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TERRESTRIAL AND SWAMP ALGAE FROM THREE ISLANDS IN THE CHAGOS ARCHIPELAGO, INDIAN OCEAN

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TERRESTRIAL AND SWAMP ALGAE FROM THREE ISLANDS IN THE CHAGOS ARCHIPELAGO, INDIAN OCEAN

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INTRODUCTION

During visits to the Chagos group of islands by two of the authors (D. J. B. in January 1973; D. J. B., C. S. from January to March 1975), several collections were made of conspicuous algal growths from terrestrial and swamp habitats. As these growths provide some interesting similarities and differences from those reported previously from other islands in the Indian Ocean (Donaldson & Whitton, 1976; Whitton & Donaldson, 1976), a brief account of their floristic composition is given here.

The Chagos Islands (6°S, 71°W) form part of the British Indian Ocean Territory. The samples described here were taken from three of these islands, Egmont, Eagle and Danger. Egmont Is. is one of the atolls which lie around the periphery of the Chagos archipelago, while Eagle Is. and Danger Is. may be considered as being part of the rim of a very large former atoll, now almost entirely submerged. No rainfall records exist for any of these three islands, but stations have at times existed on three of the other peripheral islands, Diego Garcia, Salomon Is. and Peros Banhos, the most recent being those from Peros Banhos. Here it is estimated that during 1950-1966 there occurred a mean annual rainfall of 3999 mm (Stoddart, 1971). Seasonal changes in precipitation were relatively small, with the lowest values being in May and June.

METHODS

Samples were dried soon after collection and then sealed in individual packets. They were viewed after re-wetting with distilled water. In certain cases simple cultural techniques were used either to help confirm identifications or to demonstrate the presence of further species. Species noted only after culture are noted below.

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The species categories used in the various tables of results are based on these used in an algal computer recording system held at Durham, and described further in Donaldson and Whitton (1976). The size ranges given are standard ranges used in our system; the full range of these widths have not necessarily been found in these samples from the Chagos Is.

RESULTS

Eagle Is.

Almost 50 different samples were collected here during 1975. Three quite different types of algal community were represented, two from clearings in the coconut plantations, and two from *Typha* swamp regions. Their species compositions are compared in Table 3.

A. Thin olive-brown sheets spreading across debris overlying sand in a clearing; dominated by *Nostoc commune*.

B. Flattened to hemispherical lumps, reaching a maximum height of 9 mm, lying over grey or pale brown sand in coconut clearings; frequent. The main blue-green algal layer is only 1 mm thick, the remainder of the lumps being largely filled with sand. However there is usually a zone about 2 mm thick below the main blue-green algal layer which has a faint green tinge, this being due to moss protonema and *Lyngbya martensiana*. Some of the filaments of *Tolypothrix byssoidea* are moderately calcified, while those of *Lyngbya martensiana* and *Schizothrix arenaria* are also sometimes calcified.

C. Algal layer forming patches in more or less open areas within a swamp community dominated by *Typha* sp. and *Eleocharis* sp. These algal layers are probably completely submerged after heavy rainfall, but at the time of collection formed a dark grey slimy layer overlying a dark humus; moss shoots are also mixed with the algal layer. On drying out, the algal layer turns to a grey-green colour, as a result of the highly calcified layer around the sheaths of the dominant alga, *Tolypothrix byssoidea*.

D. ± Continuous layer of blue-green algae overlying dense brown fibrous mass, near a mangrove swamp. Algal layer about 3 mm thick, gelatinous, crumbly, irregular on surface. Obvious vertical zonation (Table 4). Some, but not all, of the dominant alga, *Tolypothrix byssoidea*, is calcified.

Egmont

Samples of mat were taken from a barachois community both in 1973 and 1975. The water associated with this community presumably varies considerably in salinity according to the pattern of rainfall in the previous few weeks; at the time of study in 1975 it was slightly brackish (Na, 236 mg l^{-1}).

