

## RESEARCH ARTICLE

# A Survey of Macrofungal Diversity in Da-Lat, Southern Vietnam

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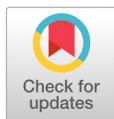
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## ABSTRACT

Da-Lat is a hilly area located in southern Vietnam. Macrofungal diversity of Da-Lat was investigated from 2018 to 2019. A total of 468 macrofungal specimens was collected and identified using the modern species concept and taxonomic and phylogenetic analyses. Among them, internal transcribed spacer(ITS) region of 401 specimens were successfully sequenced and compared with those of related species retrieved from GenBank. In total, 180 specimens were identified at the species level. The sequenced specimens were classified into 2 phyla, 13 orders, 38 families, 93 genera, and 124 species. The remaining 221 specimens (175 species) did not match the species level. This study is the first well-documented taxonomic list of macrofungi collected from southern Vietnam.

**Key words:** Biodiversity, Macrofungi, Phylogeny, Southern Vietnam, Taxonomy,



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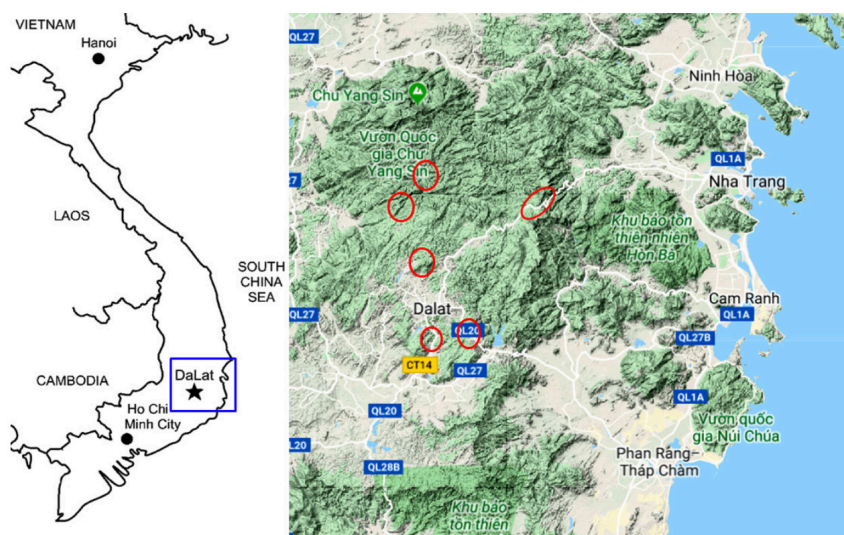
## INTRODUCTION

Vietnam is located on the eastern Indochinese Peninsula between the latitudes 8° and 24°N and the longitudes 102° and 110°E. The higher plant flora of Vietnam has been well studied. However, fungal diversity in Vietnam is poorly understood compared with that of higher plants. Since 1890, macrofungi have been collected by foreign amateur botanists and have been identified by European scholars, such as Patouillard. Many new species have been recently described in this area; however, these species have not been accepted by scientists. In 1998, a list of 829 species was compiled by Kiet [1]. However, the report is simply a checklist and does not describe where the specimens were deposited. In addition, little is known about the sequence data and morphological descriptions of previously recorded species in Vietnam. However, it is estimated that there are many more fungi in Vietnam compared to other countries. Joint research carried out by the National Institute of Biological Resources (NIBR), Ministry of the Environment

of the Republic of Korea, and the Vietnam Environmental Agency to investigate biodiversity including macrofungi in the Da-Lat region of southern Vietnam has been ongoing since 2018. In this study, we introduce the macrofungal flora of the Da-Lat region of southern Vietnam based on the identification of fungi collected between June 2018 and July 2019.

## MATERIALS AND METHODS

The survey area was located near Da-Lat City, South Vietnam. Da-Lat is the capital of Lam Dong Province, and is located in the Langbian Plateau, at an altitude of 1,400-1,500 m, at the southern tip of the Annam Mountain Range (Fig. 1). The temperature ranges from 18 to 23°C year-round. Most of the rain falls in July and October and annual rainfall is 1,750 mm [2]. The wide range of plant communities and the richness of higher plants provide a multitude of ecological niches resulting in similarly high macrofungal diversity.



