwood (continued)**					
CK111	Kendall / Holroyd	30/6/03	High	S2	>12
CK112	Kendall / Holroyd	30/6/03	High	S1	>10
CK121	Kendall / Holroyd	30/6/03	High	S3	>11
CK122	Kendall / Holroyd	30/6/03	High	S3	>20
CK131	Kendall / Holroyd	30/6/03	High	S3	>20
CK132	Kendall / Holroyd	30/6/03	High	S3	>16
CK141	Kendall / Holroyd	30/6/03	High	S3	>18
CK142	Kendall / Holroyd	30/6/03	High	S3	>26
CK151	Kendall / Holroyd	30/6/03	Med	S2	>11
CK152	Kendall / Holroyd	30/6/03	Med	S3	>15
CV111	Violet Vale / Morehead	1/7/03	High	S3	>20
CV112	Violet Vale / Morehead	1/7/03	High	S3	>15
CV12	Violet Vale / Morehead	17/7/03	Med	S2	>11
CV13	Violet Vale / Morehead	17/7/03	Med	S3	>20
CV14	Violet Vale / Morehead	17/7/03	Med	S2	>15
CV15	Violet Vale / Morehead	17/7/03	Low	S2	>8
CW21	Weipa	11/9/03	High	S3	16
CW22	Weipa	11/9/03	High	S3	18
CW23	Weipa	11/9/03	High	S2	25
CW24	Weipa	11/9/03	High	S3	12
CW25	Weipa	11/9/03	High	S3	20
CK21	Kendall / Holroyd	22/9/03	High	S3	25
CK22	Kendall / Holroyd	22/9/03	High	S3	16
CK23	Kendall / Holroyd	22/9/03	High	S3	20
CK24	Kendall / Holroyd	22/9/03	Med	S3	30
CK25	Kendall / Holroyd	22/9/03	Med	S3	20
CV21	Violet Vale / Morehead	22/9/03	Med	S2	25
CV22	Violet Vale / Morehead	22/9/03	Med	S2	20
CV23	Violet Vale / Morehead	22/9/03	Med	S3	16
CV24	Violet Vale / Morehead	22/9/03	High	S3	16
CV25	Violet Vale / Morehead	22/9/03	Med	S3	17
CJ11	Injinoo (Bamaga)	22/9/03	High	S3	14
CJ12	Injinoo (Bamaga)	22/9/03	High	S3	18
CJ13	Injinoo (Bamaga)	22/9/03	High	S3	10
CJ14	Injinoo (Bamaga)	22/9/03	High	S2	14
CJ15	Injinoo (Bamaga)	22/9/03	High	S3	22

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus argophloia* = western white gum**					
CB21	Biloela, Qld	1/6/03	ND	NS	
CB22	Biloela	1/6/03	ND	NS	
CB23	Biloela	1/6/03	ND	NS	
CB24	Biloela	1/6/03	ND	NS	
CB25	Biloela	1/6/03	ND	NS	
CB26	Biloela	1/6/03	ND	NS	
CB27	Biloela	1/6/03	ND	NS	
CB28	Biloela	1/6/03	ND	NS	
CB29	Biloela	1/6/03	ND	NS	
CB210	Biloela	1/6/03	ND	NS	
CB41	Biloela	18/12/03	ND	NS	
CB42	Biloela	18/12/03	ND	NS	
CB43	Biloela	18/12/03	ND	NS	
CB44	Biloela	18/12/03	ND	NS	
CB81	Biloela	8/12/04	Low	NS	
CB82	Biloela	8/12/04	Low	NS	
CB83	Biloela	8/12/04	ND	NS	
CB84	Biloela	8/12/04	Low	NS	
CB85	Biloela	8/12/04	ND	NS	
CB86	Biloela	8/12/04	Low	NS	
ARGO1	Narayen, 12 y old	12/5/05	Med	NS	
ARGO2	Narayen, 12 y old	12/5/05	Low	NS	
ARGO3	Narayen, 12 y old	12/5/05	Low	NS	
ARGO4	Narayen, 12 y old	12/5/05	Med	S1	6 to 12
ARGO5	Narayen, 12 y old	12/5/05	ND	NS	
ARGO6	Narayen, 12 y old	12/5/05	Low	NS	
ARGO7	Narayen, 12 y old	12/5/05	ND	NS	
ARGO8	Narayen, 12 y old	12/5/05	Low	NS	
ARGO9	Narayen, 12 y old	12/5/05	High	NS	
T1(1.3m)	Dunmore, 8y old (diff heights)	12/5/05	High	NS	
T1(2.0m)	Dunmore	12/5/05	Med	NS	
T2(1.3m)	Dunmore	12/5/05	Med	NS	
T2(2.0m)	Dunmore	12/5/05	High	NS	
T3(1.3m)	Dunmore	12/5/05	High	NS	
T3(2.0m)	Dunmore	12/5/05	High	S2	11 to 18
T4(1.3m)	Dunmore	12/5/05	High	S2	4 to 16
T4(2.0m)	Dunmore	12/5/05	High	S1	3 to 19
T5(1.3m)	Dunmore	12/5/05	High	S1	5 to 25
T5(2.0m)	Dunmore	12/5/05	High	S3	15

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus cloeziana* = Gympie messmate**					
GR31	Ringtail SF, Qld	15/9/03	ND	NS	
GR32	Ringtail SF	15/9/03	ND	NS	
GR33	Ringtail SF	15/9/03	Low	NS	
GR34	Ringtail SF	15/9/03	ND	NS	
GR35	Ringtail SF	15/9/03	ND	NS	
GR41	Ringtail SF	19/12/03	ND	NS	
GR42	Ringtail SF	19/12/03	ND	NS	
GR43	Ringtail SF	19/12/03	ND	NS	
