Phycologia (1986) Volume 25 (1), 81–86

Lessonia trabeculata sp. nov. (Laminariales, Phaeophyta), a new kelp from Chile

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E. VILLOUTA AND B. SANTELICES 1986. *Lessonia trabeculata* sp. nov. (Laminariales, Phaeophyta), a new kelp from Chile. *Phycologia* **25**: 81–86.

A new species of *Lessonia*, *L. trabeculata* Villouta et Santelices is described from Chile. The two most important characters segregating this new species from all other species of *Lessonia* are the presence of trabeculae in the cortical lacunae of blades and stipes, and holdfast morphology, which is massive and irregularly shaped. This species extends at least from Antofagasta (*c.* 23°S) to near Puerto Montt (*c.* 40°S) along temperate Pacific South America. The plants grow to 2.5 m long often forming extensive kelp beds at depths ranging between 0.5 and 20 m.

INTRODUCTION

The genus *Lessonia* is restricted to the southern hemisphere with one species in New Zealand (*Lessonia variegata* J. Agardh), one in the Tasmanian region of Australia (*Lessonia corrugata* Lucas) and three species in South America. The morphological variability present in the species of *Lessonia* led to a multiplication of names and much taxonomic confusion, especially among South American taxa (Bory 1826, 1827–1829; Montagne 1852; Skottsberg 1907, 1921; Etcheverry 1951). Recently, through a combination of morphological characters and patterns of ecological and geographical distribution, Searles (1978) recognized three species in South America: the deep water *L. flavicans* Bory, the shallower *L. vadosa* Searles and the intertidal *L. nigrescens* Bory. Both *L. vadosa* and *L. flavicans* are restricted to the southern tip of South America, extending in the Pacific from Canal Trinidad (49°S) south to Cape Horn (55°S) and north to *c.* 47°–48°S on the Atlantic coast. *L. nigrescens* occurs along the Pacific coast of South America from central Perú to Cape Horn. A fourth entity, occurring subtidally along central Chile was also mentioned by Searles. His collection was small and he suggested that this material might be a different species.

Several other workers had already noticed individuals of this subtidal species along the central Chilean coastline. Commonly it was assigned either to *Lessonia flavicans* or to *L. fuscescens* (Montagne 1852; Etcheverry 1951; Alveal 1970, 1971; Alveal *et al* 1973; Romo & Alveal 1977; Antezana *et al* 1985; Kim 1971; Westermeier 1981). No voucher specimens were preserved in any of these studies, however, for comparisons with populations from southern Chile. Extensive field work carried out in southern South America (Santelices & Ojeda 1984a, 1984b; Ojeda & Santelices 1984; Vásquez *et al* 1984) allowed us to contrast typical *Lessonia flavicans* with the deep water form occurring along central Chile, and to agree with Searles' opinion that this was a distinct entity. An account of this undescribed species of *Lessonia* is provided here. The ecological importance of this species along the Chilean coastline has been reported elsewhere (Villouta & Santelices 1984).

MATERIALS AND METHODS

A total of 21 sites were visited from June 1981 to December 1983 along the Chilean coastline between 23°S and 54°S. Individuals of *Lessonia trabeculata* sp. nov. were collected from depths of 0.5 to 20 m at 15 of these localities and gathered as drift material at five other places (see Villouta & Santelices 1984 for details). The species was found at all collection sites between Antofagasta (23°S) and Osorno (40°S), but it was absent from the southernmost localities visited (Beagle area, 54°S).

The description of external morphology is based on 73 specimens collected in Caleta Coloso (Antofagasta), Los Molles and Horcón. For comparative analysis, 48 individuals of *L. nigrescens* from Los Molles, and 17 individuals of *L. vadosa*

Fig. 1. Holotype of *Lessonia trabeculata* sp. nov. Adult sporophyte (MNHN SGO 102908).

as well as 15 individuals of *L. flavicans,* both from Canal Beagle, were also studied.

Sections for microscopic studies of internal morphology were made using freezing and paraffin techniques (Johansen 1940). The diagnostic value of histological characters was tested in 62 individuals of *L. trabeculata*; 31 of *L. nigrescens,* 15 of *L. vadosa* and 15 of *L. flavicans.*

DESCRIPTION

Lessonia trabeculata sp. nov.

