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**Marine hyphomycetes of Thailand and *Cumulospora varia* sp. nov.**

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Marine hyphomycetes collected in Thailand are listed and discussed, with the description of a new species, *Cumulospora varia* was found in several areas of Thailand is described and compared with *C. marina*.

**Key words:** *Cumulospora*, hyphomycetes, marine, Thailand.

## **Introduction**

The marine fungi of Asia and India have been relatively well investigated (e.g. India: Maria and Sridhar, 2003; Prasannarai and Sridhar, 2003; Malaysia: Alias and Jones, 2000) but in Thailand marine fungi are less well-studied (Hyde *et al.*, 1990). In this study we have investigated the marine hyphomycetes in several locations in Thailand (Fig. 23). Ten marine hyphomycetes have been recorded from Thailand (Kohlmeyer, 1984; Koch, 1986; Hyde *et al.*, 1990), representing a small percentage of those hyphomycetes described from the marine environment (Hyde *et al.*, 2000). In this paper we list the marine hyphomycetes collected during a survey of the mangrove and marine fungi of Thailand. A taxon similar to *Cumulospora marina* was encountered, and as it differs from this species, it is described as new to science.

## **Materials and methods**

Driftwood and submerged wood from coastal locations and woody samples from mangrove areas in Thailand were collected and incubated in

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sterile plastic boxes on moist tissue paper for up to 10 weeks (Jones and Hyde, 1988). Samples were examined for sporulating fungi, which were then isolated into axenic culture. Single conidial isolation was on corn meal agar (CMA) with added antibiotics (streptomycin and penicillin G). Herbarium material was deposited in BIOTEC Bangkok Herbarium (BBH), and cultures deposited in the BIOTEC Culture Collection (BCC). Measurements of sporulating structures and photographs were of material mounted in seawater.

## Results and discussion

In our survey of the marine hyphomycetes of Thailand 44 taxa were collected and some of them could not be identified (Table 1). Fewer marine hyphomycetes have been recorded in comparison with the *Ascomycota* (Kohlmeyer, 1984). This survey, however, shows that many more await characterization and description. Of the species collected many of them are well represented: *Cirrenalia pygmaea*, *C. tropicalis*, *Clavatospora bulbosa*, *Cumulospora varia*, *Periconia prolifica*, *Trichocladium melhae*, *T. nypae* and *Zalerion varium*, are known from many collections and different sites (Table 1). Many collections were also made of the recently described species *Trichocladium melhae* and *T. nypae* (Hyde *et al.*, 1999; Jones *et al.*, 2001). Some fungi were often found on seeds of *Heritiera littoralis* e.g. *Cirrenalia pygmaea*. Some of the species collected e.g. *Acrogenospora sphaerocephala* and *Bactrodesmium* cf. *moenitum* are more typical of freshwater or brackish water habitats (Palm and Stewart, 1982; Goh and Hyde, 1999; Ho *et al.*, 2002). Work is in progress to further characterize the unidentified species listed in this study and to determine their role in the marine environment. *Bactrodesmium linderi* has been found often in mangrove areas, however it has not been included in the list of obligate marine fungi by Hyde *et al.* (2000). *Trichocladium melhae* is a common species on sand attached to lignicolous material along seashores as well as *Clavatospora bulbosa* and *Zalerion varium*. *Trichocladium nypae* was often collected from not only *Nypa fruticans* material, but also others lignicolous materials.

## Taxonomy

A new fungus with dark grey to fuscous conidia was collected from various substrata (driftwood, mangrove seeds) in four provinces in Thailand. The fungus is best referred to the genus *Cumulospora* as it forms a complex cluster of subglobose cells in a knot-like group of cells, the conidium. It is illustrated and described here.