GR44	Ringtail SF	19/12/03	ND	NS	
GR45	Ringtail SF	19/12/03	ND	NS	
GR61	Ringtail SF	21/4/04	ND	NS	
GR62	Ringtail SF	21/4/04	ND	NS	
GR63	Ringtail SF	21/4/04	ND	NS	
GR64	Ringtail SF	21/4/04	ND	NS	
GR65	Ringtail SF	21/4/04	ND	NS	
GMS91	Ringtail SF	2/2/05	ND	NS	
GMS92	Ringtail SF	2/2/05	ND	NS	
GMS93	Ringtail SF	2/2/05	ND	NS	
GMS94	Ringtail SF	2/2/05	ND	NS	
GMS95	Ringtail SF	2/2/05	ND	NS	
GMS1	Pomona, 9y old trees	12/5/05	ND	NS	
GMS2	Pomona	12/5/05	Low	NS	
GMS3	Pomona	12/5/05	ND	NS	
GMS4	Pomona	12/5/05	ND	NS	
GMS5	Pomona	12/5/05	Med	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus crebra* = narrow-leaved red ironbark**					
RC11	Corrabare, near Newcastle NSW	4/4/03	ND	NS	
RC12	Corrabare	4/4/03	Med	NS	
RC13	Corrabare	4/4/03	Low	S1	3
RC14	Corrabare	4/4/03	Low	NS	
RC15	Corrabare	4/4/03	ND	NS	
RC21	Corrabare, NSW	1/5/03	Low	NS	
RC22	Corrabare	1/5/03	Low	S1	3
RC23	Corrabare	1/5/03	Low	NS	
RC24	Corrabare	1/5/03	Low	NS	
RC25	Corrabare	1/5/03	Low	NS	
RC31	Corrabare, NSW	21/8/03	Med	S1	5
RC32	Corrabare	21/8/03	ND	S1	4
RC33	Corrabare	21/8/03	ND	NS	
RC34	Corrabare	21/8/03	ND	NS	
RC35	Corrabare	21/8/03	Low	S1	3
RNG31	Girard SF, near Tenterfield, NSW	10/10/03	ND	NS	
RC41	Corrabare, NSW	19/11/03	High	S3	6
RC42	Corrabare	19/11/03	High	S3	7
RC43	Corrabare	19/11/03	High	S3	>10mm
RC44	Corrabare	19/11/03	Med	S3	3
RC45	Corrabare	19/11/03	High	S1	2
RC51	Corrabare	23/2/04	High	NS	
RC52	Corrabare	23/2/04	High	NS	
RC53	Corrabare	23/2/04	Low	NS	
RC54	Corrabare	23/2/04	Low	NS	
RC61	Corrabare	26/5/04	Med	S1	4
RC62	Corrabare	26/5/04	High	S1	8
RC63	Corrabare	26/5/04	Med	S1	3
RC64	Corrabare	26/5/04	Low	NS	
RC65	Corrabare	26/5/04	Low	NS	
RC71	Corrabare	31/8/04	Med	S1	>7mm
RC72	Corrabare	31/8/04	Med	S1	5
RC73	Corrabare	31/8/04	Med	S2	5
RC74	Corrabare	31/8/04	Med	S3	5
RC75	Corrabare	31/8/04	Med	S1	>5mm
RC81	Corrabare	23/11/04	Med	NS	
RC82	Corrabare	23/11/04	Med	S3	S3=5, S1=15
RC83	Corrabare	23/11/04	Low	S1	5
RC84	Corrabare	23/11/04	Low	S1	5
RC85	Corrabare	23/11/04	Med	S3	S3=5, S2=10, S1=20

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus delegatensis* = alpine ash from Victoria + NSW**					
AR11	Rawson, Vic	21/2/03	ND	NS	
AR12	Rawson	21/2/03	ND	NS	
AR13	Rawson	21/2/03	ND	NS	
AR14	Rawson	21/2/03	ND	NS	
AR15	Rawson	21/2/03	ND	NS	
AA11	Alexandra, Vic	20/2/03	ND	NS	
AA12	Alexandra	20/2/03	ND	NS	
AA13	Alexandra	20/2/03	ND	NS	
AA14	Alexandra	20/2/03	ND	NS	
AA15	Alexandra	20/2/03	ND	NS	
AM11	Mitta Mitta	5/03/2003	ND	NS	
AM12	Mitta Mitta	5/03/2003	ND	NS	
AM13	Mitta Mitta	5/03/2003	ND	NS	
AM14	Mitta Mitta	5/03/2003	ND	NS	
AM15	Mitta Mitta	5/03/2003	ND	NS	
AD11	Diggers Hole East	5/03/2003	ND	NS	
AD12	Diggers Hole East	5/03/2003	ND	NS	
AD13	Diggers Hole East	5/03/2003	ND	S2	3
AD14	Diggers Hole East	5/03/2003	ND	NS	
AD15	Diggers Hole East	5/03/2003	ND	NS	
AA21	Alexandra	17/6/03	ND	NS	
AA22	Alexandra	17/6/03	Low	NS	
AA23	Alexandra	17/6/03	Low	NS	
AA24	Alexandra	17/6/03	Low	S1	5
AA25	Alexandra	17/6/03	Low	NS	
AI21	Ingebirah SF, near Thredbo NSW	18/6/03	ND	NS	
AI22	Ingebirah SF	18/6/03	Low	NS	
AI23	Ingebirah SF	18/6/03	ND	NS	
AI24	Ingebirah SF	18/6/03	Low	NS	
AI25	Ingebirah SF	18/6/03	Low	NS	
AA31	Alexandra	16/9/03	Low	NS	
AA32	Alexandra	16/9/03	Med	S2	5
AA33	Alexandra	16/9/03	Low	S1	6
AA34	Alexandra	16/9/03	Low	NS	
AA35	Alexandra	16/9/03	High	S1	5
AA41	Alexandra	16/12/03	Med	NS	
