

# **FINAL REPORT**

## **FUNGAL COMMUNITIES ON DECAYING SEEDS OF THE DIPTEROCARPACEAE**

**(BRT R\_150007)**

**JANUARY 2007 – JUNE 2008**

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CHALIDA CHAMOI  
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## บทสรุปผู้บริหาร

งานวิจัยนี้ศึกษาเชื้อราที่เจริญบนซากเมล็ดยาง เพื่อให้ได้ข้อมูลทางนิเวศวิทยาของเชื้อราที่สัมพันธ์กับไม้ยืนต้นที่สำคัญในป่าเขตร้อน และเพื่อทำการแยกเชื้อราเหล่านี้เก็บเป็นเชื้อบริสุทธิ์ที่ปราศจากการปนเปื้อนเพื่อใช้ประโยชน์ต่อไป การศึกษาครั้งนี้หากพบเชื้อราชนิดใหม่ก็จะทำการตั้งชื่อ บรรยายลักษณะ และตีพิมพ์ในวารสารวิชาการนานาชาติ

วิธีการการศึกษาทำโดยเก็บตัวอย่างซากเมล็ดพืชวงศ์ยาง นำมาบ่มในภาชนะที่มีความชื้นแล้วจึงนำมาตรวจหาเชื้อรา ซากเมล็ดที่เก็บได้แก่เมล็ดยางวาด (*Dipterocarpus chartaceus*) และยางแดง (*Dipterocarpus turbinatus*) จากอุทยานแห่งชาติเขาใหญ่ ยางนา (*Dipterocarpus alatus*) จากเขตรักษาพันธุ์สัตว์ป่าเขาสะอียด ยางป่า (*Dipterocarpus costatus*) และยางพลวง (*Dipterocarpus tuberculatus*) จากอุทยานแห่งชาติภูพาน ยางแดง (*Dipterocarpus turbinatus*) จากอุทยานแห่งชาติคอยอินทนนท์ ช่วงเวลาที่ทำการศึกษาคือระหว่างเดือนมิถุนายน 2550 ถึงเดือนมิถุนายน 2551

การศึกษานี้รายงานข้อมูลของสังคมเชื้อราบนซากเมล็ดพืชวงศ์ยาง 6 สังคม โดยพบว่าจำนวนเชื้อราในแต่ละสังคมมีค่าอยู่ระหว่าง 7 ถึง 16 ชนิด และสังคมมีค่าดัชนีความหลากหลายอยู่ระหว่าง 0.7-1.0 สังคมเชื้อราบนซากเมล็ดยางวาดที่อุทยานแห่งชาติเขาใหญ่ มีค่าดัชนีความหลากหลายสูงสุด ส่วนสังคมเชื้อราบนซากเมล็ดยางพลวงที่อุทยานแห่งชาติภูพาน มีค่าความหลากหลายต่ำสุด ความคล้ายคลึงกันของเชื้อราสองสังคมมีค่าอยู่ระหว่าง 9-39% สังคมเชื้อราบนซากเมล็ดยางวาดที่อุทยานแห่งชาติเขาใหญ่ กับสังคมเชื้อราบนซากเมล็ดยางนา ที่เขตรักษาพันธุ์สัตว์ป่าเขาสะอียด มีความคล้ายคลึงกันมากที่สุด (39%) ขณะที่สังคมเชื้อราบนซากเมล็ดยางวาดที่อุทยานแห่งชาติเขาใหญ่ กับสังคมเชื้อราบนซากเมล็ดยางแดง ที่อุทยานแห่งชาติคอยอินทนนท์ มีความคล้ายคลึงกันน้อยที่สุด (9%) ไม่พบอิทธิพลของชนิดเมล็ด หรือพื้นที่ที่เก็บ ที่ส่งผลต่อความคล้ายคลึงกันของเชื้อราของสองสังคม

ผลการเปรียบเทียบเชื้อราบนซากเมล็ดยาง กับเชื้อราบนผลไม้ที่ขายตามท้องตลาด และซากใบที่เก็บมาจากสวนผลไม้และป่าธรรมชาติพบว่า ชนิดเชื้อราที่พบบนซากเมล็ดยางใกล้เคียงกับชนิดเชื้อราที่พบบนซากใบไม้ และชนิดแตกต่างไปจากเชื้อราที่พบบนผลไม้ที่ขายตามท้องตลาด ซึ่งมักพบแต่ราสกุล *Penicillium* การศึกษาครั้งนี้ยังพบเชื้อราชนิดใหม่ 2 ชนิด จากซากใบที่เก็บมาจากสวนผลไม้และป่าธรรมชาติ ซึ่งได้ทำการบรรยายลักษณะและตีพิมพ์ในวารสารวิชาการนานาชาติแล้ว

## EXECUTIVE SUMMARY

The study on fungal communities colonizing dipterocarp seeds is proposed to obtain the ecological information of fungi related to the major trees of the tropical forest, and to isolate these fungi into pure culture for further utilization. Any new fungi collected during this study are described and published.

Substratum incubation and direct examination for fungi were the investigation methods. Collected dipterocarp seeds included: *Dipterocarpus chartaceus* and *Dipterocarpus turbinatus* from Khao Yai National Park; *Dipterocarpus alatus* from Khao Soi Dao Wildlife Sanctuary; *Dipterocarpus costatus* and *Dipterocarpus tuberculatus* from Phu Phan National Park; and *Dipterocarpus turbinatus* from Doi Inthanon National Park. The period of study was between June 2007 and June 2008.

Six fungal communities colonizing dipterocarp seeds are reported in this study. The number of fungal species in the communities ranged between 7 and 16. The values of species diversity ranged between 0.7 and 1.0. The community on *D. chartaceus* seeds at Khao Yai National Park possessed the highest species diversity, while that on *D. tuberculatus* seeds at Phu Phan National Park possessed the lowest species diversity. Fungal similarities between the two communities ranged between 9-39%. Fungi on *D. chartaceus* seeds at Khao Yai National Park and those on *D. alatus* seeds at Khao Soi Dao Wildlife Sanctuary are the most similar (39%) while the similarity of fungi on *D. chartaceus* seeds at Khao Yai National Park and *D. turbinatus* seeds at Doi Inthanon National Park is the least (9%). Neither seed species nor surveying site does clearly affect the similarity of the fungi between the two communities.

The comparison of fungi on dipterocarp seeds with those on the market fruits and those on decaying leaves from the orchard and the natural forests revealed that fungi colonizing on marketed fruits were limited to the *Penicillium* species while the fungi colonizing on decaying leaves were similar to those on the dipterocarps. Two new fungi were collected on decaying leaves from the orchard and the natural forests. They were described and published.



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## FUNGAL COMMUNITIES ON DECAYING SEEDS OF THE DIPTEROCARPACEAE

### INTRODUCTION

Seed fungi are an ecological group associated with seeds or any sexual propagules of plant that usually referred to as 'seeds'. They can be divided into two categories: seed-borne fungi and seed decay fungi. Seed-borne fungi are mostly pathogenic occurring on harvested and stored seeds causing economic losses, while seed decay fungi are saprobics on decaying seeds recycling nutrients in natural forests. (Somrithipol *et al.*, 2004). A previous study on seed decay fungi have recorded over 100 species (Somrithipol, 2005) including species new to science (Somrithipol *et al.*, 2002b; 2006) and species producing bioactive compounds with pharmaceutical potential (Isaka *et al.*, 2006; Sawadjoon, 2003; Sawadjoon *et al.*, 2004). These results indicate that there are many more fungal species on decaying seeds in the Thai forest waiting to be discovered and tested their bioactive properties. A further intensive study of this fungal group on seeds of a particular plant family is required to complete the knowledge on biodiversity and ecology, and to yield more culture for future utilization.

The trees in the family Dipterocarpaceae are ecological and economical significance. They predominate and distribute over a wide area of a tropical forest of Asia. They are important sources of major commercial timber (PROSEA, 1993) and various non-timber products such as camphor and resin (Shiva and Jantan, 1998; Pooma, 2003). The results on a screening program at BIOTEC revealed that some fungi colonizing dipterocarp seeds possessed the ability in producing bioactive compounds with pharmaceutical potential (e.g.: Chinworrungsee, 2004; Chinworrungsee *et al.*, 2004; Pittayakhajonwut *et al.*, 2002). A study on fungi colonizing dipterocarp seeds will provide ecological information on microorganisms in relation to the major trees of the forest, and will provide culture for further biotechnological application.

### OBJECTIVES

The objectives of this study are:

1. To collect, identify, and isolate fungi on decaying seeds of the Dipterocarpaceae in Thailand.
2. To compare the fungal communities on different seed species
3. To compare the fungal communities on decaying seeds with the communities on their surrounding substrata.
4. To describe any new fungi collected from the study.

## LITERATURE REVIEWS

### 1. Study of Seed Decay Fungi

Previous studies of seed decay fungi have resulted in the documentation of approx. 100 species. The results indicated that anamorphic fungi were dominant and are typically leaf litter inhabiting taxa while teleomorphic fungi were poorly represented (Somrithipol *et al.*, 2004). The species with high frequency of occurrence were in the genera *Dictyochaeta*, *Thozetella*, *Dinamaspodium*, and *Cryptophialoidea* (Somrithipol, 2005).

Somrithipol (2005) studied the fungal colonization of *Dipterocarpus turbinatus*, *Chlorespondias axillaris*, and *Delonix regia* fruits at the two sites in evergreen forest of Khao Yai National Park by using litterbag method. The results revealed that fungal communities on each fruit species were different. In *D. turbinatus* and *C. axillaries*, the fungal communities at the two sites were similar. In *D. regia*, however, they were different.

Seed decay fungi prefer high humidity for growth. Study of the sequential occurrence of fungi on exposed pods of *Delonix regia* revealed that *Aspergillus*, *Chaetomium*, *Penicillium*, and *Rhizopus* colonized pod when dry and attached to the tree. As soon as the pods fall onto the forest floor these genera were replaced rapidly by seed decay fungi, e.g. *Dictyochaeta*, *Helicosporium*, *Phaeoisaria*, and *Sporoschisma*. The moisture content of the pods appears to be an important factor in determining the mycota they support (Somrithipol *et al.*, 2002a).

Two new fungi described as new species from decaying seeds in Thailand include *Cirrenalia nigrospora* and *Lauriomyces sakaeratensis*. *Cirrenalia nigrospora* was collected from seeds of *Borassus machadonis*, *Choerospondias axillaries*, *Delonix regia*, and *Hevea brasiliensis*. It is widely distributed from a low rainfall forest in the northeastern region to high humidity area in southern part of Thailand (Somrithipol *et al.*, 2002b). *Lauriomyces sakaeratensis* was collected on decaying *Dipterocarpus costatus* seeds from Sakaerat Biosphere Reserve (Somrithipol *et al.*, 2006).

### 2. Importance of Seed Decay Fungi

Seed decay fungi play an important role in recycling nutrients in the forest ecosystem. Somrithipol (2005) recorded 37 fungal species on decaying *Dipterocarpus turbinatus* seeds throughout the decomposition process, and 61 species on *Delonix regia* pods during one year of the decomposition. Many fungi isolated from decaying seeds have shown potential in the production of bioactive compounds, for example, *Kionochaeta pughii*, *Menisporopsis theobromae*, *Stachybotrys nephrospora*, and *Trichoderma gelatinosum*.

*Kionochaeta pughii* (BCC 3878) was collected on decaying dipterocarp seeds from Khao Yai National Park. The fungus produces pughinin A, pycnidione, mevalonolactone, and 7-hydroxy-2-methylchromanone. Pughinin A and pycnidione

exhibited in vitro antiplasmodial activity against *Plasmodium falciparum* (K1 strain). Pycnidione also showed anti-cancer activity against KB and BC cell lines with the IC<sub>50</sub> values of 2.0 and 1.6 µg/mL, respectively (Pittayakhajonwut *et al.*, 2002).

*Menisporopsis theobromae* (BCC 3975 and 4162) collected on decaying dipterocarp seeds from Khao Yai National Park produces various classes of bioactive substances. The strain BCC 4162 produces a new macrocyclic polylactone menisporopsin A while the strain BCC 3975 produces eight new compounds and one known dithiodiketopiperazine. Menisporopsin A possesses anti-malarial and anti-mycobacterial activities, as well as cytotoxicity against BC-1 and KB cell lines (Chinworrungsee, 2004; Chinworrungsee *et al.*, 2004).

*Stachybotrys nephrospora* (BCC 3900), an anamorphic fungus collected on decaying *Thepesia populnea* fruits from Chachoengsao Province, produces two known spirodihydrobenzofuran terpenes. Both compounds possessed antiplasmodial activity (IC<sub>50</sub> values of 0.85 and 0.15 µg/mL), and were not toxic towards the vero cell line. (Sawadjoon, 2003; Sawadjoon *et al.*, 2004).

*Trichoderma gelatinosum* (BCC 7579) was isolated on a pod of *Entada persetha* from Khao Yai National Park. The fungus produces 'hirsutellone F' exhibiting anti-mycobacterial activity against *Mycobacterium tuberculosis* (MIC<sub>50</sub> values of 3.12 µg/mL) and anti-plasmodium activity against *Plasmodium falciparum* (IC<sub>50</sub> values 4.2 µg/mL) (Isaka, *et al.*, 2006).

## MATERIALS AND METHODS

### 1. Surveying Sites

Surveying sites included: Khao Yai National Park, Khao Soi Dao Wildlife Sanctuary, Phu Phan National Park, and Doi Inthanon National Park.

### 2. Material Collecting

Decaying dipterocarp fruits and their surrounding substrata such as leaves, twigs on the forest floors were collected, placed into plastic bags and returned to the laboratory. Collected materials were identified to the plant species.

### 3. Material Examining

Collected materials were examined directly under a dissection microscope for a fungal sporulating structure. The presented structure would be removed to mount in water on a glass slide. Slides were observed and photographed under a Differential Interference Contrast microscope. Measurements and drawings would carry out using a compound microscope with camera lucida. Morphological measurements included minimum-maximum ranges and the arithmetic mean ( $\bar{x}$ ) with  $\pm$  standard deviation for  $n$  measured units. A minimum  $n$  is 50 for conidia if the material is sufficient. Materials without fungal appearance were washed with water before incubated in moist chambers at 20°C and periodically examined for emergence of a fungal sporulating structure.

### 4. Identification

#### 4.1 Principles

The morphological characteristic is a basic for identification. For anamorphic fungi, the principle of identification is based on Hughes' conidiogenesis (Hughes, 1953) and the Saccardo system.

#### 4.2 Important Literatures

The following textbooks were used for identification and description: Grove (1935, 1937), Ellis (1971, 1976), Sutton (1971, 1973, 1980), Nag Raj (1993), Kiffer and Morelet (2000) (for anamorphic fungi); Fröhlich and Hyde (2000), Hyde *et al.* (2000) (for ascomycetes); and Singer (1986) (for basidiomycetes). The following journals are consulted for the updated taxonomic references: Fungal Diversity, Nova Hedwigia, Mycologia, Mycological Research, Mycoscience, Mycotaxon, and Sydowia.

### 5. Preservation of the Specimens

After examination, substrata with colonizing fungi were dried down and deposit in the BIOTEC herbarium (BBH). Examined slides were preserved by replacing the mounting water with lactophenol, sealing the coverslip with polyvinyl alcohol,



labeling, and placing in slide boxes. Colonizing substrata were primary herbaria specimens. In case of substrata are depleted during examination, slides were served as a specimen of the fungus (Hawksworth, 1974).

## 6. Isolation and Culture Preservation

Conidia or spores were removed to suspend in a drop of sterile water on a sterile glass slide. The conidial suspension were checked under a compound microscope at low magnification to ensure the identity before transferred by a loop to streak on a medium plate (Corn Meal Agar with 0.5 mg/L streptomycin sulfate). Plates with fungal conidia were incubated at 25°C for 24-48 hour and periodically checked under a dissection microscope for germination. In case of the germination success, a small plug of agar with the germinated conidia were picked up and transferred to another CMA medium plate, at least 5-10 isolates of each species, to ensure that these isolates were identical. Pure isolate were finally transferred to grow on a PDA (Potato Dextrose Agar) medium plate before cut into small cubes (*ca.* 0.5 cm), put in a cryogenic tube with 5% glycerol and stored at -196°C at BIOTEC Culture Collection.

## 7. Analyses of the Data

The importance of each fungal taxon were determined by using the relative species abundance and the frequency of occurrence. The fungal information of each fruit species or each collecting site were analyzed in terms of species diversity, species evenness, and species richness. The Sørensen index of similarity was used for a comparison of the two fungal communities.

### 7.1 Relative Species Abundance

The relative species abundance (*A*) is the presence of individuals of the given species compare to individuals of all species. Ho *et al.* (2002) and Yanna *et al.* (2002) regarded a fungus with species abundance >10% as a dominant species.

$$A = \frac{\text{individual of a given species}}{\text{individual of all species}} \times 100$$

An individual refers to one colony.

### 7.2 Frequency of Occurrence

Frequency of occurrence (*F*) is an opportunity to encounter the given species from the collected samples.

$$F = \frac{\text{number of sample with the given species occur}}{\text{number of total sample}} \times 100$$

### 7.3 Species Diversity

Species diversity of fungi at each site was represented by the Shannon-Weaver Index ( $H'$ ) (Shannon and Weaver, 1949).

$$H' = - \sum_{i=1}^n p_i \log_2 p_i$$

Where  $p_i$  = number of individuals of each species/ number of individuals of all species,  $n$  = total number of species.

### 7.4 Species Evenness

Fungal evenness in each collection site were calculated using the species evenness index ( $E$ ) (Pielou, 1969).

$$E = H' / \log_2 S$$

Where  $H'$  = Shannon-Weaver Index of species diversity,  
 $S$  = total number of species

### 7.5 Richness Index

The richness index were calculated in the form of richness index 1 ( $R_1$ )(Margalef, 1958) and richness index 2 ( $R_2$ ) or Menhinick's index (Menhinick, 1964).

$$R_1 = S-1 / \ln (N)$$

$$R_2 = S / \sqrt{N}$$

Where  $S$  = total number of species,  
 $N$  = total number of individuals of all species

### 7.6 Index of Similarity

Fungal similarity between the two collecting sites were calculated by the Similarity Index of Sørensen ( $IS$ )

$$IS = 2C/(A+B) \times 100$$

Where  $A$  = number of species occurring in the first site,  
 $B$  = number of species occurring in the second site  
 $C$  = number of species occurring in both sites.

## RESULTS

### 1. Surveys and Sample Collecting

This study was originally proposed to investigate the fungi colonizing dipterocarp seeds in Khao Yai National Park and Sakaerat Biosphere Reserve. However, surveys at Sakaerat Biosphere Reserve resulted in a few of collected seeds and few encountering fungi. An investigation of this site was, therefore, discarded and was replaced by surveys of the other sites: Khao Soi Dao Wildlife Sanctuary, Phu Phan National Park, and Doi Inthanon National Park. Details of the surveying sites and the samples collected are shown in Table 1.

**Table 1.** Surveying sites, collected sample, and number of the samples collected

Surveying site	Collected Sample	Number of Samples
1. Khao Yai National Park	Seeds of <i>D. chartaceus</i>	71 samples
	Seeds of <i>D. turbinatus</i>	18 samples
2. Khao Soi Dao Wildlife Sanctuary	Seeds of <i>D. alatus</i>	123 samples
3. Phu Phan National Park	Seeds of <i>D. costatus</i>	56 samples
	Seeds of <i>D. tuberculatus</i>	28 samples
4. Doi Inthanon National Park	Seeds of <i>D. turbinatus</i>	53 samples

### 2. Analyses of the Fungal Data

#### 2.1 Fungal Communities on Collected Seeds

A group of fungi colonizing each seed species at each surveying site refers to a community and there are 6 communities in the present study. Fungi of each community and their frequency of occurrences are listed in Table 2.

