

APPENDIX A

Chemical Reagents

Various chemical reagents were used during the present study. Indian ink, potassium hydroxide (KOH), lactophenol and Melzer's reagent were used in the examination of fungal specimens, while Congo red was used in determination of qualitative activity of cellulase and mannanase.

Indian ink was used infrequently, but was found to be useful when observing gelatinous appendages of ascospores in some species.

Potassium Hydroxide was routinely used in the rehydration of ascomycetes, especially the apothecial ascomycetes. 3%, 5% and 10% KOH was used.

Lactophenol was used routinely in the preparation of semipermanent slides. It was prepared as following formula:

Phenol (pure crystals)	20 g
Lactic acid	20 g
Glycerol	40 g
Water	20 ml

Melzer's reagent was used in the examination of ascomycetes. Frequently colour-change reactions occur in Melzer's reagent. The amyloid reaction (blue) of apical pore is often of taxonomic importance.

Chloral hydrate	100 g
Potassium Iodide	5 g
Iodine	1.5 g
Distilled water	100 ml

Congo red was used in determination of qualitative activity of cellulase and mannanase. Cellulase or mannanase test plates (containing appropriate basal liquid medium) incubated in darkness for 16 h were stained by 0.2% Congo red for 15 min and destained by an excess 1 M NaCl.

Media

Various media were used in the current study as culture medium, storage medium or test medium, and prepared as followed formula (in 1 L distilled water).

Basal liquid medium (Cellulase)

$C_4H_{12}N_2O_6$	5 g
KH_2PO_4	1 g
$MgSO_4 \cdot 7H_2O$	0.5 g
Yeast extract	0.1 g
$CaCl_2 \cdot 2H_2O$	0.001 g
Carboxymethylcellulose	20 g

Basal liquid medium (Mannanase)

KH_2PO_4	2 g
$NaNO_3$	2 g
$MgSO_4 \cdot 7H_2O$	0.3 g
$CaCl_2 \cdot 2H_2O$	0.3 g
Trace metal solution	1 g
Locust bean gum	10 g
Corn steep solid	1 g

Corn meal agar (CMA)

Corn meal	60 g
Agar	15 g, pH 5.6

Malt peptone agar (MPA)

Malt extract	30 g
Peptone	3 g
Agar	15 g, pH 5.6

Nutrient agar (NA)

Beef extract	3 g
Peptone	5 g
Agar	15 g, pH 7

Potato dextrose agar (PDA)

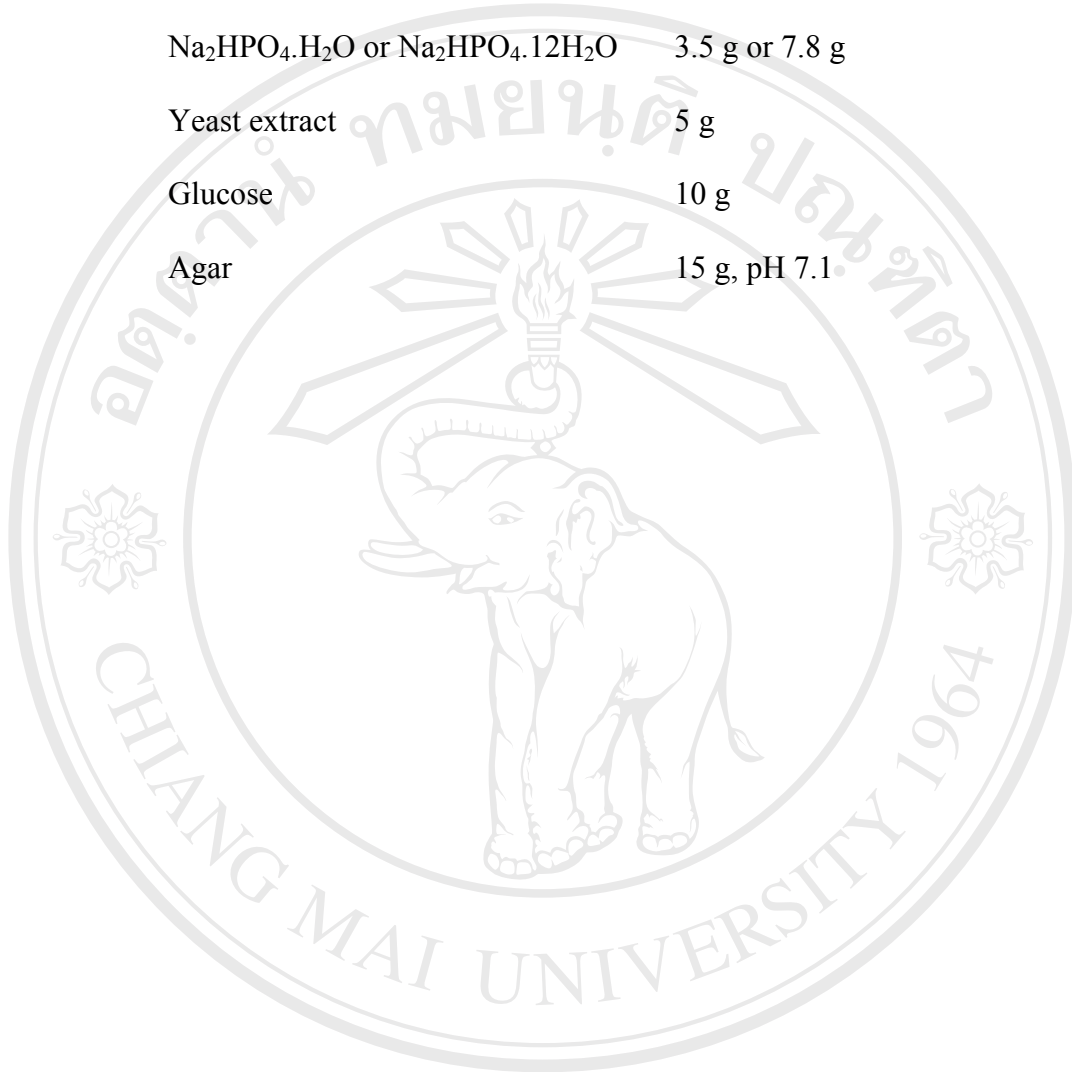
Potatoes	200 g
Glucose	20 g
Agar	15 g, pH 5.6

Skim milk agar

Skim milk	10 g
Agar	15 g

Yeast glucose agar (YGA)

KH_2PO_4	0.5 g
$\text{Na}_2\text{HPO}_4 \cdot \text{H}_2\text{O}$ or $\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$	3.5 g or 7.8 g
Yeast extract	5 g
Glucose	10 g
Agar	15 g, pH 7.1



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APPENDIX B

Table B.1 Average number of fungal isolates recovered from different tissue types from each plant.

