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Molecular analyses reveal the presence of *Corynecladia* J.Agardh (Rhodophyta, Rhodomelaceae) in the Mediterranean Sea with two new species, *C. millarii* sp. nov. and *C. mediterranea* sp. nov.

Yola METTI, Giovanni FURNARI &  
Donatella SERIO

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Faculdade de Ciências da Universidade do Porto and CIIMAR, Rua do Campo Alegre, s/n, 4169-007 Porto (Portugal)

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Natural habitat of *Corynecladia mediterranea* from its type locality in Golfo di Monte Cofano, Trapani, Sicily, Italy.

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# Molecular analyses reveal the presence of *Corynecladia* J.Agardh (Rhodophyta, Rhodomelaceae) in the Mediterranean Sea with two new species, *C. millarii* sp. nov. and *C. mediterranea* sp. nov.

**Yola METTI**

Australian Institute of Botanical Science, Botanic Gardens of Sydney,  
362 Narellan Rd, Mount Annan NSW 2567 (Australia)  
[yola.metti@botanicgardens.nsw.gov.au](mailto:yola.metti@botanicgardens.nsw.gov.au) (corresponding author)

**Giovanni FURNARI**  
**Donatella SERIO**

Department of Biological, Geological and Environmental Sciences, University of Catania,  
Via Empedocle, 58 – 95128 Catania (Italy)

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## ABSTRACT

The findings of this study expanded the geographic distribution of the genus *Corynecladia* J.Agardh, thought to be endemic to Australia. It is recorded for the first time as present in Europe, with two newly proposed species: *C. millarii* sp. nov. and *C. mediterranea* sp. nov. New collections belonging to the *Laurencia* complex were sampled from the Sicilian coasts of Italy. Examination of this material was carried out using both morphological comparisons and phylogenetic analyses of chloroplast (*rbcL*) and mitochondrial (COI-5P) nucleotide sequences. The resulting phylogenetic trees divided the Mediterranean specimens into two supported, separate branches, within the genus *Corynecladia*. Morphological analysis supported placement of these species within *Corynecladia* and as distinct from other congeners. Specifically, the two new species were conspicuous in the absence of a secondary cortex which is typical of other *Corynecladia* taxa. Included in this study is a detailed dichotomous key to the *Laurencia* complex taxa of the Mediterranean.

**KEY WORDS**  
Mediterranean,  
*Corynecladia*,  
*Laurencia*,  
dichotomous keys,  
new species.

## RÉSUMÉ

*Des analyses moléculaires révèlent la présence de Corynecladia J.Agardh (Rhodophyta, Rhodomelaceae) en Méditerranée avec deux nouvelles espèces, C. millarii sp. nov. et C. mediterranea sp. nov.*

Les résultats de cette étude ont élargi la répartition géographique du genre *Corynecladia* J.Agardh que l'on croyait endémique à l'Australie. Il est signalé pour la première fois comme présent en Europe, avec deux espèces nouvellement proposées: *C. millarii* sp. nov. et *C. mediterranea* sp. nov. De nouvelles collections appartenant au complexe *Laurencia* ont été échantillonnées sur les côtes siciliennes d'Italie. L'examen de ce matériel a été réalisé à l'aide de comparaisons morphologiques et d'analyses phylogénétiques de séquences nucléotidiques chloroplastiques (*rbcL*) et mitochondriales (COI-5P). Les arbres phylogénétiques résultants ont divisé les spécimens méditerranéens en deux branches distinctes et supportées, au sein du genre *Corynecladia*. L'analyse morphologique a confirmé le placement de ces espèces au sein de *Corynecladia* tout en les distinguant des autres congénères. Plus précisément, les deux nouvelles espèces se distinguaient par l'absence d'un cortex secondaire typique des autres taxons de *Corynecladia*. Cette étude comprend une clé dichotomique détaillée des taxons du complexe *Laurencia* de la Méditerranée.

**MOTS CLÉS**  
Méditerranée,  
*Corynecladia*,  
*Laurencia*,  
clés dichotomiques,  
espèces nouvelles.

## INTRODUCTION

The *Laurencia* complex contains 231 accepted taxa at specific and infraspecific levels (Guiry & Guiry 2023). Currently the complex contains the following genera: *Laurencia* J.V.Lamouroux (1813), *Chondrophyucus* (Tokida & Saito) Garbary & J.T.Harper (Garbary & Harper 1998), *Corynecladia* J.Agardh reinstated by Nam (2006), *Laurenciella* Cassano, Gil Rodríguez, Senties, Díaz-Larrea, M.C.Oliveira & M.T.Fujii (Cassano *et al.* 2012b), *Obelopapa* F.Rousseau, Martin-Lescanne, Payri & L. Le Gall (Rousseau *et al.* 2017), *Osmundea* Stackhouse (1809) resurrected by Nam *et al.* (1994), *Palisada* (Yamada) K.W.Nam (2007) and *Yuzurua* (K.W.Nam) Martin-Lescanne (Martin-Lescanne *et al.* 2010). These are widely distributed throughout the world, from sub-Arctic waters to tropical coasts, and from littoral to sublittoral to depths of 65 m.

In the Mediterranean Sea, taxa belonging to the *Laurencia* complex recorded to date include: *Laurencia* (with eight species and one subspecies), *Laurenciella* (one species), *Osmundea* (seven species) and *Palisada* (five species). Previous to this study *Corynecladia* was not recorded in the Mediterranean.

*Corynecladia* was first described by Agardh (1876) to encompass his own newly described species *C. umbellata*, and an unusual *Laurencia* species, *Laurencia clavata* described by Sonder (1853), both of which were described from Australian material. However, many later researchers agreed with Sonder (1853) and considered *Corynecladia clavata* (Sonder) J.Agardh to belong within *Laurencia* (Yamada 1931; Saito & Womersley 1974; Nam & Choi 2001). Nam (2006) reinstated *Corynecladia* to contain *L. clavata* after his cladistic analysis based on 49 morphological features showed *L. clavata* to consistently group outside of *Laurencia*. In 2015, the genus *Coronaphycus* Metti (Metti *et al.* 2015) was proposed during a study on the *Laurencia* of Australia and included two species: *C. elatus* (C.Agardh) Metti and *C. novus* Metti. Identifying features of the genus included in particular the presence of a secondary cortex. *Coronaphycus* was then found to be congeneric with the previously disused *Corynecladia* based on new molecular data of the genotype *C. clavata* collected from Australia (Cassano *et al.* 2019). *Corynecladia* was amended with three species, all of which were found only in Australia, and included *Corynecladia clavata*, *C. elata* (C.Agardh) Cassano, M.C.Oliveira & M.T. Fujii, and *C. nova* (Metti) Cassano, M.C.Oliveira & M.T.Fujii.

A study was undertaken recently in the Mediterranean to collect and examine plants morphologically similar to *Laurenciella marilzae* (Gil-Rodríguez, Senties, Díaz-Larrea, Cassano & M.T.Fujii) Gil-Rodríguez, Senties, Díaz-Larrea, Cassano & M.T.Fujii. Specimens were collected from along the Sicilian coast (Fig. 1) but, some of them, when examined using molecular analyses, were not *L. marilzae* but instead aligned within *Corynecladia* (Serio *et al.* 2000: figs 1-8; Furnari *et al.* 2001: figs 32-34; Serio *et al.* 2020: fig. 1). Therefore, in this study the Mediterranean specimens were carefully examined using both molecular and traditional morphological observation, resulting in the proposal of two novel species of *Corynecladia*.

## MATERIAL AND METHODS

## MORPHOLOGICAL OBSERVATIONS

Specimens were collected from 2007 to 2021 by snorkelling at various Sicilian marine stations (Italy). Morpho-anatomical observations were carried out on both living material and material preserved in a solution of 4% formalin-seawater. For microscopic observations, some specimens were stained with 1% aqueous aniline blue acidified with diluted HCl, which enhances visualization of pit connections, and observed by Zeiss Axioplan (Göttingen, Germany). Sections were made by razor blade under a stereoscopic Zeiss microscope. Photographs were made using a Zeiss Axiocam 208 color, Zeiss Axiocam ICc1 digital camera and Nikon D2X digital camera (Nikon Corporation, Tokyo, Japan). Underwater photographs were made with a Gopro Hero8 black (San Mateo, California, United States). Herbarium specimens are held at the Herbarium of the Department of Biological, Geological and Environmental Science, Plant Biology Section of the University of Catania (CAT). Herbarium abbreviations follow Thiers (2022). Examined specimens and their collection locations are reported in the Appendix.

## DNA EXTRACTION, AMPLIFICATION AND SEQUENCING

The Qiagen DNEasy Plant Mini Kit (Qiagen, Valencia, CA, United States) was used to extract total genomic DNA from silica dried material. Two gene regions were targeted for analyses; the chloroplast *rbcL* gene, which codes for the large subunit of RuBisCO, and the 5' end of the mitochondrial cytochrome c oxidase I gene (COI-5P). The two gene regions were amplified separately by polymerase chain reaction (PCR) using a Veriti 96-well thermal cycler (Thermo Fisher Scientific, Applied Biosystems, Australia). The *rbcL* gene was amplified in either one fragment using the primer pair FrbcL\_start\_sh (ATGTCTAACTCTGTAGAAG) with RrbcS\_start (GTTCCTTGTGTTAATCTCAC) or in two pieces using F645 (ATGCGTTGG AAAGAAAGATTCT) with RrbcS\_start, and FrbcL\_st\_sh with R749 (GCTCTTTCATACATATCTTCATTG) (Freshwater & Rueness 1994; Showe-Mei *et al.* 2001; Metti *et al.* 2013; Metti 2017). PCR amplifications were undertaken for the COI-5P gene region using the primer pair GAZF1 and GAZR1 (Saunders 2005). The amplification programs that were used are detailed in Freshwater & Rueness (1994) for *rbcL* and in Saunders (2005) for COI-5P. The PCR mixture was made to 20 µL, using the following concentration of reagents: 11.8 µL of dH<sub>2</sub>O, 2 µL of 10x reaction buffer (Bioline Ltd.), 1 µL of MgCl<sub>2</sub> at 25 mM (Promega, Madison, United States), 2 µL of 4x dNTPs at 2.5mM each, 0.2 µL of BioTaq DNA polymerase (Bioline Ltd.), 0.5 µL of the forward primer at 20 µM, 0.5 µL of the reverse primer at 20 µM, and 2 µL of the genomic DNA. The amplified DNA concentrations were visualized on a 1.5% agarose gel using 4 µL of PCR product. Amplified products were sent to Macrogen Korea (Seoul, South Korea) to be purified and sequenced. The same primers were used for both DNA sequencing and amplification. The resulting raw sequences were cleaned using the program Geneious 10.2.5 (<https://www.geneious.com>).

The sequences were aligned using the ClustalW Multiple Alignment program (Thompson *et al.* 1994), an accessory application within BIOEDIT v7.2.0 for PC (Hall 1999). The alignments were manually adjusted.