Plantae adultae forma arborescente, ad altitudinem 2.5 m. Hapteron massivum generatim foratum cavitativus irregularibus, structum hapteris omnino fusis. Stipes numero variabili inter 1 et 30 (raro 47), sectione basali circulari, aut subcirculari, ramosis dicotomica, aut subdicotomica forma. Laminae lineales, aut lineo-lanceolata, marginibus aequalibus, aut dentatis, latae a 9 ad 86 mm indivisae laminae, et, inter 17 et 124 mm eae in decursu divisionis. Cortex stipitum laminarum, et aliquoties hapteriorum cavitatibus mucilaginosis. Cavitates mucilaginosae stipitum et laminarum, communiter trabeculatis. Parafises sororum sporangialum longae inter 42 et 59 μm, et latae inter 5 et 8 μm. Plantae iuvens stipitibus sectione basali complanata et haptero structo hapteriis non aut partim fusis.

Sporophyte erect, shrubby to tree-like, up to 2.5 m long (Figs 1 and 2); attached to the substratum by a massive holdfast, formed by fused haptera, 13–20 cm high. A variable number (usually 1–29, rarely 47) of rounded, slightly flattened stipes arise from holdfast; stipes are strong and rigid, 3–4 times furcate to mid-portions, then repeatedly divided, dichotomously or subdichotomously, in the uppermost portions. Blades linear or linear lanceolate with smooth or dentate margins, 9–86 mm wide in undivided blades and between 17–124 mm in splitting blades. Sporangial sori formed as median bands along both surfaces of the blades. Young sporophytes sometimes with compressed stipes and flattened blades with conspicuous to fine dentate margins, and holdfast haptera free or only partially fused (Fig. 3). Juveniles (plants with holdfasts less than 15 cm in maximum diam.) with unfused haptera and most of the blades in splitting processes (Fig. 4). Cortex of stipes and blades with irregularly shaped lacunae often traversed by elongated, multicellular, fused sometimes branched filaments or trabeculae (Fig. 5) which arise from the innermost layer of cells in the lacunae.

HOLOTYPE: Adult sporophyte collected by Mr Julio Vásquez in April 1982 at 7 m depth in La Herradura de Guayacán, Coquimbo (29°58′S; 71°22′W) in Central Chile and deposited at the type collection of the Museo Nacional de Historia Natural in Santiago de Chile (MNHN SGO 102908) (Fig. 1).

ISOTYPE: At the collection of the Sala de Sistemática of the Pontificia Universidad Católica de Chile (SS/UC 5735-10).

ADDITIONAL MATERIAL EXAMINED: Plants collected along the coastline of Santa María Island, Antofagasta (23°26′S). Drift materials and plants gathered at 8 m deep. Collected by B. Santelices & E. Villouta, August 1981 (SS/UC 5735). Sporophytes collected at 8 m deep in Horcón, near Valparaíso (32°42′S) by E. Villouta (MNHN SGO 102909 and SS/UC 5736), August 1981. Plants collected at 8 m deep in Bahía Mansa, near Osorno (40°28′S) in May 1982 by E. Villouta (SS/UC 5745).

