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Marine fungi from Red Sea mangroves in Saudi Arabia with *Fulvocentrum rubrum* sp. nov. (Torpedosporales, Ascomycota)

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With 5 figures and 2 tables

Abstract: Twelve fungi (ten ascomycetes, one asexual fungus, and one basidiomycete) were recorded from 833 samples of intertidal decayed wood of *Avicennia marina* collected from three mangrove sites at the Red Sea coast of Al-Leith city, Saudi Arabia. Common fungi were: *Nia* sp. (10%), *Sammeyersia grandispora* (8.5%), *Fulvocentrum rubrum* sp. nov. (5.8%), *Marinosphaera mangrovei* (4.2%) and *Okeanomyces cucullatus* (4.2%). Among the recorded fungi, six taxa are potentially new to science, of which *Fulvocentrum rubrum* sp. nov. is described in this article based on morphology and LSU rDNA sequence analysis. Phylogenetic analyses positioned the new species within the family Juncigenaceae, Torpedosporales. *Fulvocentrum rubrum* is characterized by erumpent to superficial, membraneous ascomata with long and wide necks; asci with apical ring and 3–5-septate ascospores that are larger than those recorded in the two previously described *Fulvocentrum* species. *Fulvocentrum rubrum* differs from *F. aegyptiacum* and *F. clavatisporum* by having longer and wider ascospores that are surrounded by a gelatinous sheath and an apical ring in the ascus.

Key words: Hypocreomycetidae; manglicolous fungi; Middle East; molecular phylogeny; tropical fungi

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Introduction

The first report of marine fungi from Saudi Arabia was by Aleem (1978) who reported two species namely: *Corollospora pulchella* Kohlm., I. Schmidt & N.B. Nair (= *Clavariopsis bulbosa* Anast.) and *Okeanomyces cucullatus* (Kohlm.) K.L. Pang & E.B.G. Jones (= *Periconia prolifica* Anast.) from driftwood samples collected from the Red Sea coast in Jeddah. Bokhary et al. (1992) recorded 37 species from sea water and sea foam from the Arabian Gulf, of which 7 species were marine namely: *Paradendryphiella salina* (G.K. Sutherl.) Woudenb. & Crous, *Nereiospora comata* (Kohlm.) E.B.G. Jones, R.G. Johnson & S.T. Moss, *Dictyosporium pelagicum* (Linder) G.C. Hughes & E.B.G Jones, *Ophiobolus australiensis* T.W. Johnson & Sparrow [= *Ophiobolus littoralis* (P. Crouan & H. Crouan) Sacc.], *Papulospora halima* Anast., *Pontogeneia calospora* (Pat.) Kohlm. and *Okeanomyces cucullatus*. Further ecological and taxonomical studies of marine fungi from Red Sea and the Arabian Gulf in Saudi Arabia, resulted in the introduction of 10 new species, 4 new genera and one new family (Hodhod et al. 2012, Ariyawansa et al. 2015, Liu et al. 2015, Hyde et al. 2016, Li et al. 2016, Abdel-Wahab et al. 2016, Abdel-Wahab et al. 2017, Abdel-Wahab et al. 2018). Abdel-Wahab et al. (2014) recorded thirty-seven marine fungi from 457 samples of driftwood and intertidal decayed wood of *Avicennia marina* collected from three sites along the Red Sea coast of Saudi Arabia. Most of the recorded fungi (31) were new records for Saudi Arabia. This study further documents marine fungi from the tropical mangroves at Al-Leith city along the coast of the Red Sea, Saudi Arabia.

Kohlmeyer & Volkmann-Kohlmeyer (1987) established the genus *Swampomyces* Kohlm. & Volkm.-Kohlm. to accommodate *S. armeniacus* Kohlm. & Volkm.-Kohlm. that is characterized by clypeate ascomata, apricot centrum, cylindrical asci and one-septate ascospores that are hyaline to yellowish, appearing light apricot-colored in mass. Another species, *S. triseptatus* K.D. Hyde & Nakagiri, was described from mangroves in Australia (Hyde & Nakagiri 1992). Abdel-Wahab et al. (2001) described two new species of *Swampomyces* from Red Sea mangroves in Egypt. Combined phylogenetic analyses of SSU and LSU rDNA sequences placed the genera *Swampomyces* and *Torpedospora* Meyers in a new lineage under Hypocreomycetidae (Sakayaroj et al. 2005, Schoch et al. 2007). In these studies, the genus *Swampomyces* was polyphyletic grouping in different subclades, and Schoch et al. (2007) suggested that *S. aegyptiacus* and *S. clavatisporus* possibly belonged to a different genus. Jones et al. (2014) established *Fulvocentrum* to accommodate *S. aegyptiacus* and *S. clavatisporus* that formed a separate clade from the type species, *S. armeniacus*. The family Juncigenaceae was introduced to accommodate the genera *Juncigena* Kohlm., Volkm.-Kohlm. & O.E. Erikss., *Fulvocentrum*, and *Marinokulati* E.B.G. Jones & K.L. Pang (Jones et al. 2014) and recently the genus *Khaleijomyces* Abdel-Wahab (Abdel-Wahab et al. 2018). During this study, a new species of *Fulvocentrum* is described based on morphology and sequence data.