AA42	Alexandra	16/12/03	Med	NS	
AA43	Alexandra	16/12/03	Low	NS	
AA44	Alexandra	16/12/03	Med	S1	3
AA45	Alexandra	16/12/03	Low	S1	3

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus delegatensis* = alpine ash from Victoria + NSW (continued)**					
AR51	Rawson, Vic	11/3/04	Med	NS	
AR52	Rawson	11/3/04	Med	NS	
AR53	Rawson	11/3/04	Med	NS	
AR54	Rawson	11/3/04	Med	NS	
AR55	Rawson	11/3/04	Low	NS	
AA51	Alexandra	5/3/04	Med	NS	
AA52	Alexandra	5/3/04	Low	NS	
AA53	Alexandra	5/3/04	Low	NS	
AA54	Alexandra	5/3/04	Low	NS	
AA55	Alexandra	5/3/04	Low	NS	
AA61	Alexandra	28/6/04	Low	S1	4
AA62	Alexandra	28/6/04	ND	NS	
AA63	Alexandra	28/6/04	Med	S1	4
AA64	Alexandra	28/6/04	Low	NS	
AA65	Alexandra	28/6/04	Low	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus delegatensis* = alpine ash from Tasmania**					
AW413	Waterloo, Tas	15/12/03	Med	S3	22
AW423	Waterloo	15/12/03	Low	NS	
AW433	Waterloo	15/12/03	High	S1	15
AW443	Waterloo	15/12/03	Low	NS	
AW453	Waterloo	15/12/03	Low	NS	
AW414	Waterloo	15/12/03	ND	NS	
AW424	Waterloo	15/12/03	Low	NS	
AW434	Waterloo	15/12/03	Med	NS	
AW444	Waterloo	15/12/03	Low	S2	14
AW454	Waterloo	15/12/03	High	NS	
AW513	Waterloo, Tas	10/3/04	Med	NS	
AW523	Waterloo	10/3/04	Low	NS	
AW533	Waterloo	10/3/04	High	S3	20
AW543	Waterloo	10/3/04	High	S3	23
AW514	Waterloo	10/3/04	Low	NS	
AW524	Waterloo	10/3/04	Med	NS	
AW534	Waterloo	10/3/04	High	S3	16
AW544	Waterloo	10/3/04	High	S1	5
AW613	Waterloo	7/6/04	Low	NS	
AW623	Waterloo	7/6/04	Low	NS	
AW633	Waterloo	7/6/04	High	S2	>8
AW643	Waterloo	7/6/04	Low	NS	
AW653	Waterloo	7/6/04	Med	S2	>7
AW614	Waterloo	7/6/04	ND	NS	
AW624	Waterloo	7/6/04	Low	S2	>8
AW634	Waterloo	7/6/04	High	S3	18
AW644	Waterloo	7/6/04	Med	S2	15
AW654	Waterloo	7/6/04	Med	S2	>6
HZ1	Hartz Rd, Geeveston, Tas	Jul 2005	High	S3	23
HZ2	Hartz Rd	Jul 2005	High	S3	15
HZ3	Hartz Rd	Jul 2005	High	S3	11
HZ4	Hartz Rd	Jul 2005	High	S3	17
HZ5	Hartz Rd	Jul 2005	High	S3	23
HZ6	Hartz Rd	Jul 2005	High	S3	27
BR1	Bennetts Rd, Geeveston, Tas	Jul 2005	High	S3	27
BR2	Bennetts Rd	Jul 2005	High	S3	20
BR3	Bennetts Rd	Jul 2005	High	S3	32
BR4	Bennetts Rd	Jul 2005	High	S3	S3=6 S2=19 S1=24
BR5	Bennetts Rd	Jul 2005	Med	NS	
BR6	Bennetts Rd	Jul 2005	High	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
Eucalyptus dunnii **= Dunn's white gum**					
D91	Boambee Coffs Harbour, 9y	Jan 2004	ND	NS	
D92	Boambee	Jan 2004	ND	NS	
D93	Boambee	Jan 2004	Low	NS	
D94	Boambee	Jan 2004	Low	S1	3 to 5
D95	Boambee	Jan 2004	ND	NS	
D1	Amamoor SF Qld, 3.5 y old	12/5/05	Med	NS	
D2	Amamoor SF	12/5/05	ND	NS	
D3	Amamoor SF	12/5/05	Low	S1	5 to 12
D4	Amamoor SF	12/5/05	Med	NS	
D5	Amamoor SF	12/5/05	Med	S1	2 to 8
D6	Amamoor SF	12/5/05	Low	S2	0 to 8=S1 8 to 12=S2
D7	Amamoor SF	12/5/05	Low	S1	8
D8	Amamoor SF	12/5/05	High	S1	13
D9	Amamoor SF	12/5/05	Med	NS	
D10	Amamoor SF	12/5/05	Low	NS	
D11	Amamoor SF	12/5/05	Low	NS	
D12	Amamoor SF	12/5/05	Med	S1	3
D13	Amamoor SF	12/5/05	ND	S1	5
D14	Amamoor SF	12/5/05	Med	NS	
D15	Amamoor SF	12/5/05	Med	S1	5 to 10
D16	Amamoor SF	12/5/05	Low	NS	
Eucalyptus fibrosa **= broad-leaved red ironbark**					
RM31	McDonald SF	23/7/03	Low	NS	
RM32	McDonald SF	23/7/03	Low	S1	5
RM33	McDonald SF	23/7/03	Low	NS	
RM34	McDonald SF	23/7/03	Low	S1	5
RM35	McDonald SF	23/7/03	Med	S2	20
RBG31	Girard SF	10/10/03	Low	NS	
RT41	Taree SF	4/11/03	High	NS	
RT42	Taree SF	4/11/03	ND	NS	
RT43	Taree SF	4/11/03	High	S1	4
