

# **FINAL REPORT**

**COMPARATIVE FUNGAL DIVERSITY STUDIES OF THE  
ENDOPHYTIC AND SAPROBIC FUNGI ON THE BRACKISH  
WATER PALM *NYPA FRUTICANS* IN THAILAND.**

**BRT R 352112**

**DECEMBER 2009 – NOVEMBER 2010**

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JARIYA SAKAYAROJ  
NATTAWUT RUNGJINDAMAI  
RATTAKET CHOEYKLIN  
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**assistance with field work.**

## SUMMARY

การศึกษาราที่พบบนต้นจากซึ่งเป็นปาล์มที่ขึ้นอยู่ในบริเวณน้ำกร่อย จากแหล่งต่าง ๆ ในประเทศไทย จากการศึกษาพบราแซบโพรบที่เก็บจากแหล่งเก็บตัวอย่าง ใน 9 จังหวัดทั้งในภาคใต้ ภาคกลางและภาคตะวันออกของประเทศไทย จากจำนวนตัวอย่าง 591 ตัวอย่างพบราในกลุ่มแอสโคไมซีทมากที่สุด จำนวน 54 ชนิด ราชายังไม่พบการสืบพันธุ์แบบอาศัยเพศ 33 ชนิด เบซิดิโอไมซีท 14 ชนิดและ ราเมือก 1 ชนิด ทั้งนี้ราชนิดที่พบบ่อยจากทั้ง 6 แหล่งมีจำนวน 3 ชนิด ได้แก่ *Linocarpon appendiculatum* (12-47.4%), *Astrosphaeriella striatispora* (10.3-40%), *Trichocladium nypae* (8.8-76.3%) ซึ่งราทั้ง 3 ชนิดดังกล่าวยังพบในทุกแหล่งตัวอย่างที่เก็บอีกด้วย นอกจากนี้ยังพบเชื้อราเมือกได้แก่ *Arcyria sp.* ซึ่งไม่เคยมีรายงานพบบนตัวอย่างปาล์มชนิดอื่นหรือบนต้นจากมาก่อน ครั้งนี้จึงเป็นรายงานที่พบราเมือกเป็นครั้งแรกบนต้นจาก

The biodiversity of fungi on *Nypa fruticans* which is a brackish water palm were studied in many regions of Thailand. Saprophytic fungi from 9 locations was made with water salinity was measured at each site, resulting 54 ascomycetes , 33 anamorphic taxa , 14 basidiomycetes and 1 myxomycete. The fungi *Linocarpon appendiculatum* (12-47.4%), *Astrosphaeriella striatispora* (10.3-40%), *Trichocladium nypae* (8.8-76.3%) were the most frequent taxa. These three common taxa colonized on the *Nypa* palm materials in every location. The myxomycete *Arcyria sp.* is first recorded from our report.

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## Background

In our study of palm fungi in Thailand, we have focused entirely on those occurring in terrestrial, peat swamps and freshwater habitats. The palm *Nypa fruticans* is unusual in that it occurs from nearly fully saline waters, to freshwater, but does best at salinities of 20 ‰. It is therefore an interesting host for a variety of reasons:

1. Is the fungal community in saline conditions different to that in freshwater habitats?
2. In freshwater intertidal habitats the period the palms are exposed for are longer than those in marine tidal areas.
3. There is considerable debate as to the origin of marine fungi. Ascomycetes and basidiomycetes are almost certainly terrestrial species that have migrated from land, to freshwater and from mangroves to the sea. Thus mangrove areas may have been transitional regions for the migration of marine fungi.
4. Anatomically *Nypa* palm petioles and bases are large and can support a wide range of fungi, because of the rich food reserve.
5. Do typically marine/mangrove fungi occur as endophytes?

The primary objective of our research group is to document the fungal diversity of Thailand, their isolation into axenic culture and conservation, and to exploit their potential for the production of bioactive compounds, new chemical structures and enzyme activity. Jones et al. (2004) have summarized knowledge of the fungi reported from various substrata and habitats, and indicated some 6,000 are now documented for Thailand.

Our group has focused on marine fungi, seed and litter fungi, and those growing on various terrestrial and peat swamp palms. Hyde et al. (1997) and Fröhlich and Hyde (2000) have demonstrated that palms world wide support a particularly rich fungal diversity, focusing on those from Australia, Brunei, Indonesia, Malaysia, Singapore and Hong Kong. As a result of their studies, many new genera and species have been described.

In 2004 we commenced our studies of fungi on palms focusing on those growing on four peat swamp palms (*Eleiodoxa conferta*, *Licuala longicalycata*, *Metroxylon sagus* and *Nenga pumila*) resulting in the discovery of 51 new species, 17 of which have been

described. The saprophytic fungi on senescent terrestrial, and peat swamp palms, each supported a unique fungal diversity. Saprophytic and endophytic fungal communities of the terrestrial oil palm, were also significantly different.

### **Project Objectives**

1. To undertake a comparative floristic study of saprobic and endophytic fungi on the brackish water palm *Nypa fruticans*.
2. To compare groups between fungi colonized on *Nypa fruticans* with various water salinity.

## Introduction

*Nypa fruticans* is a brackish water palms growing in soft mud and slow moving tidal and river waters that bring in nutrients. The palm can be found as far inland as the tide can deposit the floating nuts. It is common on coasts and rivers flowing into the Indian and Pacific Oceans, from Bangladesh to the Pacific Islands.

### Saprophytic fungi isolated from *Nypa fruticans*

This palm is distributed in many regions; eastern, central and southern parts of Thailand which differ in water salinity, ranging from freshwater, brackish and marine habitats. Since Pilantanapak *et al.* (2005) have undertaken a study of saprophytic fungi colonized on *Nypa* fronds from the central region of Thailand, after that there have few studies on biodiversity of the saprophytic fungi especially marine fungi on *Nypa fruticans* from Thailand. There are still many areas of *Nypa* forests in southern Thailand that have not sampled for saprophytic fungi.

### Fungal endophytes

Endophytes are those microbes, which inhabit the living tissues without showing any clinical symptom of pathogenicity. (Sturz *et al.*, 2000 and Wilson, 1995) Endophytes may account for high fungal numbers which some may become pathogens and others are becomes saprobes following plant death (Zhou and Hyde, 2001).

Many plants have been studied for endophytic mycoflora including palms. Rodrigues and Samuals (1990) isolated endophytes from tropical palm of genera *Licuala ramasayi*, 11 fungi were isolated.

As summary of previous palm research projects during the period since 2004 study of the endophytes of *Elaeis guineensis* (oil palm in plantations) and *Licuala spinosa* have been undertaken. From this time on our report is a preliminary study of the endophytes on palm *Nypa fruticans*.

## Materials and methods

### Sample collection

Decaying petioles and fronds of *Nypa fruticans* were collected randomly at the estuarine *Nypa* forest in 1) Trang, Satun, Surat Thani, Ranong, Nakhon srithammarat and Chumphorn provinces in the south and 2) Samutsakorn, Samutprakarn and Chachoengsao provinces from the central regions. Water salinity was measured at each site and *Nypa* samples were returned to the laboratory where they were incubated in plastic boxes with moist tissue paper.

**Table 1.** Collecting locations and water salinity.

Site /Province	Salinity (psu ‰)
Surat Thani	2
Trang	5
Ranong	2
Nakhon srithamarat	25
Chumphorn	32
Satun	26
Samutsakorn	15
Samutprakarn	15
Chachoengsao	17

### Isolation of the saprophytic fungi on *Nypa fruticans*

Single spore isolations were made from the fresh and incubated materials in the laboratory. The isolation media was Corn Meal Agar (CMA) with added antibiotics (Streptomycin 0.5 g/l, Penicillin G 0.5 g/l) and the media use of both freshwater and seawater in which appropriate to the fungal collected from different of material salinity. Germinated spores were transferred to the Potato Dextrose Agar (PDA), and incubated at room temperature until growth.

### **Fungal diversity analysis**

The frequency of the fungal occurrence of each taxon collected from all collections was analyzed by using the formula below.

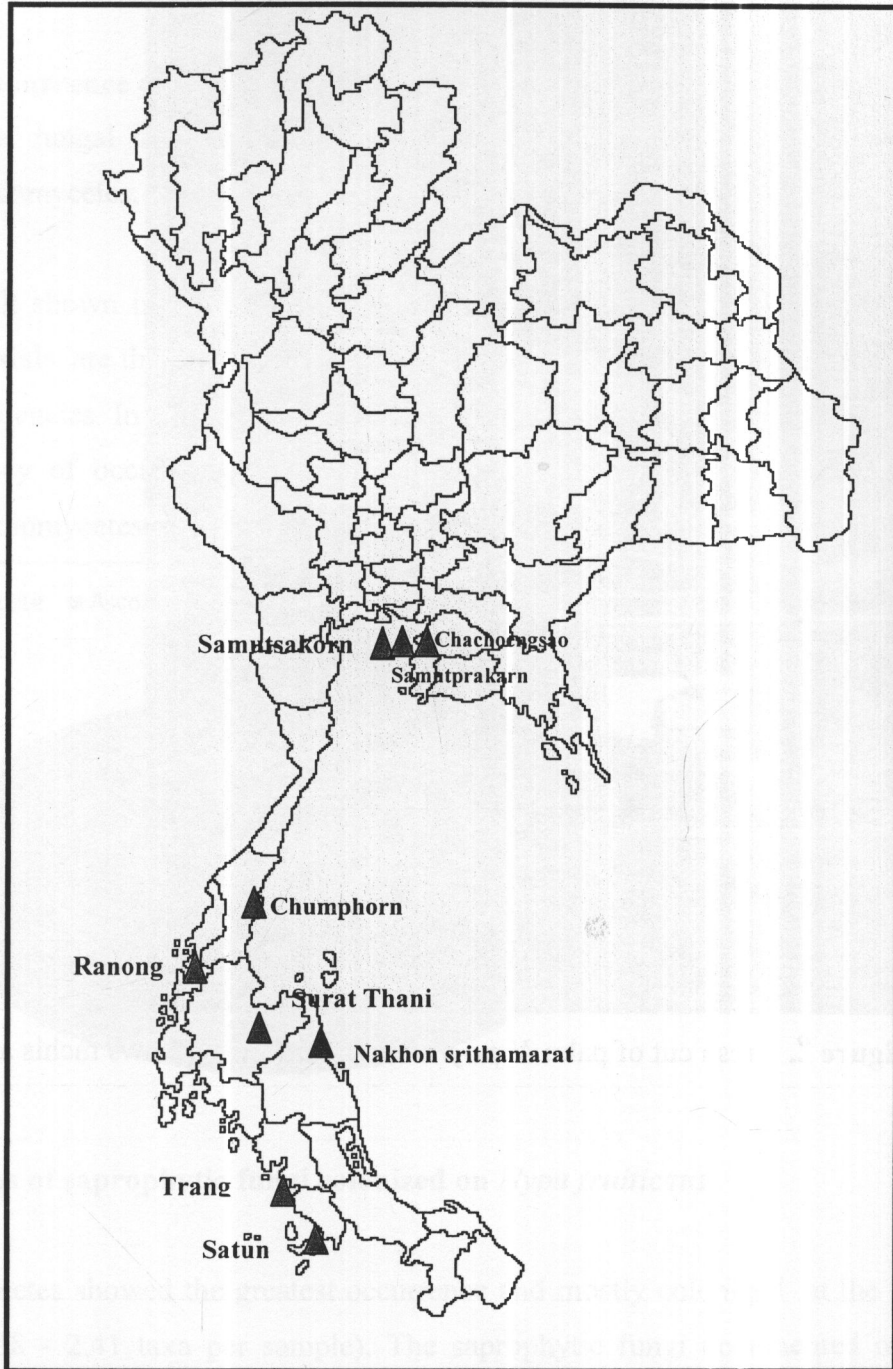
$$\text{Frequency of Occurrence(\% FO)} = \frac{\text{Occurrence of individual taxa} \times 100}{\text{Number of total samples examined}}$$

### **Isolation of the endophytic fungi from *Nypa fruticans*.**

The study of the endophytes on *Nypa fruticans* was preliminarily undertaken, to be able to formulate a plan for the second part of this study. Ten trees of *Nypa fruticans* were selected for sampling at 3 different locations in southern Thailand, (Kra Isthmus, Bang Bane (Ranong Province) and Bang Bai Mai (Surat Thani Province). A whole leaf of *Nypa fruticans* was cut from a mature tree (Figure 3). Different parts of leaf, consisting of branches, petioles, rachises, veins and laminas were sectioned into small fragments. Those pieces were kept in plastic bags and brought back for endophyte isolation in Bangkok. Moreover data *i.e.* water salinity and Global Positioning System (GPS) of each collecting site were recorded (Table 4). Our results showed that salinity of water collected from Bang Bane Beach had the highest salinity (25 psu) whiles salinity of the two another sites are 3 and 2 psu.

Plant samples were rinsed and wash with tap water and finally dried under biosafety cabinet. Simple sterilization method was used to remove epiphytes. Ten pieces of each branches, petioles, rachis, veins and laminas were submerged into disinfectant and rinsed with sterilised distilled water. They were then put onto corn meal agar adding antibiotics. Plates were incubated at room temperature and observed for fungal growth everyday for 2 weeks.

**Figure 1.** Map of Thailand ( showing the collecting locations)





**Figure 2.** Fresh cut of palm *Nypa fruticans* part (arrow shows rachis and leaves)

## Results and Discussion

### Frequency of occurrence of saprobic fungi on *Nypa fruticans*

Summary of fungal taxa collected from 9 locations 591 samples examined was supported 54 ascomycetes, 33 anamorphic fungi, 14 basidiomycetes and 1 myxomycete. (Table 2)

As the result shown in Table 2 most of the saprophytic fungi colonized on dead *Nypa* palm materials are the ascomycetes while hyphomycetes also have various taxa but show lower frequencies. In comparison of all the groups in Fig 3, the ascomycetes have greatest frequency of occurrence (53.5%) followed by anamorphic fungi of 32.67% occurrence, basidiomycetes of 13.8% and myxomycete of 0.99%.

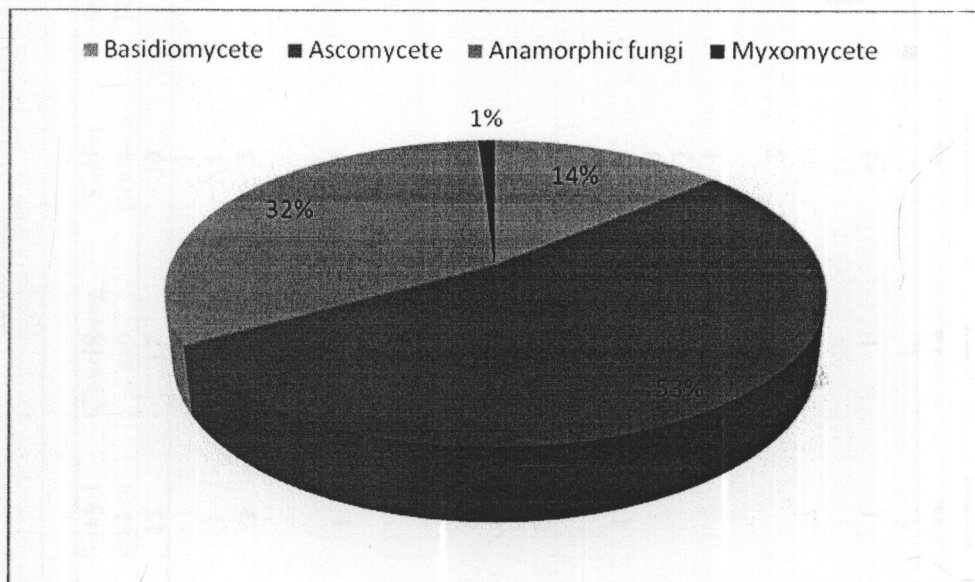


Figure 3. Groups of saprophytic fungi colonized on *Nypa fruticans*

The ascomycetes showed the greatest occurrence and mostly colonized at the bases and petioles (1.38 - 2.41 taxa per sample). The saprophytic fungi documented on the *Nypa* palm included many species reported to be host specific or showing host preference with some taxa have not been found on other terrestrial palms.