#### PHYLOGENETIC ANALYSIS

A total of 69 sequences were included for the *rbcL* alignment, ten of which were newly generated through this study. The remainder 59 sequences were downloaded from GenBank ([www.ncbi.nlm.nih.gov/nucleotide/](http://www.ncbi.nlm.nih.gov/nucleotide/)). The final length of the *rbcL* alignment was 1185 base pairs. For the COI-5P alignment a total of 66 COI-5P sequences were included with 14 being newly generated. The final length for the COI-5P alignment was 568 base pairs. Phylogenetic trees for both gene regions were rooted using Rhodomelaceae and Ceramiaceae species as outgroups (including *Chondria* C.Agardh, *Vertebrata* S.F.Gray and *Ceramium* Roth species). Newly generated sequences were deposited in GenBank (<http://www.ncbi.nlm.nih.gov>). All sequences included in this study were detailed in the Appendix.

For the *rbcL* gene region two analyses were run: Maximum Likelihood (ML) and Bayesian (BI). Both were undertaken on the online CIPRES Gateway (Miller *et al.* 2010). For ML analyses, RAxML v8.2.12 (Stamatakis 2014) was used to infer phylogenies. Node support was estimated using 1000 bootstrap replicates. The evolutionary model was set to a GTR substitution model, including a gamma-distributed rate variation, as set by RAxML. The substitution rate matrix was (A-C) = 2.172104, (A-G) = 7.258084, (A-T) = 2.061828, (C-G) = 1.209311, (C-T) = 16.498996, and (G-T) = 1.000000. The assumed nucleotide frequencies were freqA = 0.317280, freqC = 0.155187, freqG = 0.212861, and freqT = 0.314672. For the BI analyses the program MrBayes 3.2.2 (Ronquist *et al.* 2012) was used. Four chains of the Markov chain Monte Carlo (one hot and three cold) were set. All analyses started with a random tree and were calculated for 500 000 generations, with one tree sampled every 1000 generations. The first 25% of trees were discarded as a burn in. A 50% majority rule consensus tree was determined from the remaining trees. Posterior probabilities were calculated.

A separate Neighbour Joining (NJ) analysis was run for the COI-5P region. The software PAUP for PC (v.4.0a152, Swofford 2017) was used to run the NJ analyses, as well as to calculate pairwise distances using uncorrected p distances. Two thousand bootstrap replicates were run to estimate node support.

## RESULTS

#### MOLECULAR (*RBCL*)

The *rbcL* consensus tree of the ML analysis (Fig. 2) showed the *Laurencia* complex to be highly supported (ML bootstrap (boot) = 98%, BI posterior probability (pp) = 1.00) and all generic clades within it to be monophyletic. The *rbcL* tree showed the following clades to be fully supported at a generic level: *Laurencia*, *Laurenciella*, *Yuzurua*, *Chondrophyucus*, and



FIG. 1. — Distribution of *Corynecladia* J.Agardh in the Mediterranean Sea. **White arrow** indicates the type locality of *Corynecladia millarii* sp. nov.; **black arrow** indicates the type locality of *Corynecladia mediterranea* sp. nov.; and the **black circle** indicates the other station where the latter was collected.

*Osmundea. Palisada* was highly supported (ML boot = 98%, BI pp = 1.00) and *Ohelopapa* had only one sequence. The *Corynecladia* clade was moderately to highly supported (ML boot = 93%, BI pp = 0.99). This was within the same range of support as previously reported (Cassano *et al.* 2019; Serio *et al.* 2020; Metti 2022).

The *Corynecladia* clade was comprised of 11 taxa, including two topotype sequences (*C. nova*, and the generic type *C. clavata*) (Fig. 2). Intrageneric pairwise distances (p) within this clade ranged from 0.18% to 9.38%. Five species-level clades were seen, including one with only a single sequence (*C. elata*). The Mediterranean sequences formed two individual, fully supported clades (ML boot = 100%, BI pp = 1.00) as did *C. clavata*, and *C. nova*. Pairwise distances between the two Mediterranean taxa ranged from 5.64% to 6.34%.

The pairwise distances between the two Mediterranean taxa and the generic type *C. clavata* were within commonly accepted intrageneric limits (up to 7.36% for both), supporting their placement within *Corynecladia*. The proposed Mediterranean taxa *Corynecladia millarii* sp. nov. and *C. mediterranea* sp. nov. showed as sister taxa, which formed a fully supported clade. This Mediterranean clade itself resulted as sister to a clade containing both the generic type *C. clavata*, and *C. elata* (ML boot = 98%, BI pp = 1.00). Pairwise distances between these two larger clades ranged from 6.38% to 4.36%. The largest distances within the *rbcL* phylogeny were seen between *C. nova* from the east coast of Australia, and the proposed *C. millarii* sp. nov. from the Mediterranean (9.38%). Intraspecific pairwise distances within species-level clades were 0.00% except for the proposed *C. mediterranea* sp. nov. where the p values ranged from 0.00% to 0.18%, well within the generally accepted intraspecific value of 2%.

#### MOLECULAR (COI-5P)

The NJ analyses for the COI-5P loci showed the eight *Laurencia* complex genera as monophyletic clades (*Ohelopapa* was a single sequence), with only *Laurencia* moderately supported (NJ bootstrap = 91%) and *Laurenciella* weakly supported (NJ bootstrap = 80%). The *Laurencia* complex itself was unsupported, as were the other clades, including *Corynecladia*. Intra-generic pairwise distances within the *Corynecladia* assemblage

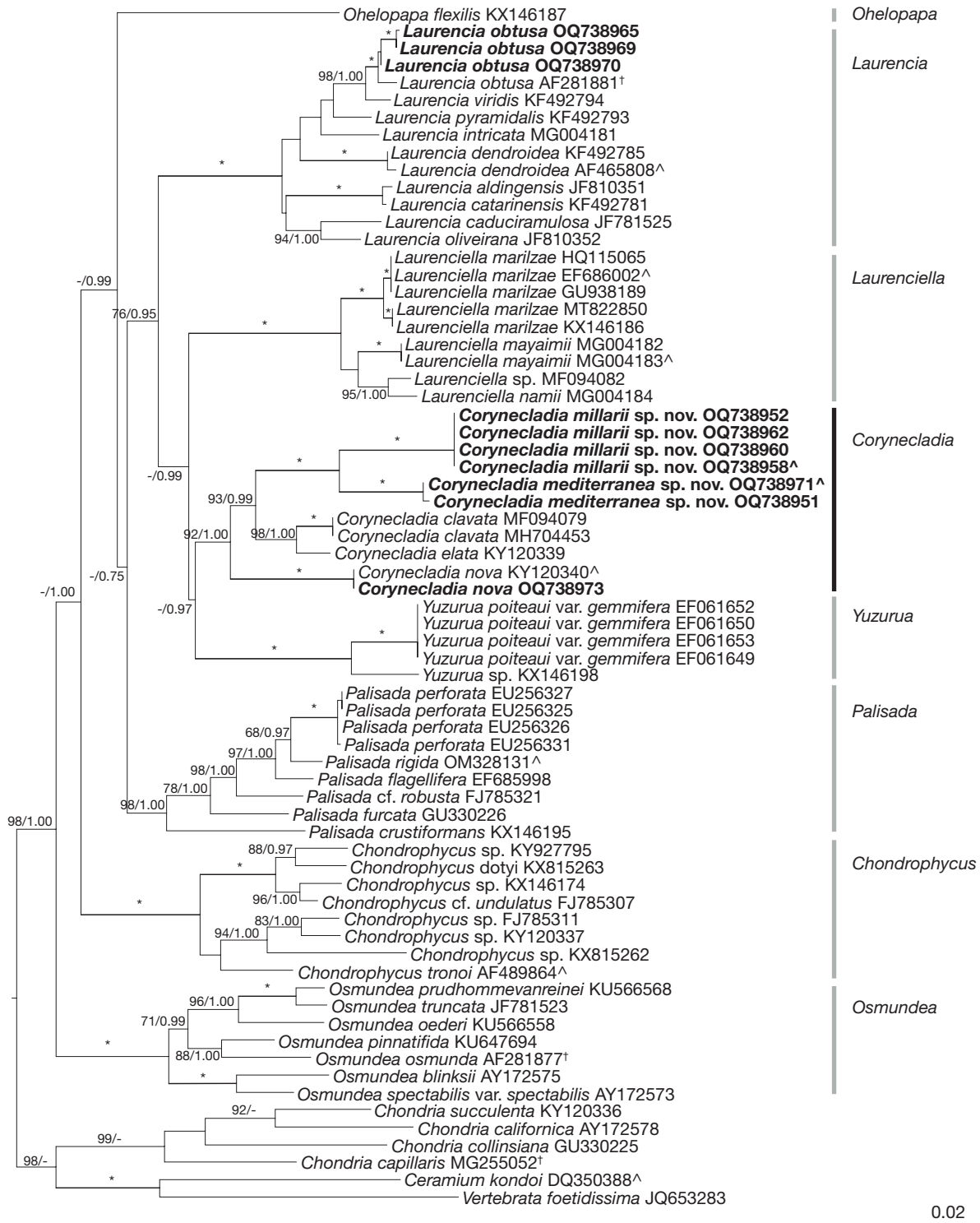


Fig. 2. — The RaxML maximum likelihood (ML) tree inferred from *rbcL* sequence data showing both ML bootstrap values (1000 replicates) and Bayesian posterior probabilities. Values greater than 65/0.65 are shown. **Bold lines** and \* indicate full support of values greater or equal to 99/0.99. Sequences in **bold** are newly generated from this study; sequences from topotype material are indicated by ^; and the genotype sequences indicated by †. GenBank accession numbers follow taxa names.

ranged from 5.11% to 10.21%. The *Corynecladia* assemblage showed two primary groupings. One was the Mediterranean group containing newly generated sequences, including *C. millarii* sp. nov. and *C. mediterranea* sp. nov., which was weakly

supported (NJ bootstrap = 71%). The other group was the Australian group, including *C. clavata* and *C. elata*, which was supported (NJ bootstrap = 95%). Clades at the species level were fully supported (NJ bootstrap = 100%) except for *C. elata*

which contained only one sequence. Intraspecific pairwise distances within the proposed *C. millarii* sp. nov. clade were 0.00 to 0.53%, within the proposed *C. mediterranea* sp. nov. were 0.70 to 0.78% and within *C. clavata* 0.18 to 0.35%.

Family RHODOMELACEAE Horaninow  
Genus *Corynecladia* J. Agardh

*Corynecladia millarii* sp. nov.  
(Figs 3-5)

Plants red in colour, soft in texture, forming tufts up to 7 cm high; thalli terete up to 1 mm in diameter, arising from a discoid holdfast with secondary stoloniferous branches; branching irregularly alternate, usually with 2(3) orders of branches; ultimate branchlets are cylindrical-clavate; four periaxial cells per vegetative axial segment. Secondary pit-connections between cortical cells localized in middle to inner part of the cells. Cortical cells with one (rarely two) corps en cerise. No lenticular thickenings. Tetrasporangia in parallel arrangement cut-off abaxially from the third and fourth periaxial cells. It differs from other species of *Corynecladia* in showing neither secondary cortication nor starch grains in medullary cells and from genera *Laurencia* and *Laurenciella* in the occurrence of deep secondary pit connections between cortical cells. It differs from the related *C. mediterranea* mainly in different molecular sequences.