RT44	Taree SF	4/11/03	High	S1	4
RT45	Taree SF	4/11/03	High	S2	5
RM41	Mogo SF	4/12/03	High	NS	
RM42	Mogo SF	4/12/03	Med	S1	5
RM43	Mogo SF	4/12/03	Low	NS	
RM44	Mogo SF	4/12/03	Med	S2	S2=6, S1=9
RM45	Mogo SF	4/12/03	Med	S2	7
RI81	Glenugie SF, NSW	3/12/04	Med	S1	3
RI82	Glenugie SF	3/12/04	Med	S2	3

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus grandis* = rose gum**					
RR31	Ringtail SF, Qld	15/9/03	Low	NS	
RR32	Ringtail SF	15/9/03	Low	S2	9
RR33	Ringtail SF	15/9/03	High	S3	7
RR34	Ringtail SF	15/9/03	ND	NS	
RR35	Ringtail SF	15/9/03	Med	S3	5
FT41	Tuckers Nob SF, 20-30y, NSW	10/11/03	Low	NS	
FT42	Tuckers Nob SF	10/11/03	Low	S1	5
FT43	Tuckers Nob SF	10/11/03	ND	NS	
FT44	Tuckers Nob SF	10/11/03	ND	NS	
FT45	Tuckers Nob SF	10/11/03	ND	NS	
RR41	Ringtail SF, Qld	19/12/03	Med	S3	10
RR42	Ringtail SF	19/12/03	ND	NS	
RR43	Ringtail SF	19/12/03	Low	NS	
RR44	Ringtail SF	19/12/03	ND	NS	
RR45	Ringtail SF	19/12/03	ND	NS	
FO51	Orara East SF, NSW	23/2/04	Med	S1	7
FO52	Orara East SF	23/2/04	Med	S1	5
FO53	Orara East SF	23/2/04	Low	NS	
FO54	Orara East SF	23/2/04	Low	NS	
FW51	Wedding Bells SF, NSW	24/2/04	Med	S1	5
FW52	Wedding Bells SF	24/2/04	Low	NS	
FW53	Wedding Bells SF	24/2/04	Low	NS	
FW54	Wedding Bells SF	24/2/04	Low	NS	
FW55	Wedding Bells SF	24/2/04	Med	NS	
RR61	Ringtail SF, Qld	21/4/04	Low	NS	
RR62	Ringtail SF	21/4/04	ND	NS	
RR63	Ringtail SF	21/4/04	Low	NS	
RR64	Ringtail SF	21/4/04	Low	NS	
RR65	Ringtail SF	21/4/04	Low	NS	
FN61	Newry SF, NSW, 20-30y	5/7/04	Low	NS	
FN62	Newry SF	5/7/04	Low	NS	
FN63	Newry SF	5/7/04	Med	NS	
FN64	Newry SF	5/7/04	Med	NS	
FN65	Newry SF	5/7/04	Low	NS	
FW71	Wild Cattle Ck SF, NSW, 20-30y	28/9/04	Med	S1	7
FW72	Wild Cattle Ck SF	28/9/04	Med	S1	7
FW73	Wild Cattle Ck SF	28/9/04	Med	S2	17
FW74	Wild Cattle Ck SF	28/9/04	Med	S1	13
FW75	Wild Cattle Ck SF	28/9/04	Med	S2	S2=5, S1=18

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus grandis* = rose gum (continued)**					
FN81	Newry SF, NSW, 20-30y	24/11/04	ND	S1	5
FN82	Newry SF	24/11/04	ND	NS	
FN83	Newry SF	24/11/04	Low	NS	
FN84	Newry SF	24/11/04	ND	NS	
FN85	Newry SF	24/11/04	ND	S1	5
RG81	Pine Creek SF, NSW	3/12/04	Med	S1	3
RG82	Pine Creek SF	3/12/04	Med	S1	3
RSG91	Ringtail SF, Qld	2/2/05	Low	NS	
RSG92	Ringtail SF	2/2/05	Low	NS	
RSG93	Ringtail SF	2/2/05	ND	NS	
RSG94	Ringtail SF	2/2/05	Low	NS	
RSG95	Ringtail SF	2/2/05	Med	S1	5
RSG96	Ringtail SF	2/2/05	High	S2	10
***Eu. grandis/saligna* hybrid**					
HT11	Tuckers Knob SF, NSW	17/3/03	Low	NS	
HT12	Tuckers Knob SF	17/3/03	Low	NS	
HT13	Tuckers Knob SF	17/3/03	ND	NS	
HT14	Tuckers Knob SF	17/3/03	ND	NS	
HT15	Tuckers Knob SF	17/3/03	ND	NS	
***Eucalyptus pilularis* = blackbutt**					
BO11	Olney, NSW	4/4/03	Med	NS	
BO12	Olney	4/4/03	Low	S1	
BO13	Olney	4/4/03	ND	NS	
BO14	Olney	4/4/03	Low	NS	
BO15	Olney	4/4/03	Low	NS	
BO21	Olney, NSW	29/4/03	Low	S1	8
BO22	Olney	29/4/03	Low	NS	
BO23	Olney	29/4/03	Low	NS	
BO24	Olney	29/4/03	Low	NS	
BO25	Olney	29/4/03	Low	NS	
BB31	Brooman SF, near Batemans B	22/7/03	Med	NS	
BB32	Brooman SF	22/7/03	Low	NS	
BB33	Brooman SF	22/7/03	Low	NS	
BB34	Brooman SF	22/7/03	ND	NS	
BT31	Tomerong SF	22/7/03	ND	NS	
BO31	Olney	21/8/03	High	S1	8
BO32	Olney	21/8/03	Low	NS	
BO33	Olney	21/8/03	High	NS	
BO34	Olney	21/8/03	Med	NS	
BO35	Olney	21/8/03	Med	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus pilularis* = blackbutt (continued)**					
