RESERVE BANK OF AUSTRALIA

RURAL CREDITS DEVELOPMENT FUND

PROGRESS REPORT - AUGUST 31,1986

1. Title: Causes of Wandoo Decline In The Upper Great Southern of Western Australia.

2. Grant Number : OGD/8667.

3. Date of Report : 31 August 1986.
Period Covered : 17 March 1986-31 August 1986.
First Progress Report.

4. Grantee organisation : Department Conservation & Land Management.

5. Name of grantees:
Dr J. Tippett
Mr P. Brown

6. Personnel engaged & time on project :

Paul H. Brown, Research Officer, Tree Research Centre, Narrogin.	40%
Dr Joanna Tippett, Research Officer 50 Hayman Rd Como.	20%
Paul D. Albone, Research Assistant Tree Research Centre, Narrogin	100%
Jason Goff, Technical Assistant Tree Research Centre, Narrogin	10%

7. Personnel in training

During the first six months of this project, Paul Albone has recieved training in setting up plots; recording site, tree and stand parameters; recording and describing types of damage to wandoo boles and branches; and identification of possible causal agents, particularly insects and fungal organisms.

8.1 OBJECTIVES

To determine the role of biotic agents in the decline of Eucalyptus wandoo in the Upper Great Southern of Western Australia.

To seek correlations between damage caused by insects and fungi (and any other biotic agents) with various environmental conditions.

To produce a guide for the diagnosis of diseases of Eucalyptus wandoo based on the description of specific symptoms.

8.2 PROGRESS TO DATE
OBJECTIVE ONE - ROLE OF BIOTIC AGENTS

There had been no detailed information available on any of the agents associated with crown decline of Eucalyptus wandoo in Western Australia. Therefore, the first phase of this project was to describe and record photographicaly the various types of external and internal damage to wandoo and to identify the causal agents associated with each damage type.

During the first six months of the project we have concentrated on recording the amount and types of damage to wandoo in the Narrogin region.

8.2.1 Establishment of Plots.

Nine plots have been established, the condition of trees assessed and all external symptoms of damage and disease recorded.
Five plots are in Dryandra state forest, the other 4 at Quinns timber reserve near Highbury. The 5 plots at Dryandra are all on different soil types (CSIRO classification). One plot was established in an area recently burnt.

The following method has been adopted for establishing plots and assessing the condition of trees.
(i) After locating a plot the following site and stand parameters were recorded: land status, annual rainfall, altitude, distance to cleared farmland, distance to services (e.g. gravel road), land class, CSIRO soil type and landform, topographic position, morphological type, slope category and aspect, rocky outcrop type, drainage, disturbance, surface salinity, vegetation system, surface area of remnant vegetation, condition of vegetation, fuel age, number of seedlings saplings and poles within plot, maximum stand height, height of co-dominant trees, average length of bole, understory species and their percentage ground cover.

(ii) All trees within a 20 metre radius of the centre of the plot with a DBHOB greater than 7.5 cm have the following information recorded :
Distance and direction from centre peg, tree species, status (coppice, stag, etc.), DBHOB.

(iii) The 13 wandoo closest to the centre peg with a DBHOB between 7.5 cm and 25 cm have the following detailed information recorded:
Tree height, height to crown break, size class, dominance class, crown quality, crown depth, crown spread, leaf density, crown epicormic growth, size and number of dead branches, leaf condition, presence of flagging branches, phenological status.
Percentage bark retention, bole epicormic growth, presence of dry - siding. The incidence of all external bole symptoms.

8.2.2 External Symptoms of Damage.
(Examples shown in figures 5,9,10).

A total of 34 symptoms have been photographed and/or described, some of which appear to be superficial (Table 1). As the causes of most symptoms were initially unknown they were given colloquial descriptive names. As the agents causing the symptoms are identified there is some reclassification of symptoms.

Representative samples of each external symptom type have been fully described, measured and photographed in colour positive and black and white film.

8.2.3 Internal Symptoms

Techniques

The amount and type of internal damage associated with the external symptoms is described and analysed by felling and disecting trees exhibiting different external symptoms, types at each plot. The stump/lignotuber and all major lateral roots are excavated and examined. Twelve trees have been felled, examined and cut into sections. All observations for each transverse cut through stem and branches are recorded on computer data sheets. The details recorded for each transverse face include; height above ground (root, bark or branch), bark and sapwood widths, presense of kino veins (width and distance from cambium), bark discolouration, sapwood decay, heartwood discolouration heartwood decay. (Kino viens help estimate time elapsed since trees suffered different types of damage, see example Figure 8).