HABITAT: This species forms extensive subtidal

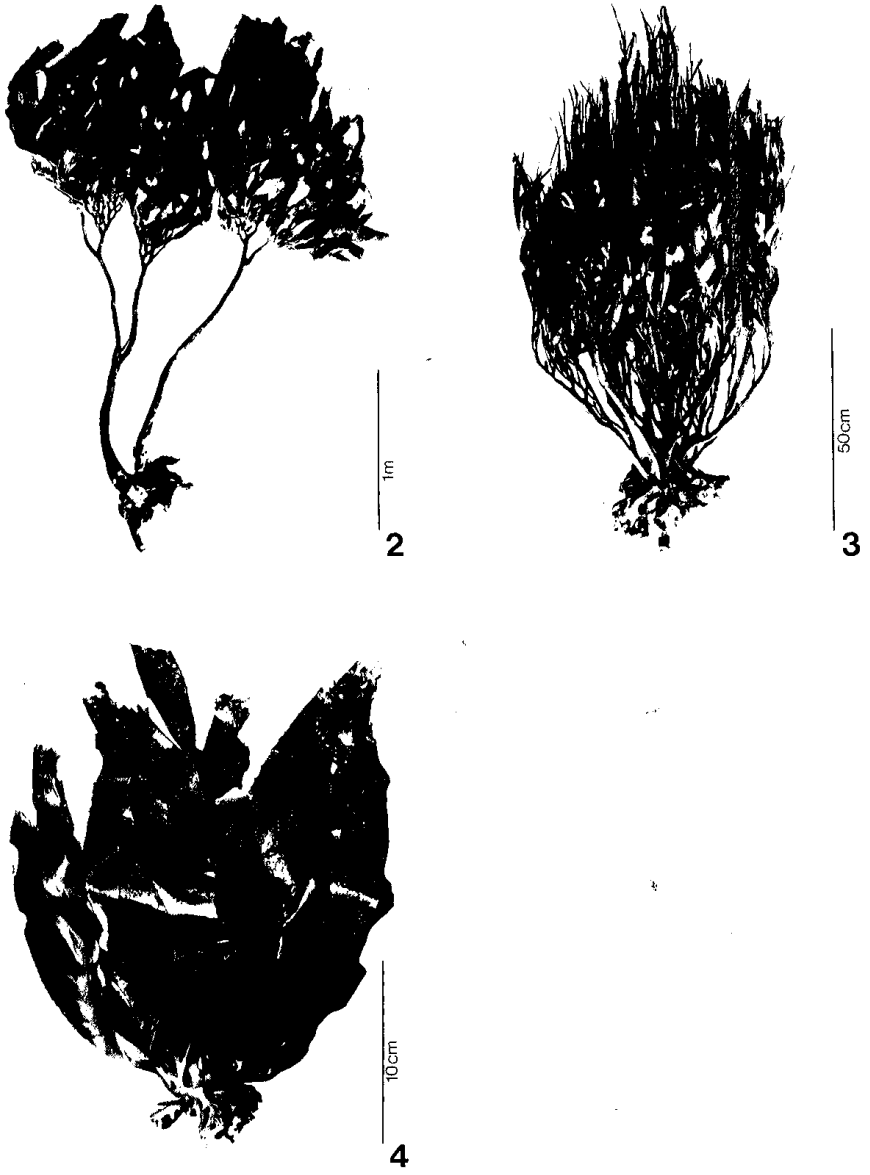

Fig. 2. Adult plant of *Lessonia trabeculata* sp. nov. with massive, asymmetrical holdfast and long and rigid stipes branched at the uppermost end. Plant collected at a depth of 8 m in Horcón in August 1981.

Fig. 3. Juvenile sporophyte of *Lessonia trabeculata* sp. nov. with unfused or partially fused haptera, many stipes and narrow blades. Plant collected at a depth of 7–8 m in Horcón in August 1981.

Fig. 4. Young sporophyte of *Lessonia trabeculata* sp. nov. with free haptera, compressed and short stipes and flattened blades with dentate margins. Plant collected at a depth of 2 m in Horcón in August 1981.

kelp beds on rocky bottoms in areas exposed and semi-exposed to heavy surge. This is the type of subtidal habitat most commonly found along northern and central Chile (20°S to 40°S) and, therefore, this species is the most important kelp in this area.

OBSERVATIONS AND DISCUSSION

The most obvious characters separating this species from all other known *Lessonia* species are the presence of trabeculae in the cortical lacunae of blades and stipes and the external morphology of the holdfast. Cortical lacunae were a constant feature in all the plants examined and at least 30% of all lacunae examined in any given plant had trabeculae. Sometimes these multicellular branched filaments were missing from the blades of a given specimen, but they were present in the cortical lacunae of the stipes. In general, however, trabeculae were more frequently found in cortical lacunae of the blades.

The external morphology of the thallus changes throughout the life of the plants. Young individ-

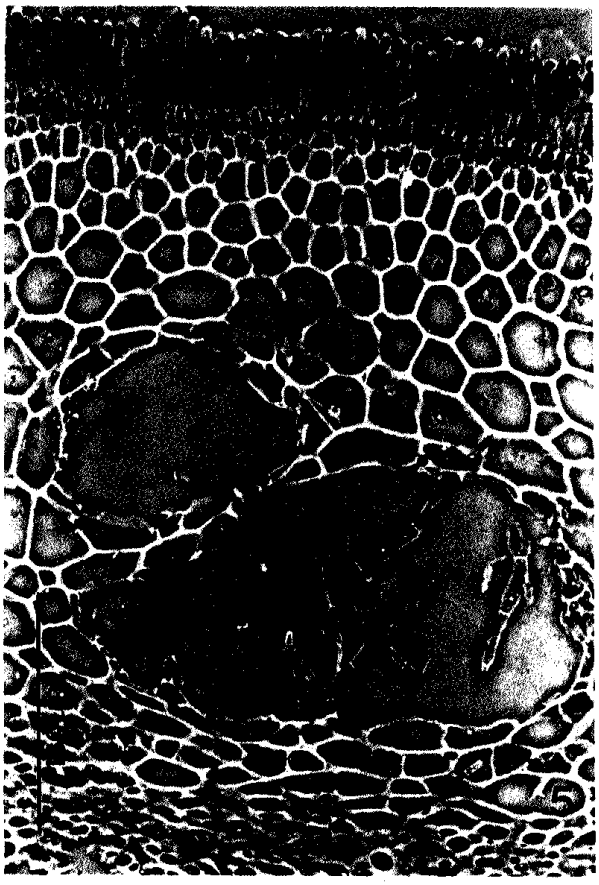

Fig. 5. Transection of a blade of *Lessonia trabeculata* sp. nov. showing the cortical lacunae and the elongated, multicellular filaments (trabeculae).