##### 2.1.1 Fungal Community 1: Fungi on *Dipterocarpus chartaceus* seeds at Khao Yai National Park

A total of 317 individual fungi (15 species) colonized on 71 samples of *Dipterocarpus chartaceus* seeds collected from Khao Yai National Park. *Dictyochaeta* sp. 1 was the most abundant species. Other dominant species included *Thozetella* sp. 1, *Dinemasporium lanatum*, and *Physalidium elegans*. This community possessed the fungal species diversity (H) of 1, species evenness (E) of 1.17, and the richness index (R1) of 2.43 (The analysis is in Appendix Table 1).

##### 2.1.2 Fungal Community 2: Fungi on *Dipterocarpus turbinatus* seeds at Khao Yai National Park

A total of 62 individual fungi (8 species) colonized on 18 samples of *Dipterocarpus turbinatus* seeds collected from Khao Yai National Park. *Dinemasporium lanatum*, *Thozetella* sp. 1, and *Dictyochaeta* sp. 1 were common species. This community

possessed the fungal species diversity (H) of 0.78, species evenness (E) of 0.7, and the richness index (R1) of 1.70 (The analysis is in Appendix Table 2).

### **2.1.3 Fungal Community 3: Fungi on *Dipterocarpus alatus* seeds at Khao Soi Dao Wildlife Sanctuary**

A total of 198 individual fungi (16 species) colonized on 123 samples of *Dipterocarpus alatus* seeds collected from Khao Soi Dao Wildlife Sanctuary. *Dictyochaeta* sp. 1 was the most abundant species. Other dominant species included *Thozetella* sp. 1, *Chaetospermum camelliae*, *Dinemasporium lanatum*, and *Helicomyces* species. This community possessed the fungal species diversity (H) of 0.86, species evenness (E) of 1.04, and the richness index (R1) of 2.84 (The analysis is in Appendix Table 3).

### **2.1.4 Fungal Community 4: species on *Dipterocarpus costatus* seeds at Phu Phan National Park**

A total of 53 individual fungi (15 species) colonized on 56 samples of *Dipterocarpus costatus* seeds collected from Phu Phan National Park. The dominant species included *Penicillium* sp. 1, *Dictyochaeta* sp. 1, *Chalara* sp. 1, and *Thozetella* sp. 1. This community possessed the fungal species diversity (H) of 1.07, species evenness (E) of 1.26, and the richness index (R1) of 3.53 (The analysis is in Appendix Table 4).

### **2.1.5 Fungal Community 5: species on *Dipterocarpus tuberculatus* seeds at Phu Phan National Park**

A total of 38 individual fungi (12 species) colonized on 28 samples of *Dipterocarpus tuberculatus* seeds collected from Phu Phan National. A species of one unidentified coelomycete was the most abundant. Others dominant species included: *Penicillium* sp. 2, *Chaetomella raphigera*, and one unidentified species of hyphomycete. This community possessed the fungal species diversity (H) of 0.86, species evenness (E) of 0.93, and the richness index (R1) of 3.02 (The analysis is in Appendix Table 5).

### **2.1.6 Fungal Community 6: species on *Dipterocarpus turbinatus* seeds at Doi Inthanon National Park**

A total of 27 individual fungi (7 species) colonized on 53 samples of *Dipterocarpus turbinatus* seeds collected from Doi Inthanon National Park. *Gliocladium* species was the most abundant. This community possessed the fungal species diversity (H) of 0.77, species evenness (E) of 0.65, and the richness index (R1) of 1.82 (The analysis is in Appendix Table 6).



**Table 2.** List of all fungi and their frequency of occurrence in each community

No.	Fungi	Frequency of occurrence (F)					
		1*	2*	3*	4*	5*	6*
1	<i>Beltrania</i> sp. 1	-	-	-	3.6	-	-
2	<i>Canalisporium caribense</i>	1.4	-	-	-	-	-
3	<i>Chaetomella raphigera</i>	-	-	-	-	14.3	-
4	<i>Chaetospermum camelliae</i>	-	-	20.3	1.8	-	-
5	<i>Chalara</i> sp.1	50.7	-	-	10.7	3.6	-
6	<i>Clonostachy</i> sp.1	-	-	-	7.1	-	-
7	<i>Coniella castaneicola</i>	-	-	-	-	-	3.8
8	<i>Cryptophiale guadalcanalense</i>	14.1	-	-	-	-	-
9	<i>Cryptophiale iriomoteanum</i>	1.4	-	-	-	-	-
10	<i>Cryptophiale kakombensis</i>	25.4	-	-	-	-	-
11	<i>Cryptophiale udagawae</i>	19.7	-	0.8	-	-	-
12	<i>Cryptophialoidea secunda</i>	15.5	27.8	-	-	3.6	-
13	<i>Dictyochaeta</i> sp. 1	76.1	77.8	43.1	12.5	-	-
14	<i>Dictyochaeta</i> sp. 2	-	22.2	2.4	-	3.6	3.8
15	<i>Dictyochaetopsis</i> sp. 1	-	5.6	-	-	-	-
16	<i>Dinemasporium lanatum</i>	63.4	88.9	19.5	-	3.6	-
17	<i>Gliocephalotrichum</i> sp. 1	-	-	0.8	-	-	-
18	<i>Gliocladium</i> sp. 1	-	-	-	-	-	13.2
19	<i>Gonytrichum</i> sp. 1	-	-	2.4	-	-	-
20	<i>Helicomycetes roseus</i>	7.0	-	-	-	-	-
21	<i>Helicomycetes</i> sp. 1	-	-	17.9	-	-	-
22	<i>Helicosporium</i> sp. 1	-	27.8	-	1.8	-	-
23	<i>Kiliophora ubiensis</i>	-	-	-	1.8	-	-
24	<i>Kionochaeta ramifera</i>	29.6	-	-	-	-	-
25	<i>Lauriomyces sakaeratensis</i>	-	-	-	1.8	-	-
26	<i>Menispora</i> sp. 1	-	-	-	3.6	-	-
27	<i>Menisporopsis theobromae</i>	-	-	1.6	-	-	-
28	<i>Paliphora porosa</i>	2.8	-	-	-	-	-
29	<i>Penicillium</i> sp. 1	-	-	-	17.9	-	-
30	<i>Penicillium</i> sp. 2	-	-	-	3.6	21.4	-
31	<i>Phaeoisaria clematidis</i>	-	-	2.4	-	-	-
32	<i>Phoma</i> sp. 1	-	-	0.8	-	3.6	-
33	<i>Physalidium elegans</i>	60.6	-	1.6	-	-	-
34	<i>Stilbella</i> sp. 1	-	-	0.8	-	-	-
35	<i>Subulispora procurvata</i>	-	-	-	-	3.6	-
36	<i>Thozetella</i> sp. 1	71.8	83.3	23.6	10.7	-	11.3
37	<i>Thozetella</i> sp. 2	-	-	2.4	5.4	-	1.9
38	<i>Trichoderma</i> sp. 1	7.0	-	7.3	-	-	-
39	Basidiomycete ( <i>Mycena</i> ?)	-	-	-	-	-	5.7
40	Unidentified Coelomycete 1	-	-	-	7.1	-	-
41	Unidentified Coelomycete 2	-	-	-	5.4	53.6	-
42	Unidentified Coelomycete 3	-	11.1	-	-	-	-
43	Unidentified Coelomycete 4	-	-	-	-	-	11.3
44	Unidentified sp.1	-	-	-	-	10.7	-
45	Unidentified sp.2	-	-	-	-	7.1	-
46	Unidentified sp.3	-	-	-	-	7.1	-

\* Notes: 1: *Dipterocarpus chartaceus* - Khao Yai National Park; 2: *Dipterocarpus turbinatus*- Khao Yai National Park; 3: *Dipterocarpus alatus*- Khao Soi Dao Wildlife Sanctuary; 4: *Dipterocarpus costatus*- Phu Phan National Park; 5: *Dipterocarpus tuberculatus*- Phu Phan National Park; 6: *Dipterocarpus turbinatus*- Doi Inthanon National Park

## 2.2 Comparison of the Fungal Communities on Dipterocarp Seeds

Ecological information of each community is summarized in Table 3. More than half of the total samples were collected from Khao Yai National Park. More samples collected tend to yield more fungal species although the statistic significance of this relationship is low ( $R^2 = 0.44$ ).

**Table 3.** Some ecological information of each community

	1*	2*	3*	4*	5*	6*
Total Species (S)	15	8	16	15	12	7
Total Individual (N)	317	62	198	53	38	27
Total Sample collected	71	18	123	56	28	53
Species Diversity (H)	1.00	0.78	0.86	1.07	0.86	0.77
Species Evenness (E)	1.17	0.70	1.04	1.26	0.93	0.65
Richness Index (R1)	2.43	1.70	2.84	3.53	3.02	1.82
Richness Index (R2)	0.84	1.02	1.14	2.06	1.95	1.35

\* Notes: 1: *Dipterocarpus chartaceus* - Khao Yai National Park; 2: *Dipterocarpus turbinatus*- Khao Yai National Park; 3: *Dipterocarpus alatus*- Khao Soi Dao Wildlife Sanctuary; 4: *Dipterocarpus costatus*- Phu Phan National Park; 5: *Dipterocarpus tuberculatus*- Phu Phan National Park; 6: *Dipterocarpus turbinatus*- Doi Inthanon National Park

The number of species in each community ranged between 7 and 16. The values of species diversity ranged between 0.7 and 1.0. The community of fungi on *Dipterocarpus chartaceus* seeds at Khao Yai National Park possessed the highest species diversity, while the community on *Dipterocarpus costatus* seeds at Phu Phan National Park possessed the highest species evenness. The fungal community on *Dipterocarpus tuberculatus* seeds at Phu Phan National Park possessed the lowest species diversity and the lowest species evenness. Species diversity of these communities may be affected by various factors; such as, the surveying site, seed species and the stage of decay.

Fungal similarities between the two communities are ranked in Table 4. A matrix of these similarities (Table 5) is presented in UPGMA dendrogram (Figure 1). Fungal similarities between the two communities ranged between 9-39%. Fungi on *D. chartaceus* seeds at Khao Yai National Park and those on *D. alatus* seeds at Khao Soi Dao Wildlife Sanctuary are the most similar while the similarity of fungi on *D. chartaceus* seeds at Khao Yai National Park and *D. turbinatus* seeds at Doi Inthanon National Park is the least. No particular similarity between communities on the same seed species or the same surveying site indicated that neither seed species nor surveying site does clearly affect the similarity of the fungi between the two communities.

**Table 4.** Rank of similarities of a pair of fungal communities

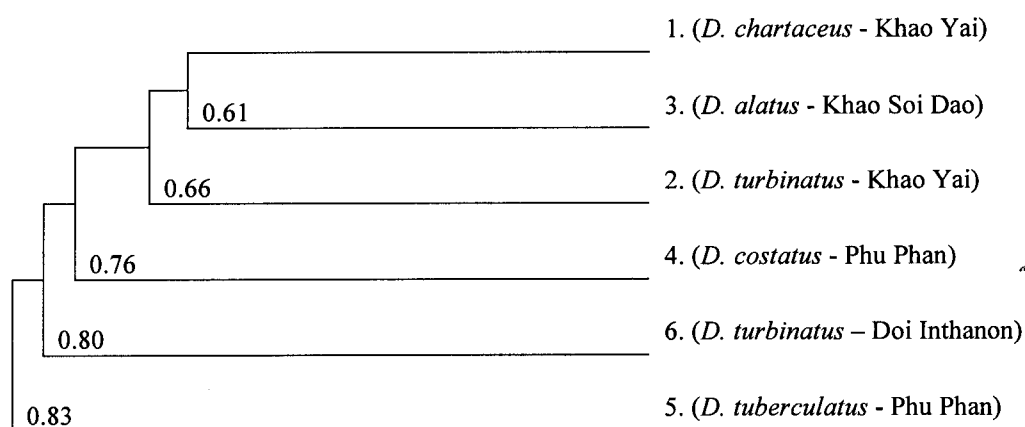
Rank	Similarity	Pair of communities			
1	38.7	1. ( <i>D. chartaceus</i> - Khao Yai)	&	3. ( <i>D. alatus</i> - Khao Soi Dao)	
2	34.8	1. ( <i>D. chartaceus</i> - Khao Yai)	&	2. ( <i>D. turbinatus</i> - Khao Yai)	
3	33.3	2. ( <i>D. turbinatus</i> - Khao Yai)	&	3. ( <i>D. alatus</i> - Khao Soi Dao)	
4	26.7	2. ( <i>D. turbinatus</i> - Khao Yai)	&	6. ( <i>D. turbinatus</i> - Doi Inthanon)	
5	26.1	2. ( <i>D. turbinatus</i> - Khao Yai)	&	4. ( <i>D. costatus</i> - Phu Phan)	
5		3. ( <i>D. alatus</i> - Khao Soi Dao)	&	6. ( <i>D. turbinatus</i> - Doi Inthanon)	
7	25.8	3. ( <i>D. alatus</i> - Khao Soi Dao)	&	4. ( <i>D. costatus</i> - Phu Phan)	
8	22.2	1. ( <i>D. chartaceus</i> - Khao Yai)	&	5. ( <i>D. tuberculatus</i> - Phu Phan)	
8		4. ( <i>D. costatus</i> - Phu Phan)	&	5. ( <i>D. tuberculatus</i> - Phu Phan)	
10	21.4	3. ( <i>D. alatus</i> - Khao Soi Dao)	&	5. ( <i>D. tuberculatus</i> - Phu Phan)	
11	20.0	1. ( <i>D. chartaceus</i> - Khao Yai)	&	4. ( <i>D. costatus</i> - Phu Phan)	
12	18.2	4. ( <i>D. costatus</i> - Phu Phan)	&	6. ( <i>D. turbinatus</i> - Doi Inthanon)	
13	10.5	5. ( <i>D. tuberculatus</i> - Phu Phan)	&	6. ( <i>D. turbinatus</i> - Doi Inthanon)	
14	10.0	2. ( <i>D. turbinatus</i> - Khao Yai)	&	5. ( <i>D. tuberculatus</i> - Phu Phan)	
15	9.1	1. ( <i>D. chartaceus</i> - Khao Yai)	&	6. ( <i>D. turbinatus</i> - Doi Inthanon)	

\* Notes: 1: *Dipterocarpus chartaceus* - Khao Yai National Park; 2: *Dipterocarpus turbinatus*- Khao Yai National Park; 3: *Dipterocarpus alatus*- Khao Soi Dao Wildlife Sanctuary; 4: *Dipterocarpus costatus*- Phu Phan National Park; 5: *Dipterocarpus tuberculatus*- Phu Phan National Park; 6: *Dipterocarpus turbinatus*- Doi Inthanon National Park

**Table 5.** A matrix of the similarities between the two fungal communities

Community	Similarity (%)					
	1*	2*	3*	4*	5*	6*
1*	100.0	34.8	38.7	20.0	22.2	9.1
2*		100.0	33.3	26.1	10.0	26.7
3*			100.0	25.8	21.4	26.1
4*				100.0	22.2	18.2
5*					100.0	10.5
6*						100.0

\* Notes: 1: *Dipterocarpus chartaceus* - Khao Yai National Park; 2: *Dipterocarpus turbinatus*- Khao Yai National Park; 3: *Dipterocarpus alatus*- Khao Soi Dao Wildlife Sanctuary; 4: *Dipterocarpus costatus*- Phu Phan National Park; 5: *Dipterocarpus tuberculatus*- Phu Phan National Park; 6: *Dipterocarpus turbinatus*- Doi Inthanon National Park



**Figure 1.** Cluster diagram (UPGMA) of the fungal communities on decaying dipterocarp seeds in the present study

### 2.3 Comparison between Fungi on Dipterocarp Seeds and on other substrata

Market fruits (10 samples) and decaying leaves in an orchard (10) and natural forests (50) were also collected to isolate for fungi, and compared with those on the dipterocarp seeds. The results revealed that fungi on market fruits were limited to the *Penicillium* species while the species colonizing decaying leaves were similar to those on the dipterocarp. Two new fungi were also collected on decaying leaves from the orchard and the natural forest which indicated that these habitats require the further study.



### 3. Description of the Fungal Species on Dipterocarp Seeds

Some identified fungal species colonizing dipterocarp seeds in this study are described in an alphabetically order.

#### 3.1 *Canalisporium caribense* (Hol.-Jech. & Mercado) Nawawi & Kuthub.

Sporodochia scattered, punctiform, glistening, black. Mycelium immersed. Conidiophores micronematous, fasciculatous, simple, clavate, smooth, septate, pale brown, 20-25  $\mu\text{m}$  long, 2-3.5  $\mu\text{m}$  thick. Conidiogenous cells integrated, terminal, holoblastic, clavate or cylindrical. Conidia muriform, broadly ellipsoidal to obovoid in surface view and cylindrical to clavate in lateral view, comprising of a single small hyaline basal cell and two rows of 3-6 upper cells, smooth-walled, dark brown to blackish brown with dark banded at the septa, 25-50  $\mu\text{m}$  long, 15-30  $\mu\text{m}$  wide.

Nawawi and Kuthubutheen (1989) proposed the genus *Canalisporium* for sporodocial fungi that having flattened dorsiventrally conidia with single layer of arranged cells supported by a small hyaline basal cell. Conidia of *Canalisporium caribense* compose of: a hyaline small basal and apical cell, 2 rows of the middle cells with 3-6 cells in each row, and thick and dark banded septa. The conidial size is 25-50  $\mu\text{m}$  long, and 15-30  $\mu\text{m}$  wide.

#### 3.2 *Chaetomella raphigera* Swift

*Conidiomata* pycnidial with single longitudinal ostiole, stipitate with short stalk, unilocular, 100-200  $\mu\text{m}$  high, 150-450  $\mu\text{m}$  wide. *Setae* cylindrical to clavate, brown, smooth, septate, up to 150  $\mu\text{m}$  high, 2-6  $\mu\text{m}$  wide. *Conidiophores* filiform, smooth, septate, hyaline, branch verticillately or irregularly, arising from the inner cells of the pycnidial wall. *Conidiogenous cells* integrated, terminal, polyblastic, sympodial, denticulate, clavate or cylindrical. *Conidia* allantoid, 1-cell, smooth-walled, hyaline, 7-10  $\mu\text{m}$  long, 1.5-2  $\mu\text{m}$  wide.

Morphology of conidioma is a distinctive character of the genus *Chaetomella*. *Chaetomella raphigera* is distinguished by coil or clavate shape of seta apices (Sutton and Sarbhoy, 1976; Sutton, 1980).

#### 3.3 *Chaetospermum camelliae* Agnihothrudu

*Conidiomata* stromatic, pycnidoid, scattered to gregarious and confluent, subepidermal or subperidermal in origin, innate erumpent, globose to subglobose or hemispherical in sectional view, 450-500  $\mu\text{m}$  wide, 300-350  $\mu\text{m}$  deep, initially closed but dehiscing by an irregular split in the apical wall, yellowish brown and waxy when dry, pearl white and gelatinous when moist, unilocular, with the locule occasionally irregular divided or convoluted, glabrous; wall 25-50  $\mu\text{m}$  thick, of textura intricata to textura oblita in gel. *Conidiophores* arising at the base and sides of the conidiomatal wall, loosely aggregated, branched, septate at the base, colourless, smooth, invested in gel. *Conidiogenous cells* discrete, subcylindrical or irregular, colourless, smooth, bearing an

apical cluster of up to 3 conidia. *Conidia* cylindrical with rounded or obtuse ends, straight or slightly curved, colourless, smooth, (19-) 21-29  $\mu\text{m}$  long, 4-5 (-5.5)  $\mu\text{m}$  wide ( $\bar{x}$  = 24.8  $\times$  4.5  $\mu\text{m}$ ), bearing 2-4 subpolar appendages at each end; appendages cellular, tubular, unbranched, attenuated, flexuous, 9-20 ( $\bar{x}$  = 15)  $\mu\text{m}$ ; mean conidium length/width ratio = 5.5/1.