**Fig. 1.** Map of collection sites in southern Vietnam. Red circles indicate collection area.

The fruiting bodies of macrofungi were collected between June 2018 and July 2019. Regular and planned survey trips were conducted, and information on the collecting sites, habitats, hosts, substrates, and fruiting bodies was noted as field records, and photographs were taken to document the survey. All samples were brought to the laboratory, observed morphologically under the microscope, and then dried on a warm dryer (WiseVen, Daihan Scientific, Wonju, Korea). The dried specimens were deposited in the NIBR herbarium and they were initially identified based on their macroscopic and microscopic features according to previously published descriptions [3-10]. A total of 468 specimens were identified based on macroscopic and microscopic characteristics. Microstructures, such as the shape and size of spores, basidia

and asci, cystidia, as well as tissue status were examined according to the method of Largent [11] using a Nikon eclipse 80i microscope (Nikon, Tokyo, Japan). Taxonomic classification of species and associated nomenclature were assigned using the Mycobank database (<http://www.mycobank.org/>). Genomic DNA was extracted using the NucleoSpin Plant II kit (Macherey-Nagel Inc., Bethlehem, PA, USA) according to the manufacturer's instructions. Internal transcribed spacer (ITS) and partial nuclear large subunit (LSU) rDNA regions were amplified using primers specific for ITS5 [12] and LR5 [13] as described by Lee and Jung [14]. DNA sequencing was performed at the DNA Synthesis and Sequencing Facility (Cosmogenetech, Seoul, Korea) using the primers mentioned above. The resulting nucleotide sequences were edited using MEGA7 software [15]. Species identities were confirmed by comparison with reference sequences in the GenBank database of the National Center for Biotechnology Information (NCBI) using the basic local alignment search tool (BLAST) [16]. A neighbor-joining phylogenetic analysis was conducted in PAUP 4.0b10 [17] with the Jukes–Cantor correction. All fungal taxa were enumerated and classified according to current taxonomy using a combination of these morphological and phylogenetic analyses.

## RESULTS

The ITS and partial LSU rDNA regions were successfully amplified and sequenced using the polymerase chain reaction. In total, 401 of the 468 specimens collected were successfully sequenced and compared with those of related species retrieved from GenBank. The sequence data of specimens were deposited in NIBR database (<http://species.nibr.go.kr>). A total of 180 specimens were identified at the species level. The sequenced specimens were classified into 2 phyla, 13 orders, 39 families, and 93 genera. The orders with the most species were Polyporales (35 species), Agaricales (38 species), Boletales (16 species), Russuales (15 species), and Hymenochaetales (9 species). However, the identity of 221 specimens, including *Russula* spp., *Cystiodontia* spp., *Mycena* spp., and *Clavulinopsis* spp. was not ensured at the species level, as no sequences from the NCBI database were available or no matches were made for the species when blasted against the GenBank database. These specimens were classified into 2 phyla, 13 orders, 41 families, 80 genera, and 175 species (Table 1).

### List of macrofungi from southern Vietnam

#### Ascomycota Caval.-Sm.

#### Leotiomycetes O.E. Erikss. & Winka

#### Helotiales Nannf. ex Korf & Lizon

#### Helotiaceae Rehm

1. *Diccephalospora rufocornea* (Berk. & Broome) Spooner, *Bibliotheca Mycologica* 116: 272 (1987) Specimen examined: Oct 23 2018, NIBRFG0000503948

