Actes del Simposi Internacional de Botanica Pius Font i Quer, 1988. Vol. 1. Criptogamia: 73-76.

An endophytic *Streblonema (Phaeophyta)* associated with galls in *Fucus spiralis (Phaeophyta)* from the Canary Islands

J. AFONSO-CARRILLO, M. SANSON, M. C. GIL-RODRIGUEZ, M. CHACANA & J. REYES
Department of Vegetal Biology, University of La Laguna, 38271 La Laguna, Canary Islands.

Abstract

Un *Streblonema (Phaeophyta)* endofítico asociado con agallas en el *Fucus spiralis* en las Islas Canarias.

Se observaron agallas verrucosas de 1-7 mm de diámetro en el engrosamiento central de plantas de *Fucus spiralis*. Las agallas presentan una estructura radial no organizada, debido a la elongación y división de las células corticales. Todas las plantas de *Fucus spiralis* con agallas presentaron filamentos de *Streblonema sp.*, creciendo entre las células del hospedante. Sin embargo, en ausencia de evidencias experimentales, la relación entre la existencia de agallas y la presencia de filamentos endofíticos de *Streblonema* es incierta.

Summary

Galls observed in *Fucus spiralis* are wart-like protrusions 1-7 mm in diameter, restricted to the midrib of mature plants. Gall structure consists of a radial and unorganized growth of the cortical tissue as a result of the cells enlargement and division. Plants of *F. spiralis* bearing galls were always collected with *Streblonema sp.* filaments growing between host cells. But the relation between the occurrence of galls in *Fucus* and the presence of endophytic filaments of *Streblonema* remain uncertain in the absence of experimental evidence.

INTRODUCTION

Diseases caused by different organisms (fungi, bacteria, nematodes of parasitic algae) have been described in some seaweeds (ANDREWS, 1977). Among the marine algae several species of the endophytic filamentous genus *Streblonema* Derbès et Solier *(Ectocarpales, Phaeophyta)* have been reported to be pathogens on macrophytes.

Streblonema aecidioides De Toni induce a brown spot disease on *Undaria* (YOSHIDA & AKIYAMA, 1979); *S. scabiosum* Stechell et Gardner induce circular distortions on *Nereocystis* (SETCHELL & GARDNER, 1922) and an undescribed *Streblonema sp.* is associated with the presence of galls on *Nereocystis, Macrocystis* and *Laminaria* (ANDREWS, 1977; APT, 1988). A gall results from an abnormal growth of cells by hypertrophy (enlargement) and hyperplasy (proliferation), resulting in a structure that has a pronounced departure from normal morphology.

The present investigation was prompted by the collection, in the Canary Islands, of numerous plants of *Fucus spiralis* bearing abundant galls. These galls may be related to the presence of endophytic *Streblonema*-like filaments. In this work general features on the morphology and the anatomical structure of galls are reported, and some aspects of the endophytic filamentous algae are described. Nevertheless, ethiological aspects have not been investigated.

MATERIALS AND METHODS

Data were obtained from plants of *Fucus spiralis* with galls collected in La Tejita and El Médano (Tenerife, Canary Islands). Anatomical studies were carried out on selected fragments fixed in 4% formalin in sea-water. Sections 20-25 μm thick, were cut and stained with 5% aqueous aniline blue and mounted in 20% aqueous «Karo» dextrose.

OBSERVATIONS AND DISCUSSION

Single or irregularly grouped galls were found on the proximal region of *Fucus spiralis* plants (Photo 1). They are restricted to the stipe-like midrib of mature plants but occasionally occur on the more basal flattened fronds. Galls were never seen on the holdfasts. Outgrowths appear as rounded or flattened, wart-like protrusions 1-7 mm in diameter (Photo 2).