Pycnidial morphology and cylindrical conidia with cellular appendages at both ends are distinguished characters of the genus *Chaetospermum* (Nag Raj, 1993)..

### 3.4 *Cryptophiale guadalcanalense* Matsush.

*Colonies* effuse, sparse, brown to black. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, apex 1-3 times dichotomously branched, straight, smooth, septate, brown to dark brown, 170-240  $\mu\text{m}$  long, 6-8  $\mu\text{m}$  thick. *Fertile region* subapical, 70-90  $\mu\text{m}$  long, 13-16  $\mu\text{m}$  wide, comprising of two rows of conidiogenous cells born on each side of the conidiophore and obscured by a dark shield of sterile, flatten, lobe cells. *Conidiogenous cells* integrated, enteroblastic. *Conidia* subulate, with 1 median septum, smooth-walled, hyaline to subhyaline, 16-24  $\mu\text{m}$  long, 1.5-2  $\mu\text{m}$  wide, aggregated in slimy mass.

### 3.5 *Cryptophiale iriomoteanum* Matsush.

*Colonies* effuse, sparse, brown to black. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, simple, subulate, slightly flexuous, smooth, septate, brown to dark brown, up to 200  $\mu\text{m}$  long, 5-7  $\mu\text{m}$  thick. *Fertile region* subapical, 40-80  $\mu\text{m}$  long, 12-16  $\mu\text{m}$  wide, comprising of two rows of conidiogenous cells born on each side of the conidiophore and obscured by a dark shield of sterile, flatten, lobe cells. *Conidiogenous cells* integrated, enteroblastic. *Conidia* narrowly obclavate, strongly curved, with 1 median septum, smooth-walled, hyaline to subhyaline, 14-25  $\mu\text{m}$  long, 1.5-2.5  $\mu\text{m}$  wide, aggregated in slimy masses.

### 3.6 *Cryptophiale kakombensis* Pirozynski

*Colonies* effuse, sparse, brown to black. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, simple, subulate, slightly flexuous, smooth, septate, brown to dark brown, up to 320  $\mu\text{m}$  long, 8-10  $\mu\text{m}$  thick. *Fertile region* subapical, up to 100  $\mu\text{m}$  long, 15-25  $\mu\text{m}$  wide, comprising of two rows of conidiogenous cells born on each side of the conidiophore and obscured by a dark shield of sterile, flatten, lobe cells. *Conidiogenous cells* integrated, enteroblastic. *Conidia* falcate, with 1 median septum, smooth-walled, hyaline to subhyaline, 20-30  $\mu\text{m}$  long, 1.5-2.5  $\mu\text{m}$  wide, aggregated in slimy masses.

### 3.7 *Cryptophiale udagawae* Pirozynski & Ichinoe apud Pirozynski

*Colonies* effuse, sparse, brown to black. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, apex 1-2 times dichotomously branched, straight, smooth, septate, brown to dark brown, up to 280  $\mu\text{m}$  long, 6-10  $\mu\text{m}$  thick. *Fertile region*

subapical, 40-80  $\mu\text{m}$  long, 14-20  $\mu\text{m}$  wide, comprising of two rows of conidiogenous cells born on each side of the conidiophore and obscured by a dark shield of sterile, flatten, lobe cells. *Conidiogenous cells* integrated, enteroblastic. *Conidia* falcate, with 1 median septum and a short appendage, smooth-walled, hyaline to subhyaline, 20-35  $\mu\text{m}$  long, 1.5-3  $\mu\text{m}$  wide, aggregated in slimy masses.

*Cryptophiale* species are distinguished by morphologies of conidiophores (e.g. branching patterns, location of fertile region) and conidia (e.g. shape, size, septation) (Kuthubutheen and Sutton, 1985). Four species were recorded in the present study.

A

A key to species of *Cryptophiale* based on the present study:

- 1. Conidiophore branch ..... 2
- 1. Conidiophore unbranch, conidia without apical appendage ..... 3
- 2. Conidia with an apical appendage ..... *C. udagawae*
- 2. Conidia without apical appendage ..... *C. guadalcanalense*
- 3. Conidia narrowly obclavate and strongly curved ..... *C. iriomoteanum*
- 3. Conidia falcate ..... *C. kakombensis*

### 3.8 *Cryptophialoidea sucunda* (Kuthub. & B. Sutton) Kuthub. & Nawawi

*Colonies* effuse, glistening, light brown to brown. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, simple, subulate, flexuous, smooth and thick-walled, brown to dark brown, up to 260  $\mu\text{m}$  long, 10-12  $\mu\text{m}$  thick. *Conidiogenous cells* phialidic, lageniform, with collarettes, 10-15  $\mu\text{m}$  long, 3-6  $\mu\text{m}$  wide, arranged in a single row on only one side around the middle of the conidiophore. *Conidia* falcate, with 1 median septum, smooth-walled, hyaline to subhyaline, 20-30  $\mu\text{m}$  long, 1.5-2.5  $\mu\text{m}$  wide, aggregated in slimy masses.

A single row of phialides arranging on only one side at the middle of subulate conidiophores and flacate, 1-septate conidia are distinguished characteristics of this species (Kuthubutheen and Sutton, 1985).

### 3.9 *Dinemasporium lanatum* Nag Raj & Castañeda Ruíz

*Conidiomata* stromatic, cupulate, setose, superficial, dark brown to black, 300-350  $\mu\text{m}$  high, 300-400  $\mu\text{m}$  wide. Setae subulate, straight or curved, dark brown, thick and smooth-walled, up to 1000  $\mu\text{m}$  long, 4-7  $\mu\text{m}$  wide. *Conidiophores* smooth, septate, hyaline, branched, arising from the upper cells of the basal stroma. Conidiogenous cells integrated, terminal, enteroblastic, cylindrical to obclavate. *Conidia* falcate to naviculate with truncate base and acute apex, 1-cell, thin and smooth-walled, hyaline, 15-30  $\mu\text{m}$  long, 2-2.5  $\mu\text{m}$  wide, with a single filiform appendage at each end.

Cupulate conidioma with pigmented seta, enteroblastic conidiogenous cells, and naviculate conidia with a cellular appendage at each end are important characters of the genus *Dinemasporium*. *Dinemasporium lanatum* was identified based on its conidial measurements (Nag Raj, 1993).

### 3.10 *Helicomyces roseus* Link

*Colonies* effuse, flocculose, white. *Mycelium* superficial. *Conidiophores* micronematous, mononematous, mostly arising as short lateral branches of the repent mycelium. *Conidiogenous cells* monoblastic, developing as denticles on the repent hyphae, or as the terminal cells of the conidiophores. *Conidia* filament, helicoid, multiseptate, basal cell slightly swollen, hyaline but white in mass, coiled 2-3 times in one plane, filament 4-5  $\mu\text{m}$  wide, coils 25-60  $\mu\text{m}$  in diam.

Hyaline helicoid conidia born on undefined conidiophores is important characteristics of *Helicomyces*. According to Goos (1985), the measurements indicated this fungus *H. roseus*.

### 3.11 *Kionochaeta ramifera* (Matsush.) P. M. Kirk & B. Sutton

*Colonies* sparse, brown to dark brown. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, solitary, subulate, straight or flexuous, smooth and thick-walled, septate, brown to dark brown, up to 330  $\mu\text{m}$  long, 5-10  $\mu\text{m}$  thick, with lateral branches and fertile region at the middle. *Lateral branches* subulate, divergent, smooth and thick-walled, up to 15 in a whorl, apex sterile, 50-100  $\mu\text{m}$  long, 4-6  $\mu\text{m}$  wide. *Fertile regions* situated immediately below the basal of lateral branches, comprising of compactly, several branches terminating into conidiogenous cells. *Conidiogenous cells* ampulliform to lageniform. *Conidia* narrowly clavate, slightly curved, 1-cell, smooth-walled, hyaline to subhyaline, 5-10  $\mu\text{m}$  long, 0.5-1.5  $\mu\text{m}$  wide, aggregated in slimy droplet.

*Kionochaeta* species are distinguished by morphologies of conidiophores (e.g. branching patterns, location of fertile region) and conidia (e.g. shape, size, septation) (Kuthubutheen and Nawawi, 1988). In *Kionochaeta ramifera*, conidiophores possess sterile, lateral, setiform branches. Apices of the main axis of conidiophores and lateral branches are sterile. The conidial size 8-12  $\mu\text{m}$  long 1-1.5  $\mu\text{m}$ .

### 3.12 *Lauriomyces sakaeratensis* Somrithipol, Kosol, & E.B.G. Jones

*Colonies* effuse, with white sporulation. *Mycelium* immersed. Stroma and hyphopodia absent. Setae simple, subulate, smooth and thick-walled, brown to dark brown, up to 500  $\mu\text{m}$  long, 5.0-6.0  $\mu\text{m}$  wide at the base. *Conidiophores* macronematous, mononematous, straight or flexuous, thick and smooth-walled, brown to dark brown, paler toward the rounded apex, 100-160  $\mu\text{m}$  long, 5.0-5.5  $\mu\text{m}$  wide at the base, 3.8-4.5  $\mu\text{m}$  wide at the apex. *Branches* cylindrical to doliiform, thin and smooth-walled, hyaline to subhyaline. *Primary branches* in clusters of 3-5 at conidiophore apex, 4.5-7.5  $\mu\text{m}$  long, 2.5-3.5  $\mu\text{m}$  wide. Subsequent branches in clusters of 3-7, 4.0-4.5  $\mu\text{m}$  long, 1.5-2.0  $\mu\text{m}$  wide. Ramoconidia and conidia holoblastic, unicellular, hyaline to subhyaline, thin and smooth-walled, in acropetal branched chains. *Ramoconidia* cylindrical to obclavate, 4.0-6.5  $\mu\text{m}$  long, 1.0-1.7  $\mu\text{m}$  wide at the broadest part. *Conidia* narrow obclavate to obclavate, 3.0-6.5  $\mu\text{m}$  long, 1.0-1.5  $\mu\text{m}$  wide at the broadest part.

*Lauriomyces sakaeratensis* markedly differs from other *Lauriomyces* species in possessing obclavate conidia (Somrithipol *et al.*, 2006)

### 3.13 *Menisporopsis thobromae* S. Hughes

*Colonies* sparse, hairy, with dark synnemata (up to 10  $\mu\text{m}$  wide). *Mycelium* immersed. *Setae* subulate, straight, unbranched, thick and smooth-walled, 200-400  $\mu\text{m}$  long, 5-7  $\mu\text{m}$  wide, surrounded by tightly compacted conidiophore filaments. *Conidiophores* macronematous, synnematos, straight or bending out of the seta at the apex, unbranched, brown to dark brown, smooth, up to 120  $\mu\text{m}$  long, 3  $\mu\text{m}$  wide at the upper part, 1  $\mu\text{m}$  wide at the lower part. *Conidiogenous cells* integrated, terminal, monophialidic, cylindrical, collarette. *Conidia* acrogenous, fusiform, curved, thin and smooth-walled, one-cell, hyaline to sub hyaline, with a single setula (up to 10 long) at each end, 14-18  $\mu\text{m}$  long, 2-3  $\mu\text{m}$  wide, aggregated in a liquid droplet.

*Menisporopsis* is identified by conidia with setulae born on synnematos conidiophores with a central, subulate, tall, seta (Ellis, 1971). Tsui *et al.* (1999) recently provided a key to accepted 6 taxa. Species are distinguished by morphologies of conidiogenous cells (number of opening) and conidia (septation and number of setulae at each end). *Menisporopsis theobromae* has 1-celled conidia with a single setula at each end.

### 3.14 *Paliphora porosa* Kuthub.

*Colonies* effuse, golden brown. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, simple, straight or flexuous, gradually tapering to an acute apex, golden brown, smooth but somewhat roughened at the apices, septate, 200-300  $\mu\text{m}$  long, 5-10  $\mu\text{m}$  wide. *Conidiogenous cells* integrated, intercalary, tretic, 1-loci situated immediately below each transverse septa and present in most cells of conidiophores. *Conidia* solitary, pleurogenous, cylindrical to clavate, acute at both ends, 1-septate, hyaline to pale brown, 10-25  $\mu\text{m}$  long, 1-2.5  $\mu\text{m}$  wide.

Two *Paliphora* species have been described: *P. aurea* and *P. porosa*. *Paliphora porosa* mainly differs from the former in having only one tretic conidiogenous locus below each transverse septum while the former has up to three loci (Kuthubutheen, 1987).

### 3.15 *Phaeoisaria clematidis* (Fuckel) S. Hughes

*Colonies* effuse, hairy, with black synnemata up to 450  $\mu\text{m}$  high covered with pale grey powdery mass of conidia. *Mycelium* immersed. *Conidiophores* macronematous, synnematos, straight or slightly flexuous, branched toward the apex, brown, thick and smooth-walled, septate, 2  $\mu\text{m}$  wide, splaying out at the apex and along the sides of the upper half of each synnemata. *Conidiogenous cells* integrated, terminal, sympodial, denticulate, clavate to cylindrical, pale brown. *Conidia* acropleurogenous, solitary, dry, ellipsoidal to obovoid, pointed at the base, thin and smooth-walled, 1-celled, subhyaline to pale brown, 4-10  $\mu\text{m}$  long, 1.5-4  $\mu\text{m}$  wide.

The genus *Phaeoisaria* is characterized by having pigmented synnemata with sympodial, denticulate conidiogenous cells. Castañeda Ruíz et al. (2002) recently noted on the genus and accepted 14 species. They are mainly distinguished by synnemata morphologies, conidial shapes and sizes. *Phaeoisaria clematidis* possesses hyaline conidia, and indeterminate synnemata with terminal and lateral conidiogenous cells (Castañeda Ruíz et al., 2002).

### 3.16 *Physalidium elegans* Mosca

*Colonies* effuse, grey. *Mycelium* partly superficial partly immersed. *Conidiophores* macronematous, mononematous, simple, straight or flexuous, dark brown, septate, thick and smooth-walled, with short, subulate, verticil branches at the septa, up to 600 µm long, 5-9 µm wide at the base, 2-2.5 µm wide at the apex. *Conidiogenous cells* integrate, monoblastic, lageniform to subulate, terminal on branches and a stipe. *Conidia* solitary, smooth-walled, comprising of a dark brown, obovoid to ellipsoidal central cell (7-11 µm long, 6-7 µm wide) and two smaller, hyaline, sub spherical lateral cells (2-4.5 µm long, 2-6 µm wide).

Conidial morphology is the distinguishing character of the species (Ellis, 1971).

### 3.17 *Subulispora procurvata* Tubaki

*Colonies* effuse, gery. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, simple, straight or flexuous, smooth, septate, pale olive to brown, up to 320 µm long, 3-5 µm thick. *Conidiogenous cells* integrated, terminal, polyblastic, sympodial, cicatrized, with numerous scars. *Conidia* solitary, acropleurogenous, subulate, truncate at the base, pointed and bent at the apex, 0-3 septate, hyaline, thin and smooth-walled, 35-60 µm long, 2.5-3 µm wide at the broadest part.

*Subulispora procurvata* is identified by subulate, hyaline conidia with bent apex born on sympodial conidiogenous cells at the terminal of simple conidiophores (Ellis, 1976).

## 4. New Species Described from the Present Study

Two new fungi have been collected during this study. They have been described and submitted to publish in the international journals with an impact factor.

### 4.1 *Dictyoarthrinium synnematicum* Somrithipol

A manuscript describing *Dictyoarthrinium synnematicum* was submitted to the journal 'Mycologia' and was published in December 2007.

'Somrithipol, S. 2007. A synnematous species of *Dictyoarthrinium* from Thailand. *Mycologia* 99: 792-796. (Appendix 2)

#### 4.2 *Lauriomyces synnematicum* Somrithipol, Chamoi, & Thongnuch

A manuscript describing *Lauriomyces synnematicum* is submitted to an editor of the journal 'Nova Hedwigia'.

'Somrithipol, S, C. Chamoi, & B. Thongnuch. 2009. A synnematous species of *Lauriomyces* from Thailand. *Nova Hedwigia* (Appendix 3)

### CONCLUSION

The results are summarized as the follows:

1. There are six fungal communities colonizing dipterocarp seeds in the present study including: 1, the community on *Dipterocarpus chartaceus* seeds at Khao Yai National Park; 2, on *D. turbinatus* seeds at Khao Yai National Park; 3, on *D. alatus* seeds at Khao Soi Dao Wildlife Sanctuary; 4, on *D. costatus* seeds at Phu Phan National Park; 5 on *D. tuberculatus* seeds at Phu Phan National Park; and 6 the community on *D. turbinatus* seeds at Doi Inthanon National Park.

2. The number of fungal species in the communities ranged between 7 and 16. The values of species diversity ranged between 0.7 and 1.0. The community on *D. chartaceus* at Khao Yai National Park possessed the highest species diversity, while that on *D. tuberculatus* at Phu Phan National Park possessed the lowest species diversity.

3. Fungal similarities between the two communities ranged between 9-39%. Fungi on *D. chartaceus* at Khao Yai National Park and those on *D. alatus* at Khao Soi Dao Wildlife Sanctuary are the most similar while the similarity of fungi on *D. chartaceus* at Khao Yai National Park and *D. turbinatus* at Doi Inthanon National Park is the least. Neither seed species nor surveying site does clearly affect the similarity of the fungi between the two communities.

4. The comparison of fungi on dipterocarp seeds with those on the market fruits and those on decaying leaves from the orchard and the natural forests revealed that the colonization of marketed fruits was limited to the *Penicillium* species while the fungi colonizing decaying leaves were similar to those on the dipterocarps.

5. Two new fungi were collected on decaying leaves from the orchard and the natural forest. They were described and published.

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**APPENDIX 1: APPENDIX TABLES**

**Appendix Table 1.** The parameters and analysis of the fungal community on *Dipterocarpus chartaceus* seeds from Khao Yai National Park

<b>Fungi</b>	<b>I</b>	<b>F</b>	<b>A</b>	<b>pi</b>	<b>pi log pi</b>
<i>Dictyochaeta</i> sp. 1	54	76.1	17.0	0.170347	-0.13094
<i>Thozetella</i> sp. 1	51	71.8	16.1	0.160883	-0.12766
<i>Dinemasporium lanatum</i>	45	63.4	14.2	0.141956	-0.12036
<i>Physalidium elegans</i>	43	60.6	13.6	0.135647	-0.11769
<i>Chalara</i> sp.1	36	50.7	11.4	0.113565	-0.10729
<i>Kionochaeta ramifera</i>	21	29.6	6.6	0.066246	-0.07809
<i>Cryptophiale kakombensis</i>	18	25.4	5.7	0.056782	-0.07074
<i>Cryptophiale udagawae</i>	14	19.7	4.4	0.044164	-0.05984
<i>Cryptophialoidea secunda</i>	11	15.5	3.5	0.0347	-0.05065
<i>Cryptophiale guadalcanalense</i>	10	14.1	3.2	0.031546	-0.04735
<i>Trichoderma</i> sp.	5	7.0	1.6	0.015773	-0.02842
<i>Helicomyces roseus</i>	5	7.0	1.6	0.015773	-0.02842
<i>Paliphora porosa</i>	2	2.8	0.6	0.006309	-0.01388
<i>Canalisporium caribense</i>	1	1.4	0.3	0.003155	-0.00789
<i>Cryptophiale iriomoteanum</i>	1	1.4	0.3	0.003155	-0.00789
<b>Total Species (S)</b>	<b>15</b>				
<b>Total Individual (N)</b>	<b>317</b>				
<b>Total Sample collected</b>	<b>71</b>				
<b>Species Diversity (H)</b>	<b>1.00</b>				
<b>Species Evenness (E)</b>	<b>1.17</b>				
<b>Richness Index (R1)</b>	<b>2.43</b>				
<b>Richness Index (R2)</b>	<b>0.84</b>				

**Notes** I: Individual of each species; F: Frequency of occurrence; A: Species abundance;  $p_i$  = number of individuals of each species/ number of individuals of all species.

