

# The reinstatement of the name *Ulva nematoidea* Bory de Saint-Vincent (Chlorophyta) and the placement of *U. costata* (Howe) Hollenberg in its taxonomic synonymy

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**Abstract** — The continued use of the name *Ulva costata* (Howe) Hollenberg in the literature of benthic marine algae for the Pacific coast of both North and South America prompts me to present evidence that *Ulva nematoidea* Bory de Saint-Vincent is a taxonomic synonym of *U. costata* with priority and is the correct name for this taxon. A lectotype is designated for *U. nematoidea*, and the lectotype of *U. fasciata* f. *costata* is discussed.

biogeography / Chile / Chlorophyta / marine green algae / *Ulva costata* / *Ulva nematoidea*

**Résumé** — Rétablissement du nom *Ulva nematoidea* Bory de Saint-Vincent (Chlorophyta) et placement de *U. costata* (Howe) Hollenberg en synonymie. La persistance de l'usage du nom *Ulva costata* (Howe) Hollenberg dans la littérature traitant des algues marines benthiques de la côte Pacifique de l'Amérique du Nord et de l'Amérique du Sud m'a incité à démontrer que *Ulva nematoidea* Bory de Saint-Vincent est un synonyme taxinomique de *U. costata* sur lequel il a priorité et qu'il est le nom correct pour ce taxon. Un lectotype est désigné pour *U. nematoidea* et le lectotype de *U. fasciata* f. *costata* est discuté. (Traduit par la Rédaction)

algues vertes marines / biogéographie / Chili / Chlorophyta / *Ulva costata* / *Ulva nematoidea*

## INTRODUCTION

An historical background and review of the two primary taxa under discussion, *Ulva nematoidea* and *U. costata*, is called for. Bory de Saint-Vincent (1828) described *U. nematoidea* from Concepcion, Chile, based on a collection made in 1823 (Howe, 1914) by D'Urville during the voyage of 'La Coquille'. Bory de Saint-Vincent also reported what he thought to be *U. fasciata* Delile. Initially, Montagne (1839), in reporting collections made by Gaudichaud from Chile and from Callao in Peru by d'Orbigny, treated *U. nematoidea* within the taxonomic synonymy of *U. lactuca* Linnaeus [var.] *palmata* C. Agardh (1823). He also included as a synonym "*Ulva lactuca* [var.] *longissima*, Montag., Herb.". But later, in reporting this same alga from Paita, Peru, based on material collected by d'Orbigny during the voy-

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age of 'La Bonite', Montagne (1846a, p. 6) recognized the name *Ulva nematoidea* and gave the following description: "*U. fronde membranacea tenui a basi in lacinias lineares longissimas margine concolori discolorive crispato-undulatas fissa*". He stated that a more careful study of additional specimens convinced him of the distinctiveness of this species, referring to the ridge-like nerve in the basal part of the frond and the more intense green color of the central portion of the blade than the margins of the blades. He also stated that he was convinced that Bory's Chilean record of *U. fasciata* was not genuine *U. fasciata* of Delile (1813, 1826), described from Alexandria, Egypt, but Bory de Saint-Vincent's two forms, *U. nematoidea* and his so-called *U. fasciata*, could be found in the same clump or gathering. He thought that it was impossible to decide where one form began and the other ended.

Kützing (1849) treated *Ulva nematoidea* within the taxonomic synonymy of *U. fasciata*. He was followed by such authors as J. Agardh (1883) and DeToni (1889), and thus the name *U. nematoidea* was largely neglected. In a still later work on Chilean algae Montagne (1854) expressed disagreement with Kützing's treating *U. nematoidea* in synonymy with *U. fasciata*. Instead, Montagne recognized it as a distinct species (*Phycoseris nematoidea*) and placed *Phycoseris lobata* Kützing (1849) in its synonymy. Etcheverry (1986) also recognized *U. nematoidea*.