TYPE MATERIAL. — Italy • Sicily, Syracuse, Capo Murro di Porco; 37°00'37"N, 15°18'28"E; epilithic; 0.1 m depth; 13.III.2021; D. Serio; holotype (tetrasporophyte): CAT[CAT 2721]; GenBank: OQ738957, OQ738958 • *ibid.*; isotypes: CAT[CAT 2722, CAT 2723]; GenBank: OQ738959, OQ738960, OQ738961, OQ738962 • *ibid.*; 15.III.2007; paratype (tetrasporophyte): CAT[CAT 2063]; GenBank: OQ738952 • *ibid.*; 25.IV.2021; paratype (tetrasporophyte): CAT[CAT 2727].

TYPE LOCALITY. — Italy, Sicily, Syracuse, Capo Murro di Porco.

ETYMOLOGY. — The specific epithet is in honor of the late friend and colleague Dr Alan Millar from Sydney, Australia.

DISTRIBUTION. — Type locality and probably more widely distributed.

HABITAT. — Plants epilithic in upper subtidal up to 1 m depth.

#### DESCRIPTION

Plants epilithic, soft, red and up to 7 cm high. Terete throughout, attached to substrate by a discoid holdfast with stolon-like branches and smaller discoid holdfasts (Fig. 3A, B). Erect axes, 1 mm in diameter in the middle portion of the thallus, irregularly alternately branched, usually with 2-3 orders of branches. Branchlets with slight epidermal cell projection near the apex (Fig. 4A). Cortical cells with one (rarely two) corps en cerise (Fig. 4B). In transverse section cortical cells quadratic to rectangular, not radially elongated nor arranged as a palisade, measuring 20-25 × 15-20 μm in the middle portions of the plant (Fig. 4C). Cortical cells connected to each other by thin secondary pit-connections. In longitudinal section these secondary pit-connections localized in the middle to inner part of the cells (Fig. 4D) making them hardly visible in surface view. Medullary cells rounded, 35-40 × 25-30 μm in the middle portions of the thallus, larger toward the centre. Walls of medullary cells without lenticular thickenings

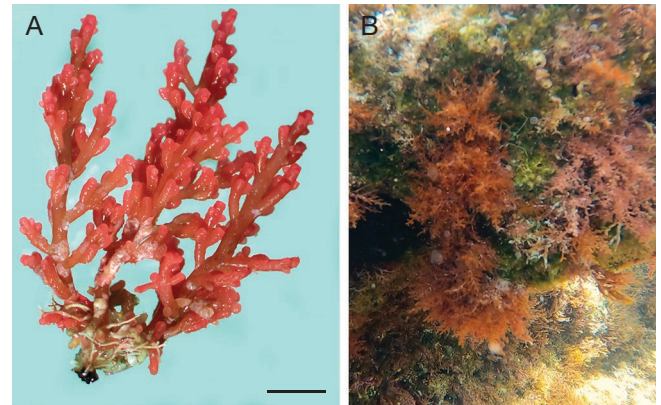


FIG. 3. — *Corynecladia millarii* sp. nov.: A, plant habit of holotype CAT 2721; B, plant in natural habitat. Scale bar: 1 cm.

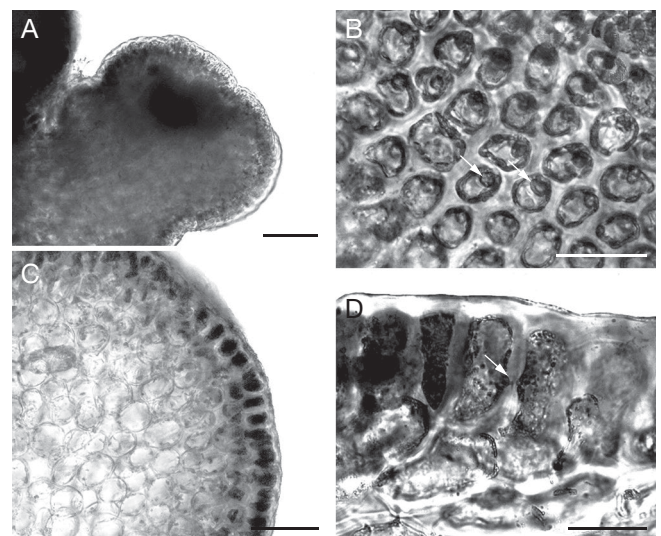


FIG. 4. — *Corynecladia millarii* sp. nov., holotype CAT 2721: A, branchlet showing epidermal cells slightly projecting near the apex; B, epidermal cells in surface view showing one corps en cerise per cell (white arrows); C, transverse section of the thallus; D, longitudinal section showing secondary pit connections between epidermal cells located in median part of the cells (white arrow). Scale bars: A, C, 100 μm; B, D, 50 μm.

(Fig. 4C). Each vegetative axial segment cuts off four periaxial cells (Fig. 5B). Tetrasporangial initials cut off abaxially from the third and fourth periaxial cells (Fig. 5A, B). No additional tetrasporangial periaxial cells produced. Mature tetrasporangia tetrahedrally divided, measuring 60-70 μm in diameter. Tetrasporangia in a parallel arrangement along the axis of the stichidium (Fig. 5C). Gametangia unknown.

*Corynecladia mediterranea* sp. nov.  
(Figs 6-8)

Plants red-yellowish in colour, soft in texture, forming tufts up to 8 cm high; thalli terete up to 2 mm in diameter, arising from a discoid holdfast with secondary stoloniferous branches; branching irregularly alternate, usually with 2(3) orders of branches; ultimate

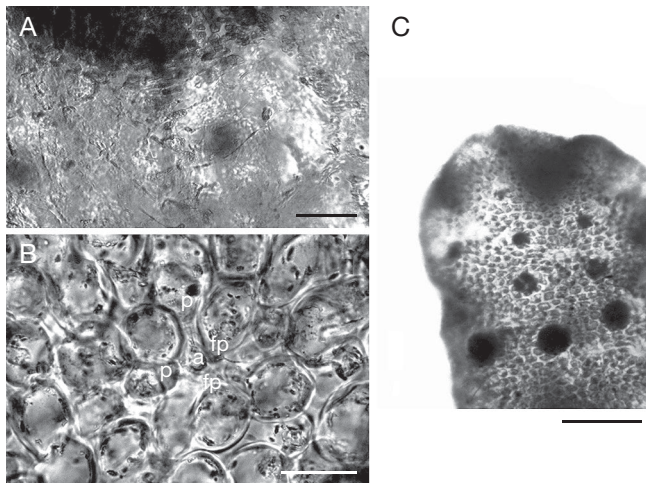


FIG. 5. — *Corynecladia millarii* sp. nov., holotype CAT 2721: **A**, longitudinal section of a tetrasporic branch showing a tetrasporangium cut off abaxially from a fertile pericentral cell; **B**, transverse section of a tetrasporic branch near the apex showing the axial cell (a) with two sterile (p) and two elongate fertile (fp) pericentral cells; **C**, tetrasporangial branchlet showing parallel arrangement of tetrasporangia. Scale bars: A, B, 50  $\mu$ m; C, 200  $\mu$ m.

branchlets are cylindrical-clavate; four periaxial cells per vegetative axial segment. Secondary pit-connections between cortical cells localized in middle to inner part of the cells. Cortical cells with one corpus en cerise. No lenticular thickenings. Tetrasporangia in parallel arrangement cut-off abaxially from the third and fourth periaxial cells. It differs from other species of *Corynecladia* in showing neither secondary cortication nor starch grains in medullary cells and from genera *Laurencia* and *Laurenciella* in the occurrence of deep secondary pit connections between cortical cells. It differs from the related *C. millarii* mainly in different molecular sequences.

**TYPE MATERIAL.** — Italy • Sicily, Trapani, San Vito Lo Capo, Golfo di Monte Cofano; 38°06'21"N, 12°41'36"E; epilithic; 0.5 m depth; 9.VII.2017; D. Serio; holotype (tetrasporophyte): CAT[CAT 2724]; GenBank: OQ738971 • *ibid.*; Porto Palo di Capo Passero; 36°39'03.8"N, 15°04'37.4"E; epilithic; 0.2 m depth; 8.V.2021; D. Serio; paratype (tetrasporophyte): CAT[CAT 2726]; GenBank: OQ738950, OQ738951.

**TYPE LOCALITY.** — Italy, Sicily, Trapani, San Vito Lo Capo, Golfo di Monte Cofano.

**ETYMOLOGY.** — The specific epithet indicates the Sea in which the species was found.

**DISTRIBUTION.** — Type locality, Golfo di Monte Cofano (Trapani, Sicily); Porto Palo di Capo Passero (Syracuse, Sicily); and probably more widely distributed.

**HABITAT.** — Plants epilithic in upper subtidal up to 1 m depth.

**DESCRIPTION**

Plants epilithic, soft, red yellowish, up to 8 cm high, terete throughout, attached to substrate by a discoid holdfast with stolon-like branches and smaller discoid holdfasts (Fig. 6A, B). Erect axes, 1-2 mm in diameter in the middle portion of the thallus, irregularly alternate, usually with 2(-3) orders of branches. Epidermal cells with slight projection near the apex (Fig. 7A). One corp en cerise per cortical cells (Fig. 7B). Cortical cells showing thin secondary pit-connections. In longitudinal section they appeared localized in the middle

to inner part of the cells (Fig. 8A). In transverse section, cortical cells quadratic to rectangular, neither radially elongated nor arranged as a palisade, measuring 25-30  $\times$  30-35  $\mu$ m in the middle portions of the plant (Fig. 8B). Medullary cells rounded, 40-50  $\times$  35-45  $\mu$ m in the middle portions of the plant, larger toward the center of the axes. Walls of medullary cells without lenticular thickenings (Fig. 8B). Each vegetative axial segment cuts off four periaxial cells (Fig. 8D). Tetrasporangial initials cut off abaxially from the third and fourth periaxial cells (Fig. 8D). No additional tetrasporangial periaxial cells produced. Mature tetrasporangia tetrahedrally divided, 90-100  $\mu$ m in diameter. Tetrasporangia forming a parallel arrangement along the axis of the stichidium (Fig. 8C). Gametangia unknown.

**DISCUSSION**

The purpose of this study was to determine the taxonomy of Mediterranean thalli with both habit and gross morphology similar to *Laurenciella marilzae* as reported by Serio *et al.* (2000: figs 1-8), Furnari *et al.* (2001: figs 32-34) and Serio *et al.* (2020: fig. 1). In both *rbcL* and COI-5P analyses the above studied specimens grouped as two separate taxa within the *Corynecladia* clade, and not in either the *Laurencia* or *Laurenciella* clades.

The type species of *Corynecladia* is *C. clavata*, described from southern Australia. In the *rbcL* molecular results of this study both Mediterranean taxa nested in the same clade as *C. clavata*, supporting their placement in this genus. *Corynecladia millarii* sp. nov. and *C. mediterranea* sp. nov. each showed to be fully supported clades within the genus. Also, they were separated from each other by large interspecific pairwise distances, indicating two separate species.

*Corynecladia* itself was a moderately supported genus with large intrageneric distances. However, although intrageneric distances within *Corynecladia* were large, these large distances were only due to *C. nova*, which had a maximum pairwise distance from *C. millarii* sp. nov. of 9.38%, and from *C. mediterranea* sp. nov. of 9.28%. On the resulting phylogenetic tree *C. nova* is alone on a branch basal to the other *Corynecladia* taxa. These results could be support for recognizing *C. nova* at a generic level. However, these two distances were the only values that were outside of the generally accepted value of 8% for intrageneric distances. The next largest pairwise distance between *C. nova* and any other *Corynecladia* taxa was 6.59% (*C. clavata*), which was less than between *C. clavata* and either of the new Mediterranean taxa. All other interspecific distances between *C. nova* and other *Corynecladia* taxa were again below commonly accepted intrageneric distance limits, supporting *C. nova* as best belonging within *Corynecladia*. Perhaps future discoveries and more molecular sampling of this genus will help to further elucidate its placement and *Corynecladia* intrageneric relationships overall.

