

# FORESTCHECK

## MACROFUNGI, LITTER, TWIG AND COARSE WOODY DEBRIS

### PROGRESS REPORT ON MONITORING FOR 2001/2002

Prepared by  
Science Division, Manjimup  
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R.M. Robinson and R.H. Smith

#### **Introduction**

Fungi are considered one of the most important forest organisms in terms of both biodiversity and forest function. Soil, litter and wood inhabiting fungi play major roles in decomposition and nutrient cycling. Mycorrhizal fungi enhance nutrient uptake of plants and may enhance plant resistance to some pathogens. In addition, underground truffle-like fungi are an important food source for small mammals, especially following disturbance such as fire.

Species richness has a close relationship with habitat structure. Coarse woody debris and litter are not only vital as substrates for fungi and many invertebrates but also as refugia for larger invertebrates, reptiles and mammals. Many organisms rely on a habitat mosaic for development and persistence when confronted with disturbance and for recolonisation following disturbance. Litter cover and the recovery of this cover following disturbance such as logging and regeneration burning is also important in the maintenance of soil moisture regimes.

Research on fungi in Western Australia's southern forests is in its infancy. Knowledge on fungal diversity and the ecological roles that fungi play and the maintenance and/or recovery of a diverse habitat for both ground dwelling organisms and as substrates for nutrient enhancing organisms is of vital importance to Forest Managers making decisions on Sustainable Forest Management.

The objective of this component of the FORESTCHECK program was to:

1. Monitor and record the species of macrofungi in the various treatments of managed jarrah forest (gap, shelterwood, TEAS) and in uncut forest. Trends in species composition, richness and abundance and substrate utilization will be analysed over time.
2. To measure and record the amount of litter, small wood and twigs (SWT) and Coarse woody debris (CWD) on the ground in the various treatments of managed jarrah forest (gap, shelterwood, TEAS) and in uncut forest. Trends within and between the treatments will be analysed over time.

#### **Field and Lab work - 2001/2002**

Litter and CWD assessment was carried out from Feb-April and the SWT assessment in July 2002.

Macrofungi transects were installed at all sites during Feb-April 2002. Assessment of all the sites was carried out in June 2002. Voucher specimens have been processed and where possible identified. An overall species list and one for each individual site has been determined.

Weather disrupted and significantly increased the time period over which the macrofungal assessment was done. Normally light rain is not too disruptive but during June frequent heavy rain was encountered. In addition to difficulties in recording data and negotiating often-difficult terrain (logs, discarded tops etc), voucher specimens deteriorate rapidly if collected wet.

In total, 314 voucher specimens were collected representing 170 species. Processing had to be completed almost immediately as they deteriorate rapidly. This proved to be a more time consuming task than anticipated as the vast majority of species had not been encountered previously and detailed descriptions were necessary to validate their identity.

### Data Management

All the fungi data has been entered onto a Microsoft Excell worksheet. Species diversity and abundance at each site and a frequency rating of 1 (rare) to 8 (very common) for each species at each site has been determined. The data includes a complete list of 192 species recorded across all the sites, their life modes (mycorrhizal, saprotrophic, parasitic) and the substrate on which they were fruiting. Analysis is ongoing.

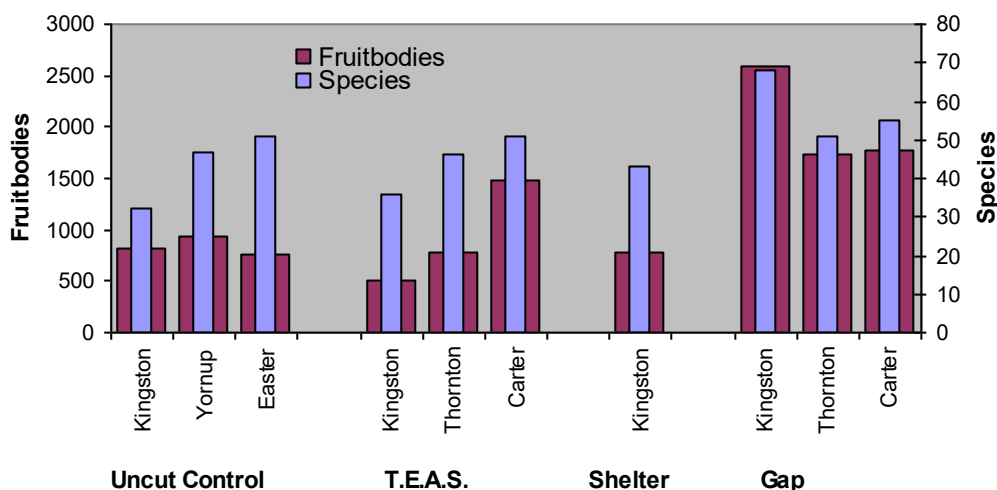
The litter, small wood and twigs (SWT) and CWD data has been entered onto a Microsoft Excell worksheet. Litter and SWT loads ( $t\ ha^{-1}$ ) and CWD volumes ( $m^3\ ha^{-1}$ ) have been calculated for each site.