*Ulva costata* (Howe) Hollenberg was originally described by Howe (1914) as *U. fasciata* forma *costata* from the Chinch Islands off the coast of west central Peru. Howe indicated that his new forma corresponded to Bory de Saint-Vincent's (1828) record of "*Ulva fasciata*" from the Voyage of the 'Coquille' in that area but was scarcely the same as Delile's Mediterranean species. Howe described thalli of *U. fasciata* forma *costata* as having the main divisions narrow and elongate, 30-70 cm long and 0.5-2.0 cm wide, crisped and ruffled and often spirally contorted. The base was more or less distinctly costate (this region being 120-150  $\mu\text{m}$  thick, which was twice as thick as the remaining lamina). Yet Howe also remarked that in some thalli the costa was indistinct, and then there was a strong resemblance to *U. fasciata* f. *taeniata* Setchell [later *U. taeniata* (Setchell) Setchell & Gardner (1920)]. Howe (1914, p. 21) remarked that Bory de Saint-Vincent's *U. nematoidea* from Concepcion, Chile, "can hardly be said to be costate and the name cannot be accurately applied to Dr Coker's [i.e., the Peruvian] plant." On the other hand, Bornet (1892), who had access to authentic specimens in PC, stated that the median zone of the blade of *U. nematoidea* reaches up to 314  $\mu\text{m}$  in thickness with the margins of the blade to 42  $\mu\text{m}$ .

Taylor (1947) recorded some additional collections of *Ulva fasciata* f. *costata* from Peru. In his report on the marine algae from the Juan Fernandez Islands off the coast of Chile, Levring (1941) recognized Bory de Saint-Vincent's *U. nematoidea* and at the same time treated *U. fasciata* [f.] *costata* Howe as a taxonomic synonym and, following Montagne (1854), *Phycoseris lobata* Kützing (1849) also as a taxonomic synonym. *Phycoseris lobata* had also been described from Chile and was later depicted by Kützing (1856). Levring asserted that it was Montagne (1846b, pl. 14), in reporting *U. fasciata* from Algeria, who emphasized that *U. nematoidea* was well separated from *U. fasciata*. Montagne described the margins of the blade of *U. fasciata* as being about twice as thickened as the central distal parts of the blade. Levring (1941, pl. 49, fig. 1) depicted a syntype of *U. nematoidea* in the Agardh Herbarium in Lund, namely, a specimen collected by D'Urville during the voyage of the 'La Coquille' and determined by Bory de Saint-Vincent. That specimen consisted of very elongate, narrow, ruffled blades divided at the base. Levring also stated his opinion that it was likely that California material that had been called *U. fasciata costata* by Setchell & Gardner

(1920) and distributed as *Phycotheca Boreali-Americana* Nr 863 belonged to *U. nematoidea*. In a later publication Levring (1960) restated his opinion that on the basis of "the variation in habit, size etc." *U. nematoidea*, *U. lobata*, and *U. fasciata* [f.] *costata* all belong to the same species, viz., *U. nematoidea*. Kim (1971) accepted that taxonomic viewpoint.

In the same year Hollenberg (1971), without reference to *Ulva nematoidea*, elevated Howe's forma *costata* to the species level, validating the binomial *Ulva costata*. He also reported the occurrence of this species (based on a Peruvian type) from California. This name was used in the *Marine Algae of California* by Abbott and Hollenberg (1976).

Dawson *et al.* (1964) reiterated Howe's record of *Ulva fasciata* [f.] *costata* for Peru, and later Acleto (1980) used Hollenberg's name, *U. costata*. Santelices & Abbott (1978) reported the occurrence of *U. costata* for the first time from Chile, including it in a group of "bipolar species" with distributions in central and northern Chile (and Peru) as well as the Pacific coast of North America. Santelices (1980) later expanded on this topic of bipolar distribution, reporting a distribution of *U. costata* on the coast of South America from 4 to 20 South latitude on the South American coast and in the North Pacific from California to northern Mexico. Yet Santelices (1989) later admitted that in Chile *U. costata* had also been recorded under the name *U. nematoidea*. In their catalogue of the benthic marine algal flora for the temperate coast of Pacific South America, Ramírez and Santelices (1991) recognized *Ulva costata*, including records of *U. nematoidea* from Chile and Peru in their list of collections. They also acknowledged Levring's (1941) treatment of *U. fasciata* f. *costata* and *U. lobata* as conspecific with *U. nematoidea*. Yet they did not explain why they did not use the name with nomenclatural priority, *U. nematoidea*.

## MATERIALS AND METHODS

Authentic specimens of *Ulva nematoidea* Bory from Pacific South America in PC were examined and photographed. A loan of authentic material of *U. fasciata* f. *costata* Howe in NY was received and these specimens also studied.

