TRYPHOCARIA ATTACK IN REGROWTH JARRAH PILOT STUDY

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SUMMARY

This pilot study assessed the effects of bullseye borer (*Tryphocaria sp.*) attack in regrowth jarrah (*Eucalyptus marginata* Donn ex Sm.) in two site types in an area near Collie. Four tree dominance classes, three log diameter classes and three heights in the tree were assessed, with transects being run in 6 ha of each site type.

The results indicated *Tryphocaria* attacks occurred more in Havel-type S than in T type with 78 per cent and 60 per cent respectively of jarrah trees having medium to heavy attack. The dominant and co-dominant trees in S type had heavier attack than found in T type, but attacks in suppressed and sub dominant trees were similar in each type.

INTRODUCTION

Assessments of regrowth karri (*Eucalyptus diversicolor* F.Muell) have shown that the bullseye borer (*Tryphocaria sp.*) is commonly found in a range of tree diameter classes and dominance classes. While surveys have been carried out, more biological data on the insects occurrence, and the possible economic losses owing to reduced timber quality, need further assessment.

The adult female *Tryphocaria* lays eggs which hatch into larvae. The larvae work around the tree in a spiral fashion, eating sapwood just below the cambium. The tree responds by growing over the wound, causing a swelling or callus. When the larvae are fully grown the bores through the sapwood and excavate an ear-shaped chamber between sapwood and bark, and then tunnel into the heartwood where they pupate. The pupation chamber is often associated with staining. The result of the burrowing is the formation of callus, which is tissue that develops after the wounding in an attempt by the tree to cover the wound. It is known as an overgrowth. Any visual intensity rating is based on the resulting callus and frass ejection holes, together with gum staining.

Reports of *Tryphocaria* damage in regrowth jarrah have indicated a need for similar surveys to those carried out in the karri forest. The assessment included the effect of *Tryphocaria* attack on jarrah trees grown on the two sites. Four tree dominance classes, three log diameter classes, and three different heights in the tree were assessed.

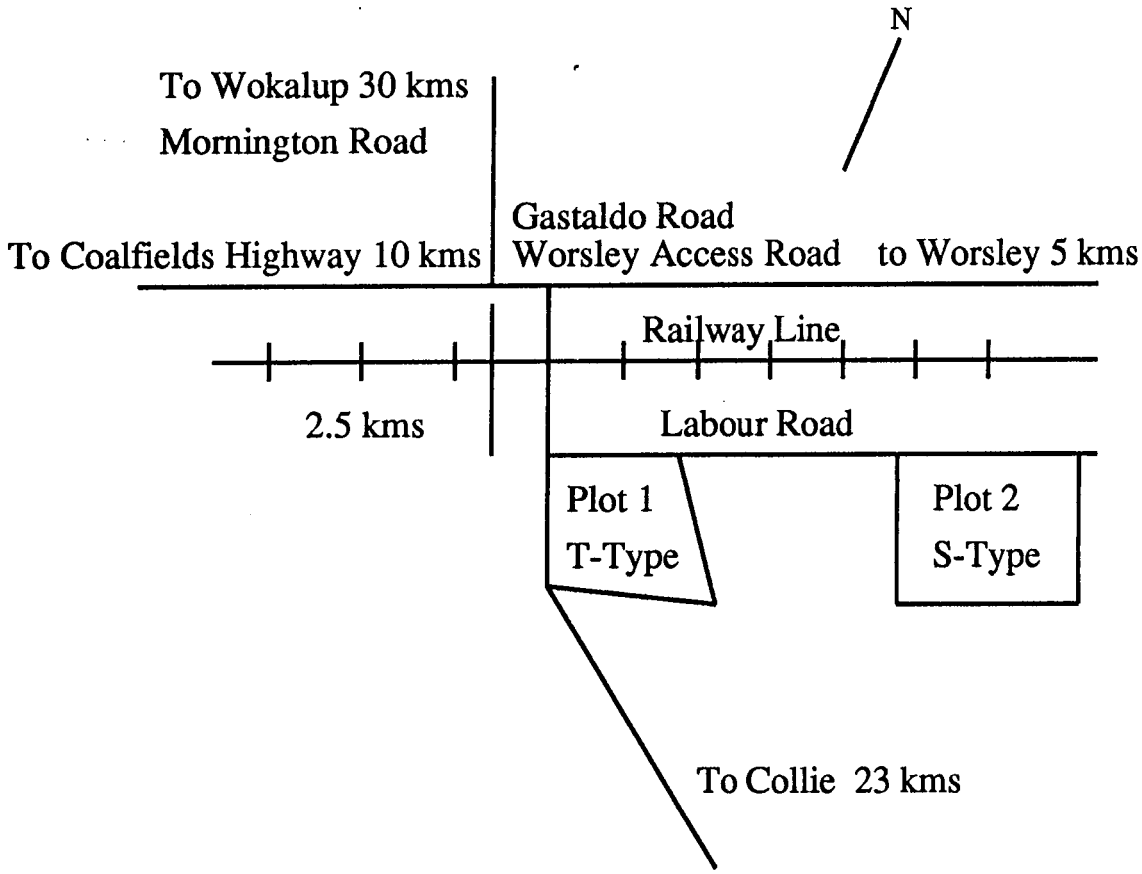
Jarrah regrowth stem showing spiral damage to bark caused by larvae feeding in the cambium

