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# **First year Report**

**November 2006 – October 2007**

**Title: Potential Application of Fungal**

**Isolates from Palms**

**(BRT R\_650001)**

**Principal investigator: Prof. E.B.G. Jones**

**Researcher assistants: Mr.Rattaket Choeyklin**

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**Miss Sujinda Sommai**



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# POTENTIAL APPLICATION OF FUNGAL ISOLATES FROM PALMS

BRT R\_650001

## FIRST YEAR REPORT

**Progress Report No 2:** November 2006 – October 2007 (1 year report)

**Principal Researcher:** Professor E.B. Gareth Jones

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**Duration:** One year (November 2006 – October 2007)

**Date:** 31<sup>st</sup> October, 2007.

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## 1. SUMMARY OF REPORT:

We tested the ability of selected fungi isolated from palms to inhibit the growth and overgrowth of colonies of *Ganoderma boninense*, the cause of basal stem rot of oil palm trees in a yeast extract agar medium. 280 fungi were tested for their antagonism towards *G. boninense*, with 86 strains showing inhibition of 65 % or more, of the radial growth of the pathogen. Our work suggests that these have potential as natural agents for the biological control of the basal stem rot oil palm trees.

## 2. OBJECTIVES OF THIS STUDY:

- 2.1. To evaluate the potential of saprobic and endophytic palm fungi as antagonists of the oil palm pathogen *Ganoderma boninense* (Part I).
- 2.2. Utilization of oil palm waste for the production of edible mushrooms by local community farmers (Part II).

**Duration:** One year (November 2006 – October 2007)

## **Part I**

### **3. MATERIAL AND METHODS**

#### **3.1. Location:**

Samples of living and decaying palms were collected from various locations in Thailand and examined for saprobic fungi, isolates were made and are deposited in the BIOTEC Culture Collection. Endophytic fungi were also isolated from selected palms to increase the diversity species for the experimental work.

#### **3.2. Sample collection::**

Seven visits were made in September, October, and November 2005 and January, March, November 2006 and March 2007 to collect palm material and for the isolation of endophytic and saprophytic fungi.

#### **3.3. Fungi for tested:**

Initially 280 palm fungi were selected to test for antagonism towards *G. boninense*.

#### **3.4. Radial growth of fungi:**

Three hundred and forty palm fungi were grown to determine their radial growth as well as those of the pathogenic stains. This will enable the timing of inoculation of antagonist and pathogenic isolates of *Ganoderma sp.*, *G. boninense* and *G. australe*. Table 1 lists the original of the pathogenic *Ganoderma* strains.

#### **3.5. Dual culture method:**

The method used to study interactions between the palm fungi and the pathogen was similar to that used by Cavalcante and Eaton (1981). Mycelial plugs removed from the growing margins of cultures of tested fungi were placed at one side of a Petri dish

containing yeast extract agar (with added 10 g/L glucose) and incubated at 25°C for 1 day (for faster growth fungi) and 3 days (for slower growing fungi). After this time, cores removed from the margins of actively growing cultures of the pathogen, *G. boninense* were placed at the opposite sides of the dishes and the plates incubated under the same conditions. Three replicate pairings of each isolate were made, including self-paired controls. Plates were examined daily to determine the outcome of interactions between the organisms. Antagonists showing high specificity to *Ganoderma* will be further screened for bioactive activity (Figs.3, 4).

### 3.6. Description of *Ganoderma boninense* Pat.

Basal stem rot (BSR) caused by *Ganoderma boninense* Pat. is the most destructive disease of oil palm in South-East Asia (Khairudin, 1993). The disease can infect all stages of the oil palm plants. The disease progresses slowly but every plant usually dies. **Basidiocarps** annual, pileate, broadly attached, somewhat triquetrous, semicircular, about 4 cm wide and 3.5 cm thick at the base, woody hard; pilear surface reddish bay, glabrous, smooth, glossy and concentrically zonate, cuticle up to 0.3 mm, tubes up to 1.5 cm long, reddish brown; cortex up to 1 cm thick, pale reddish brown to pale cinnamon towards the pileus.