## RESULTS

Several old collections in the folder of *Ulva nematoidea* Bory de Saint-Vincent deposited in PC have been examined. The evidence strongly supports the selection of a collection of three blades (Fig. 1) to be the lectotype. The handwriting on the specimen is that of Bory de Saint-Vincent (*vide* F. Ardré) and has the following label data: "*Ulva multifida* Bory Côtes du Chili à la Concepcion rapportés par Durville." In a different ink are the words: "*Phycoseris fasciata* ? *nematoidea* Kg." It is possible that the manuscript name "*Ulva multifida* Bory" was not used when it was realized that that name had already been used by Smith (1808) for what is the basionym of *Cutleria multifida* (Smith) Greville. The smallest specimen (the one in the center) measures 16 cm in length, and the tallest reaches



Fig. 1. *Ulva nematoidea* Bory de Saint-Vincent. Lectotype specimen in PC. Scale bar: 3 cm.

24 cm. The blades are ruffled and uniformly bright green in color. This uniformity in their green color was the main distinction mentioned by Bory de Saint-Vincent (1828) in his original description, when he contrasted his new species with *Ulva fasciata* Delile, which had blades that were dark green at the outside and lighter in the midregion.

Other specimens of *Ulva nematoidea* in PC include:

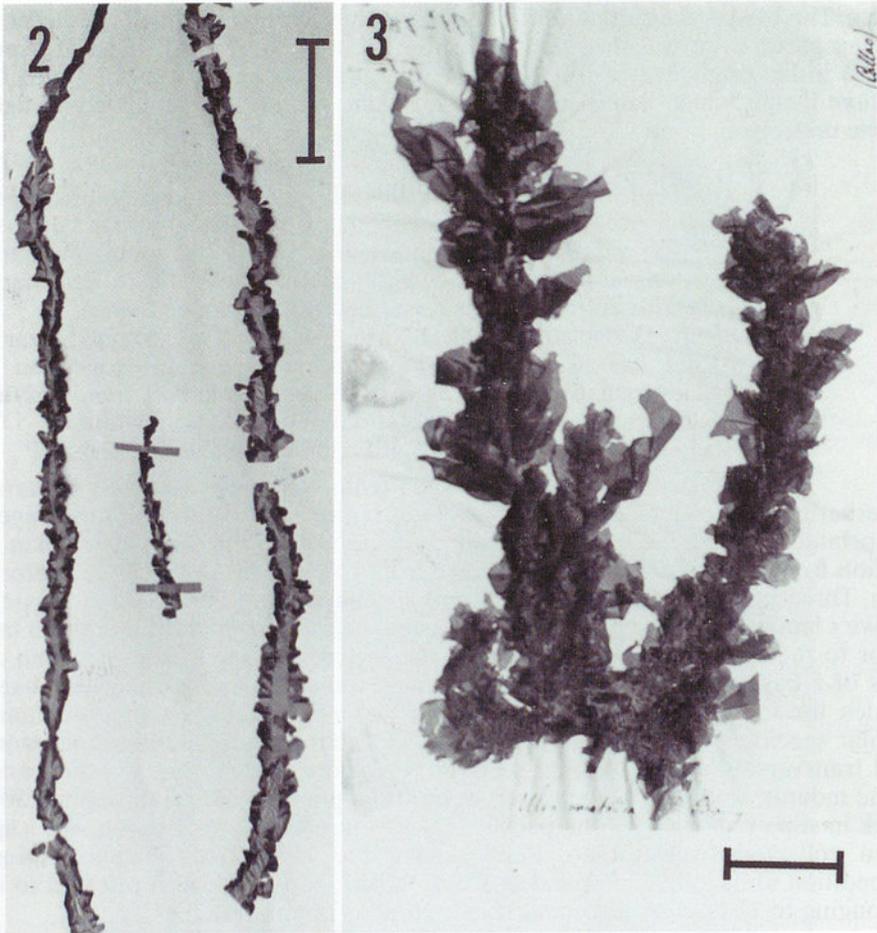
- 1) (In the Thuret Herbarium) "Côtes du Pérou, Gaudichaud-Voyage de la Bonite", and with the words: "plante remarquable par l'épaisseur de la partie médiane de la fronde". This plant is very long and narrow (51 cm long and only 2.5 cm wide) and with slightly ruffled margins (Fig. 2). This collection was reported by Montagne (1846a).
- 2) "Ex coll. D'Orbigny (Callao)". This specimen is branched near the base and has highly ruffled margins (Fig. 3). This collection was reported originally by Montagne (1839, as *Ulva lactuca* [var.] *palmata*).
- 3) "M. Gaudichaud Perou ad Gigartinam Gaudichaudii Mont."
- 4) "*Ulva nematoidea* and *U. fasciata* Delile Pérou M. Gaudichaud".

