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Existence of plants bearing tetrasporangia and spermatangial receptacles (mixed phases) in the genus *Laurencia* Lamouroux (Rhodomelaceae)

by

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With 9 figures

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Abstract: With the aim of determining the phenology of *Laurencia pinnatifida* (Hudson) Lamouroux, in Tenerife (Canary Islands), a periodical observation was carried out during one year, in which sterile, male, female, tetrasporangial and mixed phases plants were observed.
The existence of specimens bearing tetrasporangia and spermatangial receptacles (mixed phases) constitutes a novelty within the genus *Laurencia* Lamouroux.

Resumen: Con la finalidad de conocer la fenología de *Laurencia pinnatifida* (Hudson) Lamouroux, en Tenerife (Islas Canarias), se realizaron recolecciones periódicas durante un año, observándose plantas tetrasporangiales, estériles, masculinas y femeninas. Así como ejemplares portadores de fases mixtas (tetrasporangios y espermatangios), constituyendo estos una novedad para el género *Laurencia* Lamouroux.

Introduction

The existence of tetrasporophyte plants with male organs is frequently recorded in Florideophyceae. It has also been reported that in some Rhodomelaceae female sexual organs and tetrasporangia are found on the same thallus. These variations occur frequently and abundantly in *Callithamnion, Polysiphonia,* and others and are called "mixed phases". For a phenological study, we are currently carring out research on species of *Laurencia* on Tenerife Island. During one year we have periodically collected samples of *Laurencia pinnatifa* (Hudson) Lamouroux. We have encountered some plants that show characters which have not been observed before in this genus.

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Material and methods

Once gathered and carried to the laboratory, the specimens were placed in aerated aquaria filled with sea water and illuminated with natural light, at the same temperatures as in the natural habitats of the plants. Immediately some specimens were checked for life-history studies.

Voucher specimens were preserved in 4% formalin and others were dried and deposited in the Herbarium at the University of La Laguna, Dpto. of Vegetal Biology (Botany), Tenerife, Canary Islands.

Results

Laurencia pinnatifida (Fig. 1) is an widely distributed species that has been studied by several authors (Boergesen 1930, Díaz-Piferrer 1970, Lawson & John 1982 and Saito 1982). It is characterized by its thick thallus, its cartilagineous consistency and its brown-red colour. The thalli are compressed, becoming cylindrical towards the base. Dichotomous branching is irregular and the branches have short obtuse apiculate branchlets.

The longitudinally elongated epidermal surface cell have no secondary pit-connections. They are neither protuberant nor do they show a palisade arrangement. There are no "corps en cérise", but iridescent bodies are observed. The cortical cells are isodiametric, while the medulla cells are long and narrow, with thick walls and with lenticular thickenings.

Tetrasporophytes bear tetrasporangia on simple stichidial branches (Fig. 2), showing adaxial development and parallel arrangement (Fig. 3).

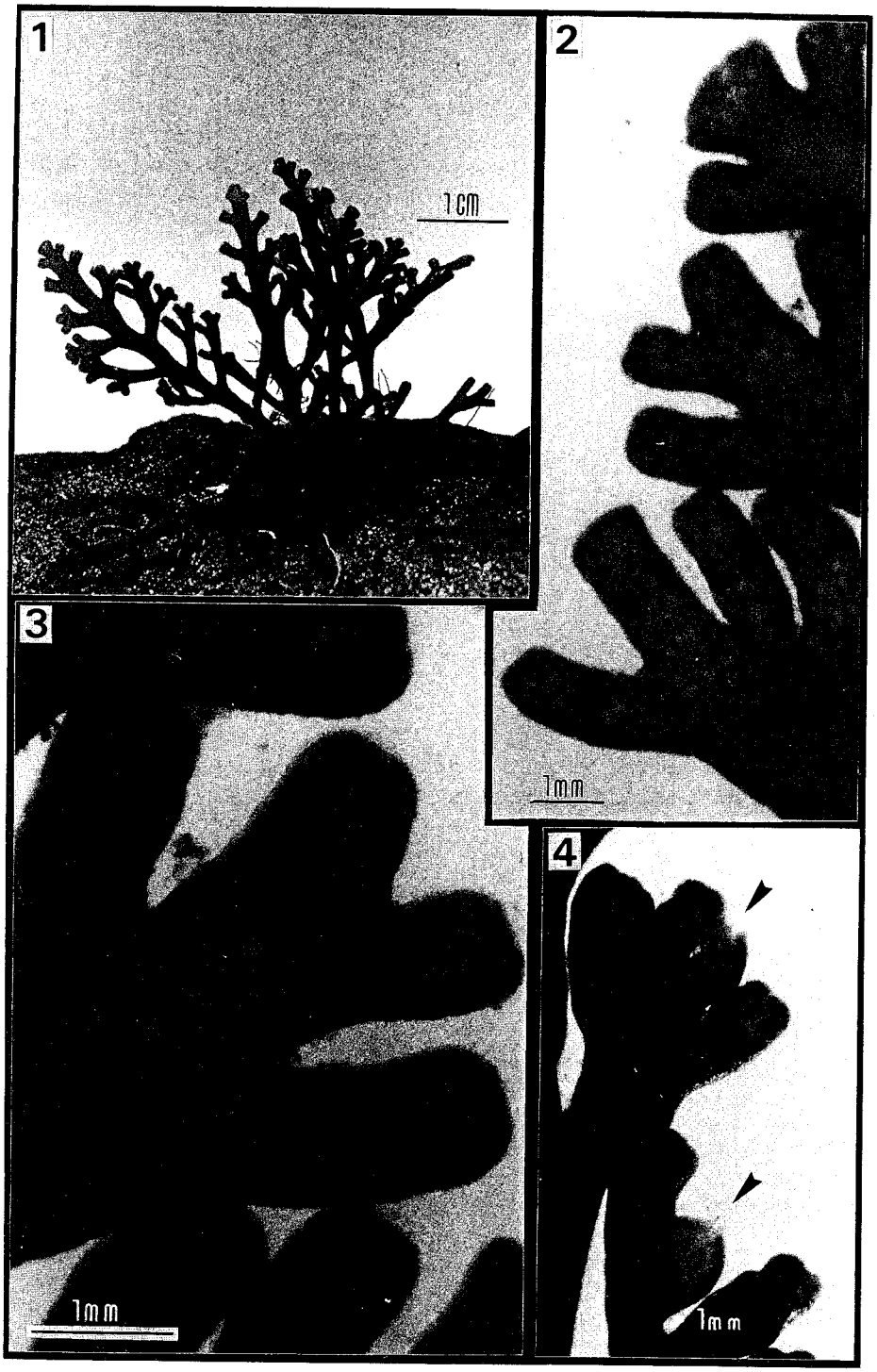
Female gametophytes have sessile, urceolate cystocarps with enlarged bases and single apical pores (Fig. 4). The cystocarps are laterally arranged on the ultimate branchlets. Male gametophytes bear cup-like (Saito 1969) terminal spermatangial receptacles (Fig. 5).