Materials and methods

Details of collecting sites: On 7 April 2015, we collected 833 intertidal decaying branches of *Avicennia marina* from three mangrove stands along the Red Sea coast near Al-Leith City, Saudi Arabia. These sites were: Al-Leith site number one (20º49'104' N 39º27'262" E), 100 km north of Al-Leith city near Al-Qattan Resort; Al-Leith two (20º13' 633" N 40º08'636" E), 30 km north of Al-Leith city inside the National Aquaculture Group company and Al-Leith three (20º02'08" N 40º25'66" E), 20 km south of Al-Leith city near Bin Saleh gas station. *Avicennia marina* is the only mangrove tree occurring at the three sites. The forest floor was soft and muddy and the trees reached circa 6 meters. Sample preparation, incubation, examination, photographic documentation, description, single spore isolation and deposition of herbarium material were as previously described in Abdel-Wahab et al. 2009, Abdel-Wahab et al. 2014, Abdel-Wahab et al. 2016. Percentage occurrence of the fungi was calculated as no. of collections×100/no. of samples. Holotype material of the new species was deposited at the herbarium of the CBS-KNAW Fungal Biodiversity Centre, Utrecht, The Netherlands (CBS). MycoBank and Facesoffungi numbers were registered (Jayasiri et al. 2015, MycoBank 2018).

DNA extraction, sequencing and phylogenetic analyses: Fungal cultivation, DNA extraction, PCR, sequencing and phylogenetic analyses were as previously described in Abdel-Wahab et al. 2016, Abdel-Wahab et al. 2018. The LSU rDNA sequence of the new species was deposited at GenBank (Fig. 1). The sequence was aligned with those of *Fulvocentrum* species and other genera of Juncigenaceae, other families in the order Torpedosporales and representative taxa of the orders: Hypocreales, Microascales and Xylariales using ClustalX (Thompson et al. 1997) and optimized manually. Maximum likelihood and Bayesian posteriori probabilities phylogenetic inference were determined as described in Abdel-Wahab et al. (2016). TIMef and SYM+G were the best fit for LSU rDNA dataset as determined in Modeltest 3.7 and MrModeltest 2.3, respectively (Nylander 2004, Posada & Crandall 1998). The alignment was deposited in TreeBASE (http://www.treebase.org) under the submission S22380.

Results

Twelve fungi (ten ascomycetes, one asexual fungus, and one basidiomycete) were recorded from 833 samples of intertidal decayed wood of *Avicennia marina* collected from three mangrove sites at the Red Sea coast of Al-Leith city, Saudi Arabia. Common fungi were: *Nia* sp. (10%), *Sammeyersia grandispora* (8.5%), *Fulvocentrum rubrum* sp. nov. (5.8%), *Marinosphaera mangrovei* (4.2%) and *Okeanomyces cucullatus* (4.2%). Among the recorded fungi, six taxa are new to science, of which *Fulvocentrum rubrum* sp. nov. is described in this article based on morphology and phylogenetic analyses of the LSU rDNA sequence. The remaining new taxa will be published in due course. *Fulvocentrum rubrum* and *S. grandispora* were recorded from the three sites, while four fungi were recorded from two sites (Table 1).

Table 1. Marine fungi recorded from Al-Leith mangroves. % = percentage of occurrence, # New record for Saudi Arabia, *New species to science, N = number of fungal collections

	Al-Leith 1		Al-Leith 2		Al-Leith 3		Total	
Fungi	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Ascomycetes								
#**Ascocylindrica marina* Abdel-Wahab, Bahkali & E.B.G.Jones	12	3.3			1	0.26	13	1.6
#**Farasanispora* sp.	3	0.8			3	0.8	6	0.7
Fulvocentrum aegyptiacum (Abdel-Wahab, El-Sharouney & E.B.G. Jones) E.B.G. Jones & Abdel-Wahab					2	0.5	2	0.2
#**Fulvocentrum rubrum* Abdel-Wahab sp. nov.	24	6.6	1	1.1	23	6.1	48	5.8
Haiyanga salina (Meyers) K.L. Pang et E.B.G. Jones	3	0.8					3	0.3
#**Lulworthia* sp.					2	0.5	2	0.2
Marinosphaera mangrovei K.D. Hyde					35	9.3	35	4.2
#**Murangium* sp.	4	1					4	0.5
Okeanomyces cucullatus (Kohlm.) K.L. Pang & E.B.G. Jones					35	9.3	35	4.2
Sammeyersia grandispora (Meyers) S.Y. Guo, E.B.G. Jones & K.L. Pang	14	3.8	7	7.7	50	13.3	71	8.5
Asexual Fungi								
Moleospora maritima Abdel-Wahab, Abdel-Aziz et Nagah	20	5.5			7	1.9	27	3.2
Basidiomycetes								
#**Nia* sp.	4	1.1			79	21	83	10
Total number of samples	366		90		377		833	
Total number of fungal collections Number	81		8		237		326	
of fungi per sample	0.2		0.1		0.62		0.4	
Total number of fungi	8		2		10		12	
Ascomycetes	6		2		8		10	
Asexual fungi	1		-		1		1	
Basidiomycetes	1		-		1		1	

Phylogenetic analyses

The LSU rDNA dataset comprised 32 taxa, of which 18 belong to Torpedosporales, 5 Hypocreales, 6 Microascales, and 3 taxa from the Xylariales were used as outgroup taxa