### Key Findings

#### 1. Macrofungi

A total of 192 species of macro fungi were recorded across all the sites. Preliminary analysis shows that there were no obvious differences in species diversity between the treatments, but the abundance in the gap treatment appears to be higher (FIG. 1). Species diversity and abundance on the Kingston gap treatment, however, does appear to be higher than the same treatment at Thornton and Carter.

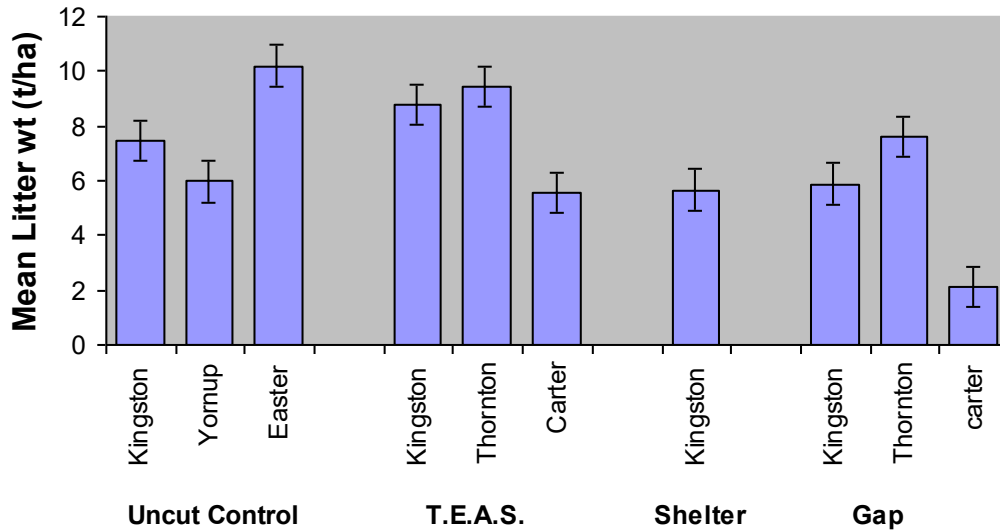
Species composition at each site has not yet been investigated. This may have some bearing on the higher abundance in the gap treatments. Field observation suggests that within these treatments there was a higher number of wood decay species, such as *Calocera* sp., *Gymnopilus* spp. and *Pholiotia* spp., which tend to fruit in high numbers. These species may also reflect the state of decay of the wood on these sites as they appear to be early colonisers of wood and are not found in such large numbers on well-rotted wood. Some species may also prefer burnt wood.



**Figure 1.** Macrofungi species diversity and abundance at each FORESTCHECK site in June 2002.

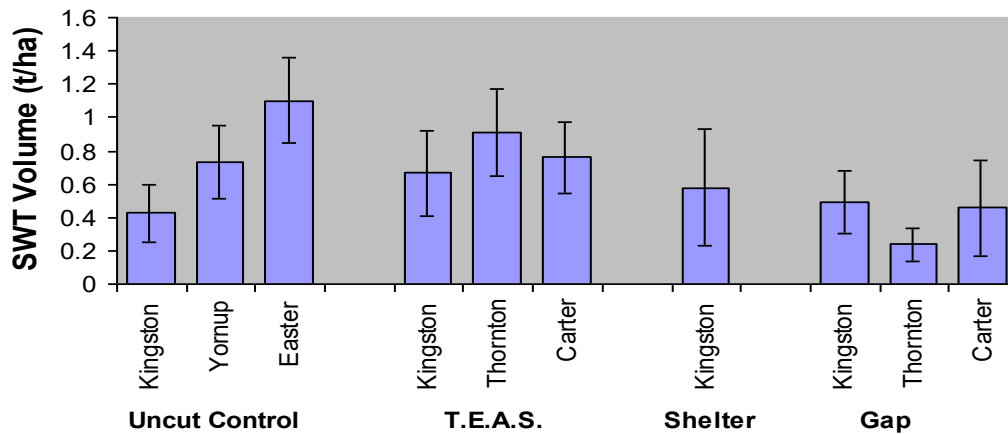
#### 2. Litter, Small Wood and Twigs (SWT) and Coarse Woody Debris (CWD)