Table 2 Frequency of occurrence of saprophytic fungi on *Nypa fruticans* with various salinity from 9 locations of Thailand.

Fungi	Frequency								
	Trang	Satun	Samut sakorn	Chachoeng sao	Samut prakarn	Surat Thani	Ranong	Chumphorn	Nakhon sri thammarat
Salinity(psu ‰)	5	26	15	17	15	2	2	32	25
<i>Ascomycetes</i>									
<i>Aniptodera chesapeakensis</i>	3	1	1	1	3	2			1
<i>Aniptodera longispora</i>	2								
<i>Aniptodera nypae</i>	8	13	7	6	11	1	15	3	23
<i>Aniptodera intermedia</i>	2	2			2		2		1
<i>Anthostomella nypae</i>	3	1		2			1		
<i>Anthostomella</i> sp.					1				
<i>Arecophila</i> sp.	1				3		6		8
<i>Astrophaeriella nypae</i>	3	1		4	3		1		2
<i>Astrophaeriella striatispora</i>	9	8		4	8	14	8		13
<i>Carinispora nypae</i>	4	1							
<i>Carinispora velatispora</i>			3						
<i>Cosmospora</i> sp.	2					5	1		
<i>Dactylospora haliotrepha</i>		1							
<i>Fasciatispora nypae</i>		6		3	1				
<i>Frondicola tunitricuspis</i>							1		
<i>Halosarpheia viscosa</i>		2			3			1	
<i>Halosarpheia marina</i>		1							1
<i>Halosarpheia</i> sp.					1				
<i>Helicascus nypae</i>	7					1			
<i>Kallichroma tethys</i>		1							
<i>Leptosphaeria nypicola</i>	2	17	3	1	2	1	8		7
<i>Leptosphaeria australiensis</i>					1				1
<i>Leptosphaeria</i> sp.	5	4			1	3			
<i>Lignicola laevis</i>	1	2			9	2	6	1	18
<i>Lignicola nypae</i>	3	12	1		4	1	2	4	3
<i>Linocarpon appendiculatum</i>	17	23	12	18	16	14	17	2	5

Table 2 (continued)

Fungi	Frequency									
	Trang	Satun	Samut sakorn	Chachoeng sao	Samut prakarn	Surat Thani	Ranong	Chumphorn	Nakhon sri thammarat	
Salinity(psu ‰)	5	26	15	17	15	2	2	32	25	
<i>Linocarpon bipolaris</i>	2					1				
<i>Linocarpon nypae</i>			3	8	2	7	7	2	3	
<i>Linocarpon angustatum</i>	1	2	2			2			1	
<i>Linocarpon longisporum</i>		2								
<i>Lophiostoma</i> sp.	1			1						
<i>Lulworthia grandispora</i>	6	1	1		5		3		8	
<i>Marinosphaera mangrovei</i>		2					1			
<i>Massarina</i> sp.	1									
<i>Massarina thalassiae</i>	1									
<i>Natantispora retorquens</i>	2		1		1	1			2	
<i>Neolinocarpon globosicarpum</i>										
<i>Neptunella longirostris</i>	1	4	2		7	1	3	4	9	
<i>Oceanititis cincinnatula</i>	2	4					2		6	
<i>Oxydothis nypae</i>	2	2		1	5		19		2	
<i>Phomatospora nypicola</i>		4	4		1	3				
<i>Rimora mangrovei</i>					8					
<i>Saagaromyces abomnis</i>						1				
<i>Saagaromyces ratmagiriensis</i>						1				
<i>Saccadoella mangrovei</i>						2				
<i>Savoryella cf aquatica</i>	1	1				1				
<i>Savoryella paucispora</i>		4	1	1	1					
<i>Savoryella lignicola</i>		5			11	10	1	1	1	
<i>Savoryella cf lignicola</i>					2					
<i>Trisporella beccariana</i>	5	5	4	1	2	3	9		5	
<i>Trispora unicaudata</i>		1							1	
<i>Trematosphaeria mangrovei</i>	1									
<i>Vibrissia nypicola</i>	4	21		5	5		5		1	
<i>Verruculina enalia</i>		1					3			
<b>Anamorphic fungi</b>										
<i>Acrogenospora sphaerocephala</i>	1						1		1	

Table 2 (continued)

Fungi	Frequency									
	Trang	Satun	Samut sakorn	Chachoeng sao	Samut prakarn	Surat Thani	Ranong	Chumphorn	Nakhon sri thamarat	
Salinity(psu ‰)	5	26	15	17	15	2	2	32	25	
<i>Canalisporium pulchrum</i>							1			
<i>Cirrenalia macrocephala</i>		2								
<i>Cirrenalia pygmaea</i>						1				
<i>Cirrenalia cf tropicalis</i>						1			2	
<i>Chloridium</i> sp.						1			1	
<i>Cumulospora</i> sp.		1			3	1		6	4	
<i>Dactylaria</i> sp.1	1		1							
<i>Dactylaria</i> sp.2				1						
<i>Dictyosporium elegans</i>					2	2	1			
<i>Helicoma</i> sp.		1								
<i>Helicoma hyalonema</i>					1	1				
<i>Helicorhoidion nypicola</i>		3	5	8	3	1	1	2	10	
<i>Helicosporium hongkongense</i>						1				
<i>Helicosporium pannosum</i>						1				
<i>Monacrosporium</i> sp.					1	1				
<i>Monodictys</i> sp.1		1				2				
<i>Monodictys</i> sp.2				1						
<i>Periconia prolifica</i>										1
<i>Sporidesmium</i> sp.1		6					5			
<i>Sporidesmium</i> sp.2							1			
<i>Sporoschisma</i> sp.							1			
<i>Thozzella nivea</i>										
<i>Trichocladium nypae</i>	8	38	13	27	45	1	39	1	12	
<i>Trichocladium achrasporum</i>		3				25				
<i>Trichocladium cf linderi</i>										
<i>Vanakripa</i> sp.	2	3			1	2	2		1	1
<i>Zalerion varium</i>		1								
<i>Zalerion maritimum</i>					1			1	2	
unidentified				1						



Table 3. Lists of basidiomycetes collected from *Nypa fruticans* from several provinces in Thailand.

Original Code	Genus	Epithet	Order	Family	Collection Date	Substrate	Province
RCK00214	<i>Marasmiellus</i>	sp.1	Agaricales	Marasmiaceae	15/9/2010	Nypa leaf	Samutsakorn
RCK00215	<i>Psathyrella</i>	sp.1	Agaricales	Psathyrellaceae	15/9/2010	Nypa petiole	Samutsakorn
1(25/1/2010)	<i>Psathyrella</i>	sp.2	Agaricales	Psathyrellaceae	25/1/2010	Nypa petiole	Surat Thani
RCK00226	<i>Schizophyllum</i>	<i>commune</i>	Agaricales	Schizophyllaceae	15/9/2010	Nypa petiole	Samutsakorn
RCK00228	<i>Coprinus</i>	sp.	Agaricales	Coprinaceae	15/9/2010	Nypa petiole	Samutsakorn
RCK00230	<i>Marasmiellus</i>	sp.2	Agaricales	Marasmiaceae	15/9/2010	Nypa petiole	Samutprakarn
1(24/1/2010)	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	24/1/2010	Nypa petiole	Ranong
1(28/4/2010)	<i>Hyphoderma</i>	<i>sambuci</i>	Polyporales	Meruliaceae	28/4/2009	Nypa petiole	Nakhon srithammarat
3(28/4/2010)	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	28/4/2009	Nypa petiole	Nakhon srithammarat
RCK00227	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	15/9/2010	Nypa petiole	Samutsakorn
RCK00232	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	15/9/2010	Nypa petiole	Samutprakarn
RCK00236	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	15/9/2010	Nypa petiole	Samutprakarn
RCK00238	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	15/9/2010	Nypa petiole	Samutprakarn
RCK00240	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	15/9/2010	Nypa petiole	Samutprakarn
RCK00241	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	15/9/2010	Nypa sheath	Samutprakarn
RCK00242	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	15/9/2010	Nypa sheath	Samutprakarn
RCK00243	<i>Grammothele</i>	<i>fuligo</i>	Polyporales	Polyporaceae	15/9/2010	Nypa sheath	Samutprakarn
RCK00233	<i>Phanerochaete</i>	sp.	Polyporales	Phanerochaetaceae	15/9/2010	Nypa petiole	Samutprakarn
2(28/4/2010)	Unidentified	Unidentified	Unidentified	Unidentified	24/4/2010	Nypa petiole	Nakhon srithammarat

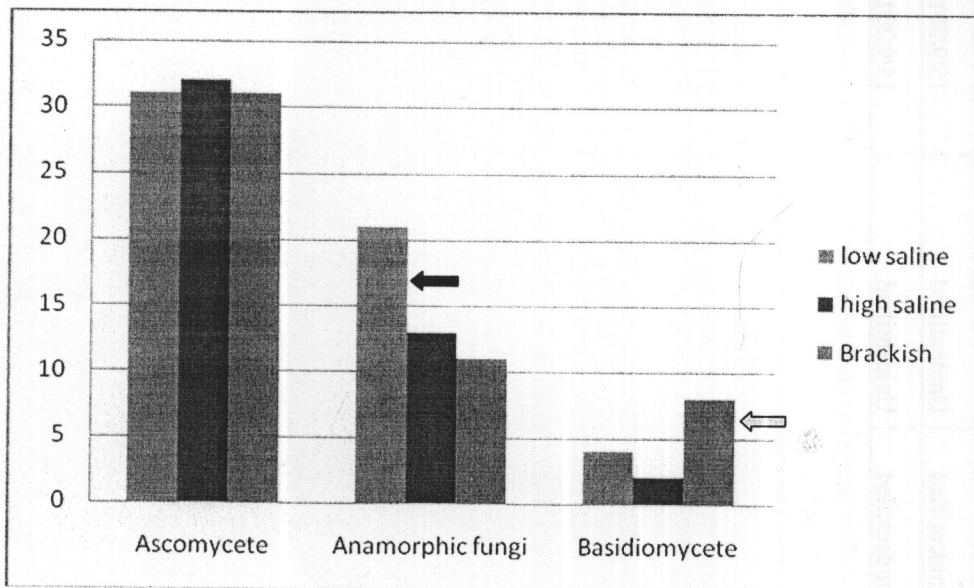
Table 3. (continued)

Original Code	Genus	Epithet	Order	Family	Collection Date	Substrate	Province
RCK00218	Unidentified	Unidentified	Unidentified	Unidentified	15/9/2010	Nyipa petiole	Samutsakorn
RCK00231	Unidentified	Unidentified	Unidentified	Unidentified	15/9/2010	Nyipa petiole	Samutprakarn

### Comparison of fungal groups at different salinity

When compare the water salinity of the collection sites (data shown in **Table 1**), the fungal groups colonized on the materials from different salinity is significantly distinct from freshwater (0-5 psu.) brackish (5-15 psu.) to marine (>15 psu.) (**Figure 4**).

The locations with low water salinity (Trang, Ranong and Surat Thani province), many of fungal taxa colonized are similar to the freshwater group (e.g. *Helicosporium* *Helicoma* and *Acrogenospora*). In contrast when the locations have higher level of salinity (Samutsakorn, Satun, Samutprakarn, Nakhon srithammarat and Chachoengsao provinces ) the fungal taxa colonizing the materials are more to marine fungi group (*Halosarpheia*, *Saagaromyces*, *Lulworthia* and *Savoryella*) (Pilantanapak, et al.2005).



**Figure 4. Comparison of fungal groups at different salinity**

From data shown in Fig.4, there is no significant difference among the ascomycete group found at any salinity while in the hyphomycete and basidiomycete groups they are relatively different. Lower water salinity yielded higher occurrence of hyphomycete (black arrow) as well as the basidiomycete that have greater colonization at low water salinity (yellow arrow) However we also found the true marine basidiomycetes such as *Halocyphina villosa* and *Calathella* sp. which can colonized on materials in fully saline water.

From this study five collections of Basidiomycota were found from Ranong, Nakhon Si Thammarat, Samut Sakhon, Surat thani and Samut Prakan Provinces. Among these the

polyporaceous fungi were quite common on palm, especially a fungus *Grammothele fuligo*. Moreover, this fungus was frequently found at the basal part of *Nypa* palm.

Twenty-one samples of basidiomycetes on *Nypa fruticans* were collected from all collections. Six samples belong to the order Agaricales divided into four families i.e. Marasmiaceae (2 samples), Psathyrellaceae (2 samples), Schizophyllaceae (1 sample), and Coprinaceae (1 sample). One sample was identified to species level, while five samples were identified to genera level.

Twelve samples belong to the order Polyporales divided into three families i.e. Polyporaceae (10 sample), Meruliaceae (1 sample), Phanerochaetaceae (1 sample). Eleven samples were identified to species level, while one sample was identified to genera level. The family Polyporaceae is a largest saprophytic group of basidiomycetes collected from *Nypa fruticans*, followed by the Meruliaceae and Phanerochaetaceae, respectively. *Grammothele fuligo* is very common and represents as the largest number of collections on *Nypa fruticans*. Additionally, other three basidiomycetes samples are await further identification.

### ***Grammothele fuligo***

BASIDIOCARPS annual. PILEUS resupinate, widely effused, hard and brittle, bluish white when fresh to bluish-grey and dark brown when mature. HYMENIAL SURFACE pores. PORES SURFACE bluish white, grey, darkening with age to almost black. PORES angular, thin-walled, 8 – 16 per mm. TUBES shallow. CONTEXT dark brown and very thin. BASIDIA clavate, hyaline in Melzer's reagent, thin-walled,  $25 - 30 \times 4 - 6 \mu\text{m}$ , sterigmata very long  $5 \times 1 - 2 \mu\text{m}$ . BASIDIOSPORES cylindrical to slightly allantoid, hyaline, thin-walled, smooth and non-amyloid,  $8 - 9 \times 3.5 - 4 \mu\text{m}$ . HYPHAL SYSTEM dimitic, generative hyphae with clamped, hyaline,  $2 - 3 \mu\text{m}$  wide, skeletal hyphae, thick-walled to solid, olivaceous light brown in 5% KOH, dextrinoid in Melzer's reagent,  $3 - 5 \mu\text{m}$  wide, unbranched. DENDROHYPHIDIA present, especially along the pore edges. SUBSTRATE on *Nypa fruticans*. Distribution in pantropical (Ryvarden and Johansen, 1980). **Figure 10**



**Short description of basidiomycetes collected from *Nypa fruticans***

***Phanerochaete* sp.**

Fruit body resupinate, smooth, cream to pale yellowish-brown. Monomitic hyphal system, generative hyphae slightly thick-walled, simple septa present, hyaline in Melzer' reagent, 4-5  $\mu\text{m}$  wide. Cystidia hardly encrusted with crystal, 40 x 11  $\mu\text{m}$ . Basidiospores allantoid to cylindrical, 5.12 x 2.82  $\mu\text{m}$  (n=25, Q=1.90), verrucose, apiculus, thin-walled, hyaline.