METHODS

This pilot study was commenced in mid 1991, following the increased reports of damage to regrowth jarrah by *Tryphocaria*, and the resulting need to assess the incidence of attack. Two plots in typical regrowth jarrah, located in Hamilton Block in Collie District at the junction of Mornington and Labour Roads that had been attacked by the insect were visually assessed using transects (Fig 1).

Figure 1. **Location map of *Tryphocaria* assessment plots**

(Not to Scale)



The two plots were cut over as part of a logging operation in 1980-82 but also have had a light prop cutting operation that was not recorded in H.O.C.S. The site is prime regrowth jarrah in the 1125 mm rainfall zone, with the site types of S and T (Havel 1975). These two types were chosen because they are representative of regrowth jarrah forests.

Six hectares of regrowth jarrah were assessed, in each of the two site types, using six transects in each plot at 50 metre spacing.

To keep overall number of trees to a manageable figure, the trees were assessed within 5m to the right of the transect. Trees that were badly damaged by means other than insect attack (e.g. fire and mechanical damage), were greater than 50 cm diameter, or were mature were excluded.

The assessment method was based on general Inventory assessment practices.

Visual intensity rating

A visual intensity rating was designed so that the measurements of damage on the outside of the tree could be related to defects in the timber. The ratings used were:

(i)	Diameter class	1	20 - 30 cm
		2	30 - 40 cm
		3	40 - 50 cm

Note: The timber industry of the future will mill an increasing proportion of regrowth jarrah. The *Tryphocaria* larvae attack these regrowth forests and the diameters used were considered typical of the resource.

(ii)	Dominance class	1	dominant
		2	co-dominant
		3	sub-dominant
		4	suppressed

Note: *Tryphocaria* attacks regrowth jarrah at varying intensities. Tree dominance is recorded to determine which size tree is most susceptible to attack.

(iii)	Intensity of attack	0	no visual attack
		1	slight attack
		2	medium attack
		3	heavy attack

Where;

1. One or 2 small calluses of < 15 cm (grub tracks) per 3 m bole length. No frass vents visible. (The term 'callus' is used to describe the swelling of the bark directly above the insect gallery or the encasement of the bullseye).

2. More than 2 calluses per 3 m bole length. Callus spiralling < 50 per cent of the circumference of the bole length. Frass vents may be visible.

3. Callus occurring over the whole bole length or intense callusing in certain areas of the 3 m bole length. Calluses may link up as they spiral around the bole, and the area of intense callusing has caused a large swollen area of the bole.

(iv)	Height in tree	0 - 3 m
		3 - 6 m
		6 - 9 m.

The data were analysed using analysis variance to assess the effect on intensity of attack by *Tryphocaria* in relation to diameter class, dominance class, and height in tree.

RESULTS AND DISCUSSION

S Type

Two hundred and fifty four trees were visually assessed for *Tryphocaria* damage (126 trees in Havel S type and 128 in Havel T type).

Of the 126 trees assessed in S type, only 26 trees had no attack or very slight attack. Many were heavily attacked by larvae, with some trees having a visual rating of 2 and 3 for the full bole (Fig. 2).

Dominant trees

The dominant trees were affected most in the mid-length log 3 - 6 m, the butt log was second and the crown log was least affected. Because the assessment was visual and the crown logs are more difficult to view, the visual rating in some trees could be higher than indicated by the results. Most of the dominant trees in this survey are of good form and would be defect-free except for *Tryphocaria* attack.