COI-5P results were congruent with *rbcL* results although *Corynecladia* was unsupported. In this case COI-5P was



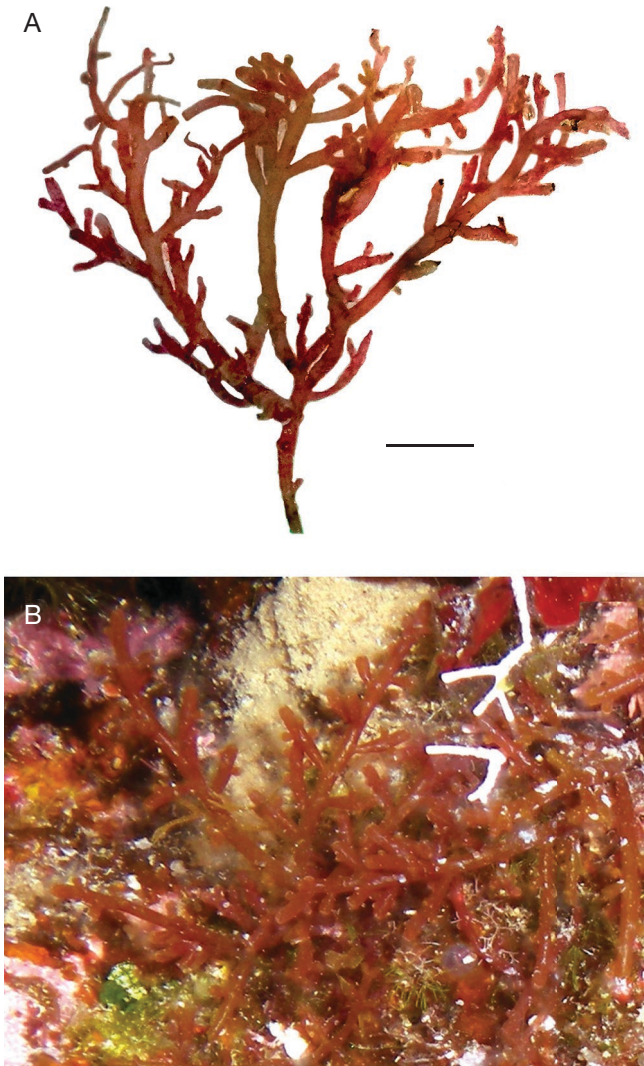


FIG. 6. — *Corynecladia mediterranea* sp. nov.: **A**, plant habit of holotype CAT 2724; **B**, plant in natural habitat. Scale bar: 5 mm.

not enough to resolve the genus. Most genera within the complex were also unsupported, except for *Laurencia* (ML bootstrap = 91%) and *Laurenciella* (ML bootstrap = 80%). Both *C. millarii* sp. nov. and *C. mediterranea* sp. nov. resulted within *Corynecladia*, defined by the presence of the generitype *C. clavata* within the clade. And again the Mediterranean sequences formed two, well separated taxa.

The genus *Corynecladia* has been considered a synonym of *Laurencia* (Yamada 1931; Kylin 1956) until Nam (2006: 693) reached the conclusion that “*Corynecladia* should be reinstated for the type species *L. clavata*”. Nam based this move on particular characters of *Laurencia clavata* Sonder (now *C. clavata* (Sonder) J. Agardh), specifically the marked constriction at the base of the ultimate branchlets, as well as its unique verticillate branching structure. In that paper, Nam, after having reported Womersley’s (2003: 460) opinion that in *L. clavata* “tetrasporangia seem to be abaxially produced from outer cortical cells” stated that “a critical examination of their (tetrasporangia) origin is needed”. This observation

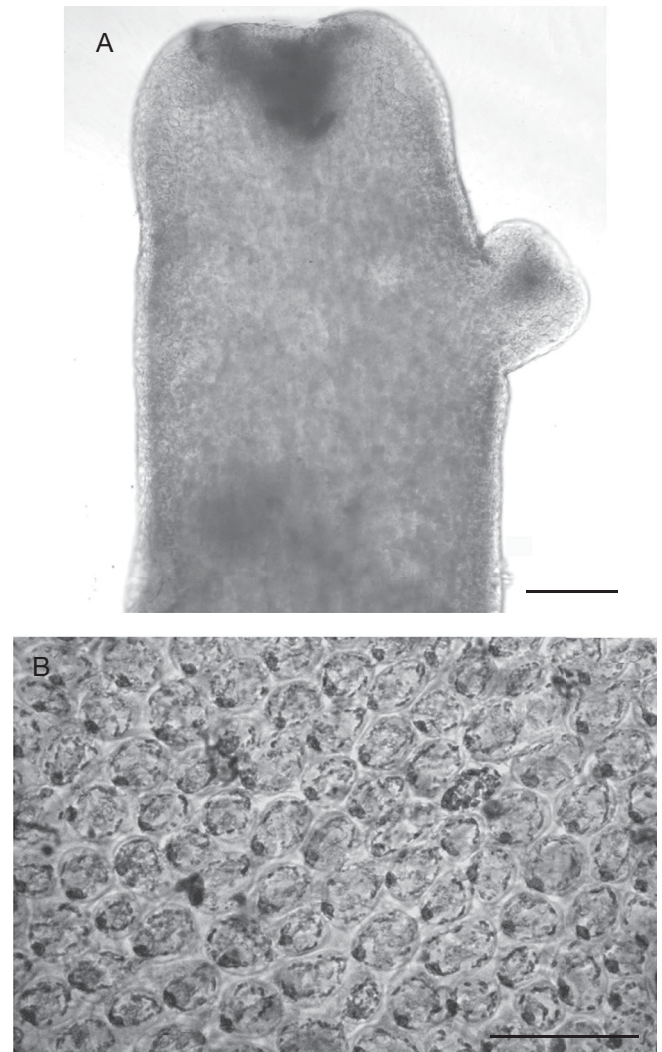


FIG. 7. — *Corynecladia mediterranea* sp. nov., holotype CAT 2724: **A**, apical part of a branch showing epidermal cells slightly projecting near the apex; **B**, epidermal cells in surface view showing one corpus en crise per cell. Scale bars: A, 150 µm; B, 100 µm.

of Womersley led some researchers (Cassano *et al.* 2019: 13) to consider the possibility that sporangia in *Corynecladia*, in addition to originating from particular periaxial cells, could also be produced from subcortical cells. In support of this latter possibility, they refer to observations made by Agardh (1876) and Womersley (2003). However, Womersley’s (2003) statement “... Tetrasporangia... in parallel arrangement cut off abaxially from outer cells...” appears to be unreliable. The parallel arrangement of sporangia is derived from their production from particular periaxial cells. When sporangia are produced from outer cortical cells the result is a random arrangement of sporangia. From both Womersley’s and Harvey’s illustrations tetrasporangia clearly appear in a parallel arrangement which is incompatible with an outer subcortical cell origin (Harvey 1862: pl. CLXXXIX, as *Chondria clavata* (Sonder) Harvey; Womersley 2003: fig. 206D). Observations recorded by Agardh (1876) state that in both *Corynecladia* and *Laurencia*: “*Sphaerosporae infra apicem*

TABLE 1. — Comparison of morphological features within *Corynecladia* J.Agardh. **Asterisk** indicates the paper, reported in the references below, where the corresponding character was observed.

	<i>Corynecladia millarii</i> sp. nov.	<i>Corynecladia mediterranea</i> sp. nov.	<i>Corynecladia nova</i> (Metti) Cassano, M.C.Oliveira & M.T.Fujii	<i>Corynecladia clavata</i> (Sonder) J.Agardh	<i>Corynecladia elata</i> (C.Agardh) Cassano, M.C.Oliveira & M.T.Fujii		
Height of the thallus	Up to 7 cm	Up to 8 cm	Up to 2-3 cm	10-15 cm or higher	Up to 40 cm		
Colour	Red	Red yellowish	Various shades of pink	Reddish-brown	Reddish-brown		
Thallus	Terete	Terete	Compressed except near the base	Terete	Compressed except near the base		
Texture	Soft	Soft	Sturdy but not strictly cartilaginous	Subcartilaginous	Rigid		
Vegetative structure	Type of attachment	Discoid holdfast and stolon-like branches	Discoid holdfast and stolon-like branches	Few thick rhizoids that grow along the substrate	Discoid holdfast	Discoid holdfast or creeping branches	
	Corps en cerise per cell	1 (occasionally 2) in cortical cells	1 in cortical cells	Absent	Not detectable	Not detectable	
	Epidermal cells (projection)	Present	Present (slightly)	Present (slightly)	Absent	Absent	
	Secondary pit connections	Present	Present	Present	Present	Present	
	Secondary cortication	Absent	Absent	Present	Present	Present	
	Refractive discoid starch grains	Absent	Absent	Absent?	Present	Absent	
	Lenticular thickenings	Absent	Absent	Absent	Absent	Present	
	Pericentral cells	4	4	4	4	4	
	Tetrasporangial stichidium	Additional	Absent	Absent	–	–	Absent
		Tetrasporangia (position)	3 <sup>rd</sup> , 4 <sup>th</sup>	3 <sup>rd</sup> , 4 <sup>th</sup>	–	–	3 <sup>rd</sup> , 4 <sup>th</sup>
Tetrasporangia (arrangement)		Parallel	Parallel	Parallel	Parallel*	Parallel	
Female structure	Procarp-bearing segment	–	–	–	–	5	
	Cystocarp shape	–	–	Ovoid with ostiole not protuberant	Conical to hemispherical with rounded to truncated apex*	Ovoid with ostiole not protuberant	
Male structure	Origin of spermatangial branches	–	–	From one of two lateral on suprabasal cell of the trichoblast	From one of two lateral on suprabasal cell of the trichoblast	From one of two lateral on suprabasal cell of the trichoblast	
	Type locality	Capo Murro di Porco, Syracuse, Sicily, Mediterranean sea	Porto Palo di Capo Passero, Syracuse, Sicily, Mediterranean sea	Plantation Point, Jervis Bay, NSW, Australia	Lefevre Peninsula, South Australia	King Island, Bass Strait, Australia	
	Habitat	Up to 1m depth	Up to 1m depth	Up to 9 m depth	Up to 30 m depth	Up to 25 m depth	
References	This study	This study	Metti <i>et al.</i> (2015); Cassano <i>et al.</i> (2019)	Womersley (2003); Cassano <i>et al.</i> (2019); *Saito & Womersley (1974)	Nam & Choi (2001); Cassano <i>et al.</i> (2019)		

*ramulorum sine ordinem in zonam transversalem aggregatae in cellulis infra-corticalibus formatae, rotundate tringule divisa*” (Sporangia within apices of branches with any order in transversal zones arranged forming in subcortical cells, rounded and triangularly divided) (Agardh 1876: 642, 644 for *Corynecladia* and *Laurencia*, respectively). More recently,

in both genera parallel arrangement of tetrasporangia and their pericentral cell origins are consistently observed (Saito 1967; Saito & Womersley 1974; Metti *et al.* 2015; Cassano *et al.* 2019). Therefore, we conclude that in *Corynecladia* the tetrasporangia are produced only from particular periaxial cells.