**Hyphal system** amphimitic; generative hyphae with clamps, 2-3 µm wide; arboriform hyphae yellow, solid, 2-5 µm wide, branching at the top; pilear cuticle composed of a palisade of hyphae ends, dark brown, amyloid, thick-walled and irregular club-shaped with swelling and small protuberances, up to 100 µm long, 6-12 µm at the top.

**Basidiospores** truncate to oblong ellipsoid, 10-12 × 7-8 µm, yellow and finely asperulate.



Figure 1. *Ganoderma boninense* on oil palm tree (arrowed).

#### 4. RESULTS

340 palm fungi were studied to determine their radial growth and are listed in Tables 1 (slow growing species), 2 (moderately fast growing strains) and 3 (faster growing fungi). The interactions between the organisms are showed in Table 4.

**Table 1. Fungi showing slow growth (0.01-2.49 cm at two weeks) on freshwater yeast extract agar.**

No.	morph	radial growth ( cm )
1	8	1.85
2	9	0.93
3	10	1.90
4	11	2.05
5	15	2.42
6	19	0.80
7	22	1.93
8	34	1.77
9	36	2.32
10	49	2.28
11	80	1.53
12	81	1.00
13	82	1.00
14	83	2.33
15	84	2.02
16	88	2.30
17	93	1.88
18	94	0.60
19	100	1.53
20	102	1.60
21	106	1.00
22	110	2.20
23	111	0.80
24	113	1.32
25	114	2.17
26	118	0.60
27	120	1.02
28	121	0.60
29	127	0.95
30	135	0.73
31	143	1.13
32	145	0.68
33	147	1.28
35	2.2	2.10
36	10.1	2.47
37	12.12	0.42
38	13.13	2.17
39	15.15	2.47
40	20.2	0.53
41	24.24	0.40
42	28.28	2.03
43	38.38	2.15
44	39.39	1.03



**Table 1. Continued.**

<b>No.</b>	<b>morph</b>	<b>radial growth ( cm )</b>
45	40.4	1.10
46	8.8	0.85
47	89	0.93
48	41.41	1.40
49	43.43	2.45
50	143	1.13
51	46.46	2.45
52	50.5	1.20
53	64.64	0.43
54	65.65	0.80
55	66.66	0.13
56	74.74	0.18
57	92.92	0.62
58	93.93	0.75
59	103.103	1.90
60	106.106	1.77
61	113.113	0.30
62	118.118	1.87
63	119.119	0.33
64	122.122	0.87
65	124.124	0.73
66	128.128	1.82
67	130.13	0.80
68	139.139	1.97
69	142.142	2.07
70	150.15	2.00
71	156.156	2.43
72	158.158	1.97
73	159.159	2.47
74	167.167	0.83
75	193.193	0.15
76	198.198	0.83
77	199.199	1.60
78	204.204	1.00
79	206.206	1.73
80	213.213	1.50
81	216.216	0.97
82	219.219	1.47
83	220.22	1.93
84	223.223	1.67
85	229.229	0.23
86	233.233	0.72
87	234.234	1.57
88	237.237	1.17

**Table 1. Continued.**

<b>No.</b>	<b>morph</b>	<b>radial growth ( cm )</b>
89	238.238	0.60
90	239.239	2.33
91	243.243	1.53
92	246.246	1.67
93	247.247	0.35
94	248.248	1.73
95	250.25	1.40
96	254.254	1.93
97	260.26	2.43
98	267.267	1.37
99	269.269	2.37
100	271.271	0.47
101	273.273	1.22
102	274.274	0.50
103	277.277	0.43
104	286.286	0.50
105	292.292	2.43
106	293.293	0.57
107	296.296	2.47
108	297.297	0.67
109	304.304	0.72
110	309.309	0.40
111	311.311	0.70
112	319.319	2.43
113	339.339	0.50
114	341.341	1.10
115	343.343	2.40