COLEOPTERA : Cerambycidae

Tryphocaria punctipennis : Causing severe damage.Very common. (Figures 1.-4.)

Tryphocaria acanthocera (Bullseye borer) : Very rare.

Cerambycidae ("Corker") : Common, some damage. No adult specimins collected.

Cerambycidae ("Basal borer") : Frequently recorded at Quinns Timber Reserve, unidentified.

: Buprestidae

Buprestidae (Jewel Beetle) : Uncommon, damage to unhealthy trees.

LEPIDOPTERA : Cossidae

Xyleutes Sp. (Cossid Moth) : Few seen, some internal damage. (Figures 5.-7.)

: Xylorictidae

Xylorictidae ("Bark-cutter) : Causing some branch girdling. Less common.

Xylorictidae ("Cubical-cracking") : Common, minimal damage.

ISOPTERA : (Termites)

Bifiditermes improbus : Only a few collonies found.

HYMENOPTERA : Formicidae

Podomyrma Sp.: Very common, often found in cavities created by other boring insects.

Table 1a. Insects associated with the bole of E. wandoo in the Narrogin area.

DRY-SIDING (cambial kill) : Various causes, mostly fire scars.

SPLITTING : Three types, unknown cause, some superficial, others go through to the cambium. (Figure 9.)

SCRIBBLER : Unusual bark shed, superficial, unknown cause.

CUBICAL BARK CRACKING : Two different types, one caused by fire, other is unknown. Superficial. (Figure 10.).

DEEP BARK SHED : Unusual "scollop" bark shed, common, superficial, unknown cause.

BRANCH STUMPS : Old branch stumps are often entry points for boring insects.

SWELLING/OUTGROWTH : Unusual swellings are quite common,some caused by T.punctipennis larvae, others - cause unknown.

Table 1b. Miscellaneous external symptoms associated with E.wandoo in the Narrogin area.

Results

There were several types of internal damage not obviously associated with external symptoms. These include termite and ant cavities, straw rot and other types of wood decay, various types of discolouration. Internal symptoms associated with each external symptom type (previously described) were photographed and recorded.

8.2.4 Identification of causual agents.

For many of the bole symptoms described there have been no casual agents yet identified. However, encouraging progress in identifying insects (mostly borers) and fungal organisms associated with various types of damage has been achieved during the project. Some 5 insects have been identified to genera and a further 5 insects have been classified down to family level (Table 1). Three fungi have been isolated, their identity to be checked by CMI (Commonwealth Mycological Institute).

Insects Causing Damage.

A total of 10 species (of which 8 are 'borers') have been recorded causing damage to bark and wood of live Eucalyptus wandoo (Table 1).

Most of the borer specimens collected were immature 'larval' stages with few distinguishing features, making them difficult to classify further than family. To enable identification to genus and species level insect traps have been placed around the boles of 34 trees to capture adult specimens as they emerge. During the montly inspections of traps information on life histories of the insects will also be recorded.

All of the insects identified cause varying amounts of internal damage and cause possible timber degrade of affected trees. However, only two - Tryphocoria punctipennis and the Xyloryctidid 'bark-cutter' moth larvae - appear to cause branch death in living E. wandoo by girdling ('ringbarking') branches. The life history of these two potentially damaging insects can be sunnarized as follows:

A *Tryphocaria punctipennis* (*Coleoptera* : *Cerambycidae*). Figures 1-4.
There is a paucity of literature on the life histoy of this longicorn beetle. We suggest that its life history includes
i) Deposition of eggs on surface of bark
ii) Eggs hatch and larvae bore through bark to cambial zone.
iii) Larvae move along sapwood/bark boundary which causes a cavity to form. This damage to the trees can be severe as girdling of stems and branches can result.
iv) After an unknown period the larvae bore upward through sapwood into heartwood (see photographs) and pupate. Meanwhile bark covering the gallery maybe shed exposing the cambium (illustrated).

The damage caused by this beetle is widespread. The larvae were found at 6 of the established plots. It was also noted that wandoo does produce kino in response to larval activity and sometimes the kino inhibits their development.

B Xyloractid moth (*Lepidoptera* : *Xylorictidae*)
i) The moths lay their eggs on the bark surface.
ii) The eggs hatch and larvae mine in towards the cambium
iii) The larvae pupate in the heartwood.