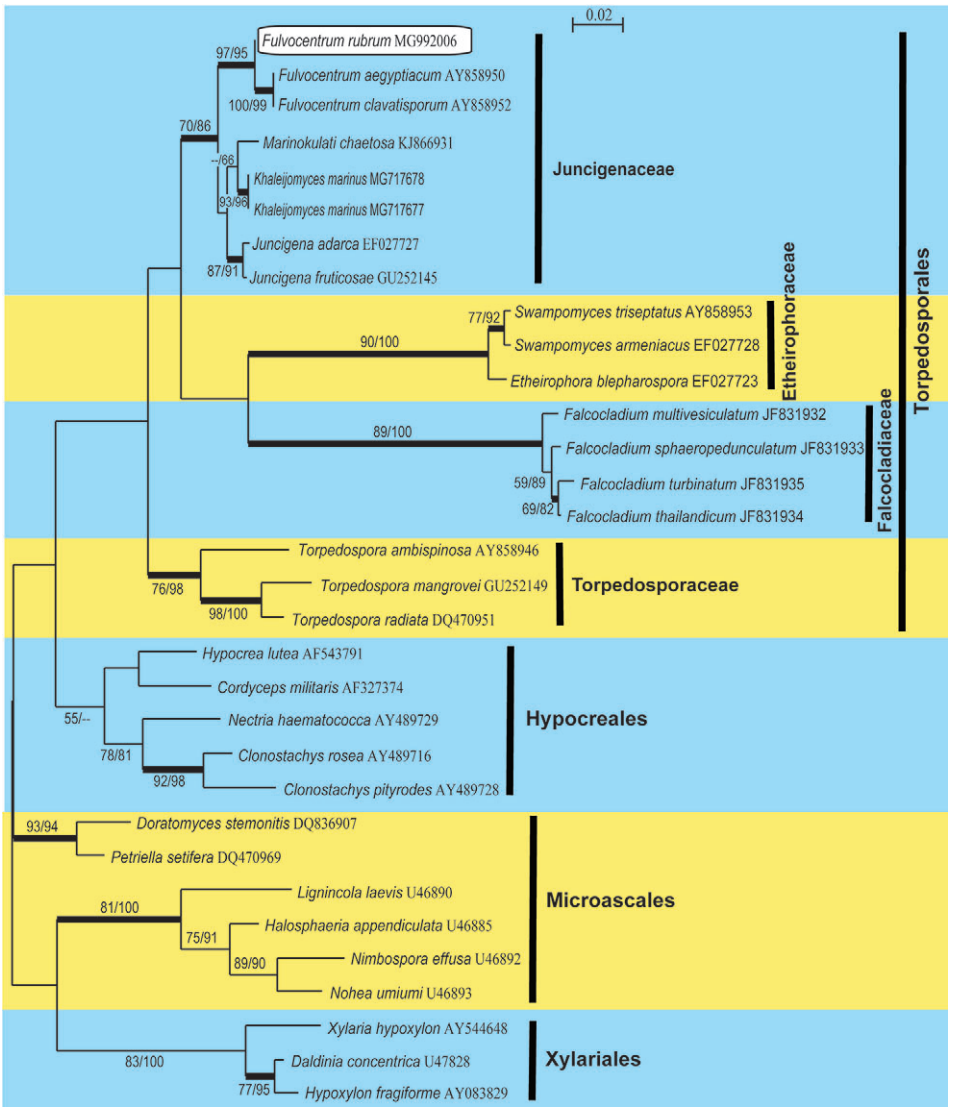

Fig. 1. Phylogenetic relationships of *Fulvocentrum rubrum* with other *Fulvocentrum* species and other genera in Juncigenaceae and related orders based on nucleotide sequences of LSU rDNA. The maximum likelihood tree (ML) (-ln likelihood = 10279.53) was constructed in Paup. Bootstrap support on the nodes represent ML and MP ≥ 50%. Branches received Bayesian pp ≥ 95% are in bold. The tree is rooted to Xylariales. The sequence of the new species in a box.

(Fig. 1). The maximum parsimony dataset consisted of 836 characters that included: 519 constant, 90 variable parsimony-uninformative and 277 parsimony-informative characters. Maximum parsimony analyses resulted in one most parsimonious tree with a tree length of 796 steps, a consistency index of 0.5666, a retention index of 0.7666 and a rescaled consistency index of 0.4343. Maximum likelihood analysis yielded one tree (-ln likelihood = 10279.53) which is shown in Figure 1. *Fulvocentrum rubrum* grouped with *F. aegyptiacum* and *F. clavatisporum* with high statistical support (97% ML/ 95% MP /100 BYPP) and along with the genera *Juncigena*, *Khaleijomyces* and *Marinokulati* in the Juncigenaceae, Torpedosporales (Jones et al. 2014, Jones et al. 2015).

Taxonomy

Fulvocentrum rubrum Abdel-Wahab & E.B.G. Jones, **sp. nov.** Fig. 2

MycoBank: MB 824542; Facesoffungi number: FoF 04376.

Etymology: From the Latin *rubrum* = red, in reference to the Red Sea where the species was collected.

Diagnosis: Ascomata 145–270 µm in diameter (excluding neck), globose to subglobose, olive-brown to dark-brown in colour, erumpent to superficial, coriaceous, single, ostiolate with long and wide necks, contents apricot colored in mass. Neck 310–390 µm long, 50–55 µm wide, hyaline to yellow-brown in colour, periphysate. Peridium 16–22 µm thick, one-layered, 8 to 11 cell layers, thick-walled, forming a *textura angularis*, olive-brown to dark-brown in colour. Paraphyses 1–2 µm, numerous, hyaline, in a gel, unbranched, non-septate, attached to the top and the bottom of the ascomatal cavity. Asci 95–130 × 13–19 µm ($\bar{x}$ = 110.9 × 15.8 µm, n = 20), 8-spored, thin-walled, with an apical ring, non-amyloid, fusiform or obclavate, persistent, developing from ascogenous tissue at the base of the ascomata, faint-apricot in color. Ascospores 25–33 × 6–9 µm ($\bar{x}$ = 30.7 × 7.7 µm, n = 30), 3–5-septate, ellipsoidal or clavate with rounded ends, hyaline to faint-apricot, smooth-walled, overlapping bi-seriate in asci, weakly constricted at the septa, surrounded by gelatinous or amorphous material. Asexual morph: Unknown.