Specimens examined. Thailand. Lam Fah Pha, Samutprakarn Province, *Nypa* petioles, Collector, R. Choeyklin, 15 September 2010 (RCK00233).

***Marasmiellus* sp.**

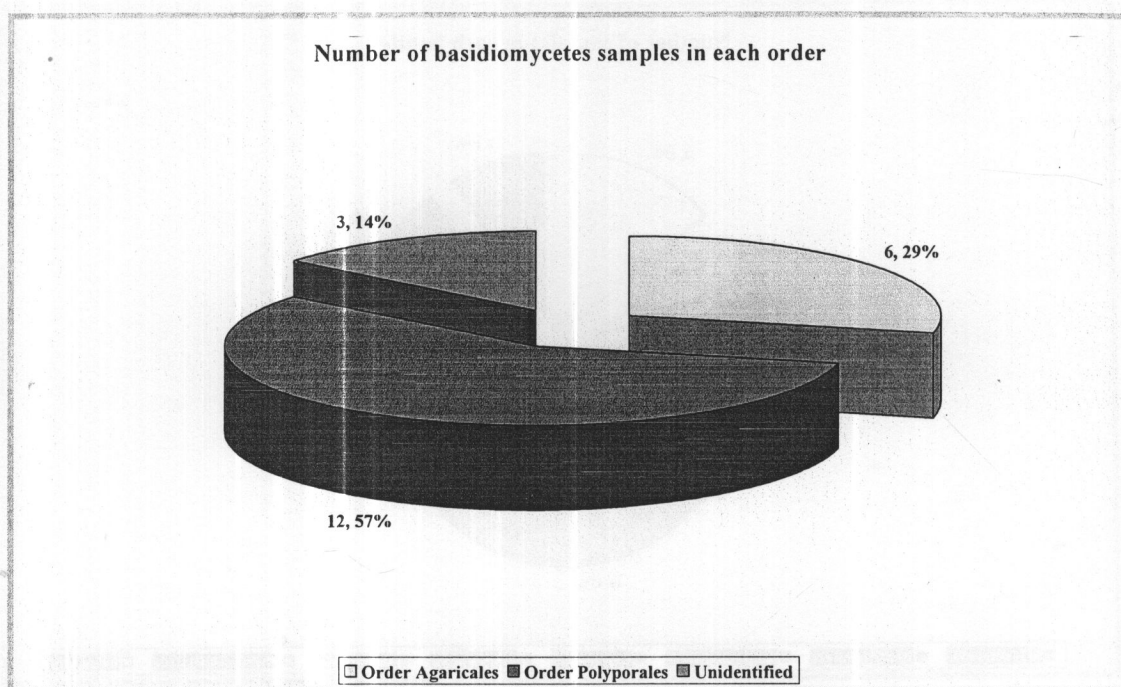
Fruit body stipitate-captate to sessile, pileus 3-15 mm wide, stipe 5 x 0.5 mm, cylindrical, colour fading from dark brown to cream base to apexed, stipe surface prunnose, twisted and slightly striate. Basidiospore subglobose to ellipsoid, fusoid, non-dextrinoid, thin-walled, smooth.

Specimens examined. Thailand. Samutsakorn Province, *Nypa* leaf, Collector, R. Choeyklin, 15 September 2010 (RCK00214).

***Psathyrella* sp.**

Fruit body stipitate-captate. Pileus parabolic, diameter 18 mm wide, slightly striate and inrolled at pileus margin. Texture very thin less than 1 mm thick. Lamellae attachment adnate, lamellae-face purplish-black and micaceous, lamellae colour purplish-black. Stipe cylindrical, 18.5 x 2.5 mm, stipe surface longitudinal- striate. Context hollowed, cream colour. Basidiospore subglobose to ellipsoid, 7.88 x 5.92  $\mu\text{m}$  (n=25, Q=1.35) thick-walled, wall up to 1  $\mu\text{m}$  thick, smooth, hyaline to nearly pale brown when young, brown colour when mature in Melzer's reagent, germ pore present, basidiospores are various size and some immature spore has a guttulate inside the spore.

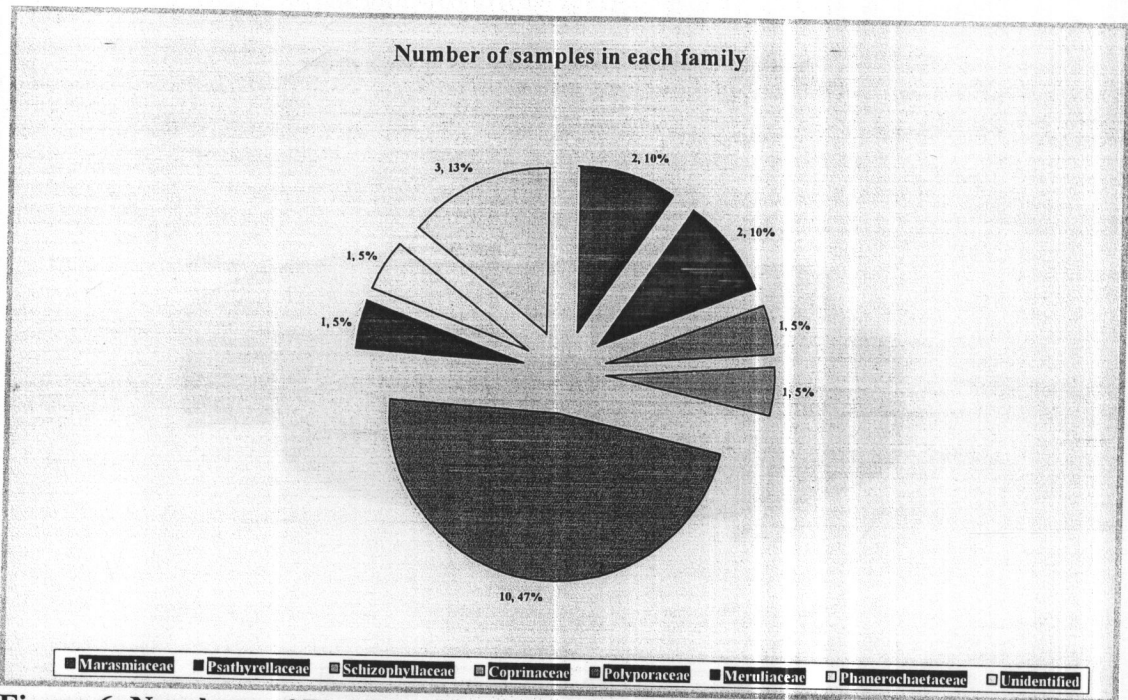
Specimens examined. Thailand. Samutsakorn Province, *Nypa* petioles, Collector, R. Choeyklin, 15 September 2010 (RCK00215).



**Figure 5. Numbers of Basidiomycetes samples in each order.**

The result of our study showed that the numbers of basidiomycetes samples are divided into three groups (Fig.5) The order Agaricales gave highest occurrence (6 samples, 29%) followed by the Polyporales (12 samples, 57%) and unidentified (3 samples, 14%).

The number of basidiomycetes samples are divided into several families including Marasmiaceae (2 samples, 10%), Psathyrellaceae (2 samples, 10%), Schizophyllaceae (1 sample, 5%), Coprinaceae (1 sample, 5%), Polyporaceae (10 samples, 47%), Meruliaceae (1 sample, 5%), Phanerochaetaceae (1 sample, 5%) and unidentified (3 samples, 13%).(Fig. 6)



**Figure 6. Numbers of Basidiomycetes samples in each family.**

Saprotrophic basidiomycetes are usually found on petioles of *Nypa fruticans*, because the petioles possess larger area for fungal attachment, suitable humidity, optimal temperature and nutrients (Jones and Choeyklin, 2008). These factors might facilitate a greater chance for saprotrophic basidiomycete colonization. Substrate utilization by saprotrophic basidiomycetes depends on the substrata and environment from which they were isolated (Jones and Choeyklin, 2008).

### **Numbers of endophytic fungi isolated on *Nypa fruticans***

Our results demonstrate that endophytic fungi of *Nypa fruticans* which were collected from three different locations mostly came from vein (339 isolates) and lamina (266 isolates) while only a few endophyte isolates obtained from branch, petiole and rachis (Table 4). Considering on different collecting sites, Kra Isthmus yielded highest numbers of fungal endophytes of 328 isolates. Meanwhile Bang Bai Mai and Ban Bane gave lower numbers of endophytes accounting for 136 and 157 isolates, respectively. In conclusion, 621 fungal strains were obtained from *Nypa fruticans*.

Some endophyte strains were randomly selected for further study on bioactivities and phylogenetics studies. The chosen strains were deposited at BIOTEC Culture Collection (BCC) accounting 186, 75 and 82 for Kra Isthmus, Bang Bai Mai and Bang Bane, respectively.

Due to fungal endophytes failed to produce a sexual structure, our isolates were categorized according to their morphotypes which varied in term of types of mycelium, colors of hypha and types of colony. Sixty eight morphotypes which is most diverse were recorded from endophytes obtained from Kra Isthmus. Moreover, 44 and 45 morphotypes were recognized from another 2 sites. The numbers of strains which are the most 3 frequent morphotypes of each collecting sites were shown in Table 5. Most abundant morphotypes isolated from *Nypa fruticans* from Kra Isthmus is Type 1 accounting 128 isolates (39 %), while morphotype 68 and 2 are the second and third frequently strains with 21 and 20 isolates, respectively. Meanwhile *Nypa fruticans* harbors lower amounts of morphotypes.

**Table 4.** Details of the locations where *Nypa fruticans* fronds collected for endophytic study.

Date of collection	Sub site	Collecting Site	City/Province	Plant Code	Plant sample (frond)	Water salinity (psu)	GPS
24 January 2010		Kra Isthmus	Kraburi/Ranong	KG	3	3	9.568N, 98.401E
25 January 2010	Ban Koe Sano	Bang Bai Mai	Surat Thani	BM	3	2	9.604N, 99.203E
25 January 2010	Ban Au Kei	Bang Bane Beach	Kapoe/Ranong	BB	2	25	9.585N, 98.586E

**Table 5.** Number of endophytic fungi isolated from different *Nypa fruticans* parts.

Code	Location	Plant parts				Petiole	Rachis	Vein	Lamina	Total (isolate)	Net Total (isolate)
		Branch									
1KG	Kra Isthmus	-					141	129	270		
2KG	Kra Isthmus	-		3			32	20	55		
3KG	Kra Isthmus	1					2	-	3		
										328	
1BM	Bang Bai Mai	-					29	34	63		
2BM	Bang Bai Mai	-				1	6	15	22		
3BM	Bang Bai Mai	-					18	33	51		
										136	
1BB	Bang Bane	4		4	2		24	70	104		
2BB	Bang Bane	-		1			14	38	53		
										157	
Grand total										621	

Note

KG = Kra Isthmus (Kor Kod Gra)

BM = Bang Bai Mai

BB = Bang Bane

**Table 6.** Number of the most frequent morphotypes of endophytic fungi isolated and selected for further studies.

Collecting Site	Total number (isolates)	Selected number (isolate)*	Morphotype (group)	Most three frequent morphotypes (isolates)		
				Morphotype 1	Morphotype 2	Morphotype 3
Kra Isthmus	328	186 (91+95)	68	Type 1 (128)	Type 68 (21)	Type 2 (20)
Bang Bai Mai	136	75 (21+54)	44	Type 1 (17)	Type 9 (8)	Type 8 & 10 (7)
Bang Bane	157	82 (52+30)	45	Type 1 (36)	Type 2 (16)	Type 3 (14)

\* In the bracket

First and second numbers represent fungal isolates which were sent to BBC Culture Collection and Novartis Project, respectively.

### **Common fungi recorded on *Nypa fruticans***

*Linocarpon appendiculatum* (12-47.4%), *Astrosphaeriella striatispora* (10.3-40%), *Trichocladium nypae* (8.8-76.3%) were the most frequent taxa or common taxa on the *Nypa* palm from our collection.

The largest group recorded from this report is host specific especially on *Nypa fruticans* many taxa found high frequency of occurrence with some species is unique to *Nypa fruticans* e.g. *Tirisporella beccariana* (Figure7). Further collections of these fungi are required to resolve their ecological niche. The other factor affecting the presence or absence of the fungi is seasonality (rainfall) with variation in pH, salinity and temperature at the sampling locations.

### **New record fungi colonized on *Nypa fruticans***

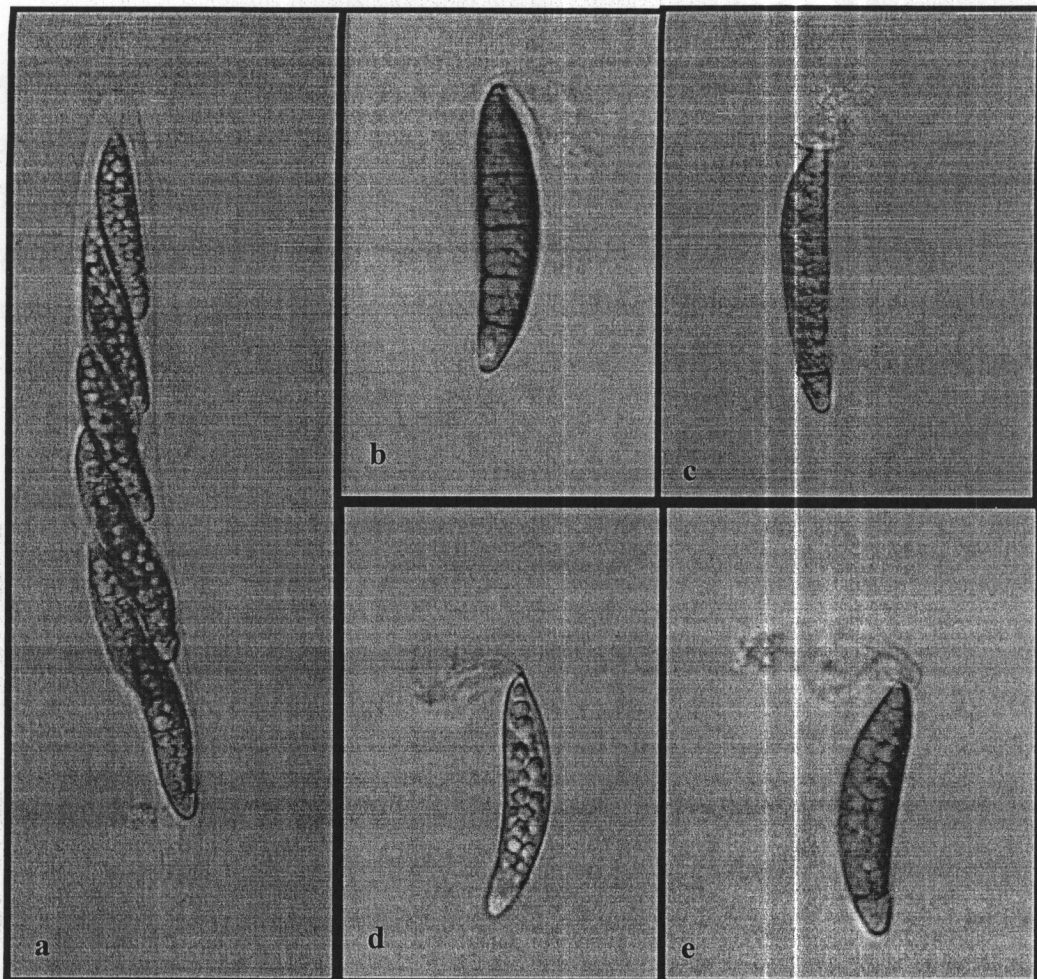
From our data has shown in Table 2 have some fungal group that firstly occur on *Nypa fruticans* such as one slime mold (myxomycota) *Arcyria* sp. have never been reported on any palm materials include *Nypa fruticans*.