#### Sordariomycetes O.E. Erikss. & Winka

#### Hypocreales Lindau

**Table 1.** List of macrofungi from southern Vietnam not identified to species level (Continued)

Phylum	Order	Family	Genus	No. of species	
Ascomycota	Hypocreales	Ophiocordycipitaceae	<i>Ophiocordyceps</i>	1	
	Pezizales	Helvellaceae	<i>Helvella</i>	2	
	Xylariales	Xylariaceae	<i>Xylaria</i>	3	
Basidiomycota	Agaricales	Amanitaceae	<i>Amanita</i>	1	
		Clavariaceae	<i>Clavulinopsis</i>	10	
		Cortinariaceae	<i>Cortinarius</i>	2	
		Cystostereaceae	<i>Cystiodontia</i>	11	
		Hydnangiaceae	<i>Laccaria</i>	1	
		Hygrophoraceae	<i>Cyphellostereum</i>	2	
			<i>Humidicutis</i>	1	
			<i>Hygrocybe</i>	3	
		Hymenogastraceae	<i>Hypholoma</i>	6	
		Phaeocollybia	<i>Phaeocollybia</i>	2	
			<i>Crepidotus</i>	2	
		Inocybaceae	<i>Inocybe</i>	1	
		Lyophyllaceae	<i>Termitomyces</i>	3	
		Marasmiaceae	<i>Clitocybula</i>	1	
			<i>Gerronema</i>	1	
			<i>Hydropus</i>	1	
			<i>Lactarius</i>	2	
			<i>Marasmiellus</i>	5	
			<i>Marasmius</i>	2	
			Mycenaceae	<i>Camarophylloopsis</i>	1
				<i>Entoloma</i>	1
				<i>Lactifluus</i>	1
				<i>Mycena</i>	9
				<i>Panellus</i>	6
			Resinomycena	<i>Resinomycena</i>	1
				<i>Gymnopus</i>	2
		Mycetinis	<i>Mycetinis</i>	4	
			<i>Hymenopellis</i>	2	
		Physalacriaceae	<i>Hohenbuehelia</i>	1	
		Pleurotaceae	<i>Gymnopilus</i>	1	
		Strophariaceae	<i>Hebeloma</i>	1	
			<i>Psilocybe</i>	1	
			<i>Tricholoma</i>	1	
		Tricholomataceae	<i>Tubaria</i>	1	
		Tubariaceae	<i>Pseudohydnum</i>	1	
		Auriculariales	Exidiaceae	<i>Boletellus</i>	1
Boletales	Boletaceae		<i>Boletus</i>	1	
	<i>Phylloporus</i>	1			
	<i>Retioboletus</i>	2			
	<i>Tylopilus</i>	1			
	Hygrophoropsidaceae	<i>Hygrophoropsis</i>	2		
	Tapinellaceae	<i>Tapinella</i>	1		
	Cantharellales	Cantharellaceae	<i>Clavulina</i>	1	
<i>Craterellus</i>		1			
Hydnaceae		<i>Hydnum</i>	3		
Gomphales	Gomphaceae	<i>Gomphus</i>	1		
		<i>Ramaria</i>	1		
Hymenochaetales	Hymenochaetaceae	<i>Coltricia</i>	6		
		<i>Fuscoporia</i>	1		
		<i>Phaeolus</i>	1		
		<i>Phellinus</i>	1		
		<i>Pyrofomes</i>	1		
		Rickenellaceae	<i>Leifia</i>	1	
		Schizoporaceae	<i>Phanerochaete</i>	1	

**Table 1.** List of macrofungi from southern Vietnam not identified to species level

Phylum	Order	Family	Genus	No. of species			
	Phallales	Phallaceae	<i>Clathrus</i>	2			
	Polyporales	Ganodermataceae	<i>Ganoderma</i>	1			
			Meruliaceae	<i>Flaviporus</i>	1		
		<i>Phlebia</i>		1			
		<i>Podoscypha</i>		2			
		Phanerochaetaceae	<i>Resinicium</i>	1			
			<i>Trichaptum</i>	1			
			<i>Macrohyporia</i>	1			
		Polyporaceae	<i>Flabellophora</i>	<i>Grammothelopsis</i>	1		
				<i>Microporellus</i>	1		
				<i>Microporus</i>	1		
				<i>Neofomitella</i>	1		
				<i>Polyporus</i>	1		
				<i>Trametes</i>	1		
				Russulales	Auriscalpiaceae	<i>Artomyces</i>	1
						<i>Auriscalpium</i>	1
	Russulales	Lachnocladiaceae	<i>Vararia</i>	1			
		Russulaceae	<i>Russula</i>	25			
		Stereaceae	<i>Stereum</i>	2			
			<i>Xylobolus</i>	1			
	Thelephorales	Bankeraceae	<i>Phellodon</i>	1			
		Thelephoraceae	<i>Thelephora</i>	1			
			Total	175			

