70990

7. ALGAE RESEARCH

7.1. SEASONAL CHANGES IN MARINE FLORA ALONG KENYA COAST

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INTRODUCTION

Marine flora are a prominent feature of the intertidal zone of Kenya coast. Extensive studies have been carried out by various scientists in the systematics and identification of algae. Gerlaff (1960), Taylor (1966), Isaac (1967, 1968) Isaac and Isaac (1968), and Moorjani (1969, 1977, 1978, 1980) but these by no means exhaust the roll call of species. Marine flora extend from the low water level of neap tides (ie they are rarely exposed except at spring tides) to situations well beyond in deep water. Some are exposed for considerable periods during spring tides while others, although situated high on the shore grow in pools and depressions where certain amount of water is left by the receding tide.

The East African coast experiences monsoonal effect ie S.E. monsoon winds (March - September) and N.E monsoon winds (October - March), intertidal algae do suffer stress of dessication due to exposure to direct insolation and high temperatures at different times of the year. Algae show some kind of zonation within the intertidal zone and thus at the high tide level its even more distinct, within the same intertidal zone there will be marked differences between algae within the intertidal pools and the adjacent areas, several factors could be attributed to, for the difference these may include, salinity, substrate (rocky, sandy and muddy) and temperature.

Thus, the studies which have been carried out on Kenya coast have made no attempt to relate the occurence and distribution of the algae with the seasonal changes. Consequently, following successful studies on the systematics and identification of marine algae on the Kenya coast with the help of Dr. Coppejans (January 1986), it became necessary for detailed studies to be done to indicate the changes in the intertidal vegetation throughout the year in a diversity of localities along the Kenya coast (North and South coast). The study is also to determine the variation in the occurence and distribution of the intertidal vegetation in relation to the two monsoon periods ie N.E (October-March) and S.E (April-September) besides the effect of parameters like tidal effect, salinity, substrate and air temperature in relation to the occurence and distribution of the algae.

METHODS AND MATERIALS

Regular monthly samples are taken at ten stations which were selected as likely to be different yet characteristic areas. Of the ten stations; five are on the north coast and the remainder (5) on the south coast, to represent the whole coast. At the selected stations permanent transects have been made and thus the

species found within the transect are identified and the paremeters ie air temperature salinity and substrata are recorded at every sampling time/site. Beside, those algal species which (could not be identified are carried to the laboratory for further microscopic work. The tide table is for the reference in relation to the time at which the low tides occur during the day. Thus all the information is computated in a tabular form for the whole one year duration. Therefore the vertical distribution of marine algae is studied by using the belt transect method.

RESULTS AND DISCUSSION

The results tend to indicate the following:

(a) Of all the algal species, there are certain species that occur along the coast (North and South) virtually throughout the year on different substrates.

(i) Sandy : This substratum is mainly occupied by Lyngbya majuscula, Enteromorpha kylini; Polysiphonia variegata and Centroseras clarilatum.

(ii) Rocky: Is a substratum of a wide range of species, but the most common that seem to occur throughout the year include: Gracilaria saliconrnia, Ulva tropica, Dictyosphaeria cavernosa, Rhizoclonium grande; Cladophoropsis sundanensis, Laurencia sp, Hypnea cornuta, Turbinaria sp Amphiroa fragillisima, Gelidiella acerosa; Pterocladia parva and chondria sp.

(iii) Muddy : Mainly occupied by sea grasses; Halophila ovalis and Thalasia hemprichii; with the following algae of common occurence: Halimeda reschii, Helimeda discoidea, Halimeda opuntia Halimedamacroloba, Codium geppii, Codium dwarkense, Galaxaura oblongata, Udotea palmetta and Avrainvillea erecta.

(iv) Sand covered shallow Rocky pools: Mainly occupied by Cystoseira myrica, Padina boryana Enteromorpha kylinii, Chaetomorpha indica, and Boergesenia forbesii

(v) Deep Rocky Pools: Some of these pools support the growth of the seagrass Thalassiadendron ciliatum (formerly Cymodocea ciliata) on which Gracilaria corticata is an epiphyte. Other algal species include: Amphiroa fragilissima, Saragassum sp. Padina gymnospora, Chondrococcus hornemanii, Hypnea cornuta, Boergesenia forbesii, Hypnea pannosa, Sarconema filiformes and Dictyota bartayresii

(vi) Cliff: Cliff overhangs offer a good habitat for certain species of algae and these include: Bostrychia binderi, Bostrychia tenella, Cladophora sp and Murayella periclados.