Culture characteristics: Colonies on Potato Dextrose Agar (PDA), covering 20–25 mm diameter after 21 days in the dark at 25 °C; circular with complete edge, white to dull-yellow in colour; reverse dull-yellow.

Type specimen: Saudi Arabia, Red Sea, El-Leith mangroves, (N 20º49'104", E 39º27'262"), 100 km north of Al-Leith city near Al-Qattan Resort, intertidal wood of *Avicennia marina*, 7 April 2015, M.A. Abdel-Wahab (CBS H–22565, holotype).

Notes: *Fulvocentrum rubrum* closely resembles *F. clavatisporum*, however, the former has larger ascomata (145–270 µm vs 160–190 µm) with longer and wider necks, bigger asci (95–130 × 13–19 µm vs 80–96 × 10–13 µm) and bigger ascospores (25–33 × 6–9 µm vs 25–28 × 5–6 µm) than the latter species. *Fulvocentrum rubrum* has an apical ring in the asci while only an apical thickening is present in *F. clavatisporum*. Ascospores of *F. ru-*

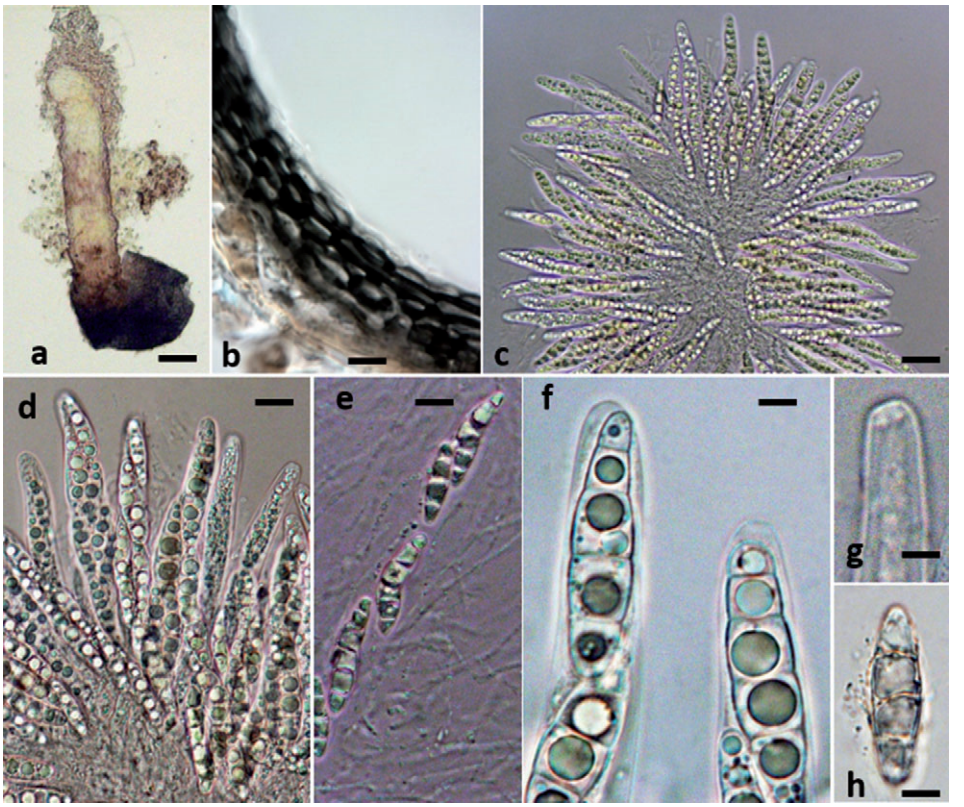

Fig. 2. ***Fulvocentrum rubrum*** from holotype **(**CBS H–22565**)**. **a** Squash of ascoma. **b** Vertical section through peridium. **c, d** Squash of the ascomatal centrum showing asci and ascospores. **e** Paraphyses. **f, g** Apical part of asci showing apical ring. **h** ascospore surrounded by amorphous material. Scale bars: a = 50 µm, b = 10 µm, c = 35 µm, d = 16 µm, e = 10 µm, f–h = 5 µm.

brum are 3–5-septate and surrounded by a gelatinous or amorphous materials while those of *F. clavatisporum* are 3-septate and without a sheath (Table 2). *Fulvocentrum aegyptiacum* has cylindrical asci with an apical thickening and smaller ascospores than those of *F. rubrum* (15–20 × 6–8 µm vs 25–33 × 6–9 µm) and its ascomata develop under a thin darkened superficial pseudostroma, covering the area where ascomata develop and composed of host cells with darkened fungal hyphae. That pseudostroma is absent in *F. rubrum* (Abdel-Wahab et al. 2001). *Swampomyces armeniacus* has clypeate ascomata, cylindrical asci and 1-septate ascospores (Kohlmeyer & Volkmann-Kohlmeyer 1987). *Swampomyces triseptatus* has ascomata immersed under a pseudostroma, cylindrical asci with an apical thickening and pore and shorter ascospores than *F. rubrum* (Hyde & Nakagiri 1992) (Table 2).