**Clavicipitaceae** O.E. Erikss.

2. *Drechmeria gunnii* (Berk.) Spatafora, Kepler & C.A. Quandt, IMA Fungus 6 (2): 358 (2015)  
 ≡ *Cordyceps gunnii* (Berk.) Berk. (1860)  
 Specimen examined: Jun 17 2018, NIBRFG0000503773

**Xylariales** Nannf.**Xylariaceae** Tul. & C. Tul.

3. *Xylaria allantoidea* (Berk.) Fr., Nova Acta Regiae Societatis Scientiarum Upsaliensis Ser. 3, 1: 127 (1851)  
 Specimen examined: Oct 22 2018, NIBRFG0000503939; Jul 01 2019, NIBRFG0000506815
4. *Xylaria fraseri* M.A. Whalley, Y.M. Ju, J.D. Rogers & Whalley, Mycotaxon 74 (1): 139 (2000)  
 Specimen examined: Jun 30 2019, NIBRFG0000506809
5. *Xylaria penicilliopsis* (Henn.) Y.M. Ju, IMA Fungus 7 (1): 141 (2016) = *Xylaria moelleroclavus* J.D. Rogers, Y.M. Ju & Hemmes (1997)  
 Specimen examined: Jun 19 2018, NIBRFG0000503817
6. *Xylaria telfairii* (Berk.) Sacc., Sylloge Fungorum 1: 320 (1882)  
 Specimen examined: Oct 22 2018, NIBRFG0000503925

**Basidiomycota** Whittaker ex R.T. Moore**Agaricomycetes** Doweld**Agaricales** Underw.

**Agaricaceae** Chevall.

7. *Nidularia deformis* (Wild) Fr., Symb. Gasteromyc. 1: 3 (1817)  
Specimen examined: Jul 01 2019, NIBRFG0000506814

**Amanitaceae** R. Heim ex Pouzar

8. *Amanita subovalispora* Thongbai, Raspé & K.D. Hyde, Mycosphere 9 (3): 488 (2018)  
Specimen examined: Oct 20 2018, NIBRFG0000503879
9. *Amanita elliptica* Q. Cai, Y.Y. Cui & Zhu L. Yang, Fungal Diversity 91: 142 (2018)  
Specimen examined: Oct 20 2018, NIBRFG0000503883
10. *Amanita orientifulva* Zhu L. Yang, M. Weiss & Oberw., Mycologia 96 (3): 643 (2004)  
Specimen examined: Oct 23 2018, NIBRFG0000503974
11. *Amanita parvicurta* Y.Y. Cui, Q. Cai & Zhu L. Yang, Fungal Diversity 91: 112 (2018)  
Specimen examined: Jun 29 2019, NIBRFG0000506778; Jun 29 2019, NIBRFG0000506780
12. *Amanita suborientifulva* Raspé, Thongbai, & K.D. Hyde, Mycosphere 9 (3): 486 (2018)  
Specimen examined: Oct 22 2018, NIBRFG0000503940

**Clavariaceae** Chevall.

13. *Clavaria zollingeri* Lév., Annales des Sciences Naturelles Botanique 5: 155 (1846)  
Specimen examined: Oct 22 2018, NIBRFG0000503928
14. *Clavaria fumosa* Pers., Annalen der Botanik (Usteri) 15: 31 (1795)  
Specimen examined: Jun 17 2018, NIBRFG0000503807