Litter loads on all sites ranged from 2.1 t ha<sup>-1</sup> to 10.2 t ha<sup>-1</sup> (Fig.2), and generally reflect the ages of the various treatments. The uncut control at Easter is an old-growth site and has the greatest accumulation of litter, while the gap at Carter has only recently been cut and burnt and has the lowest litter load. The TEAS treatments have similar litter loads to that on the uncut controls. Litter is rapidly accumulating on the older gap treatments at Kingston and Thornton.



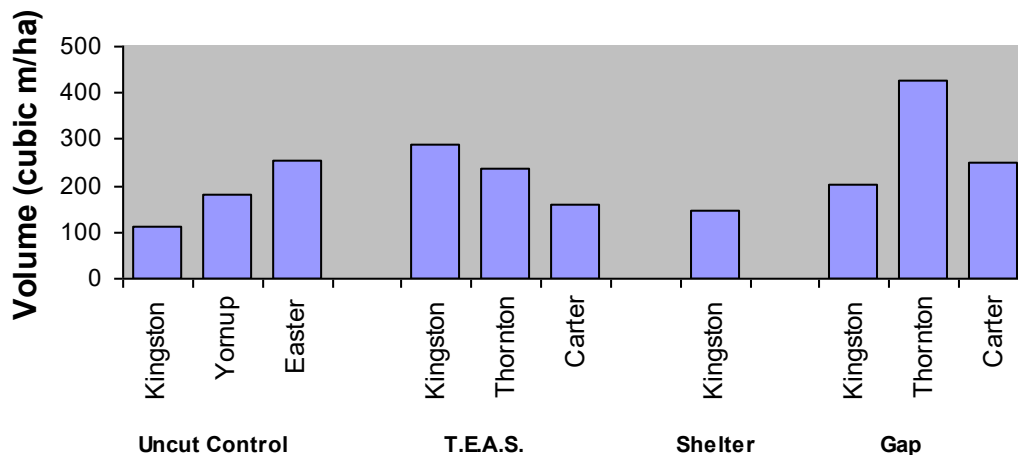
**Figure 2.** The mean litter loads (t ha<sup>-1</sup>) calculated at each FORESTCHECK site in April 2002.

As was the case with the litter, the SWT loads generally reflected the age of the forest within the treatments (Fig. 3). Loads ranged from 0.2 t ha<sup>-1</sup> to 1.1 t ha<sup>-1</sup>. The heaviest load being on the old growth site at Easter and the lowest loading being on the gap at Thornton. The TEAS have similar loads to that on the uncut controls. This component of the ground cover is very variable, as indicated by the large standard errors.



**Figure 3.** The weight (t ha<sup>-1</sup>) of SWT measured at each FORESTCHECK site in July 2002.

The greatest volume of CWD was measured at the Thornton gap site (Fig. 4). This may be due to the fact that one end of this transect was close to the road where logs and debris that had been pushed into heaps. Generally, however, all treatment sites had volumes of CWD within the range of that found on the uncut control sites, about 110-300 m<sup>3</sup> ha<sup>-1</sup>. The quality or state of decay was not assessed, but observation suggests that the wood on the gap and shelterwood sites was more solid than that generally found on the uncut controls.



**Figure 4.** The volume (m<sup>3</sup> ha<sup>-1</sup>) of CWD measured at each FORESTCHECK site in April 2002.

Further analysis will look at the relationship between litter loads and CWD volumes and the composition of the fungal community found in each treatment. They can also be included and used in the analyses of the data collected by other FORESTCHECK teams.