The loan of *Ulva fasciata* f. *costata* from NY consisted of 10 packets on 6 herbarium sheets, including some copies of Howe's (1914) pl. 1 and the pages of his printed account. All but one packet corresponded to the Robert E. Coker collection from the Chincha Islands of Peru in full agreement with Howe's information. Three packets each contained a full specimen. One of these had "Type" in Howe's handwriting and a note that it was the basis of his plate 1, the photo taken prior to the specimen being dried. It is the logical lectotype. This specimen consists of a basal part split near the base and extending out into two long narrow blades, the longer segment about 48 cm in extent. Two other packets contained similar specimens, these being isotypes. Mica mounts consisted of whole mounts and transverse and longitudinal sections (of blades and stipes). On the basis of these mounts, blades were measured to be 40-48  $\mu\text{m}$  in thickness but up to 250  $\mu\text{m}$  thick in stipe regions. The one packet that was not a Coker collection was a specimen collected from Callao, Peru, during the U.S. South Pacific Exploring Expedition under the Command of Capt. Wilkes, and Howe also referred to it as belonging to *U. fasciata* f. *costata*. It is treated as a paratype.

## DISCUSSION

The evidence strongly supports the acceptance of Levring's (1941, 1960) contention that *Ulva nematoidea* Bory de Saint-Vincent is the correct name for a complex of forms that have gone under the names *U. costata* (Howe) Hollenberg [= *U. fasciata* var. *costata* Howe] and *U. lobata* (Kützting) Setchell & Gardner. It is possible that *U. taeniata*<sup>1</sup> is also conspecific, being a more strongly ruffled form. Earlier in his report of *U. nematoidea* from southwestern Africa, Wynne (1986) has offered evidence to support Levring's taxonomic viewpoint. The recent treatment of the benthic marine algae of central Chile by Hoffmann & Santelices (1997) includes five species of *Ulva*: *U. costata* (Howe) Hollenberg, *U. lactuca* Linnaeus, *U. lobata* (Kützting) Setchell & Gardner, *U. rigida* C. Agardh, and *U. taeniata*

<sup>1</sup> Records of *Ulva taeniata* from New Zealand (Chapman, 1956) and Australia (Womersley, 1984) were later treated as *Ulva stenophylla* Setchell & Gardner (Phillips, 1988; Adams, 1994).



Figs 2-3. *Ulva nematoidea* Bory de Saint-Vincent. Fig. 2. Specimen with the label: "Côtes du Pérou, Gaudichaud-Voyage de la Bonite". Fig. 3. Specimen "Ex coll. D'Orbigny (Callao)". (Both in PC). Scale bar: 6 cm in Fig. 2; 3 cm in Fig. 3.

(Setchell) Setchell & Gardner. Thalli of *U. costata* are said to be "elongated, sometimes spirally twisted, with undulate to ruffled margins and a conspicuous midrib up to 160  $\mu\text{m}$  thick" and that "cells of midrib are anticlinally oriented, 12-15  $\mu\text{m}$  in diameter and 3-4 times as tall". Thalli of *U. lobata* can be "up to 30 cm long and 15 cm wide, deeply lobed, with markedly ruffled margins", and "an important diagnostic character is that the central part of *U. lobata* fronds is thick due to thick-walled, elongated cells". This "diagnostic" character is very similar to the previously described *U. costata* with its "conspicuous midrib". Finally, thalli of *U. taeniata* are said to "lack a midrib, are usually single, although sometimes they are split from base to apex, and spirally coiled"; furthermore, "in cross-section, cells are subquadrate at margins and anticlinally elongate, twice longer than wide at the central part of the frond", "to 150  $\mu\text{m}$  at the central parts", which compares favorably with the "160  $\mu\text{m}$ " thickness noted in *U. costata*. Earlier, Ramírez &

