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Changes in Growth, Reproduction, Alginic Acid and Mannitol Contents of *Turbinaria decurrens* Bory

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Results obtained on the changes in growth, reproduction, alginic acid and mannitol contents of *Turbinaria decurrens* carried out for one year from March, 1973 to February, 1974 are presented. Young plants of *T. decurrens* appear in May and grow to a maximum size between December and February. Branching starts from August and maximum number of branched plants occur in November. Reproductive plants were observed throughout the year. The yield of alginic acid varies from 16.3 to 26.3 % and the estimated mannitol content from 1.5 to 8.7 %. *T. decurrens* may be harvested in the months between December and February for extraction of alginic acid.

Introduction

Along the Mandapam coast, the alginophyte *Turbinaria* is represented by three species, *Turbinaria conoides*, *T. ornata* and *T. decurrens*. Seasonal variations in growth, alginic acid and mannitol contents were observed in *Turbinaria conoides* (Umamaheswara Rao 1969) and *Turbinaria ornata* (Umamaheswara Rao and Kalimuthu 1972). In the third species *T. decurrens* observations were made on growth, fruiting cycle and oospore output for one year (Kaliaperumal and Umamaheswara Rao, unpublished). As information on the seasonal changes in the alginic acid and mannitol contents of *T. decurrens* is lacking, data were collected for one year from March, 1973 to February, 1974 on the growth and fruiting cycles and on the monthly changes in the alginic acid and mannitol contents. Results obtained for one year are dealt with in this paper.

Material and Methods

Turbinaria decurrens was collected from a rocky boulder, below the littoral zone in the Gulf of Mannar. Mean height of the plants and the percentage of fruiting plants in the population were estimated as described in an early paper on *Turbinaria ornata* (Umamaheswara Rao and Kalimuthu 1972). The plants were sun-dried, powdered and then used for chemical analysis. The method suggested by Suzuki (1955) was followed for the extraction of alginic acid. The estimation of mannitol was done by the per iodic acid method of Cameron *et al.* (1948). The analysis was repeated four times and the mean values are given on the dry weight basis.

Results

Monthly changes in growth, fruiting plants and yield of alginic acid and mannitol are shown in Fig. 1 and each of these can be summarised as follows:

Growth cycle:

Juvenile plants of *Turbinaria decurrens* were seen in May and their rate of growth was slow till July. From August the growth of the plants in the population became rapid and attained the maximum growth in February. The data collected on the mean height of the plants together with their standard deviation are plotted in Figure 1 A. While measuring the plants, data were collected on the percentage occurrence of branched and unbranched plants in the monthly samples (Fig. 1 B). Plants are unbranched between May and July. Later the branches were seen on plants from August and maximum number of branched plants occurred in November.

Reproductive cycle:

The reproductive structures, "Receptacles" usually appeared on the plants after attaining a minimum height of 7 cm. Fertile receptacles in the plants occurred in all months of the year and maximum number of reproductive plants was seen in the single peak period of the growth cycle, December–February. Figure 1 B shows the changes in the abundance of fruiting plants in the population of *Turbinaria decurrens* during the period from March 1973 to February, 1974.

Quantitative changes in the alginic acid and mannitol:

Figure 1 C shows the monthly changes observed in the alginic acid content of *Turbinaria decurrens*. The yield