Table 2. Comparison of the morphology of *Fulvocentrum rubrum* and closely similar fungi.

Fungus	Ascomata	Asci	Ascospores
Fulvocentrum aegyptiacum (Abdel-Wahab et al. 2001)	240–280 µm high, 170–190 µm wide, single, developing under a thin darkened superficial pseudostroma.	145–155 × 9–10 µm, cylindrical, thin-walled, short pedicellate and apically thickened, non-amyloid.	15–20 × 6–8 µm, 3-septate, ellipsoidal, hyaline, uniseriate, constricted at the septa and smooth.
F. clavatisporum (Abdel-Wahab et al. 2001)	160–170 µm high, 160–190 µm wide, single, developing under a thin darkened superficial peudostroma.	80–96 × 10–13 µm, oblong, thin-walled, short pedicellate and apically thickened, non-amyloid.	25–28 × 5–6 µm, 3-septate, clavate, biseriate, hyaline and weakly constricted at the septa.
F. rubrum (this study)	145–270 µm in diam., single.	95–130 × 13–19 µm, fusiform or obclavate, thin-walled, with an apical ring, persistent, non-amyloid.	25–33 × 6–9 µm, 3–5-septate, ellipsoidal or clavate with rounded ends, hyaline to faint-apricot, smooth-walled, overlapping bi-seriate in asci, surrounded by gelatinous or amorphous material.
Swampomyces armeniacus (Kohlmeyer & Volkmann-Kohlmeyer 1987)	370–450 µm high, 290–370 µm wide, single, clypeate.	99–132 × 13–17 µm, cylindrical, short pedunculate, persistent, non-amyloid.	13.3–19.5 × 6–8.9 µm, one-septate, broad ellipsoidal, not constricted at the septum, uni- or biseriate, smooth.
Swampomyces triseptatus (Hyde & Nakagiri 1992)	240–320 µm high, 175–200 µm wide, single, developing under a thin darkened superficial pseudostroma.	120–150 × 10–12 µm, cylindrical, short pedunculate, thin-walled, apically thickened with indication of a pore, non-amyloid.	18–25 × 8–11 µm, 3-septate, overlapping uniseriate, ellipsoidal, weakly constricted at the septa.

Notes on three undescribed species are given below:

***Farasanispora* sp.** Fig. 3

This species was recorded from two mangrove sites in the current study and might represent a new species to science. *Farasanispora* Abdel-Wahab, Bahkali & E.B.G. Jones was recently established to accommodate *F. avicenniae* Abdel-Wahab, Bahkali & E.B.G. Jones that was collected from Farasan Island mangroves in Saudi Arabia (Li et al. 2016). The new collection differs from *F. avicenniae* by having 1–4-septate ascospores that are hyaline to dark-brown to black and wider asci (140–165 × 28–43 µm vs 115–162 × 23–34 µm) and ascospores (34–39 × 11–16 µm vs 30–39 × 9–13 µm). Ascospores in *F. avicenniae* are 1-septate and hyaline (Li et al. 2016).