The moth is capable of causing considerable damage due to the girdling action of the larvae. It is not as common as *T. punctipennis*.

Entomological studies are continuing.

Lesions and Decay Caused by Fungi.

Bark lesions have been found in 3 trees dissected to describe internal symptoms. Of the 64 samples plated to isolate fungi 37 pieces yielded *Cytospora* sp. The pathogenicity of this fungus is being tested and our tentative identification to species level is being checked. The consistency with which the *Cytospora* was isolated was surprising, especially as other fungi were rarely isolated.

The characteristics and identity of one other fungus thought to be causing death of wandoo twigs and foliage are being studied.

Armillaria luteobubalina is known to also be causing patch death of wandoo at several localities in the Upper Great Southern. This root decay fungus is distributed widely but impact is usually localized (Figures 11-12). No evidence of root diseases, apart from *Armillaria* sp. has been found.

OBJECTIVE TWO - CORRELATIONS WITH ENIRONMENTAL CONDITIONS.

Detailed data has been collected for each plot (see Section 8.2.1) in a way which will enable correlations between types of damage and various site and/or stand conditions to be analysed on computer. Further plots are to be established now methods have been developed.

OBJECTIVE THREE - PHOTOGRAPHIC GUIDE.

Both the internal and external symptoms of each damage type have been described in detail and photgraphed in both colour positives and black and white film. A small sample of the already large library of (some 350 colour positive and 200 black and white) photographs are attached. This work will continue.

8.3 PROSPECTS OF ACHIEVING OBJECTIVES

8.3.1 Objective One - Role of Biotic Agents

Information in the preceeding sections should indicate that good progress is being made in identifying and isolating organisms either associated with, or causing crown decline of wandoo.

Over the next 6 months we will be continuing to put the effort into the description, collection, and identification of organisms associated with crown decline of wandoo. This will include both the study of (i) organisms associated with damage to the bark and wood, and (ii) the identification and quantification of the damage caused to wandoo by leaf defoliating organisms.

In addition, a series of studies are to be initiated to assess the time between damage occuring and specific symptoms being expressed in the field. This will include (i) the aging of kino veins, and (ii) the sequnence of leaf and bark shed after branch girdling.

8.3.2. Objective Two - Correlations with Environmental Conditions.

Further plots will be established now that methods have been developed. A final analysis of all records will indicate incidence and distribution of different diseases of wandoo in the Upper Great Southern. We will be able to seek correlations between damage caused by different organisms and site conditions.

8.3.3 Objective Three - Photographic Guide.

A small sample of photographs are included in this report. Our objective to produce a photo-guide of diseases of Eucalyptus wandoo should be easily met. More insects and fungi causing damage to the trees will be identified as the study progresses.