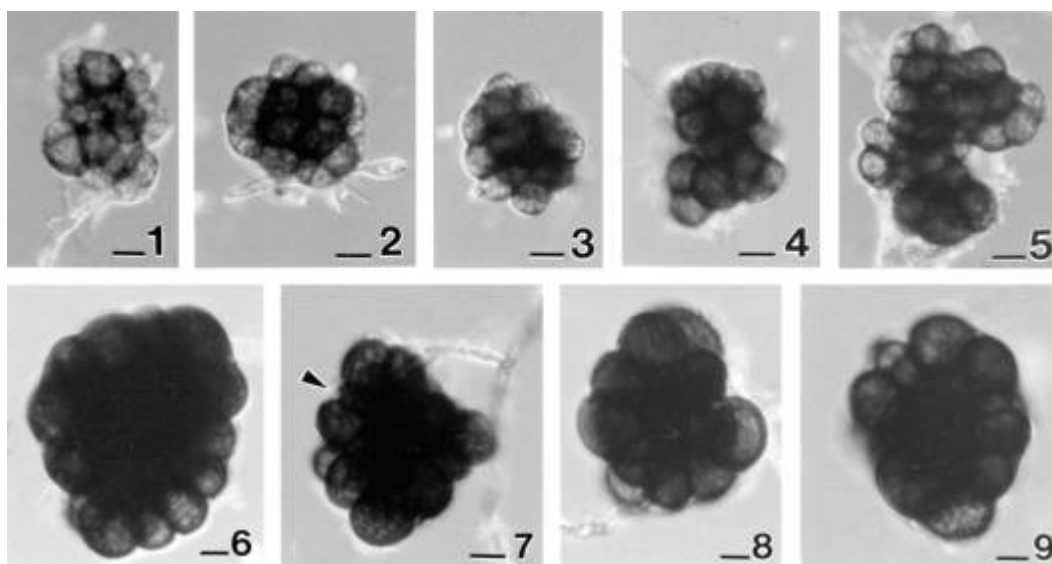
**Table 1.** Marine hyphomycetes identified from 15 provinces in Thailand: 1 = Kohlmeyer (1984), 2 = Koch (1986), 3 = Hyde *et al.* (1990) and 4 = our studies.

Fungus	Locations (see Fig. 23 for locations)	References
<i>Acrogenospora sphaerocephala</i>	1	4
<i>Bactrodesmium linderi</i>	1, 9	4
<i>Bactrodesmium cf. moenitum</i>	12	4
<i>Bactrodesmium sp.</i>	8	4
<i>Cirrenalia pseudomacrocephala</i>	8	3
<i>Cirrenalia pygmaea</i>	4, 8, 9, 10, 11, 12	1,2,3,4
<i>Cirrenalia sp.</i>	3, 15	4
<i>Cirrenalia tropicalis</i>	2, 8, 9, 12, 15	3,4
<i>Clavatospora bulbosa</i>	1, 4, 7, 8, 9, 10, 13, 15	2,4
<i>Cumulospora marina</i>	8	4
<i>Cumulospora varia</i>	1, 3, 12, 14	4
<i>Ellisemia sp.</i>	6	4
<i>Epicoccum-like sp. 1</i>	8	4
<i>Epicoccum-like sp. 2</i>	7	4
<i>Graphium-like sp.</i>	5, 15	4
<i>Helicoon sp.</i>	8	3
<i>Humicola-like sp.</i>	12	4
<i>Monodictys sp.</i>	12	4
<i>Mycelia sterilia</i>	8	3
<i>Papulaspora halima</i>	8	4
<i>Periconia prolifica</i>	2, 3, 4, 7, 8, 9, 12	1,3,4
<i>Pithomyces sp.</i>	4	4
<i>Sporidesmium cf. tropicale</i>	2, 6	4
<i>Tetraploa aristata</i>	15	4
<i>Trichocladium achrasporum</i>	1	4
<i>Trichocladium alopallonella</i>	4, 8	1,3
<i>Trichocladium cf. constrictum</i>	1, 12	4
<i>Trichocladium melhae</i>	1, 3, 12, 13, 15	4
<i>Trichocladium nypae</i>	2, 9, 13, 15	4
<i>Trichocladium cf. opacum</i>	8, 12	4
<i>Trichocladium sp.</i>	9, 12	4
Unidentified spp. 1-14	1, 2, 3, 5, 8, 9, 10, 12, 15	4
<i>Varicosporina ramulosa</i>	9	4
<i>Xylomyces sp. 1</i>	8	3
<i>Xylomyces sp. 2</i>	15	4
<i>Zalerion varium</i>	3, 4, 7, 12, 13, 15	4

***Cumulospora varia* Chatmala & Somrithipol, sp. nov.** (Figs. 1-5, 10-15)

*Etymology:* from Latin, *varia*-various, referring to the variable muriform shape of the conidia.

*Hyphae* septatae, ramosae, superficialibus vel immerses, pallide brunneae. *Conidiophora* obsoletis vel similis hyphis. *Cellulae conidiogenae* holoblasticae, integratae,



**Figs. 1-9.** Conidia of *Cumulospora* species. 1-5. *C. varia* (from holotype). 6-9. *C. marina* strain PGI 257 with sheath-like structure around the conidia (arrowed). Bars: 1-9 = 10  $\mu$ m.

terminales, determinatae. *Conidia*: 24-87  $\times$  21-51  $\mu$ m, atrogriseis vel fuscis, solitaria, disseminata vel gregaria, multicellulatis, muriformibus.