BR31	Ringtail SF	15/9/03	Low	NS	
BR32	Ringtail SF	15/9/03	ND	NS	
BR33	Ringtail SF	15/9/03	ND	NS	
BR34	Ringtail SF	15/9/03	Low	NS	
BR35	Ringtail SF	15/9/03	Low	NS	
BOE41	Orara East SF	16/10/03	ND	NS	
BOE42	Orara East SF	16/10/03	ND	NS	
BOE43	Orara East SF	16/10/03	Med	NS	
BOE44	Orara East SF	16/10/03	ND	NS	
BOE45	Orara East SF	16/10/03	ND	NS	
BW41	Wauchope SF	4/11/03	Low	NS	
BW42	Wauchope SF	4/11/03	Low	NS	
BW43	Wauchope SF	4/11/03	Low	NS	
BW44	Wauchope SF	4/11/03	ND	NS	
BW45	Wauchope SF	4/11/03	Low	NS	
BO41	Olney	20/11/03	Low	NS	
BO42	Olney	20/11/03	ND	NS	
BO43	Olney	20/11/03	Low	NS	
BO44	Olney	20/11/03	Low	S1	5
BO45	Olney	20/11/03	Low	NS	
BY41	Yerriyong SF	20/11/03	Low	NS	
BY42	Yerriyong SF	20/11/03	Med	S2	5
BY43	Yerriyong SF	20/11/03	Low	NS	
BY44	Yerriyong SF	20/11/03	Low	NS	
BY45	Yerriyong SF	20/11/03	Med	S1	5
BR41	Ringtail SF	19/12/03	Med	NS	
BR42	Ringtail SF	19/12/03	Low	NS	
BR43	Ringtail SF	19/12/03	Low	NS	
BR44	Ringtail SF	19/12/03	Med	NS	
BR45	Ringtail SF	19/12/03	Low	NS	
BOE51	Orara East SF	4/2/04	ND	NS	
BOE52	Orara East SF	4/2/04	ND	NS	
BOE53	Orara East SF	4/2/04	ND	NS	
BOE54	Orara East SF	4/2/04	ND	NS	
BO51	Olney	24/2/04	Low	NS	
BO52	Olney	24/2/04	Low	NS	
BO53	Olney	24/2/04	Med	NS	
BO54	Olney	24/2/04	High	NS	
BO55	Olney	24/2/04	Low	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus pilularis* = blackbutt (continued)**					
BR61	Ringtail SF	21/4/04	ND	NS	
BR62	Ringtail SF	21/4/04	ND	NS	
BR63	Ringtail SF	21/4/04	ND	NS	
BR64	Ringtail SF	21/4/04	ND	NS	
BR65	Ringtail SF	21/4/04	ND	NS	
BO61	Olney	27/5/04	ND	NS	
BO62	Olney	27/5/04	Med	NS	
BO63	Olney	27/5/04	Med	NS	
BO64	Olney	27/5/04	Low	NS	
BO65	Olney	27/5/04	Med	NS	
BW61	Wedding Bells SF	28/6/04	ND	NS	
BW62	Wedding Bells SF	28/6/04	Low	NS	
BW63	Wedding Bells SF	28/6/04	ND	NS	
BW64	Wedding Bells SF	28/6/04	Low	S1	4
BW65	Wedding Bells SF	28/6/04	ND	NS	
BO71	Olney	31/8/04	Med	NS	
BO72	Olney	31/8/04	Med	NS	
BO73	Olney	31/8/04	Med	S1	12
BO74	Olney	31/8/04	Med	S1	4
BO75	Olney	31/8/04	Low	NS	
BO81	Olney	24/11/04	Med	S1	5
BO82	Olney	24/11/04	Med	NS	
BO83	Olney	24/11/04	Low	NS	
BO84	Olney	24/11/04	Low	NS	
BBT91	Ringtail SF	2/2/05	Med	NS	
BBT92	Ringtail SF	2/2/05	Low	NS	
BBT93	Ringtail SF	2/2/05	Med	NS	
BBT94	Ringtail SF	2/2/05	Low	NS	
BBT95	Ringtail SF	2/2/05	Low	NS	
BBT96	Ringtail SF	2/2/05	Med	NS	
***Eucalyptus regnans* = mountain ash, Tasmania**					
DR30.1	Dunrobin, near Ellendale, Tas	Jul 2005	Low	NS	
DR30.2	Dunrobin	Jul 2005	Med	NS	
DR30.3	Dunrobin	Jul 2005	Low	NS	
DR30.4	Dunrobin	Jul 2005	Med	NS	
DR30.5	Dunrobin	Jul 2005	High	NS	
DR30.6	Dunrobin	Jul 2005	Low	NS	
DR30.7	Dunrobin	Jul 2005	Med	NS	
TN47.1	Tyenna, Tas	Jul 2005	Low	NS	
TN47.2	Tyenna	Jul 2005	Med	NS	
TN47.3	Tyenna	Jul 2005	Low	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus regnans* = mountain ash, Tasmania (continued)**					
TN47.4	Tyenna	Jul 2005	Med	NS	
TN47.5	Tyenna	Jul 2005	Med	NS	
TN47.6	Tyenna	Jul 2005	Low	NS	
1/1	Hartz spur1, Tas, near Geeveston	Feb 2006	ND	NS	
2/1	Hartz spur1	Feb 2006	Med	NS	
3/1	Hartz spur1	Feb 2006	Med	S3	17
4/1	Hartz spur1	Feb 2006	Low	NS	
5/1	Hartz spur1	Feb 2006	Low	NS	
1/2	Edwards spur2, Tas, near Geeveston	Feb 2006	High	S1	5 to 10
2/2	Edwards spur2	Feb 2006	Med	S1	5 to 16
3/2	Edwards spur2	Feb 2006	ND	NS	
4/2	Edwards spur2	Feb 2006	Med	S1	5
5/2	Edwards spur2	Feb 2006	Med	NS	
6/2	Edwards spur2	Feb 2006	Med	NS	