Tissue type	<i>Alpinia malaccensis</i>				<i>Amomum siamense</i>			
	Wet season		Dry season		Wet season		Dry season	
	HKM	DP	HKM	DP	HKM	MPG	HKM	MPG
Pseudostem	5.1	7.4	7.3	4.8	4.4	6.0	6.5	5.2
Rhizome	3.3	2.2	4.4	2.8	3.1	4.7	4.8	4.2
Vein (old)	4.8	6.3	6.8	5.7	5.2	5.6	5.8	6.4
Intervein (old)	4.5	6.3	6.6	6.1	5.8	7.0	6.7	6.3
Vein (young)	4.6	4.3	4.7	4.0	4.7	6.2	3.0	4.6
Intervein (young)	4.3	4.1	5.4	3.7	5.2	6.7	2.2	2.6

Tissue type	<i>Etilingera littoralis</i>				<i>Etilingera elatior</i>			
	Wet season		Dry season		Wet season		Dry season	
	HKM	MPG	HKM	MPG	QSBG	CMU	QSBG	CMU
Pseudostem	5.8	5.2	3.5	3.3	3.0	1.2	1.1	1.0
Rhizome	2.0	4.3	1.1	1.8	1.1	1.2	2.5	1.0
Vein (old)	0.4	1.0	2.4	3.4	5.3	2.9	4.3	4.1
Intervein (old)	0.6	1.5	3.2	1.5	1.3	1.5	2.2	1.5
Vein (young)	1.0	1.5	2.0	2.8	0.4	1.5	2.0	1.5
Intervein (young)	0.3	0.5	1.9	1.6	0.1	1.4	1.1	0.3

Tissue type	<i>Alpinia galanga</i>				<i>Zingiber officinale</i>			
	Wet season		Dry season		Year 2000		Year 2001	
	CM	LP	CM	LP	PC	PB	PC	PB
Pseudostem	4.1	3.2	3.8	3.2	4.1	5.0	4.3	4.0
Rhizome	2.2	1.3	1.1	0.9	2.5	2.2	3.0	1.7
Vein (old)	3.0	1.1	2.2	2.1	5.1	4.7	5.7	3.4
Intervein (old)	3.5	0.6	3.7	1.5	4.1	5.2	5.1	1.7
Vein (young)	2.8	1.0	3.7	1.4	3.3	4.3	5.1	3.2
Intervein (young)	2.1	0.5	2.2	1.3	3.1	4.0	5.8	2.7

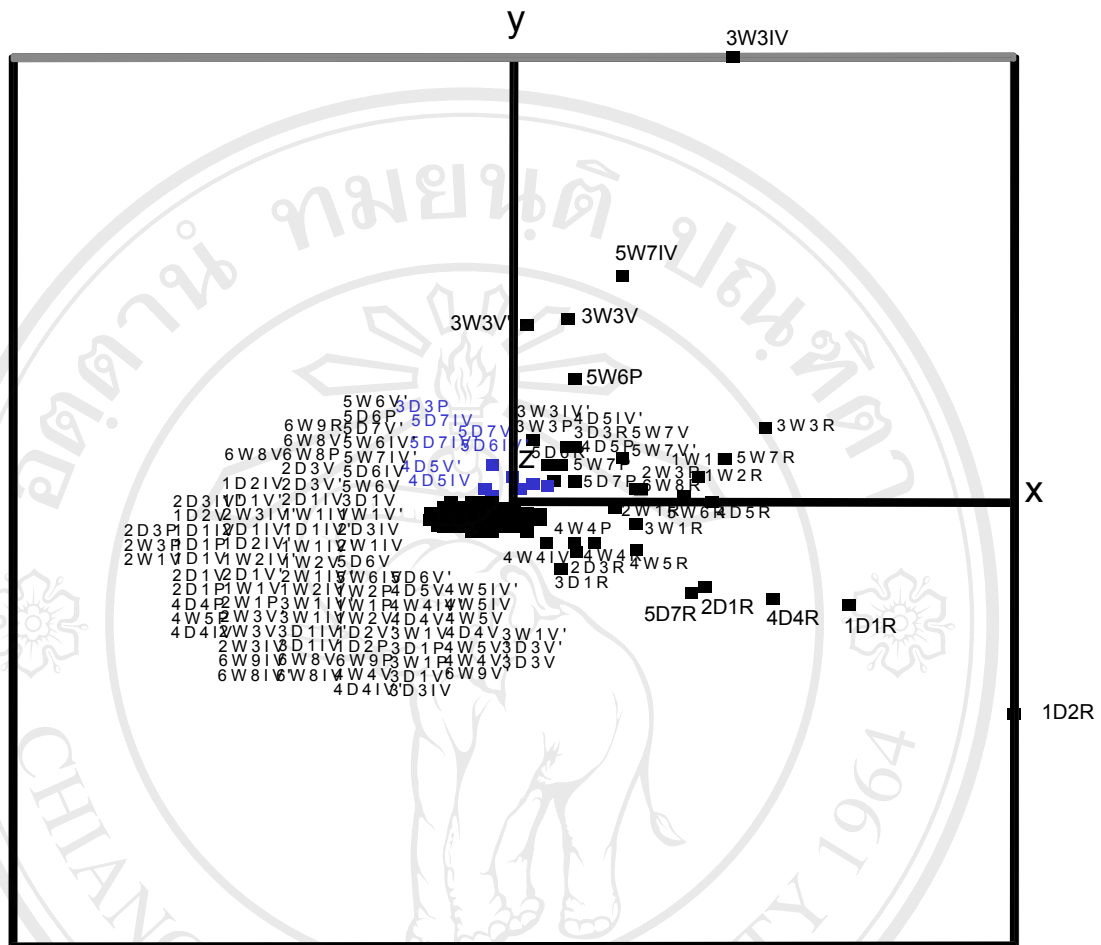


Figure B.1 Three dimensional correspondence analyses for the fungal compositions of Zingiberaceae. The first digit refers to plant species: 1. *Alpinia malaccensis*, 2. *Amomum siamense*, 3. *Etilingera littoralis*, 4. *Etilingera elatior*, 5. *Alpinia galanga*, 6. *Zingiber officinale*. The second digit refers to sites: 1. Huay Kok Ma, 2. Doi Pui, 3. Medicinal Plant Garden, 4. Queen Sirikit Botanic Garden, 5. Chiang Mai University, 6. Chiang Mai Province (Hangdong), 7. Lampang Province (Muang), 8. Phayao Province (commercial), 9. Phayao Province (backyard), D. dry season, W. wet season, IV. intervein from old leaf, V. vein from old leaf, IV'. intervein from young leaf, V'. vein from young leaf, P. pseudostem, R. rhizome. Percentage of total variance explained by the models is 99%.