Santelices (1991) had treated *U. nematoidea* as a taxonomic synonym of *U. costata*, but without an explanation why they did not use the name that has priority. Therefore, the purpose of this paper is to call attention to Levring's (1941) arguments for treating *U. nematoidea* Bory de Saint-Vincent as the correct name for this complex of species of *Ulva* that is found on the temperate coast of Pacific North and South America. Thalli of *U. nematoidea* typically have elongate, narrow blades, are often ruffled (strongly or slightly), and often have a costate proximal portion, although this may not be pronounced depending on habitat (Levring, 1960). Later taxonomic synonyms include *U. costata*, *U. lobata*, and probably *U. taeniata*. This paper has also designated lectotypes for *U. nematoidea* (Fig. 1) in PC and *U. fasciata* f. *costata* in NY.

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#### REFERENCES

- ABBOTT I.A. & HOLLENBERG G.J., 1976 — Marine Algae of California. Stanford, California, Stanford University Press, xii + 827 p.
- ACLETO O., C., 1980 — Notas sobre las algas marinas del Peru I. Nuevos registros. *Publicaciones del Museo de Historia Natural "Javier Prado"*, Botanica, Serie B, No. 30, 33 p.
- ADAMS N.M., 1994 — *Seaweeds of New Zealand. An Illustrated Guide*. Christchurch, Canterbury University Press, 360 p.
- AGARDH C.A., 1823 [1822-1823] — *Species algarum...* Vol. 1, part 2. Lundae, pp. [i-viii] + 169-398 (1822), 399-531 (1823).
- AGARDH J.G., 1883 — Till algernes systematik. Nya bidrag. VI. Ulvaceae. *Acta Universitatis lundensis* 19 (2), 177 + [4] p., pls I-IV.
- BORNET E., 1892 — Les algues de P.-K.-A. Schousboe récoltées au Maroc & dans la Méditerranée de 1815 à 1829. *Mémoires de la Société des Sciences Naturelles de Cherbourg* 28: 165-376, 3 pls.
- BORY DE SAINT-VINCENT J.-B., 1828 [1826-1829] — Cryptogamie. In: Duperrey L.I., *Voyage autour du monde, exécuté par ordre du roi sur la corvette de sa majesté, La Coquille, pendant les années 1822, 1823, 1824 et 1825*. Paris, Botanique, 301 p. + Atlas. [1827 = pp. 1-96; 1828 = pp. 97-200; 1829 = pp. 201-301; 1826 = Atlas.]
- CHAPMAN V.J., 1956 — The marine algae of New Zealand Part I. Myxophyceae and Chlorophyceae. *Journal of the Linnean Society of London, Botany*, 55: 333-501, pls 24-50.
- DAWSON E.Y., ACLETO C. & FOLDVIK N., 1964 — The seaweeds of Peru. *Beihefte zur Nova Hedwigia* 13: 1-111, 81 pls.
- DELILE A.R., 1813, 1826 — Flore d'Égypte, Explication des planches. In: *Description de l'Égypte... Histoire naturelle*. 1<sup>ère</sup> ed. Tome 2, Paris, Imprimerie Impériale, pp. 145-320 (1813) + separate Atlas: *Description de l'Égypte ou Recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française, publié par les ordres de sa majesté l'Empereur Napoléon le Grand. Histoire Naturelle*. Tome 2. Botanique - Minéralogie. Paris, Imprimerie Impériale, 62 pls, (1826).
- DE TONI G.B., 1889 — *Sylloge algarum. Vol. I. Chlorophyceae*. Patavii, 12 + cxxxix + 1,315 p.
- ETCHEVERRY H., 1986 — *Algas marinas bentónicas de Chile. Oficina Regional de Ciencia y Tecnología de la UNESCO para América Latina y el Caribe*, Montevideo, [4] + 379 p.