9. EXPECTED DATE OF COMPLETION : JAN, 1988

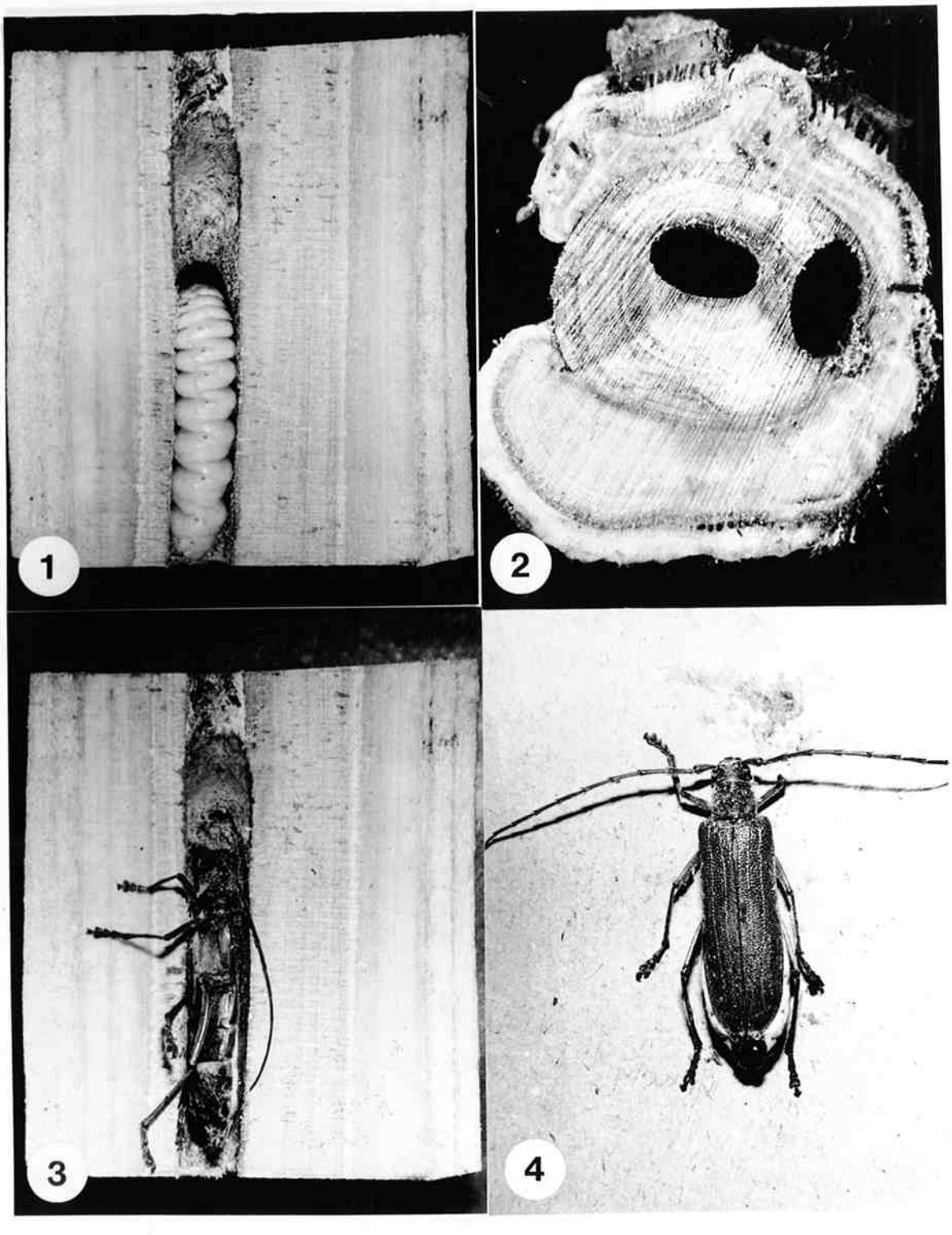
10. TITLES OF PAPERS ARISING : NONE TO DATE

Paul Brown

Paul H. Brown
Joanna T. Tippett

Joanna Tippett

September 1986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Figures 1-4

1. Longitudinal section of E. wandoo branch showing Tryphocaria punctipennis larva in its pupal cell. (x1)

2. Cross section of E. wandoo branch showing internal damage caused by T. punctipennis larvae. Note area of cambial kill and kino vein in outer bark.

3. T. punctipennis beetle recently pupated but still enclosed within the pupal cell (x1).

4. The T.Punctipennis beetle. (x1)

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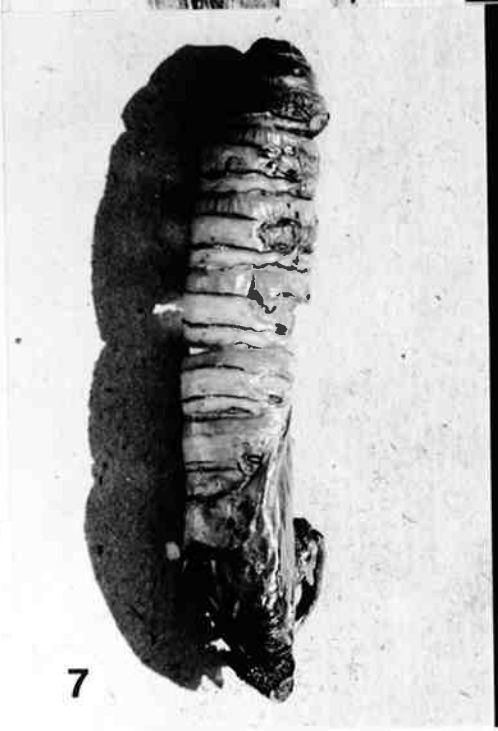