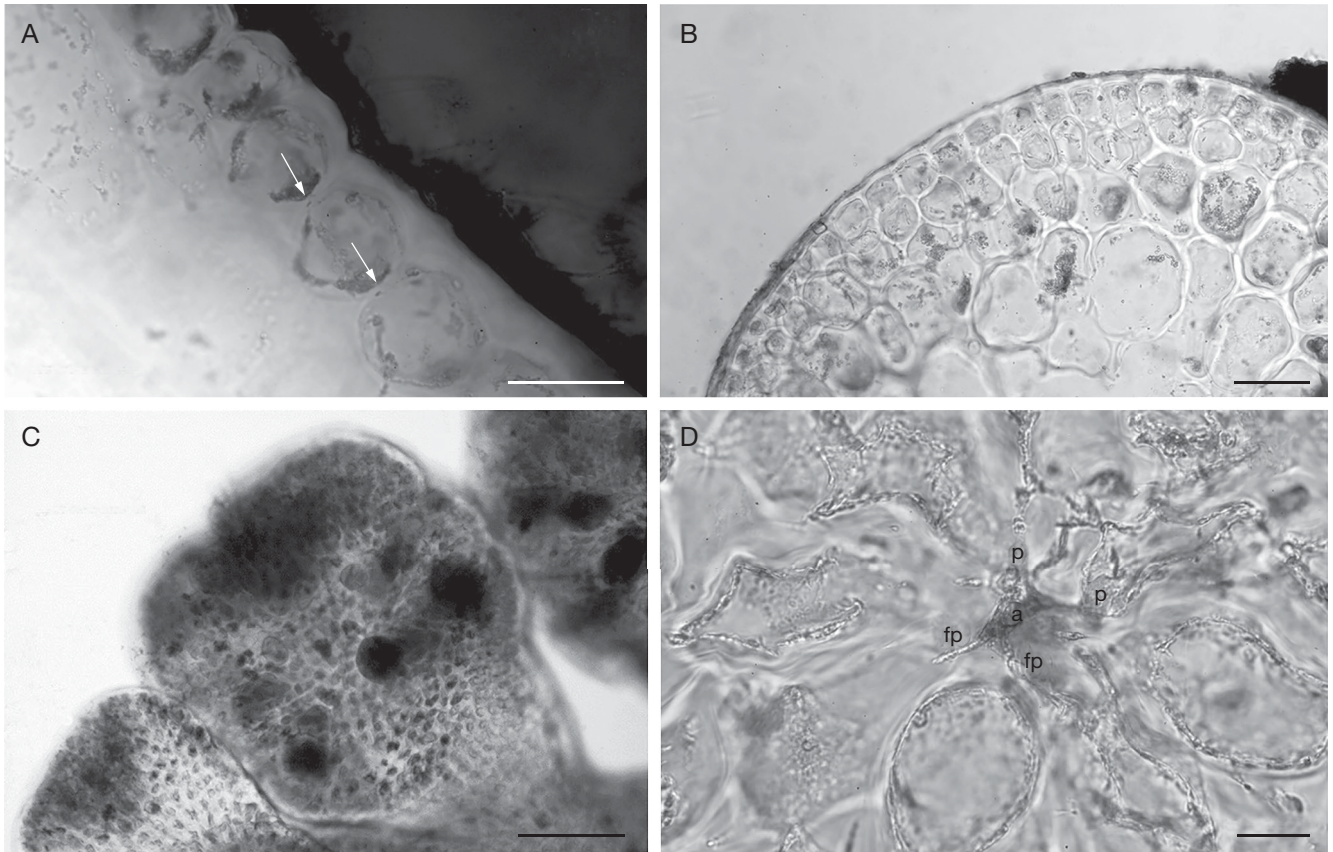


FIG. 8. — *Corynecladia mediterranea* sp. nov., holotype CAT 2724: **A**, longitudinal section showing secondary pit connection between epidermal cells located in median part of the cells, white arrows indicate secondary pit connections between epidermal cells; **B**, transverse section of the thallus near the base; **C**, tetrasporangial branchlet showing parallel arrangement of tetrasporangia; **D**, transverse section of a tetrasporic branch near the apex showing an axial cell (**a**) with two sterile (**p**) and two elongate fertile (**fp**) pericentral cells. Scale bars: A, 40  $\mu$ m; B, 100  $\mu$ m; C, 200  $\mu$ m; D, 20  $\mu$ m.

At the time of this study, in the Mediterranean were 22 *Laurencia* complex species recognized. This included nine *Laurencia* and one *Laurenciella* species, which share the characteristic of four pericentral cells with *Corynecladia*. The two newly proposed taxa differ from both *Laurencia* and *Laurenciella* genera in the visibility of secondary pit-connections, in particular, *Corynecladia* secondary pit connections are thin, deep and hardly visible from surface view. The three *Laurencia* taxa that are most similar to *C. millarii* sp. nov. and *C. mediterranea* sp. nov. include: *Laurencia obtusa* which mainly differs by the irregular ramification of both branches and branchlets; *L. microcladia* which primarily differs by the presence of lenticular thickenings and displaying a whorled branching structure; and *L. glandulifera* which differs from the proposed *Corynecladia* species by the presence of very short, wart-like ultimate branchlets. A dichotomous key was developed and included in this study to explain in detail the differences between all the Mediterranean *Laurencia* complex taxa, and includes the two newly proposed *Corynecladia* species.

Finally, it's noteworthy that, apart from molecular affinity, *C. millarii* sp. nov. and *C. mediterranea* sp. nov. in both vegetative and reproductive characters seem closer to *Lau-*

*rencia* and *Laurenciella*, from which they mainly differ in the occurrence of deep secondary pit connections between cortical cells, than to *Corynecladia* from which they differ in showing neither secondary cortication nor starch grains in medullary cells. Thus, *Corynecladia* is a very morphologically variable genus (Table 1) including species with a secondary cortication (wider in *C. elata* and *C. nova* [Metti *et al.* 2015], less wide in *C. clavata* [Nam & Choi 2001], absent in Mediterranean species [this study]), starch grains in medullary and subcortical cells (rather evident only in *C. clavata*, absent in Mediterranean species), and with secondary pit connections between cortical cells localized in the middle to inner part of the cells (the last character present in Mediterranean species and in *C. nova* [see Metti *et al.* 2015: fig 6C]).

Based on the above considerations, the following further amendment of the genus *Corynecladia* is proposed:

#### *Corynecladia* J.Agardh gen. emend.

*Species genera et ordines algarum, seu descriptiones succinctae specierum, generum et ordinum, quibus algarum regnum constituitur* 3: 642 (Agardh 1876).

KEY TO THE MEDITERRANEAN SPECIES OF THE *LAURENCIA* COMPLEX

1. Thalli throughout compressed or with only ultimate branchlets cylindrical. Two pericentral cells per axial segment, spermatangial branches of filament-type and tetasporangia produced from epidermal cells ..... 2  
 — Thalli throughout cylindrical. Two or four pericentral cells per axial segment ..... 6
2. Secondary pit connections between epidermal cells present ..... 3  
 — Secondary pit connections between epidermal cells absent ..... 5
3. Axes arising from a spreading basal crust. Spermatangial depressions cup-like, but slightly sunken. Species living in the littoral zone ..... *Osmundea verlaquei* G.Furnari  
 — Axe(s) arising from a discoid holdfast or from a stoloniferous holdfast ..... 4
4. Epidermal cells in surface view very elongated longitudinally. Spermatangial depressions cup-shaped. Cystocarps urceolate. Species living in the lower littoral zone to upper sublittoral zone .....  
 ..... *Osmundea truncata* (Kützing) K.W.Nam & Maggs  
 — Epidermal cells in surface view very elongated longitudinally in the basal and median parts of the thallus, isodiametric in the subapical parts. Spermatangial depressions cup-shaped, but slightly sunken, located at the bifurcation of the branches. Cystocarps ovoid. Species living in the upper sublittoral zone (up to 7 m depth) .....  
 ..... *Osmundea oederi* (Gunnerus) G.Furnari  
 — Epidermal cells in surface view polyhedral. Spermatangial depressions pocket-shaped. Cystocarps ovoid. Species living in the lower sublittoral zone or if in shallower water in shaded habitats .....  
 ..... *Osmundea pelagosae* (Schiffner) K.W.Nam
5. Axes arising from a thick spreading crust. Epidermal cells, in transverse section, radially elongated and palisade-like. Medullary cells without lenticular thickenings. Spermatangial depressions cup-shaped. Species living in the littoral zone ..... *Osmundea pelagiensis* G.Furnari  
 — Axes arising from a stoloniferous holdfast. Epidermal cells, in transverse section, obconic and not palisade-like. Medullary cells with lenticular thickenings. Spermatangial depressions pocket-shaped. Species living in the littoral zone ..... *Osmundea pinnatifida* (Hudson) Stackhouse  
 (Its occurrence in the Mediterranean sea should be confirmed.)
6. Secondary pit connections between epidermal cells present. Four pericentral cells per axial segment ..... 7  
 — Secondary pit connections between epidermal cells absent. Two pericentral cells per axial segment ..... 16
7. Adult thalli not taller than 20 mm ..... 8  
 — Thalli up to 15 cm or more high ..... 9
8. One to three (rarely four) erect axes, arising from a discoid holdfast. Axes simple or with one short subapical branchlet. Epidermal cells slightly projecting near the apex. Medullary cells with lenticular thickenings. Species epiphytic on both seagrasses leaves and macroalgae .....  
 ..... *Laurencia minuta* Vandermeulen, Garbary & Guiry subsp. *scammaccae* G.Furnari & Cormaci  
 — One (occasionally two or three) erect axes arising from a discoid holdfast. Axes to four orders of ramification. Epidermal cells not projecting near the apex. Species epiphytic only on seagrasses leaves .....  
 ..... *Laurencia epiphylla* Boisset & Lino
9. Thalli more or less densely entangled ..... 10  
 — Thalli erect not entangled ..... 11
10. Thalli densely entangled forming compact tufts. Branching irregularly spiral. In transverse section the axial cell not distinguishable in median portions of the thallus. Species living in the lower littoral to upper sublittoral zones ..... *Laurencia intricata* J.V.Lamouroux  
 — Thalli prostrate flexuous and frequently entangled. In transverse section, the axial cell is readily distinguishable in median portions of the thallus. Branching sparse, irregular with branches and branchlets often inserted nearly at a right angle. Branchlets with apices obtuse. Species living in the lower sublittoral zone or if in shallower water in shaded habitats ..... *Laurencia chondrioides* Børgesen
11. Presence of deciduous branchlets formed abundantly near branches. Species living in the sublittoral zone .....  
 ..... *Laurencia caduciramulosa* Masuda & Kawaguchi  
 — Absence of deciduous branchlets ..... 12
12. Axes radially ramified. Branches and branchlets spirally ramified giving a pyramidal outline to the thallus ... 13  
 — Axes irregularly or whorled ramified ..... 14