**Appendix Table 2.** The parameters and analysis of the fungal community on *Dipterocarpus turbinatus* seeds collected from Khao Yai National Park

<b>Fungi</b>	<b>I</b>	<b>F</b>	<b>A</b>	<b>pi</b>	<b>pi log pi</b>
<i>Dinemasporium lanatum</i>	16	88.9	25.8	0.258065	-0.15181
<i>Thozetella</i> sp. 1	15	83.3	24.2	0.241935	-0.1491
<i>Dictyochaeta</i> sp. 1	14	77.8	22.6	0.225806	-0.14593
<i>Cryptophiloides secunda</i>	5	27.8	8.1	0.080645	-0.08818
<i>Helicosporium</i> sp. 1	5	27.8	8.1	0.080645	-0.08818
<i>Dictyochaeta</i> sp. 2	4	22.2	6.5	0.064516	-0.0768
Unidentified coelomycete sp. 3	2	11.1	3.2	0.032258	-0.04811
<i>Dictyochaetopsis</i> sp.	1	5.6	1.6	0.016129	-0.02891
<b>Total Species (S)</b>	<b>8</b>				
<b>Total Individual (N)</b>	<b>62</b>				
<b>Total Sample collected</b>	<b>18</b>				
<b>Species Diversity (H)</b>	<b>0.78</b>				
<b>Species Evenness (E)</b>	<b>0.70</b>				
<b>Richness Index (R1)</b>	<b>1.70</b>				
<b>Richness Index (R2)</b>	<b>1.02</b>				

**Notes** I: Individual of each species; F: Frequency of occurrence; A: Species abundance;  $p_i$  = number of individuals of each species/ number of individuals of all species.

**Appendix Table 3.** The parameters and analysis of the fungal community on *Dipterocarpus alatus* seeds collected from Khao Soi Dao Wildlife Sanctuary

<b>Fungi</b>	<b>I</b>	<b>F</b>	<b>A</b>	<b>pi</b>	<b>pi log pi</b>
<i>Dictyochaeta</i> sp. 1	53	43.1	26.8	0.267677	-0.15322
<i>Thozetella</i> sp. 1	29	23.6	14.6	0.146465	-0.12219
<i>Chaetospermum camelliae</i>	25	20.3	12.6	0.126263	-0.11348
<i>Dinemasporium lanatum</i>	24	19.5	12.1	0.121212	-0.11109
<i>Helicomyces</i> sp. 1	22	17.9	11.1	0.111111	-0.10603
<i>Trichoderma</i> sp.	9	7.3	4.5	0.045455	-0.06102
<i>Dictyochaeta</i> sp. 2	3	2.4	1.5	0.015152	-0.02757
<i>Gonytrichum</i>	3	2.4	1.5	0.015152	-0.02757
<i>Phaeoisaria clematidis</i>	3	2.4	1.5	0.015152	-0.02757
<i>Thozetella</i> sp. 2	3	2.4	1.5	0.015152	-0.02757
<i>Menisporopsis theobromae</i>	2	1.6	1.0	0.010101	-0.02016
<i>Physalidium elegans</i>	2	1.6	1.0	0.010101	-0.02016
<i>Cryptophiale udagawae</i>	1	0.8	0.5	0.005051	-0.0116
<i>Gliocephalotrichum</i>	1	0.8	0.5	0.005051	-0.0116
<i>Phoma</i> sp. 1	1	0.8	0.5	0.005051	-0.0116
<i>Stilbella</i> sp. 1	1	0.8	0.5	0.005051	-0.0116
<b>Total Species (S)</b>	<b>16</b>				
<b>Total Individual (N)</b>	<b>198</b>				
<b>Total Sample collected</b>	<b>123</b>				
<b>Species Diversity (H)</b>	<b>0.86</b>				
<b>Species Evenness (E)</b>	<b>1.04</b>				
<b>Richness Index (R1)</b>	<b>2.84</b>				
<b>Richness Index (R2)</b>	<b>1.14</b>				

**Notes** I: Individual of each species; F: Frequency of occurrence; A: Species abundance;  
 $p_i$  = number of individuals of each species/ number of individuals of all species.

**Appendix Table 4.** The parameters and analysis of the fungal community on *Dipterocarpus costatus* seeds collected from Phu Phan National Park

<b>Fungi</b>	<b>I</b>	<b>F</b>	<b>A</b>	<b>pi</b>	<b>pi log pi</b>
<i>Penicillium</i> sp. 1	10	17.9	18.9	0.188679	-0.13666
<i>Dictyochaeta</i> sp. 1	7	12.5	13.2	0.132075	-0.11612
<i>Chalara</i> sp.1	6	10.7	11.3	0.113208	-0.10711
<i>Thozetella</i> sp. 1	6	10.7	11.3	0.113208	-0.10711
Unidentified Coelomycete 1	4	7.1	7.5	0.075472	-0.0847
<i>Clonostachy</i> sp.1	4	7.1	7.5	0.075472	-0.0847
Unidentified Coelomycete 2	3	5.4	5.7	0.056604	-0.07059
<i>Thozetella</i> sp. 2	3	5.4	5.7	0.056604	-0.07059
<i>Beltrania</i> sp. 1	2	3.6	3.8	0.037736	-0.05371
<i>Penicillium</i> sp. 2	2	3.6	3.8	0.037736	-0.05371
<i>Menispora</i> sp. 1	2	3.6	3.8	0.037736	-0.05371
<i>Lauriomyces sakaeratensis</i>	1	1.8	1.9	0.018868	-0.03253
<i>Kiliophora ubiensis</i>	1	1.8	1.9	0.018868	-0.03253
<i>Chaetospermum camelliae</i>	1	1.8	1.9	0.018868	-0.03253
<i>Helicosporium</i> sp. 1	1	1.8	1.9	0.018868	-0.03253
<b>Total Species (S)</b>	<b>15</b>				
<b>Total Individual (N)</b>	<b>53</b>				
<b>Total Sample collected</b>	<b>56</b>				
<b>Species Diversity (H)</b>	<b>1.07</b>				
<b>Species Evenness (E)</b>	<b>1.26</b>				
<b>Richness Index (R1)</b>	<b>3.53</b>				
<b>Richness Index (R2)</b>	<b>2.06</b>				

**Notes** I: Individual of each species; F: Frequency of occurrence; A: Species abundance;  $p_i$  = number of individuals of each species/ number of individuals of all species.



**Appendix Table 5.** The parameters and analysis of the fungal community on *Dipterocarpus tuberculatus* seeds collected from Phu Phan National Park

<b>FUNGI</b>	<b>I</b>	<b>F</b>	<b>A</b>	<b>pi</b>	<b>pi log pi</b>
Unidentified Coelomycete 2	15	53.6	39.5	0.394737	-0.15935
<i>Penicillium</i> sp. 2	6	21.4	15.8	0.157895	-0.12657
<i>Chaetomella raphigera</i>	4	14.3	10.5	0.105263	-0.10292
Unidentified sp. 2	3	10.7	7.9	0.078947	-0.08705
Unidentified sp. 1	2	7.1	5.3	0.052632	-0.0673
Unidentified sp. 3	2	7.1	5.3	0.052632	-0.0673
<i>Chalara</i> sp.1	1	3.6	2.6	0.026316	-0.04157
<i>Subulispora procurvata</i>	1	3.6	2.6	0.026316	-0.04157
<i>Dictyochaeta</i> sp. 2	1	3.6	2.6	0.026316	-0.04157
<i>Dinemasporium lanatum</i>	1	3.6	2.6	0.026316	-0.04157
<i>Cryptophiloides secunda</i>	1	3.6	2.6	0.026316	-0.04157
<i>Phoma</i> sp. 1	1	3.6	2.6	0.026316	-0.04157
<b>Total Species (S)</b>	<b>12</b>				
<b>Total Individual (N)</b>	<b>38</b>				
<b>Total Sample collected</b>	<b>28</b>				
<b>Species Diversity (H)</b>	<b>0.86</b>				
<b>Species Evenness (E)</b>	<b>0.93</b>				
<b>Richness Index (R1)</b>	<b>3.02</b>				
<b>Richness Index (R2)</b>	<b>1.95</b>				

**Notes** I: Individual of each species; F: Frequency of occurrence; A: Species abundance;  
 $p_i$  = number of individuals of each species/ number of individuals of all species.

**Appendix Table 6.** The parameters and analysis of the fungal community on *Dipterocarpus turbinatus* seeds collected from Doi Inthanon National Park

<b>FUNGI</b>	<b>I</b>	<b>F</b>	<b>A</b>	<b>pi</b>	<b>pi log pi</b>
<i>Gliocladium</i> sp. 1	7	13.2	25.9	0.259259	-0.15199
Unidentified Coelomycete 4	6	11.3	22.2	0.222222	-0.14516
<i>Thozetella</i> sp. 1	6	11.3	22.2	0.222222	-0.14516
Basidiomycete ( <i>Mycena</i> )	3	5.7	11.1	0.111111	-0.10603
<i>Coniella castaneicola</i>	2	3.8	7.4	0.074074	-0.08373
<i>Dictyochaeta</i> sp. 2	2	3.8	7.4	0.074074	-0.08373
<i>Thozetella</i> sp. 2	1	1.9	3.7	0.037037	-0.05301
<b>Total Species (S)</b>	<b>7</b>				
<b>Total Individual (N)</b>	<b>27</b>				
<b>Total Sample collected</b>	<b>53</b>				
<b>Species Diversity (H)</b>	<b>0.77</b>				
<b>Species Evenness (E)</b>	<b>0.65</b>				
<b>Richness Index (R1)</b>	<b>1.82</b>				
<b>Richness Index (R2)</b>	<b>1.35</b>				

Notes I: Individual of each species; F: Frequency of occurrence; A: Species abundance;  
 $p_i$  = number of individuals of each species/ number of individuals of all species.

**APPENDIX 2: PUBLICATION REPRINT**

## A synnematosus species of *Dictyoarthrinium* from Thailand

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**Abstract:** Genus *Dictyoarthrinium* is reviewed. *Dictyoarthrinium synnematicum*, collected on decaying banana leaves in Thailand, is illustrated, described as a new species and compared with related taxa. The fungus differs from other *Dictyoarthrinium* species in having a synnematosus structure. This species is the first synnematosus record of an anamorphic fungus with basauxic conidiophores. A key to species of *Dictyoarthrinium* is provided.

**Key words:** anamorphic fungi, basauxic conidiophores, hyphomycetes, synnemata, taxonomy

### INTRODUCTION

Hughes (1952) erected the genus *Dictyoarthrinium* S. Hughes for two new fungi from the Gold Coast (now Ghana): *D. quadratum* S. Hughes, the type species, and *D. africanum* S. Hughes. The genus is characterized by muriform conidia borne on terminal and lateral, septate, basauxic conidiophores. Hughes (1952) compared *D. quadratum* with the description and illustration of *Tetracoccusporium sacchari* J.A. Stev. and said that these two taxa are congeneric.

Damon (1953) examined the type material of *T. sacchari*, compared it with *D. quadratum* and concluded that both taxa are congeneric. Damon (1953) therefore transferred *T. sacchari* to genus *Dictyoarthrinium* as *Dictyoarthrinium sacchari* (J.A. Stev.) Damon, with *D. quadratum* as its heterotypic synonym. Rao and Rao (1964) described *D. lilliputeum* P.

Rag. Rao & D. Rao. and *D. microsporium* P. Rag. Rao & D. Rao. from India while *Dictyoarthrinium rabaulense* Matsush. was described from Japan (Matsushima 1971, 1988).

During a continuing investigation on saprobic microfungi in Thailand, a synnematosus fungus with acropleurogenous and cruciform conidia borne on septate and basauxic conidiophores was collected on decaying banana leaves. The morphologies of conidium and conidiophores suggest placement of this fungus in genus *Dictyoarthrinium*. However this collection differs from others by the production of synnemata and therefore is described as a new species.

### MATERIALS AND METHODS

Decaying leaves were collected, identified to species and taken to the laboratory. Leaves were washed with water before incubation in moist chambers and periodically observed under a dissection microscope for sporulating fungi. Fungi were mounted in water on glass slides and examined, measured and photographed under a differential interference contrast microscope. Conidial measurements included minimum and maximum ranges with arithmetic mean ( $\bar{x}$ ) for  $n$  measurements. Single spore isolations were made on cornmeal agar with 0.5 mg/L streptomycin sulfate added to suppress bacterial growth. Slides were preserved by replacing the mounting water with lactophenol and sealed with polyvinyl alcohol. All specimens were dried and deposited in BIOTEC Bangkok Herbarium (BBH). Cultures are deposited in BIOTEC Culture Collection (BCC), Thailand.

### TAXONOMY

*Dictyoarthrinium synnematicum* Somrithipol sp. nov.

FIGS. 1–14

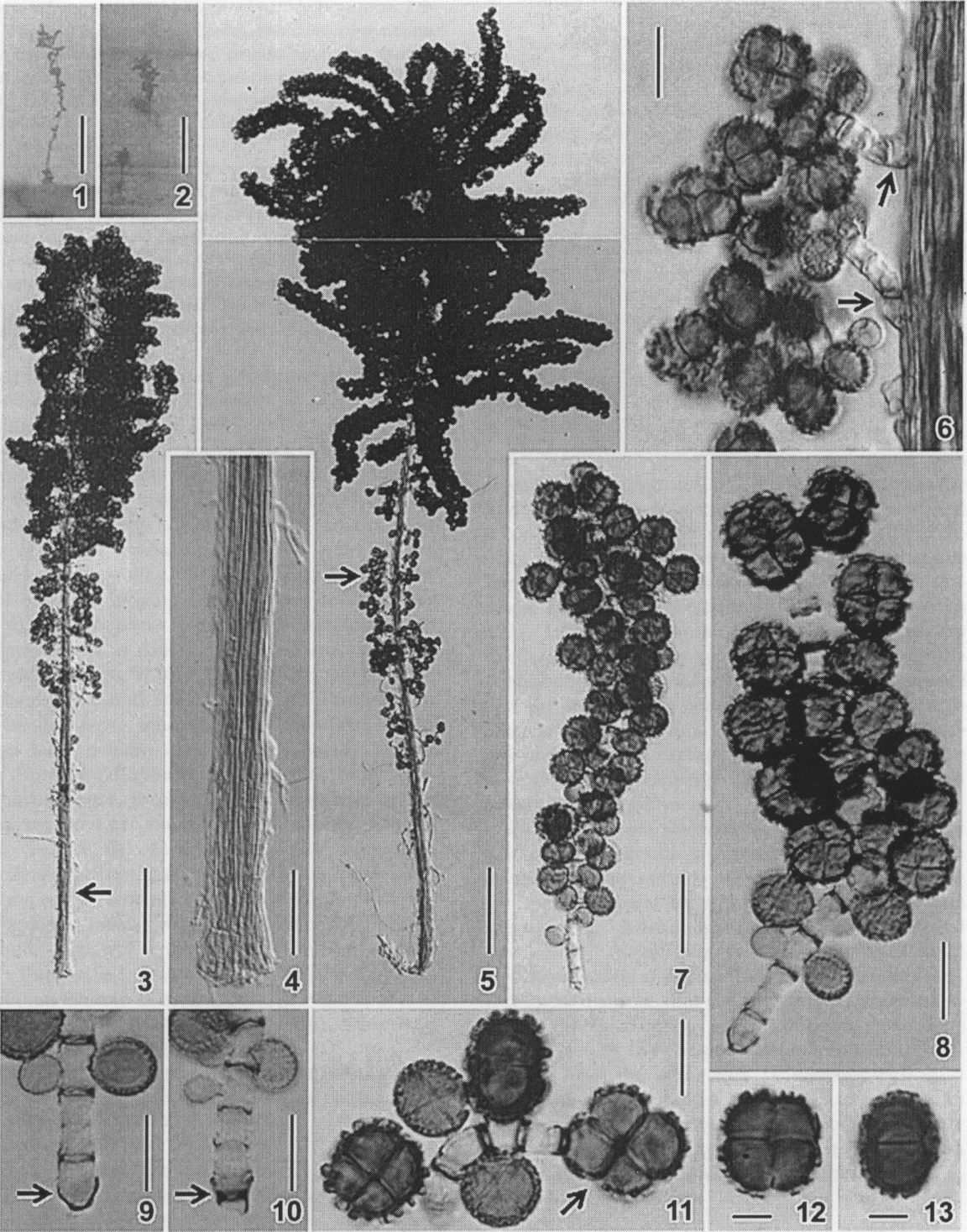
*Coloniae* in folio putrescent atrae; synnematibus disperses. *Synnemata* solitaria, dispersa, atra, 600–2200  $\mu$ m alta, 10–20  $\mu$ m crassa; filamentis adpressis. *Filamenta synnematum* brunnea vel pallide brunnea, septatis, laevis, 2–3  $\mu$ m

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FIGS. 1–13. Light micrographs of *Dictyoarthrinium synnematicum* (from holotype). 1, 2. Synnemata on decaying leaves. 3. Mature synnema (arrow points to magnification in FIG. 4). 4. A synnematosus stipe with septate filaments closely adpressed along their length. 5. Aged synnema with long conidiophores on the upper part (arrow points to magnification in FIG. 6). 6. Conidiophore mother cells (arrow) arising laterally from the synnematosus filaments. 7, 8. Basauxic conidiophores with acropleurogenous conidia. 9, 10. Conidiophore mother cells (arrow). 11. Integrated conidiogenous cells with attached conidia (an arrow indicates an acrogenous conidium). 12, 13. Mature conidia in face and side view respectively. Bars: 1 = 300  $\mu$ m; 2 = 1000  $\mu$ m; 3, 5 = 100  $\mu$ m; 4, 7 = 25  $\mu$ m; 6, 8, 9, 10, 11 = 10  $\mu$ m; 12, 13 = 5  $\mu$ m.



crassa; ramis brevibus, lateribus, cellulas matricales conidiophori ferrentibus. *Cellulae matricales conidiophori* subgloboseae vel cupulatae, brunneae vel pallide brunneae, 1.5–3 µm longae, 3.5–5 µm latae. *Conidiophora* macronematosa, basauxica, cylindrica, flexuosa, pallide brunnea, septatis atro-brunneis fasciatis, laevia, crassitunicata, usque 450 µm longa, 4–5 µm lata; cellulis matricibus conidiophori singularibus exorientibus; conidiophora vetusta et longa partem superam synnematum formata, conidiophora juvenalis et brevibus partem inferam synnematum formata. *Cellulae conidiogenae* sursum in conidiophoris incorporatae, intercalares et terminales, cylindricae, 3.5–9 µm longae, 3.5–6 µm latae. *Conidia* holoblastic, acropleurogena, solitaria, quadrata, globosa vel subglobose, complanata, cruciatim quadricellula, brunnea vel atro-brunnea, crassitunicata, tuberculata, aspectu frontali 10–14 µm diam, aspectu laterali 6–11 µm crassa; secessio scizolytica. *Teleomorphis* ignota.