**Cortinariaceae** R. Heim ex Pouzar

15. *Cortinarius brunneoviolaceus* Bidaud, Atlas des Cortinaires 8: 291 (1996)  
Specimen examined: Jun 17 2018, NIBRFG0000503792

**Entolomataceae** Kotl. & Pouzar

16. *Clitopilus prunulus* (Scop.) P. Kumm., Der Führer in die Pilzkunde: 97 (1871)  
Specimen examined: Jun 16 2018, NIBRFG0000503729

**Hydnangiaceae** Gäum. & C.W. Dodge

17. *Laccaria vinaceoavellanea* Hongo, Memoirs of Shiga University 21: 62 (1971)  
Specimen examined: Oct 23 2018, NIBRFG0000503973

**Hygrophoraceae** Lotsy J.P.

18. *Cantharellus minor* Peck, Annual Report on the New York State Museum of Natural History 23: 122 (1872)  
Specimen examined: Jun 29 2019, NIBRFG0000506790; Jul 03 2019, NIBRFG0000506839

**Inocybaceae** Jülich

19. *Inocybe squarrosolutea* (Corner & E. Horak) Garrido, Bibliotheca Mycologica 120: 177 (1988)  
Specimen examined: Jul 03 2019, NIBRFG0000506828

**Lyophyllaceae** Jülich

20. *Asterophora lycoperdoides* (Bull.) Ditmar, Neues Journal für die Botanik 3 (3-4): 56 (1809)  
Specimen examined: Jun 17 2018, NIBRFG0000503777

**Mycenaceae** Overeem

21. *Favolaschia manipularis* (Berk.) Teng, Zhong Guo De Zhen Jun [Fungi of China]: 760 (1963)  
Specimen examined: Jun 30 2019, NIBRFG0000506798
22. *Gerronema kuruvens* K.P.D. Latha & Manim., Phytotaxa 364 (1): 84 (2018)  
Specimen examined: Jul 01 2019, NIBRFG0000506818
23. *Panellus luminescens* Corner, Gardens Bulletin Singapore 39: 132 (1986)  
Specimen examined: Jun 30 2019, NIBRFG0000506810
24. *Panellus stipticus* (Bull.) P. Karst., Bidrag till Kännedom av Finlands Naturoch Folk 32: 96 (1879)  
Specimen examined: Oct 23 2018, NIBRFG0000503971; Jun 17 2018, NIBRFG0000503799.
25. *Xeromphalina enigmatica* K.W. Hughes & R.H. Petersen, Mycologia 107 (6): 1280 (2015)  
Specimen examined: Jun 17 2018, NIBRFG0000503785

**Omphalotaceae** Bresinsky

26. *Gymnopus brassicolens* (Romagn.) Antonín & Noordel., Mycotaxon 63: 363 (1997)  
Specimen examined: Jun 17 2018, NIBRFG0000503768; Jun 17 2018, NIBRFG0000503770;  
Jul 03 2019, NIBRFG0000506832; Jul 03 2019, NIBRFG0000506833
27. *Marasmiellus polygrammus* (Mont.) J.S. Oliveira, Mycological Progress 18 (5): 735 (2019) ≡  
*Gymnopus polygrammus* (Mont.) J.L. Mata(2003)  
Specimen examined: Jun 17 2018, NIBRFG0000503801

**Physalacriaceae** Corner

28. *Cyptotrampa glabra* Zhu L. Yang & J. Qin, Fungal Biology 120: 518 (2016)  
Specimen examined: Jun 19 2018, NIBRFG0000503835; Jul 02 2019, NIBRFG0000506821
29. *Hymenopellis raphanipes* (Berk.) R.H. Petersen, Beihefte zur Nova Hedwigia 137: 213 (2010)  
Specimen examined: Oct 20 2018, NIBRFG0000503856; Oct 21 2018,  
NIBRFG0000503901; Oct 23 2018, NIBRFG0000503952
30. *Oudemansiella submucida* Corner, Gardens Bulletin Singapore 46 (1): 70 (1994)  
Specimen examined: Oct 22 2018, NIBRFG0000503926; Jun 30 2019, NIBRFG0000506804
31. *Xerula sinopudens* R.H. Petersen & Nagas., Reports of the Tottori Mycological Institute 43: 41 (2006)  
Specimen examined: Jun 17 2018, NIBRFG0000503794