***Eu. regnans/obliqua* hybrid**					
MG411	Geeveston, Tas	15/12/03	Low	NS	
MG421	Geeveston	15/12/03	ND	NS	
MG431	Geeveston	15/12/03	ND	NS	
MG441	Geeveston	15/12/03	Low	NS	
MG451	Geeveston	15/12/03	Med	NS	
MGH412	Glen huon, Tas	15/12/03	ND	NS	
MGH422	Glen huon	15/12/03	Low	NS	
MGH432	Glen huon	15/12/03	Low	NS	
MGH442	Glen huon	15/12/03	ND	NS	
MGH452	Glen huon	15/12/03	Low	NS	
MG511	Geeveston	10/3/04	High	S3	15
MG521	Geeveston	10/3/04	High	S2	>8
MG531	Geeveston	10/3/04	High	S2	>10
MG541	Geeveston	10/3/04	High	S2	>8
MGH512	Glen huon	10/3/04	High	S3	25
MGH522	Glen huon	10/3/04	High	S3	29
MGH532	Glen huon	10/3/04	High	S1	3
MGH542	Glen huon	10/3/04	Med	S1	10
MG611	Geeveston	7/6/04	High	S3	20
MG621	Geeveston	7/6/04	Med	NS	
MG631	Geeveston	7/6/04	Med	S3	20
MG641	Geeveston	7/6/04	Med	NS	
MG651	Geeveston	7/6/04	Med	S2	14

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus regnans/obliqua* hybrid (continued)**					
MGH612	Glen huon	7/6/04	High	S2	>10
MGH622	Glen huon	7/6/04	High	S3	>10
MGH632	Glen huon	7/6/04	High	S1	8
MGH642	Glen huon	7/6/04	High	S3	>10
MGH652	Glen huon	7/6/04	High	S3	>10
***Eucalyptus saligna* = Sydney blue gum**					
BG81	Kangaroo River SF, NSW	3/12/04	Low	S2	10
BG82	Kangaroo River SF	3/12/04	Low	S2	10
***Eucalyptus sieberi* = silvertop ash**					
SGA11	Stoney Peak, E Gipps A	26/3/2003	ND	NS	
SGA12	E Gipps A	26/3/2003	ND	NS	
SGA13	E Gipps A	26/3/2003	Low	NS	
SGA14	E Gipps A	26/3/2003	ND	NS	
SGA15	E Gipps A	26/3/2003	Low	NS	
SGA16	E Gipps A	26/3/2003	Low	NS	
SGB11	Tonghi, E Gipps B	26/3/2003	Low	NS	
SGB12	E Gipps B	26/3/2003	Med	NS	
SGB13	E Gipps B	26/3/2003	ND	NS	
SGB14	E Gipps B	26/3/2003	Low	NS	
SGB15	E Gipps B	26/3/2003	ND	NS	
SGC11	Purgagoolah, E Gipps C	26/3/2003	Low	NS	
SGC12	E Gipps C	26/3/2003	Low	NS	
SGC13	E Gipps C	26/3/2003	Low	NS	
SGC14	E Gipps C	26/3/2003	ND	NS	
SGC15	E Gipps C	26/3/2003	Low	NS	
SGA21	Stoney Peak, E Gipps A	10/6/03	Med	NS	
SGA22	E Gipps A	10/6/03	Med	NS	
SGA23	E Gipps A	10/6/03	Low	NS	
SGA24	E Gipps A	10/6/03	Low	NS	
SGA25	E Gipps A	10/6/03	Med	S1	
SGB21	Tonghi, E Gipps B	10/6/03	ND	NS	
SGB22	E Gipps B	10/6/03	Low	NS	
SGB23	E Gipps B	10/6/03	Low	S2	2
SGB24	E Gipps B	10/6/03	ND	NS	
SGB25	E Gipps B	10/6/03	ND	NS	
SGC21	Purgagoolah, E Gipps C	10/6/03	ND	NS	
SGC22	E Gipps C	10/6/03	ND	NS	
SGC23	E Gipps C	10/6/03	Low	NS	
SGC24	E Gipps C	10/6/03	Low	NS	
SGC25	E Gipps C	10/6/03	Low	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus sieberi* = silvertop ash (continued)**					
SGA31	Stoney Peak, E Gipps A	24/9/03	Low	NS	
SGA32	E Gipps A	24/9/03	Low	NS	
SGA33	E Gipps A	24/9/03	Low	NS	
SGA34	E Gipps A	24/9/03	Low	NS	
SGA35	E Gipps A	24/9/03	Low	NS	
SGB31	Tonghi, E Gipps B	24/9/03	Low	NS	
SGB32	E Gipps B	24/9/03	Low	NS	
SGB33	E Gipps B	24/9/03	Low	S1	5
SGB34	E Gipps B	24/9/03	Low	NS	
SGB35	E Gipps B	24/9/03	Low	NS	
SGC31	Purgagoolah, E Gipps C	24/9/03	Low	NS	
SGC32	E Gipps C	24/9/03	Low	NS	
SGC33	E Gipps C	24/9/03	Med	NS	
SGC34	E Gipps C	24/9/03	Med	S1	3
SGC35	E Gipps C	24/9/03	Med	NS	
SGA51	Stoney Peak, E Gipps A	10/2/04	Low	NS	
SGA52	E Gipps A	10/2/04	Low	NS	
SGA53	E Gipps A	10/2/04	ND	NS	
SGA54	E Gipps A	10/2/04	Med	NS	
SGA55	E Gipps A	10/2/04	Low	NS	
SGB51	Tonghi, E Gipps B	10/2/04	High	NS	
SGB52	E Gipps B	10/2/04	High	NS	
SGB53	E Gipps B	10/2/04	High	NS	
SGB54	E Gipps B	10/2/04	Low	NS	
SGB55	E Gipps B	10/2/04	High	S2	3