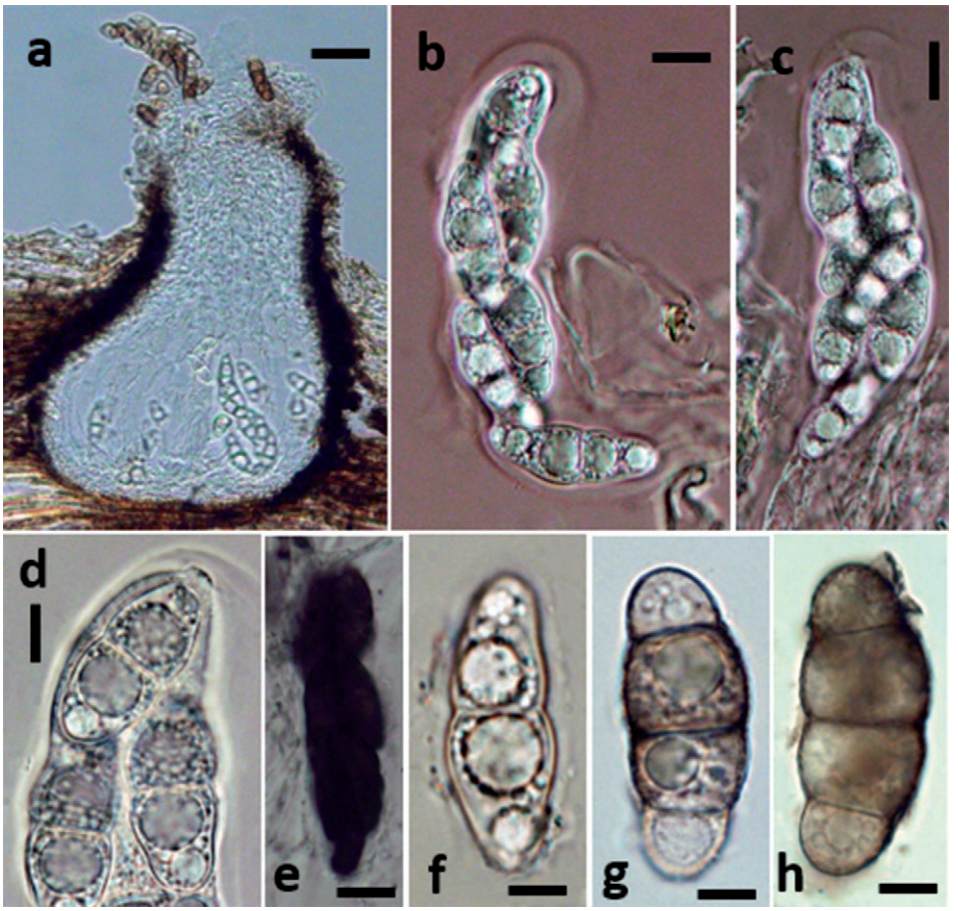

Fig. 3. ***Farasanispora*** **sp. a** Vertical section of ascoma. **b, c** Asci. d Apical part of ascus showing ocular chamber. **e** Ascus with black ascospores. **f–h** Ascospores. Scale bars: a = 50 µm, b, c = 15 µm, d = 10 µm, e = 25 µm, f–h = 7 µm.

Murangium **sp.** Fig. 4

This species was recorded on the bark of the pneumatophores of *Avicennia marina* in Al-Leith site 1 and did not grow in culture. The monotypic genus *Murangium* (Patellariaceae) was established by Seaver (1951) to accommodate *M. sequoiae* (Plowr. ex W. Phillips) Seaver which was described from the bark of *Sequoiadendron giganteum* (Lindl.) J. Buchh. in terrestrial habitats from California, USA. The species from Saudi Arabian mangroves has one- to four-spored asci and much smaller ascospores (20–36 × 10–16 µm vs 85–153 × 37–75 µm) that are dark-brown to black and surrounded by a gelatinous sheath.

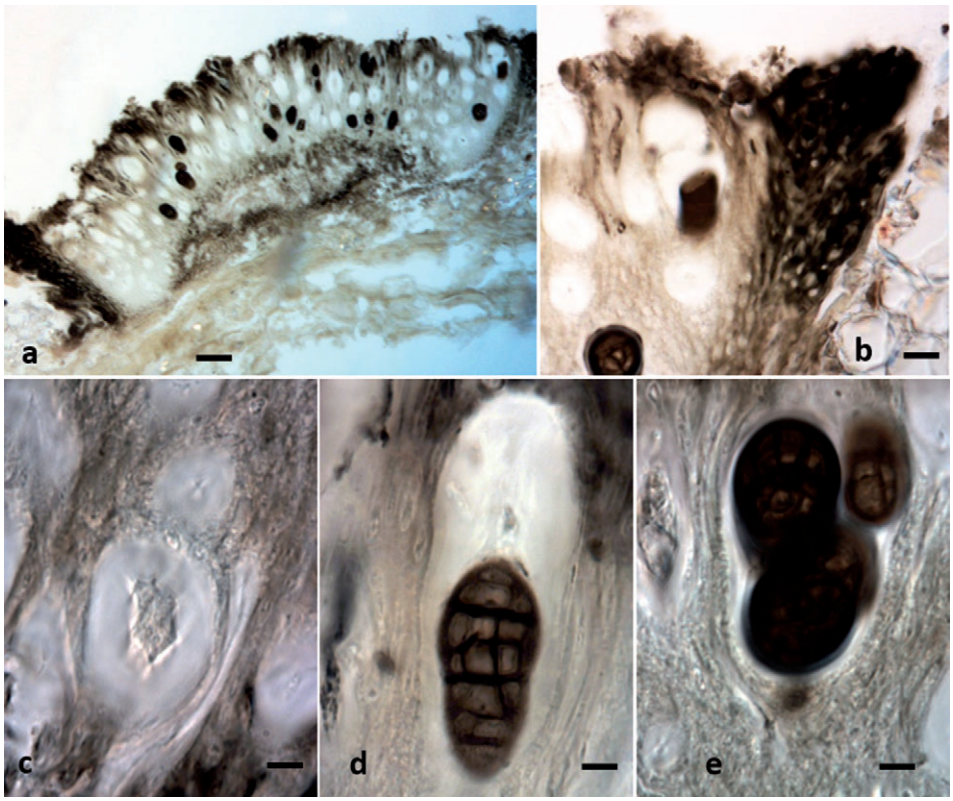

Fig. 4. ***Murangium*** **sp. a** Vertical section of apothecium. **b** Exciple (peridium) and epithecium. **c** Immature ascus. **d** One-spored ascus. **e** Four-spored ascus. Scale bars: a = 50 µm, b = 10 µm, c–e = 5 µm.

Nia **sp.** Fig. 5

The undescribed species of *Nia* R.T. Moore & Meyers was the most common species in the current study. The genus *Nia* has three marine species (Moore & Meyers 1959, Rossello et al. 1993, Barata et al. 1997, Wijayawardene et al. 2017). *Nia* sp. closely resembles *N. vibrissa* R.T. Moore & Meyers by having basidiospores with one apical appendage and four lateral appendages, however, the new species is characterized by smooth basidiocarps that are hyaline to yellowish in color and four-spored basidia vs hairy basidiocarps that are yellow-orange to orange-brown in color and 4- to 8-spored-basidia in *Nia vibrissa* (Barata et al. 1997). Phylogenetic analyses of SSU and LSU rDNA sequences placed *Nia* sp. in a monophyletic clade with *Nia vibrissa* R.T. Moore & Meyers with high statistical support (data not shown), however, molecular data is not available for *N. globispora* Barata & Basilio or *N. epidermoidea* M.A. Rosselló & Descals. Azevedo et al. (2018) explored whether *N. vibrissa* was a species complex and showed that one strain differed from the other evaluated strains.