The detailed composition of the mat is somewhat variable, but always had a layer dominated by Oscillatoriaceae overlying a layer of purple photosynthetic bacteria. The single sample of mat returned in 1973 was much thicker than any of the 10 samples returned in 1975, the photosynthetic layer reaching a depth of 10 mm and with obvious vertical zonations of the various blue-green algae present. Details of this mat profile are summarized in Table 1. The composition of this mat rather closely resembles one already described for rock pools on the Florida Keys, U.S.A., even though these latter are intertidal (Fischer and Golubić, in Ginsburg, 1967) and termed by Golubić (1973) a 'stratified community mat in intertidal rock pool'.

The samples returned in 1975 were much thinner, with the blue-green algal layer about 3-4 mm thick. A consolidated species list is given in Table 2.

Danger Is.

All terrestrial algal crusts were dominated by *Tolypothrix byssoidea*. Other species represented are listed in Table 5.

DISCUSSION

All these terrestrial and swamp algal communities are dominated by blue-green algae, and only in the *Typha - Eleocharis* swamp on Eagle Is. are eukaryotic algae represented by more than a few scattered cells. Three out of the six different types of algal community described from these three islands are dominated by *Tolypothrix byssoidea*, though the structure and composition of all three examples are each rather different. The extent to which this alga becomes calcified varies markedly, with the most highly calcified material occurring in the *Typha - Eleocharis* swamp. During the more detailed studies of the authors on Aldabra (Donaldson & Whitton, 1976; A. D. and B. A. W., unpublished data), no sample of *Tolypothrix byssoidea* has ever been found which approaches this swamp community in extent of calcification.

REFERENCES

Donaldson, A. and Whitton, B. A. 1976. Algal flora of freshwater pools on Aldabra Atoll. *Atoll Research Bulletin*, this issue.

Ginsburg, R. N. 1967. Stromatolites. *Science, N. Y.* 157: 339-440.

Golubić, S. 1973. The relationship between blue-green algae and carbonate deposits. In: Carr, N. G. & Whitton, B. A. (Eds) *The biology of Blue-green Algae*. 676 pp., pp. 434-472. Blackwell Scientific Publications, Oxford.

Stoddart, D. R. 1971. Rainfall on Indian Ocean Ocean coral islands. *Atoll Research Bulletin* 147: 1-21.

Whitton, B. A. and Donaldson, A. 1976. Terrestrial and freshwater algae of three Western Indian Ocean islands. *Atoll Research Bulletin*, this issue.

Table 1. Vertical zonation of thick barachois mat community, Egmont Is. Relative frequency of photosynthetic organisms in a particular zone of the profile is given on a (subjective logarithmic) scale of 1-5.

		depth mm	0 - 0.05	0.05 - 1.5	1.5 - 6	6 - 9	9 - 10
		colour	olive-brown	olive	dark blue-green	pink	
010532	*Aphanocapsa montana*		1	3			
010632	*Aphanothece* sp. > 2 ≤ 4 µm			2			
010902	*Calothrix braunii*						2
010911	*C. parietina*		2				
011538	*Chroococcus minutus*				2		
011534	*C. turgidus*				4		
014205	*Lyngbya digueti*				4		
015202	*Nostoc commune*		4 (± dead)				
015802	*Plectonema boryanum*				1	2	
016631	*Schizothrix* sp. ≤ 1 µm		4	5	3	3	
016931	*Spirulina subtilissima*					5	5
	purple photosynthetic bacteria (various species)						

Table 2. Consolidated list of algal species from barachois mat community, Egmont Is.

O10531 *Aphanocapsa fusco-lutea* Hansg. > 1 ≤ 2 µm

O10532 *A. montana* Cramer > 2 ≤ 4 µm

O10632 *Aphanothece* sp. > 2 ≤ 4 µm

O10902 *Calothrix braunii* Born. et Flah.

O10911 *C. parietina* Thuret

O11538 *Chroococcus minutus* (Kütz.) Näg. > 4 ≤ 6 µm, non-lamellate sheath

O11534 *C. turgidus* (Kütz.) Näg. > 8 ≤ 16 µm, lamellate sheath

O11540 *C. turicensis* (Näg.) Hansg. > 8 ≤ 16 m, non-lamellate sheath

O12201 *Entophysalis granulosa* Kütz.

O13602 *Hyella fontana* Hüber et Jadin

O14205 *Lyngbya digueti* Gom.