**Table 2. Fungi showing moderate growth (2.50-5.90 cm at two weeks) on freshwater yeast extract agar.**

No.	morph	radial growth ( cm )
1	1	5.25
2	2	3.35
3	4	3.23
4	5	2.50
5	6	2.83
6	7	3.63
7	12	2.87
8	14	3.00
9	18	3.53
10	20	3.17
11	21	4.63
12	23	3.80
13	24	4.88
14	25	3.37
15	26	3.05
16	28	3.28
17	30	2.80
18	32	2.77
19	33	4.33
20	37	3.30
21	39	2.67
22	40	2.65
23	85	5.33
24	98	3.88
25	99	2.63
26	101	4.00
27	105	5.30
28	123	4.02
29	131	4.47
30	136	3.70
31	137	3.63
32	144	5.27
33	1.1	4.07
34	4.4	3.67
35	7.7	4.50
36	11.11	2.80
37	17.17	4.40
38	18.18	4.35
39	23.23	2.77
40	27.27	5.73
41	29.29	2.60
42	30.3	2.80
43	31.31	3.63
44	32.32	3.10
45	37.37	2.63
46	5.5	3.87

**Table 2. Continued.**

<b>No.</b>	<b>morph</b>	<b>radial growth ( cm )</b>
48	47.47	5.03
50	48.48	3.57
51	49.49	3.37
52	51.51	2.87
53	52.52	2.97
54	53.53	4.42
55	54.54	4.27
56	57.57	3.60
57	60.6	3.55
58	63.63	3.40
59	67.67	3.27
60	68.68	3.37
61	72.72	4.27
62	76.76	5.90
63	77.77	5.03
64	80.8	4.90
65	82.82	3.97
66	83.83	5.70
67	84.84	3.23
68	85.85	5.57
69	96.96	3.17
70	98.98	3.70
71	99.99	4.13
72	100.1	3.90
73	104.104	5.93
74	108.108	5.47
75	109.109	2.77
76	134.134	3.97
77	135.135	5.03
78	136.136	4.17
79	144.144	2.67
80	154.154	3.87
81	163.163	5.43
82	175.175	3.20
83	177.177	3.07
84	184.184	4.43
85	187.187	4.23
86	190.19	4.30
87	194.194	5.43
88	195.195	2.83
89	203.203	3.33
90	205.205	4.93
91	208.208	3.70
92	212.212	4.13
93	215.215	5.60
94	217.217	5.50

**Table 2. Continued.**

<b>No.</b>	<b>morph</b>	<b>radial growth ( cm )</b>
95	221.221	5.73
96	225.225	4.20
97	227.227	3.07
98	240.24	2.67
99	241.241	2.50
100	245.245	3.33
101	257.257	5.00
102	264.264	5.73
103	272.272	2.77
104	278.278	5.33
105	279.279	4.83
106	288.288	4.83
107	294.294	5.20
108	298.298	5.70
109	301.301	5.10
110	303.303	5.07
111	325.325	2.87
112	327.327	3.50
113	329.329	5.70
114	330.33	4.67
115	332.332	5.93
116	345.345	5.10



**Table 3. Fungi showing fast radial growth (up to 6.00 cm at two weeks) on freshwater yeast extract agar.**

No.	morph	radial growth ( cm )
1	16	7.13
2	17	7.20
3	96	6.17
4	97	6.07
5	104	7.40
6	108	7.30
7	125	7.30
8	3.3	6.87
9	6.6	7.20
10	14.14	7.30
11	16.16	7.30
12	19.19	7.30
13	21.21	6.80
14	22.22	6.27
15	25.25	6.70
16	26.26	7.20
17	34.34	7.40
18	44.44	7.20
19	58.58	6.38
20	59.59	7.20
21	69.69	6.73
22	71.71	7.20
23	73.73	6.40
24	75.75	6.23
25	78.78	7.10
26	79.79	6.53
27	81.81	6.90
28	86.86	6.57
29	87.87	6.07
30	88.88	6.90
31	90.9	7.30
32	94.94	7.20
33	101.101	7.20
34	110.11	6.77
35	111.111	7.20
36	112.112	6.83
37	115.115	7.20
39	126.126	7.13
40	127.127	6.28
41	129.129	7.20
42	132.132	7.20
43	133.133	7.20
44	137.137	6.53
45	138.138	7.20