*Holotypus*. Thailandia, foliis putrescentibus *Musae*, S. Somrithipol lectus (SFC 2132 in BBH).

Cultura ex-typo: BCC 22059.

*Colonies* on decaying leaves black with scattered synnemata (FIGS. 1, 2). *Synnemata* solitary, scattered, black, 600–2200 µm high, 10–20 µm thick (FIGS. 3, 5), with filaments closely adpressed along most of their length (FIG. 4). *Filaments* brown to pale brown, septate, smooth-walled, 2–3 µm thick, with short, lateral branches bearing conidiophore mother cells (FIG. 6). *Conidiophore mother cells* subglobose to cupulate, brown to pale brown, 1.5–3 µm long, 3.5–5 µm wide (FIGS. 6, 9, 10). *Conidiophores* macronematous, basauxic, cylindrical, flexuous, pale brown, with dark banded septa, smooth- and thin-walled, up to 450 µm long, 4–5 µm wide (FIGS. 7, 8, 14), arising singly from conidiophore mother cells; older conidiophores longer, formed at the upper part of the synnemata, younger conidiophores shorter formed below (FIGS. 3, 5). *Conidiogenous cells* integrated, intercalary and terminal, cylindrical, 3.5–9 µm long, 3.5–6 µm wide (FIG. 11). *Conidia* holoblastic, acropleurogenous, solitary, square, globose or subglobose, flattened, cruciately septate, 4-celled, brown to dark brown, thick-walled, tuberculata, 10–14 ( $\bar{x} = 12.0 \pm 1$ ,  $n = 50$ ) µm diam in face view, 6–11 ( $\bar{x} = 8.3 \pm 1$ ,  $n = 50$ ) µm thick in side view (FIGS. 11–14), schizolytic secession. *Teleomorph* absent.

*Holotype*: THAILAND. PRACHIN BURI: Ban Wang Bon, an abandoned orchard, decaying leaves of banana, 01 I 2006, S. Somrithipol (SFC 2132 in BBH).

Ex-typo culture: BCC 22059.

*Etymology*: refers to the synnemata.

*Colonies* on cornmeal agar reaching 2.5–3.0 cm diam in 7 d, translucent with hyaline submerged mycelium; turning to pale brown with age, no pigmentation of the agar. Sporulation was not found during 30 d incubation.

#### KEY TO SPECIES OF *Dictyoarthrinium*

1. Conidia 16-celled, conidia 20–28 × 19–26 µm . . . . . *D. africanum*
1. Conidia 4-celled . . . . . 2
  2. Synnemata present, conidial diameter 10–14 µm . . . . . *D. synnematicum*
  2. Synnemata absent . . . . . 3
3. Conidial diameter 20–27 µm . . . . . *D. rabaulense*
3. Conidial diameter less than 20 µm . . . . . 4
  4. Conidial wall verrucose, conidiophores 55–124 × 4.0–5.5 µm, conidial diameter 11–14 µm . . . . . *D. sacchari*
  4. Conidial wall tuberculate . . . . . 5
5. Conidiophores 36–54 × 3.5–6.5 µm, conidial diameter 7–15.5 µm . . . . . *D. lilliputeum*
5. Conidiophores 75–252 × 5–9 µm, conidial diameter 7–11 µm . . . . . *D. microsporium*

#### DISCUSSION

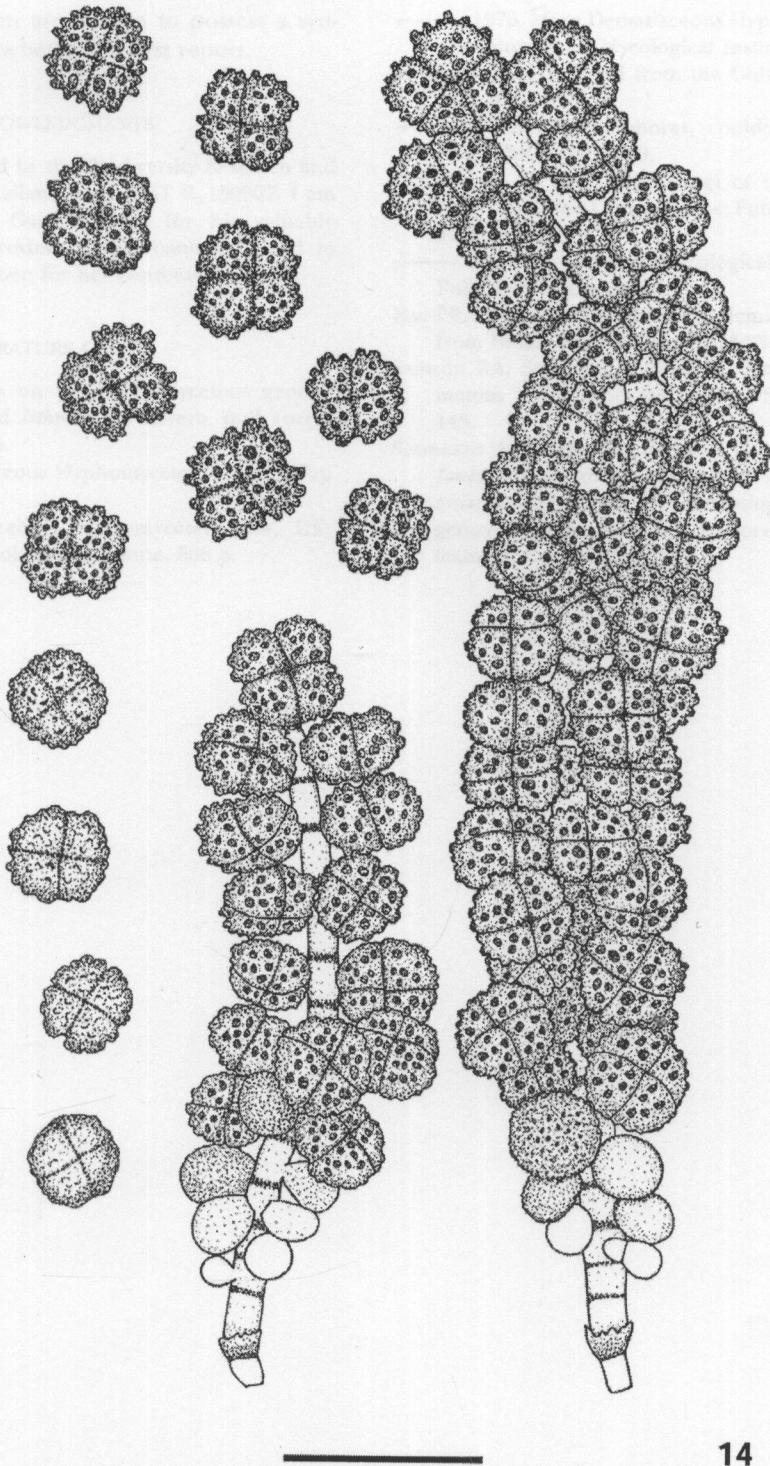
Hughes (1953) in his new classification of anamorphic fungi introduced a section for those with basauxic conidiophores or conidiophores that arise and elongate from a cup-shaped basal cell called a conidiophore mother cell. Fungi with such a character are uncommon, with few genera, and include *Arthrinium*, *Catenospegazzinia*, *Cordella*, *Dictyoarthrinium*, *Endocalyx*, *Pteronidium* and *Spegazzinia* (Ellis 1971, 1976, Subramanian 1991). These genera are distinguished by the position of conidia on the conidiophores, the occurrence of setae and stroma and the septation of conidia and conidiophores. In *Dictyoarthrinium* conidia are acropleurogenous, septate and borne on septate conidiophores while setae and stroma are lacking. The new fungus is best referred to this genus.

*Dictyoarthrinium synnematicum* differs from other species of the genus in possessing synnemata. The present of synnemata is an important characteristic for species separation within several hyphomycete species (e.g. *Janetia synnematos* [Sivanesan and Hsieh 1990], *Melanographium selenioides* [Ellis 1963] and *Memnoniella stilboidea* [Ellis 1976]). Samson et al. (1989) have shown that the morphological classification of the synnematos species of genus *Penicillium* is supported by the chemotaxonomic evidence.

Apart from the synnemata *D. synnematicum* most resembles *D. microsporium* and *D. lilliputeum* in conidium and conidiophore morphologies. However conidiophores of the new species are longer than those of the two previous species. Conidia of the *D. synnematicum* also are larger than those of *D. microsporium*.

Most anamorphic fungi with basauxic conidiophores have free, mononematous conidiophores while few form a stroma or a cup-shaped fruiting structure.





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FIG. 14. Line drawing of *Dictyoarthrinium synnematicum* (from holotype), conidiophores and conidia. Bar = 10  $\mu$ m.

However none of them are known to possess a synnema, *D. synnematicum* being the first report.

#### ACKNOWLEDGMENTS

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**APPENDIX 3: PUBLICATION DRAFT**

## A synnematosus species of *Lauriomyces* from Thailand

by

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With 1 figures

Somrithipol, S., C. Chamoi & B. Thongnuch (2008): A synnematosus species of *Lauriomyces* from Thailand. – Nova Hedwigia

**Abstract:** *Lauriomyces synnematicum*, collected on decaying leaves in Thailand is illustrated, described as a new species and compared with related taxa. The fungus differs from other *Lauriomyces* species in having a synnematosus structure.

**Key words:** anamorphic fungi, hyphomycetes, new species, synnema, taxonomy.

### Introduction

During our investigation on saprobic leaf litter fungi in tropical forests of Thailand, Three *Lauriomyces* species has previously been collected, illustrated, and described (Somrithipol et al. 2006, Somrithipol & Jones 2007). A recent collection yielded a further *Lauriomyces* species whose morphological characteristics differ significantly from the other known taxa. This fungus is, therefore, describes as a new species.

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## Materials and methods

Decaying plant material on the forest floor were collected and incubated in moist chambers and periodically observed for fungi. The methods of examination and isolation follow Somrithipol & Jones (2003). Conidial measurements include minimum-maximum ranges and the arithmetic mean ( $\bar{x}$ )  $\pm$  standard deviation for  $n$  measurements. All materials examined were dried down and deposited in BIOTEC Bangkok Herbarium (BBH). Cultures are deposited in BIOTEC Culture Collection (BCC), Thailand.

## Taxonomy

**Lauriomyces synnematicum** Somrithipol, Chamoi et Thongnuch, sp. nov.

Fig. 1

Ad fungos anamorficos hyphomycetes pertinens. Coloniae sparsa, niveae, synnematibus disperses. *Synnemata* solitaria vel communia, atra, 50-225  $\mu\text{m}$  alta, 7.5-20  $\mu\text{m}$  crassa; 5-10 filamentis adpressis. *Filamenta synnematum* septatis, laevia, crassitunicata, brunnea vel atro-brunnea, 5-6  $\mu\text{m}$  lata, ramis terminaribus. Rami cylindrici, laeves, tenuitunicati, hyalini vel subhyalini. Rami primarii 3-5, fasciculati ad apices filamentum, 6.5-9.5  $\mu\text{m}$  longi, 1.5-2.5  $\mu\text{m}$  lati. Rami secundarii 3-5 fasciculati, 6-8  $\mu\text{m}$  longi, 1-2  $\mu\text{m}$  lati. Ramoconidia et conidia holoblastica, cylindrica, unicellularia, hyalina vel subhyalina, laevia, tenuitunicata, acropetaliter in catenis ramosis cohaerentia, 4.5-7.5  $\mu\text{m}$  longa, ad 0.7-1.3  $\mu\text{m}$  lata. Teleomorphis ignota.

HOLOTYPUS: THAILANDIA, Nakhon Rachasimae Provincia, in folio putrescentem dicotyledoneae, a B. Thongnuch lectus, 23 V 2008 (SFC 2156 in BBH). Cultura ex-typo: BCC 000000.

ETYMOLOGY: refers to the synnematal structure

Anamorphic hyphomycete. Colonies scattered, white conidial sporulation with scattered synnemata. *Synnemata* solitary or group, scattered, black, 50-225  $\mu\text{m}$  high, 7.5-20  $\mu\text{m}$

thick with 5-10 filaments closely adpressed along most of their length. Filaments septate, thick and smooth-walled, brown to dark brown, 5-6  $\mu\text{m}$  wide, with terminal branches. Branches cylindrical, thin and smooth-walled, hyaline to subhyaline. Primary branches in clusters of 3-5 at filament apex, 6-7.5  $\mu\text{m}$  long ( $\bar{x} = 7.0 \pm 0.68 \mu\text{m}$ ,  $n = 5$ ), 1.0-2.5  $\mu\text{m}$  wide ( $\bar{x} = 2.0 \pm 0.28 \mu\text{m}$ ,  $n = 5$ ). Subsequent branches in clusters of 3-5, 6-7.5  $\mu\text{m}$  long ( $\bar{x} = 6.75 \pm 0.68 \mu\text{m}$ ,  $n = 5$ ), 1-2  $\mu\text{m}$  wide ( $\bar{x} = 1.4 \pm 0.28 \mu\text{m}$ ,  $n = 5$ ). Ramoconidia and conidia holoblastic, cylindrical, unicellular, hyaline to subhyaline, thin- and smooth-walled, in acropetal branched chains, 4.5-7.5  $\mu\text{m}$  long ( $\bar{x} = 5.4 \pm 0.61 \mu\text{m}$ ,  $n = 50$ ), 0.7-1.3  $\mu\text{m}$  wide ( $\bar{x} = 1.0 \pm 0.12 \mu\text{m}$ ,  $n = 50$ ). Teleomorph unknown.

### Discussion

The genus *Lauriomyces* R.F. Castañeda was erected by Castañeda-Ruíz & Kendrick (1990) with *L. pulchra* R.F. Castañeda & W.B. Kendr. as the type species. Presently 8 species are belonged to the genus (Castañeda-Ruíz & Kendrick 1990, Crous & Wingfield 1994, Somrithipol et al. 2006, Somrithipol & Jones 1007). Species of *Lauriomyces* are mainly distinguished by conidial shape and size (Somrithipol & Jones 2007).

*Lauriomyces synnematicum* is grouped among the -species with cylindrical conidia. However, conidia of the new species are shorter than those of *L. cylindricus* and narrower than those of the other cylindrical conidia species. *Lauriomyces synnematicum* also differs the other species of the genus in possessing synnemata. The synnema is an important characteristic to distinguish several hyphomycete species, for example: *Janetia synnematos* (Sivanesan and Hsieh 1990), *Melanographium selenioides* (Ellis 1963), *Memnoniella stilboidea* (Ellis 1976) and *Dictyoarthrinium synnematicum* (Somrithipol 2007).

Somrithipol & Jones (2007) illustrated the gelatinization process during the conidial formation of *L. cylindricus*, resulting in deposition of mucilage between the conidia to join them into a persistent chain. This conidial chain is only the character distinguishing the genus *Lauriomyces* from *Haplographium*. In *L. synnematicus*, the mucilage was less evident but some persistent chains could be observed.

### Acknowledgements

This study was supported by the Biodiversity Research and Training Program in Thailand (BRT) grant BRT R\_150007. We are grateful to Prof. E.B. Gareth Jones for his valuable comments and critical review of the manuscript; to Prof. Morakot Tanticharoen and Dr. Kanyawim Kirtikara, BIOTEC, for their continued support.

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Received \*\*\*; accepted in revised form \*\*\*

### Legend

**Fig. 1.** Line drawings of *Lauriomyces synnematicus* (from holotype). A synnema with filaments bearing branched chains of conidia and cylindrical conidia. Bars: = 10  $\mu$ m.

**APPENDIX 4: ARTICLES FOR BRT NEWS LETTER**

## รายนชากเมล็ด คักยภาพทางด้านเภสัชกรรม และการสนับสนุนจากโครงการบิโออาร์ที

การใช้ประโยชน์ทรัพยากรธรรมชาติแตกต่างกันไปตามสถานะภาพและองค์ความรู้ของผู้ใช้ ก่อให้เกิดรูปแบบที่หลากหลายไม่แพ้ตัวทรัพยากรเอง ศูนย์พันธุวิศวกรรมและเทคโนโลยีชีวภาพแห่งชาติ (ศช.) มีแนวทางในการศึกษาและนำเอาทรัพยากรชีวภาพที่มีอยู่มาสร้างทางเลือกในการใช้ประโยชน์ รวมทั้งเพิ่มมูลค่าให้แก่ทรัพยากรธรรมชาติเหล่านั้น โดย ศ. ดร. มรกต ตันติเจริญ ผู้อำนวยการฯ ได้เล็งเห็นโอกาสในการใช้ประโยชน์รากลุ่มต่าง ๆ ที่มีอยู่หลากหลายในระบบนิเวศ และเห็นชอบเมื่อมีการเสนอโครงการสำรวจความหลากหลายของรากลุ่มที่เจริญบนชากเมล็ดและผลของพืชขึ้น โดยมีนายสายัณห์ สมฤทธิ์ผล เป็นผู้ดำเนินการศึกษา และโครงการพัฒนาองค์ความรู้และศึกษานโยบายการจัดการทรัพยากรชีวภาพในประเทศไทยหรือโครงการบิโออาร์ที ได้ให้การสนับสนุนในระยะแรก

จากจุดเริ่มต้นในครั้งนั้น ส่งผลให้ปัจจุบันมีราที่คัดแยกมาจากชากเมล็ดและผลกว่า 500 สายพันธุ์ จาก 120 ชนิด เก็บรักษาอยู่ที่ห้องปฏิบัติการเก็บรักษาสายพันธุ์จุลินทรีย์ของ ศช. โดยในจำนวนนี้เป็นชนิดใหม่ของโลก (new species) ที่ตีพิมพ์แล้ว 2 ชนิด และมากกว่าครึ่งเป็นชนิดที่พบเป็นครั้งแรกในประเทศไทย (new record) สายพันธุ์รากลุ่มนี้ได้ถูกนำไปตรวจสอบสารออกฤทธิ์ทางชีวภาพที่มีศักยภาพในทางเภสัชกรรม โดยกลุ่มงานวิจัยทรัพยากรชีวภาพของ ศช. ซึ่งก็ให้ผลเป็นที่น่าสนใจอย่างยิ่ง

ที่สำคัญคือการพบว่ารา *ไตรโคเดอร์มา เจลาติโนซัม* (*Trichoderma gelatinosum* P. Chaverri & Samuels) สายพันธุ์ที่แยกได้จากชากฝักสะบ้า (*Entada pursaetha* DC.) มีความสามารถผลิตสารในกลุ่ม 'เฮอรัสเทลโลน' (Hirsutellones) ซึ่งมีคุณสมบัติยับยั้ง *มายโคแบคทีเรียม ทูเบอร์คูโลซิส* (*Mycobacterium tuberculosis*) เชื้อสาเหตุวัณโรค นำไปสู่การจดสิทธิบัตรคุ้มครองการผลิต และการใช้ประโยชน์สารดังกล่าวทั้งในประเทศไทย [1] และสหรัฐอเมริกา [2]