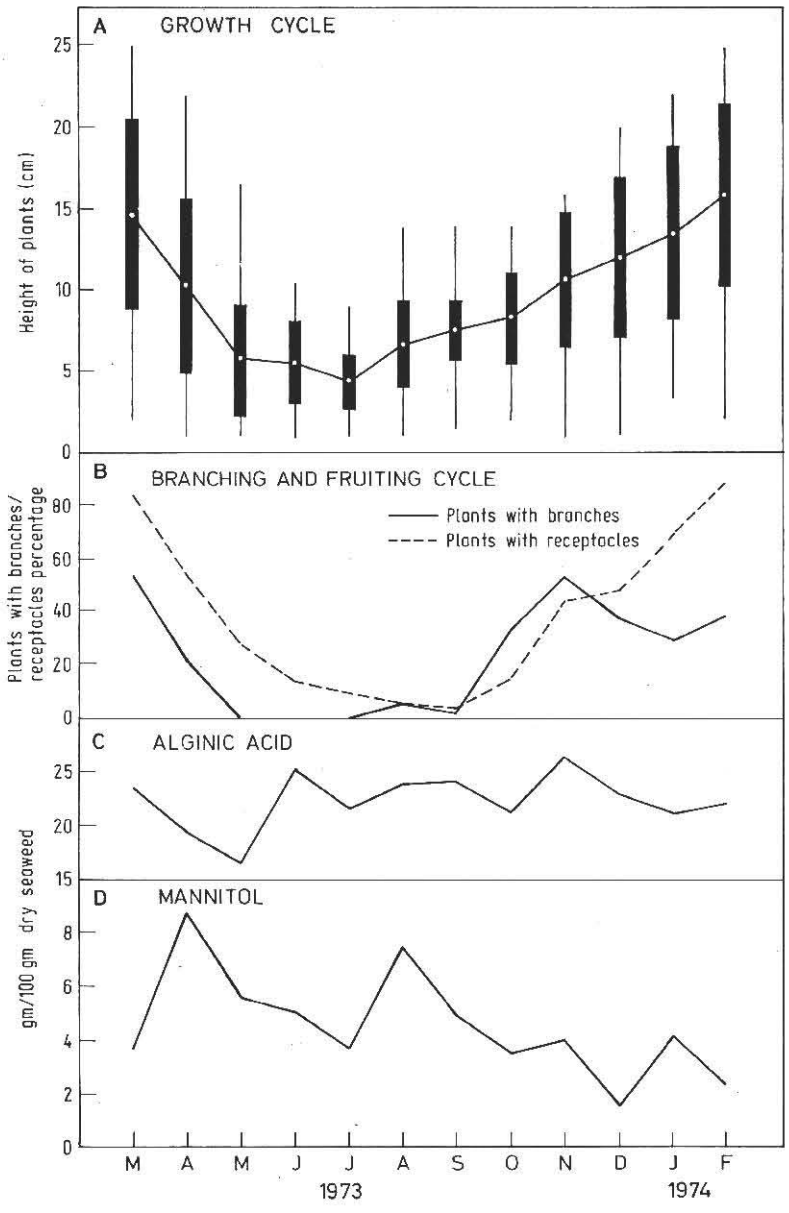

Fig. 1. Monthly changes in the mean height of the plants (A); Frequency of branched and fruiting plants (B); and in the yield of Alginic acid (C) and mannitol (D). The broad vertical lines in the growth curve (A) indicate the standard deviation of the mean values and narrow lines the maximum and minimum range in the samples analysed.

of alginic acid varied from 16.3 to 26.3% during the period of study. There are no marked changes in the yield of alginic acid during the period of this study and the values obtained are low in April and May, 1973.

Figure 1 D shows the monthly changes in the mannitol content of *Turbinaria decurrens*. The amount of mannitol varied from 1.5 to 8.7%, but the monthly changes are somewhat irregular. In general, the mannitol content in this alga appears to be high during the early stages of the growth cycle and low during the peak growth cycle.

Discussion

The results obtained in this study indicate that young plants of *Turbinaria decurrens* appear in May and grow to a maximum size of 12.09–15.78 cm between December and February. Branching starts from August and maximum number of branched plants occur in November. Reproductive plants are present throughout the year and the number of fruiting plants vary from month to month which closely agrees with the growth cycle of this alginophyte. In having a prolonged fruiting period it is similar to *Turbinaria ornata* (Umamaheswara Rao and Kalimuthu 1972). The growth and reproductive cycle in *Turbinaria decurrens* for the period March, 1973 to February, 1974 is found to be almost similar to that observed between March, 1972 to February, 1973. (Kaliaperumal and Umamaheswara Rao, unpublished).

The yield of alginic acid in *Turbinaria decurrens* varies from 16.3 to 26.3 % and it is low when compared with 23.2 to 35.6 % yield in *Turbinaria conoides* (Umamahes-

wara Rao 1969) and 22 to 33 % yield in *Turbinaria ornata* (Umamaheswara Rao and Kalimuthu 1972). The estimated mannitol is 1.5 to 8.7 % and it is high when compared with *Turbinaria conoides* and *T. ornata*. In brown algae mannitol content decreases with the development of reproductive structures (Jones 1957, Umamaheswara Rao 1969, Umamaheswara Rao and Kalimuthu 1972) and the irregular changes in mannitol observed in *T. decurrens* may be due to the presence of fruiting plants in all months of the year. From the information available on growth, reproduction and chemical changes, it may be concluded that the maximum growth period from December to February may be suitable for harvesting *T. decurrens* and for extraction of alginic acid along with the other commercially used alginophytes.

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