13. Thalli soft in texture. Axes not percurrent. Epidermal cells very projecting near the apex. Tetrasporangia produced from both the third and the fourth pericentral cells. Species living in the lower littoral to upper sublittoral zone ..... *Laurenciella marilzae* (Gil-Rodríguez *et al.*) Gil-Rodríguez *et al.*  
 — Thalli more or less cartilaginous in texture. Axes percurrent, branchlets often grouped in whorls, decreasing in length in the upper parts of the thallus giving it a conical outline. Epidermal cells not projecting near the apex. Tetrasporangia produced from only the fourth pericentral cell. Species living in the sublittoral zone ..... *Laurencia pyramidalis* Bory ex Kützing
14. In surface view, secondary pit-connections easily visible. In longitudinal section they appear localized in the outer part of the cells ..... 15  
 — In surface view, secondary pit-connections thin and hardly visible. In longitudinal section they appear localized in the middle to inner part of the cells. Species living in the lower littoral to upper sublittoral zone .....  
 ..... *Corynecladia millarii* Metti, G. Furnari & Serio, sp. nov.  
 — ..... *Corynecladia mediterranea* Metti, G. Furnari & Serio, sp. nov.  
 (The above two species distinguish each other only in different molecular sequences.)
15. Branches and branchlets irregularly ramified. Medullary cells without lenticular thickenings. Species living in the sublittoral zone ..... *Laurencia obtusa* (Hudson) J.V.Lamouroux  
 — Branches and branchlets in whorls of 2-3, clavate and restricted at their bases. Medullary cells with lenticular thickenings. Species living in the sublittoral zone ..... *Laurencia microcladia* Kützing  
 — Branches and branchlets very short with wart-like ultimate branchlets subverticillately arranged. Medullary cells without lenticular thickenings. Species living in the lower littoral to upper sublittoral zones ..... *Laurencia glandulifera* (Kützing) Kützing
16. Thalli soft in texture. Spermatangial branches of filament-type and tetrasporangia produced from epidermal cells. Species living in the lower littoral zone ..... *Osmundea maggsiana* Serio, Cormaci & G. Furnari  
 — Thalli cartilaginous in texture. Spermatangial branches of trichoblast-type, tetrasporangia produced from pericentral cells ..... 17
17. Axes arising from a thick basal crust. Thalli yellowish, blackish at the base. Species living in the littoral zone ..... *Palisada tenerima* (Cremades) Serio, Cormaci, G. Furnari & Boisset  
 — Axes arising from a discoid holdfast with or without stolon-like branches ..... 18
18. Epidermal cells of branches and all ultimate branchlets in transverse section obconic and not palisade-like. Branching divaricate with branches arising at open angles to 90°. Species living in the littoral zone in bays and lagoon ..... *Palisada patentiramea* (Montagne) Cassano *et al.*  
 — Epidermal cells of branches and ultimate branchlets in transverse section radially elongated and palisade-like ..... 19
19. Axes and branches irregularly and alternately ramified. Apices sunken with mamillate edges. Species living in the sublittoral zone ..... *Palisada thuyoides* (Kützing) Cassano *et al.*  
 — Axes and branches very densely clothed with numerous truncate, wart-like ultimate branchlets, subverticillately arranged. Species living in the lower littoral zone ..... *Palisada perforata* (Bory) K.W.Nam  
 — Axes irregularly ramified, naked in the proximal parts. Branches irregularly and alternately ramified, branchlets subopposite, frequently subverticillately arranged in the median parts, branches of the third order often unilateral. Species living in the upper sublittoral zone ..... *Palisada maris-rubri* (K.W.Nam & Saito) K.W.Nam

#### DESCRIPTION

Apical cell sunk in an apical pit of branchlet; central axis recognisable only near apical cell; forming extensive cortex; four periaxial cells on vegetative axial segments; the first periaxial cell underneath the trichoblasts; secondary pit connections between cortical cells present; secondary cortication present or not (according to species); medullary and subcortical cells with numerous refractive discoid starch grains (according to species); spermatangial development of trichoblast type; spermatangial branches produced from one of two laterals on suprabasal cell of trichoblasts; procarp-bearing segments with five periaxial cells; tetrasporangial in parallel arrangement; tetrasporangial production only from particular periaxial cells. Differs from *Laurencia*/*Laurenciella* also in molecular sequences.

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## APPENDIX

APPENDIX. — A list of species used for molecular work in this study, including newly generated *rbcL* and COI-5P sequences, and downloaded GenBank sequences.

Species	Accession number	Location and collecting data	Reference	Marker
<i>Ceramium kondoi</i> Yendo	DQ350388	Japan, Niigata, Itoigawa, E.C.Yang, G.Y.Cho, K.Kogame, S.M.Boo, C1315	GenBank	<i>rbcL</i>
<i>Chondria californica</i> (Collins) Kylin	AY172578	United States, California, San Diego County, Beach Club Reef (La Jolla Shores), 1.VII.1996, M.Volovsek	Mclvor <i>et al.</i> (2002)	<i>rbcL</i>
<i>Chondria capillaris</i> (Hudson) M.J.Wynne	MG255052	Ireland, Frinavarra, 17.VIII.2004, SAP106295	Sutti <i>et al.</i> (2018)	<i>rbcL</i>
<i>Chondria capillaris</i>	MF094021	United Kingdom, England, Swanage, 7.VI.2015, PD2129	Díaz-Tapia <i>et al.</i> (2017)	COI-5P
<i>Chondria collinsiana</i> M.A.Howe	GU330225	Brazil, Rio de Janeiro, Armação dos Búzios, Praia Rasa, 13.I.2005, V.Cassano, J.C.De-Paula, SP399.865	Cassano <i>et al.</i> (2012b)	<i>rbcL</i>
<i>Chondria crassicaulis</i> Harvey	GU223872	Japan, Niigata Pref., Kashiwazaki, Kujira-nami, 03.V.2008, Kashiwazaki-A4	Kurihara <i>et al.</i> (2010)	COI-5P
<i>Chondria dangeardii</i> E.Y.Dawson	GU223879	United States, Hawaii, Molokai, 21.III.2008, ARS03592	Kurihara <i>et al.</i> (2010)	COI-5P
<i>Chondria decipiens</i> Kylin	MG272232	United States, California, San Nicolas Island, 14.XI.2012, UC2025838	Sutti <i>et al.</i> (2018)	COI-5P
<i>Chondria scintillans</i> G.Feldmann	KF492717	France, Brittany, Roscoff-Theven, 05.XII.2002, F.Rousseau, JML0048	Machín-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Chondria succulenta</i> (J.Agardh) Falkenberg	KY120336	Australia, NSW, Batehaven, 30.V.2005, Y.Metti, YM309, NSW879470	Metti <i>et al.</i> (2015)	<i>rbcL</i>
<i>Chondrophycus dotyi</i> (Y.Saito) K.W.Nam	HQ423050	United States, Hawaii, Oahu, Waikiki Natatorium, 27.IV.2007, K.Shultz, BISH669750 (#00693)	Sherwood <i>et al.</i> (2010)	COI-5P
<i>Chondrophycus dotyi</i>	KX815263	United States, Hawaii, Oahu, Sandy Beach, 31.V.2015, E.Stein, SP 469.710	Sentías <i>et al.</i> (2016)	<i>rbcL</i>
<i>Chondrophycus</i> sp.	FJ785311	New Caledonia, Loyalty Islands, Beautemps/Beaupré, 06.IV.2005, C.Payri, IRD112	Martin-Lescanne <i>et al.</i> (2010)	<i>rbcL</i>
<i>Chondrophycus</i> sp.	GU223885	United States, Hawaii, Richardson Beach Park, 23.I.2008, A.Kurihara, K.Conklin, ARS 03326	Sherwood <i>et al.</i> (2010)	COI-5P
<i>Chondrophycus</i> sp.	KX146174	New Caledonia, Loyalty Islands, Beautemps/Beaupré, C.Payri, 06.IV.2005, JML0250	Rousseau <i>et al.</i> (2017)	<i>rbcL</i>
<i>Chondrophycus</i> sp.	KX815262	Mexico, Quintana Roo, Isla Mujeres, Garrafon de Castilla, 12.II.2007, A.Sentías, M.C.Gil-Rodríguez, UAMIZ1240	Sentías <i>et al.</i> (2016)	<i>rbcL</i>
<i>Chondrophycus</i> sp.	KY120337	Australia, Norfolk Island, Collins Head, intertidal, 21.III.2005, Y.Metti, A.Millar, YM296, NSW900770	Metti <i>et al.</i> (2015)	<i>rbcL</i>
<i>Chondrophycus</i> sp.	KY927795	South Africa, 09.VI.2010, R.J.Anderson, J.J.Bolton, CMF-2017	Francis <i>et al.</i> (2017)	<i>rbcL</i>
<i>Chondrophycus succisus</i> (A.B.Cribb) K.W.Nam	GU223884	United States, Molokai, 11.II.2007, ARS02583	Kurihara <i>et al.</i> (2010)	COI-5P
<i>Chondrophycus tronoi</i> (E.Ganzon-Fortes) K.W.Nam	AF489864	Philippines	GenBank	<i>rbcL</i>
<i>Chondrophycus</i> cf. <i>undulatus</i> (Yamada) Garbary & Harper	FJ785307	New Caledonia, Maré, Loyalty Is., 22.III.2005, C.Payri, IRD100	Martin-Lescanne <i>et al.</i> (2010)	<i>rbcL</i>
<i>Chondrophycus undulatus</i>	HQ422752	United States, Hawaii, Maui, Ahihi Bay (Site 2), 25.VI.2007, A.Kurihara, #02493	Sherwood <i>et al.</i> (2010)	COI-5P
<i>Chondrophycus undulatus</i>	HQ422996	United States, Hawaii, Oahu, Hauula Beach Park, 18.IX.2007, A.Kurihara, #02922	Sherwood <i>et al.</i> (2010)	COI-5P
<i>Corynecladia clavata</i> (Sonder) J.Agardh	MF094079	Australia, Victoria, Walkerville, 20.I.2015, P.Díaz-Tapia, M.Brookes, PD1300	Díaz-Tapia <i>et al.</i> (2017)	<i>rbcL</i>
<i>Corynecladia clavata</i>	MH704453	Australia, Victoria, The Caves, 20.I.2015, P.Díaz-Tapia, M.Brookes, SPF58163	GenBank	<i>rbcL</i>
<i>Corynecladia clavata</i>	MH704456	Australia, Victoria, The Caves, 20.I.2015, P.Díaz-Tapia, M.Brookes, SPF58163	GenBank	COI-5P
<i>Corynecladia clavata</i>	MK260194	Australia, Victoria, Point Lonsdale, Town Beach, 18.V.2010, G.T.Kraft, R.Kraft, B.Dog jr., GWS017395	GenBank	COI-5P