**Pleurotaceae** Kühner

32. *Pleurotus pulmonarius* (Fr.) Quél., Mémoires de la Société d'Émulation de Montbéliard ser. 2, 5: 113 (1872)  
Specimen examined: Oct 20 2018, NIBRFG0000503860



**Schizophyllaceae** Quél.

33. *Schizophyllum commune* Fr., Systema Mycologicum 1: 330 (1821)  
Specimen examined: Oct 20 2018, NIBRFG0000503872; Jun 29 2019, NIBRFG0000506791

**Strophariaceae** Singer & A.H. Sm.

34. *Gymnopilus lepidotus* Hesler, Mycologia Memoirs 3: 40 (1969)  
Specimen examined: Oct 21 2018, NIBRFG0000503908
35. *Gymnopilus picreus* (Pers.) P. Karst., Bidrag till Kännedom av Finlands Naturoch Folk 32: 400 (1879)  
Specimen examined: Jun 17 2018, NIBRFG0000503787
36. *Gymnopilus sapineus* (Fr.) Maire, Fungi Catalaunici: Contributions à l'étude de la Flore Mycologique de la Catalogne: 96 (1933) ≡ *Gymnopiluspenetrans* (Fr.) Murrill (1912)  
Specimen examined: Jun 17 2018, NIBRFG0000503780
37. *Hypholoma fasciculare* (Huds.) P. Kumm., Der Führer in die Pilzkunde: 72 (1871)  
Specimen examined: Oct 22 2018, NIBRFG0000503944
38. *Kuehneromyces mutabilis* (Schaeff.) Singer & A.H. Sm., Mycologia 38: 505 (1946)  
Specimen examined: Oct 23 2018, NIBRFG0000503966
39. *Pholiota multicingulata* E. Horak, Australian Journal of Botany Suppl. 10: 33 (1983)  
Specimen examined: Oct 22 2018, NIBRFG0000503923; Jul 03 2019, NIBRFG0000506835
40. *Protostropharia ovalispora* Yen W. Wang & S.S. Tzean, Taiwania 60 (4): 162 (2015)  
Specimen examined: Jul 03 2019, NIBRFG0000506841

**Tricholomataceae** R. Heim ex Pouzar

41. *Pleurella ardesiaca* (G. Stev. & G.M. Taylor) E. Horak, New Zealand Journal of Botany 9: 477 (1971)  
Specimen examined: Jun 30 2019, NIBRFG0000506802
42. *Singerocybe alboinfundibuliformis* (S.J. Seok et al.) Zhu L. Yang, J. Qin & Har. Takah., Mycologia 106 (5): 1022 (2014)  
Specimen examined: Oct 22 2018, NIBRFG0000503927
43. *Tricholomopsis decora* (Fr.) Singer, Schweizerische Zeitschrift für Pilzkunde 17: 56 (1939)  
Specimen examined: Jun 17 2018, NIBRFG0000503797
44. *Panaeolus subbalteatus* (Berk. & Broome) Sacc., Sylloge Fungorum 5: 1124 (1887)  
Specimen examined: Oct 20 2018, NIBRFG0000503875

**Auriculariales** J. Schröt.**Auriculariaceae** Fr. ex Lindau

45. *Auricularia nigricans* (Sw.) Birkebak, Looney & Sánchez-García, North American Fungi 8 (6): 12 (2013) = *Auricularia polytricha* (Mont.) Sacc. (1885)  
Specimen examined: Oct 20 2018, NIBRFG0000503862
46. *Elmerina hispida* (Imazeki) Y.C. Dai & L.W. Zhou, Mycologia 105 (5): 1224 (2013)  
Specimen examined: Oct 22 2018, NIBRFG0000503924