APPENDIX C

Table C.1 Fungi reported from Zingiberaceae (Farr *et al.*, 1989; Sontirat *et al.*, 1994; <http://www.indexfungorum.org/Names/Names.asp>; present study).

Fungi		Host
<i>Acremonium stromaticum</i>	Anamorphic fungi	<i>Zingiber officinalis</i>
<i>Alternaria alternata</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Alternaria</i> sp.	Anamorphic fungi	<i>Curcuma roscoeana</i>
<i>Amphisphaeria amomi</i>	Ascomycetes	<i>Amomum</i> sp.
<i>Aposphaeria alpiniae</i>	Anamorphic fungi	<i>Alpinia</i> sp.
<i>Armillaria mellea</i>	Basidiomycetes	<i>Zingiber officinale</i>
<i>Arrhenia minuta</i>	Basidiomycetes	<i>Amomum</i> sp.
<i>Arthrimum euphorbiae</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Aschersonia philippinensis</i>	Anamorphic fungi	<i>Zingiber</i> sp.
<i>Aschersonia samoensis</i>	Anamorphic fungi	<i>Zingiber</i> sp.
<i>Ascochyta zingiberi</i>	Anamorphic fungi	<i>Zingiber mioga</i>
<i>Ascochyta zingibericola</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Aspergillus wentii</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Asterina</i> sp.	Ascomycetes	<i>Geostachys rupestris</i>
<i>Athelia rolfsii</i>	Basidiomycetes	<i>Zingiber officinale</i>
<i>Aulographum aframomi</i>	Ascomycetes	<i>Aframomum</i> sp.
<i>Bartalinia robillardoides</i>	Anamorphic fungi	<i>Hedychium coronarium</i>
<i>Beltraniella portoricensis</i>	Anamorphic fungi	<i>Heritiera littoralis</i>
<i>Berkleasmium nigroapicale</i>	Anamorphic fungi	<i>Amomum siamense</i>
<i>Berkleasmium suthheppuiense</i>	Anamorphic fungi	<i>Amomum siamense</i>
<i>Bertia tessellata</i>	Ascomycetes	<i>Amomum</i> sp.
<i>Botryodiplodia theobromae</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Caldariomyces</i> sp.	Anamorphic fungi	<i>Languas galanga</i>
<i>Canalisporium caribense</i>	Anamorphic fungi	<i>Amomum siamense</i>
<i>Catacauma alpiniae</i>	Ascomycetes	<i>Alpinia coerulea</i>
<i>Catacauma elettaria</i>	Ascomycetes	<i>Elettaria cardamomum</i>
<i>Catacauma renealmiae</i>	Ascomycetes	<i>Renealmia</i> sp.
<i>Ceratocystis pilifera</i>	Ascomycetes	<i>Heritiera peralata</i>
<i>Cercoseptoria zingiberis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Cercospora alpiniae</i>	Anamorphic fungi	<i>Alpinia</i> sp.
<i>Cercospora alpiniae-katsumadae</i>	Anamorphic fungi	<i>Alpinia katsumadai</i>
<i>Cercospora alpiniae-katsumadaicola</i>	Anamorphic fungi	<i>Alpinia katsumadai</i>
<i>Cercospora alpiniicola</i>	Anamorphic fungi	<i>Alpinia oxyphylla</i>
<i>Cercospora amomi</i>	Anamorphic fungi	<i>Amomum dealbatum</i>
<i>Cercospora apii</i>	Anamorphic fungi	<i>Hedychium coronarium</i>
<i>Cercospora curcumae</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Cercospora curcumae-longae</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Cercospora curcumina</i>	Anamorphic fungi	<i>Curcuma angustifolia</i>
<i>Cercospora hedychii</i>	Anamorphic fungi	<i>Hedychium coccineum</i>
<i>Cercospora hitcheniae</i>	Anamorphic fungi	<i>Hitchenia caulina</i>
<i>Cercospora nicolaiae</i>	Anamorphic fungi	<i>Nicolaia</i> sp.
<i>Cercospora</i> sp.	Anamorphic fungi	<i>Alpinia officinarum</i>
<i>Cercospora</i> sp.	Anamorphic fungi	<i>Amomum corynostachyum</i>
<i>Cercospora</i> sp.	Anamorphic fungi	<i>Curcuma amada</i>
<i>Cercospora</i> sp.	Anamorphic fungi	<i>Hedychium coronarium</i>

Table C.1 (Continued).

