

DISTRIBUTION OF BENTONIC BLUE GREEN ALGAE IN THE
COASTAL WATERS OF PENANG ISLAND, REDANG
MARINE PARK

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DISTRIBUTION OF BENTHIC BLUE GREEN ALGAE IN THE CORAL REEFS IN
PENANG ISLAND, REDANG MARINE PARK

By

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PROJEK PENYELIDIKAN I DAN II**

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LIST OF ABBREVIATIONS

%	Percentage
$^{\circ}\text{C}$	Degree Celsius
ppm	Parts per million
L	Liter
g	Gram
kg	Kilogram
μm	Micrometer
μM	Micromole
$\mu\text{g g}^{-1}$	Microgram per gram
NH_4	Ammonium
NO_2^-	Nitrite
PO_4^{3-}	Orthophosphate
NO_3^-	Nitrate
$(\text{NH}_4)_2\text{SO}_4$	Ammonium sulfate
$\text{C}_6\text{H}_6\text{O}$	Phenol
$\text{C}_2\text{H}_5\text{OH}$	Etanol
$\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]\cdot 2\text{H}_2\text{O}$	Sodium nitroprusside
$\text{C}_6\text{H}_5\text{Na}_3\text{O}_7$	Sodium citrate
NaOH	Sodium hydroxide
NaNO_2	Natrium nitrite
$\text{NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{SO}_2\cdot\text{NH}_2$	Sulfanilamide
HCL	Hydrochloric acid
$\text{C}_{12}\text{H}_{14}\text{N}_2\cdot 2\text{HCl}$	N-(1-naphtyl)-ethylenediamine dihydrochloric
NH_4Cl	Ammonium chloride
$\text{CuSO}_4\cdot 5\text{H}_2\text{O}$	Copper sulfat
H_2SO_4	Sulfuric acid
$\text{K}(\text{SbO})\text{C}_4\text{H}_6\text{O}_6$	Potassium antimonyl tartrate
$(\text{NH}_4)_6\text{MO}_7\text{O}_{24}\cdot 4\text{H}_2\text{O}$	Ammonium molybdat

ABSTRACT

A study on the benthic blue green algae in the coral reefs of Penang Island, Redang Marine Park was carried out once a month from July to October 2004. Blue green algae have generated much interest among the researchers for many years. However, little is known about these benthic algae in Malaysia. Hence, this study was mainly concerned on the taxonomic study of the blue greens and to explore their natural distribution in the corals reefs associated with other seaweeds in Penang Island. The relationship of the nutrient (ammonium, nitrite, orthophosphate and nitrate) concentrations with the distribution of the cyanophyta was also determined. General collection, Line Intercept Transect (LIT) and Quadrat methods were employed for the distribution study in four stations. A new approach that was previously used for coral mapping purpose in Serge *et al.* (2003) was also used in this study to show the actual distribution pattern. Standard Methods for Water Analysis were used for water analysis in five established stations around the island.

The values of the environmental parameters for temperature ranged from 26.9 to 31.9 °C, salinity ranged from 28.3 to 32.1 ppt, pH values recorded were between 7.58 to 8.02, oxygen content was between 2.00 to 6.78 mg/l and conductivity values ranged from 45.8 to 55.8 ms.

Generally, there were seven main species of blue green growing associated mainly with green algae recorded in Penang Island. These include *Schizothrix calcicola*, *Hydrocoleum coccineum*, *Microcoleus lyngbyaceus*, *Phormidium crosbyanum*.

Oscillatoria rubescens, *Anabaopsis sp.* and *Lyngbya sordida*. All these cyanophytes were filamentous types and contained different shades of coloration; ranging from brown, red and bluish green depending on the photosynthetic pigments (phycoerythrin and phycocyanin). Only one species possess heterocyst.

