ABSTRACT

We investigated the dynamics of attached and free-living bacterial abundance over a period of 18 months in tropical coastal waters of Malaysia. We measured at both oligotrophic coastal water (Port Dickson) and eutrophic estuary (Klang), and hypothesized that attached bacteria are predominant in eutrophic waters. We also addressed whether attached and free-living bacteria differ phylogenetically. We found that bacterial abundance was higher at Klang than Port Dickson (Student's *t*-test: $t = 4.87$, $df = 19$, $P < 0.001$). Attached bacteria also formed a large fraction of the total bacteria at Klang (75 ± 13%) relative to Port Dickson (56 ± 22%), and showed preference for chlorophyll *a* based particles rather than total suspended solids. The bacterial community structure was clearly different between the two stations but was similar between the attached and free-living bacterial population. Our results showed the importance of attached bacteria in eutrophic water where they could play a major role in carbon and nutrient cycling.

ABSTRAK

Kami mengkaji dinamik kelimpahan bakteria yang berkoloni di zarah-zarah dan hidup bebas selama 18 bulan di pantai tropika Malaysia. Kami mengukur di pantai oligotrofik (Port Dickson) dan muara eutrofik (Klang) dan mengadakan hipotesis bahawa bakteria berkoloni di zarah-zarah adalah predominan di air eutrofik. Kami juga menunjukkan sama ada bakteria yang berkoloni di zarah-zarah dan hidup bebas berbeza secara filogenetik. Kami mendapati kelimpahan bakteria adalah lebih tinggi di Klang daripada Port Dickson (Student's *t*-test: $t = 4.87$, $df = 19$, $P < 0.001$). Bakteria yang berkelompok di zarah-zarah juga membentuk satu pecahan yang besar dari jumlah bakteria di Klang (75 ± 13%) relatif dengan Port Dickson (56 ± 22%), dan menunjukkan keutamaan pada zarah-zarah berasaskan klorofil *a* daripada jumlah pepejal terampai. Struktur komuniti bakteria adalah berbeza di antara kedua-dua stesen tetapi adalah serupa di antara populasi bakteria berkoloni di zarah-zarah dan hidup bebas. Keputusan kami menunjukkkan bakteria berkoloni di zarah-zarah amat penting di air eutrofik di mana mereka memainkan peranan utama dalam kitaran karbon dan nutrisi.

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LIST OF SYMBOLS AND ABBREVIATIONS

Symbols and units

<	:	less than
>	:	more than
±	:	plus minus
%	:	Percent
’	:	Minute
^{o}	:	Degree
^{o}C	:	degree Celsius
α	:	Alpha
β	:	Beta
δ	:	Delta
CV	:	coefficient of variation
df	:	degree of freedom
M	:	Molar
ml	:	Milliliter
mg L^{-1}	:	milligram per liter
mg mL^{-1}	:	milligram per milliliter
mM	:	Millimolar
N	:	Normality
n	:	sample size
nm	:	Nanometer
P	:	attained level of significance
R^2	:	multiple correlation coefficient
SD	:	standard deviation

t	:	Student's *t* variable
μm	:	Micrometer
μM	:	Micromolar
μL	:	Microliter
μg	:	Microgram
μg mL^{-1}	:	microgram per milliliter
μg L^{-1}	:	microgram per liter
w/v	:	weight per volume
v/v	:	volume per volume
V	:	Voltage

Chemical substances and formulas

DAPI	:	4',6-diamidino-2-phenylindole
EDTA	:	ethylenediaminetetraacetic acid
HCl	:	hydrogen chloride
KCl	:	potassium chloride
KI	:	potassium iodide
$MgCl_2$	:	magnesium chloride
$MnCl_2$	:	manganese(II) chloride
NaAc	:	sodium acetate
NH_4	:	Ammonium
NO_2	:	Nitrite
NO_3	:	Nitrate
PO_4	:	Phosphate
SDS	:	sodium dodecyl sulfate
SiO_4	:	Silicate

TAE	:	tris-acetate- ethylenediaminetetraacetic acid
TE	:	tris-ethylenediaminetetraacetic acid
Tris-HCl	:	tris-hydrogen chloride

Abbreviations

BLAST	:	Basic Local Alignment Search Tool
bp	:	base pair
CFB	:	cytophaga-flavobacterium-bacteriodetes
Chl *a*	:	chlorophyll *a*
DGGE	:	denaturing gradient gel electrophoresis
DNA	:	deoxyribonucleic acid
DO	:	dissolved oxygen
DOC	:	dissolved organic carbon
E	:	East
e.g.	:	exempli gratia of example given
et al.	:	et alia
GF/F	:	glass fiber filter
HMW	:	high-molecular-weight
i.e.	:	id est or that is
LMW	:	low-molecular-weight
N	:	North
NCBI	:	National Center for Biotechnology Information
OR	:	Oregon
OTU	:	operational taxonomic unit
PAST	:	Palaeontological Statistics
PCR	:	polymerase chain reaction

PLFA	:	phospholipids fatty acid
rDNA	:	ribosomal deoxyribonucleic acid
RDP	:	Ribosomal Database Project
RNA	:	ribonucleic acid
rRNA	:	ribosomal ribonucleic acid
tRNA	:	transfer ribonucleic acid
TSS	:	total suspended solids
USA	:	United States of America

LIST OF APPENDICES