*Hyphae* septate, branched, superficial or immersed, pale brown. *Conidiophores* absent. *Conidiogenous cells* holoblastic, integrated, terminal, determinate. *Conidia* 24-87  $\times$  21-51  $\mu$ m ( $\bar{x}$  = 34.6  $\times$  46.7  $\mu$ m, n = 30), dark grey to fuscous, solitary, scattered or gregarious, muriform. *Conidia* initially spiral (Fig. 10), but cell division in several planes, leads to a tangled knot of cells that may number 40 or more and up to 20  $\mu$ m diam. or more of each individual cell (Figs. 1-5, 11-15).

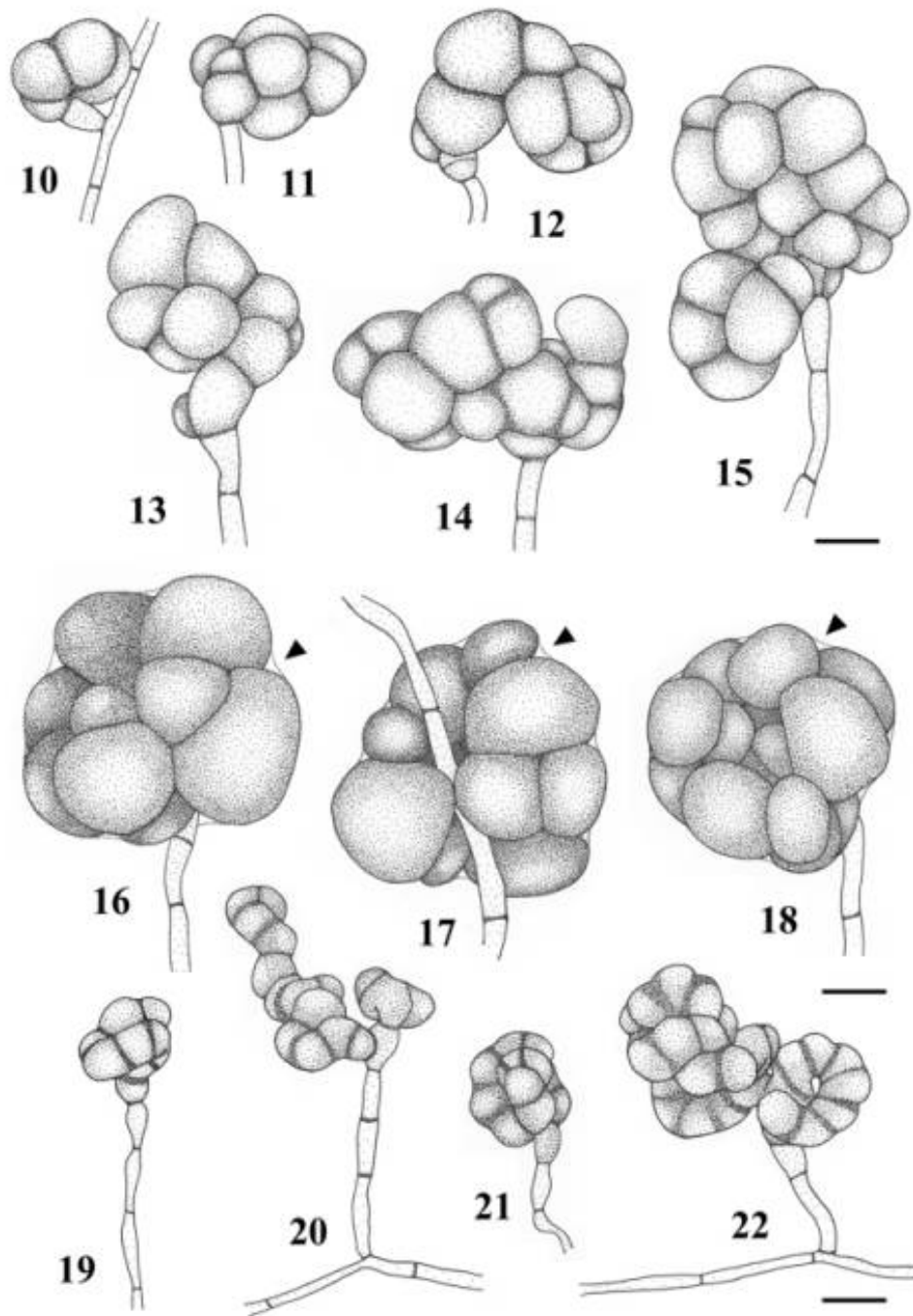
*Mode of life*: saprobic.