*Nypa fruticans* may be considered as one of the mangrove hosts supporting richest fungal diversity in mangroves as could be seen from the present and previous studies. But there are more expected numbers of the saprophytic fungi on this palm because of the unclear description on some taxa await further identification.

In conclusion, this study shows that the submerged parts of the *Nypa fruticans* fronds have richness in fungal diversity, due to the salinity gradient which is directly important factor affected to the fungal group colonized on the *Nypa* palm. Because of this, further biodiversity study on this palm still need to be made.



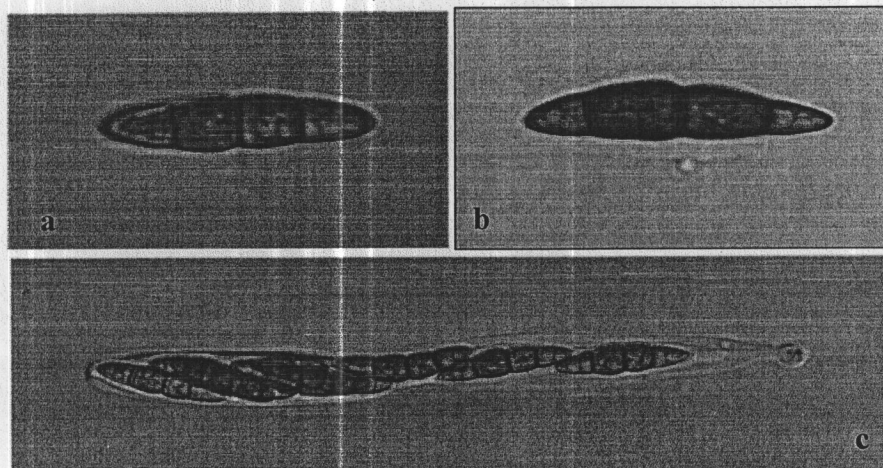
Common fungi found on *Nypa fruticans*



**Figure 7.** *Tirisporella beccariana*

**a.** ascus with 8 matured ascospores.

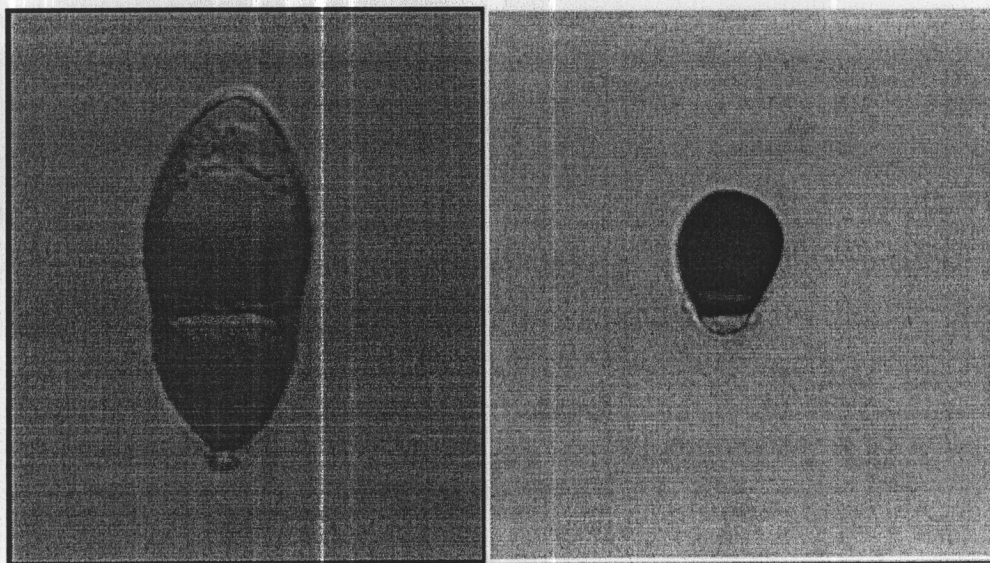
**b-e** ascospore with polar appendages and hyaline end cell.



**Figure 8.** *Astrosphaeriella striatispora*

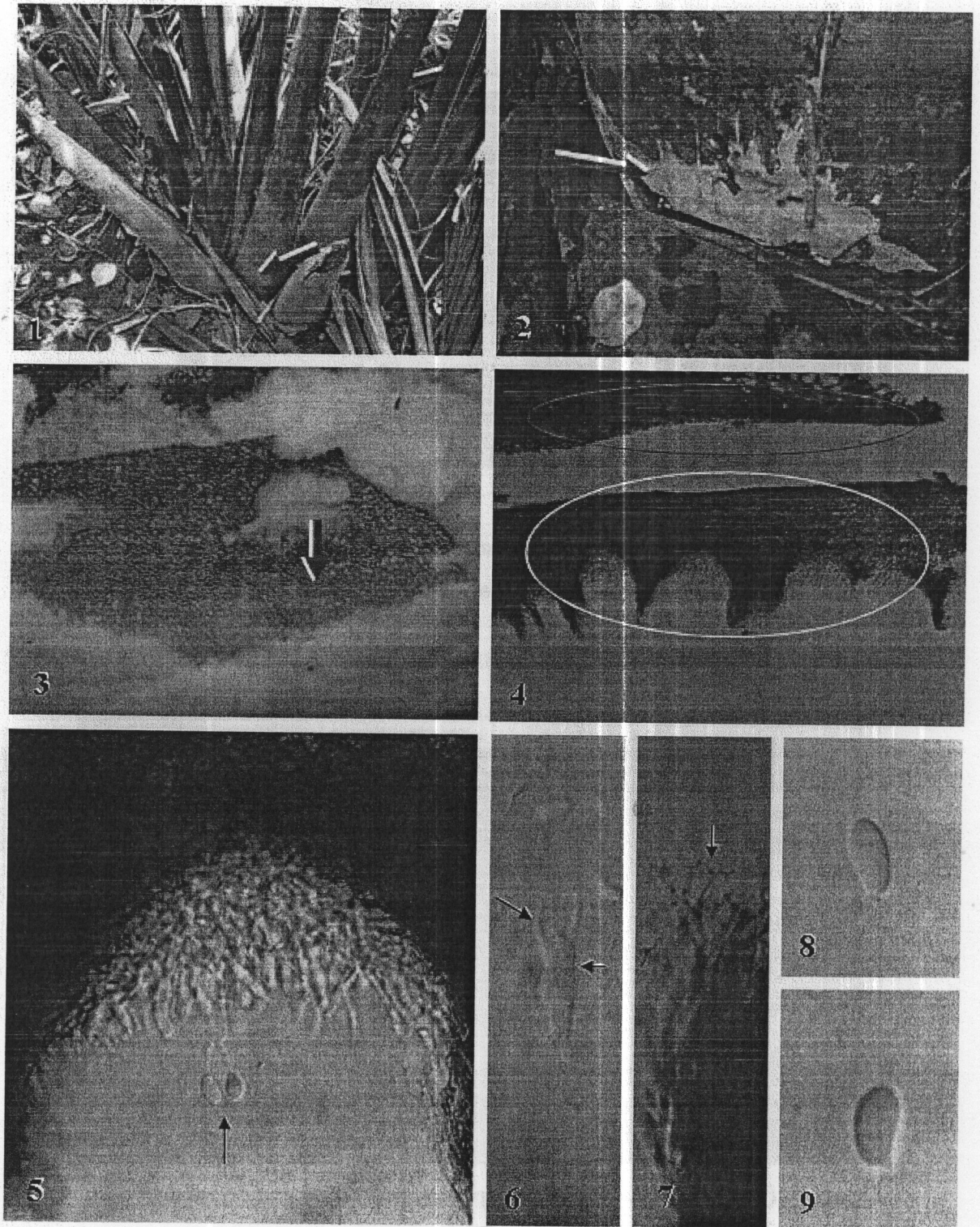
**a-b** ascospore with mucilaginous sheath.

**c.** ascus with 8 ascospores.



**Figure 9.** (a) *Helicascus nypae* ascospore with hyaline end cell and

(b) *Trichocladium nypae* conidia with hyaline end cell.



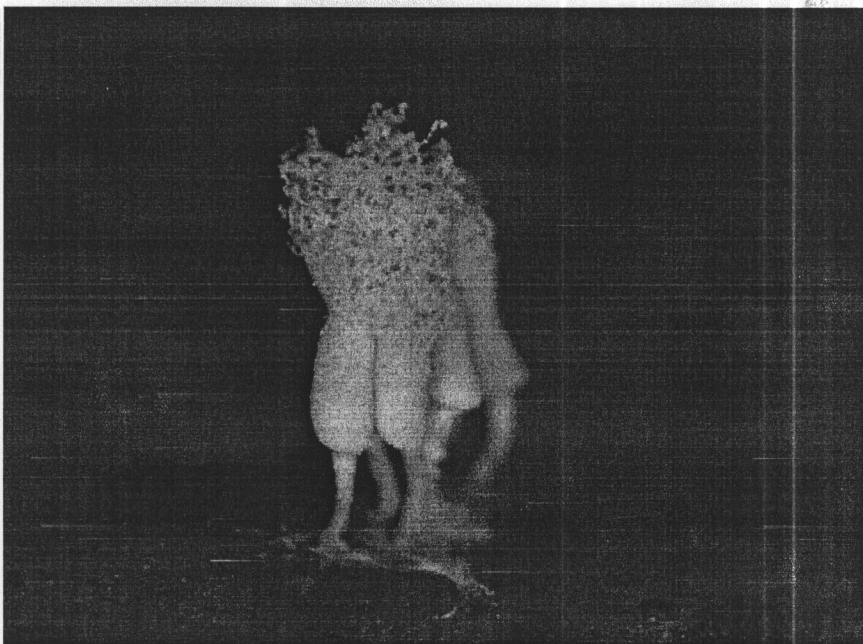
**Figure 10.** *Grammothele fuligo*. 1. Basal frond of *Nypa fruticans*. 2. Basidiocarps in natural habitat. 3. Basidiocarp 7 $\times$ . 4. Longitudinal section of basidiocarp 4 $\times$ . (white circle), red circle is plant tissue. 5. Basidia with basidiospores on sterigmata 40 $\times$ .

6. Basidia 60 $\times$ . 7. Dendrohyphidia from pore edges. 8 – 9. Basidiospores. (4-6, 8-9).  
Stained with Melzer's reagent. (7). Stained with phloxine.

**New record fungi on *Nypa fruticans***



**Figure 11.** *Calathella* sp. (young stage of fruiting body)



**Figure 12.** The Myxomycete *Arcyria* sp. (as first record on *Nypa fruticans*)

### **Acknowledgements**

This work was supported by the TRF/BIOTEC Special Program for Biodiversity Research and Training research grant BRT R\_352112. We would like to thank Prof.Morakot Tanticharoen, Dr.Kanyawim Kirtikara, Dr.Lily Eurwilaichitr at BIOTEC for their continual interest and support.

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Appendix I  
Part I Output

1. Poster presentation at the 14<sup>th</sup> BRT annual meeting at Ubolrachathani 10-12 October 2010.





# ต้นจากพืชผู้ให้ตลอดชีวิต

อธิลักษณ์ สอยส่อง, ชีวาน เบนจาลิน กาเรท โจนส์, ณัฐวุฒิ รุ่งจินดาชัย, รัตเชตร เชยกลิ่น, สุจินดา สมหมาย และ จริญญา สาขาโรจน์

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## ทำความรู้จักกับต้นจาก

ต้นจาก (*Nypa fruticans*) เป็นพืชจำพวกปาล์มชนิดหนึ่ง มีถิ่นที่อยู่อาศัยในแถบอินโดแปซิฟิก หรือ ภูมิภาคเอเชียตะวันออกเฉียงใต้ ซึ่งการกระจายตัวของพืชชนิดนี้มีในหลายประเทศได้แก่ อินเดีย ศรีลังกา มาเลเซีย อินโดนีเซีย ฟิลิปปินส์ จีน และประเทศไทย พืชชนิดนี้เป็นพืชที่ชอบขึ้นบริเวณริมแม่น้ำ ซึ่งดินมีลักษณะเป็นดินโคลนเลนน้ำมีไปจนถึง ชายเลนและปากแม่น้ำที่ไหลลงสู่ทะเล ซึ่งทำให้ต้นจากสามารถขึ้นอยู่ได้ทั้งบริเวณที่เป็นน้ำจืดและน้ำกร่อย



ปาล์มต้นจาก

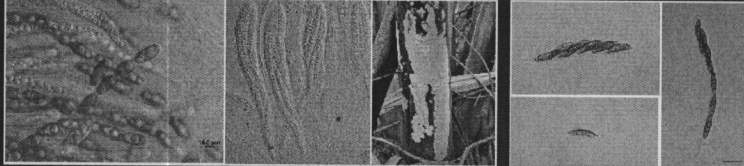
## นานาประโยชน์จากต้นจาก

มนุษย์คุ้นเคยและรู้จักพืชชนิดนี้มาช้านานไม่ต่างกับพืชชนิดอื่นในตระกูลปาล์มเช่น ต้นมะพร้าว แต่คนไทยส่วนมากที่ไม่ได้สังเกตเห็นอาศัยอยู่กับต้นจากนี้มักจะไม่ค่อยรู้ว่าแท้จริงแล้ว ต้นจาก มีคุณประโยชน์ไม่ต่างจากต้นมะพร้าวเช่นกัน ทั้งประโยชน์โดยตรงและโดยอ้อม ประโยชน์โดยตรงส่วนใหญ่คือการนำมาใช้บริโภค ได้แก่ ส่วนของผลจากนำมารับประทานสด การนำส่วนยอดหรือเรียกว่างวงจากมาทำน้ำตาล น้ำผึ้ง และน้ำส้มจากงวงจาก และขนมจาก(ภาคใต้) ส่วนใบนำมาเย็บเป็นต้นจากสำหรับหมวกตุง ใบอ่อนที่เพิ่งจะแตกยอดคนนำมาตากแห้งทำใบมวนบุหรี่ยาสูบ และใบแก่นำมาทอหมวกซึ่งเรารู้จักกันดีคือ หมวกจาก