The first visible stage of galls development is a slight elevation on the midrib surface. This elevation and

posterior unorganized growth are derived from cells placed below the epidermal region. Obvious differences occur between galls anatomy and the midrib normal anatomy. In section, the midrib normal anatomy consists of a thick central medula, a thin cortex and a monostromatic epidermal layer (Photo 3). Gall sections show a radial and unorganized growth of the cortical tissue as a result of the cells enlargement and division (Photo 4). At the gall marginal region cortical cells are larger and colorless. The epidermal layer is absent.

Plants of *F. spiralis* bearing galls were always collected with *Streblonema sp.* filaments growing between host cells. No filaments were observed in plants without galls. Filaments are invariably present in early stages of gall development (Photo 5) and in the midrib normal tissue of plants bearing galls (fig. 1). Nevertheles, they are usually absent in mature galls. *Streblonema sp.* filaments grown near the surface, penetrating only a short distance or forming a thick layer of matted filaments on the surface. Filaments are irregularly branched, with cells 7-14 μm long by 4-7 μm in diameter. Uniseriate plurilocular sporangia (fig. 2) 30-32 μm long by 9-10 μm in diameter and hairs up to 240 μm long are present. Unilocular sporangia were not observed.

Galls observed in *F. spiralis* are the result of an abnormal hypertrophic and hyperplasic growth of cortical cells. These galls appear to be associated with the presence of an endophytic filamentous *Streblonema*-like algae. Actually, identification of *Streblonema sp.* is considered tentative. Placement into this genus is based on the unspecialized endophytic nature of filaments. Occurrence of galls on marine algae associated with endophytic brown filaments algae have been reported in some Phaeophyta genus (*Cystoseira, Laminaria, Nereocystis* and *Macrocystis*). Similar galls have not been previously reported in *Fucus*. According to ANDREWS (1977) and APT (1988) only one organism (*Streblonema sp.*) has been isolated from internal galls tissue. Galls studied by APT (1988) in *Nereocystis* have filaments of *Streblonema sp.* during all stages of gall development (forming a dense pseudoepidermal layer on the surface of mature galls) and no filaments occur in normal tissues. Nevertheless, galls studied in *Fucus* have *Streblonema sp.* filaments mainly in early stages, but also occur in normal tissue and they are rare in mature galls. The relation between the occurrence of galls in *Fucus* and the presence of endophytic filaments of *Streblonema* is unclear and remains uncertain. Further studies and experimental evidence are needed before this matter can be firmly settled.

REFERENCES

ANDREWS, J.H. 1977.— Observations on the pathology of seaweeds on the Pacific Northwest. *Can. J. Bot.*, 55: 1019-1027.

APT, K.E. 1988.— Etiology and development of hyperplasia induced by *Streblonema sp. (Phaeophyta)* on members of the Laminariales *(Phaeophyta). J. Phycol.*, 24: 28-34.

SETCHELL, W.A. & GARDNER, N.L. 1922.— New species of *Pylaiella* and *Streblonema*. Phycological contributions V. *Univ. Calif. Publ. Bot.*, 7: 385-402.

YOSHIDA, T. & AKIYAMA, K. 1979.— *Streblonema (Phaeophyceae)* infection in the frond of cultivated *Undaria (Phaeophyceae)*. In Jensen, A. & J. R. Stein (Eds.), *Proceedings of the ninth international seaweed symposium*, Science Press, Princeton: 219-223.