#### Indicator Species Approach

At present we do not have sufficient knowledge of the fungal flora present in WA forests or the roles that individual species play in ecosystem function that would enable an indicator species approach to be taken for monitoring. Also, it is especially difficult to take this approach with fungi. The only practical method of recording fungi is on the presence of fruit bodies, and many species do not produce fruit bodies regularly. Therefore the absence of fruit bodies does not indicate the absence of the fungus. For now, at least, the more appropriate approach to monitoring fungi is to record diversity.

#### Modification to Methods, Difficulties

The position of transects was modified from the original proposal. Due to site constraints in several of the treatments transects were surveyed at 60 m either side of the centre line instead of 90 m as stated in the original proposal. Each transect was divided into 4 sectors (0-50, 50-100, 100-150 and 150-200 m) on which the fungi species frequency rating (1-8) was based.

Originally 3 visits to each site to collect fungal data were proposed on a fortnightly basis. This proved to be very ambitious. The amount of data collected, voucher collection and processing and species identification all proved to be an enormous amount of work. Inclement weather often halted field work but it also made available the extra time needed to process voucher collections. A maximum of 2 sites could only be completed in one day then a full day was needed to process voucher collections. This resulted in taking 3 weeks to do a single circuit of all 10 sites. However, it appears that the timing of assessment coincided with the peak of the fruiting season, resulting in a large number of species being recorded.

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Litter SWT and CWD measurements went smoothly. The measurement of small wood and twigs (10-25 mm diam.) on each site has been added to the operating plan.

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## APPENDIX 1. List of fungal species recorded in FORESTCHECK survey, June 2002.

Sp #	Species
46	Agaric "creamy white"
115	Agaric "orange frosty"
82	Agaric "Lepiota-like, cream-grey"
156	Agaric "light brown - red scales on stem"
18	Agaric "light brown-olive"
12	Agaric "olive"
76	Agaric "orange with brick red scales/white gills"
97	Agaric "pure white"
174	Agaric "red/yellow/red"
170	Agaric "yellow brown-moist"
23	Agaric ? <i>Clitocybe</i>
71	<i>Agaricus</i> sp. "small - flat- red stain"
38	<i>Agaricus</i> sp. "small"
33	<i>Agaricus</i> sp. "yellow stainer"
39	<i>Agaricus</i> sp. "large cap, purplish scales"
120	<i>Aleuria rhenana</i>
114	<i>Amanita</i> sp. "apricot-pink margin"
186	<i>Amanita</i> sp. "grey-brown"
45	<i>Amanita</i> sp. "white, deeply rooted"
28	<i>Amanita</i> sp. "white, stout"
6	<i>Amanita xanthocephala</i>
35	<i>Amanita xanthocephala</i> forma <i>macalpiniana</i>
180	<i>Armillaria luteobubalina</i>
188	<i>Austroboletus laccunosa</i>
103	<i>Boletellus obscurecoccineus</i>
93	<i>Boletus ananiceps</i>
29	<i>Boletus</i> sp. "dull maroon"
49	<i>Boletus</i> sp. "red pores and stem"
95	<i>Boletus</i> sp. "small yellow/cream pores"
99	<i>Boletus</i> sp. "yellow-red, stains blue"
9	<i>Calocera</i> sp. "yellow"
140	<i>Clavaria</i> sp. "pink-buff coral"
81	<i>Clavulina</i> sp. "grey-brown"
14	<i>Clitocybe</i> sp.
181	<i>Collybia</i> aff. <i>butracea</i>
143	<i>Collybia</i> sp. "buff funnel"
151	<i>Collybia</i> sp. "large"
15	<i>Coltricia oblectans</i>
32	<i>Coprinus</i> sp.
128	<i>Coprinus</i> sp. "basal hairs"
147	<i>Cortinarius (Dermocybe) austroveneta</i>
34	<i>Cortinarius (Dermocybe)</i> sp. "olive-yellow gills"
Sp #	Species
168	<i>Cortinarius (Dermocybe)</i> sp. "brown with mustard yellow gills"
40	<i>Cortinarius (Dermocybe)</i> sp. "chestnut"