## APPENDIX. — Continuation.

Species	Accession number	Location and collecting data	Reference	Marker
<i>Corynecladia elata</i> (C.Agardh) Cassano, M.C.Oliveira & M.T.Fujii	KY120339	Australia, Western Australia, Rottneest Island, subtidal, 15.XI.2008, James Eu, JE01, NSW900764	Metti <i>et al.</i> (2015)	<i>rbcl</i>
<i>Corynecladia elata</i>	OR046643	Australia, Western Australia, Rottneest Island, 15.XI.2008, J.Eu, JE01, NSW900764	This study	COI-5P
<i>Corynecladia mediterranea</i> Metti, G.Furnari & Serio, sp. nov.	OQ738971	Italy, Sicily, Trapani, San Vito Lo Capo, Golfo di Monte Cofano (38°06'21"N, 12°41'36"E), 09.VII.2017, D.Serio, MCZ2, CAT2724	This study	<i>rbcl</i>
<i>Corynecladia mediterranea</i> sp. nov.	OQ738951	Italy, Sicily, Syracuse, Porto Palo di Capo Passero (36°39'03.8"N, 15°04'37.4"E), 08.V.2021, D.Serio, 4CPm21, CAT2726	This study	<i>rbcl</i>
<i>Corynecladia mediterranea</i> sp. nov.	OQ738950	Italy, Sicily, Syracuse, Porto Palo di Capo Passero (36°39'03.8"N, 15°04'37.4"E), 08.V.2021, D.Serio, 4CPm21, CAT2726	This study	COI-5P
<i>Corynecladia mediterranea</i> sp. nov.	OR046646	Greece, Grecia Peloponneso, Gerolimenas (36°28'45"N, 22°24'02"E), 31.VIII.2009, D.Serio, GR1	This study	COI-5P
<i>Corynecladia mediterranea</i> sp. nov.	OR046647	Italy, Sicily, Trapani, San Vito Lo Capo, Castelluzzo (38°06'21"N, 12°41'36"E), 01.VII.2009, D.Serio, MC4	This study	COI-5P
<i>Corynecladia mediterranea</i> sp. nov.	OR046648	Italy, Sicily, Trapani, San Vito Lo Capo, Castelluzzo (38°06'21"N, 12°41'36"E), 09.VII.2017, D.Serio, MCZ2	This study	COI-5P
<i>Corynecladia mediterranea</i> sp. nov.	OR046645	Italy, Favignana, Cala San Nicola, 01.IX.2017, D.Serio, FV5	This study	COI-5P
<i>Corynecladia millarii</i> Metti, G.Furnari & Serio, sp. nov.	OQ738952	Italy, Sicily, Syracuse, Cap Murro di Porco, 15.III.2007, D.Serio, CAT 2063	This study	<i>rbcl</i>
<i>Corynecladia millarii</i> sp. nov.	OQ738962	Italy, Sicily, Syracuse, Cap Murro di Porco (37°00'37"N, 15°18'28"E), 13.III.2021, D.Serio, CMPR4, CAT 2723	This study	<i>rbcl</i>
<i>Corynecladia millarii</i> sp. nov.	OQ738961	Italy, Sicily, Syracuse, Cap Murro di Porco (37°00'37"N, 15°18'28"E), 13.III.2021, D.Serio, CMPR4, CAT 2723	This study	COI-5P
<i>Corynecladia millarii</i> sp. nov.	OQ738960	Italy, Sicily, Syracuse, Cap Murro di Porco (37°00'37"N, 15°18'28"E), 13.III.2021, D.Serio, CMPR2, CAT 2722	This study	<i>rbcl</i>
<i>Corynecladia millarii</i> sp. nov.	OQ738959	Italy, Sicily, Syracuse, Cap Murro di Porco (37°00'37"N, 15°18'28"E), 13.III.2021, D.Serio, CMPR2, CAT 2722	This study	COI-5P
<i>Corynecladia millarii</i> sp. nov.	OQ738958	Italy, Sicily, Syracuse, Cap Murro di Porco (37°00'37"N, 15°18'28"E), 13.III.2021, D.Serio, CMPR1, CAT 2721	This study	<i>rbcl</i>
<i>Corynecladia millarii</i> sp. nov.	OQ738957	Italy, Sicily, Syracuse, Cap Murro di Porco (37°00'37"N, 15°18'28"E), 13.III.2021, D.Serio, CMPR2, CAT 2722	This study	COI-5P
<i>Corynecladia millarii</i> sp. nov.	OR046644	Italy, Sicily, Syracuse, Cap Murro di Porco, 15.III.2007, D.Serio, CAT 2063	This study	COI-5P
<i>Corynecladia nova</i> (Metti) Cassano, M.C.Oliveira & M.T.Fujii	KY120340	Australia, NSW, Jervis Bay, Plantation Pt, subtidal, 15.II.2005, Y.Metti, A.Millar, YM194, NSW900767	Metti <i>et al.</i> (2015)	<i>rbcl</i>
<i>Corynecladia nova</i>	OQ738973	Australia, NSW, Jervis Bay, Plantation Pt, subtidal, 15.II.2005, Y.Metti, A.Millar, YM195, NSW1130351	This study	<i>rbcl</i>
<i>Laurencia aldingensis</i> Y.Saito & Womersley	JF810351	Brazil, Rio de Janeiro, Arma ção dos Búzios, Praia, Rasa, 13.I.2005, V.Cassano, J.C.De-Paula	Cassano <i>et al.</i> (2012b)	<i>rbcl</i>
<i>Laurencia caduciramulosa</i> Masuda & S.Kawaguchi	JF781525	Spain, Canary Islands, Tenerife, Punta del Hidalgo, 6.V.2008, M.C.Gil-Rodríguez, M.T.Fujii, V.Cassano, J.Díaz-Larrea,	Machín-Sánchez <i>et al.</i> (2012)	<i>rbcl</i>
<i>Laurencia catarinensis</i> Cordeiro-Marino & Fujii	KF492781	Spain, Canary Islands, Tenerife, Punta del Hidalgo, 22.VI.2012, M.C.Gil-Rodríguez, M.Machín- Sánchez, MMS0151	Machín-Sánchez <i>et al.</i> (2014)	<i>rbcl</i>
<i>Laurencia dendroidea</i> J.Agardh	AF465808	Brazil, Sao Paulo, Ubatuba, Ilha das Couves, 19.I.2001, M.T.Fujii	Fujii <i>et al.</i> (2006)	<i>rbcl</i>
<i>Laurencia dendroidea</i>	HQ422746	United States, Hawaii, ARS02549	GenBank	COI-5P

## APPENDIX. — Continuation.

Species	Accession number	Location and collecting data	Reference	Marker
<i>Laurencia dendroidea</i>	KF492725	Spain, Canary Islands, La Gomera, Punta de La Dama, 21.IX.2009, Eva Aylagas, M.Machín-Sánchez, MMS0183	Machín-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Laurencia dendroidea</i>	KF492726	Spain, Canary Islands, La Gomera, Charco del Conde, 23.IX.2009, Eva Aylagas, M.Machín-Sánchez, MMS0182	Machín-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Laurencia dendroidea</i>	KF492785	Spain, Canary Islands, Tenerife, El Pris, 13.V.2011, M.C.Gil-Rodríguez, M.Machín-Sánchez, MMS0082	Machín-Sánchez <i>et al.</i> (2014)	<i>rbcl</i>
<i>Laurencia dendroidea</i>	KX258827	Oman, Dohfar (17°27'36.0"N, 55°14'24.0"E), 01.IX.2001, M.Wynne, WYNR154	Rousseau <i>et al.</i> (2017)	COI-5P
<i>Laurencia dendroidea</i>	MH388711	Venezuela, Falcon, Playa Buchuacos, 06.X.2012, G.García-Soto, UA1120	García-Soto & López-Bautista (2018)	COI-5P
<i>Laurencia dendroidea</i>	OR046643	Australia, WA, Rottneest Island, 15.XI.2008, J.Eu, JE05	This study	COI-5P
<i>Laurencia dendroidea</i>	MT822855	Australia, NSW, Batehaven, 30.V.2005, Y.Metti, NSW879472 (YM302)	Metti 2017	COI-5P
<i>Laurencia intricata</i> J.V.Lamouroux	MG004181	United States, Florida, Key Biscayne, Crandon Park, 13.VIII.2013, FTG167917	Collado-Vides <i>et al.</i> (2018)	<i>rbcl</i>
<i>Laurencia nidifica</i> J.Agardh	HQ422750	United States, Hawaii, Oahu, Laie, 08.IV.2007, A.Kurihara, #02526	Sherwood <i>et al.</i> (2010)	COI-5P
<i>Laurencia nipponica</i> Yamada	GU223874	Russia, Sakhalin Island, Tangi, 23.VI.2003, T.Abe, Russia-C5	Kurihara <i>et al.</i> (2010)	COI-5P
<i>Laurencia obtusa</i> (Hudson) J.V.Lamouroux	AF281881	Ireland, Co. Donegal, Fanad Head (intertidal pool), 06.VII.1998, #455	Nam <i>et al.</i> (2000)	<i>rbcl</i>
<i>Laurencia obtusa</i>	OQ738953	Italy, Syracuse, MPA Plemmirio, Capo Murro di Porco, 13.III.2021, D.Serio, CMPA1	This study	COI-5P
<i>Laurencia obtusa</i>	OQ738955	Italy, Syracuse, MPA Plemmirio, Capo Murro di Porco, 13.III.2021, D.Serio, CMPA2	This study	COI-5P
<i>Laurencia obtusa</i>	OQ738965	Italy, Favignana, Cala Faraglioioni, 02.IX.2017, D.Serio, FV8	This study	<i>rbcl</i>
<i>Laurencia obtusa</i>	OQ738969	Italy, Sicily, San Vito Lo Capo, Castelluzzo, 08.I.2011, D.Serio, MCA5	This study	<i>rbcl</i>
<i>Laurencia obtusa</i>	OQ738970	Italy, Sicily, San Vito Lo Capo, Castelluzzo, 09.VII.2017, D.Serio, MCZ1	This study	<i>rbcl</i>
<i>Laurencia obtusa</i>	OQ738946	Italy, Syracuse, MPA Plemmirio, Capo Murro di Porco, 08.V.2021, D.Serio, 2CPm2021	This study	COI-5P
<i>Laurencia obtusa</i>	OQ738948	Italy, Syracuse, MPA Plemmirio, Capo Murro di Porco, 08.V.2021, D.Serio, 3CPm2021	This study	COI-5P
<i>Laurencia obtusa</i>	KX258828	France, Languedoc-Roussillon, Pyrenees-Orientales, Cap Beart, Banyuls-sur-Mer, 11.VII.2007, L.Bittner, LBC0053	Rousseau <i>et al.</i> (2017)	COI-5P
<i>Laurencia oliveirana</i> Yoneshigue-Valentin, M.J.Wynne & V.Cassano	JF810352	Brazil, Ponta da Cabeça, Arraial do Cabo, Rio de Janeiro, 2008, V.Cassano, J.C.De-Paula, SP399.857	Cassano <i>et al.</i> (2012b)	<i>rbcl</i>
<i>Laurencia pacifica</i> Kylin	HQ544189	United States, 20.V.2010, B.Clarkston, K.Hind, S.Toews, GWS022084	GenBank	COI-5P
<i>Laurencia pyramidalis</i> Bory ex Kützing	KF492756	Spain, Canary Islands, Fuerteventura, Garcey, 10.IX.2012, M.Machín-Sánchez, MMS0154	Machín-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Laurencia pyramidalis</i>	KF492793	Spain, Canary Islands, Fuerteventura, Garcey, 10.IX.2012, M.Machín-Sánchez, MMS0154	Machín-Sánchez <i>et al.</i> (2014)	<i>rbcl</i>
<i>Laurencia viridis</i> Gil- Rodríguez & Haroun	KF492760	Portugal, Azores, Santa Maria, Boca de ribeira seca, 02.VII.2011, M.T.Fujii, A.Neto, J.Pombo, M.Machín-Sánchez, MMS0038	Machín-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Laurencia viridis</i>	KF492794	Portugal, Azores, Santa Maria, Boca de ribeira seca, 02.VII.2011, M.T.Fujii, A.Neto, J.Pombo, M.Machín-Sánchez, MMS0038	Machín-Sánchez <i>et al.</i> (2014)	<i>rbcl</i>
<i>Laurenciella marilzae</i> (Gil- Rodríguez, Senties, Díaz-Larrea, Cassano & M.T.Fujii) Gil-Rodríguez, Senties, Díaz-Larrea, Cassano & M.T.Fujii	EF686002	Spain, Punta del Hidalgo Tenerife, Canary Islands, 12.VII.2006, Gil-Rodríguez, TFCPhyc.N#13129	Gil-Rodríguez <i>et al.</i> (2009)	<i>rbcl</i>
<i>Laurenciella marilzae</i>	GU938189	Brazil, Laje de Santos Marine State Park, Parcel do Sul, Sao Paulo, 2007, R.Rocha-Jorge, SP399814	Rocha-Jorge <i>et al.</i> (2010)	<i>rbcl</i>

APPENDIX. — Continuation.