Accepted: June 1989

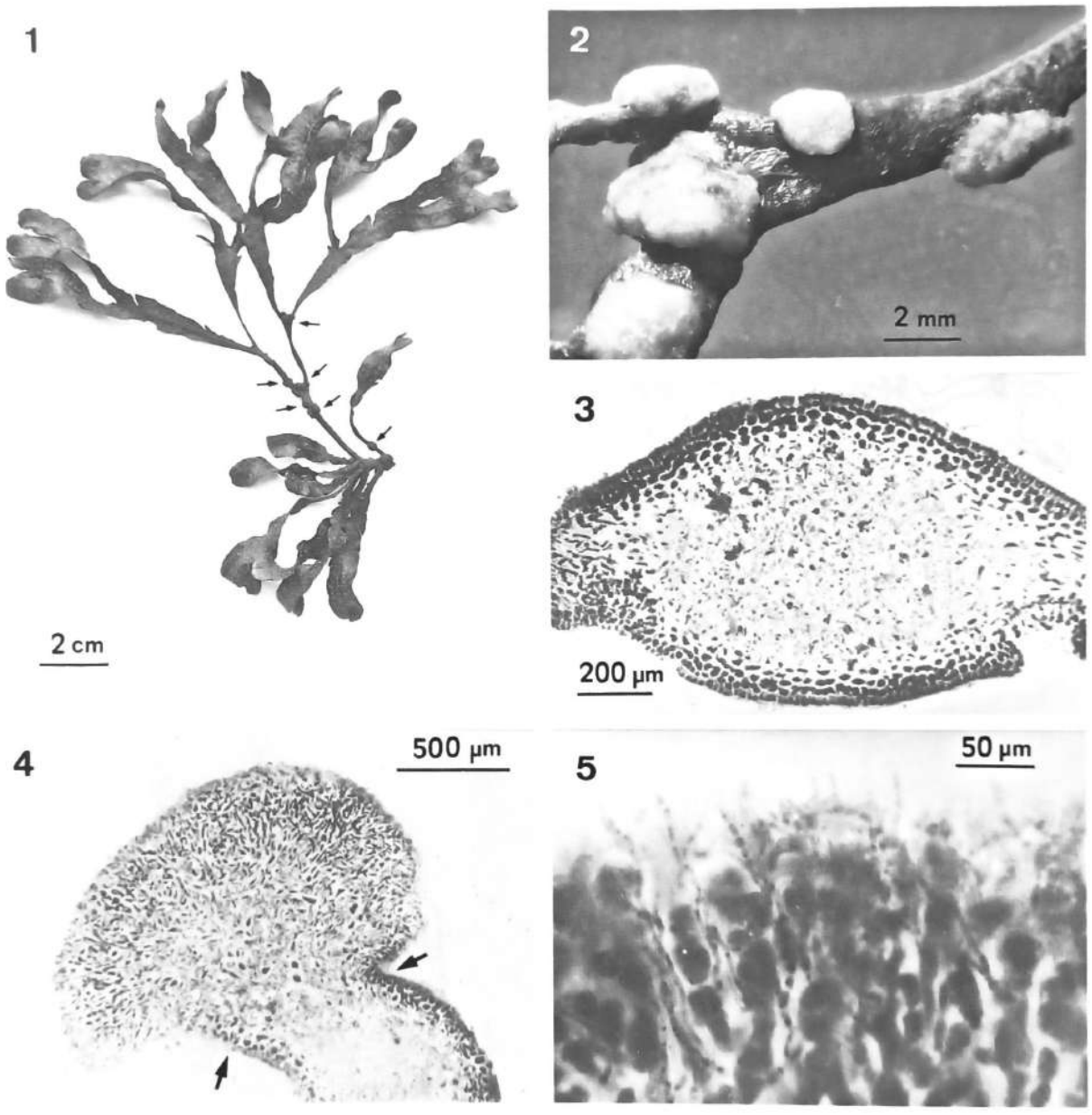

Photo 1-5: Galls and *Streblonema sp.* filaments in *Fucus spiralis*. 1. Plant of *Fucus spiralis* showing numerous galls (arrows) on the midrib. 2. Detail of midrib bearing several galls. 3. Transverse section of normal midrib tissue. 4. Transverse section of developing gall tissue on midrib. Arrows mark the base of gall tissue. 5. *Streblonema sp.* filaments penetrating between host cells in early stages of gall development