**Table 3. Continued.**

No.	morph	radial growth ( cm )
46	140.14	6.83
47	148.148	7.20
48	149.149	7.20
49	155.155	6.57
50	162.162	7.20
51	164.164	6.13
52	168.168	6.03
53	173.173	7.20
54	174.174	7.20
55	179.179	7.20
56	182.182	7.20
57	183.183	7.20
58	186.186	6.40
59	188.188	6.90
60	189.189	7.20
61	191.191	7.20
62	197.197	7.20
63	200.2	6.60
64	201.201	5.93
65	210.21	7.20
66	211.211	7.20
67	224.224	7.13
68	228.228	7.20
69	230.23	7.20
70	231.231	6.90
71	232.232	7.20
72	235.235	7.20
73	236.236	7.20
74	244.244	7.20
75	249.249	7.20
76	252.252	7.20
77	253.253	7.20
78	255.255	7.20
79	262.262	7.20
80	266.266	7.20
81	268.268	7.20
82	275.275	7.20
83	276.276	7.20
84	280.28	7.20
85	281.281	7.20
86	284.284	7.20
87	287.287	6.80

**Table 3. Continued.**

<b>No.</b>	<b>morph</b>	<b>radial growth ( cm )</b>
88	289.289	7.20
89	291.291	7.20
90	295.295	7.20
91	302.302	7.20
92	306.306	7.20
93	307.307	6.40
94	312.312	6.07
95	314.314	6.07
96	315.315	7.20
97	316.316	7.20
98	317.317	7.20
99	320.32	6.33
100	323.323	7.20
101	324.324	7.20
102	326.326	7.20
103	328.328	7.20
104	331.331	6.63
105	333.333	7.20
106	334.334	7.20
107	336.336	7.20
108	338.338	6.63
109	340.34	7.20

#### **4.1. DUAL CULTURE OF ANTAGONISTS AND PATHOGEN ON YEAST EXTRACT AGAR.**

In the dual culture study, a wide variety of reactions were produced by selected palm fungi against the oil palm pathogen *Ganoderma boninense* (Table 4). The results show that strains produced percentage inhibition of radial growth by over 65%. Sample antifungal activity by the dual culture method are illustrated in Figures 3-4.

**Table 4. Growth of *Ganoderma boninense* when grown on media with selected antagonists.**

No.	test Fungi (no.)	radial growth of <i>Ganoderma boninense</i> (cm) control = 7.2	% inhibition of radial mycelial growth
1	1	2.9	59.7
2	2	3.2	55.6
3	4	3.6	50.0
4	5	3.9	45.8
5	6	3.2	55.6
6	7	3.5	51.4
7	8	4.0	44.4
8	10	4.4	38.9
9	12	3.6	50.0
10	14	3.7	48.6
11	16	2.1	70.8
12	17	1.8	75.0
13	18	3.1	56.9
14	20	3.4	52.8
15	21	3.3	54.2
16	23	3.0	58.3
17	24	2.5	65.3
18	25	3.7	48.6
19	26	3.9	45.8
20	28	4.0	44.4
21	30	4.0	44.4
22	32	3.8	47.2
23	33	3.8	47.2
24	36	4.9	31.9
25	37	3.8	47.2
26	39	4.2	41.7
27	40	3.7	48.6
28	81	5.5	23.6
29	83	4.1	43.1
30	84	4.5	37.5
31	85	3.4	52.8
32	88	3.4	52.8
33	93	7.2	0.0
34	94	7.3	-1.4
35	96	2.7	62.5
36	97	2.5	65.3
37	98	2.4	66.7
38	99	3.5	51.4
39	100	4.8	33.3
40	101	1.7	76.4
41	104	0.8	88.9
42	106	5.4	25.0
43	108	2.1	70.8
44	110	4.0	44.4