ส่วนต่างๆ ของต้นจาก ประกอบด้วย ผลจากและงวงจาก นำมาผลิตเป็นน้ำตาลและขนมจาก

ประโยชน์โดยอ้อม ต้นจากเป็นพืชที่มีความสำคัญต่อระบบนิเวศ เนื่องจาก ต้นจากต้องขึ้นในบริเวณดินเลนริมแม่น้ำซึ่งส่วนใหญ่ของลำต้นอันยาวใหญ่ขึ้นเองทำให้สามารถปักตะกอนดินที่แม่น้ำพัดพามาอีกทั้งยังชะลอความแรงของกระแสน้ำในแม่น้ำได้อีกด้วย นอกจากนี้ ต้นจากยังมีคุณสมบัติที่ทนต่อความเค็มทำให้สามารถอาศัยอยู่ในบริเวณปากแม่น้ำและป่าชายเลนอันเป็นผลทำให้เป็นดินที่อุดมด้วยสิ่งมีชีวิตต่างๆ เช่น กุ้ง หอย ปู ปลา ไล้เดือนและสัตว์ครึ่งบกครึ่งน้ำต่างๆ รวมถึงจุลินทรีย์ โดยจุลินทรีย์เหล่านี้มีหน้าที่สำคัญในการเป็นผู้ย่อยสลายของระบบนิเวศทั้ง แบคทีเรีย รา สาหร่ายและ โกลโคน ซึ่งหน้าที่ของจุลินทรีย์เหล่านี้จะเริ่มเมื่อต้นจากเริ่มเน่าตายกลายเป็นซากพืชซึ่งเป็นวัตถุดิบสำคัญต่อไปเพื่อเป็นอาหารของจุลินทรีย์ โดยมีมนุษย์นำจุลินทรีย์เหล่านี้มาศึกษาวิจัยเพื่อค้นคว้าสารเคมีที่เป็นประโยชน์ใหม่ ได้แก่ เอนไซม์และสารออกฤทธิ์ทางชีวภาพ ได้อีกต่อหนึ่ง ซึ่งเชื้อราเป็นจุลินทรีย์ที่สัมพันธ์กับลำต้นจากอย่างใกล้ชิด โดยเชื้อราที่พบบ่อยบนซากต้นจาก ได้แก่ เชื้อรา *Trisporella beccariana* และ *Astrosphaeriella striatospora* โดยเฉพาะเชื้อรา *Astrosphaeriella striatospora* มีความสามารถในการผลิตเอนไซม์โคติเนสส์ได้ โดยเอนไซม์ดังกล่าวสามารถนำไปพัฒนาต่อเป็นยาต้านเชื้อราที่ก่อโรคกับพืช ซึ่งเชื้อราชนิดนี้เป็นเชื้อราที่สามารถพบได้เฉพาะบนต้นจากเท่านั้น ยังไม่มีรายงานว่าพบบนปาล์มหรือพืชชนิดอื่น การนำเชื้อราชนิดนี้มาทำการศึกษาจึงจำเป็นต้องเก็บซากต้นจากมาคัดแยกเชื้อราออกมาเท่านั้น



จุลินทรีย์ที่อาศัยอยู่บนซากต้นจาก ได้แก่ ราและเชื้อรา เชื้อรา *Trisporella beccariana* (ซ้าย) และ *Astrosphaeriella striatospora* (ขวา)

## ต้นจากกับการอนุรักษ์

จากประโยชน์ดังกล่าวข้างต้นไม่ว่าจะเป็นโดยตรงหรือโดยอ้อม มนุษย์เป็นผู้ได้รับประโยชน์ทั้งสิ้นดังนั้นจึงเป็นการดีที่ต้องมีการอนุรักษ์ป่าจากไว้ ต้นจากเป็นพืชที่เจริญเติบโตได้ง่าย เพียงผลที่ร่วงหล่นจากต้นก็สามารถงอกบนดินเลนได้เป็นต้นใหม่ ปัจจุบันมีการตัดทำลายป่าจากเพื่อนำพื้นที่ไปใช้เป็นอย่างอื่น ทำให้พื้นที่ป่าจากลดลง ถ้ามนุษย์ไม่มีการตัดทำลายป่าจากลงไปมากว่านี้ เราจะเหลือทรัพยากรที่สำคัญนี้ไว้ให้กับชุมชนต่อไปอีกนาน

## กิตติกรรมประกาศ

ผลงานวิจัยนี้ได้รับทุนสนับสนุนจากโครงการพัฒนาองค์ความรู้และศึกษานโยบายการจัดการทรัพยากรชีวภาพในประเทศไทย ซึ่งร่วมจัดตั้งโดยสำนักงานกองทุนสนับสนุนการวิจัยและศูนย์พันธุวิศวกรรมและเทคโนโลยีชีวภาพแห่งชาติ รหัสโครงการ BRT\_R35-21 12

2. Manuscript draft for Indian Journal of Marine Science.

**Biodiversity of the fungi on palm *Nypa fruticans* from various regions of Thailand.**

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**Abstract**

The biodiversity of fungi on *Nypa fruticans*, a brackish water palm as studied in many regions. Saprophytic fungi from 6 locations were collected and water salinity measured at each site, seventy-two fungal taxa were recorded from our study, forty eight ascomycetes, nineteen anamorphic taxa, three coelomycetes and two basidiomycetes were recorded. *Linocarpon appendiculatum* (12-47.4%), *Astrosphaeriella striatispora* (10.3-40%) and *Trichocladium nypae* (8.8-76.3%) were the most frequently collected species. These three common fungi colonized *Nypa* at each collection and collection site. The basidiomycete *Grammothele fuligo* was collected and shown to be a regular species on *Nypa* material.

**Introduction**

*Nypa fruticans* is a brackish water palm that grows in soft mud and slow moving tidal and river waters that bring in nutrients. The palm can be found as far inland as the tide can deposit the floating nuts. It is common on coasts and rivers flowing into the Indian and Pacific Oceans, from Bangladesh to the Pacific Islands. The fungi colonizing it have been well documented by Hyde (1992), Hyde and Alias (1999) and Hyde *et al.* (1999). Currently, 106 fungal taxa have been recorded on *Nypa fruticans* from South East Asian countries including: Brunei (Hyde 1988, 1992a, Hyde and Sarma 2006), Malaysia (Hyde *et al.* 1999, Hyde and Alias 1999, 2000), Phillipines (Besitulo *et al.* 2002), Papua New Guinea (Hyde 1992b) and Thailand (Hyde 1988, Hyde and Nakagiri 1989, Hyde 1992b, Pilantanapak 2005). Since Pilantanapak *et al.* (2005) have undertaken a study of saprophytic fungi colonized on *Nypa* fronds from the central region of Thailand, after that there have few studies on biodiversity of the saprophytic fungi especially marine fungi on *Nypa fruticans* from Thailand.

This palm is distributed in many regions; eastern , central and southern parts of Thailand which differ in water salinity, ranging from freshwater , brackish and marine habitats. In this study we have investigated the fungi associated with *Nypa fruticans* in Trang, Satun and Surat Thani province in the south and Samutsakorn, Samutprakarn and Chachoengsao province from the central region. There are still many areas of *Nypa* forests in southern Thailand that have not sampled for saprophytic fungi.

## **Materials and methods**

### **Sample collection**

Decaying petioles and fronds of *Nypa fruticans* were collected randomly at the various sites : 1) Trang, Satun and Surat Thani province in the south and 2) Samutsakorn, Samutprakarn and Chachoengsao province from the central region. Water salinity was measured at each site and *Nypa* samples were returned to the laboratory where they were incubated in plastic boxes with moist tissue paper.

### **Isolation**

Single spore isolations were made from the fresh and incubated materials in the laboratory. The isolation medium was Corn Meal Agar (CMA) with added antibiotics (Streptomycin 0.5 g/l, Penicillin G 0.5 g/l) made up with either freshwater or seawater as appropriate. When spores germinated they were transferred to Potato Dextrose Agar (PDA), and incubated at room temperature.

### **Fungal diversity analysis**

The frequency of the fungal occurrence of each taxon collected from the collection analyzed by use the formula below.

$$\text{Frequency of Occurrence(\% FO)} = \frac{\text{Occurrence of taxon A} \times 100}{\text{Number of samples examined}}$$

## **Results**

### **Frequency of occurrence of fungi saprobic on *Nypa fruticans***

Summary of fungal taxa collected from 6 locations with 331 samples examined supporting 48 ascomycetes, 19 anamorphic taxa, 3 coelomycetes and 2 basidiomycetes (Table 1).

**Table 1.** Frequency of occurrence of saprophytic fungi on *Nypa fruticans* from 6 Thai locations.

Fungi	Frequency of occurrence (%)					
	Trang	Satun	Surat Thani	Samut Prakarn	Chacho engsao	Samut Sakorn
Salinity:	5	26	2	15	17	15 psu ‰
Ascomycetes						
<i>Aniptodera chesapeakensis</i>	3.4	1.1	2.5	3.9	2.6	1.1
<i>Aniptodera longispora</i>	2.3					
<i>Aniptodera nypae</i>	9.2	13.9	2.5	13.7	15.8	8.0
<i>Aniptodera intermedia</i>	2.3	2.3		3.9		
<i>Anthostomella nypae</i>	3.4	1.1		1.96	5.3	
<i>Arecophila</i> sp.	1.1			5.9		
<i>Astrosphaeriella nypae</i>	3.4	1.1		5.9	10.5	
<i>Astrosphaeriella striatissima</i>	10.3	9.2	40	7.8	10.5	
<i>Carinispora nypae</i>	4.6	1.1				
<i>Carinispora velatispora</i>						3.4
<i>Cosmospora</i> sp.	2.3		15			
<i>Dactylospora haliotrepha</i>		1.1				
<i>Fasciatispora nypae</i>		6.9		1.96	7.9	
<i>Halosarpheia viscosa</i>		2.3		7.8		
<i>Halosarpheia marina</i>		1.1				
<i>Helicascus nypae</i>	8.0		2.5			
<i>Kallichroma tethys</i>		1.1				
<i>Leptosphaeria australiensis</i>				1.96		
<i>Leptosphaeria nypicola</i>	2.3	19.5	2.5	1.96	2.6	3.4
<i>Leptosphaeria</i> sp.	5.7	4.6	7.5	1.96	2.6	
<i>Lignincola laevis</i>	1.1	2.3	5	15.7	2.6	
<i>Lignincola nypae</i>	3.4	12.9	2.5			1.1
<i>Linocarpon appendiculatum</i>	19.5	24.7	32.5	21.6	47.4	12
<i>Linocarpon bipolaris</i>	2.3		2.5			
<i>Linocarpon nypae</i>			15	3.9	23.7	3.4
<i>Linocarpon angustatum</i>	1.1	2.3	5			2.3
<i>Linocarpon longisporum</i>		2.3				
<i>Lophiostoma mangrovei</i>				15.7		
<i>Lophiostoma</i> sp.	1.1					
<i>Lulworthia grandispora</i>	6.9	1.1		9.8		1.1
<i>Marinosphaera mangrovei</i>		2.3				
<i>Massarina</i> sp.	1.1					
<i>Mongkiella thalassiae</i>	1.1					
<i>Natantispora retorquens</i>	2.3		2.5			
<i>Neptunella longirostris</i>	1.1	4.6		1.96		2.3

Table 1.(continued)

Fungi	Frequency of occurrence (%)					
	Trang	Satun	Surat Thani	Samut Prakarn	Chacho eng sao	Samut Sakorn
Salinity:	5	26	2	15	17	15 psu ‰
<i>Oceanitis cincinnatula</i>	2.3	4.6				
<i>Oxydothis nypae</i>	2.3	2.3		9.8	2.6	
<i>Phomatospora nypicola</i>		4.6	5	1.96		4.6
<i>Saagaromyces ratnagiriensis</i>			2.5			
<i>Saccadoella cf. mangrovei</i>			5			
<i>Savoryella cf. aquatica</i>	1.1	1.1				
<i>Savoryella paucispora</i>		4.6		1.96	2.6	1.1
<i>Savoryella lignicola</i>		5.7	22.5	13.7	2.6	
<i>Tirisporella beccariana</i>	5.7	5.7	7.5	1.96	2.6	4.6
<i>Trematosphaeria mangrovei</i>	1.1					
<i>Vibrissea nypicola</i>	4.6	25.6		7.8	13.2	
<i>Verruculina enalia</i>		1.1				
<i>Tirisporella unicaudata</i>		1.1				
<b>Hyphomycetes</b>						
<i>Acrogenospora sphaerocephala</i>	1.1					
<i>Cirrenalia macrocephala</i>		2.3				
<i>Cumulospora sp.</i>		1.1		5.9		
<i>Dactylaria sp.</i>	1.1					1.1
<i>Dictyosporium sp.</i>			5	1.96	7.9	
<i>Helicoma sp.</i>		1.1				
<i>Helicoma hyalonema</i>			2.5			
<i>Helicorhoidion nypicola</i>	3.4	26.9	5	7.8	26.3	5.7
<i>Helicosporium pannosum</i>			2.5			
<i>Helicosporium hongkongense</i>			2.5			
<i>Monodictys sp.</i>		1.1	2.5	1.96		
<i>Halenospora varium</i>		1.1		1.96	2.6	
<i>Monacosporium sp.</i>						
<i>Sporidesmium sp.</i>		6.9	2.5			
<i>Thozzella nivea</i>			2.5			
<i>Trichocladium achrasporum</i>		3.4				
<i>Trichocladium nypae</i>	8.8	40.9	62.5	64.7	76.3	13
<i>Vanakripa sp.</i>	2.3	3.4	5	19.6		
<b>Coelomycetes</b>						
<i>Diplodia sp.</i>		1.1	2.5	1.96		
<i>Phoma sp.</i>		2.3				
<i>Phomopsis sp.</i>		2.3				
<b>Basidiomycetes</b>						
<i>Grammothele fuligo</i>	1.1			1.96		
<i>Halocyphina villosa</i>			2.5			
Average number of fungi per sample	2.41	1.97	1.3	1.53	1.9	1.38
Total taxa	36	47	31	33	20	16
Total 72 taxa						

Of the fungi recorded, the basidiomycetes encountered were: *Halocyphina villosa*, and *Grammothele fuligo*. The latter species is a new record as a mangrove species (Jones et al., 2009). When comparing the fungal community on *Nypa* at various salinities differences were observed. At low salinity sites (Trang and Surat Thani province), many of the fungal taxa were freshwater species (e.g. *Helicosporium Helicoma* and *Acrogenospora*). In contrast at locations with a higher level of salinity (Samutsakorn, Satun, Samutprakarn and Chachoengsao province) the fungal taxa were typically marine fungi (*Halosarpheia*, *Saagaromyces*, *Lulworthia* and *Savoryella*).

### **Common fungi recorded on *Nypa fruiticans***

*Linocarpon appendiculatum* (12-47.4%), *Astrosphaeriella striatispora* (10.3-40%) and *Trichocladium nypae* (8.8-76.3%) were the most frequently collected taxa on the *Nypa* palm. Many fungi collected were host specific to *Nypa fruiticans* with a high frequency of occurrence, while some species are unique to *Nypa fruiticans* e.g. *Tirisporella beccariana*. Further collections of these fungi is required to resolve their ecological niche. The other factor affecting the presence or absence of the fungi is seasonality (rainfall) with variation in pH, salinity and temperature at the sampling locations.

### **New Record Fungi colonized on *Nypa fruiticans***

From our data has shown in Table 1 have two taxa firstly occur on *Nypa fruiticans* are *Cosmospora* sp. and *Arecophila* sp., the *Cosmospora* sp. rarely colonized on palm materials even in other terrestrial and freshwater palm species was that surprisingly colonized on brackish water palm like *Nypa fruiticans* because most of the fungi in genus *Cosmospora* are pathogenic fungi and saprophytic fungi on woody plant tissue or dicotyledonous plant (Rossman et al. 1999) This fungus have many characteristic similar to the genus *Cosmospora* according to Rossman (1983) while they have red color ascumata and change into positive dark red color reaction with KOH and have two cells ascospores.

The other new record taxa from our data is *Arecophila* sp., this fungus was identified into genus *Arecophila* because of the similar characteristic by having unitunicate, cylindrical asci with subapical ring and brown bicellular ascospores. However, our fungus has superficial and long neck ascumata with no reaction with

Melzer's reagent (J-) and the ascospore different from *Arecophila nypae* by without striate wall and not surrounded by a mucilaginous sheath.