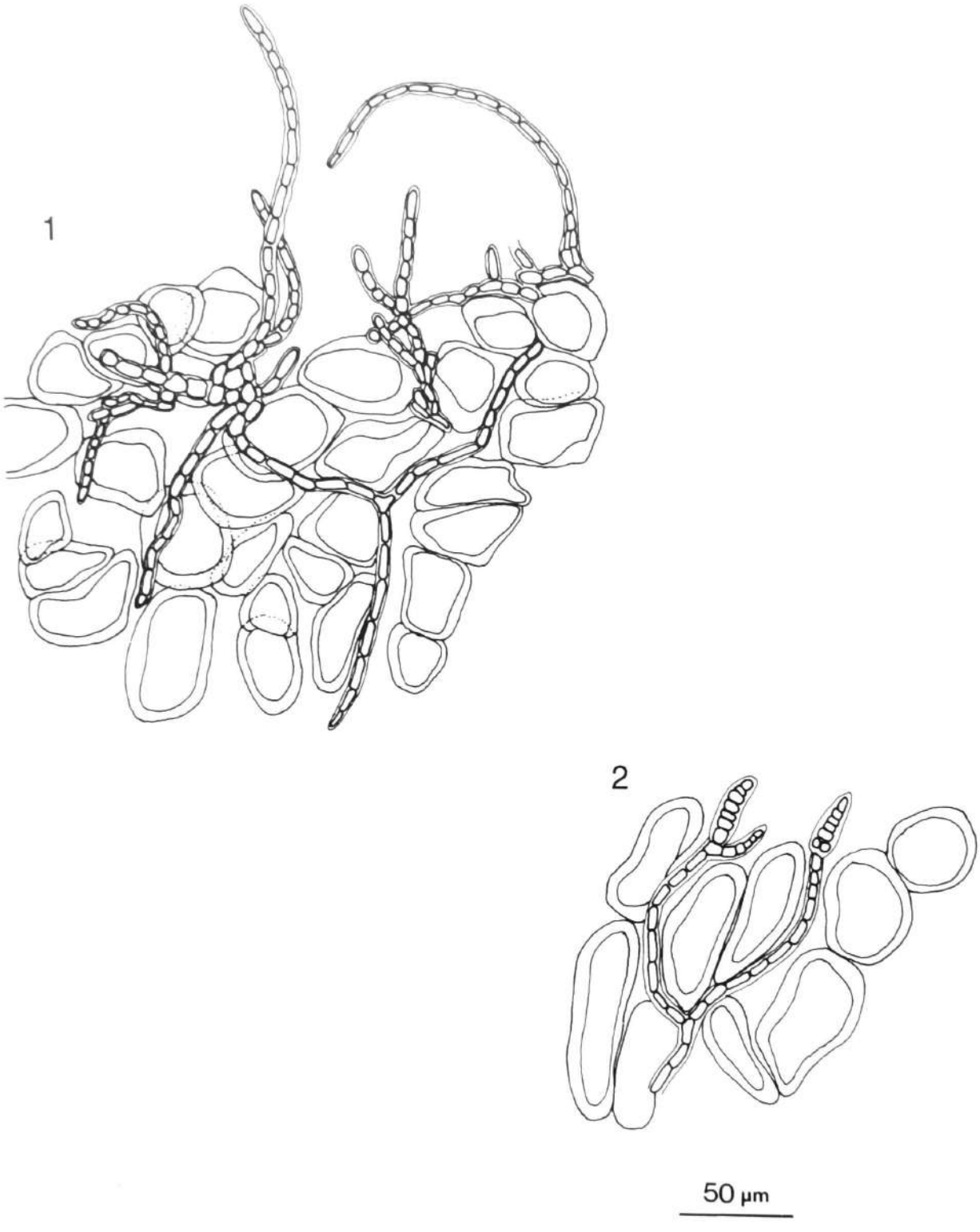

Fig. 1-2: Transverse section of midrib showing *Streblonema sp.* filaments. 1. *Streblonema sp.* filaments penetrating between host cells of normal tissue. 2. *Streblonema sp.* filaments with plurilocular sporangia