Co-dominant trees

The co-dominant trees were affected most in the butt log and the mid-length log, with the crown log less attacked. If the first 3 m is heavily attacked by larvae, it is likely that the tree will be attacked all the way up the bole, which happened in 60 per cent of the trees.

Sub-dominant trees

Sub-dominant trees were affected most in the mid-length log, followed by the butt log, and the crown log was least affected.

Suppressed trees

In the survey there were only 11 trees classified as suppressed. The most affected length was the butt log, then the mid-length log and the crown log least affected.

Type T site

Of the 128 trees assessed in T site type 40 per cent had medium to heavy attack in this high quality future pole stand (Fig. 3)

Swelling on the surface of regrowth Jarrah stem caused by Tryphocaria larvae feeding in the cambium.

Dominant trees

The dominant trees in the survey were attacked only slightly with over half of the trees having slight or no attack. The mid-length log was attacked the most, and the crown log attacked the least.

The overall quality of the dominant trees was high, and without the *Tryphocaria* attack the stand would have been virtually defect-free.

Co-dominant trees

All 51 co-dominant trees surveyed had attack in both the butt log and mid-length log. Overall the crown logs appeared free of attack by the insect.

Sub-dominant trees

The full length of the suppressed trees had been attacked to a moderate degree, however, many trees were not tall enough for a valid comparison with the other classifications.