**Boletales** E.-J. Gilbert

**Boletaceae** Chevall.

47. *Austroboletus fusisporus* (Kawam. ex Imazeki & Hongo) Wolfe, *Bibliotheca Mycologica* 69: 96 (1980)  
Specimen examined: Jul 02 2019, NIBRFG0000506822
48. *Boletellus indistinctus* G. Wu, F. Li & Zhu L. Yang, *Fungal Diversity* 81: 61 (2016)  
Specimen examined: Jun 16 2018, NIBRFG0000503744; Jun 29 2019, NIBRFG0000506795
49. *Boletus tylopilopsis* B. Feng, Yang Y. Cui, J. P. Xu & Zhu L. Yang, *Fungal Diversity* 81: 206 (2015)  
Specimen examined: Jun 16 2018, NIBRFG0000503735
50. *Caloboletus yunnanensis* Kuan Zhao & Zhu L. Yang, *Mycological Progress* 13 (4): 1132 (2014)  
Specimen examined: Jun 16 2018, NIBRFG0000503731; Jun 16 2018, NIBRFG0000503743
51. *Chiuia virens* (W.F. Chiu) Yan C. Li & Zhu L. Yang, *Fungal Diversity* 81: 79 (2016) ≡ *Tylopilus virens* (W.F. Chiu) F.L. Tai (1979)  
Specimen examined: Jun 19 2018, NIBRFG0000503820
52. *Lanmaoa asiatica* G. Wu & Zhu L. Yang, in Wu, Zhao, Li, Zeng, Feng, Halling & Yang, *Fungal Diversity*: 10.1007/s13225-015-0322-0, [9] (2015)  
Specimen examined: Jun 16 2018, NIBRFG0000503737; Jun 16 2018, NIBRFG0000503739; Jun 16 2018, NIBRFG0000503749
53. *Leccinum rugosiceps* (Peck) Singer, *Mycologia* 37: 799 (1945)  
Specimen examined: Jun 16 2018, NIBRFG0000503725; Jun 16 2018, NIBRFG0000503755
54. *Phylloporus luxiensis* M. Zang, *Actamicrobiol. sin.*: 283 (1978)  
Specimen examined: Jun 16 2018, NIBRFG0000503757
55. *Rubinoboletus ballouii* (Peck) Heinem. & Rammeloo (1983) ≡ *Tylopilus ballouii* (Peck) Singer (1947)  
Specimen examined: Jun 17 2018, NIBRFG0000503765
56. *Strobilomyces confusus* Singer, *Farlowia* 2: 108 (1945)  
Specimen examined: Oct 21 2018, NIBRFG0000503912; Jul 03 2019, NIBRFG0000506838
57. *Strobilomyces seminudus* Hongo, *Trans. Mycol. Soc. Japan*: 197 (1983)  
Specimen examined: Jun 17 2018, NIBRFG0000503764
58. *Sutorius magnificus* (W.F. Chiu) G. Wu & Zhu L. Yang, *Fungal Diversity* 81: 145 (2016) ≡ *Boletus magnificus* W.F. Chiu (1948)  
Specimen examined: Jun 16 2018, NIBRFG0000503728; Jun 16 2018, NIBRFG0000503732; Jun 16 2018, NIBRFG0000503738

**Sclerodermataceae** Corda

59. *Scleroderma citrinum* Pers., *Synopsis methodica fungorum*: 153 (1801)  
Specimen examined: Jun 29 2019, NIBRFG0000506779; Jun 29 2019, NIBRFG0000506782
60. *Scleroderma sinnamariense* Mont., *Annales des Sciences Naturelles Botanique* 14: 331 (1840)  
Specimen examined: Jun 16 2018, NIBRFG0000503754; Jun 29 2019, NIBRFG0000506796