(vii) Epiphytes: The most common epiphytes include: Chaetomorpha crassa, Enteromorpha Vamulosa, Cladophora mauritiana, Jamia pumila.

(b) There is more species diversity and high density of vegetation particularly the chlorophytes during the months of May - August, with the highest being in July - August which is within the S.E monsoon winds period. And there is less species diversity and low density of vegetation during the months November - February with the lowest being during the months December - February which falls during the N.E monsoon winds period. (refer to the tables 1 - 12).
This could be attributed to the fact that during the months of March - September is characterized by an influx of fresh water (low satinity) into the ocean from the inland and through underground seepage due to the rains and besides the temperatures during this period are relatively low ie 24.9°C - 28.5°C, hence this tends to favour the growth of certain species of algae particularly the chlorophytes and Centroseras Clavilatum (Red algae). Among the chlorophytes the following seem to be favoured E. kylinii, Ulva sp , Cladophora sp., Cladophoropsis sundanensis, Chaetomorpha indica, Boodlea composita.
The salinities range between 30.0 - 34.5‰and compared to the normal marine salinity of 35.0‰

It is interesting and important too to note that during this time when we have the highest density of vegetation and species diversity the lowest spring tides occur during the night and hence the intertidal vegetation is not as such exposed to direct insolation during day light hours and thus avoiding the stress of high temperatures and dessication or drying. Whilst during the months of December - February when there is sparse algal growth the lowest spring tide occur during daylight hours, the salinities are high ie 35.0 - 36.5 (During this time there is no rain and reduced seepage of water) and the temperatures are high upto 33 C. Thus the exposure of algae to the combined stress of high temperature and high salinity could be a major factor behind the sparse vegetation since high temperature lead to drying and dessication of the algae and hence less population.

(c) There are some species which are found on the south coast and not on the north coast and the vice versa does not hold. For example Avrainvillea erecta has only been collected at Gazi (south coast) and not on the North coast. Therefore a general observation is that there is more species diversity of marine algae on the south coast as compared to the north coast. The verification as to why it is so is being investigated.

(d) The density of most Rhodophytes does not change throughout the year since they predominantly grow in the mid tide and low tide zones. These are in most cases are not subjected to much of the temperature and salinity effects except the tidal effect which is experienced as a result of high tides and the waves thus dislocating some of the species. Among the species that their density does not seem to vary include: Gelidiopsis variabilis, Gelidiella acerosa, Chondrococcus hornemanii, and Laurencia sp.