Fungi		Host
<i>Cercospora</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Cercospora stahlianthi</i>	Anamorphic fungi	<i>Stahlianthus involucrata</i>
<i>Cercospora zingiberi</i>	Anamorphic fungi	<i>Zingiber mioga</i>
<i>Cercospora zingibericola</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Ceriospora elettariae</i>	Ascomycetes	<i>Elettaria cardamomum</i>
<i>Ceuthocarpon tjibodense</i>	Ascomycetes	<i>Elettaria</i> sp.
<i>Chalara rostrata</i>	Anamorphic fungi	<i>Geostachys</i>
<i>Chalara</i> sp.	Anamorphic fungi	<i>Geostachys rupestris</i>
<i>Chlamydomyces palmarum</i>	Anamorphic fungi	<i>Curcuma aromatica</i>
<i>Chrysocelis globbae</i>	Basidiomycetes	<i>Globba marantina</i>
<i>Cladosporium</i> sp.	Anamorphic fungi	<i>Hedychium coronarium</i>
<i>Cladosporium</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Cladosporium</i> spp.	Anamorphic fungi	<i>Amomum</i> sp.
<i>Cladosporium tenuissimum</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Clasterosporium</i> sp.	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Cochliobolus geniculatus</i>	Ascomycetes	<i>Zingiber officinale</i>
<i>Cochliobolus lunatus</i>	Ascomycetes	<i>Curcuma longa</i>
<i>Colletotrichum capsici</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Colletotrichum gloeosporioides</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Colletotrichum</i> sp.	Anamorphic fungi	<i>Hedychium</i> sp.
<i>Colletotrichum zingiberis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Coniothyrium alpiniicola</i>	Anamorphic fungi	<i>Alpinia nutans</i>
<i>Coniothyrium</i> sp.	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Coniothyrium zingiberis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Corticium centrifugum</i>	Basidiomycetes	<i>Zingiber mioga</i>
<i>Corticium rolfsii</i>	Basidiomycetes	<i>Zingiber officinale</i>
<i>Corticium solani</i>	Basidiomycetes	<i>Zingiber officinale</i>
<i>Corticium</i> sp.	Basidiomycetes	<i>Zingiber officinale</i>
<i>Crepidotus alpiniae</i>	Basidiomycetes	<i>Alpinia aromatica</i>
<i>Curvularia intermedia</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Curvularia lunata</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Curvularia</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Cylindrocarpon tenue</i>	Anamorphic fungi	<i>Heritiera littoralis</i>
<i>Dactylaria curcumae</i>	Anamorphic fungi	<i>Curcuma aromatica</i>
<i>Dactylium alpiniae</i>	Anamorphic fungi	<i>Alpinia speciosa</i>
<i>Daedalea sanguinea</i>	Basidiomycetes	<i>Heritiera</i> sp.
<i>Dendryphiella infuscans</i>	Anamorphic fungi	<i>Curcuma aromatica</i>
<i>Desmellopsis aframomicola</i>	Basidiomycetes	<i>Aframomum citratum</i>
<i>Dictyopeltella domingensis</i>	Ascomycetes	<i>Renealmia aromatica</i>
<i>Dictyopeltis domingensis</i>	Ascomycetes	<i>Renealmia aromatica</i>
<i>Dictyosporium elegans</i>	Anamorphic fungi	<i>Heritiera littoralis</i>
<i>Didymella</i> sp.	Ascomycetes	<i>Elettaria cardamomum</i>
<i>Didymostilbe macrospora</i>	Anamorphic fungi	<i>Amomum</i> sp.
<i>Dimeriella dendrocalami</i>	Ascomycetes	<i>Zingiber mioga</i>
<i>Diplodia natalensis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Dischloridium laeense</i>	Anamorphic fungi	<i>Amomum</i> sp.
<i>Dothidella renealmiae</i>	Ascomycetes	<i>Renealmia</i> sp.
<i>Drechslera maydis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Fomes robiniae</i>	Basidiomycetes	<i>Heritiera minor</i>
<i>Fusariella bizzoeriana</i>	Anamorphic fungi	<i>Heritiera littoralis</i>
<i>Fusarium longipes</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Fusarium oxysporum</i>	Anamorphic fungi	<i>Zingiber officinale</i>

Table C.1 (Continued).

Fungi		Host
<i>Fusarium oxysporum</i> f. sp. <i>zingiberi</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Fusarium roseum</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Fusarium solani</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Fusarium</i> sp.	Anamorphic fungi	<i>Alpinia zerumbet</i>
<i>Fusarium</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Gaeumannomyces amomi</i>	Ascomycetes	<i>Alpinia malaccensis</i>
<i>Gaeumannomyces amomi</i>	Ascomycetes	<i>Amomum siamense</i>
<i>Ganoderma applanatum</i>	Basidiomycetes	<i>Heritiera trifoliolata</i>
<i>Ganoderma australe</i>	Basidiomycetes	<i>Heritiera trifoliolata</i>
<i>Ganoderma laccatum</i>	Basidiomycetes	<i>Heritiera trifoliolata</i>
<i>Geotrichum zingiberis-saccharati</i>	Anamorphic fungi	<i>Zingiber saccharati</i>
<i>Gliocladium roseum</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Glomerella cingulata</i>	Ascomycetes	<i>Zingiber officinale</i>
<i>Gnomonia scitaminearum</i>	Ascomycetes	<i>Amomum</i> sp.
<i>Gonatopyricularia amomi</i>	Anamorphic fungi	<i>Amomum villosum</i>
<i>Graphium album</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Graphium</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Guignardia amomi</i>	Ascomycetes	<i>Amomum krervanh</i>
<i>Guignardia citricarpa</i>	Ascomycetes	<i>Elettaria cardamomum</i>
<i>Helicobasidium mompa</i>	Basidiomycetes	<i>Zingiber</i> sp.
<i>Helicogloea indica</i>	Basidiomycetes	<i>Zingiberaceae</i>
<i>Hendersonia</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Hendersonia zingiberi</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Hydropisphaera rufofusca</i>	Ascomycetes	<i>Elettaria</i> sp.
<i>Hymenochaete perpusilla</i>	Basidiomycetes	<i>Heritiera littoralis</i>
<i>Hypocrella zingiberis</i>	Ascomycetes	<i>Zingiber</i> sp.
<i>Hypoxyton serpens</i>	Ascomycetes	<i>Zingiber officinale</i>
<i>Khuskia oryzae</i>	Ascomycetes	<i>Zingiber officinale</i>
<i>Klastospora curcumae</i>	Basidiomycetes	<i>Curcuma longa</i>
<i>Lecanocybe lateralis</i>	Basidiomycetes	<i>Hedychium flavescens</i>
<i>Leiosphaerella amomi</i>	Ascomycetes	<i>Alpinia malaccensis</i>
<i>Leiosphaerella amomi</i>	Ascomycetes	<i>Amomum siamense</i>
<i>Leptophyma grandispora</i>	Ascomycetes	<i>Zingiberaceae</i>
<i>Leptosphaeria alpiniae</i>	Ascomycetes	<i>Alpinia nutans</i>
<i>Leptosphaeria</i> sp.	Ascomycetes	<i>Hedychium coronarium</i>
<i>Leptosphaeria</i> sp.	Ascomycetes	<i>Kaempferia rotundata</i>
<i>Leptosphaeria</i> sp.	Ascomycetes	<i>Zingiber officinale</i>
<i>Leptosphaeria zingiberis</i>	Ascomycetes	<i>Zingiber officinale</i>
<i>Linocarpon alpiniae</i>	Ascomycetes	<i>Alpinia</i> sp.
<i>Linocarpon zingiberacicola</i>	Ascomycetes	<i>Zingiberaceae</i>
<i>Lophodermium javanicum</i>	Ascomycetes	<i>Elettaria</i> sp.
<i>Macrophoma hedychii</i>	Anamorphic fungi	<i>Hedychium coronarium</i>
<i>Macrophomina phaseolina</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Maireella tarrietae</i>	Ascomycetes	<i>Heritiera trifoliolata</i>
<i>Marasmiellus pacificus</i>	Basidiomycetes	<i>Alpinia purpurata</i>
<i>Marasmius amomi</i>	Basidiomycetes	<i>Amomum</i> sp.
<i>Marasmius equicrinis</i>	Basidiomycetes	<i>Heritiera minor</i>
<i>Maravaria pseudosuprastomatalis</i>	Basidiomycetes	<i>Globba</i> sp.
<i>Meliola amomicola</i>	Ascomycetes	<i>Amomum caryophyllata</i>
<i>Meliola heritiericola</i>	Ascomycetes	<i>Heritiera littoralis</i>
<i>Meliola monopl</i>	Ascomycetes	<i>Alpinia aromatica</i>
<i>Memnoniella echinata</i>	Anamorphic fungi	<i>Zingiber officinalis</i>

Table C.1 (Continued).