***Cosmospora* sp.**

**Ascomata:** Perithecia 350 – 500 um high, 250 - 350 um in diameter , superficial, aggregate , gregarious , coriaceous, globose to obpyriform orange to red color, collapse when dry changing color in 3% KOH to deeply red , ostioles obtuse. **Asci with Paraphyses :** 75-100 x 30-37.5 um., 8-spored , clavate, thin-walled, unitunicate deliquescing early , lacking an apical ring. **Ascospore:** 32.5 – 37.5 x 10 – 15 um., biseriate to multiseriate , hyaline, 2-celled , ellipsoid, striate , not constrict or slightly constrict at the septum, with round or conical ends, no mucilaginous sheath or appendages.

**Habitat:** Saprobic on petiole and base of *Nypa fruiticans*.

**Specimen examine :** Trang , Surat thani and Ranong provinces, Thailand .

Anamorph : Unknown.

However most of this genera have anamorphs; *Acremonium*, *Fusarium* and *Volutella* sp. while in our collection this fungus did not produce any conidia then the identification to the species level have to use the molecular phylogenies base on ITS sequences.

***Arecophila* sp.**

**Ascomata** 150-200 um in diameter., immersed, becoming superficial, globose , black carbonaceous , solitary or gregarious. Ostiole central, papillate. **Neck** up to 350 um long. **Paraphyses** absent. **Asci** 100-125 x 12.5-15 um., 8-spored, cylindrical, unitunicate, short pedicellate, apical rounded, with J- subapical ring, **Ascospores** 25-30 x 5 um., biseriate, ellipsoidal, slightly curved, 2-celled, pale brown to brown, not constricted at the septum, smooth wall and not surrounded by any mucilaginous sheath or apical appendages.

**Habitat:** Saprobic on petiole and base of *Nypa fruiticans*.

**Specimen examine :** Trang and Samutprakarn provinces Thailand .On petioles and bases of *Nypa fruiticans*.

Anamorph : Unknown.

**Discussion**

This study compares the fungi occurring on the intertidal and terrestrial (non-marine) or freshwater of *Nypa* palm, the ascomycetes showed the greatest diversity and colonized the bases and petioles (1.38 - 2.41 taxa per sample). The saprophytic fungi



documented on the *Nypa* palm included many species found to be host specific or showing host preference with some taxa not found on other terrestrial palms.

### Groups of fungi recorded on *Nypa fruiticans*

Pilantanapak et al. (2005) divided fungi recorded on *Nypa fruiticans* in Thailand into four groups 1). Typically marine/mangrove. 2). Host specific/host preference. 3). Facultative marine. 4) Unknown affinity. From the data presented in Table 1 we can discern three groups. (Table 2)

**Table 2.** Groups of fungi recorded on *Nypa fruiticans*

Groups	Fungi
Typically marine/mangrove	<i>Aniptodera chesapeakensis</i> <i>Aniptodera longispora</i> <i>Halosarpheia viscosa</i> <i>Oceanitis cincinnatula</i> <i>Kallichroma tethys</i> <i>Marinosphaera mangrovei</i> <i>Lophiostoma mangrovei</i> <i>Lignincola laevis</i> <i>Lulworthia grandispora</i> <i>Natantispora retorquens</i> <i>Neptunella longirostris</i> <i>Trematosphaeria mangrovei</i> <i>Cirrenalia macrocephala</i> <i>Savoryella lignicola</i> <i>Savoryella paucispora</i> <i>Saagaromyces ratnagiriensis</i> <i>Trichocladium achrasporum</i> <i>Zalerion varium</i> <i>Verruculina enalia</i>
Host specific/ <i>Nypa</i> specific	<i>Aniptodera nypae</i> <i>Aniptodera intermedia</i> <i>Anthostomella nypae</i> <i>Astrosphaeriella nypae</i> <i>Astrosphaeriella striatispora</i> <i>Carinispora nypae</i> <i>Fasciatispora nypae</i> <i>Helicascus nypae</i> <i>Leptosphaeria nypicola</i> <i>Lignincola nypae</i> <i>Linocarpon appendiculatum</i> <i>Linocarpon bipolaris</i> <i>Linocarpon angustatum</i> <i>Oxydothis nypae</i> <i>Tirisporella beccariana</i> <i>Vibrissea nypicola</i> <i>Trichocladium nypae</i> <i>Helicorhoidion nypicola</i>
Facultative marine	Not found

Groups	Fungi
Unknown affinity	<i>Arecophila</i> cf. ( new ) <i>Cosmospora</i> sp. (new) <i>Lophiostoma</i> sp. <i>Leptosphaeria</i> sp. <i>Massarina</i> sp. <i>Mongkiella thalassiae</i> <i>Dactylaria</i> sp. <i>Acrogenospora sphaerocephala</i> <i>Vanakripa</i> sp. <i>Diplodia</i> sp. <i>Phoma</i> sp. <i>Phomopsis</i> sp. <i>Helicoma hyalonema</i> <i>Helicosporium pannosum</i> <i>Helicosporium hongkongense</i> <i>Thozettella nivea</i>

Moreover, there are evidence indicates that there are probably more than 40 species that are unique to *Nypa fruiticans* (Hyde and Alias 2000) The list of the fungi as shown in Table 3 are the fungi only known on *Nypa fruiticans* . From our collection found marine fungal taxa with low frequency support those occurrences on the materials they still have ability to grow and reproduce when totally or periodically submerged in seawater or estuarine water (Kohlmeyer and Kohlmeyer 1979).

### **Comparison of fungi colonizing the brackish water palm *Nypa fruiticans* with other terrestrial palm.**

A comparison of the fungi colonizing on peat swamp palm *Eleiodoxa conferta* with *Nypa fruiticans* (Pinnoi 2006) shows that there are few species/genera in common: *Astrosphaeriella*, *Linocarpon* and *Oxydothis*. However, the genera *Carinispora*, *Fasciatispora*, *Halocyphina*, *Helicascus*, *Lignicola* and *Lulworthia*, which are common on *Nypa*, have not been recorded on *E. conferta*. These genera are more commonly found on substrata in marine habitats (Poonyth et al., 1999) and may require sodium chloride for growth, while those on *E. conferta* may not be salt tolerant. The latter may be more tolerant to acidic waters, while marine fungi tend to occur in more alkaline waters. When compare with other palm such as *Licuala longicalycata* (Pinruen 2007) group of the fungi on those palm were definitely different although in some site that has condition nearly freshwater habitat, there are some freshwater species occurred on *Nypa* : *Helicoma* ,

*Helicosporium* and *Thozettella*. However, considering that most of the fungi found on *Nypa* palm are intertidal and do not appear to occur on non-palm hosts. There are only two other species of mangrove palm which may support these intertidal palm fungi (i.e. *Calamus erinaceus*, *Oncosperma tigillarum*; Tomlinson 1986)

### **Numbers and biodiversity of fungi on *Nypa fruiticans***

*Nypa fruiticans* may be considered as one of the mangrove hosts supporting richest fungal diversity in mangroves as could be seen from the present and previous studies. The latest estimate numbers of the fungi on this palm of the Southeast Asian countries (Thailand, Brunei, Malaysia, Phillipines, Papua New Guinea and Indonesia) and India is 106 species which includes our data (72 taxa) in Thailand which some taxa overlapping with other terrestrial and freshwater hosts. (listed in **Table 4**) But there are more expected numbers of the saprophytic fungi on this palm because of the unclear description on some taxa to be awaiting for corrected the identification.

In conclusion, this study shows that the submerged parts of the *Nypa fruiticans* fronds have richness in fungal diversity but however, due to the salinity gradient which is directly important factor affected to the fungal group colonized on the *Nypa* palm. Because of this, further study of biodiversity on this palm still need to determine.

### **Acknowledgements**

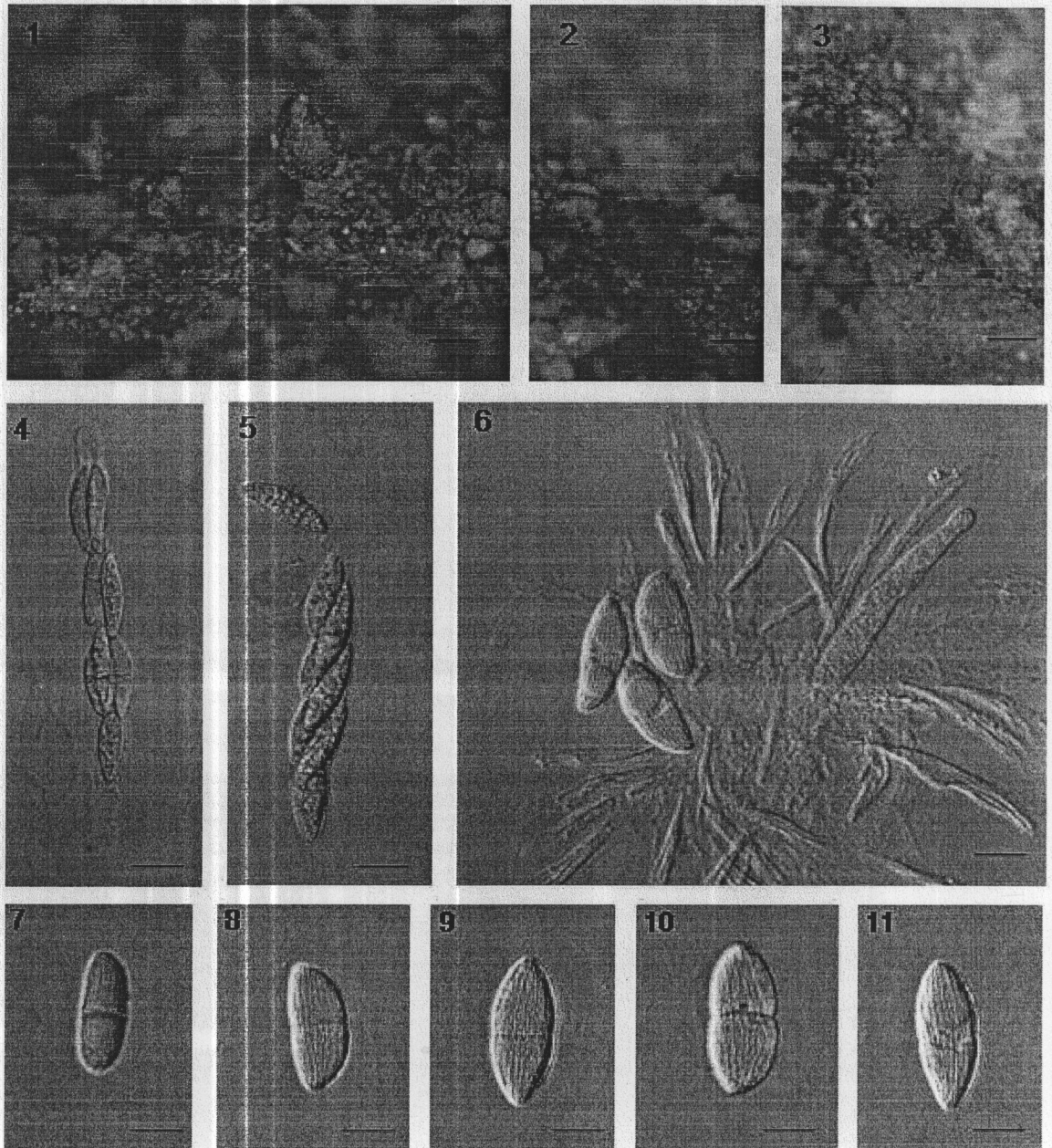
This research was supported by a research grant from the Biodiversity and Training Program (BRT R\_352112) of Thailand. We would like to thank Prof.Morakot Tanticharoen, Dr.Kanyawim Kirtikara, Dr.Lily Eurwilaichitr at BIOTEC for their continued interest and support.

Table 3. Saprophytic fungi only known from *Nypa fruticans*

Fungi	Known distribution on <i>Nypa</i>	References
<i>Aniptodera nypae</i> K.D. Hyde	Malaysia	Hyde (1994a);
<i>Aniptodera intermedia</i> K.D. Hyde & Alias	Malaysia	Hyde et al. (1999)
<i>Anthostomella nypae</i> K.D. Hyde, B.S. Lu & Alias	Brunei, Malaysia	Hyde et al. (1999)
<i>Anthostomella nypensis</i> K.D. Hyde, B.S. Lu & Alias	Malaysia	Hyde et al. (1999)
<i>Anthostomella nypicola</i> K.D. Hyde, B.S. Lu & Alias	Malaysia	Hyde et al. (1998)
<i>Arecophila nypae</i> K.D. Hyde	Malaysia	Hyde (1996)
<i>Astrosphaeriella nypae</i> K.D. Hyde	Brunei, Indonesia, Malaysia	Hyde & Fröhlich (1998)
<i>Astrosphaeriella nypicola</i> (Cooke & Massee) K.D. Hyde & J. Fröhl.	Malaysia	Hyde (1996)
<i>Astrosphaeriella striatospora</i> (K.D. Hyde) K.D. Hyde	Brunei, Indonesia, Malaysia	Hyde (1989) 1992a, 1993
<i>Apioclypea nypicola</i> K.D. Hyde	Malaysia	Hyde (1996)
<i>Carinispora nypae</i> K.D. Hyde	Brunei, Malaysia	Hyde (1992a, 1993);
<i>Carinispora velatispora</i>	Malaysia	Hyde (1994)
<i>Fasciatispora nypae</i> K.D. Hyde	Brunei, Malaysia	Hyde (1991a, 1992a, 1993)
<i>Fronidcola tunitricuspis</i> K.D. Hyde	Brunei	Hyde (1992a)
<i>Helicascus nypae</i> K.D. Hyde	Brunei; Malaysia	Hyde (1991b, 1992a)
<i>Helicorhoidion nypicola</i> K.D. Hyde & Goh	Malaysia	Hyde et al. (1999)
<i>Leptosphaeria nypicola</i> K.D. Hyde & Alias	Malaysia	Hyde et al. (1999)
<i>Linocarpon nypae</i> (Henn.) K.D. Hyde	Brunei, Malaysia	Hyde (1988)
<i>Linocarpon angustatum</i> Alias & K.D. Hyde	Malaysia	Hyde and Alias (1999)
<i>Linocarpon appendiculatum</i> K.D. Hyde	Brunei, Malaysia, Indonesia, Papua New Guinea	Hyde (1988, 1989, 1992a,c, 1993)
<i>Linocarpon longisporum</i> K.D. Hyde	Brunei, Malaysia	Hyde (1992)
<i>Linocarpon bipolaris</i> K.D. Hyde	Brunei	Hyde (1992a,c)
<i>Lignicola nypae</i> K.D. Hyde & Alias	Brunei, Malaysia, Philippines, Thailand	Hyde (1988, 1992a,c, 1993)
<i>Manglicola guatemalensis</i> Kohlm. & E. Kohlm.	Guatemala, Thailand	Kohlmeier and Kohlmeier (1971)
<i>Neolinocarpon globosicarpum</i> K.D. Hyde	Brunei, Malaysia	Hyde (1992a, 1993)

Table 3. (continued)