JULY 1986

ALGAL SPECIES	1	2	3	4	5	6	7	8	9	10	11
CHLOROPHYTES.											
E. Kylinii	C	C	C	C	R	C	R	R	R	R	R
E. clathrata	-	-	-	-	-	R	-	-	R	-	-
E. ramulosa	R	R	-	R	R	R	R	-	R	R	R
U. reticulata	R	R	R	R	-	C	R	R	-	-	A
U. pertusa	C	R	C	-	-	C	-	R	-	-	R
U. pulchra	C	R	R	R	R	C	C	C	-	-	-
U. fasciata	C	R	C	C	C	C	C	C	-	-	R
U. tropica	C	C	C	R	-	-	-	R	-	-	-
C. crassa	R	R	R	R	C	-	R	R	R	-	R
C. indica	C	R	R	R	-	-	C	-	-	-	-
R. grande	-	R	C	C	-	-	C	C	C	-	C
C. mauritiana	R	R	R	R	R	-	R	R	R	-	R
B. composita	C	R	R	R	R	-	-	R	R	-	R
C. sundanensis	C	C	R	C	R	R	R	C	R	-	C
V. pachynema	R	R	-	R	-	-	-	R	-	-	A
V. aegagrophila	C	R	R	R	C	C	R	C	C	-	A
B. forbesii	C	C	R	C	C	C	C	C	C	-	C
D. cavernosa	R	R	-	-	-	-	-	-	-	-	R
A. erecta	-	-	-	-	-	-	-	-	R	C	-
B. hypnoides	-	R	-	-	-	-	-	-	R	-	-
H. venschii	-	-	-	R	C	-	-	-	C	-	-
H. discoidea	-	R	-	-	-	-	-	-	-	C	-
H. macroloba	-	R	-	-	-	-	-	-	-	C	-
C. dwarkense	R	-	-	-	-	-	-	-	R	-	-
Cladophora sp 1	R	-	-	-	R	-	R	R	-	-	-
U. palmetta	-	-	-	-	-	-	-	-	-	A	-
H. opuntia	-	-	-	C	C	-	-	-	C	-	-
C. occidentalis	-	-	-	-	-	-	-	-	-	-	-
C. hilderbrandtii	-	-	-	-	-	-	-	-	R	R	-
C. comosa	-	-	-	-	-	-	-	-	-	R	-
H. tuna	-	R	-	-	-	-	-	-	-	-	-
PHAEOPHYTES											
D. bartayresii	R	-	-	-	-	-	-	R	-	-	-
D. dwaricata	R	-	R	-	-	-	-	R	-	-	-
P. boryana	C	C	-	R	R	R	R	R	R	-	R
P. gymnospora	C	-	-	-	C	C	R	C	-	-	-
P. tetrastromatca	R	-	-	-	C	-	-	R	-	-	-
T. conoides	R	-	-	-	R	-	-	R	-	-	-
T. tanzamensis	R	R	-	-	R	-	-	R	-	-	R
T. kenyaensis	-	-	-	-	-	-	-	-	-	-	-
T. onnataonata	R	-	-	-	R	-	-	R	-	-	-
T. decurrens	R	R	-	-	R	-	R	R	R	-	-
C. myrica	C	R	-	-	-	-	C	-	R	-	R
C. trinodes	-	-	-	-	C	-	-	R	-	-	-
Sargassum Sp.	C	C	-	-	C	C	C	C	C	-	R
RHODOPHYTES											
G. oblangata	R	-	-	-	-	-	-	-	-	-	-
G. obtusata	R	-	-	-	-	-	-	-	-	-	-
Gelidium Sp.1	R	-	-	-	-	-	-	R	-	-	R
W. miniata	C	-	-	R	R	-	R	R	-	-	-
G. aterosa	R	R	-	R	R	R	R	R	R	-	-
G. mynocladia	R	R	R	-	R	-	-	-	-	-	R

P. parva	R	R	-	R	R	R	R	R	-	-	-
P. nana	R	R	-	-	R	-	-	-	-	-	-
J. pumila	C	C	-	C	C	-	R	C	-	-	R
J. adherenis	R	-	-	-	-	-	-	-	-	-	-
A. fragilissima	C	R	-	C	C	C	R	C	C	-	C
A. rigida	-	-	-	R	C	-	-	R	-	-	-
Amphoroa Sp.1	-	-	-	-	R	-	-	C	-	-	R
G. salicornia	C	C	R	C	R	C	R	C	C	C	C
G. corticata	C	-	-	-	-	C	-	-	-	-	-
G. edulis	R	-	-	-	-	R	R	-	R	-	R
G. fergusoni	-	-	-	-	-	R	-	-	-	R	-
G. crassa	R	R	C	-	R	C	R	C	C	-	A
A. tribulus	-	-	-	-	-	-	-	-	-	-	R
G. variabilis	R	-	R	-	R	C	R	R	R	-	R
S. filiforme	C	R	-	C	C	C	C	C	R	-	R
H. pannosa	R	-	-	-	-	-	-	R	-	-	R
H. nidulans	C	-	-	-	-	-	-	-	-	-	-
H. cornuta	C	R	R	C	C	C	C	C	R	C	R
H. nidifica	-	R	-	-	R	-	-	-	-	-	-
H. musciformis	C	-	-	-	R	C	-	-	-	-	-
C. indica	C	R	-	-	R	-	C	-	-	-	R
C. globulifera	R	-	-	-	-	-	-	-	-	-	-
C. camonii	R	-	-	-	-	-	-	-	-	-	-
C. clavilatum	C	C	C	C	C	R	R	R	R	R	R
S. aculeata	R	R	-	R	R	R	C	R	R	-	R
Polysiphonia Sp.	-	R	-	-	-	-	-	-	-	-	-
M. periclados	R	-	-	-	R	-	C	R	-	-	-
B. tenella	R	-	-	-	R	-	R	R	-	-	-
B. ginderi	C	-	-	-	C	-	C	C	-	-	-
A. glomerata	R	-	-	-	-	-	-	-	-	-	-
V. fimbriata	R	-	-	-	-	-	-	-	-	-	-
C. dasyphylla	C	C	R	R	-	R	-	R	-	-	R
C. hornemanii	C	R	-	R	R	-	-	C	-	-	R
A. spicifera	R	R	R	R	R	C	R	R	R	R	R
L. perforata	R	-	-	-	-	-	-	-	-	-	-
L. papillosa	C	R	R	R	R	R	-	R	-	-	R
L. collumelaris	-	-	-	-	-	-	-	R	R	-	-
A. nana	R	R	-	-	R	-	R	R	-	-	-
Gracilaria sp	-	-	-	-	-	-	A	R	C	-	-
Geldiaceae sp.1	-	-	-	-	-	-	-	C	-	-	-
H. venusta	-	-	-	-	-	-	-	-	-	-	R