Fungi		Host
<i>Memnoniella zingiberis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Micropeltis ekmanii</i>	Ascomycetes	<i>Renealmia aromatica</i>
<i>Microthyriella azorica</i>	Ascomycetes	<i>Hedychium gardnerianum</i>
<i>Microthyriella scutelliformis</i>	Ascomycetes	<i>Amomum</i> sp.
<i>Microthyrium subulatum</i>	Ascomycetes	<i>Amomum subulatum</i>
<i>Monosporium alpiniae</i>	Anamorphic fungi	<i>Alpinia speciosa</i>
<i>Morfea moniliforme</i>	Ascomycetes	<i>Alpinia</i> sp.
<i>Mycena aculeifera</i>	Basidiomycetes	<i>Amomum</i> sp.
<i>Mycena digitata</i>	Basidiomycetes	Zingiberaceae
<i>Mycosphaerella alpiniae</i>	Ascomycetes	<i>Alpinia katsumadai</i>
<i>Mycosphaerella alpinicola</i>	Ascomycetes	<i>Alpinia oxyphylla</i>
<i>Mycosphaerella amomi</i>	Ascomycetes	<i>Amomum compactum</i>
<i>Mycosphaerella hedychii</i>	Ascomycetes	<i>Hedychium coronarium</i>
<i>Mycosphaerella</i> sp.	Ascomycetes	<i>Amomum coccineum</i>
<i>Mycosphaerella</i> sp.	Ascomycetes	<i>Hedychium coronarium</i>
<i>Mycosphaerella</i> sp.	Ascomycetes	<i>Zingiber officinale</i>
<i>Mycosphaerella zingiberi</i>	Ascomycetes	<i>Zingiber officinalis</i>
<i>Mycosphaerella zingiberis</i>	Ascomycetes	<i>Zingiber mioga</i>
<i>Myrothecium roridum</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Myrothecium</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Nakataea</i> sp.	Anamorphic fungi	<i>Languas galanga</i>
<i>Nectria albo-fimbriata</i>	Ascomycetes	<i>Elettaria</i> sp.
<i>Nectria aureofulva</i>	Ascomycetes	<i>Elettaria</i> sp.
<i>Nectria dolichospora</i>	Ascomycetes	<i>Amomum</i> sp.
<i>Nectria egans</i>	Ascomycetes	<i>Zingiber crescentia</i>
<i>Nectria haematococca</i>	Ascomycetes	<i>Elettaria cardamomum</i>
<i>Nectria leucotricha</i>	Ascomycetes	<i>Elettaria</i> sp.
<i>Nectria raripila</i>	Ascomycetes	<i>Elettaria</i> sp.
<i>Nectria sesquiphialis</i>	Ascomycetes	Zingiberaceae
<i>Nectriella setulosa</i>	Ascomycetes	<i>Elettaria</i> sp.
<i>Nectriella zingiberis</i>	Ascomycetes	<i>Zingiber officinale</i>
<i>Nectriella zingiberis</i> var. <i>pallida</i>	Ascomycetes	<i>Zingiber officinale</i>
<i>Neottiospora curcumae</i>	Anamorphic fungi	<i>Curcuma amada</i>
<i>Passalora curcumae</i>	Anamorphic fungi	<i>Curcuma reclinata</i>
<i>Patinellaria hedychii</i>	Ascomycetes	<i>Hedychium acuminatum</i>
<i>Pellicularia rolfsii</i>	Basidiomycetes	<i>Zingiber mioga</i>
<i>Penicillium</i> spp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Periconia minutissima</i>	Anamorphic fungi	<i>Hedychium gardnerianum</i>
<i>Pestalospaeria alpiniae</i>	Ascomycetes	<i>Alpinia oxyphylla</i>
<i>Pestalotia funerea</i> var. <i>hedychii</i>	Anamorphic fungi	<i>Hedychium coronarium</i>
<i>Pestalotia</i> sp.	Anamorphic fungi	<i>Amomum subulatum</i>
<i>Pestalotia vismae</i>	Anamorphic fungi	<i>Amomum subulatum</i>
<i>Pestalotiopsis alpiniae</i>	Anamorphic fungi	<i>Alpinia galanga</i>
<i>Pestalotiopsis microspora</i>	Anamorphic fungi	<i>Hedychium coronarium</i>
<i>Phaeochaetia amomicola</i> var. <i>minispora</i>	Ascomycetes	<i>Amomum magnificum</i>
<i>Phaeodactylium alpiniae</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Phaeodactylium alpiniae</i>	Anamorphic fungi	<i>Alpinia</i> sp.
<i>Phaeodactylium curvularioides</i>	Anamorphic fungi	<i>Curcuma aromatica</i>
<i>Phaeodactylium venkatesanum</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Phaeorobillarda curcumae</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Phaeosaccardinula javanica</i>	Ascomycetes	<i>Alpinia speciosa</i>
<i>Phaeosphaeria zingiberis</i>	Ascomycetes	<i>Zingiber officinale</i>

Table C.1 (Continued).