The benthic cyanobacterial populations in the study area formed prostrate horizontal microbial mats and globular colonies spreading over loose sandy sediments or attached to coral rubbles and dead coral fragments. They formed colored patches of up to 1 m² or more and expand in the course of days to months. The mats were initially dominated by a single cyanobacterial taxon as observed in July and August, but the older mats comprised of a mixture of different morphotypes once the growth rate of the dominant species slowed down as seen in October, which might be due to changes in nutrient concentrations in the water.

Generally the distribution pattern of the cyanobacteria increased with the increase in nutrient concentrations. All the cyanophytes reacted differently to the nutrient concentrations. *Anabaopsis sp.* was more abundant when ammonium concentration in the water was low and this might be due to their ability of fixing nitrogen. *Phormidium crosbyanum* were most abundant with the increase of orthophosphate concentration in the water. The other species occurred sparsely in the presence of both this nutrients.

ABSTRAK

Taburan Alga Biru Hijau Bentik di Kawasan Terumbu Karang di Pulau Pinang, Taman Laut Pulau Redang

Satu kajian ke atas taburan alga biru hijau di kawasan terumbu karang di Pulau Pinang, Taman Laut Pulau Redang telah dijalankan sebulan sekali dari bulan Julai hingga Oktober. Tidak banyak yang diketahui tentang alga biru hijau di Malaysia. Oleh itu, kajian ini dijalankan untuk mengkaji taburan semulajadi dan taxonomi alga ini. Kaitan di antara taburan semulajadi alga ini dengan kandungan nutrien (ammonium, nitrite, orthofosfat dan nitrate) dalam air di persekitaran Pulau Pinang turut dikaji. Teknik LIT, Quadrat dan pengutipan specimen biasa telah digunakan untuk mengkaji taburan algae biru hijau di empat stesen kajian. Satu cara baru diadaptasi daripada Serge *et al.* (2003) bagi menunjukkan taburan sebenar substrat di kawasan kajian turut digunakan.

Nilai persekitaran di kawasan kajian bagi parameter suhu dicatatkan antara 26.9 hingga 31.9 °C, saliniti antara 28.3 hingga 32.1 ppt, nilai pH berada antara 7.58 hingga 8.02, kandungan oksigen berada pada tahap 2.00 hingga 6.78 mg/l dan nilai konduktiviti berada antara 35.8 hingga 55.8 ms.

Tujuh spesis alga biru hijau telah dijumpai di kawasan Pulau Pinang. Ini termasuklah *Schizothrix calcicola*, *Hydrocoleum coccineum*, *Microcoleus lyngbyaceus*, *Phormidium crosbyanum*, *Oscillatoria rubescens*, *Anabaeopsis sp.* and *Lyngbya sordida*. Kesemua spesis alga ini adalah daripada jenis berfilamen dan menunjukkan perbezaan

warna yang jelas bergantung kepada kandungan pigmen fotosintesis. Hanya satu spesis alga mempunyai heterosis.

Kebanyakan koloni alga biru hijau di Pulau Pinang dijumpai di kawasan terumbu karang yang telah mati dan di atas pasir. Ia mampu membentuk hamparan sejauh satu meter dengan kadar pertumbuhannya yang cepat. Koloni alga dalam hamparan ini didapati terdiri daripada satu jenis taxa sahaja pada bulan Julai dan Ogos, tetapi ia membentuk campuran beberapa taxa pada bulan September apabila kadar pertumbuhan koloni asal menjadi perlahan. Ini mungkin disebabkan oleh perubahan kandungan nutrien dalam air.

Pada amnya, taburan alga biru hijau meningkat dengan peningkatan nutrien dalam air. Namun, bukan semua spesis alga ini bertumbuh pada kadar yang sama pada perubahan kandungan nutrien dalam air. Misalnya, taburan *Anabaopsis sp.* meningkat dengan pengurangan kandungan ammonium dalam air. Ini mungkin kerana kebolehnya mengikat nitrogen dari atmosfera. Taburan *Phormidium crosbyanum* pula meningkat dengan peningkatan kandungan orthofosfat dalam air. Spesis lain didapati berkembang baik dengan kehadiran kedua-dua sumber nitrogen dan orthofosfat di dalam air.