**Table 4. Continued.**

No.	test Fungi (no.)	radial growth of <i>Ganoderma boninense</i> (cm) control = 7.2	% inhibition of radial mycelial growth
45	111	5.0	30.6
46	113	7.3	-1.4
47	114	4.8	33.3
48	105	3.6	50.0
49	121	6.3	12.5
50	123	4.0	44.4
51	131	4.2	41.7
52	136	2.8	61.1
53	137	3.6	50.0
54	144	3.2	55.6
55	145	4.6	36.1
56	1.1	3.8	47.2
57	2.2	4.0	44.4
58	3.3	2.6	63.9
59	4.4	4.1	43.1
<b>60</b>	<b>6.6</b>	<b>1.0</b>	<b>86.1</b>
61	7.7	3.4	52.8
62	10.10	3.1	56.9
63	11.11	4.4	38.9
64	13.13	3.5	51.4
<b>65</b>	<b>14.14</b>	<b>1.0</b>	<b>86.1</b>
66	15.15	4.5	37.5
<b>67</b>	<b>16.16</b>	<b>0.9</b>	<b>87.5</b>
68	17.17	3.1	56.9
69	18.18	3.4	52.8
<b>70</b>	<b>19.19</b>	<b>2.2</b>	<b>69.4</b>
71	21.21	2.7	62.5
<b>72</b>	<b>22.22</b>	<b>2.4</b>	<b>66.7</b>
73	25.25	2.7	62.5
74	26.26	2.8	61.1
75	27.27	2.9	59.7
76	31.31	3.1	56.9
<b>77</b>	<b>34.34</b>	<b>2.0</b>	<b>72.2</b>
78	43.43	3.6	50.0
79	44.44	2.7	62.5
<b>80</b>	<b>46.46</b>	<b>2.4</b>	<b>66.7</b>
81	47.47	3.2	55.6
82	48.48	3.0	58.3
83	49.49	4.5	37.5
84	50.50	4.7	34.3
85	51.51	3.4	52.8
86	52.52	3.8	47.2
87	53.53	3.7	48.6
88	54.54	3.0	58.3



**Table 4. Continued.**

No.	test Fungi (no.)	radial growth of <i>Ganoderma boninense</i> (cm) control = 7.2	% inhibition of radial mycelial growth
89	57.57	3.1	56.9
90	58.58	2.3	68.1
91	59.59	1.0	86.1
92	60.60	3.3	54.2
93	63.63	3.8	47.2
94	65.65	4.9	31.9
95	67.67	4.3	40.3
96	68.68	2.3	68.1
97	69.69	2.5	65.3
98	71.71	3.0	58.3
99	72.72	3.4	52.8
100	73.73	2.9	59.7
101	75.75	3.5	51.4
102	76.76	2.3	68.1
103	77.77	2.8	61.1
104	78.78	2.4	66.7
105	79.79	2.3	68.1
106	80.80	3.3	54.2
107	81.81	2.3	68.1
108	82.82	3.1	56.9
109	83.83	2.6	63.9
110	84.84	3.0	58.3
111	85.85	2.8	61.1
112	86.86	2.7	62.5
113	87.87	3.2	55.6
114	88.88	2.4	66.7
115	90.90	0.7	90.3
116	94.94	2.5	65.3
117	96.96	5.2	27.8
118	98.98	3.5	51.4
119	99.99	3.1	56.9
120	100.100	4.1	43.1
121	101.101	1.2	83.3
122	103.103	3.1	56.9
123	104.104	2.6	63.9
124	106.106	5.9	18.1
125	108.108	2.6	63.9
126	109.109	4.0	44.4
127	110.110	2.1	70.8
128	111.111	2.1	70.8
129	112.112	2.4	66.7
130	115.115	2.3	68.1
131	118.118	3.2	55.6
132	126.126	2.5	65.3