Fungi		Host
<i>Phaeotrichoconis crotalariae</i>	Anamorphic fungi	<i>Zingiber officinalis</i>
<i>Phakopsora elettariae</i>	Basidiomycetes	<i>Phaeomeria speciosa</i>
<i>Pseudocercospora hedychii</i>	Anamorphic fungi	<i>Hedychium coccineum</i>
<i>Pseudocercospora nicolaiae</i>	Anamorphic fungi	<i>Nicolaia</i> sp.
<i>Phoma amomi</i>	Anamorphic fungi	<i>Amomum compactum</i>
<i>Phoma</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Phomopsioides natalinae</i>	Anamorphic fungi	<i>Hedychium gardnerianum</i>
<i>Phomopsis alpiniae</i>	Anamorphic fungi	<i>Alpinia nutans</i>
<i>Phomopsis conspicua</i>	Anamorphic fungi	<i>Alpinia</i> sp.
<i>Phomopsis</i> sp.	Anamorphic fungi	<i>Hedychium</i> sp.
<i>Phomopsis zingiberis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Phyllachora alpiniae</i>	Ascomycetes	<i>Alpinia coerulea</i>
<i>Phyllachora elettariae</i>	Ascomycetes	<i>Elettaria cardamomum</i>
<i>Phyllachora renealmiae</i>	Ascomycetes	<i>Renealmia</i> sp.
<i>Phyllachora</i> sp.	Ascomycetes	<i>Tapeinochilos</i> sp.
<i>Phyllosticta alpiniae</i>	Anamorphic fungi	<i>Alpinia speciosa</i>
<i>Phyllosticta alpiniae-kelungensis</i>	Anamorphic fungi	<i>Alpinia kelungensis</i>
<i>Phyllosticta curcumae</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Phyllosticta elettariae</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Phyllosticta hedychii</i>	Anamorphic fungi	<i>Hedychium</i> sp.
<i>Phyllosticta</i> sp.	Anamorphic fungi	<i>Amomum cardamomum</i>
<i>Phyllosticta</i> sp.	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Phyllosticta</i> sp.	Anamorphic fungi	<i>Kaempferia rotundata</i>
<i>Phyllosticta</i> sp.	Anamorphic fungi	<i>Zingiber aromaticum</i>
<i>Phyllosticta zingiberis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Phyllosticta zingiberis</i>	Anamorphic fungi	<i>Zingiber zerumbet</i>
<i>Placostroma elettariae</i>	Ascomycetes	<i>Elettaria floribunda</i>
<i>Poria</i> sp.	Basidiomycetes	<i>Zingiber officinale</i>
<i>Protocreopsis zingibericola</i>	Ascomycetes	<i>Zingiberaceae</i>
<i>Pseudocercospora alpiniae</i>	Anamorphic fungi	<i>Alpinia officinarum</i>
<i>Pseudocercospora alpiniicola</i>	Anamorphic fungi	<i>Alpinia officinarum</i>
<i>Puccinia aframomi</i>	Basidiomycetes	<i>Aframomum citratum</i>
<i>Puccinia aframomi-gigantei</i>	Basidiomycetes	<i>Aframomum giganteum</i>
<i>Puccinia curcumae</i>	Basidiomycetes	<i>Curcuma</i> sp.
<i>Puccinia roscoae</i>	Basidiomycetes	<i>Roscoea alpina</i>
<i>Puccinia zingiberis</i>	Basidiomycetes	<i>Zingiber officinale</i>
<i>Pyrenochaetina curcumae</i>	Ascomycetes	<i>Curcuma aromatica</i>
<i>Pyricularia curcumae</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Pyricularia distorta</i>	Anamorphic fungi	<i>Alpinia</i> sp.
<i>Pyricularia distorta</i>	Anamorphic fungi	<i>Catymbrium</i> sp.
<i>Pyricularia globbae</i>	Anamorphic fungi	<i>Globba</i> sp.
<i>Pyricularia kookicola</i>	Anamorphic fungi	<i>Amomum siamense</i>
<i>Pyricularia longispora</i>	Anamorphic fungi	<i>Amomum siamense</i>
<i>Pyricularia variabilis</i>	Anamorphic fungi	<i>Amomum siamense</i>
<i>Pyricularia zingiberis</i>	Anamorphic fungi	<i>Curcuma aromatica</i>
<i>Pyricularia zingiberis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Pyriculariopsis miogae</i>	Anamorphic fungi	<i>Zingiber mioga</i>
<i>Ramichloridium amomi</i>	Anamorphic fungi	<i>Amomum krervanh</i>
<i>Rhabdospora elettariae</i>	Anamorphic fungi	<i>Elettaria</i> sp.
<i>Rhizoctonia solani</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Rhizoctonia</i> sp.	Anamorphic fungi	<i>Alpinia purpurata</i>
<i>Rhizoctonia</i> sp.	Anamorphic fungi	<i>Hedychium coronarium</i>

Table C.1 (Continued).

Fungi		Host
<i>Rhizoctonia</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Rhombostilbella crus-pavonis</i>	Anamorphic fungi	<i>Amomum magnificum</i>
<i>Rosellinia zingiberis</i>	Ascomycetes	<i>Zingiber officinale</i>
<i>Schroeteriaster elettariae</i>	Basidiomycetes	<i>Elettaria</i> sp.
<i>Sclerotium rolsfii</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Scolecobasidium humicola</i>	Anamorphic fungi	<i>Zingiber officinalis</i>
<i>Scolecobasidium terreum</i>	Anamorphic fungi	<i>Zingiber officinalis</i>
<i>Septoria amomi</i>	Anamorphic fungi	<i>Amomum villosum</i>
<i>Septoria renealmiae</i>	Anamorphic fungi	<i>Renealmia cinnamomum</i>
<i>Septoria</i> sp.	Anamorphic fungi	<i>Curcuma</i> sp.
<i>Septoria</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Septoria zingiberis</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Sesquicillium asymmetricum</i>	Anamorphic fungi	Zingiberaceae
<i>Sphaceloma cardamomi</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Sphaceloma curcumae</i>	Anamorphic fungi	<i>Curcuma</i> sp.
<i>Sphaceloma</i> sp.	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Sporidesmina malabarica</i>	Anamorphic fungi	<i>Curcuma</i> sp.
<i>Sporidesmiopsis malabarica</i>	Anamorphic fungi	<i>Curcuma</i> sp.
<i>Sporidesmium minigelatinosum</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Sporobolomyces</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Stachybotrys sansevieriae</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Stachybotrys subsimplex</i>	Anamorphic fungi	<i>Hedychium gardnerianum</i>
<i>Stenella alpiniae</i>	Anamorphic fungi	<i>Alpinia</i> sp.
<i>Stilbella candidula</i>	Anamorphic fungi	<i>Amomum</i> sp.
<i>Strossmayeria notabilis</i>	Ascomycetes	<i>Amomum coccineum</i>
<i>Taphrina linearis</i>	Ascomycetes	<i>Globba marantina</i>
<i>Taphrina maculans</i>	Ascomycetes	<i>Zingiber cassumuner</i>
<i>Taphrina maculans</i>	Ascomycetes	<i>Zingiber zerumbet</i>
<i>Thanatephorus cucumeris</i>	Basidiomycetes	<i>Curcuma domestica</i>
<i>Thirumalacharia curcumae</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Trametes strigata</i>	Basidiomycetes	<i>Heritiera</i> sp.
<i>Trichasterina heritierae</i>	Ascomycetes	<i>Heritiera angustifolia</i>
<i>Tripospermum</i> sp.	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Tubulicium vermiferum</i> ssp. <i>raphidosporum</i>	Basidiomycetes	<i>Aframomum</i> sp.
<i>Typhula thindii</i>	Basidiomycetes	<i>Hedychium acuminatum</i>
<i>Uredo aframomi</i>	Basidiomycetes	<i>Aframomum</i> sp.
<i>Uredo amomi</i>	Basidiomycetes	<i>Amomum involucreatum</i>
<i>Uredo elettariae</i>	Basidiomycetes	<i>Elettaria cardamomum</i>
<i>Uredo kaempferiae</i>	Basidiomycetes	<i>Kaempferia ethela</i>
<i>Uredo longozyi</i>	Basidiomycetes	<i>Aframomum daniellii</i>
<i>Vermicularia curcumae</i>	Anamorphic fungi	<i>Curcuma longa</i>
<i>Vermicularia zingiberiae</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Verticillium chlamydosporium</i>	Anamorphic fungi	<i>Zingiber officinale</i>
<i>Wiesneriomyces javanicus</i>	Anamorphic fungi	<i>Heritiera littoralis</i>
<i>Xenosporium amomi</i>	Anamorphic fungi	<i>Amomum siamense</i>
<i>Xenosporium intermedium</i>	Anamorphic fungi	<i>Elettaria cardamomum</i>
<i>Xenosporium mirabile</i>	Anamorphic fungi	<i>Elettaria</i> sp.
Basidiomycetes	44	
Ascomycetes	85	
Anamorphic fungi	171	
Total taxa	300	