SGC51	Purgagoolah, E Gipps C	10/2/04	Med	NS	
SGC52	E Gipps C	10/2/04	Med	NS	
SGC53	E Gipps C	10/2/04	ND	NS	
SGC54	E Gipps C	10/2/04	High	NS	
SGC55	E Gipps C	10/2/04	High	NS	
SGA61	Stoney Peak, E Gipps A	21/5/04	Low	S1	3
SGA62	E Gipps A	21/5/04	High	NS	
SGA63	E Gipps A	21/5/04	High	NS	
SGA64	E Gipps A	21/5/04	Med	NS	
SGA65	E Gipps A	21/5/04	Med	NS	
SGB61	Tonghi, E Gipps B	21/5/04	ND	NS	
SGB62	E Gipps B	21/5/04	High	S2	6
SGB63	E Gipps B	21/5/04	Low	NS	
SGB64	E Gipps B	21/5/04	Low	NS	
SGB65	E Gipps B	21/5/04	Low	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus sieberi* = silvertop ash (continued)**					
SGC61	Purgagoolah, E Gipps C	21/5/04	Med	NS	
SGC62	E Gipps C	21/5/04	Low	NS	
SGC63	E Gipps C	21/5/04	Med	NS	
SGC64	E Gipps C	21/5/04	Med	NS	
SGC65	E Gipps C	21/5/04	Med	NS	
SGA71	Stoney Peak, E Gipps A	20/9/04	Low	NS	
SGA72	E Gipps A	20/9/04	Low	NS	
SGA73	E Gipps A	20/9/04	ND	NS	
SGA74	E Gipps A	20/9/04	Low	NS	
SGA75	E Gipps A	20/9/04	Med	NS	
SGB71	Tonghi, E Gipps B	20/9/04	Med	NS	
SGB72	E Gipps B	20/9/04	Med	NS	
SGB73	E Gipps B	20/9/04	Med	NS	
SGB74	E Gipps B	20/9/04	Med	NS	
SGB75	E Gipps B	20/9/04	Med	NS	
SGC71	Purgagoolah, E Gipps C	20/9/04	Med	NS	
SGC72	E Gipps C	20/9/04	Low	NS	
SGC73	E Gipps C	20/9/04	Low	NS	
SGC74	E Gipps C	20/9/04	Low	NS	
SGC75	E Gipps C	20/9/04	Med	NS	
***Eucalyptus tetradonta* = Darwin stringybark**					
DW111	Weipa, Qld	27/6/03	ND	NS	
DW112	Weipa	27/6/03	Med	NS	
DW121	Weipa	27/6/03	Low	NS	
DW122	Weipa	27/6/03	Low	NS	
DW131	Weipa	27/6/03	Low	NS	
DW132	Weipa	27/6/03	ND	NS	
DW141	Weipa	27/6/03	ND	NS	
DW142	Weipa	27/6/03	ND	NS	
DW151	Weipa	27/6/03	ND	NS	
DW152	Weipa	27/6/03	ND	NS	
DK111	Kendall / Holroyd, Qld	30/6/03	ND	NS	
DK112	Kendall / Holroyd	30/6/03	ND	NS	
DK121	Kendall / Holroyd	30/6/03	ND	NS	
DK122	Kendall / Holroyd	30/6/03	ND	NS	
DK131	Kendall / Holroyd	30/6/03	Low	NS	
DK132	Kendall / Holroyd	30/6/03	Med	NS	
DK141	Kendall / Holroyd	30/6/03	ND	NS	
DK142	Kendall / Holroyd	30/6/03	ND	NS	
DK151	Kendall / Holroyd	30/6/03	Low	NS	
DK152	Kendall / Holroyd	30/6/03	Low	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus tetradonta* = Darwin stringybark (continued)**					
DV111	Violet Vale / Morehead, Qld	1/7/03	ND	NS	
DV112	Violet Vale / Morehead	1/7/03	ND	NS	
DV12	Violet Vale / Morehead	17/7/03	Low	S1	2
DV13	Violet Vale / Morehead	17/7/03	ND	NS	
DV14	Violet Vale / Morehead	17/7/03	Low	NS	
DV15	Violet Vale / Morehead	17/7/03	Low	NS	
DW21	Weipa	11/9/03	Low	NS	
DW22	Weipa	11/9/03	Low	NS	
DW23	Weipa	11/9/03	ND	NS	
DW24	Weipa	11/9/03	ND	NS	
DW25	Weipa	11/9/03	ND	NS	
DK21	Kendall / Holroyd	22/9/03	Low	NS	
DK22	Kendall / Holroyd	22/9/03	ND	NS	
DK23	Kendall / Holroyd	22/9/03	ND	NS	
DK24	Kendall / Holroyd	22/9/03	ND	NS	
DK25	Kendall / Holroyd	22/9/03	ND	NS	
DV21	Violet Vale / Morehead	22/9/03	Low	NS	
DV22	Violet Vale / Morehead	22/9/03	Low	NS	
DV23	Violet Vale / Morehead	22/9/03	ND	NS	
DV24	Violet Vale / Morehead	22/9/03	Low	NS	
DV25	Violet Vale / Morehead	22/9/03	ND	NS	
DJ11	Injinoo (Bamaga), Qld	22/9/03	Low	NS	
DJ12	Injinoo (Bamaga)	22/9/03	Low	NS	
DJ13	Injinoo (Bamaga)	22/9/03	Low	NS	
DJ14	Injinoo (Bamaga)	22/9/03	ND	NS	
DJ15	Injinoo (Bamaga)	22/9/03	ND	NS	
DW31	Weipa	6/12/03	Low	NS	
DW32	Weipa	6/12/03	Low	NS	
DW33	Weipa	6/12/03	Low	NS	
DW34	Weipa	6/12/03	Low	NS	
DW35	Weipa	6/12/03	Low	NS	
DV31	Violet Vale / Morehead	10/12/03	Low	NS	