KEY : R = Rare C = Common A = Abundant

FEBRUARY 1987

ALGAL SPECIES	1	2	3	4	5	6	7	8	9	10	11
CHLOROPHYTES											
E. kylinii	R	C	R	R	C	C	C	C	R	R	C
E. clathrata	-	-	R	C	-	-	-	-	-	-	-
E. ramulosa	-	R	-	-	-	-	-	-	C	R	-
U. reticulata	A	C	-	R	R	A	C	R	-	-	R
U. pertusa	C	-	-	-	C	R	R	R	C	-	-
U. pulchra	R	R	-	-	R	C	R	R	-	-	-
U. fascrata	C	-	C	R	C	C	C	C	R	-	-
U. tropica	-	R	-	-	R	-	-	-	-	-	R
C. crassa	R	R	-	R	C	-	C	C	R	-	R

C. indica	-	-	-	-	-	-	C	R	-	-	-
R. grande	-	-	C	R	-	-	C	C	-	-	C
C. mauritiana	R	R	-	-	R	R	C	C	-	-	-
C. patentirames f. Longiarticulata	-	-	-	-	-	-	-	-	-	-	-
B. composita	-	R	-	-	R	R	R	C	-	-	R
M. montagnei	-	-	-	-	-	-	-	-	-	-	-
C. sundanensis	R	-	-	-	-	R	-	A	-	-	R
V. pachynema	R	R	-	-	-	R	-	R	-	-	R
V. aegagrophila	-	-	-	-	R	C	-	R	R	-	R
B. forbesii	C	C	R	R	C	R	C	C	R	-	R
D. cavernosa	C	R	-	R	R	-	R	C	-	-	R
A. erecta	-	-	-	-	-	-	-	-	C	R	-
B. hypnoides	-	R	-	-	-	-	-	-	C	-	-
C. racemisa(macrophysc)	C	-	-	-	-	-	-	-	-	-	-
H. renschii	C	-	-	C	C	-	-	-	-	-	-
H. discoidea	R	R	-	C	-	-	-	-	C	C	-
H. maeroloba	-	R	-	R	-	-	-	-	-	-	-
C. dwaruense	R	-	-	-	-	-	-	-	-	C	-
Cladophora	R	-	-	-	R	-	R	R	-	-	-
U. palmetta	-	-	-	-	-	-	-	-	-	A	-
H. opuntia	-	-	-	R	R	-	-	-	-	-	-
C. ociidentalis	R	-	-	-	-	-	-	-	C	-	-
PHAEOPHYTES											
D. gartayresii	R	-	-	-	-	-	-	-	-	-	-
D. dwaricata	R	-	-	-	-	-	-	-	-	-	-
P. bonyana	C	C	-	-	R	R	R	R	-	-	R
P. gymnospora	C	-	-	-	C	C	-	C	-	-	-
P. tetrastomatica	R	-	-	-	R	-	-	R	-	-	-
T. conoides	R	-	-	-	C	-	-	C	-	-	-
T. tanzaniensis	R	R	-	-	R	-	-	R	-	-	-
T. decurrens	R	-	-	-	C	-	-	R	-	-	R
T. kenyaensis	R	R	-	-	R	-	-	R	-	-	-
T. ornata ornata	-	-	-	-	R	-	-	R	-	-	-
C. myrica	R	-	-	-	-	-	-	-	-	-	R
C. trinodes	-	-	-	-	C	-	-	C	-	-	-
Sargassum sp	R	-	-	R	R	R	R	R	-	-	-
RHODOPHYTES											
G. oblongata	R	-	-	-	-	-	-	-	-	-	-
G. obtusata	R	-	-	-	-	-	-	-	-	-	-
Gelidium sp1	-	-	-	-	-	-	-	C	-	-	-
W. miniata	R	-	-	-	R	-	-	R	-	-	R
G. acerosa	R	R	-	R	R	R	-	C	-	-	C
G. myriocladia	-	-	-	-	R	-	-	R	-	-	R
G. parva	R	-	-	-	R	R	-	R	-	-	R
P. nana	-	-	-	R	-	-	-	R	-	-	-
J. pumita	C	-	-	C	C	R	-	C	R	-	-
J. adherens	-	-	-	-	-	-	-	R	-	-	-
A. fragilissima	C	R	R	R	C	R	-	C	C	-	R
A. rigida	R	R	-	-	R	R	-	R	-	-	R
Amphrioa sp1	-	-	-	-	-	-	-	R	-	-	-
G. salicornia	C	C	R	R	-	C	C	R	R	C	R
G. corticata	R	-	-	R	R	C	-	R	-	-	-
G. edulis	-	-	-	-	-	R	R	-	R	-	-
G. fergusoni	R	-	-	-	-	-	-	-	-	-	-
A. tribulus	-	-	-	-	-	-	-	-	-	-	C
G. variabilis	R	-	-	-	R	C	-	R	-	-	-