Descriptions of fungi that probably undescribed species

Berkleasmium sp.

Colonies on natural substratum in the form of sporodochia, granular, black, shiny. *Mycelium* immersed in the substratum, composed of pale brown to brown, smooth, branched. *Conidiophores* up to 17 μm high, 3.5–4.5 μm diam, macronematous, septate, hyaline to very pale brown, smooth. *Conidia* 17–18.5 \times 15.5–17 μm , (\bar{x} = 18.1 \times 16.1 μm , n = 20), solitary, broadly clavate, muriform, smooth.

Material examined: THAILAND, Chiang Mai, Doi Suthep Pui National Park, on dead pseudostems of *Amomum siamense* (Zingiberaceae), 15 October 2000, B. Bussaban CMUZS116.

Known distribution: Thailand

Dactylaria sp. 1

Colonies on natural substratum scattered, brown. *Conidiophores* up to 200 μm long, 4–5 μm thick, macronematous, unbranched, straight or flexuous, septate, dark brown, becoming pale brown to subhyaline towards the denticulate apex.

Conidiogenous cells integrated, terminal, cylindrical, proliferating sympodially, with cylindrical denticles. Conidial secession schizolytic. *Conidia* 40–42.5 \times 7–7.5 μm , (\bar{x} = 41.6 \times 7.4 μm , n = 20), solitary, dry, naviculate to fusiform, mostly with parallel sides, conically acuminate at the base, hyaline to pale brown, smooth, 4-septate.

Material examined: THAILAND, Chiang Mai, Doi Suthep Pui National Park, on dead pseudostems of *Amomum siamense* (Zingiberaceae), 15 October 2000, B. Bussaban CMUZS40.

Known distribution: Thailand

***Dactylaria* sp. 2**

Colonies on natural substratum scattered, greyish to olivaceous brown. *Conidiophores* up to 46 µm long, 3–4 µm thick, macronematous, unbranched, straight or flexuous, septate, dark brown, becoming pale brown to subhyaline towards the denticulate apex. *Conidiogenous cells* integrated, terminal, cylindrical, proliferating sympodially, with cylindrical denticles. Conidial secession schizolytic. *Conidia* 15.5–20 × 1.5–1.7 µm, (\bar{x} = 17.8 × 1.6 µm, n = 20), solitary, dry, naviculate, rounded at the apex, conically acuminate at the base, hyaline, smooth, 4-septate.

Material examined: THAILAND, Chiang Mai, Doi Suthep Pui National Park, on dead pseudostems of *Amomum siamense* (Zingiberaceae), 15 October 2000, B. Bussaban CMUZS125.

Known distribution: Thailand

***Dictyosporium* sp. 1**

Colonies on natural substratum in the form of sporodochia, greenish to black. *Conidiophores* short, bearing cylindrical conidiogenous cells. *Conidia* 30.5–37.5 × 13.5–17 µm, (\bar{x} = 33.0 × 15.4 µm, n = 20), uniformly medium brown, broadly ellipsoidal, not complanate, consisting of 6 curved rows of cells closely appressed together, each row terminating in an incurved, hook-like apex. The rows of the cells

separate only under pressure. The basal cells of the conidia being provided with appendages which is hyaline, swollen at the apex.

Material examined: THAILAND, Chiang Mai, Doi Suthep Pui National Park, on dead pseudostems of *Amomum siamense* (Zingiberaceae), 15 October 2000, B. Bussaban CMUZS113.

Known distribution: Thailand

***Dictyosporium* sp. 2**

Colonies on natural substratum in the form of sporodochia, golden brown. *Conidiophores* short, bearing cylindrical conidiogenous cells. *Conidia* 30.5–35.5 × 13.5–15.5 μm, (\bar{x} = 23.9 × 14.3 μm, n = 20), uniformly pale brown with hyaline apex cells, cylindrical, not complanate, consisting of 5 rows of cells arranged in a compact cylinder. Conidial appendages absent.

Material examined: THAILAND, Chiang Mai, Doi Suthep Pui National Park, on dead pseudostems of *Amomum siamense* (Zingiberaceae), 15 October 2000, B. Bussaban CMUZS115.

Known distribution: Thailand

***Pyricularia* sp.**

Colonies on natural substratum scattered, dark brown. *Conidiophores* up to 150 μm long, 4.5–5 μm thick, macronematous, rarely branched, straight, septate, dark brown near the base, often subhyaline at the apex. *Conidiogenous cells* cylindrical, denticulate; each denticle cylindrical, thin-walled, mostly cut off as by septum to form

a separating cell. *Conidia* 115–125 × 6–7.5 µm, (\bar{x} = 120.5 × 6.2 µm, n = 20), solitary, dry, obpyriform to obclavate, hyaline to pale brown, smooth, 6–7-septate.