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110	<i>Cortinarius (Dermocybe)</i> sp. "red orange"
146	<i>Cortinarius (Myxacium)</i> sp. "orange-brown"
125	<i>Cortinarius (Phlegmacium)</i> sp. "purple-grey"
158	<i>Cortinarius</i> aff. <i>micro archerii</i>
173	<i>Cortinarius basirubescens</i>
172	<i>Cortinarius</i> sp. "banded stem"
73	<i>Cortinarius</i> sp. "brown with purplish tints"
68	<i>Cortinarius</i> sp. "brown" ?(34)
154	<i>Cortinarius</i> sp. "chestnut"
57	<i>Cortinarius</i> sp. "dark brown/lemon-yellow gills"
7	<i>Cortinarius</i> sp. "rooting stem"
121	<i>Cortinarius</i> sp. "slender brown"
131	<i>Cortinarius</i> sp. "slender lilac"
124	<i>Cortinarius</i> sp. "yellow-olive"
184	<i>Cortinarius</i> spp. (unidentified)
171	<i>Cortinarius vinaceolamellatus</i>
22	<i>Crepidotus</i> sp. "dark brown"
118	<i>Crepidotus</i> sp. "large creamy-tan"
83	<i>Crepidotus</i> sp. "on marri stag"
61	<i>Crepidotus</i> sp. "small brown"
21	<i>Crepidotus</i> sp. "small white"
148	<i>Crucibulum laeve</i>
138	<i>Daldina concentrica</i>
187	<i>Dictyoporus</i> sp.
123	<i>Discomycete</i> "yellow stalked"
31	<i>Entoloma (Leptonia)</i> sp. "blue-black"
153	<i>Entoloma (Leptonia)</i> sp. "small dark grey-brown"
30	<i>Entoloma</i> sp. "creamy white"
167	<i>Entoloma</i> sp. "dark grey - blue gill edge"
25	<i>Entoloma</i> sp. "grey-brown - blue stem"
77	<i>Entoloma</i> sp. "grey-brown - brown stem"
135	<i>Entoloma</i> sp. "tall, grey-brown"
78	<i>Entoloma/Leptonia</i> "grey - decurrent gills"
159	<i>Exidia glandulosus</i>
41	<i>Fistulina hepatica</i>
91	<i>Fistulinella mollis</i>
11	<i>Galerina</i> sp. "hanging gills" and "conic"
111	<i>Galerina</i> sp. "large"
58	<i>Galerina</i> sp. "small cap, eccentric stipe - on wood"
42	<i>Galerina</i> sp. "small on bark"
8	<i>Gymnopilus austrosapineus</i>
43	<i>Gymnopilus</i> sp.
105	<i>Gymnopilus</i> sp. "chestnut scales, forked gills"

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Sp #	Species
26	<i>Gymnopilus</i> sp. "reddish cap, orange gills"
85	<i>Gymnopilus</i> sp. "slender"
117	<i>Hebeloma</i> sp.?
56	<i>Heterotexus peziziformis</i>
132	Hydnoid crust "light yellow"
100	<i>Hypholoma australe</i>

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59	<i>Hypholoma brunneum</i>
108	<i>Hypomyces chrysospermus</i>
1	<i>Inocybe australiensis</i>
20	<i>Inocybe</i> sp. "scaly cap" see sp. 277 Fire Fungi
53	<i>Inocybe</i> sp. "tan skirt"
137	<i>Inocybe</i> sp. "creamy-brown"
48	<i>Inocybe</i> sp. "grey"
65	<i>Inocybe</i> sp. "large scaly cap"
113	<i>Inocybe</i> sp. "radially fibrillose, pink stem"
169	<i>Inocybe</i> sp. "shaggy stem"
162	<i>Inocybe</i> sp. "small light brown, fibrillose"
74	<i>Laccaria</i> aff. <i>masonii</i>
36	<i>Laccaria lateritia</i>
142	<i>Lactarius eucalypti</i>
185	<i>Lepiota cristata</i>
166	<i>Lepiota</i> sp. "creamy-brown"
24	<i>Lycoperdon</i> sp.
190	<i>Macrolepiota konradii</i>
55	<i>Marasmius crinis-equi</i>
183	<i>Marasmius elegans</i>
191	<i>Marasmius</i> sp. "white umbrella"
75	<i>Marasmius</i> sp. "large brown, on Zamia stems"
101	<i>Merulius</i> sp. "pink-buff"
50	<i>Mycena</i> aff. <i>rorida</i>
134	<i>Mycena</i> aff. <i>subcapillaris</i>
44	<i>Mycena</i> aff. <i>subgallericulata</i>
66	<i>Mycena pura</i>
144	<i>Mycena sanguinolenta</i>
163	<i>Mycena</i> sp. "brown-grey, on wood"
51	<i>Mycena</i> sp. "buff umbrella"
80	<i>Mycena</i> sp. "ginger foot"
27	<i>Mycena</i> sp. "long stem"
165	<i>Mycena</i> sp. "small grey - bleach"
88	<i>Mycena</i> sp. "tiny white with decurrent gills"
64	<i>Mycena</i> sp. "tiny white, on twigs"
182	<i>Mycena</i> spp. (unidentified)
164	<i>Nidula candida</i>
112	<i>Omphalina chromacea</i>
122	<i>Omphalina</i> sp. "orange in moss - on log"