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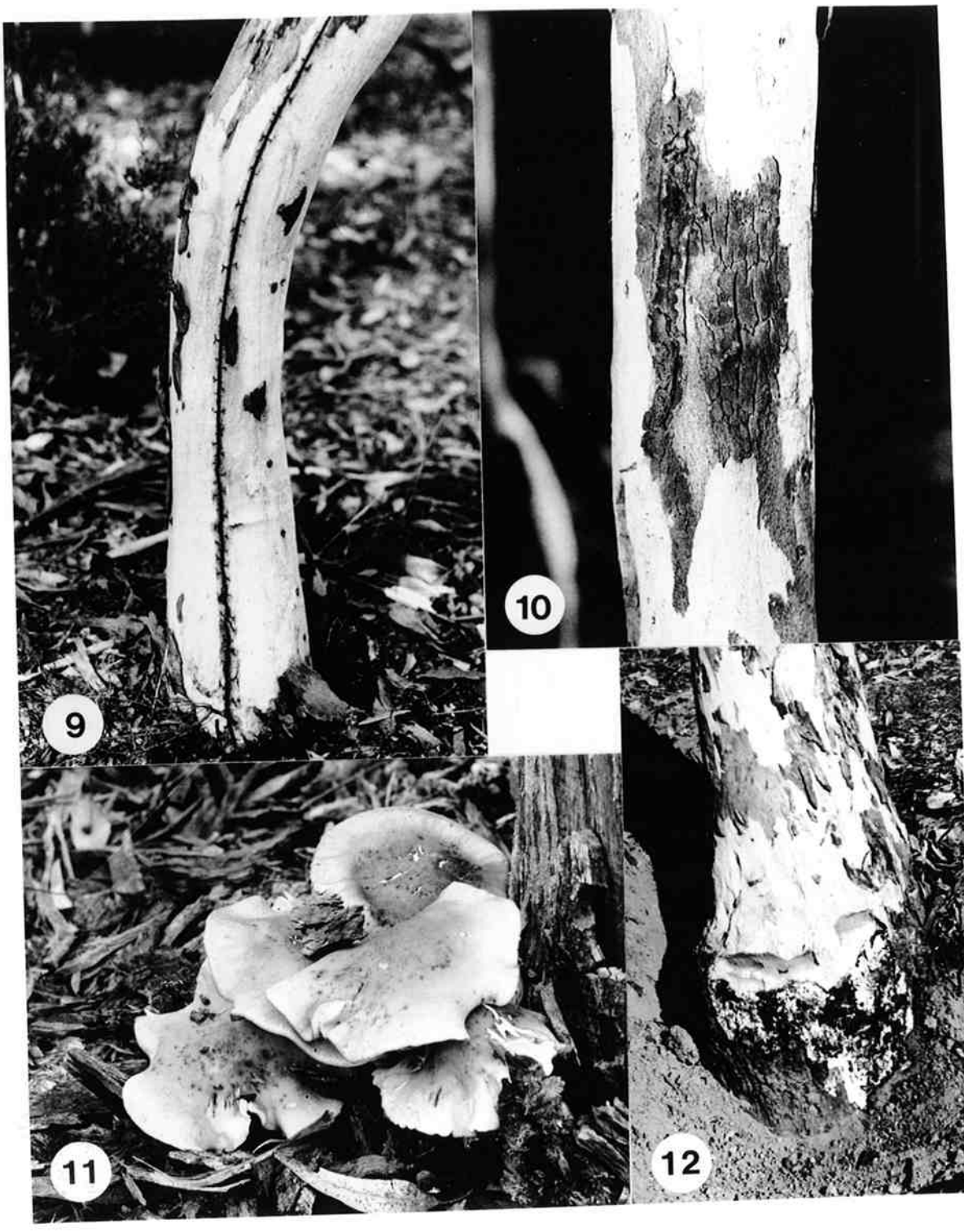
Figures 5-8

5. External view of the exit hole of the cossid moth, Xyleutes sp. The E. wandoo was still living.

6. Longitudinal section showing the internal damage caused by the cossid moth. Note the presence of the pupal case in the exit hole. (x ¾)

7. A cossid moth pupal case. (x1)

8. Cross section of an E. wandoo stem showing an extensive kino vein associated with bark necrosis. Kino vein some distance out from the combial zone indicating damage not recent. (x½)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Figures 9-12

9. Base of *E.wandoo* exhibiting a large longitudinal basal split in bark.

10. *E.wandoo*, external syptom described as `cubical cracking` caused by xylorictid.

11. *Armillaria luteobubalina* fruiting bodies at the base of a dead *E. wandoo*.

12. *Armillaria*, mycelial fans at base of dying *E. wandoo*.