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Growth and Reproduction of *Dictyota binghamiae* J. G. AGARDH

M. FOSTER, M. NEUSHUL, and E. Y. CHI

Department of Biological Sciences, University of California, Santa Barbara, California 93106

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Introduction

Dictyota binghamiae J. G. AGARDH (1894: 72) is one of the largest species of this widely distributed and common brown algal genus. It is found in the sublittoral, growing at depths from the sublittoral fringe down to 38 m (SMITH, 1969). The species is confined to and widely distributed along the Pacific Coast of North America, ranging from Godkin Pt., Hope Island, British Columbia (NORRIS and ABBOTT, 1972) to central Baja California (DAWSON, 1961). We have found that in the Santa Barbara area this plant is most abundant at depths of 6—8 m, growing on rocks exposed to moderate surge or current.

The present study was undertaken in part to provide a more complete description of the vegetative and reproductive morphology of this plant than has heretofore been available. In addition, vegetative growth rates were measured and the formation and release of gametes and spores was studied. Hopefully the results obtained will contribute to a better understanding of the biology of a plant that has been the subject of some taxonomic confusion in the past (DAWSON, 1950a; b) and which is a common member of the local kelp bed community.

Materials and methods

Plants used in the experimental parts of this study were collected by divers from a depth of 4—18 m on Naples Reef, a rocky offshore shelf located 4 miles west of the university campus. The plants were transported to the laboratory and placed in running seawater culture facilities described in detail elsewhere (NEUSHUL and DAHL, 1967).

Growth rates under laboratory conditions were determined using branches from 3 plants collected on 9/28/67 from a depth of 9 m. One large dichotomous branch was selected from each plant and placed in a greenhouse culture tank maintained at $15 \pm 2°C$. The sunlight intensity was reduced with a neutral density screen to give an intensity of approximately 3000 ft-c at noon as measured by a Weston Sunlight Illumination Meter, Mod. 756. The tank was supplied with running sea water which entered at a rate of 0.5 l/min. Moderate surge conditions were simulated by attaching the branches to vertical rods which were moved back and forth through the water by a rotating crank. The apparatus created a sinusoidal velocity change of the water relative to the branches having a maximum speed of about 0.3 m/sec.

Growth was measured using a contact printing process. Sheets of Kodak single weight studio proof photographic paper (F) were placed in transparent plastic bags. Branches were removed from the water and spread out flat over the bags. Then the whole assembly was exposed to sunlight or bright artificial light. After exposure, the plants were immediately returned to the water and the paper was fixed in regular photographic fixing solution. The process produces a clear image of the branch on the paper. Prints were made of the 3 branches at the beginning of the growth experiment. After 11 days, the branches were again printed. All tips were numbered on the prints for identification. Ten terminal and ten lateral tips were selected at random from each branch for measurement. For the purpose of this experiment a tip was considered "lateral" if the branch it was on was shorter than the other branch in the dichotomy (Fig. 1). Terminal and lateral branch growth was determined from the prints by measuring from a given tip to the nearest basal dichotomy below the tip (Fig. 1). Growth was then calculated by subtracting measurements on the first prints from measurements on the second. In addition, the number of new apices produced by each tip during the experiment was determined to give an indication of meristematic activity.

The development and release of reproductive structures was studied in dish culture. Pieces of branches with sori

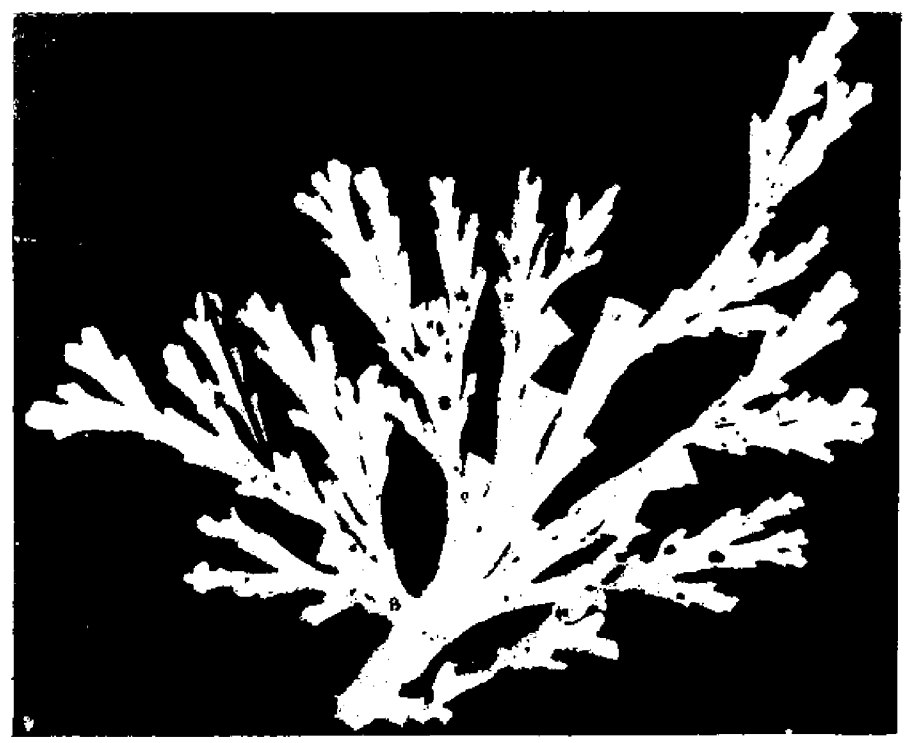

Fig. 1
Contact print of a *D. binghamiae* branch. The black numbers were used in identifying tips in successive prints (not all tips were labeled in this print). The double arrow shows a typical length measurement from a terminal tip to the nearest basal dichotomy. A lateral tip (L) is indicated. Scale = 5 cm.