**Table 4. Continued.**

No.	test Fungi (no.)	radial growth of <i>Ganoderma boninense</i> (cm) control = 7.2	% inhibition of radial mycelial growth
133	127.127	3.3	54.2
<b>134</b>	<b>129.129</b>	<b>0.6</b>	<b>91.7</b>
<b>135</b>	<b>132.132</b>	<b>2.5</b>	<b>65.3</b>
136	133.133	4.2	41.7
137	134.134	3.8	47.2
138	135.135	2.7	62.5
139	136.136	3.3	54.2
140	137.137	2.7	62.5
<b>141</b>	<b>138.138</b>	<b>1.0</b>	<b>86.1</b>
142	140.140	2.8	61.1
143	142.142	3.9	45.8
144	144.144	3.5	51.4
145	145.145	3.0	58.3
<b>146</b>	<b>148.148</b>	<b>0.5</b>	<b>93.1</b>
<b>147</b>	<b>149.149</b>	<b>1.2</b>	<b>83.3</b>
148	122.122	5.1	29.2
149	124.124	5.0	30.6
150	150.150	4.9	31.9
151	163.163	2.6	63.9
152	164.164	2.7	62.5
<b>153</b>	<b>168.168</b>	<b>2.5</b>	<b>65.3</b>
154	169.169	4.1	43.1
155	173.173	2.8	61.1
156	167.167	7.2	0.0
<b>158</b>	<b>174.174</b>	<b>1.8</b>	<b>75.0</b>
159	177.177	3.2	55.6
<b>160</b>	<b>179.179</b>	<b>1.0</b>	<b>86.1</b>
<b>161</b>	<b>151.151</b>	<b>1.7</b>	<b>76.4</b>
<b>162</b>	<b>182.182</b>	<b>2.2</b>	<b>69.4</b>
<b>163</b>	<b>183.183</b>	<b>1.6</b>	<b>77.8</b>
<b>164</b>	<b>189.189</b>	<b>2.1</b>	<b>70.8</b>
<b>165</b>	<b>191.191</b>	<b>1.4</b>	<b>80.6</b>
<b>166</b>	<b>197.197</b>	<b>0.9</b>	<b>87.5</b>
167	200.200	3.2	55.6
168	61.61	4.9	31.9
169	145.145	2.9	59.7
170	147.147	6.8	5.6
171	184.184	3.2	55.6
172	187.187	2.8	61.1
173	188.188	2.7	62.5
174	190.190	3.5	51.4
175	193.193	7.2	0.0
176	195.195	3.1	56.9

**Table 4. Continued.**

<b>No.</b>	<b>test Fungi (no.)</b>	<b>radial growth of <i>Ganoderma boninense</i> (cm) control = 7.2</b>	<b>% inhibition of radial mycelial growth</b>
177	198.198	7.2	0.0
178	201.201	4.3	40.3
179	203.203	3.8	47.2
180	204.204	7.2	0.0
181	205.205	3.2	55.6
182	186.186	2.7	62.5
183	194.194	2.7	62.5
184	199.199	5.8	19.4
185	208.208	3.1	56.9
186	211.211	4.4	38.9
187	215.215	2.8	61.1
188	216.216	7.2	0.0
189	217.217	2.6	63.9
190	219.219	7.2	0.0
191	220.220	3.4	52.8
192	223.223	7.2	0.0
193	228.228	3.5	51.4
194	230.230	1.8	75.0
195	231.231	2.4	66.7
196	232.232	1.2	83.3
197	235.235	0.9	87.5
198	236.236	1.8	75.0
199	244.244	1.5	79.2
200	249.249	2.1	70.8
201	252.252	2.3	68.1
202	253.253	1.6	77.8
203	255.255	1.8	75.0
204	257.257	2.2	69.4
205	210.210	1.8	75.0
206	224.224	2.4	66.7
207	245.245	4.6	36.1
208	250.250	6.0	16.7
209	254.254	5.4	25.0
210	206.206	4.1	43.1
211	225.225	4.4	38.9
212	227.227	3.0	58.3
213	233.233	6.8	5.6
214	234.234	3.8	47.2
215	237.237	4.1	43.1
216	240.240	3.4	52.8
217	246.246	4.0	44.4
218	247.247	7.2	0.0
219	248.248	6.1	15.3
220	256.256	6.2	13.9