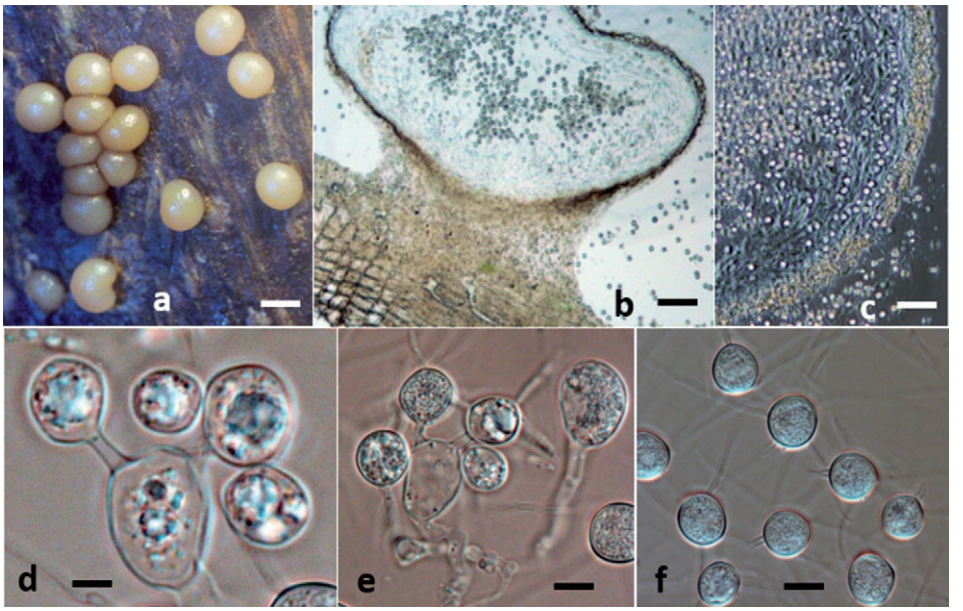

Fig. 5. ***Nia*** sp. a Basidiocarps on wood. b Vertical section of basidiocarp. c Section through peridium. d–e Basidia with four basidiospores at different stages of development. f Basidiospores. Scale bars: a = 500 µm, b = 60 µm, c = 30 µm, d = 6 µm, e–f = 10 µm.

Discussion

Fifty-six marine fungi were previously recorded from marine habitats in Saudi Arabia (Aleem 1978, Bokhary et al. 1992, Hodhod et al. 2012, Abdel-Wahab et al. 2014, Ariyawansa et al. 2015, Liu et al. 2015, Hyde et al. 2016, Li et al. 2016, Abdel-Wahab et al. 2016, Abdel-Wahab et al. 2017, Abdel-Wahab et al. 2018). Twelve fungi were recorded in this study. Low fungal diversity was reported in previous studies from Red Sea mangroves both from the Egyptian or Saudi Arabian coasts (Abdel-Wahab 2005, Abdel-Wahab et al. 2014). Only one mangrove tree is found in this area and may account for the low fungal diversity. Half of the recorded fungi (six species) are potentially new to science which reflects that marine habitats in Saudi Arabia are understudied and further sampling is needed. *Fulvocentrum* species were commonly recorded from Red Sea mangroves and they may be the key stone species that play the major ecological role in substrate turn over in this harsh environment (Abdel-Wahab 2005, Abdel-Wahab et al. 2014).

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References

Abdel-Wahab, M.A. (2005): Diversity of higher marine fungi from Egyptian Red Sea mangroves. – Bot. Mar. 48: 348–355.

Abdel-Wahab, M.A., Bahkali, A.H., Jones, E.B.G., Elgorban, A.M., Abdel-Aziz, F.A. et al. (2016): Two new species of *Kallichroma* (Bionectriaceae, Hypocreales) from Saudi Arabian mangroves. – Phytotaxa 260: 66–74.

Abdel-Wahab, M.A., Dayarathne, M.C., Suetrong, S., Guo, S.-Y., Alias, S.A. et al. (2017): New saprobic marine fungi and a new combination. – Bot. Mar. 60: 469–488.

Abdel-Wahab, M.A., El-Samawaty, A.M., El Gorban, A.M., Yassin, M.A. & Alsaadi, M.H. (2018): *Khaleijomyces marinus* gen. et sp. nov. (Juncigenaceae, Torpedosporales) a new lignicolous marine fungus from Saudi Arabia. – Phytotaxa 340: 277–285.

Abdel-Wahab, M.A., El-Sharouny, H.M. & Jones, E.B.G. (2001): Two new intertidal lignicolous *Swampomyces* species from Red Sea mangroves in Egypt. – Fungal Divers. 8: 35–40.

Abdel-Wahab, M.A., Hodhod, M.S., Bahkali, A.H.A. & Jones, E.B.G. (2014: Marine fungi of Saudi Arabia. – Bot. Mar. 57: 323–335.

Abdel-Wahab, M.A., Nagahama, T. & Abdel-Aziz, F.A. (2009y: Two new *Corollospora* species and one new anamorph based on morphological and molecular data. – Mycoscience 50: 147–155.

Aleem, A.A. (1978): New records of marine fungi from the Red Sea. – Bulletin of the Faculty of Science, King Abdel-Aziz University, Jeddah 2: 131–132.