วัณโรคยังคงความสำคัญในเอเชียตะวันออกเฉียงใต้ เนื่องจากเป็นพื้นที่ที่องค์การอนามัยโลกรายงานว่ามีผู้ติดเชื้อสูงสุด [3] สิทธิบัตรดังกล่าวระบุถึงปัญหาสำคัญของการควบคุมวัณโรคในปัจจุบันว่า เกิดจากขาดยารักษาที่มีประสิทธิภาพ "ไอโซไนอะซิด (Isoniazid) และไรแฟมพิน (Rifampin) ซึ่งเป็นตัวยาหลักที่ใช้กันอยู่นั้นค้นพบเมื่อสามสิบปีที่แล้ว จึงมีเชื้อวัณโรคสายพันธุ์ที่ดื้อยาทั้งสองเกิดขึ้นเป็นจำนวนมาก ดังนั้นจึงจำเป็นต้องมียาชนิดใหม่เพื่อใช้รักษาโรคนี้" [1] สิทธิบัตรได้แสดงให้เห็นอย่างชัดเจนว่า สารในกลุ่ม เฮอรัสเทลโลน รวมถึงสารอนุพันธ์ มีฤทธิ์ยับยั้งการเจริญของเชื้อ *มายโคแบคทีเรียม ทูเบอร์คูโลซิส* โดยมีความเป็นพิษต่อเซลล์ต่ำหรือไม่มีเลย ดังนั้นจึงสามารถใช้สารเหล่านี้เป็นองค์ประกอบของยาที่ใช้รักษาวัณโรคได้ [1] นอกจากนี้ *ไตรโคเดอร์มา เจลาติโนซัม* ยังมีคุณสมบัติเด่นคือเจริญเร็วและสร้างสปอร์เป็นจำนวนมาก จึงลดเวลาที่ใช้ในกระบวนการหมัก (fermentation) และสามารถควบคุมคุณภาพของหัวเชื้อได้ หากจะมีการนำไปใช้ผลิตในทางอุตสาหกรรม

ราที่สำรวจพบบนชากผลและเมล็ดมิได้มีแต่เพียง *ไตรโคเดอร์มา เจลาติโนซัม* เท่านั้นที่ผลิตสารประกอบที่มีศักยภาพในทางเภสัชกรรม บทความรายงานสารออกฤทธิ์ทางชีวภาพของกลุ่มงานวิจัยทรัพยากรชีวภาพ ศช. ที่พิมพ์ลงในวารสารวิชาการนานาชาติอย่างต่อเนื่อง เป็นสิ่งที่ยืนยันศักยภาพของรากลุ่มนี้ได้เป็นอย่างดี เช่นการ



พบว่ารา *เมนิสปอโรพซิส ไทรโบรเม* (*Menisporopsis theobromae* S. Hughes) สายพันธุ์ที่แยกได้จากซากผลยางวาด (*Dipterocarpus chartaceus* Sym.) ผลิตสารประกอบชนิดใหม่ที่ได้รับการตั้งชื่อว่า 'เมนิสปอโรพซิน เอ' (Menisporopsin A) [4] สารนี้มีฤทธิ์ต้านเชื้อวัณโรค มาเลเรีย รวมทั้งยับยั้งการเจริญของเซลล์มะเร็ง หรือรา *เคียวโนคิตา พิวไฮ* (*Kionochaeta pughii* Kuthub. & Nawawi) สายพันธุ์ที่แยกได้จากซากผลยางวาดเช่นกัน ผลิตสารประกอบชนิดใหม่ที่ได้รับการตั้งชื่อว่า 'พิวฮินิน เอ' (Pughinin A) [5] มีฤทธิ์ต้านเชื้อมาเลเรีย นอกจากนี้รา *สแต็กกีโบทริส เนโฟรสปอรา* (*Stachybotrys nephrospora* Hansf.) สายพันธุ์ที่แยกได้จากซากผลโพธิ์ทะเล (*Thespesia populnea* (L.) Sol. ex Correa) ก็สามารถผลิตสารกลุ่ม 'เทอร์พีน' (terpene) สองชนิด [6] ที่มีฤทธิ์ต้านเชื้อมาเลเรียด้วยเช่นกัน ซึ่งราเหล่านี้ล้วนแล้วแต่พบเป็นครั้งแรกในประเทศไทย (new record) จากการศึกษาครั้งนี้ทั้งสิ้น

ผลการวิจัยดังกล่าวได้แสดงให้เห็นว่า การศึกษารานซากเมล็ดที่ได้รับการสนับสนุนทุนวิจัยจากโครงการพัฒนาองค์ความรู้และศึกษานโยบายการจัดการทรัพยากรชีวภาพในประเทศไทยในระยะแรก ได้ดำเนินมาในแนวทางอันเป็นประโยชน์ทั้งในด้านข้อมูลความหลากหลายและอนุกรมวิธาน รวมทั้งเอื้ออำนวยต่อการนำไปใช้ประโยชน์ต่อยอดในอนาคต ดังนั้นจึงได้มีการศึกษารานซากเมล็ดต่อเนื่อง ภายใต้โครงการ 'สังคมเข็รรานซากเมล็ดพืชวงศ์ยาง' โดยรับทุนสนับสนุนจากโครงการป็อาร์ที เพื่อสำรวจ 'ทุนทางธรรมชาติ' ของประเทศที่มีศักยภาพในอันที่จะนำไปใช้ประโยชน์ต่อไป

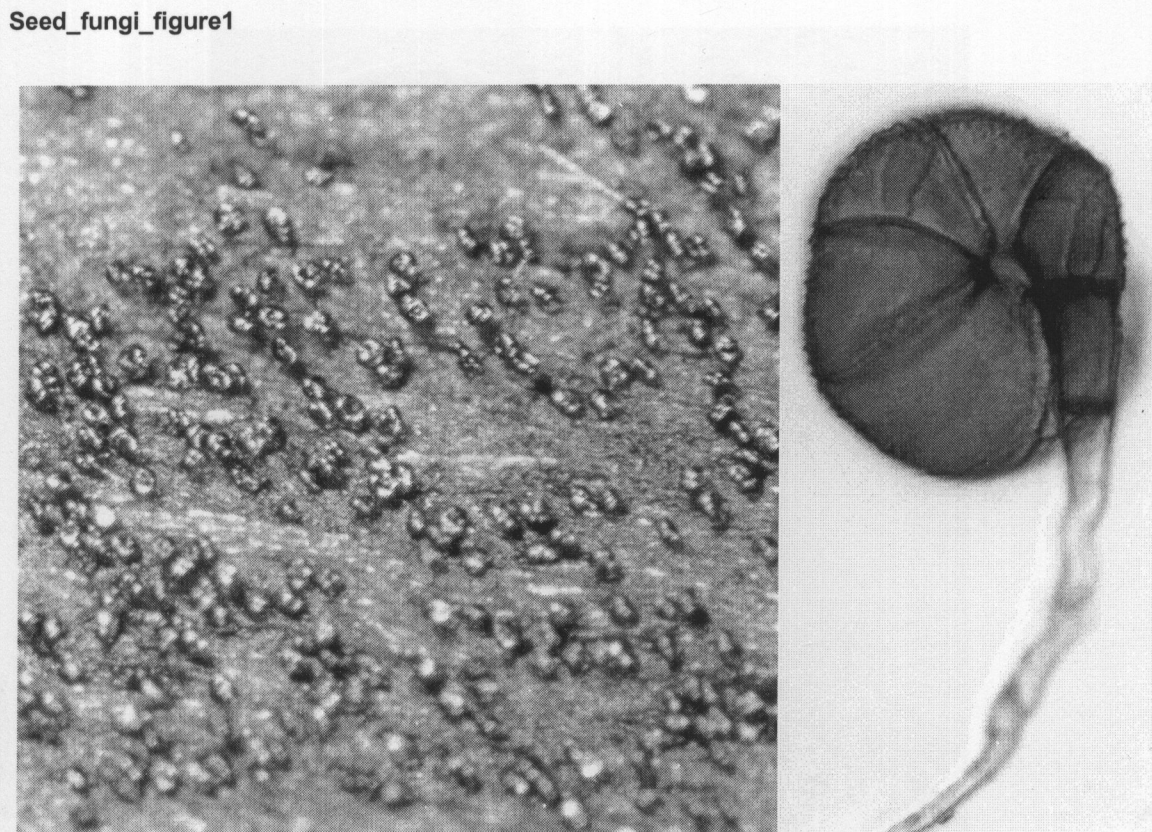
### เอกสารอ้างอิง

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(เรื่องและภาพโดย ดร. สายันท์ สมฤทธิ์ผล ศูนย์พันธุวิศวกรรมและเทคโนโลยีชีวภาพ)

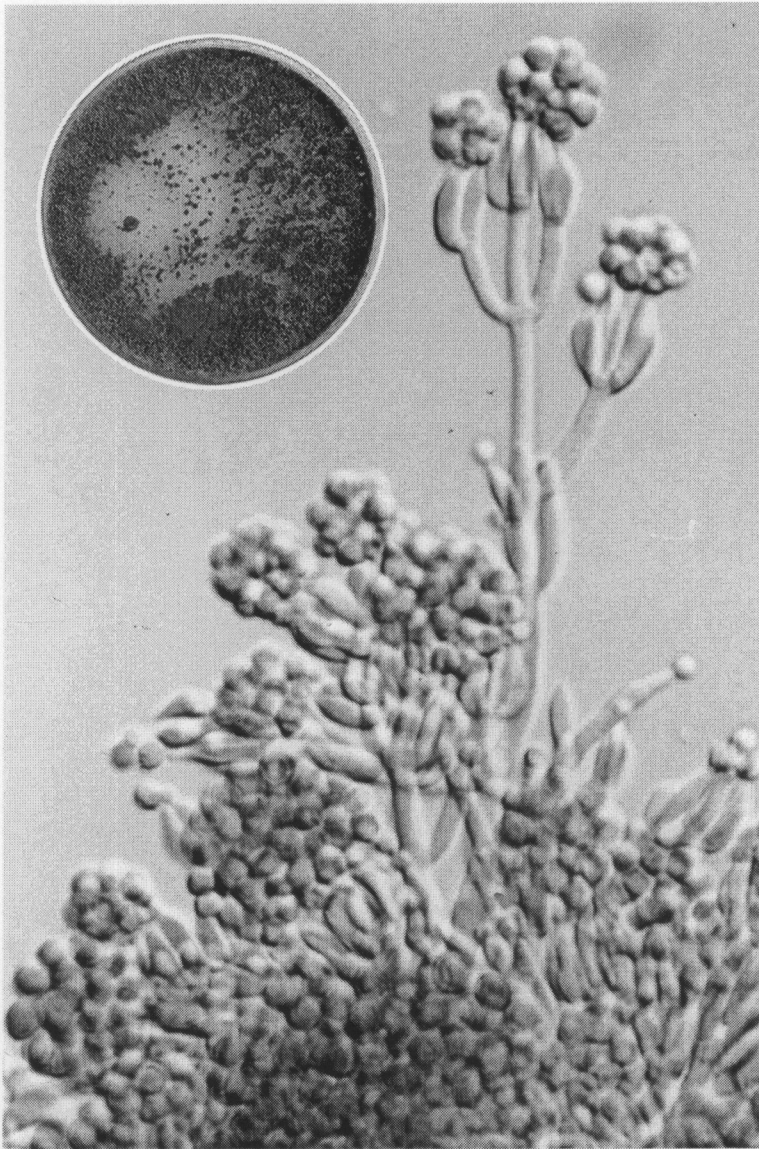
## ภาพประกอบและคำบรรยายภาพ

Seed\_fungi\_figure1



ชนิดใหม่จากซากเมล็ด - เซอร์เรนาเลีย ในโกโรสปอรา (*Cirrenalia nigrospora* Somrithipol, Chatmala & E.B.G. Jones) เป็นหนึ่งในราชชนิดใหม่ของโลกที่พบบนซากเมล็ดและพิมพ์รายงานในวารสารวิชาการนานาชาติ แล้ว ลักษณะเด่นคือ สปอร์ผนังหนาสีดำ มีผนังกันแบ่งเป็นช่อง ๆ และมีวนขีดเป็นเกลียว ราชชนิดนี้พบเจริญบนซากเมล็ดยางพารา สีเสียดเทศ และหางนกยูงฝรั่ง แพร่กระจายในหลายพื้นที่ทั้งภาคอีสานและภาคใต้

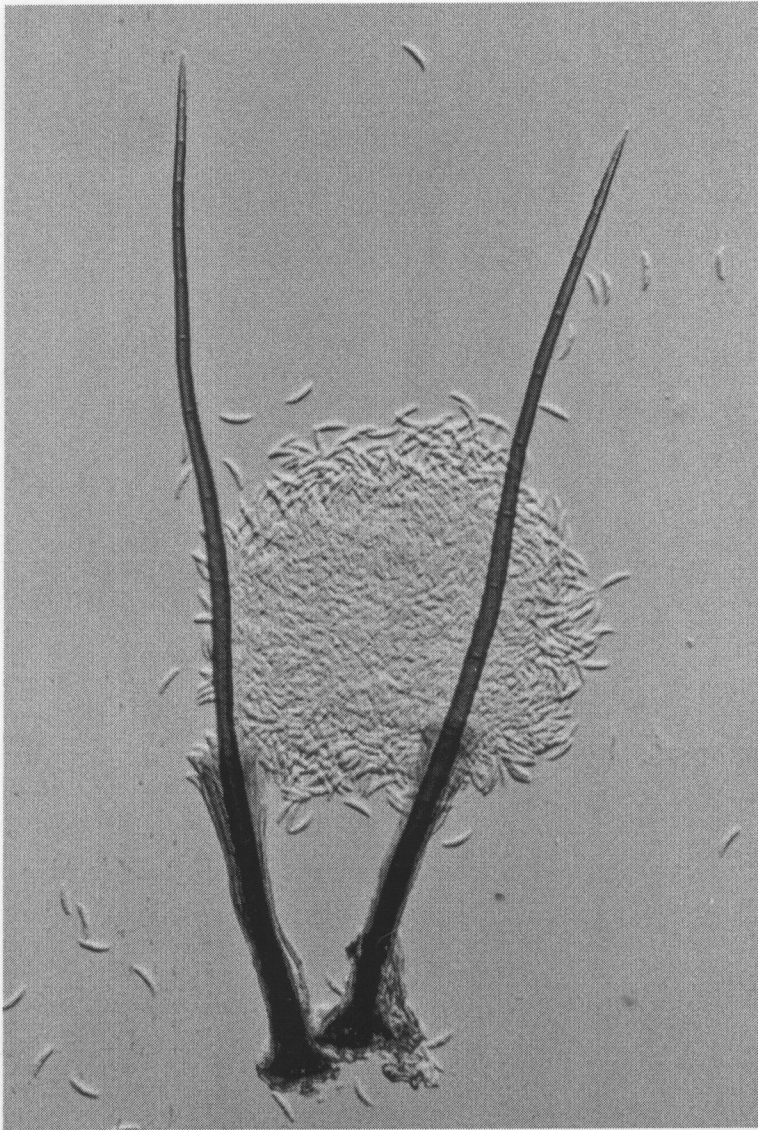
Seed\_fungi\_figure2



จากทรัพยากรและองค์ความรู้สู่สิทธิบัตร – ไตรโคเดอร์มา เจลาติโนซัม (*Trichoderma gelatinosum* P. Chaverri & Samuels) ลักษณะเด่นที่ปรากฏบนอาหารสังเคราะห์คือ มีเส้นใยเจริญรวมกันเป็นกระจุก ปกคลุมด้วยสปอร์สีเขียวเข้มจำนวนมาก ส่วนลักษณะที่เห็นด้วยกล้องจุลทรรศน์คือ สปอร์ทรงกลมเกิดรวมกันเป็นกลุ่มบริเวณปลายเซลล์ผลิตสปอร์ที่มีลักษณะคล้ายรูปดอก สายพันธุ์ราชชนิดนี้ที่แยกได้จากซากผักสะบ้า ผลิตสารในกลุ่ม 'เฮอร์สเทลโลน' ซึ่งมีคุณสมบัติต้านเชื้อวัณโรค และนำไปสู่การจดสิทธิบัตร

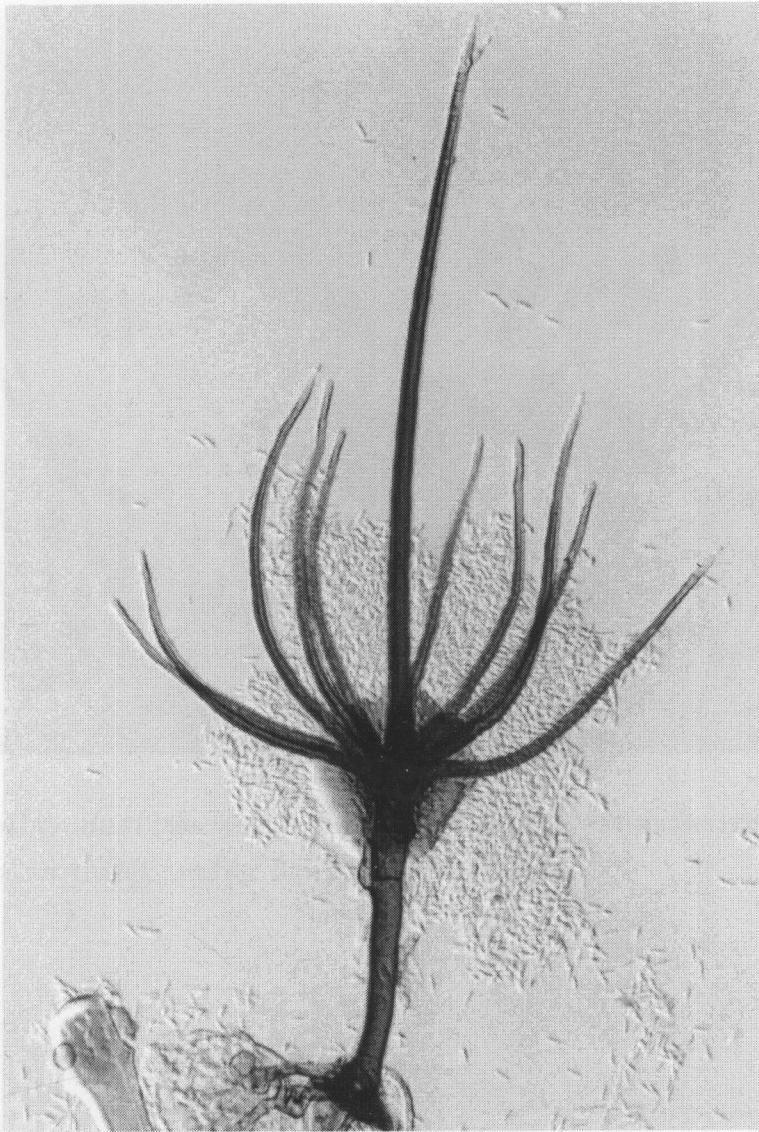


Seed\_fungi\_figure3



เมนิสปอโรปซิส โทโรโบรเม (*Menisporopsis theobromae* S. Hughes)  
— สายพันธุ์ของราชนิดนี้ที่แยกได้จากซากผลยางวาด ผลิตสารใหม่ 'เม  
นิสปอโรปซิน เอ' มีฤทธิ์ต้านเชื้อวัณโรค มาเลเรีย และยับยั้งเซลล์มะเร็ง

Seed\_fungi\_figure4



เคียวโนคิตา พิวไฮ (*Kionochaeta pughii* Kuthub. & Nawawi) – สายพันธุ์ของราชชนิดนี้ที่แยกได้จากซากผลยางวาด ผลิตภัณฑ์ใหม่ 'พิวฮินิน เอ' มีฤทธิ์ต้านเชื้อมาเลเรีย