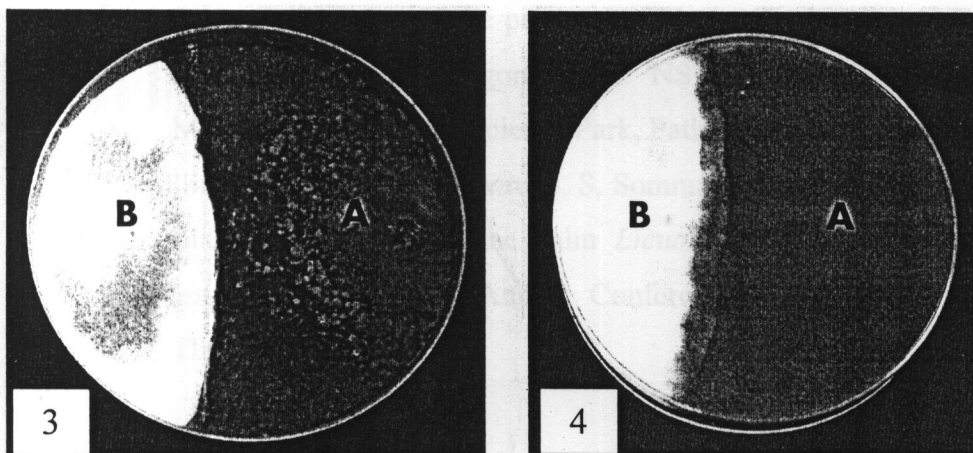
**Table 4. Continued.**

<b>No.</b>	<b>test Fungi (no.)</b>	<b>radial growth of <i>Ganoderma boninense</i> (cm) control = 7.2</b>	<b>% inhibition of radial mycelial growth</b>
221	212.212	3.9	45.8
222	262.262	2.1	70.8
223	264.264	2.4	66.7
224	266.266	1.6	77.8
225	268.268	2.4	66.7
226	275.275	1.8	75.0
227	276.276	1.8	75.0
228	278.278	3.2	55.6
229	279.279	3.2	55.6
230	281.281	2.1	70.8
231	221.221	1.8	75.0
232	241.241	3.3	54.2
233	267.267	7.1	1.4
234	269.269	3.2	55.6
235	272.272	4.0	44.4
236	273.273	7.2	0.0
237	277.277	7.2	0.0
238	280.280	1.9	73.6
239	287.287	2.6	63.9
240	289.289	2.4	66.7
241	291.291	1.9	73.6
242	292.292	4.2	41.7
243	294.294	3.1	56.9
244	295.295	2.3	68.1
245	296.296	3.6	50.0
246	301.301	3.8	47.2
247	302.302	2.4	66.7
248	303.303	4.6	36.1
249	326.326	2.2	69.4
250	327.327	3.2	55.6
251	328.328	2.3	68.1
252	329.329	2.5	65.3
253	330.330	4.0	44.4
254	331.331	2.9	59.7
255	332.332	2.2	69.4
256	333.333	1.4	80.6
257	334.334	2.5	65.3
258	338.338	2.6	63.9
259	340.340	1.6	77.8
260	341.341	5.0	30.6
261	343.343	4.2	41.7
262	345.345	3.0	58.3
263	306.306	1.9	73.6
264	307.307	3.0	58.3

Table 4. Continued.