Ariyawansa, H.A., Hyde, K.D., Jayasiri, S.C., Buyck, B., Chethana, K.W.T. et al. (2015): Fungal Diversity Notes 111–246: Taxonomic and phylogenetic contributions to fungal taxa. – Fungal Divers. 75: 27–274.

Azevedo, E., Barata, M. & Caeiro, M.F. (2018): Morphological and phylogenetic analyses of *Nia vibrissa*, a marine Basidiomycota collected in Portuguese waters. – Reg. Stud. Mar. Sci. 23: 53–59.

Barata, M., Basilio, M.C. & Baptist-Ferreira, J.L. (1997): *Nia globospora*, a new marine gasteromycete on baits of *Spartina maritima* in Portugal. – Mycol. Res. 101: 687–690.

Bokhary, H.A., Moslem, M.A. & Parvez, S. (1992): Marine fungi of the Arabian Gulf Coast and Saudi Arabia. – Microbiologica 15: 281–290.

Hodhod, M.S., Abdel-Wahab, M.A., Bahkali, A.H.A. & Hyde, K.D. (2012): *Amarenographium solium* sp. nov. from Yanbu mangroves in the Kingdom of Saudi Arabia. – Crypt. Mycol. 33: 285–294.

Hyde, K.D., Hongsanan, S., Jeewon, R., Bhat, D.J., Mckenzie, E.H.C. et al. (2016): Fungal diversity notes 367–490: taxonomic and phylogenetic contributions to fungal taxa. – Fungal Divers. 80: 1–270.

Hyde, K.D. & Nakagiri, A. (1992): Intertidal fungi from Australia. The genus *Swampomyces* including *S. triseptatus* sp. nov. – Sydowia 44: 122–130.

Kohlmeyer, J. & Volkmann-Kohlmeyer, B. (1987): Marine fungi from Belize with a description of two new genera of ascomycetes. – Bot. Mar. 30: 195–204.

Jayasiri, S.C., Hyde, K.D., Ariyawansa, H.A., Bhat, J., Buyck, B. et al. (2015): The Faces of Fungi database: fungal names linked with morphology, phylogeny and human impacts. – Fungal Divers. 74: 3–18.

Jones, E.B.G., Suetrong, S., Cheng, W.-H., Rungjindamai, N., Sakayaroj, J. et al. (2014): An additional fungal lineage in the Hypocreomycetidae (*Falcocladium* species) and the taxonomic re-evaluation of *Chaetosphaeria chaetosa* and *Swampomyces* species, based on morphology, ecology and phylogeny. – Crypt. Mycol. 35: 119–138.

Jones, E.B.G., Suetrong, S., Sakayaroj, J., Bahkali, A.H.A., Abdel-Wahab, M.A. et al. (2015): Classification of marine Ascomycota, Basidiomycota, Blastocladiomycota and Chytridiomycota. – Fungal Divers. 73: 1–72.

Li, G.J., Hyde, K.D., Zhao, R.L., Sinang, H., Abdel-Aziz, F.A. et al. (2016): Fungal diversity notes 253–370: taxonomic and phylogenetic contributions to fungal taxa. – Fungal Divers. 78: 1–237.

Liu, J.K., Hyde, K.D., Jones, E.B.G., Ariyawansa, H.A., Bhat, D.J. et al. (2015): Fungal Diversity Notes 1–110: Taxonomic and phylogenetic contributions to fungal species. – Fungal Divers. 72: 1–197.

Moore, R.T. & Meyers, S.P. (1959): Thalassiomycetes 1. Principles of delimitation of the marine mycota with the description of a new aquatically adapted deuteromycete genus. – Mycologia 51: 871–876.

Mycobank (2018): Available from: http://www. www.mycobank.org (accessed 5 August 2018).

Nylander, J.A.A. (2004): MrModeltest v2. Program distributed by the author. – Evolutionary Biology Center, Uppsala University, Uppsala.

Posada, D. & Crandall, K.A. (1998): Modeltest: testing the model of DNA substitution. – Bioinformatics 14: 817–818.

Rossello, M.A., Descals, E. & Cabrer, B. (1993): *Nia epidermoidea*, a new marine gasteromycete. – Mycol. Res. 97: 68–70.

Sakayaroj, J., Pang, K.L., Jones, E.B.G., Vrijmoed, L.L.P. & Abdel-Wahab, M.A. (2005): A systematic reassessment of marine ascomycetes *Swampomyces* and *Torpedospora*. – Bot. Mar. 48: 395–406.

Schoch, C.L., Sung, G.-H., Volkmann-Kohlmeyer, B., Kohlmeyer, J. & Spatafora, J.W. (2007): Marine fungal lineages in the Hypocreomycetidae. – Mycol. Res. 111: 154–162.

Seaver, F.J. (1951): The North American Cup-fungi (Inopercolates Edn). – Seaver, F.J., New York, 428 pp.

Thompson, J.D., Gibson, T.J., Plewniak, F., Jeanmougin, F. & Higgins, D.G. (1997): The ClustalX windows interface: flexible strategies for multiple sequence alignment aided by quality analysis tools. – Nucleic Acids Res. 25: 4876–4882.

Wijayawardene, N.N., Hyde, K.D., Rajeshkumar, K.C., Hawksworth, D.L., Madrid, H. et al. (2017): Notes for genera: Ascomycota. – Fungal Divers. 86: 1–594.

Yachareon, S., Tian, Q., Chomnunti, P., Boonmee, S., Chukeatirote, E.et al. (2015): Patellariaceae revisited. – Mycosphere 6: 290–326.

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