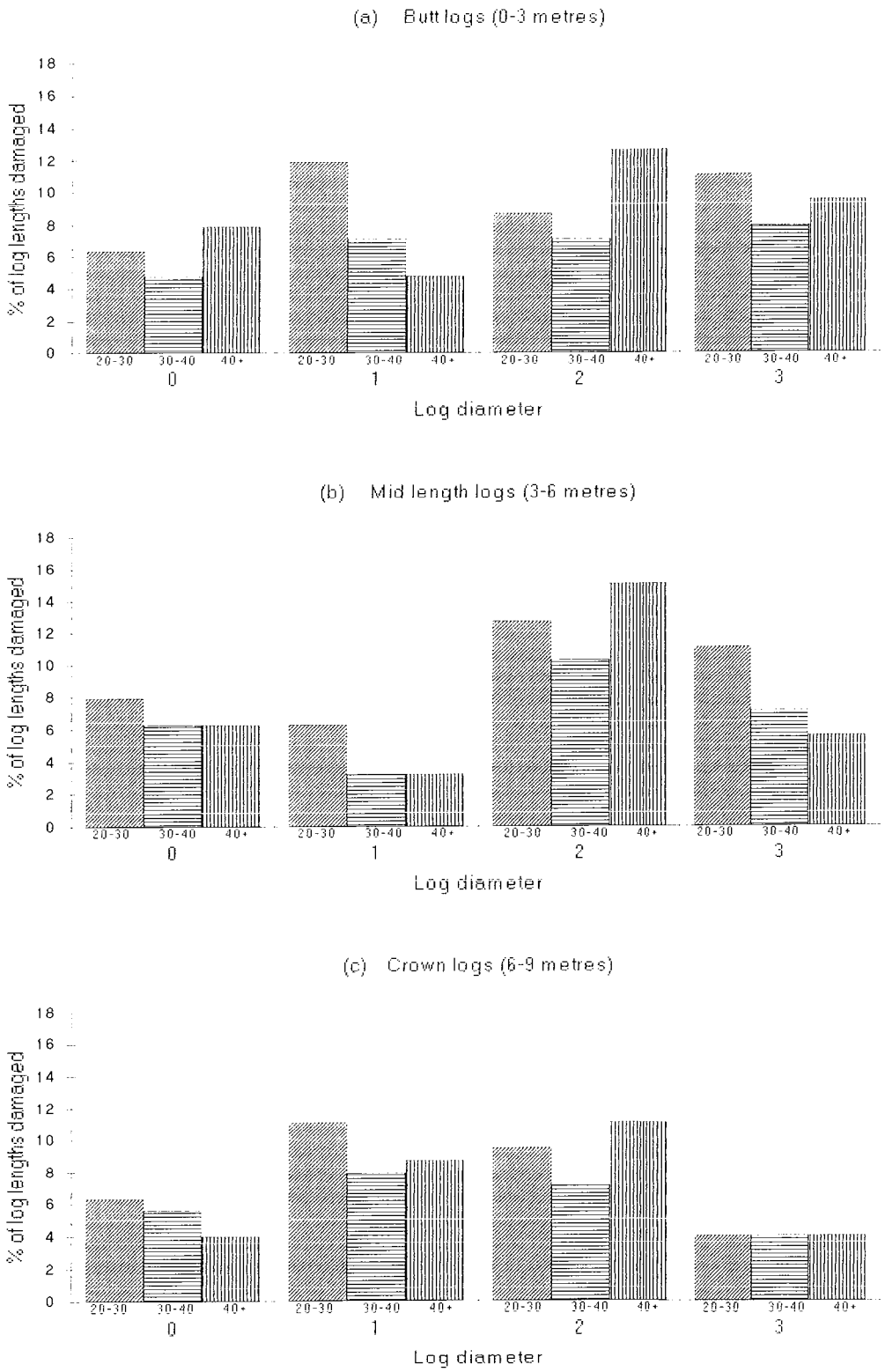
Overall comparison between S and T

The results of this pilot study indicated that *Tryphocaria* attacks more trees in S Type than in T Type sites. The mean ratings of intensity of *Tryphocaria* attack in Type S and Type T sites were 1.6 and 1.3 respectively. However, even in T types, 60 per cent of trees had medium to heavy attack.

Both the dominant and co-dominant trees in S type displayed more attack than T type. Attack in suppressed and sub-dominant trees in S and T type were very similar.

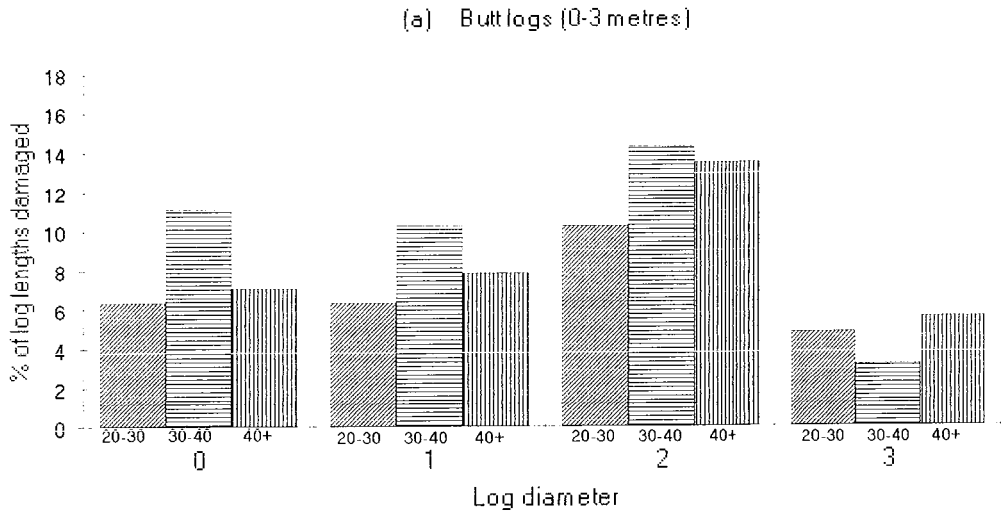
Separate analyses of variance were carried out on data from the two sites, because of memory limitations in the available computing facilities. The results indicated differences in the sites, apart from the differences in mean ratings of intensity of *Tryphocaria* attack referred to above (Table 1).

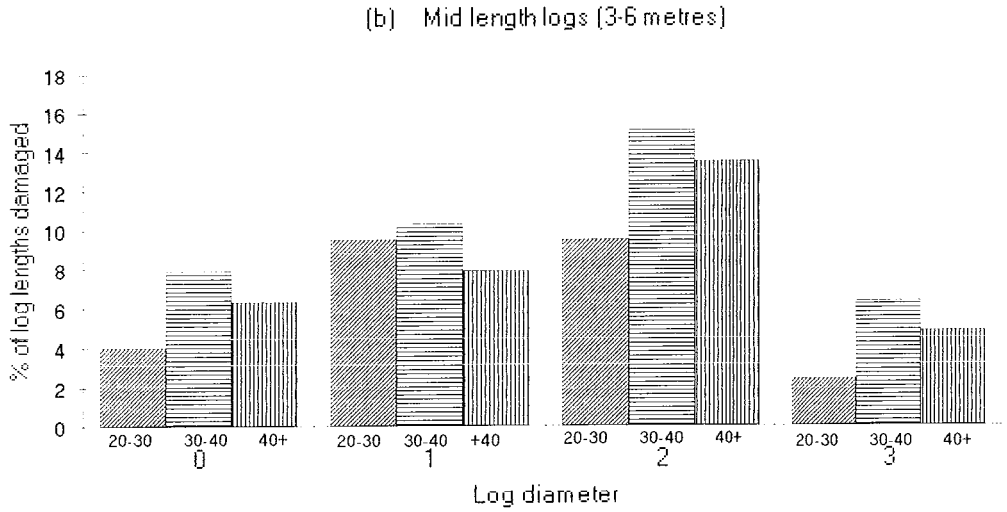
Figure 2. Assessment of Tryphocaria attack in regrowth jarrah trees in S type forest