O15202 *Nostoc commune* Vaucher

O15702 *Phormidium angustissimum* W. et G.S. West

O15704 *P. foveolarum* Gom.

O15802 *Plectonema boryanum* Gom.

O15931 *Pleurocapsa minor* Hansg. ≤ 4 µm

O15932 *Pleurocapsa* sp. > 4 ≤ 6 µm

O16631 *Schizothix* sp. ≤ 1 µm

O16931 *Spirulina subtillissima* ≤ 1 µm

Table 3. Species composition of four different algal communities, Eagle Is. The details given are generalizations based on a range of samples, and for composites where vertical zonation is apparent. Organisms seen only after cultures are indicated by +, rather than a frequency score.

		A	B	C	D
010531	*Aphanocapsa fusco-lutea* > 1 ≤ 2 μm			2	
010902	*Calothrix braunii*				+
010950	*Calothrix* sp.			+	
011534	*Chroococcus turgidus* > 8 ≤ 16 μm, lamellate sheath				1
011541	*C. spelaeus* > 16 ≤ 32 μm non-lamellate sheaths			2	
012640	*Gloeocapsa dermachroa* > 2 ≤ 4 μm sheaths yellow-brown		2		
012645	*Gloeocapsa* sp. > 2 ≤ 4 μm, sheath violet		1		
012732	*Gloeothece palea* > 2 ≤ 4 μm			1	5
012733	*G. rupestris* > 4 ≤ 6 μm			3	
013107	*Hapalosiphon welwitschii*			+	+
014202	*Lyngbya allorgei*	1			1
014211	*L. martensiana*	2	3		
014252	*Lyngbya* sp. > 1 ≤ 2 μm		2		
014801	*Microcoleus chthonoplastes*		1	2	3
015202	*Nostoc commune*	5		3	2
015218	*N. piscinale*			+	
015211	*N. punctiforme*			2	+
015704	*Phormidium foveolatum*			+	+
015511	*Oscillatoria claricentrosa*			2	
015802	*Plectonema boryanum*	+			
015932	*Pleurocapsa* sp. ≤ 4 μm				1
016602	*Schizothrix arenaria*		3	2	5
017601	*Tolypothrix byssoidea*	2	5	5	3
017606	*T. distorta*			+	+
062050	*Akanthochloris* sp.		1		
120250	*Closterium* sp.			1	
122150	*Spirogyra* sp.			2	
	palmelloid green alga (*c.* 13 μm diameter)			2	
160732	*Oedogonium* sp. > 8 ≤ 12 μm			1	
160801	*Pithophora oedogonia*			2	
239950	unknown moss(es)		2	3	

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Table 4. Vertical zonation of algal layer from mangrove swamp (community D in Table 3). Relative frequency of photosynthetic organisms in a particular zone of the profile is given on a (subjective logarithmic) scale of 1-5.

		0 - 0.5 pale brown	0.5 - 2.0 dark green	2.0 - 2.5 dark green	2.5 - 3.0 dark green	Fibrous layer brown
011534	*Chroococcus turgidus*	1	1			
012732	*Gloeothece palea*	5	5	4	4	3
014202	*Lyngbya allorgei*	2				
014801	*Microcoleus chthonoplastes*	2	2	2	4	
015202	*Nostoc commune*	2				
015704	*Phormidium foveolarum*	2				
015932	*Pleurocapsa* sp. $\leq$ 4 µm	2	1	1	1	
016602	*Schizothrix arenaria*	2	5	5	5	5
017602	*Tolypothrix byssoidea*	3	2			

Table 5. Species list for algal crusts from Danger Is.

010532 *Aphanocapsa montana* > 2 ≤ 4 µm

012640 *Gloeocapsa dermochroa* > 2 ≤ 4 µm, sheath yellow-brown

012641 *G. kutzingiana* > 4 ≤ 6 µm, sheath yellow-brown

014211 *Lyngbya martensiana*

014801 *Microcoleus chthonoplastes*

015202 *Nostoc commune*

015802 *Plectonema boryanum*

015817 *P. notatum*

015931 *Pleurocapsa* sp. ≤ 4 µm

016650 *Schizothrix* sp. (c. 4.5 µm wide)

017602 *Tolypothrix byssoidea*