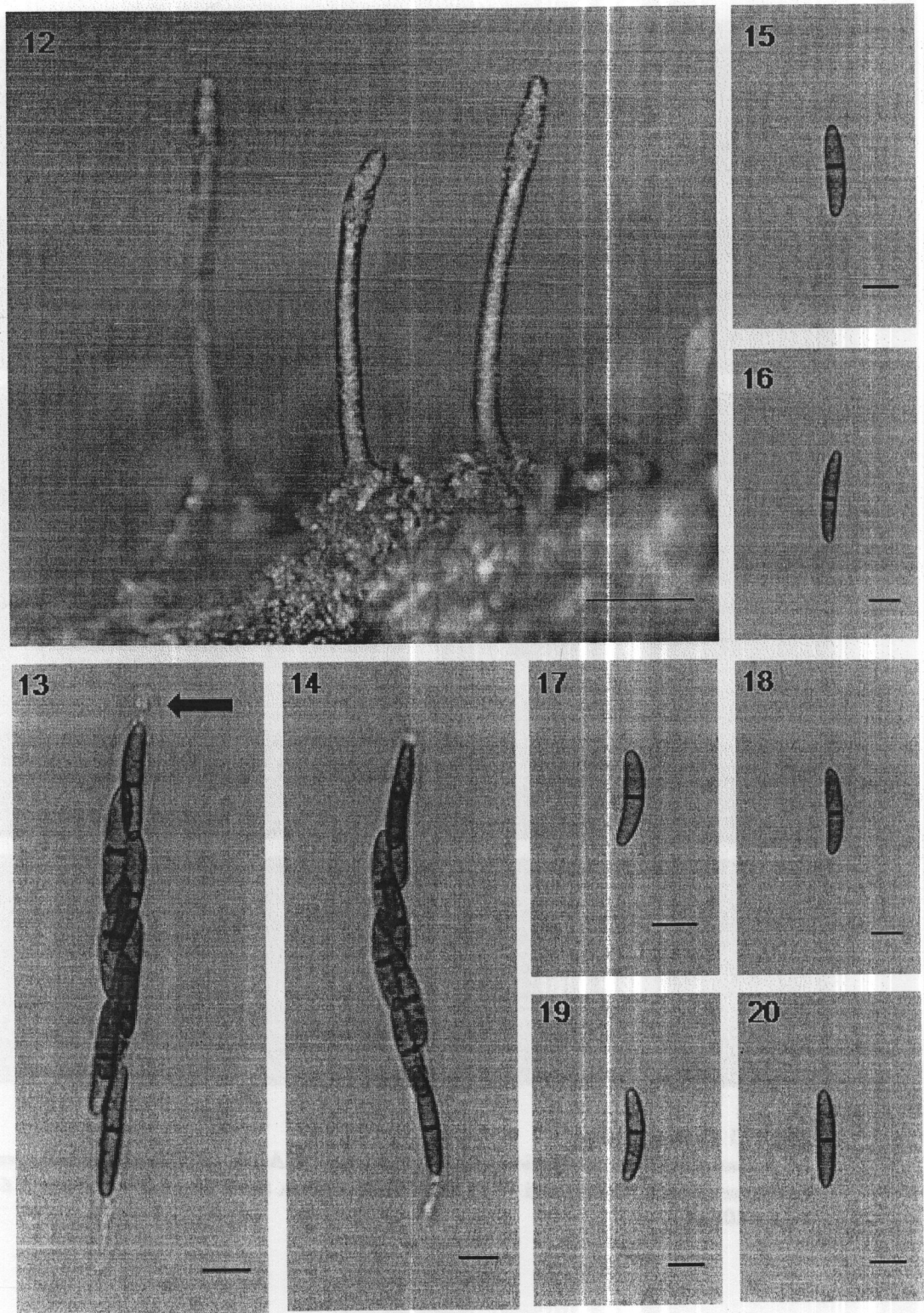
Fungi	Known distribution on <i>Nypa</i>	References
<i>Neolinocarpon nypicola</i> K.D. Hyde & Alias	Malaysia	Hyde and Alias (1999)
<i>Nipicola carbonispora</i> K.D. Hyde	Brunei	Hyde (1992a,b)
<i>Nipicola selangorensis</i> K.D. Hyde	Malaysia	Hyde (1994a)
<i>Nypaella frondicola</i> K.D. Hyde & B. Sutton	Brunei, Malaysia	Hyde and Sutton (1992)
<i>Oxydothis nypae</i> K.D. Hyde & Nakagiri	Brunei, Malaysia, Thailand	Hyde (1992a, 1994b); Hyde and Nakagiri (1989)
<i>Oxydothis nypicola</i> K.D. Hyde	Malaysia	Hyde (1994)
<i>Phomatospora bellaminuta</i>	Malaysia	Kohlmeyer et al. (1995)
<i>Phomatospora nypae</i> K.D. Hyde & Alias	Malaysia	Hyde (1993)
<i>Phomatospora nypicola</i> K.D. Hyde	Malaysia	Hyde and Alias (1999)
<i>Plectrophomella nypae</i> K.D. Hyde & B. Sutton	Brunei, Malaysia	Hyde and Sutton (1992)
<i>Pleurophomopsis nypae</i> K.D. Hyde & B. Sutton	Brunei	Hyde and Sutton (1992)
<i>Tirisporella beccariana</i> (Ces.) E.B.G. Jones, K.D. Hyde & Alias	Malaysia, Philippines	Jones et al. (1996)
<i>Trichocladium nypae</i> K.D. Hyde & Goh	Brunei, Malaysia	Goh and Hyde (1999); Hyde (1992a); Hyde et al. (1999)
<i>Vibrisea nypicola</i> K.D. Hyde & Alias	Brunei, Malaysia	Hyde (1992a); Hyde and Alias (1999)



**Figs. 1-11** *Cosmospora* sp.

**1-3** Ascumata on base and petiole of *Nypa fruticans*. **4**. Ascus with immature ascospores.

**5**. Mature ascus. **6**. Young asci. **7-11** Shiated ascospores. Scale bars 1-3 = 100  $\mu$ m; 4-6 = 20  $\mu$ m; 7-11 = 10  $\mu$ m.



**Figs 12-20** *Ascophila* sp.

12. Ascomata on petiole base of *Nypa fruticans*. 13-14. Ascus with J-subapical ring (arrow). 15-20. Ascospores. Scale bars 12 = 200  $\mu$ m; 13-14 = 20  $\mu$ m; 15-20 = 10  $\mu$ m.

**Table 4.** List of the fungi described on *Nypa fruticans* from South East Asia

Taxa	Taxa
<b>Ascomycetes</b>	
<i>Aniptodera chesapeakeensis</i> Shearer and M.A Mill	<i>Linocarpon nypae</i> K.D.Hyde
<i>Aniptodera</i> cf. <i>limnetica</i>	<i>Linocarpon angustatum</i> K.D.Hyde and Alias
<i>Aniptodera longispora</i> K.D.Hyde	<i>Linocarpon longisporum</i> K.D.Hyde
<i>Aniptodera nypae</i> K.D.Hyde	<i>Lophiostoma mangrovei</i> Kohlm. And Vittal
<i>Aniptodera intermedia</i> K.D.Hyde and Alias	<i>Lophiostoma</i> sp.
<i>Anthostomella nypicola</i> K.D.Hyde, Alias and B.S. Lu	<i>Lulworthia grandispora</i> (500-1000x3.7um) Meyers
<i>Anthostomella nypae</i> K.D.Hyde, Alias and B.S. Lu	<i>Lulworthia grandispora</i> (462-500x3.7um) Meyers
<i>Anthostomella nypensis</i> K.D.Hyde, Alias and B.S. Lu	<i>Manglicola guatemalensis</i> Kohlm. and E. Kohlm.
<i>Anthostomella</i> cf. <i>remii</i>	<i>Marinosphaera mangrovei</i> K.D.Hyde
<i>Arecophila nypae</i> K.D.Hyde	<i>Massarina</i> sp.
<i>Arecophila</i> sp.	<i>Mongkiella thalassiae</i> Kohlm. and Volkm.- Kohlm.
<i>Astrosphaeriella</i> cf. <i>mangrovis</i>	<i>Natantispora retorquens</i> Shearer and J.L.Crane
<i>Astrosphaeriella nypae</i> K.D.Hyde	<i>Neolinocarpon globosicarpum</i> K.D.Hyde
<i>Astrosphaeriella striatispora</i> K.D.Hyde	<i>Neolinocarpon</i> cf. <i>nypicola</i>
<i>Carinispora nypae</i> K.D.Hyde	<i>Neptunella longirostris</i> Kohlm.
<i>Carinispora velatispora</i> K.D.Hyde	<i>Oceanitis cinninnatula</i> Shearer and J.L.Crane
<i>Cosmospora</i> sp.	<i>Ophiostomella</i> sp.
<i>Dactylospora haliotrephe</i> Kohlm. And E.Kohlm.	<i>Oxydothis nypicola</i> K.D.Hyde
<i>Fasciatispora lignicola</i> Alias, E.B.G.Jones and Kuthub.	<i>Oxydothis nypae</i> K.D.Hyde and Nakagiri
<i>Fasciatispora nypae</i> K.D.Hyde	<i>Oxydothis</i> sp.1
<i>Fasciatispora petrakii</i>	<i>Oxydothis</i> sp.2
<i>Halorosellinia oceanica</i> Whalley, E.B.G.Jones, K.D.Hyde and Laessoe	<i>Phomatospora nypae</i> K.D.Hyde
<i>Halosarpheia abonnis</i> Kohlm.	<i>Phomatospora nypicola</i> K.D.Hyde and Alias
<i>Halosarpheia viscosa</i> Shearer and J.L.Crane	<i>Rosellinia</i> sp.
<i>Halosarpheia marina</i> Kohlm.	<i>Saagaromyces ratnagiriensis</i> S.D.Patil and Borse
<i>Halosarpheia</i> sp.	<i>Saccadoella</i> cf. <i>mangrovei</i>
<i>Helicascus nypae</i> K.D.Hyde	<i>Savoryella</i> cf. <i>aquatic</i>
<i>Herpotrichia nypicola</i> K.D.Hyde and Alias	<i>Savoryella paucispora</i> Jorgen Koch
<i>Kallichroma tethys</i> Kohlm. And Volkm.-Kohlm.	<i>Swampomyces</i> sp.
<i>Leptosphaeria australiensis</i> G.C.Hughes	<i>Tirisporella beccariana</i> E.B.G.Jones, K.D.Hyde and Alias
<i>Leptosphaeria nypicola</i> K.D.Hyde and Alias	<i>Trematosphaeria mangrovei</i> Kohlm.
<i>Leptosphaeria</i> sp.	<i>Tirispora unicaudata</i> E.B.G.Jones and Vrijmoed
<i>Lignincola laevis</i> Hohnk	<i>Trematosphaeria lineolatispora</i> K.D.Hyde
<i>Lignincola nypae</i> K.D.Hyde and Alias	<i>Tubeufia</i> sp
<i>Linocarpon appendiculatum</i> K.D.Hyde	<i>Verruculina enalia</i> Kohlm. and Volkm.- Kohlm.
<i>Linocarpon livistonae</i>	<i>Vibrissea nypicola</i> K.D.Hyde and Alias



Table 4. (continued)

Taxa	Taxa
<p><b>Mitosporic fungi</b></p> <p><i>Acrogenospora sphaerocephala</i>  <i>Cirrenalia macrocephala</i> Meyers and R.T.Moore  <i>Cirrenalia pygmaea</i> Kohlm.  <i>Cumulospora</i> sp.  <i>Dactylaria</i> sp.1  <i>Dictyosporium elegans</i>  <i>Dictyosporium</i> sp.  <i>Diplodia</i> sp.  <i>Helicoma</i> sp.  <i>Helicoma hyalonema</i>  <i>Helicorhoidion nypicola</i> K.D.Hyde and Goh  <i>Helicosporium pannosum</i>  <i>Helicosporium hongkongense</i>  <i>Monodictys</i> sp.1  <i>Halenospora varium</i>  <i>Monacosporium</i> sp.  <i>Nypella frondicola</i> K.D.Hyde and B.sutton  <i>Phoma</i> sp.  <i>Phomopsis</i> sp.  <i>Pestalotiopsis</i> sp.  <i>Plectophomella nypae</i> K.D.Hyde and B.sutton  <i>Pleospora</i> sp.  <i>Pleurophomopsis nypae</i> K.D.Hyde and B.sutton  <i>Sporidesmium</i> sp.  <i>Tetraploa</i> cf. <i>aristata</i>  <i>Thozettella nivea</i>  <i>Trichocladium allopallonellum</i>(Meyers and R.T.Moore) Kohlm.  <i>Trichocladium achrasporum</i> (Meyers and R.T.Moore) Dixon  <i>Trichocladium nypae</i> K.D.Hyde and Goh  <i>Vanakripa</i> sp.  <i>Xylomyces</i> cf. <i>rhizophorae</i></p>	<p><b>Basidiomycetes</b></p> <p><i>Grammothele fuligo</i>  <i>Halocyphina villosa</i> Kohlm.</p>

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Appendix II

## List of the fungi deposited in BIOTEC Culture Collection

OriginalCode	BCCCode	Genus	Epithet	Order	Family	CollectionDate	Substrate	Province
NF00001	37005	<i>Anthostomella</i>	<i>nypae</i>	Xylariales	Xylariaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00002	37688	<i>Trisporaella</i>	<i>beccariana</i>	Incertae sedis	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00003	37006	<i>Astrophaeriella</i>	<i>striatipora</i>	Pleosporales	Melanommataceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00004	37007	<i>Helicascus</i>	<i>nypae</i>	Pleosporales	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00005	37008	<i>Trematosphaeria</i>	<i>mangrovis</i>	Pleosporales	Pleomassariaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00006	37009	<i>Dactylaria</i>	sp.	Helotiales	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00007	37010	<i>Carinispora</i>	<i>nypae</i>	Pleosporales	Phaeosphaeriaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00008	38265	<i>Trichocladium</i>	<i>nypae</i>	Sordariales	Chaetomiaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00009	37689	<i>Ascosalium</i>	<i>cinnamulum</i>	Microascales	Halosphaeriaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00010	37690	<i>Vanakripa</i>	sp.	Incertae sedis	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00011	37691	<i>Mauritian</i>	<i>rhizophorae</i>	Pyrenulales	Requienellaceae	2-Feb-2009	Wood (Unidentified)	Rayong
NF00012	37692	<i>Aniptodera</i>	<i>chesapeakeensis</i>	Microascales	Halosphaeriaceae	2-Feb-2009	Wood (Unidentified)	Rayong
NF00014	37694	<i>Lophiostoma</i>	<i>mangrovei</i>	Pleosporales	Lophiostomataceae	2-Feb-2009	Wood (Unidentified)	Rayong
NF00015	37695	<i>Aureobasidium</i>	sp.	Dothideales	Dothioraceae	4-Mar-2009	Leaf (Nypa fruticans)	Trang
NF00018	37696	<i>Trichoderma</i>	sp.	Hypocreales	Hypocreaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00021	37062	<i>Syncephalastrum</i>	sp.	Mucorales	Syncephalastraceae	4-Mar-2009	Rachis (Nypa fruticans)	Trang
NF00022	37697	<i>Cladosporium</i>	sp.	Capnodiales	Davidiellaceae	4-Mar-2009	Rachis (Nypa fruticans)	Trang
NF00023	37061	<i>Nigrospora</i>	sp.	Trichosphaeriales	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00024	37698	<i>Nodulisporium</i>	sp.	Xylariales	Xylariaceae	4-Mar-2009	Leaf (Nypa fruticans)	Trang
NF00025	37699	<i>Olpitrichum</i>	sp.	Incertae sedis	Incertae sedis	4-Mar-2009	Leaf (Nypa fruticans)	Trang
NF00026	39121	<i>Astrophaeriella</i>	<i>nypae</i>	Pleosporales	Melanommataceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00027	39122	<i>Lulworthia</i>	<i>grandispora</i>	Lulworthiales	Lulworthiaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00028	38266	<i>Aniptodera</i>	<i>nypae</i>	Microascales	Halosphaeriaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00029	39123	<i>Linocarpon</i>	<i>appendiculatum</i>	Incertae sedis	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00030	38267	<i>Neptunella</i>	<i>longirostris</i>	Microascales	Halosphaeriaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00032	38268	<i>Anthostomella</i>	<i>nypae</i>	Xylariales	Xylariaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00033	38269	<i>Anthostomella</i>	<i>nypae</i>	Xylariales	Xylariaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00034	38270	<i>Trisporaella</i>	<i>beccariana</i>	Incertae sedis	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00035	38271	<i>Trisporaella</i>	<i>beccariana</i>	Incertae sedis	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00036	38272	<i>Astrophaeriella</i>	<i>striatipora</i>	Pleosporales	Melanommataceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00037	38273	<i>Astrophaeriella</i>	<i>striatipora</i>	Pleosporales	Melanommataceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00039	38274	<i>Helicascus</i>	<i>nypae</i>	Pleosporales	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00040	38275	<i>Trematosphaeria</i>	<i>mangrovis</i>	Pleosporales	Pleomassariaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00041	38276	<i>Trematosphaeria</i>	<i>mangrovis</i>	Pleosporales	Pleomassariaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00042	39124	<i>Carinispora</i>	<i>nypae</i>	Pleosporales	Phaeosphaeriaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00043	39125	<i>Carinispora</i>	<i>nypae</i>	Pleosporales	Phaeosphaeriaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00044	39126	<i>Vanakripa</i>	sp.	Incertae sedis	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang