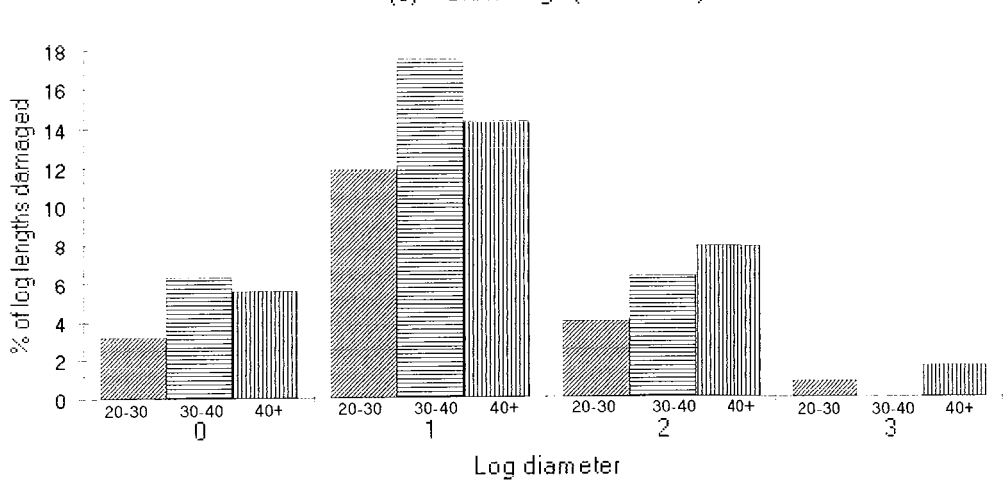


0 = No visual attack
1 = Slight attack 1 or 2 < 15 cm callus or overgrowth
2 = Medium attack > 2
3 = Heavy attack intense callus or overgrowth

Figure 3. Assessment of Tryphocaria attack in regrowth jarrah trees in T type forest







0 = No visual attack
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In the S Type site, the non-significance of each of the factors and intersections indicated that *Tryphocaria* attack was not affected by dominance class, diameter class, or height in tree. However, in the T Type site, height in tree was significant ($p < 0.001$).

Table 1

Analysis of variance of intensity of *Tryphocaria* attack in regrowth jarrah.

S TYPE SITE

Source	df	F - value	Prob > F
Dominance class	3	0.56	0.64
Diameter class	2	0.41	0.66
Dominance x diameter	5*	0.67	0.65
Height in tree	2	0.14	0.87
Dominance x height	6	1.54	0.17
Diameter x height	4	2.71	0.03
Dominance x diameter x height	8	1.87	0.07

T TYPE SITE

Source	df	F - value	Prob > F
Dominance class	3	0.75	0.52
Diameter class	2	0.22	0.80
Dominance x diameter	4*	1.60	0.18
Height in tree	2	8.66	0.00
Dominance x height	6	0.55	0.77
Diameter x height	4	1.35	0.25
Dominance x diameter x height	7	0.83	0.56

* The different degrees of freedom are the result of missing cells in the dominance class by diameter class matrix.

The results on the 6 ha sample indicated that *Tryphocaria spp.* is widespread throughout both S and T type sites, affecting different sized trees on varying forest types, and that the quality of the timber from jarrah regrowth forests will be substantially reduced.

Further work on the effect of *Tryphocaria* on wood quality is recommended, as well as further study of the insect and possible methods of control.

REFERENCE

HAVEL, J. (1975). Site-vegetation mapping in the northern jarrah forest (Darling Range). II. Location and mapping of site-vegetation types. Forests Department of Western Australia. Bulletin 87.