

## ABSTRACT

A survey of the organisms associated with *Gracilaria changii* Abbott, Zhang and Xia and their potential ability to cause disease was conducted. Farmed and wild populations of *Gracilaria changii* were screened for the presence of organisms associated with disease symptoms. Of 43 bacterial isolates, eight induced disease symptoms in non-axenic *G. changii* incubated in seawater medium. Four of the eight isolates also induced disease symptoms in axenic thalli in marine broth. Three bacterial isolates that is K1B1, M1B26 and M1B29 which repeatedly caused disease symptoms were selected for assessing their ability to cause disease in two different culture media. The comparison of disease symptoms on axenic thalli in seawater medium and marine broth, showed that disease symptoms were manifested earlier in marine broth for isolates M1B29 and M1B26 whereas K1B1 showed stronger disease symptoms in seawater medium. Strains K1B1 and M1B26 were identified as *Deleya aesta* and strain M1B29 as *Deleya marina*.

Eleven fungal isolates were obtained. They were from the genera *Penicillium*, *Aspergillus*, *Cladosporium*, *Gliomastix* and *Pestalotia*. One yeast-like fungi was observed. Two of the isolates could not be identified due to the lack of fruiting bodies, thus they were designated sterile mycelia. Most of the fungal isolates, however, were soil fungi. The isolation medium: Seawater Potato Dextrose Agar and Malt Extract Agar, may not be optimum for the isolation of aquatic fungi. Baiting technique was used to isolate aquatic fungi

however, the small number of samples screened were insufficient to yield aquatic fungi.

When axenic thalli were re-infected with fungal isolates, two displayed mycelial growth. The fungal isolates which re-infected axenic thalli were *Aspergillus* sp. and *Pestalotia* sp. Cyst-like growths were observed in cross-sections of thalli incubated with *Pestalotia* sp.

Three virus-like particles from homogenates of 'sick' thalli were observed under Transmission Electron Microscope. Two were rod-like, three hexagonal and one filamentous. These VLPs are similar to VLPs found in plants. The virus-like particles were unable to re-infect *G. changii*.

Twenty-five taxa of epiphytic algae from the division Cyanophyta, Chlorophyta, Phaeophyta, Bacillariophyta and Rhodophyta were identified from the surface of *G. changii* thalli of farmed and wild populations with Chlorophyta being the predominant division. The epiphytes obtained from wild populations especially Carey Island and Morib exhibited higher species diversity compared to farmed populations. An endophytic alga *Audouinella* sp. was observed in cross-sections of *G. changii*. The presence of another endophytic alga, *Streblonema* sp. was suspected in the same cross-section.

An unicellular organism with cell-wall degrading ability was described from cells of whitened *Gracilaria* thalli.

A checklist of the microflora and disease causing organisms in *G. changii* would form an important basis for formulating disease control and proper management of seaweed mass culture systems in Malaysia.

## ABSTRAK

Kajian organisma-organisma yang dikaitkan dengan *Gracilaria changii* Abbott, Zhang & Xia dan kebolehan organisma-organisma tersebut menyebabkan penyakit telah dilaksanakan.

Populasi *G. changii* yang ditanam di ladang dan yang tumbuh secara liar telah diskriminasi untuk kehadiran organisma-organisma yang berhubungkait dengan simptom-simptom penyakit. Daripada 43 isolat bakteria, didapati lapan menyebabkan simptom penyakit dalam talus bukan 'axenic' *G. changii* yang dieram dalam medium air laut. Empat daripada lapan isolat itu menyebabkan simptom penyakit dalam talus 'axenic' yang dieram dalam kaldu marin. Tiga isolat bakteria yang berulang kali menyebabkan penyakit iaitu K1B1, M1B26 dan M1B29 dipilih untuk membuat perbandingan kebolehan mereka menyebabkan penyakit dalam dua media pengkulturan yang berlainan. Perbandingan simptom penyakit ke atas talus 'axenic' dalam medium air laut dan kaldu marin bagi tiga isolat bakteria menunjukkan bahawa dua isolat menunjukkan kesan simptom penyakit yang lebih awal dalam kaldu marin manakala isolat K1B1 menunjukkan simptom penyakit yang ketara apabila dieram dalam medium air laut. Strain K1B1 dan M1B26 telah diidentifikasi sebagai *Deleya aesta* dan strain M1B29 sebagai *Deleya marina*.

Sebelas isolat fungi telah diperolehi. Mereka adalah dari genera *Penicillium*, *Aspergillus*, *Cladosporium*, *Gliomastix* dan *Pestalotia*. Satu jenis

fungi menyerupai yis diperhatikan. Dua daripada isolat yang diperolehi tidak dapat diidentifikasi disebabkan ketiadaan jasad buah. Oleh itu, mereka dikategorikan sebagai miselia steril. Kebanyakan daripada isolat fungi yang diperolehi adalah fungi tanah. Medium pengisolation: 'Seawater Potato Dextrose Agar' dan 'Malt Extract Agar' mungkin bukan optimum untuk pengisolation fungi akuatik. Teknik 'baiting' digunakan untuk mengisolat fungi akuatik, tetapi jumlah sampel yang kecil tidak mencukupi untuk mendapatkan fungi akuatik. Apabila talus 'axenic' dijangkiti semula dengan isolat fungi, dua menghasilkan pertumbuhan miselia. Isolat fungi yang menjangkit semula talus adalah *Aspergillus* sp. dan *Pestalotia* sp. Pertumbuhan menyerupai sist diperhatikan dalam keratan rentas talus yang dieram bersama *Pestalotia* sp.

Partikel menyerupai virus diperhatikan di bawah Mikroskop Transmissi Elektron daripada homogenat talus yang 'sakit'. Dua berbentuk batang, tiga hexagonal dan satu berfilamen. Partikel menyerupai virus ini menyerupai partikel virus yang dijumpai dalam tumbuh-tumbuhan. Partikel menyerupai virus itu tidak berupaya menjangkiti semula *G. changii*.

Sebanyak dua puluh lima taxa algae epifitik dari divisi Cyanofita, Chlorofita, Phaeofita, Bacillariofita dan Rhodofita diidentifikasi daripada permukaan talus *G. changii* dari populasi ladang dan populasi liar. Divisi Chlorofita adalah yang paling kerap dijumpai. Epifit algae dari populasi liar menunjukkan diversiti yang lebih tinggi berbanding dengan populasi ladang. Alga endofitik *Audouinella* sp. telah dijumpai dalam keratan rentas *G. changii*.

Kehadiran satu lagi alga endofit, *Streblonema* sp. disyaki dalam keratan rentas yang sama.

Organisma unisel yang berkemungkinan mempunyai kebolehan melarutkan dinding sel telah dijumpai dalam sel talus *G. changii* yang 'sakit'.

Suatu senarai-semak mikroflora dan organisma penyebab penyakit dalam *G. changii* akan membentuk asas untuk formulasi kawalan penyakit and pengurusan kultur-massa rumpair yang lebih baik di Malaysia.