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STEROLS OF THE SENEGALESE BROWN ALGA *PADINA VICKERSIAE*

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Key Word Index—*Padina vickersiae*; Phaeophyceae; brown algae; cholesterol; fucosterol; seasonal variation.

Abstract—Contrary to all the brown algae already studied for sterol content the Senegalese *Padina vickersiae* contains a great amount of cholesterol, chiefly in the later stages of growth. The seasonal variation of the sterols is studied and compared to other Phaeophyceae belonging to the genus *Cystoseira*.

INTRODUCTION

Some species belonging to the genus *Padina* have been studied for antimicrobial and antifungal properties [1–6]. In the course of our investigation of the Senegalese algae we have been interested in the endemic *Padina* species, namely *P. vickersiae*. This alga is particularly abundant along the coast near Dakar. The investigation of the sterol content gave surprising results.

RESULTS AND DISCUSSION

The usual work-up for sterol purification, including digitonin precipitation, alkaline hydrolysis and silica gel chromatography, yielded the sterol fraction which was analysed by GLC and GC/MS. Cholesterol and fucosterol were the major sterols but 22-dehydrocholesterol, 24-methylenecholesterol, campesterol, stigmasterol and sitosterol were also identified. A sterol sample obtained from a batch of algae harvested during the year 1982 had a ratio of fucosterol to cholesterol of 40:50 (F:C < 1). This compares with some species of brown algae belonging to the genus *Cystoseira* (Table 1) in which the ratio F:C is always high, fucosterol being the major sterol for all the previously described Phaeophyceae. *P. vickersiae* is in fact the first exception with cholesterol as the major sterol. It was, therefore, interesting to study the seasonal variation of the sterol content of this alga. This seasonal variation was marked by an increasing yield of sterols during the growth of the alga (Table 1), as observed for most secondary metabolites in microorganisms, usually stored just before the resting phase. Another interesting fact was the decrease of the sterol content of *P. vickersiae* with depth, confirming the results observed for *Cystoseira zosteroides* (Table 1). The ratio F:C, ranged from 2.5 to 0.7, and was very low for a Phaeophyceae species and the ratio decreased with depth and with the season from March to July. A similar variation was observed for the Mediterranean *Cystoseira elegans*, but the F:C ratios ranged from 38 to 12.

Thus *P. vickersiae* is an exception in the Phaeophyceae, with unusually high amounts of cholesterol all the season round. Cholesterol is even the major sterol at the later stages of the growth. However, it is not a general feature of the genus *Padina*. Indeed *Padina arborescens* [7] has already been described with fucosterol as the major sterol; for the Mediterranean *Padina pavonia* we observed more than 90% of fucosterol (F:C = 19).

EXPERIMENTAL

Algal material. Padina vickersiae (Hoyt) was harvested at Fann Cape near Dakar (Senegal) at the beginning of the month from

Table 1. Sterols of *P. vickersiae* and *Cystoseira* species

Samples	Date	Sterols %*	F:C†
C. zosteroides‡	May	0.02	7
C. tamariscifolia	June	0.07	18
C. fimbriata	Sept	0.11	26
C. mediterranea	June	0.08	38
P. vickersiae Fann Cape	May	0.06	1.7
P. vickersiae Sarene Cape§	May	0.04	1.2
Seasonal variation			
C. elegans	April	0.03	38
C. elegans	May	0.01	22
C. elegans	June	0.02	22
C. elegans	July	0.10	12
P. vickersiae	March	0.01	2.5
P. vickersiae	April	0.02	2
P. vickersiae	May	0.06	1.7
P. vickersiae	June	0.07	0.8
P. vickersiae	July	0.05	0.7

*Expressed as % of dry weight.
†F:C = fucosterol %:cholesterol %.
‡30 m depth.
§1 m depth.

March to July. The sample of *P. vickersiae* was harvested at Sarene Cape (100 km South Dakar) 1 m deep and *P. pavonia* (L.) Lamour was harvested near Perpignan at Banyuls-sur-Mer (French Mediterranean coast). *Cystoseira elegans* (from April to July), *C. fimbriata* and *C. mediterranea* were harvested at Banyuls-sur-Mer, *C. zosteroides* at Roche Torreilles (30 m deep) near Perpignan, *C. tamariscifolia* at Biarritz (French Atlantic coast).

Extraction. The freeze-dried algae were extracted with hexane using a Soxhlet apparatus and the solvent removed to yield the lipidic fraction.

Sterol analysis. After KOH–MeOH saponification of the lipid extract, the unsaponifiable residue was dried and silylated by HMDS + TMCS in pyridine. The sterol-TMSi derivative was submitted to GLC and GC/MS [8]. Sterols were identified by comparison with literature data [8, 9]. GLC on 1% OV-1, glass column (3 mm × 2.80 m) at 235°; N_2 flow of 30 ml/min (theoretical plates 2000/m); RR_t: cholesterol (1.00), 22-dehydrocholesterol (0.91), 24-methylenecholesterol (1.25), campesterol (1.28), stigmasterol (1.40) and fucosterol (1.60). GC/MS. on 1% OV-1, glass column (3 mm × 4 m), temperature 230° to 280° at the rate of 1°/min.

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