uals have many compressed stipes frequently with conspicuous to fine dentate margins and holdfast haptera free or only partially fused. As the plants grow older, there is a reduction in the number of haptera and blades. The holdfast shape changes due to hapteral fusion coupled with hapteral losses as a result of grazing by snails, sea urchins, limpets and crustacea. Simultaneously, stipe and blades elongate, but fish grazing reduces the number and length of blades and stipes. Thus, adult sporophytes normally show a few elongated stipes branched only in the uppermost portions. The holdfast is irregularly shaped, massive and asymmetrical, allowing the immediate separation of *L. trabeculata* from the other three species of *Lessonia* reported for South America. The holdfasts of *L. vadosa* and *L. flavicans* have unfused, branched haptera while the holdfast of *L. nigrescens* is also massive, but is more symmetrical, and conical or subconical (Fig. 6).

A comparison of the four species of *Lessonia* presently recognized in South America indicates that several other anatomical and morphological differences also exist (Fig. 6). These are related to branching pattern, shape of the blades, thickness of cortex and medulla and presence and disposition of lacunae (Table 1).

Our species differs from *Lessonia variegata* from New Zealand in having significantly shorter

Table 1. Some characteristics distinguishing the South American species of *Lessonia*

	L. trabeculata	*L. nigrescens*	*L. vadosa*	*L. flavicans*
Holdfast	massive, asymmetrical, irregularly shaped	massive, conical or hemispherical	dissected, with unfused haptera	dissected, with unfused haptera
Stipes	rigid	flexible	rigid	rigid
Blades	narrow (1–12 cm)	very narrow (1–4 cm)	narrow (2–9 cm)	broad (6–40 cm)
Colour of the plants	brown	dark green, almost blackish	brown	dark brown
Number of cell rows in meristoderm	2–3	2–3	1–2	1–2
Number of cell layers in cortex	7–15	10–16	5–8	5–8
Shape of cortical cells	polygonal	polygonal	polygonal	rectangular
Cortical lacunae	present	absent	present	absent
Trabeculae in lacunae	present	absent	absent	absent
Thickness of medullary tissue	up to 50 μm	up to 100 μm	up to 50 μm	up to 25 μm
Habitat	subtidal (0.5–20 m)	intertidal (+1 to −1 m)	shallow subtidal (0.5–2 m)	deep subtidal (2–20 m)