Material examined: THAILAND, Chiang Mai, Doi Suthep Pui National Park, on dead pseudostems of *Amomum siamense* (Zingiberaceae), 15 October 2000, B. Bussaban CMUZS60.

Known distribution: Thailand

***Xenosporium* sp.**

Colonies on natural substratum effuse, at first white with scattered developing conidia, becoming dark brown. *Mycelium* superficial, composed of pale to dark brown, branching, septate hyphae. *Conidiophores* up to 45 µm long, 4.5–5 µm thick, macronematous, erect or flexuous, septate, simple, pale brown to brown, smooth. *Conidia* 56–71 × 29–37 µm (\bar{x} = 61.6 × 33.2 µm, n = 20), formed singly at the apex of conidiophore, at first hyaline, becoming dark brown with hyaline, distinctly cylindrical basal cell, composed of 5 rows of cells with dark, thickened walls, muriform, ellipsoid. *Secondary conidia* 5–10 µm diam, subglobose to globose, 3–4 formed at the apex of the primary conidia, muriform, hyaline to brown.

Material examined: THAILAND, Chiang Mai, Doi Suthep Pui National Park, on dead pseudostems of *Amomum siamense* (Zingiberaceae), 15 October 2000, B. Bussaban CMUZS138.

Known distribution: Thailand

APPENDIX D

Nucleotide sequence and GenBank accession number of ITS1 5.8S ITS2 rRNA of

Chaetomium globosum (CMUZE0132)51: [DQ003217](#). Reports *Chaetomium globosum*...[gi:62912505]

LOCUS DQ003217 575 bp DNA linear PLN 02-MAY-2005
DEFINITION *Chaetomium globosum* 18S ribosomal RNA gene, partial sequence; internal transcribed spacer 1, 5.8S ribosomal RNA gene, and internal transcribed spacer 2, complete sequence; and 28S ribosomal RNA gene, partial sequence.
ACCESSION DQ003217
VERSION DQ003217.1 GI:62912505
KEYWORDS .
SOURCE *Chaetomium globosum*
ORGANISM *Chaetomium globosum*
Eukaryota; Fungi; Ascomycota; Pezizomycotina; Sordariomycetes; Sordariomycetidae; Sordariales; Chaetomiaceae; *Chaetomium*.
REFERENCE 1 (bases 1 to 575)
AUTHORS Bussaban,B.
TITLE Evaluation of endophytic fungi on antimicrobial production
JOURNAL Unpublished
REFERENCE 2 (bases 1 to 575)
AUTHORS Bussaban,B.
TITLE Direct Submission
JOURNAL Submitted (09-APR-2005) Biology, Chiang Mai University, Huaykaew, Muang, Chiang Mai 50200, Thailand
FEATURES
Location/Qualifiers
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541 gctgaactta agcatatcaa taagcgaagg aagct

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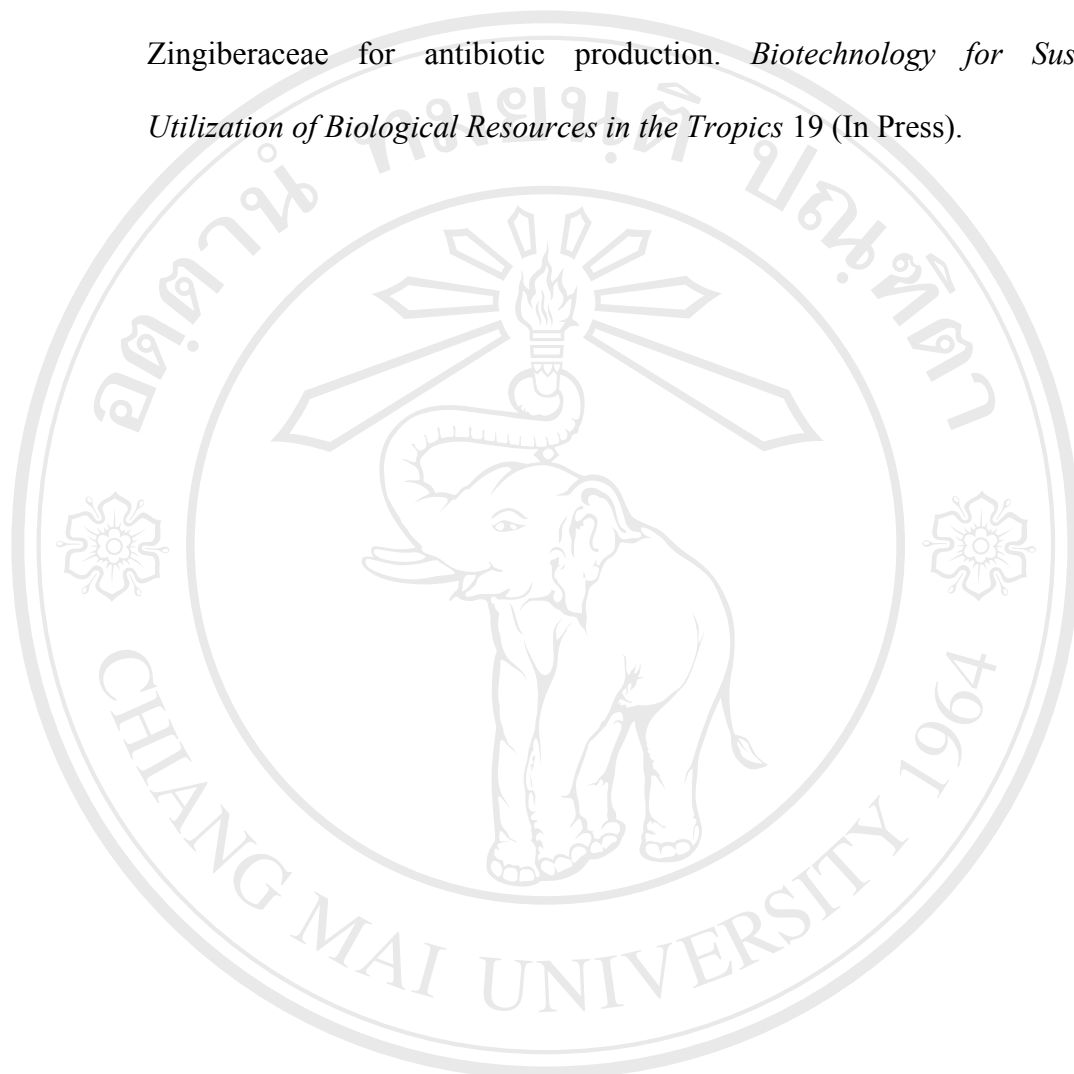
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