S. filiforme	C	R	-	R	R	C	R	R	-	-	R
H. pannosa	R	R	-	-	R	-	-	-	-	-	-
H. nidulans	R	-	-	-	-	-	-	-	-	-	-
H. cornuta	C	C	R	R	C	C	C	C	R	-	R
H. nidifica	R	R	-	-	-	-	-	-	-	-	-
C. indica	C	-	-	-	R	R	R	-	-	-	-
C. globulifera	R	-	-	-	-	-	-	-	-	-	-
C. camouii	R	-	-	-	-	-	-	-	-	-	-
C. clavilatum	C	C	R	R	R	R	R	R	-	-	-
S. aculeata	R	R	-	R	R	R	-	-	-	-	-
Polysiphoma sp	R	R	-	-	-	-	-	R	-	-	-
M. periclados	R	-	-	-	R	-	R	R	-	-	-
B. tenella	R	-	-	-	R	-	R	R	-	-	-
B. binderi	C	-	-	-	C	-	C	C	-	-	-
A. glomerata	R	-	-	-	-	-	-	-	-	-	-
V. fimbriata	R	-	-	-	-	-	-	-	-	-	-
C. dasyphylla	C	C	-	-	-	-	-	R	-	-	-
Chondrocollus hornemanii	R	R	-	-	R	R	-	R	-	-	-
A. spicifera	R	R	-	-	R	R	-	R	-	-	-
L. perforata	R	-	-	-	-	-	-	-	-	-	-
L. papillosa	R	R	-	-	-	R	R	R	-	-	-
L. columellaris	R	R	-	-	-	-	-	-	-	-	-
A. nana	R	R	C	-	R	-	-	R	-	-	-
Gracilania sp	-	-	-	-	-	-	C	R	R	-	-
Gehdiaceae sp 1	-	-	-	-	-	-	-	C	-	-	-
H. venusta	-	-	-	-	-	-	-	-	-	-	R

KEY

1= Mackenzie Point
2= Mkomani
3= Old Nyali
4= Reef Hotel
5= Kanamai
6= Malindi
7= Diani
8= Tiwi
9= Gazi
10= Port Reitz
11= Fort Jesus