*Known distribution*: Thailand.

*Holotype*: THAILAND, Gulf of Thailand, Mu Ko Chang National Park, Trat province, unidentified driftwood, Feb. 2001, re-inoculated on decayed wood by I. Chatmala IT152 (BBH).

*Other material examined*: THAILAND, Andaman Sea, Hat Chao Mai National Park, Trang Province, decayed seeds of *Heritiera littoralis* Dryand. ex W. Ait., July 2000, re-inoculated on decayed wood by I. Chatmala (IT70); Gulf of Thailand, Rayong Province, unidentified driftwood, Nov. 2003, collected by I. Chatmala, J. Sakayaroj and E.B.G. Jones (IT533); Gulf of Thailand, Yaring, Pattani province, unidentified driftwood, Jan. 2004, collected by I. Chatmala, J. Sakayaroj, S. Phongpaichit and E.B.G. Jones (IT543).

*Type culture*: BCC 11375 (isolated from holotype).



**Figs. 10-22.** Various conidia. **10-15.** *Cumulospora varia* (from holotype). **16-18.** *Cumulospora marina* strain PGI 257 with sheath-like structure (arrowed). **19-22.** *Zalerion varium* strain IT 412. Bars: 10-22 = 10  $\mu$ m.

***Cumulospora marina*** I. Schmidt. Mycotaxon 24: 420, 1985 (Figs. 6-9, 16-18)

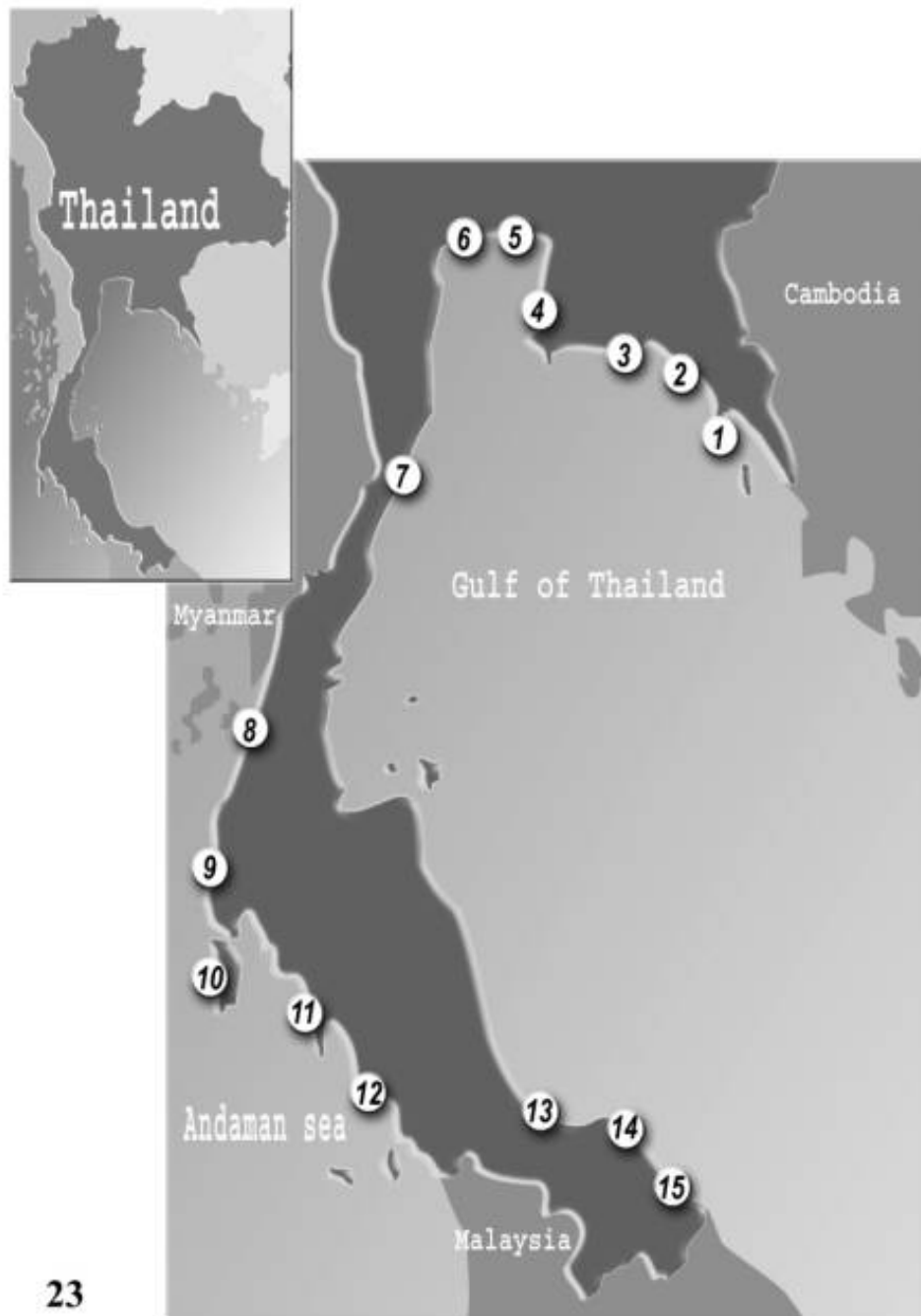
= *Vesicularia marina* I. Schmidt, Natur Naturschutz Mecklenburg 12: 177, 1974 (nom. Illegit.).