**Suillaceae** (Singer) Besl & Bresinsky

61. *Suillus bovinus* (L.) Roussel, Flore du Calvados et terrains adjacents, composéesuivant la méthode de Jussieu: 34 (1806)  
Specimen examined: Jun 29 2019, NIBRFG0000506776; Jun 29 2019, NIBRFG0000506789; Jun 29 2019, NIBRFG0000506794
62. *Suillus luteus* (L.) Roussel, Flore du Calvados et terrains adjacents, composéesuivant la méthode de Jussieu: 34 (1821)  
Specimen examined: Jun 17 2018, NIBRFG0000503775

**Dacrymycetales** Lindau**Dacrymycetaceae** Bref.

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Specimen examined: Jun 29 2019, NIBRFG0000506777; Jul 03 2019, NIBRFG0000506840

**Gloeophyllales** Thorn**Gloeophyllaceae** Jülich

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Specimen examined: Jun 16 2018, NIBRFG0000503752; Oct 21 2018, NIBRFG0000503891; Jul 03 2019, NIBRFG0000506831

**Hymenochaetales** Oberw.**Hymenochaetaceae** Donk

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Specimen examined: Jun 19 2018, NIBRFG0000503845
66. *Coltricia weii* Y.C. Dai, Sydowia 62 (1): 16 (2010)  
Specimen examined: Jun 17 2018, NIBRFG0000503783
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Specimen examined: Oct 22 2018, NIBRFG0000503917; Oct 22 2018, NIBRFG0000503934; Jul 01 2019, NIBRFG0000506816

72. *Piloporia albomarginatus* (Zipp. ex Lév.) Núñez, Mycotaxon 68: 288 (1998)  
Specimen examined: Jun 30 2019, NIBRFG0000506811

**Schizoporaceae** Jülich

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Specimen examined: Jun 19 2018, NIBRFG0000503848

**Polyporales** Gäum.

**Fomitopsidaceae** Jülich

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Specimen examined: Oct 21 2018, NIBRFG0000503888; Oct 21 2018, NIBRFG0000503903
75. *Bondarcevomyces taxi* (Bondartsev) Parmasto, Mycotaxon 70: 222 (1999)  
Specimen examined: Jul 02 2019, NIBRFG0000506825
76. *Fomitopsis pinicola* (Sw.) P. Karst., Meddelanden af Societas pro Fauna et Flora Fennica 6: 9 (1881)  
Specimen examined: Oct 21 2018, NIBRFG0000503887; Jun 29 2019, NIBRFG0000506774; Jun 29 2019, NIBRFG0000506781; Jul 03 2019, NIBRFG0000506829

**Ganodermataceae** (Donk) Donk

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Specimen examined: Oct 23 2018, NIBRFG0000503982; Jun 30 2019, NIBRFG0000506812
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Specimen examined: Jul 02 2019, NIBRFG0000506823
79. *Ganoderma flexipes* Pat., Bulletin de la Société Mycologique de France 23 (1): 75 (1907)  
Specimen examined: Jun 30 2019, NIBRFG0000506799
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Specimen examined: Jul 02 2019, NIBRFG0000506824

**Phanerochaetaceae** Jülich

82. *Byssomerulius corium* (Pers.) Parmasto, Eesti NSV Teaduste Akadeemia Toimetised 16: 383 (1967)  
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Specimen examined: Jun 19 2018, NIBRFG0000503824

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## **DISCUSSION**

Our morphological and molecular sequence analyses provide the first large-scale macrofungal diversity assessment for the southern Vietnam region. The territory of southern Vietnam is renowned for its high macrofungal diversity. Previous studies on the macrofungi of Vietnam were only based on simple morphological identification and provided brief checklists. This study is the first published on macrofungal diversity in southern Vietnam based on morphological characteristics and ITS and partial LSU rDNA sequence analyses. Given that fungal diversity from the area is understudied, new species with unusual features remain to be discovered. Therefore, future taxonomic studies based on a molecular analysis with current taxonomic concepts are needed to better understand fungal diversity in this area and to accurately assure identity of the species.

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