This taxon is well represented in the intertidal zone near Puerto de la Cruz (Northern Tenerife) (Fig. 8) where we have samples 400 specimens each month in the years 1990 and 1991. This sampling programme was set up to study the reproductive biology of *Laurencia pinnatifida.*

Phenological studies showed that sterile, tetrasporophytic and male plants were present all year round (Fig. 9). Female specimens were observed between November and June (Fig. 9), when also the largest frequency of male individuals was found.

Furthermore, there are specimens that show mixed phases: both male and tetrasporangial structures together on a single plant (Fig. 6). These mixed phases, which only occurred occasionally, were observed in the period between October and April.

Figs 1-4. *Laurencia pinnatifida* (Hudson) Lamouroux. - Fig. 1. Aspect of a plant. Fig. 2. Tetrasporangial branches. Fig. 3. Tetrasporangia in parallel lines. Fig. 4. Cystocarps (arrowheads).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Tetrasporangia and male receptacles occurred simultaneously, either on different branches (Fig. 7) or on the same one (Fig. 6). The mixed plants show cup-like receptacles (Figs 6-7). One or two of these receptacles were observed per plant, which may thus be defined as a tetrasporophyte bearing male branches. The abundance of mixed phased in *Laurencia pinnatifida* oscillated between October 1990 and April 1991. Out of 400 plants collected in December, 20 were of the mixed phase type.

Conclusion

A simultaneous existence of sexual organs and tetrasporangia on the same thallus has been reported in many occasions in the Florideophyceae, since Agardh (1863) observed this phenomenon for the first time in *Polysiphonia* Greville (Kniep 1928; Knaggs 1969). Mixed female and tetrasporangial phases have been described in many different species: e.g. *Callithamnion corymbosum* (Smith) Lyngbye (Hassinger-Huizinga 1952) and *Polysiphonia atlantica* Kapraun & Norris (as *Polysiphonia macrocarpa* Harvey; Pérez-Cirera 1982).

The existence of the mixed phases with male and tetrasporangial phases have less frequently been reported. West & Norris (1966) described this phenomenon in *Scagelia occidentale* (Kylin) Wollaston (as *Antithamnion occidentale* (Kylin) and Price (pers. com.) found it rather often in *Callithamnion* spp. Most of the references involve members of the Rhodomelaceae, but none has been found concerning the genus *Laurencia* so far. Therefore, this is the first record of simultaneous occurrence of tetrasporangia and male sexual organs in *Laurencia* thalli.

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Figs 5-7. *Laurencia pinnatifida* (Hudson) Lamouroux. - Fig. 5. Cup-like spermatangial receptacles (arrowheads). Fig. 6. Plant bearing spermatangial receptacles (arrow) and tetrasporangia (arrowhead) on the same branch. Fig. 7. Plant bearing spermatangial receptacles (arrow) and tetrasporangia (arrowheads) on different branches.


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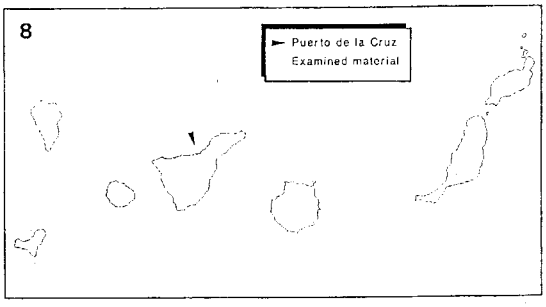

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○ Sterile plants
⊕ Tetrasporophytes
⊖ Mixed phases
♀ Female gametophytes
♂ Male gametophytes

	○	⊕	⊖	♀	♂
JAN	+	+	+	+	+
FEB	+	+	+	+	+
MAR	+	+	+	+	+
APR	+	+	+	+	+
MAY	+	+	–	+	+
JUN	+	+	–	+	+
JUL	+	+	–	–	+
AUG	+	+	–	–	+
SEP	+	+	–	–	+
OCT	+	+	+	–	+
NOV	+	+	+	+	+
DEC	+	+	+	+	+

Fig. 8. Puerto de la Cruz (Tenerife) (arrowhead). Sampling area. - Fig. 9. Phenology of *Laurencia pinnatifida* (Hudson) Lamouroux in Puerto de la Cruz (1991).

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