Seed\_fungi\_figure5

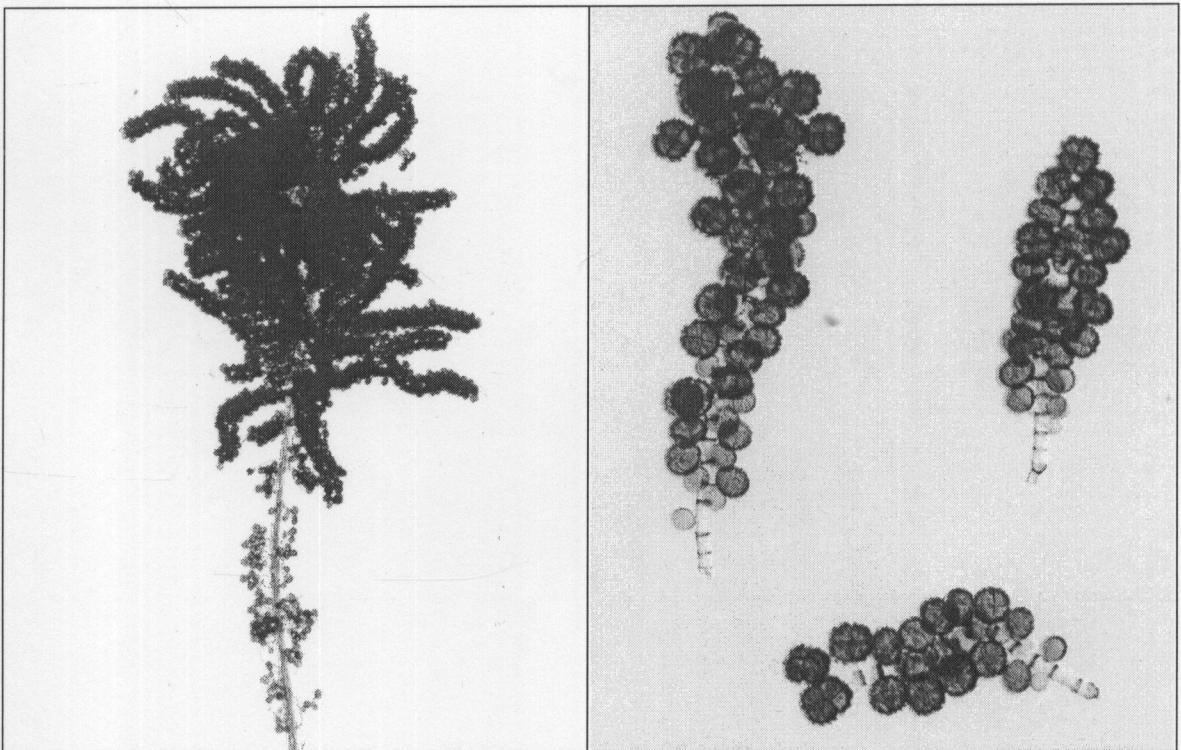


สแต็กกีโบทริส เนฟโรสปอรา (*Stachybotrys nephrospora* Hansf.) – สายพันธุ์ของราชนิดนี้ที่แยกได้จากซากผลโพธิ์ทะเล ผลิตสารในกลุ่ม 'เทอร์พีน' มีฤทธิ์ต้านเชื้อมาเลเรีย

ราชชนิดใหม่ของโลก *Dictyoarthrinium synnematum* Somrithipol บนซากใบตองที่เก็บจากสวนร้าง  
จังหวัดปราจีนบุรี

ดร.สายัณห์ สมฤทธิ์ผล นักวิจัยจากศูนย์พันธุวิศวกรรมและเทคโนโลยีชีวภาพแห่งชาติ พบราชชนิดใหม่ของโลกบนซากใบตองที่เก็บมาจากสวนร้างในจังหวัดปราจีนบุรี รมมีการสืบพันธุ์แบบไม่อาศัยเพศ ให้สปอร์สี่เหลี่ยม มีลักษณะเป็นทรงกลมแบน ภายในมีสี่เซลล์ ผนังของสปอร์หนาและขรุขระ สปอร์เหล่านี้เกิดอยู่บนก้านชูสปอร์ที่แตกแขนงออกมาจากมัดเส้นใยที่เจริญขึ้นมากล้ายกับลำต้น (synnema) ซึ่งมัดเส้นใยนี้เองเป็นลักษณะเด่นที่ราชชนิดนี้แตกต่างจากชนิดอื่นๆ ในสกุลเดียวกันนี้อย่างเด่นชัด ราชชนิดนี้จึงได้รับการตั้งชื่อตามลักษณะของมัดเส้นใยดังกล่าวนี้ว่า *Dictyoarthrinium synnematum* Somrithipol ปัจจุบันราในสกุล *Dictyoarthrinium* มีทั้งสิ้น 6 ชนิด ทุกชนิดพบในเขตร้อน ดำรงชีพเป็นผู้ย่อยสลาย อาศัยบนเศษซากพืช ผู้สนใจรายละเอียดด้านอนุกรมวิธานของราสกุล *Dictyoarthrinium* และรูปวิธานจำแนกชนิด (key) สามารถศึกษาได้จากบทความในวารสารของสมาคมราวิทยาประเทศสหรัฐอเมริกา (Mycological Society of America) เมื่อปลายปี 2550 ที่ผ่านมา

อ้างอิง: Somrithipol, S. 2007. A synnematous species of *Dictyoarthrinium* from Thailand. *Mycologia* 99: 792-796.



กลุ่มก้านชูสปอร์ที่เกิดอยู่บนมัดเส้นใยที่เจริญขึ้นมากล้ายกับลำต้น (synnema) และกลุ่มสปอร์ที่เกิดอยู่บนก้านชูสปอร์

**APPENDIX 5: DATA SHEET**



ID	Herbarium Code	China Code	Taxonomic Information	Order	Family	Genus	Species	Author Name	Localities	Site	Longitude	Habitat	Substratum	Inventory Information	Collection Date	Between Date	Investigator	Notes
SFC01706	SFC01706		Eurales		Trichomeiaceae	<i>Panicum</i>	<i>Panicum glabrum</i>	(Pres.) Steud.	Pathum Thani	13° 55' 47"	100° 40' 58"	Market	Drying orange fruits	01/04/2007	20/04/2007		Sayorn Samthitpol	
SFC01707	SFC01707		Eurales		Trichomeiaceae	<i>Panicum</i>	<i>Panicum</i> sp. 1		Pathum Thani	13° 56' 47"	100° 40' 58"	Market	Drying orange fruits	01/04/2007	20/04/2007		Sayorn Samthitpol	
SFC01708	SFC01708		Eurales		Trichomeiaceae	<i>Panicum</i>	<i>Panicum</i> sp. 2		Pathum Thani	13° 55' 47"	100° 40' 58"	Market	Drying orange fruits	01/04/2007	20/04/2007		Sayorn Samthitpol	
SFC01709	SFC01709		Eurales		Trichomeiaceae	<i>Panicum</i>	<i>Panicum</i> sp. 3		Pathum Thani	13° 55' 47"	100° 40' 58"	Market	Drying orange fruits	01/04/2007	20/04/2007		Sayorn Samthitpol	
SFC01710	SFC01710		Eurales		Trichomeiaceae	<i>Aspergillus</i>	<i>Aspergillus</i> sp. 1		Pathum Thani	13° 55' 47"	100° 40' 58"	Market	Drying orange fruits	01/04/2007	20/04/2007		Sayorn Samthitpol	
SFC01711	SFC01711		Mucorales		Mucoraceae	<i>Rhizopus</i>	<i>Rhizopus</i> sp. 1		Pathum Thani	13° 55' 47"	100° 40' 58"	Market	Drying orange fruits	01/04/2007	20/04/2007		Sayorn Samthitpol	
SFC01712	SFC01712		Hypocerales		Hypocerales	<i>Trichoderma</i>	<i>Trichoderma</i> sp.		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Drying twig	06/05/2007	06/05/2007		Sayorn Samthitpol	
SFC01713	SFC01713		Hypocerales		Hypocerales	<i>Trichoderma</i>	<i>Trichoderma</i> sp.		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	<i>Sorosmia lucum</i>	06/05/2007	06/05/2007		Sayorn Samthitpol	
SFC01714	SFC01714		Hypocerales		Hypocerales	<i>Trichoderma</i>	<i>Trichoderma</i> sp.		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Drying twig	06/05/2007	06/05/2007		Sayorn Samthitpol	
SFC01715	SFC01715		Hypocerales		Incertae sedis	<i>Mycrothecium</i>	<i>Mycrothecium</i> sp. 1		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Seeds of <i>Sarria saman</i>	06/05/2007	06/05/2007		Sayorn Samthitpol	
SFC01716	SFC01716		Eurales		Trichomeiaceae	<i>Panicum</i>	<i>Panicum</i> sp. 4		Chulachak, Bangkok	13° 55' 47"	100° 40' 58"	Market	Fruit of <i>Bombax</i> sp.	06/05/2007	06/05/2007		Sayorn Samthitpol	
SFC01717	SFC01717		Eurales		Trichomeiaceae	<i>Aspergillus</i>	<i>Aspergillus</i> sp. 2		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Bombax</i> sp.	06/05/2007	06/05/2007		Sayorn Samthitpol	
SFC01718	SFC01718		Boysophaeales		Boysophaeaceae	<i>Lasiobolus</i>	<i>Lasiobolus theobromae</i>	(Pat.) Griffon & Maubl.	Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Bombax</i> sp.	06/05/2007	06/05/2007		Sayorn Samthitpol	
SFC01719	SFC01719		Hypocerales		Incertae sedis	<i>Mycrothecium</i>	<i>Mycrothecium</i> sp. 2		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Bombax</i> sp.	06/05/2007	06/05/2007		Sayorn Samthitpol	
SFC01720	SFC01720		Hypocerales		Incertae sedis	<i>Barbatula</i>	<i>Barbatula ruberoides</i>	Tassi	Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Flowers of <i>Hibiscus</i>	04/05/2007	08/05/2007		Sayorn Samthitpol	
SFC01721	SFC01721		Xylariales		Amphisphaeriaceae	<i>Barbatula</i>	<i>Barbatula ruberoides</i>		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Diplazocarpus alatus</i>	15/05/2007	25/04/2007		Sayorn Samthitpol	
SFC01722	SFC01722		Incertae sedis		Incertae sedis	<i>Metarhizium</i>	<i>Metarhizium</i> sp.		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Diplazocarpus alatus</i>	15/05/2007	25/04/2007		Sayorn Samthitpol	
SFC01723	SFC01723		Microascales		Microascaleae	<i>Graphium</i>	<i>Graphium</i> sp.		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Diplazocarpus alatus</i>	15/05/2007	25/04/2007		Sayorn Samthitpol	
SFC01724	SFC01724		Incertae sedis		Incertae sedis	<i>Chaetosporium</i>	<i>Chaetosporium cerniseae</i>	Agnihöhr.	Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Diplazocarpus alatus</i>	15/05/2007	25/04/2007		Sayorn Samthitpol	
SFC01725	SFC01725		Incertae sedis		Incertae sedis	<i>Chaetosporium</i>	<i>Chaetosporium cerniseae</i>	Agnihöhr.	Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Diplazocarpus alatus</i>	15/05/2007	25/04/2007		Sayorn Samthitpol	
SFC01726	SFC01726		Hypocerales		Incertae sedis	<i>Mycrothecium</i>	<i>Mycrothecium</i> sp.		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Diplazocarpus alatus</i>	15/05/2007	25/04/2007		Sayorn Samthitpol	
SFC01727	SFC01727		Incertae sedis		Incertae sedis	<i>Memonella</i>	<i>Memonella echinata</i>	(Rivolta) Galloway	Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Diplazocarpus alatus</i>	15/05/2007	25/04/2007		Sayorn Samthitpol	
SFC01728	SFC01728		Hypocerales		Hypocerales	<i>Trichoderma</i>	<i>Trichoderma</i> sp.		Chulachak, Bangkok	13° 50' 43"	100° 34' 24"	Urban park	Fruit of <i>Diplazocarpus alatus</i>	15/05/2007	25/04/2007		Sayorn Samthitpol	
SFC01729	SFC01729		Incertae sedis		Incertae sedis	<i>Trochalea</i>	<i>Trochalea nivea</i>	(Berk.) Kuntze	Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01730	SFC01730		Incertae sedis		Incertae sedis	<i>Dimerisporium</i>	<i>Dimerisporium leuatum</i>	Nag Raj & R.F. Castañeda	Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01731	SFC01731		Chaetosphaeriales		Chaetosphaeriaceae	<i>Dichoploa</i>	<i>Dichoploa</i> sp. 1		Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01732	SFC01732		Incertae sedis		Incertae sedis	<i>Dichoploa</i>	<i>Dichoploa</i> sp. 1		Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01733	SFC01733					Unidentified	Unidentified		Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01734	SFC01734		Pleosporales		Tubulicaceae	<i>Helicogonium</i>	<i>Helicogonium</i> sp. 1		Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01735	SFC01735		Chaetosphaeriales		Chaetosphaeriaceae	<i>Dichoploa</i>	<i>Dichoploa</i> sp. 2		Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01736	SFC01736		Incertae sedis		Incertae sedis	<i>Cryptophloeobolus</i>	<i>Cryptophloeobolus secunda</i>	(Kuhnb. & B. Sutton) Kuhnb. & Nawawi	Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01737	SFC01737		Incertae sedis		Incertae sedis	<i>Cryptophloeobolus</i>	<i>Cryptophloeobolus secunda</i>	(Kuhnb. & B. Sutton) Kuhnb. & Nawawi	Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01738	SFC01738		Incertae sedis		Incertae sedis	<i>Cryptophloeobolus</i>	<i>Cryptophloeobolus secunda</i>	(Kuhnb. & B. Sutton) Kuhnb. & Nawawi	Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01739	SFC01739		Incertae sedis		Incertae sedis	<i>Cryptophloeobolus</i>	<i>Cryptophloeobolus secunda</i>	(Kuhnb. & B. Sutton) Kuhnb. & Nawawi	Khao Ya National Park-Hao Narok	14° 17' 30"	100° 23' 08"	Tropical Rain Forest	Fruit of <i>Diplazocarpus turbinatus</i>	29/08/2007	17/09/2007		Sayorn Samthitpol	
SFC01740	SFC01740		Incertae sedis		Incertae sedis	<i>Helicogonium</i>	<i>Helicogonium</i> sp.		Khao Ya National Park-KM29	14° 26' 08"	101° 21' 57"	Tropical Rain Forest	Fruit of <i>Diplazocarpus characeus</i>	29/08/2007	21/09/2007		Sayorn Samthitpol	
SFC01741	SFC01741		Pleosporales		Tubulicaceae	<i>Helicogonium</i>	<i>Helicogonium</i> sp.		Khao Ya National Park-KM29	14° 26' 08"	101° 21' 57"	Tropical Rain Forest	Fruit of <i>Diplazocarpus characeus</i>	29/08/2007	21/09/2007		Sayorn Samthitpol	
SFC01742	SFC01742		Incertae sedis		Incertae sedis	<i>Kromocheila</i>	<i>Kromocheila ramifera</i>	(Matsush.) P. M. Kirk & B. Sutton	Khao Ya National Park-KM29	14° 26' 08"	101° 21' 57"	Tropical Rain Forest	Fruit of <i>Diplazocarpus characeus</i>	29/08/2007	21/09/2007		Sayorn Samthitpol	
SFC01743	SFC01743		Incertae sedis		Incertae sedis	<i>Palphora</i>	<i>Palphora pinnata</i>	Kuhnb.	Khao Ya National Park-KM29	14° 26' 08"	101° 21' 57"	Tropical Rain Forest	Fruit of <i>Diplazocarpus characeus</i>	29/08/2007	21/09/2007		Sayorn Samthitpol	