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NF00045	39127	<i>Vanakripa</i>	sp.	Incertae sedis	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00049	38277	<i>Lophiostoma</i>	<i>mangrovei</i>	Pleosporales	Lophiostomataceae	2-Feb-2009	Wood (Unidentified)	Rayong
NF00051	39129	<i>Trichoderma</i>	sp.	Hypocreales	Hypocreaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00053	39130	<i>Cladosporium</i>	sp.	Capnodiales	Davidiellaceae	4-Mar-2009	Rachis (Nypa fruticans)	Trang
NF00054	38278	<i>Nigrospora</i>	sp.	Trichosphaeriales	Incertae sedis	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00055	39794	<i>Olpitrichum</i>	sp.	Incertae sedis	Incertae sedis	4-Mar-2009	Leaf (Nypa fruticans)	Trang
NF00056	39131	<i>Carrispora</i>	<i>velatispora</i>	Pleosporales	Phaeosphaeriaceae	15-Jul-2009	Petiole (Nypa fruticans)	Samut Sakhon
NF00057	39132	<i>Sporidesmium</i>	sp.	Pleosporales	Incertae sedis	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00058	39795	<i>Vibrissa</i>	<i>nypicola</i>	Helotiales	Vibrissaceae	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00059	39796	<i>Vibrissa</i>	<i>nypicola</i>	Helotiales	Vibrissaceae	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00060	39133	<i>Cumulospora</i>	sp.	Incertae sedis	Incertae sedis	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00061	39134	<i>Cumulospora</i>	sp.	Incertae sedis	Incertae sedis	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00062	39135	<i>Helicothoidion</i>	<i>nypicola</i>	Incertae sedis	Incertae sedis	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00063	39136	<i>Helicothoidion</i>	<i>nypicola</i>	Incertae sedis	Incertae sedis	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00064	39137	<i>Verruculina</i>	<i>enalia</i>	Pleosporales	Testudinaceae	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00065	39138	<i>Verruculina</i>	<i>enalia</i>	Pleosporales	Testudinaceae	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00066	39139	<i>Carrispora</i>	<i>velatispora</i>	Pleosporales	Phaeosphaeriaceae	15-Jul-2009	Petiole (Nypa fruticans)	Samut Sakhon
NF00067	39797	<i>Aniptodera</i>	<i>intermedia</i>	Microscapales	Halosphaeriaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00077	39140	<i>Marinosphaera</i>	<i>mangrovei</i>	Incertae sedis	Incertae sedis	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00078	39141	<i>Halosarphaea</i>	sp.	Microscapales	Halosphaeriaceae	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00079	40009	<i>Kallichroma</i>	<i>tethys</i>	Hypocreales	Bionectriaceae	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00080	40010	<i>Leptosphaeria</i>	<i>nypicola</i>	Pleosporales	Leptosphaeriaceae	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00083	40929	<i>Dactylospora</i>	<i>halotrephe</i>	Lecanorales	Dactylosporaceae	19-Aug-2009	Petiole (Nypa fruticans)	Satun
NF00084	40764	<i>Phormatospora</i>	<i>nypicola</i>	Xylariales	Incertae sedis	15-Jul-2009	Petiole (Nypa fruticans)	Samut Sakhon
NF00086	40765	<i>Carrispora</i>	<i>velatispora</i>	Pleosporales	Phaeosphaeriaceae	14-Dec-2009	Petiole (Nypa fruticans)	Chachoengsao
NF00087	40766	<i>Fasciatispora</i>	<i>nypae</i>	Xylariales	Incertae sedis	14-Dec-2009	Petiole (Nypa fruticans)	Chachoengsao
NF00088	40767	<i>Astrosphaeriella</i>	<i>stratispora</i>	Pleosporales	Melanormataceae	14-Dec-2009	Rachis (Nypa fruticans)	Chachoengsao
NF00089	40511	<i>Massarina</i>	sp.	Pleosporales	Massarinaceae	4-Mar-2009	Petiole (Nypa fruticans)	Trang
NF00090	40768	<i>Linocarpon</i>	<i>appendiculatum</i>	Incertae sedis	Incertae sedis	14-Dec-2009	Petiole (Nypa fruticans)	Chachoengsao
NF00091	40769	<i>Lignicola</i>	<i>laevis</i>	Microscapales	Halosphaeriaceae	14-Dec-2009	Petiole (Nypa fruticans)	Samut Prakan
NF00092	40770	<i>Oxydothis</i>	<i>nypae</i>	Xylariales	Incertae sedis	14-Dec-2009	Petiole (Nypa fruticans)	Samut Prakan
NF00093	40653	<i>Vibrissa</i>	<i>nypicola</i>	Helotiales	Vibrissaceae	14-Dec-2009	Petiole (Nypa fruticans)	Chachoengsao
NF00094	40771	Unidentified	Unidentified	Incertae sedis	Incertae sedis	14-Dec-2009	Petiole (Nypa fruticans)	Chachoengsao
NF00095	40930	Unidentified	Unidentified	Incertae sedis	Incertae sedis	14-Dec-2009	Petiole (Nypa fruticans)	Chachoengsao
NF00096	40610	<i>Helicothoidion</i>	<i>nypicola</i>	Incertae sedis	Incertae sedis	14-Dec-2009	Petiole (Nypa fruticans)	Chachoengsao
NF00099	40611	<i>Zalerion</i>	<i>maritimum</i>	Lulworthiales	Lulworthiaceae	7-Dec-2009	Wood (Unidentified)	Rayong
NF00209	40931	<i>Thozetella</i>	<i>nivea</i>	Chaetosphaeriales	Chaetosphaeriaceae	24-Jan-2010	Petiole (Nypa fruticans)	Ranong

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NF00101	40932	<i>Astrophaeriella</i>	<i>nypae</i>	Pleosporales	Melanommataceae	14-Dec-2009	Petriole (Nypa fruticans)	Samut Prakan
NF00102	41245	<i>Aniptodera</i>	<i>nypae</i>	Microascales	Halosphaeriaceae	14-Dec-2009	Petriole (Nypa fruticans)	Samut Prakan
NF00103	40933	<i>Acrogenospora</i>	<i>sphaerocephala</i>	Pleosporales	Hysteriaceae	24-Jan-2010	Petriole (Nypa fruticans)	Ranong
NF00104	41246	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00105	41247	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00106	41248	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00107	41249	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00108	41250	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00109	41251	<i>Lulworthia</i>	<i>grandispora</i>	Lulworthiales	Lulworthiaceae	14-Dec-2009	Petriole (Nypa fruticans)	Samut Prakan
NF00110	41252	<i>Cumulospora</i>	sp.	Incertae sedis	Incertae sedis	14-Dec-2009	Petriole (Nypa fruticans)	Samut Prakan
NF00168	43318	<i>Sporidesmium</i>	sp.	Pleosporales	Incertae sedis	25-Jan-2010	Petriole (Nypa fruticans)	Ranong
NF00169	43319	<i>Dictyosporium</i>	sp.	Pleosporales	Incertae sedis	14-Dec-2009	Petriole (Nypa fruticans)	Chachoengsao
NF00170	43320	<i>Leptosphaeria</i>	sp.	Pleosporales	Leptosphaeriaceae	25-Jan-2010	Petriole (Nypa fruticans)	Surat Thani
NF00171	43321	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00172	43322	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00173	43323	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00174	43324	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00175	43325	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00176	43326	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00177	43327	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00178	43328	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Ranong
NF00179	43329	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Ranong
NF00180	43330	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Ranong
NF00181	43331	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Ranong
NF00182	43332	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Ranong
NF00183	43333	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Ranong
NF00184	43334	<i>Helicascus</i>	<i>nypae</i>	Pleosporales	Incertae sedis	25-Jan-2010	Petriole (Nypa fruticans)	Surat Thani
NF00185	43335	<i>Vibrissa</i>	<i>nypicola</i>	Helotiales	Vibrissaceae	24-Jan-2010	Petriole (Nypa fruticans)	Ranong
NF00186	43336	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Petriole (Nypa fruticans)	Surat Thani
NF00187	43337	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00188	43338	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00189	43339	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00190	43340	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00191	43341	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00192	43342	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00193	43343	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00194	43344	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani

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NF00195	43345	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00196	43346	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00197	43347	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00198	43348	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00199	43349	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00200	43350	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-Jan-2010	Leaf (Nypa fruticans)	Surat Thani
NF00201	43351	<i>Phoma</i>	sp.	Pleosporales	Incertae sedis	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NF00202	43352	<i>Lulworthia</i>	<i>grandispora</i>	Lulworthiales	Lulworthiaceae	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NF00203	43353	<i>Cumulospora</i>	sp.	Incertae sedis	Incertae sedis	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NF00207	43354	<i>Neolinocarpon</i>	<i>globosicarpon</i>	Xylariales	Incertae sedis	24-Jan-2010	Petiole (Nypa fruticans)	Ranong
NF00209	43748	<i>Linocarpon</i>	<i>ripae</i>	Incertae sedis	Incertae sedis	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NF00210	43749	<i>Linocarpon</i>	<i>appendiculatum</i>	Incertae sedis	Incertae sedis	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NF00211	43750	<i>Cirrenalia</i>	<i>tropicalis</i>	Microascales	Halosphaeriaceae	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NF00212	43751	<i>Neptunella</i>	<i>longirostris</i>	Microascales	Halosphaeriaceae	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NF00213	43752	<i>Helicorhoidion</i>	<i>nycticola</i>	Incertae sedis	Incertae sedis	14-Jul-2010	Petiole (Nypa fruticans)	Chumphon
NF00214	43753	<i>Natantispora</i>	<i>retorquens</i>	Microascales	Halosphaeriaceae	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NF00215	43754	<i>Ascosalium</i>	<i>cinnamatum</i>	Microascales	Halosphaeriaceae	28-Apr-2010	Petiole (Nypa fruticans)	Nakhon Si Thammarat
NR00001	40654	<i>Halorosellinia</i>	<i>oceanica</i>	Xylariales	Xylariaceae	29-n.n.-2552	Wood (Unidentified)	Phang-nga
NR00002	40655	<i>Halorosellinia</i>	<i>oceanica</i>	Xylariales	Xylariaceae	29-n.n.-2552	Wood (Unidentified)	Phang-nga
NR00003	40656	<i>Diplodia</i>	sp.	Botryosphaeriales	Botryosphaeriaceae	29-n.n.-2552	Wood (Unidentified)	Phang-nga
NR00004	40934	<i>Astrosphaeriella</i>	<i>siriatispora</i>	Pleosporales	Melanommataceae	24-n.n.-10	Petiole (Nypa fruticans)	Surat Thani
NR00005	40935	<i>Astrosphaeriella</i>	<i>siriatispora</i>	Pleosporales	Melanommataceae	24-n.n.-10	Petiole (Nypa fruticans)	Surat Thani
NR00006	40936	<i>Linocarpon</i>	sp.	Incertae sedis	Incertae sedis	24-n.n.-10	Petiole (Nypa fruticans)	Surat Thani
NR00007	40937	<i>Linocarpon</i>	sp.	Incertae sedis	Incertae sedis	24-n.n.-10	Petiole (Nypa fruticans)	Surat Thani
NR00008	40938	<i>Linocarpon</i>	sp.	Incertae sedis	Incertae sedis	24-n.n.-10	Petiole (Nypa fruticans)	Surat Thani
NR00009	40939	<i>Cosmospora</i>	sp.	Hypocreales	Nectriaceae	24-n.n.-10	Petiole (Nypa fruticans)	Surat Thani
NR00010	40940	<i>Cosmospora</i>	sp.	Hypocreales	Nectriaceae	24-n.n.-10	Petiole (Nypa fruticans)	Surat Thani
NR00011	40941	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Petiole (Nypa fruticans)	Surat Thani
NR00012	41033	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong
NR00013	41253	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong
NR00014	41254	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong
NR00015	41034	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong
NR00016	41035	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong
NR00017	41036	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong
NR00018	41037	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong
NR00019	41038	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong
NR00020	41039	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-n.n.-10	Leaf (Nypa fruticans)	Ranong









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NF00159	42093	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00160	42094	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00161	42095	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00162	42096	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00163	42097	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00164	42098	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00165	42099	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00166	42100	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00167	42101	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00111	41878	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00112	41879	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00113	41880	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00114	41881	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Petiole (Nypa fruticans)	Ranong
NF00115	41882	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00116	41883	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00117	41884	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00118	41885	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00119	41886	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00120	41887	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00121	41888	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00122	41889	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00123	41890	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00124	41891	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00125	41892	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00126	41893	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00127	41894	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00128	41895	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00129	41896	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Petiole (Nypa fruticans)	Ranong
NF00130	41897	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00131	41898	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00132	41899	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Petiole (Nypa fruticans)	Ranong
NF00133	41900	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00134	41901	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong
NF00135	41902	Unidentified	Unidentified	Incertae sedis	Incertae sedis	25-u.n.-10	Leaf (Nypa fruticans)	Ranong





OriginalCode	BCCCode	Genus	Epithet	Order	Family	CollectionDate	Substrate	Province
NR00171	41375	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00172	41376	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00173	40964	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00174	40965	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00175	40966	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00176	40967	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00177	40968	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00178	40969	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00179	40970	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00180	40971	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00181	40972	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00182	40973	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00183	40974	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00184	40975	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00185	40976	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00186	40977	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00187	40978	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00188	40979	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00189	40980	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00190	40981	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00191	40982	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00192	40983	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00193	41377	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00194	41378	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00195	41379	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00196	41380	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong
NR00197	41381	Unidentified	Unidentified	Incertae sedis	Incertae sedis	24-u.n.-10	Petiole (Nypa fruticans)	Ranong