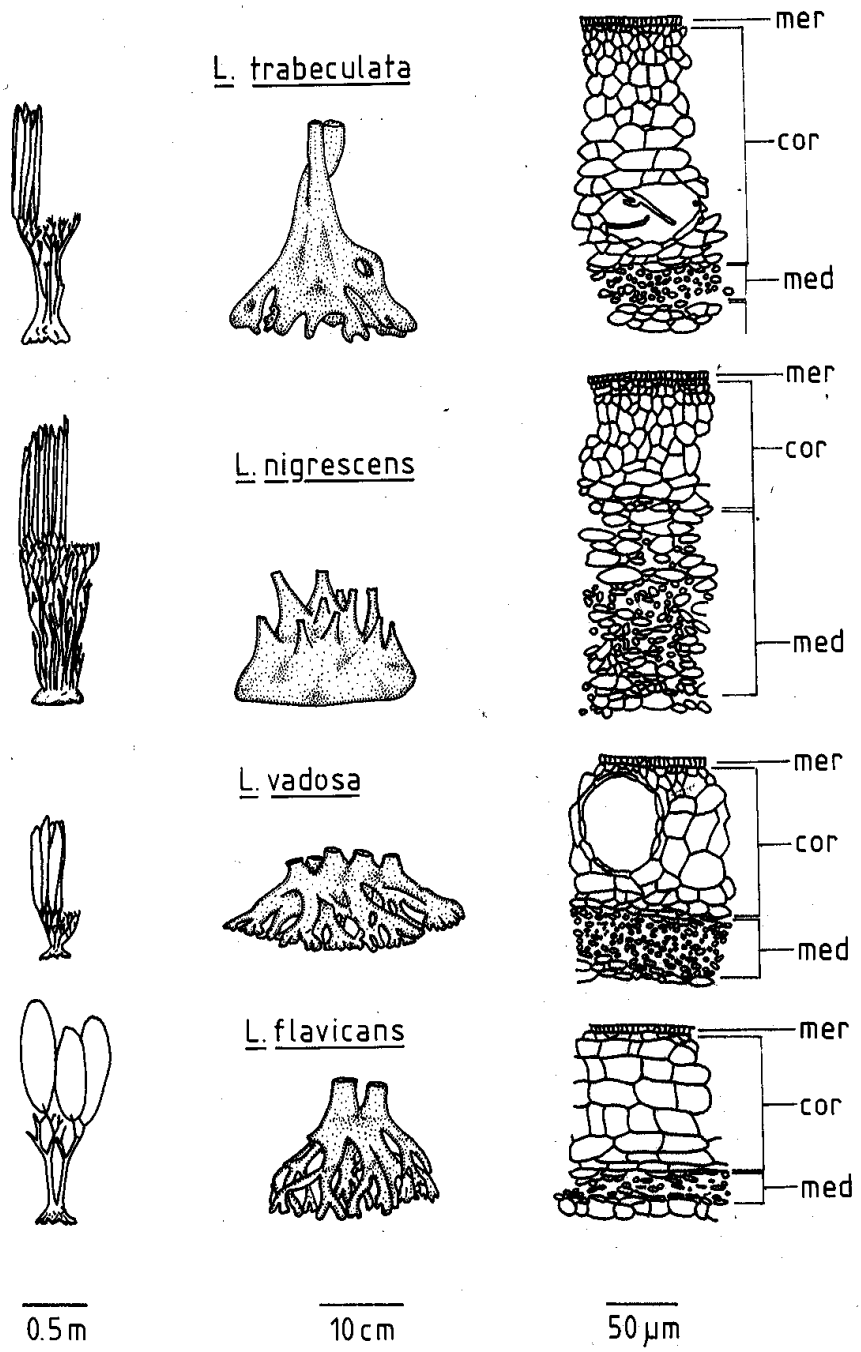

Fig. 6. Differences in external morphology and blade structure (transversal sections) among the four species of *Lessonia* presently recognized in South America. Mer = meristoderm; cor = cortex and med = medulla.

paraphyses in the sporangial sori (up to 50 µm ± 5 µm versus 80 µm in *L. variegata*; Lindauer *et al* 1961) and in the homogeneous pigmentation of blades. *L. trabeculata* differs from *L. corrugata* from Tasmania (Cribb 1954) in the absence of corrugate blades.

The results of our field explorations indicate that this species extends at least from Antofagasta (*c.* 23°S) to near Puerto Montt (*c.* 40°S). The species was not found in the Beagle Channel area, and it was not recorded by Searles (1978) at the 31 localities surveyed between Chiloe Island (43°S) and Trinidad Channel (49°S). In most of the localities visited between 23°S and 42°S along the Chilean coastline, *Lessonia trabeculata* occurred at depths ranging between 0.5 m and 20 m. Infrequently, this species shows some ecological overlap with the intertidal-shallow subtidal *L. nigrescens*. However, *L. trabeculata* generally is ecologically segregated from *L. nigrescens* and is geographically segregated from the shallow subtidal *L. vadosa* and the deeper water *L. flavicans*, both of which extend south of Chiloé Island.

Even though the presently known northern limit of distribution of *L. trabeculata* is Antofagasta (23°S) the available data in the literature tend to suggest that this species might extend as far north as Perú. Searles (1978) indicated that the Peruvian specimens identified by Howe (1914) as *Lessonia nigrescens* did not match his (Searles') interpretation of that species. These plants have holdfasts with branched haptera, one major stipe and lacunae in the cortex, all characters which correspond to *L. trabeculata*. Likewise the Peruvian *Lessonia* plant photographed by Dawson *et al* (1964) has a holdfast with branched haptera very similar to those shown by young individuals of *L. trabeculata* in central Chile.

ACKNOWLEDGMENTS

This study is part of a thesis submitted by the first author to Universidad de Concepción, Chile, to fulfill the requirements of Licenciatura in Marine Biology. The study was jointly supported by a grant from Subsecretaría de Pesca, Ministerio de Economía, Fomento y Reconstrucción and from the Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile. We acknowledge with gratitude critical reading and comments by I. A. Abbott and K. McDermid. We are grateful to R. B. Searles and the Editor for providing many useful suggestions. Leonardo Guzmoán from the Institute de la Patagonia, Renato Westermeier from the Universidad Austral de Chile and Jorge Tomicic from the Universidad de Antofagasta provided logistic support in several localities visited in this study. Waldemar Castelles provided the Latin diagnosis and Toño Larrea the photographic work. Our gratitude to all of them.

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Accepted 13 *June* 1985