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Sp #	Species
127	<i>Omphalina</i> sp. "flesh-brown"
130	Orange parasite on white resupinate polypore (sp.116)
104	<i>Panellus ligulatus</i>
179	<i>Paxillus</i> sp. "yellow, brown scales"
126	<i>Peziza</i> sp. "small khaki cup"
37	<i>Phellinus</i> sp.
136	<i>Phellinus</i> sp. "resupinate"
70	<i>Phellodon niger</i>
87	<i>Phellodon</i> sp. "brown, white margin"
160	<i>Pholiota lighlandensis</i>

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119	<i>Pholiota multicingulata</i>
192	<i>Plectania</i> sp. "black"
133	<i>Pluteus attrmarginata</i>
47	<i>Pluteus lutescens</i>
4	<i>Pluteus</i> sp. "brown velvet"
157	<i>Podoserpula pusio</i>
13	Polypore "brown with white margin"
3	Polypore "long white shelf"
116	Polypore "white resupinate"
145	<i>Poronia ericii</i>
155	<i>Protuberia canescens</i>
17	<i>Psathyrella</i> sp.
98	<i>Psathyrella</i> sp. "very tall, slender"
177	<i>Psilocybe coprophila</i>
129	<i>Pulvinula</i> sp.
176	<i>Pycnoporus coccineus</i>
52	<i>Ramaria</i> aff. <i>aurea</i> "yellow, flat tops"
102	<i>Ramaria ochroceosalmonicolor</i>
139	<i>Ramaria</i> sp. "lemon-yellow"
86	<i>Ramaria</i> sp. "orange-red, yellow stem"
72	<i>Ramaria</i> sp. "purple-pink"
79	<i>Resupinatus</i> sp. "grey with light margin"
69	<i>Russula adusta</i>
89	<i>Russula clelandii</i> group
90	<i>Russula</i> multicolor (aff. <i>cyanothanxa</i> )
92	<i>Russula neerimea</i>
178	<i>Russula persanguinea</i> (white stem)
107	<i>Russula</i> sp. "grey-white"
10	<i>Russula</i> sp. "white/white/white"
150	<i>Scutellina</i> aff. <i>margaritacea</i>
106	Slimy white marri nuts
62	<i>Stereum hirsutum</i>
84	<i>Stereum</i> sp. "black, hirsute, purplish hymenium"
141	<i>Stereum</i> sp. "chocolate borwn"
152	<i>Stereum</i> sp. "chocolate brown with cream underside"

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Sp #	Species
149	<i>Stereum</i> sp. "dark brown - yellowish margin"
5	<i>Stereum</i> sp. "grey-brown white hirsute, purple fertile layer"
109	<i>Stereum</i> sp. "purpureum"
67	<i>Stropharia semiglobata</i>
94	Thelephore "shelved hydroid"
16	Thelephore "translucent funnels"
19	<i>Trametes lilacino-gilva</i>
63	<i>Trametes versicolor</i> (brown or grey)
60	<i>Tremella mesentericia</i>
161	<i>Tricholoma</i> sp. "grey-white"
96	<i>Tricholoma</i> sp.? "beige slimy cap"
54	<i>Tricoloma eucalypticum</i>
189	<i>Tubaria rufofulva</i>
2	<i>Xerula australis</i>

