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C:N Ratio in Some Marine Macrophytes and Its Possible Ecological Significance

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Carbon and nitrogen levels have been determined for 24 species of intertidal benthic algae from the northwest coast of Spain, by means of an automatic C, H, N, combustion analyzer. These are presented here as a carbon to nitrogen ratio. Brown algae showed the highest mean values among the non-calcified algae. The rate of production of a given alga and its C:N ratio shows an inverse relationship. There was no evident relationship between the level at which a given alga was growing in the intertidal, and the C:N ratio. Older thallus parts showed a greater C:N ratio than did younger parts.

Introduction

The hydrographical significance of C:N ratios has been considered by a number of authors (Parsons and Strickland 1962, Provasoli 1963, Menzel and Ryther 1964, Trevaillon 1967, Flemmer and Biggs 1971, Quazim and Sankaranarayanan 1972, Banse 1974, and Fraga, in press), who have been concerned with the relationship between the levels of these elements in organisms and their recycling in aquatic habitats. Parsons *et al.* (1961) studied the organic composition of eleven planktonic algae cultured in the laboratory, and Mann (1972) has considered the C:N ratio as related to phenological observations.

Materials and Methods

Twenty-four species of benthic algae were collected from intertidal rocks in Vigo Bay, N.W. Spain (Tab. 1). All collections were made during the last week of January, and were processed for analysis on the same day as they were collected. The plants were dried at 80 °C for 3 hours, then ground manually to a homogeneous fine powder, and ultimately dried further at 100 °C. The dried and powdered samples were then introduced for combustion in a C, N, H, Perkin-Elmer 240 autoanalyzer. The accuracy of the analysis was verified by running known samples of glutamic acid and other amino acids (Fraga, in Press). The combustion temperature used was 840 °C.

Multiple samples of the most important species (sense from Whittaker 1965) from the intertidal communities sampled were studied, so that an evaluation of statistical variation could be obtained.

Results

The percentages of dry matter separated into carbon (1), nitrogen (2), and hydrogen (3) along with the C:N ratio (4) are presented in Figure 1. It will be seen that the amounts of carbon and nitrogen show a low positive correlation value (r equals 0.48). A graphic presentation of a regression analysis (according to the methods used by Fraga, in press) is shown in Figure 2. The formula derived from Figure 2 is that in the following equation:

$$(1) \qquad C = 5.39\,N + 12.43$$

There were significant differences found between the C:N ratio in the brown algae studied and other groups (Chlorophyta and Rhodophyta). The brown algae appear to have a lower nitrogen content than red and green algae (Fig. 1 and 2).

Discussion

Low C:N ratios are characteristic of those phases in algal growth cycles when there is a rapid increase in biomass, while higher values pertain when there is low productivity. Mann (1972) found these same trends for *Laminaria digitata* and *L. longicruris* during favorable and unfavorable growth seasons.

It seems logical to infer that the position in which an intertidal alga is growing would influence the C:N ratio because those at high intertidal sites would have thicker cell walls than those at lower less exposed levels. This seems to be the case for *Pelvetia canaliculata, Fucus spiralis* and *Himanthalia elongata*; however, greater C:N ratios were found in species below or near the mean tide