ID	Herbarium Code	Collector Code	Terminomic Information	Order	Family	Genus	Species	Author Name	Localities	Site	Longitude	Altitude	Substratum	Inventory Information	Collection Date	Herbarium Code	Investigator	Notes
SFC02174	SFC02174	Incorde seeds	Cryptophlebe	Cryptophlebe	incordec	Pinz. & Ichinoe			Khao Ya National Park-KM29	14° 26' 08"	101° 21'57"	88.625	Leaf (Unidentified)	29/08/2007	SFC02174	Sayorn Somthipol		
SFC02175	SFC02175	Hypocraea	Stibella	Stibella	incordec				Khao Ya National Park-KM29	14° 26' 08"	101° 21'57"	88.625	Fruit of Dipterocarpaceae characeus	29/08/2007	SFC02175	Sayorn Somthipol		
SFC02176	SFC02176	Incordec seeds	Caraliosporium	Caraliosporium carabense	incordec	(Hol. Jach. & Miranda) Nawanit & Kuhn.			Khao Ya National Park-KM29	14° 26' 08"	101° 21'57"	88.625	Fruit of Dipterocarpaceae characeus	29/08/2007	SFC02176	Sayorn Somthipol		
SFC02177	SFC02177	Hypocraea	Trichoderma	Trichoderma sp.	incordec				Khao Ya National Park-KM29	14° 26' 08"	101° 21'57"	88.625	Fruit of Dipterocarpaceae characeus	29/08/2007	SFC02177	Sayorn Somthipol		
SFC02178	SFC02178	Microsclera	Chelara	Chelara sp.	incordec				Khao Ya National Park-KM29	14° 26' 08"	101° 21'57"	88.625	Fruit of Dipterocarpaceae characeus	29/08/2007	SFC02178	Sayorn Somthipol		
SFC02179	-	Incordec seeds	Physalidella	Physalidella elegans	incordec	(Mossa) Rulandot			Khao Ya National Park-KM29	14° 26' 08"	101° 21'57"	88.625	Fruit of Dipterocarpaceae characeus	29/08/2007	SFC02179	Sayorn Somthipol		
SFC02180	-	-	Unidentified	Unidentified	-				Khao Ya National Park-KM29	14° 26' 08"	101° 21'57"	88.625	Fruit of Dipterocarpaceae characeus	29/08/2007	SFC02180	Sayorn Somthipol		
SFC02181	SFC02181	Incordec seeds	Cryptophlebe	Cryptophlebe	incordec	Pinz. (1989)			Thung Ya Naresuan Wildlife Sanctuary (West)	14.74666667	106.625	Leaf (Unidentified)	04/06/2008	SFC02181	Sayorn Somthipol			
SFC02182	SFC02182	Incordec seeds	Dryopteris	Dryopteris	incordec	J.L. Chen, C.H. Hwang & Tzen (1991)			Thung Ya Naresuan Wildlife Sanctuary (West)	15.74666667	99.625	Leaf (Unidentified)	04/06/2008	SFC02182	Sayorn Somthipol			
SFC02183	SFC02183	Incordec seeds	Cryptophlebe	Cryptophlebe	incordec	Pinz. (1989)			Thung Ya Naresuan Wildlife Sanctuary (West)	16.74666667	100.625	Leaf (Unidentified)	04/06/2008	SFC02183	Sayorn Somthipol			
SFC02184	SFC02184	Incordec seeds	Stachyobrya	Stachyobrya sp.	incordec	Corda (1937)			Thung Ya Naresuan Wildlife Sanctuary (West)	17.74666667	101.625	Leaf (Unidentified)	04/06/2008	SFC02184	Sayorn Somthipol			
SFC02185	SFC02185	Incordec seeds	Stachyobrya	Stachyobrya sp.	incordec	Corda (1937)			Thung Ya Naresuan Wildlife Sanctuary (West)	17.74666667	101.625	Leaf (Unidentified)	04/06/2008	SFC02185	Sayorn Somthipol			
SFC02186	SFC02186	Hypocraea	Chelocypsa	Chelocypsa	incordec	Ramball (1956)			Thung Ya Naresuan Wildlife Sanctuary (West)	18.74666667	102.625	Leaf (Unidentified)	04/06/2008	SFC02186	Sayorn Somthipol			
SFC02187	SFC02187	Incordec seeds	Mesopongas	Mesopongas	incordec	N/A			Thung Ya Naresuan Wildlife Sanctuary (West)	19.74666667	103.625	Leaf (Unidentified)	04/06/2008	SFC02187	Sayorn Somthipol			
SFC02188	SFC02188	Incordec seeds	Gynoxis	Gynoxis	incordec	S. Hughes (1952)			Thung Ya Naresuan Wildlife Sanctuary (West)	20.74666667	104.625	Leaf (Unidentified)	04/06/2008	SFC02188	Sayorn Somthipol			
SFC02189	SFC02189	Incordec seeds	Wesleyomyces	Wesleyomyces	incordec	(Corda) Roberts (1964)			Thung Ya Naresuan Wildlife Sanctuary (West)	21.74666667	105.625	Leaf (Unidentified)	04/06/2008	SFC02189	Sayorn Somthipol			
SFC02190	SFC02190	Incordec seeds	Chelocypsa	Chelocypsa	incordec	(Tass) P.M. Kirk (1984)			Thung Ya Naresuan Wildlife Sanctuary (West)	22.74666667	106.625	Leaf (Unidentified)	04/06/2008	SFC02190	Sayorn Somthipol			
SFC02191	SFC02191	Chaetosphaeriales	Thozella	Thozella	incordec	Agnihotri (1982)			Khao Soi Dao Wildlife Sanctuary	13.13666667	102.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02191	Sayorn Somthipol			
SFC02192	SFC02192	Hypocraea	Dipterocarpaceae	Dipterocarpaceae	incordec	Kuntze (1891)			Khao Soi Dao Wildlife Sanctuary	14.13666667	103.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02192	Sayorn Somthipol			
SFC02193	SFC02193	Incordec seeds	Trichoderma	Trichoderma	incordec	Spag (1923)			Khao Soi Dao Wildlife Sanctuary	15.13666667	104.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02193	Sayorn Somthipol			
SFC02194	SFC02194	Phaeosporales	Dimerisporium	Dimerisporium	incordec	Pers. (1794)			Khao Soi Dao Wildlife Sanctuary	16.13666667	105.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02194	Sayorn Somthipol			
SFC02195	SFC02195	Incordec seeds	Helicomyces	Helicomyces	incordec	Law. (1846)			Khao Soi Dao Wildlife Sanctuary	17.13666667	106.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02195	Sayorn Somthipol			
SFC02196	SFC02196	Incordec seeds	Mesopongas	Mesopongas	incordec	Link (1809)			Khao Soi Dao Wildlife Sanctuary	18.13666667	107.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02196	Sayorn Somthipol			
SFC02197	SFC02197	Incordec seeds	Chelocypsa	Chelocypsa	incordec	N/A			Khao Soi Dao Wildlife Sanctuary	19.13666667	108.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02197	Sayorn Somthipol			
SFC02198	SFC02198	Incordec seeds	Chaetosphaeriales	Chaetosphaeriales	incordec	Agnihotri (1982)			Khao Soi Dao Wildlife Sanctuary	20.13666667	109.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02198	Sayorn Somthipol			
SFC02199	SFC02199	Incordec seeds	Chaetosphaeriales	Chaetosphaeriales	incordec	N/A			Khao Soi Dao Wildlife Sanctuary	21.13666667	110.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02199	Sayorn Somthipol			
SFC02200	SFC02200	Incordec seeds	Phoma	Phoma	incordec	Spag (1923)			Khao Soi Dao Wildlife Sanctuary	22.13666667	111.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02200	Sayorn Somthipol			
SFC02201	SFC02201	Chaetosphaeriales	Chaetosphaeriales	Chaetosphaeriales	incordec	(Fückel) S. Hughes (1955)			Khao Soi Dao Wildlife Sanctuary	23.13666667	112.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02201	Sayorn Somthipol			
SFC02202	SFC02202	Incordec seeds	Corymbium	Corymbium	incordec	Nees & T. Nees (1918)			Khao Soi Dao Wildlife Sanctuary	24.13666667	113.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02202	Sayorn Somthipol			
SFC02203	SFC02203	Incordec seeds	Cryptophlebe	Cryptophlebe	incordec	Pinz. & Ichinoe (1969)			Khao Soi Dao Wildlife Sanctuary	25.13666667	114.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02203	Sayorn Somthipol			
SFC02204	SFC02204	Incordec seeds	Stibella	Stibella	incordec	Kuntze (1891)			Khao Soi Dao Wildlife Sanctuary	26.13666667	115.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02204	Sayorn Somthipol			
SFC02205	SFC02205	Hypocraea	Physalidium	Physalidium	incordec	Lindau (1900)			Khao Soi Dao Wildlife Sanctuary	27.13666667	116.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02205	Sayorn Somthipol			
SFC02206	SFC02206	Incordec seeds	Lauromyces	Lauromyces	incordec	Luppi Mosca (1965)			Khao Soi Dao Wildlife Sanctuary	28.13666667	117.2183333	Seed (Dipterocarpaceae alatus)	04/06/2008	SFC02206	Sayorn Somthipol			
SFC02207	SFC02207	Incordec seeds	Palphora	Palphora	incordec	N/A			Khao Ya National Park	29.13666667	118.2183333	Leaf (Unidentified)	04/06/2008	SFC02207	Sayorn Somthipol			
SFC02208	SFC02208	Incordec seeds	Wesleyomyces	Wesleyomyces	incordec	Kuhn. (1957)			Khao Ya National Park	14.58666667	100.9953333	Leaf (Unidentified)	29/05/2008	SFC02208	Sayorn Somthipol			
SFC02209	SFC02209	Incordec seeds	Wesleyomyces	Wesleyomyces	incordec	(Tass) P.M. Kirk (1984)			Khao Ya National Park	14.58666667	100.9953333	Leaf (Unidentified)	29/05/2008	SFC02209	Sayorn Somthipol			

ID	Herbarium Code	Collector Code	Order	Taxonomic Information	Family	Genus	Species	Author Name	Habitat Information	Site Coordinates	Longitude	Latitude	Substratum	Inventory Information	Accession Date	Investigator	Notes
CC002159	SFO02159		Charophytales	Charophytales	Sporocarpium		sacardi	E. W. Mason & S. Hughes (1949)	Khao Ya National Park	14.5896667	100.9883333		Leaf (Unidentified)	25/05/2008	08/07/2008	Savant Somrithol	
CC002160	SFO02160		Incertae sedes	Incertae sedes	Tricostella		sp.	Kunze (1891)	Khao Ya National Park	14.5896667	100.9883333		Leaf (Unidentified)	25/05/2008	08/07/2008	Savant Somrithol	
CC002161	SFO02161		Charophytales	Charophytales	Dicopylea		sp.	Spang (1923)	Khao Ya National Park	14.5896667	100.9883333		Leaf (Unidentified)	25/05/2008	08/07/2008	Savant Somrithol	
CC00001	CC00001		Incertae sedes	Incertae sedes	Dimorphosporium		sp.	Lew. (1846)	Khao Ya National Park	14.7116667	101.4216667		Seed (Unidentified)	19/5/2008	20/5/2008	Chaida Chanoi	
CC00002	CC00002		Hypocerales	Nectriaceae	Pestalotia		sp.	Enders (1988)	Khao Ya National Park	14.7116667	101.4216667		Seed (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00003	CC00003		Hypocerales	Bionectziaceae	Chionodactylus		sp.	N/A	Khao Ya National Park	14.7116667	101.4216667		Seed (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00004	CC00004		Charophytales	Charophytales	Dicopylea		sp.	Spang (1923)	Khao Ya National Park	14.7116667	101.4216667		Seed (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00005	CC00005		Incertae sedes	Incertae sedes	Chaetosporium		camelliae	Agnihotri (1952)	Khao Ya National Park	14.7116667	101.4216667		Seed (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00006	CC00006		Charophytales	Charophytales	Gonyzichium		sp.	Hess & T. Nest (1918)	Khao Ya National Park	14.7116667	101.4216667		Seed (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00007	CC00007		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00008	CC00008		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00009	CC00009		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00010	CC00010		Hypocerales	Nectriaceae	Volutella		sp.	Fr. (1932)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00011	CC00011		Incertae sedes	Incertae sedes	Gyrophium		sp.	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00012	CC00012		Incertae sedes	Incertae sedes	Mesoporus		rhodome	S. Hughes (1952)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00013	CC00013		Incertae sedes	Incertae sedes	Heteromyces		colobocarpus	Kothab. & Newell (1988)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00014	CC00014		Pleosporales	Tuberiaceae	Heteromyces		sp.	Link (1809)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00015	CC00015		Incertae sedes	Incertae sedes	Cryptophiala		Aakombers	Proz. (1988)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00016	CC00016		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00017	CC00017		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00018	CC00018		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00019	CC00019		Incertae sedes	Incertae sedes	Heteromyces		levinus	(Tassi) P. M. Kirk (1984)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00020	CC00020		Pleosporales	Incertae sedes	Phoma		sp.	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	16/02/2008	Chaida Chanoi	
CC00021	CC00021		Incertae sedes	Incertae sedes	Pseudocercaria		spora	Uecker & Kukl (1986)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00022	CC00022		Incertae sedes	Incertae sedes	Chaetosporium		camelliae	Agnihotri (1952)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00023	CC00023		Incertae sedes	Incertae sedes	Konochalea		ramifera	(Masashi) P. M. Kirk & B. Sutton (1986)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00024	CC00024		Incertae sedes	Incertae sedes	Konochalea		sparsa	P. M. Kirk & B. Sutton (1986)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/5/2008	Chaida Chanoi	
CC00025	CC00025		Incertae sedes	Incertae sedes	Mesoporus		procyonae	Varghese & V. G. Rao (1978)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	16/02/2008	Chaida Chanoi	
CC00026	CC00026		Charophytales	Charophytales	Dicopylea		sp.	Spang (1923)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/02/2008	Chaida Chanoi	
CC00027	CC00027		Incertae sedes	Incertae sedes	Cryptophiala		uliginosa	Proz. & Chooch (1988)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/02/2008	Chaida Chanoi	
CC00028	CC00028		Incertae sedes	Incertae sedes	Chaetosporium		arctocarp	(Ng) Raj. Ng Raj. (1993)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	20/02/2008	Chaida Chanoi	
CC00029	CC00029		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	3/02/2008	Chaida Chanoi	
CC00030	CC00030		Incertae sedes	Incertae sedes	Laurumyces		helicophialis	(V. Rao & de Hoog) R. F. Castaldi & W. B. Kendz. (1990)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	3/02/2008	Chaida Chanoi	
CC00031	CC00031		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	3/02/2008	Chaida Chanoi	
CC00032	CC00032		Incertae sedes	Incertae sedes	Thozziella		sp.	Kunze (1891)	Khao Ya National Park	14.7116667	101.4216667		Seed (Unidentified)	12/5/2008	3/02/2008	Chaida Chanoi	
CC00033	CC00033		Hypocerales	Nectriaceae	Volutella		sp.	Fr. (1832)	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	3/02/2008	Chaida Chanoi	
CC00034	CC00034		Incertae sedes	Incertae sedes	Unidentified		Unidentified	N/A	Khao Ya National Park	14.7116667	101.4216667		Leaf (Unidentified)	12/5/2008	3/02/2008	Chaida Chanoi	

ID	Herbarium Code	Collector Code	Terrestrial Information	Order	Family	Genus	Species	Author Name	Locality	GPS Coordinates	Longitude	Latitude	Substratum	Inventory Information	Collection Date	Investigator	Notes
CC00035		CC00035	Inciatae seeds		Selenicarpate		sp	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00036		CC00036	Inciatae seeds		Salmacaceae		bracteata	B. Sutton & Hodges (1975)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00037		CC00037	Inciatae seeds		Salicaceae		salicoides	Smith, Kozl. & E.B.G. Jones (2006)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00038		CC00038	Inciatae seeds		Konocochlea		nanophora	Kuhnle & Nawawi (1988)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00039		CC00039	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00040		CC00040	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00041		CC00041	Hypocreales		Chaetosoma		fluvr	Rambell (1995)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00042		CC00042	Inciatae seeds		Pseudonidulata		sohle	Uecker & Kukl (1985)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00043		CC00043	Inciatae seeds		Cryptophloeas		secretis	(Kuhnle & B. Sutton) Kuhnle & Nawawi (1987)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00044		CC00044	Hypocreales		Volvella		sp.	Fr. (1832)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00045		CC00045	Inciatae seeds		Konocochlea		nanophora	Kuhnle & Nawawi (1988)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00046		CC00046	Inciatae seeds		Chalara		sp	(Corda) Rabenh.	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00047		CC00047	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00048		CC00048	Inciatae seeds		Konocochlea		sp	P. M. Kirk & B. Sutton (1985)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00049		CC00049	Inciatae seeds		Lecanomyces		helophylae	(V. Rao & de Hoog) R. F. Castañeda & W.B. Kendr. (1990)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00050		CC00050	Inciatae seeds		Salicina		sp.	Parz. (1822)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00051		CC00051	Inciatae seeds		Dimerisporium		sp	Lev. (1846)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00052		CC00052	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00053		CC00053	Inciatae seeds		Cryptophloe		psudokansalevis	Matsush. (1971)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00054		CC00054	Pisporales		Helicogonium		sp	Nees (1816)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00055		CC00055	Chaetophariales		Chaetophariaceae		sp	Shag. (1923)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00056		CC00056	Hypocreales		Calcarisporium		securum	Matsush. (1975)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00057		CC00057	Hypocreales		Calcarisporium		securum	Matsush. (1975)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00058		CC00058	Inciatae seeds		Cryptophloe		Aekombeas	Proz. (1968)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00059		CC00059	Inciatae seeds		Pseudonidulata		sohle	Uecker & Kukl (1985)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00060		CC00060	Inciatae seeds		Tricarbella		sp	Kurtze (1891)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00061		CC00061	Inciatae seeds		Salmacopax		zweckas	B. Sutton & Hodges (1975)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00062		CC00062	Inciatae seeds		Konocochlea		zentrif	(Matsush.) P. M. Kirk & B. Sutton (1986)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00063		CC00063	Inciatae seeds		Phialophora		hydrophora	W.B. Kendr. (1961)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00064		CC00064	Inciatae seeds		Lecanomyces		sekensalevis	Smith, Kozl. & E.B.G. Jones (2006)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00065		CC00065	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00066		CC00066	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00067		CC00067	Pisporales		Helicogonium		sp	Nees (1816)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00068		CC00068	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00069		CC00069	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00070		CC00070	Inciatae seeds		Unidentified		Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	
CC00071		CC00071	Chaetophariales		Coryphium		sp	Nees & T. Nees (1818)	Khao Ya National Park	14.71166667	101.4216667	14.71166667	Leaf(Identified)	12/5/2008	3/6/2008	Chaido Chanoi	

ID	Herbarium Code	Culture Code	Taxonomic Information	Order	Family	Genus	Species	Author Name	Localities	SNH Label	Longitude	Height	Substrate	Inventory Information	Collector Date	Herbarium Date	Investigator	Notes
CC00072		CC00072	Incense seeds		Sapotaceae	Sapotose	bracteata	B. Sutton & Hodges (1975)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	17/6/2008	Chaido Chanoi		
CC00073		CC00073	Incense seeds		Selenicarpella	sp.	N/A	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	17/6/2008	Chaido Chanoi		
CC00074		CC00074	Incense seeds		Zenopsisora	sp.	Ameyora	S. Hughes & V.B. Kenez (1985)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	17/6/2008	Chaido Chanoi		
CC00075		CC00075	Chaetophariales		Chaetophariales	sp.	sp.	Link (1893)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	17/6/2008	Chaido Chanoi		
CC00076		CC00076	Incense seeds		Cryptophloeae	secunda	secunda	(Kuhn & B. Sutton) Kuhn & Nawwak (1987)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	23/6/2008	Chaido Chanoi		
CC00077		CC00077	Incense seeds		Cryptophloeae	akombenensis	akombenensis	Proz (1988)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	23/6/2008	Chaido Chanoi		
CC00078		CC00078	Incense seeds		Unidentified	Unidentified	Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	23/6/2008	Chaido Chanoi		
CC00079		CC00079	Incense seeds		Wiesneromyces	constrictosporus	constrictosporus	Kuhn & Nawwak (1988)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	17/6/2008	Chaido Chanoi		
CC00080		CC00080	Incense seeds		Unidentified	Unidentified	Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	17/6/2008	Chaido Chanoi		
CC00081		CC00081	Incense seeds		Spizocarp	sp.	sp.	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	17/6/2008	Chaido Chanoi		
CC00082		CC00082	Incense seeds		Unidentified	Unidentified	Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	16/6/2008	Chaido Chanoi		
CC00083		CC00083	Incense seeds		Unidentified	Unidentified	Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	17/6/2008	Chaido Chanoi		
CC00084		CC00084	Hypocreales		Cyrtodictadium	sp.	sp.	Morgan	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	12/5/2008	Chaido Chanoi		
CC00085		CC00085	Chaetosphaeriales		Diclyochaeta	sp.	sp.	Steg (1923)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	19/6/2008	Chaido Chanoi		
CC00086		CC00086	Incense seeds		Bahausraboya	sp.	sp.	Sudram, & Bhat (1977)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	19/6/2008	Chaido Chanoi		
CC00087		CC00087	Incense seeds		Mesporozete	mesozete	mesozete	S. Hughes (1952)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	19/6/2008	Chaido Chanoi		
CC00088		CC00088	Incense seeds		Pseudocylindaria	sp.	sp.	Uecker & Kukl (1986)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	23/6/2008	Chaido Chanoi		
CC00089		CC00089	Heliales		Helicaseae	Helicaseae	sp.	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	23/6/2008	Chaido Chanoi		
CC00090		CC00090	Incense seeds		Thozellea	sp.	sp.	Kurtze (1881)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	19/6/2008	Chaido Chanoi		
CC00091		CC00091	Incense seeds		Pseudonobilia	sp.	sp.	Uecker & Kukl (1988)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	19/6/2008	Chaido Chanoi		
CC00092		CC00092	Incense seeds		Selenospora	sp.	sp.	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	19/6/2008	Chaido Chanoi		
CC00093		CC00093	Pezizales		Helicosporium	sp.	sp.	Nees (1916)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	23/6/2008	Chaido Chanoi		
CC00094		CC00094	Pezizales		Helicosporium	sp.	sp.	Link (1899)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	19/6/2008	Chaido Chanoi		
CC00095		CC00095	Hypocreales		Cheilosporium	sp.	sp.	Mekuth (1975)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	18/6/2008	Chaido Chanoi		
CC00096		CC00096	Incense seeds		Cryptophloeae	udgawa	udgawa	Proz & Chinoe (1989)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	19/6/2008	Chaido Chanoi		
CC00097		CC00097	Pezizales		Helicosporium	sp.	sp.	Nees (1916)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	30/6/2008	Chaido Chanoi		
CC00098		CC00098	Incense seeds		Unidentified	Unidentified	Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	30/6/2008	Chaido Chanoi		
CC00099		CC00099	Incense seeds		Pezizospora	sp.	sp.	Preuss (1851)	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	30/6/2008	Chaido Chanoi		
CC00100		CC00100	Incense seeds		Unidentified	Unidentified	Unidentified	N/A	Khao Ya National Park	14.71166667	101.4216667	Tropical Rain Forest	Leaf(Identified)	12/5/2008	23/6/2008	Chaido Chanoi		

**APPENDIX 6: BUDGET REPORT**