- HOFFMANN A. & SANTELICES B., 1997 — *Flora Marina de Chile Central. Marine Flora of Central Chile*. Santiago, Ediciones Universidad Católica de Chile, 434 p.
- HOLLENBERG G.J., 1971 — Phycological notes. VI. New records, new combinations, and noteworthy observations concerning marine algae of California. *Phycologia* 10: 281-289.
- HOWE M.A., 1914 — The marine algae of Peru. *Memoirs of the Torrey Botanical Club* 15: 1-185, 66 pls.
- KIM D.H., 1971 — A guide to the literature and distribution of the benthic algae in Chile. Part 1. Chlorophyceae-Phaeophyceae. *Gayana, Misc.* 1: 1-82.
- KÜTZING F.T., 1849 — *Species algarum*. Lipsiae, vi + 922 p.
- KÜTZING F.T., 1856 — *Tabulae phycologicae...* Vol. VI. Nordhausen, iv + 35 p., 100 pls.
- LEVRING T., 1941 — Die Meeresalgen der Juan Fernandez-Inseln. In: Skottsberg, C. (ed.), *The Natural History of Juan Fernandez and Easter Island*. Vol. 2. Uppsala, Almqvist & Wiksells, pp. 601-670, pls 49-53.
- LEVRING T., 1960 — Contributions to the marine algal flora of Chila. *Acta Universitatis Lundensis*, N. F., Avd. 2, 56 (10), 83 + [2] p.
- MONTAGNE C., 1839 — Cryptogamie. In: d'Orbigny A., *Voyage dans l'Amérique Méridionale...* 7: Botanique. Part I. Sertum patagonicum. Paris, 19 p., 4 pls.
- MONTAGNE C., 1846a — Cryptogames cellulaires. Algues, Lichens, Hépatiques et Mousses. In: Gaudichaud C., *Voyage autour du monde exécuté pendant les années 1836 et 1837 sur la corvette La Bonite...* Botanique. Vol. 1, 2. Paris, A. Bertrand, xi + 355 p., Atlas: pls 141-145.
- MONTAGNE C., 1846b — Phyceae. In: Durieu de Maisonneuve M.C. (ed.), *Exploration scientifique d'Algérie, Flore d'Algérie, Botanique 1*. 199 p., 16 pls.
- MONTAGNE C., 1854 — Algas. In: Gay C., *Historia, fisica y politica de Chile...* Vol. 8. Paris, 228-393 p. [vol. 8(1) pp. [1]-256: 1852 vol. 8(2) p. 257-448: prob. early Mai 1854].
- PHILLIPS J.A., 1988 — Field, anatomical and developmental studies on southern Australian species of *Ulva* (Ulviceae, Chlorophyta). *Australian Systematic Botany* 1: 411-456.
- RAMÍREZ M.E. & SANTELICES B., 1991 — Catálogo de las algas marinas bentónicas de la costa temperada del Pacífico de Sudamérica. *Monografías Biológicas* No. 5. Santiago, Facultad de Ciencias Biológicas Pontificia Universidad Católica de Chile, 437 p.
- SANTELICES B., 1980 — Phytogeographic characterization of the temperate coast of Pacific South America. *Phycologia* 19: 1-21.
- SANTELICES B., 1989 — *Algas Marinas de Chile Distribucion Ecologia Utilizacion Diversidad*. Santiago, Ediciones Universidad Católica de Chile, 399 p.
- SANTELICES B. & ABBOTT I.A., 1978 — New records of marine algae from Chile and their effects on phytogeography. *Phycologia* 17: 213-222.
- SETCHELL W.A. & GARDNER N.L., 1920 — Phycological contributions I. *University of California Publications in Botany* 7: 279-324, pls 21-31.
- SMITH J.E., 1808 — *English Botany; or coloured figures of British Plants...* 1st edn. Vol. 27, pls 1873-1944. London, J. Sowerby, Publisher; printed for the author by J. Davis.
- TAYLOR W.R., 1947 — Algae collected by the "Hassler," "Albatross," and Schmitt Expeditions III. Marine algae from Peru and Chile. *Papers of the Michigan Academy of Science, Arts, and Letters* 31: 57-90, pls I-XIV.
- WOMERSLEY H.B.S., 1984 — *The marine benthic flora of southern Australia Part I. Handbook of the Flora & Fauna of South Australia*. [Place of publication not indicated, possibly Adelaide] South Australia Government Printer, 329 p.
- WYNNE M.J., 1986 — Report on a collection of benthic marine algae from the Namibian coast (southwestern Africa). *Nova Hedwigia* 43: 311-355.