No.	test Fungi (no.)	radial growth of <i>Ganoderma boninense</i> (cm) control = 7.2	% inhibition of radial mycelial growth
265	312.312	2.7	62.5
266	314.314	2.8	61.1
267	315.315	2.7	62.5
<b>268</b>	<b>316.316</b>	<b>2.3</b>	<b>68.1</b>
<b>269</b>	<b>317.317</b>	<b>2.2</b>	<b>69.4</b>
270	320.320	2.5	65.3
<b>271</b>	<b>323.323</b>	<b>1.7</b>	<b>76.4</b>
<b>272</b>	<b>324.324</b>	<b>1.8</b>	<b>75.0</b>
273	325.325	4.3	40.3
<b>274</b>	<b>336.336</b>	<b>1.6</b>	<b>77.8</b>
275	304.304	7.2	0.0
276	305.305	6.4	11.1
277	309.309	7.0	2.8
278	311.311	7.2	0.0
279	319.319	3.7	48.6
280	238.238	7.1	1.4

Note: Bold font = percentage inhibition of radial growth by over 65%.



Figs 3-4. Antifungal activity of endophytic fungi (A) against *G. boninense* (B) by dual culture method. 3. surface view 4. back view.



## 5. DELIVERABLES:

### 5.1. Oral Presentations

1. Pinruan, U. 2007. Endophytic and Saprophytic Palm Fungi and their Potential as Antagonists against the Oil Palm Pathogen, *Ganoderma boninense*. In: Special presentation of Chiang Mai Graduate Students. 26 March 2007, Faculty of Science, Chiang Mai University, Thailand.
2. Pinruan, U., Runggindamai, N., Choeyklin, R. and Jones, E.B.G. 2007. Basidiomycete endophytes of selected palms in Thailand. Annual Scientific meeting Ecology of fungal communities. British Mycological Society. 9-12 September 2007. Manchester, UK.

### 5.2 Poster Presentations

1. Pinruan, U., A. Pinnoi, K.D. Hyde, R. Jeewon & E.B.G. Jones. 2006. Endophytes of a peat swamp palm: *Licuala longicalycata* and *L. spinosa*. In: 8<sup>th</sup> International Mycological Congress, 20-25 August 2006, Cairns Convention Centre, Cairns, Australia.
2. Pinruan, U., A. Pinnoi, S. Lumyong, K.D. Hyde, R. Jeerwon & E.B.G. Jones. 2007. Endophytes of the palms: *Licuala longicalycata* and *L. spinosa* and their potential as antagonists. In: NSTDA Annual Conference, 28-30 March 2007, Thailand Science Park, Pathum Thani, Thailand.
3. Choeyklin, R., A. Pinnoi, U. Pinruan, S. Sommai & Jones, E.B.G., Occurrence of fungal endophytes of the palm *Licuala spinosa* and their potential as antagonists. In: BRT Annual Conference, 15-18 October 2007, Udon Thani, Thailand.

### 5.3. Papers in preparation

1. Endophytic fungi from palms in Thailand
2. Basidiomycete endophytes of the oil palm *Elaeis guineensis*.

## **Part II**

We have not proceeded with Part II of this project due to an inability to recruit suitable staff. Staff will be considered from the 2008 group of graduates.

### **FUTURE WORKS**

further these studies by carrying on the evaluation the potential of saprobic and endophytic palm fungi as antagonists of the oil palm pathogen *Ganoderma boninense*. The utilization of oil palm waste for the production of edible mushrooms by local community farmers has made.

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### **REFERENCES:**

- Cavalcante, M.S. and Eaton, R.A. 1981. Inhibition of wood-inhibiting fungi by actinomycetes. Doc. No. IRG/WG/1137.
- Khairudin, H. 1993. Basal stem rot of oil palm caused by *Ganoderma boninense*: an update. Proc. Of the 1993 PORIM International Palm Oil Congress Agriculture Conference. PORIM, Bangi. p. 739-749.