DV32	Violet Vale / Morehead	10/12/03	Low	NS	
DV33	Violet Vale / Morehead	10/12/03	ND	NS	
DV34	Violet Vale / Morehead	10/12/03	Low	NS	
DV35	Violet Vale / Morehead	10/12/03	Med	S1	3
DW41	Weipa	4/3/04	ND	NS	
DW42	Weipa	4/3/04	Low	NS	
DW43	Weipa	4/3/04	ND	NS	
DW44	Weipa	4/3/04	ND	NS	
DW45	Weipa	4/3/04	ND	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus tetradonta* = Darwin stringybark (continued)**					
DV41	Violet Vale / Morehead	24/3/04	Low	NS	
DV42	Violet Vale / Morehead	24/3/04	ND	NS	
DV43	Violet Vale / Morehead	24/3/04	ND	NS	
DV44	Violet Vale / Morehead	24/3/04	ND	NS	
DV45	Violet Vale / Morehead	24/3/04	ND	NS	
DP51	Pormpuraaw, Qld	4/6/04	Low	NS	
DP52	Pormpuraaw	4/6/04	Low	NS	
DP53	Pormpuraaw	4/6/04	Low	NS	
DP54	Pormpuraaw	4/6/04	ND	NS	
DP55	Pormpuraaw	4/6/04	ND	NS	
DW51	Weipa	13/6/04	Low	NS	
DW52	Weipa	13/6/04	Low	NS	
DW53	Weipa	13/6/04	Low	NS	
DW54	Weipa	13/6/04	Low	NS	
DW55	Weipa	13/6/04	Low	NS	
DK51	Kendall / Holroyd	13/6/04	Low	NS	
DK52	Kendall / Holroyd	13/6/04	Low	NS	
DK53	Kendall / Holroyd	13/6/04	ND	NS	
DK54	Kendall / Holroyd	13/6/04	Low	NS	
DK55	Kendall / Holroyd	13/6/04	Low	NS	
DV51	Violet Vale / Morehead	13/6/04	Low	NS	
DV52	Violet Vale / Morehead	13/6/04	Low	NS	
DV53	Violet Vale / Morehead	13/6/04	Low	NS	
DV54	Violet Vale / Morehead	13/6/04	Low	NS	
DV55	Violet Vale / Morehead	13/6/04	Low	NS	
DJ51	Injinoo	17/7/04	Low	NS	
DJ52	Injinoo	17/7/04	Low	NS	
DJ53	Injinoo	17/7/04	Low	NS	
DJ54	Injinoo	17/7/04	Low	NS	
DJ55	Injinoo	17/7/04	Low	NS	
DW61	Weipa	10/10/04	Low	NS	
DW62	Weipa	10/10/04	Low	NS	
DW63	Weipa	10/10/04	Low	NS	
DW64	Weipa	10/10/04	Low	NS	
DW65	Weipa	10/10/04	Low	NS	
DK61	Kendall / Holroyd	6/10/04	Low	S1	3 mm
DK62	Kendall / Holroyd	6/10/04	Low	NS	
DK63	Kendall / Holroyd	6/10/04	Low	NS	
DK64	Kendall / Holroyd	6/10/04	Low	NS	

Sample No.	Location	Date tree cut	Starch rating	Lyctine rating	Attacked mm sapwood depth
***Eucalyptus tetradonta* = Darwin stringybark (continued)**					
DV61	Violet Vale / Morehead	14/10/04	ND	NS	
DV62	Violet Vale / Morehead	14/10/04	ND	NS	
DV63	Violet Vale / Morehead	14/10/04	ND	NS	
DV64	Violet Vale / Morehead	14/10/04	ND	NS	
DV65	Violet Vale / Morehead	14/10/04	Low	NS	
DW71	Weipa	15/12/04	Low	NS	
DW72	Weipa	15/12/04	Low	NS	
DW73	Weipa	15/12/04	Low	NS	
DW74	Weipa	15/12/04	Low	NS	
DW75	Weipa	15/12/04	Low	NS	
DK71	Kendall / Holroyd	16/12/04	Med	NS	
DK72	Kendall / Holroyd	16/12/04	Low	NS	
DK73	Kendall / Holroyd	16/12/04	Low	NS	
DK74	Kendall / Holroyd	16/12/04	Low	NS	
DK75	Kendall / Holroyd	16/12/04	Low	NS	
DV71	Violet Vale / Morehead	7/12/04	ND	NS	
DV72	Violet Vale / Morehead	7/12/04	Low	NS	
DV73	Violet Vale / Morehead	7/12/04	ND	NS	
DV74	Violet Vale / Morehead	7/12/04	ND	NS	
DV75	Violet Vale / Morehead	7/12/04	ND	NS	
DW81	Weipa	May 05	Low	NS	
DW82	Weipa	May 05	Low	NS	
DW83	Weipa	May 05	Low	NS	
DW84	Weipa	May 05	Low	NS	
DW85	Weipa	May 05	Low	NS	
DK81	Kendall / Holroyd	May 05	Low	NS	
DK82	Kendall / Holroyd	May 05	Low	S1	10 mm
DK83	Kendall / Holroyd	May 05	Low	NS	
DK84	Kendall / Holroyd	May 05	Low	NS	
DK85	Kendall / Holroyd	May 05	Low	NS	
DV81	Violet Vale / Morehead	May 05	Low	NS	
DV82	Violet Vale / Morehead	May 05	Low	NS	
DV83	Violet Vale / Morehead	May 05	Low	NS	
DV84	Violet Vale / Morehead	May 05	Low	NS	
DV85	Violet Vale / Morehead	May 05	Low	NS	

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