= *Basramyces marinus* Abdullah, Abdulkadder and Goos, *International Journal of Mycology and Lichenology* 4: 181-186, 1989.

*Hyphae* septate, branched, superficial or immersed, pale brown. *Conidiophores* absent. *Conidiogenous cells* holoblastic, integrated, terminal determinate. *Conidia* 52-91 × 40-71 μm ( $\bar{x}$  = 56.0 × 68.8 μm, n = 30) solitary, scattered or gregarious, with up to 20 or more globose cells and up to 30 μm diameter or more of each cell, and with a dark brown, sheath-like structure around the conidia (Figs. 6-9, 16-18).

*Material examined*: THAILAND, Andaman Sea, Laem Son National Park, Ranong Province, decayed seeds of *Heritiera littoralis* Dryand. ex W. Ait., Jan. 2001, re-inoculated on decayed wood by I. Chatmala (PGI 257).

*Cumulospora* is a monotypic genus described by Schmidt (1985) to accommodate a dematiaceous marine hyphomycete, initially referred to as *Vesicularia marina*. The generic name *Vesicularia* was preoccupied and subsequently *Cumulospora* was erected to accommodate this fungus (Schmidt, 1985). The taxon was found on decayed wood and rhizomes of *Phragmites communis* in the Baltic Sea (Schmidt, 1974). Abdullah *et al.* (1989) described an identical fungus as *Basramyces marinus* from *Phragmites communis* in southern marshes of Iraq. Our collection differs from the previous descriptions of this fungus by having a sheath-like structure around the conidia (Figs. 7, 16-18). This sheath may not have been visible in the mounting fluids used by previous workers (Schmidt, 1974; Abdullah *et al.*, 1989). *Cumulospora marina* is widely distributed from temperate to tropical locations, and is often common on mangrove bark (Jones, unpublished data). *Cumulospora varia* differs from *C. marina* in its smaller conidial size, smaller individual cells, and paler conidia. Furthermore intercalary chlamydospores can be observed in culture of *Cumulospora marina*. Conidia of *Cumulospora varia* could be confused with those of three other marine hyphomycetes: *Monodictys pelagica*, *Cirrenalia adarca* and *Zalerion varium*. *Cumulospora varia* differs from *Monodictys pelagica* in the development of the conidia. In the latter species conidia are one-celled and then divide into many cells to form a muriform conidium. In *Cumulospora varia* conidia initially are formed from a single monoblastic cell, in the form of a chain of cells that are spirally arranged and which eventually give rise to a cluster of cells that are dense and appear muriform. Additionally, *Monodictys pelagica* has distinct black conidia, while *Cumulospora varia* has dark grey to fuscous conidia. *Cirrenalia adarca* also resembles *Cumulospora varia* in appearance with its coiled, multi-septate conidia that are often tightly coiled and muriform (Kohlmeyer *et al.*, 1997). The latter fungus never produces intercalary chlamydospores in culture. *Zalerion varium* differs from



**Fig. 23.** Map of southern of Thailand with collecting sites; 1: Trat; 2: Chanthaburi; 3: Rayong; 4: Chon Buri; 5: Samut Prakan; 6: Samut Sakhon; 7: Prachuap Khiri Khan; 8: Ranong; 9: Phangnga; 10: Phuket; 11: Krabi; 12: Trang; 13: Songkhla; 14: Pattani; 15: Narathiwat.

*Cumulospora varia* in the size of individual cells and overall conidial dimensions. Furthermore, *Zalerion varium* can be recognized by its distinct spiral conidium (Figs. 19-22).

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