Species	Accession number	Location and collecting data	Reference	Marker
<i>Laurenciella marilzae</i>	HQ115065	Mexico, Isla Mujeres, Quintana Roo, 2008, A.Senties, M.T.Fujii, UAMIZ1019	Senties <i>et al.</i> (2011)	<i>rbcl</i>
<i>Laurenciella marilzae</i>	KF492762	Spain, Canary Islands, Lanzarote, Pechiguerras, 15.I.2013, M.C.Gil Rodriguez, M.Machin-Sánchez, MMS0174	Machin-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Laurenciella marilzae</i>	KX146186	Croatia, Scedro, 11.VI.2007, J.Utge, L. Le Gall, LLG0242	Rousseau <i>et al.</i> (2017)	<i>rbcl</i>
<i>Laurenciella marilzae</i>	KX258829	Croatia, Scedro, 11.VI.2007, J.Utge, L. Le Gall, LLG0242	Rousseau <i>et al.</i> (2017)	COI-5P
<i>Laurenciella marilzae</i>	MF093987	Spain, Pta Hidalgo, Tenerife, 10.VI.2015, HV1501	Díaz-Tapia <i>et al.</i> (2017)	COI-5P
<i>Laurenciella marilzae</i>	MT822847	Italy, Sicily, San Vito Lo Capo (Trapani), 09.VII.2017, MCZ6	This study	COI-5P
<i>Laurenciella marilzae</i>	MT822850	Italy, Sicily, Bruccoli (Siracusa), 18.VII.2017, BZ1	This study	COI-5P
<i>Laurenciella mayaimii</i> L.Collado-Vides, Cassano & M.T.Fujii	MG004176	United States, Florida, Biscayne Bay, Deering Estate, 12.VIII.2013, SPF58079	Collado-Vides <i>et al.</i> (2018)	COI-5P
<i>Laurenciella mayaimii</i>	MG004177	United States, Florida, Biscayne Bay, Deering Estate, 12.VIII.2013, SP469170	Collado-Vides <i>et al.</i> (2018)	COI-5P
<i>Laurenciella mayaimii</i>	MG004178	United States, Florida, Key Largo, 14.VIII.2013, FTG167920	Collado-Vides <i>et al.</i> (2018)	COI-5P
<i>Laurenciella mayaimii</i>	MG004182	United States, Florida, Biscayne Bay, Deering Estate, 12.VIII.2013, SPF58079	Collado-Vides <i>et al.</i> (2018)	<i>rbcl</i>
<i>Laurenciella mayaimii</i>	MG004183	United States, Florida, Key Largo, 14.VIII.2013, FTG167920	Collado-Vides <i>et al.</i> (2018)	<i>rbcl</i>
<i>Laurenciella</i> sp.	MF094082	Australia, Twen Reef, Victoria, intertidal, 19.I.2015, PD1524	Díaz-Tapia <i>et al.</i> (2017)	<i>rbcl</i>
<i>Laurenciella namii</i> Popolizio, C.W.Schneider & C.E.Lane	MG004179	United States, Florida, Key Biscayne, Crandon Park, 12.VIII.2013, SPF57893	Popolizio <i>et al.</i> (2022)	COI-5P
<i>Laurenciella namii</i>	MG004184	United States, Florida, Key Biscayne, Crandon Park, 12.VIII.2013, SPF57893	Popolizio <i>et al.</i> (2022)	<i>rbcl</i>
<i>Ohelopapa flexilis</i> (Setchell) F.Rousseau, Martin- Lescanne, Payri & L. Le Gall	KX146187	French Polynesia, Tahiti, Tahara reef, 24.III.2007, A.Apham, 01A07	Rousseau <i>et al.</i> (2017)	<i>rbcl</i>
<i>Ohelopapa flexilis</i>	KX258830	French Polynesia, Tahiti, Tahara reef, 24.III.2007, A.Apham, 01A07	Rousseau <i>et al.</i> (2017)	COI-5P
<i>Osmundea blinksii</i> (Hollenberg & I.A.Abbott) K.W.Nam	AY172575	United States, California, San Mateo Co., Ano Nuevo, Greyhound Rock, 17.VII.1996, C.A.Maggs	Mclvor <i>et al.</i> (2002)	<i>rbcl</i>
<i>Osmundea oederi</i> (Gunnerus) G.Furnari	KU566532	Portugal, Azores, Sao Miguel, Ferraria, 27.VI.2011, E.Nogueira, V.Cassano, A.Senties, MMS0010	Machin-Sánchez <i>et al.</i> (2016)	COI-5P
<i>Osmundea oederi</i>	KU566558	Portugal, Azores, Sao Miguel, Ferraria, 27.VI.2011, E.Nogueira, V.Cassano, A.Senties, MMS0010	Machin-Sánchez <i>et al.</i> (2016)	<i>rbcl</i>
<i>Osmundea oederi</i>	KX258833	France, Normandy, Manche, Grand Colomier nord, îles Chausey (48°52'48.0"N, 1°49'58.8"W), 16.IV.2008, L. Le Gall, LLG1116	Rousseau <i>et al.</i> (2017)	COI-5P
<i>Osmundea osmunda</i> (S.G.Gmelin) K.W.Nam & Maggs	AF281877	Ireland, Co. Donegal, St. John's Point, 12.X.1999, #1038	Nam <i>et al.</i> (2000)	<i>rbcl</i>
<i>Osmundea osmunda</i>	KJ960860	France, Brittany, Le Loup, 30.VIII.2011, L.Couceiro, M.Robuchon, RMAR2969	GenBank	COI-5P
<i>Osmundea pinnatifida</i> (Hudson) Stackhouse	KF492771	Portugal, Azores, Pico, Santa Cruz Ribeiras-Piscinas, 29.VI.2011, M.T.Fujii, A.Neto, M.Machin-Sánchez, MMS0034	Machin-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Osmundea pinnatifida</i>	KU647694	Portugal, 29.VI.2011, MMS0034	Machin-Sánchez <i>et al.</i> (2016)	<i>rbcl</i>
<i>Osmundea prudhommevanreinei</i> Machin-Sánchez & Gil- Rodríguez	KU566546	Spain, Canary Islands, Tenerife, Playa Paraiso, 08.V.2012, M.C.Gil-Rodríguez, M.Machin-Sánchez, MMS0144	Machin-Sánchez <i>et al.</i> (2016)	COI-5P
<i>Osmundea prudhommevanreinei</i>	KU566568	Spain, Canary Islands, Tenerife, Playa Paraiso, 08.V.2012, M.C.Gil-Rodríguez, M.Machin-Sánchez, MMS0144	Machin-Sánchez <i>et al.</i> (2016)	<i>rbcl</i>
<i>Osmundea spectabilis</i> (Postels & Ruprecht) K.W.Nam	KM254320	United States, California, McAbee Beach, Monterey, 21.V.2010, B.Clarkston, K.Hind, S.Toews, GWS022243	Saunders (2014)	COI-5P

## APPENDIX. — Continuation.

Species	Accession number	Location and collecting data	Reference	Marker
<i>Osmundea spectabilis</i>	KM254469	United States, California, Bird Rock, Pacific Grove, 22.V.2010, B.Clarkston, K.Hind, S.Toews, GWS022314	Saunders (2014)	COI-5P
<i>Osmundea spectabilis</i> var. <i>spectabilis</i>	AY172573	United States, California, Cambria, San Luis Obispo, 10.VII.1996	Mclvor <i>et al.</i> (2002)	<i>rbcl</i>
<i>Osmundea splendens</i> (Hollenberg) K.W.Nam	KM254322	United States, California, Santa Cruz (Four Mile), 19.V.2010, B.Clarkston, K.Hind, S.Toews, GWS021984	Saunders (2014)	COI-5P
<i>Osmundea truncata</i> (Kützing) K.W.Nam & Maggs	JF781523	Spain, Islas Canarias, Tenerife, Barranquera, 2008, TFCPHYC14650	Cassano <i>et al.</i> (2012b)	<i>rbcl</i>
<i>Palisada</i> cf. <i>robusta</i> K.W.Nam	FJ785321	New Caledonia, Lifou, C.Payri, 23.III.2005, IRD92	Martin-Lescanne <i>et al.</i> (2010)	<i>rbcl</i>
<i>Palisada crustiformans</i> (K.J.McDermid) A.R.Sherwood, A.Kurihara & K.W.Nam	KX146195	United States, Hawaii, Isaac Hale Beach, 24.I.2008, A.Kurihara, ARS3327	Rousseau <i>et al.</i> (2017)	<i>rbcl</i>
<i>Palisada crustiformans</i>	KX258840	United States, Hawaii, Isaac Hale Beach, 24.I.2008, A.Kurihara, ARS3327	Rousseau <i>et al.</i> (2017)	COI-5P
<i>Palisada flagellifera</i> (J.Agardh) K.W.Nam	EF685998	Spain, Canary Islands, Tenerife, Playa Paraiso, 12.VII.2006, M.C.Gil-Rodríguez, M.T.Fujii, A.Sentíes, TFC Phyc. N#13127	Gil-Rodríguez <i>et al.</i> (2010)	<i>rbcl</i>
<i>Palisada flagellifera</i>	KF492772	Spain, Canary Islands, Tenerife, Punta del Hidalgo, 13.I.2012, M.C.Gil-Rodríguez, M.Machín-Sánchez, MMS0095	Machín-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Palisada furcata</i> (Cordeiro-Marino & M.T.Fujii) Cassano & M.T.Fujii	GU330226	Brazil, Praia de Tambau, Paraiba, 24.II.2004, M.T.Fujii, SP399.928	Cassano <i>et al.</i> (2012a)	<i>rbcl</i>
<i>Palisada parvipapillata</i> (C.K.Tseng) K.W.Nam	GU223895	United States, Hawaii, Oahu, 18.IX.2007, ARS02921	Kurihara <i>et al.</i> (2010)	COI-5P
<i>Palisada perforata</i> (Bory) K.W.Nam	EU256325	Spain, Canary Islands, Tenerife, Playa Paraiso, 14.VII.2006, M.C.Gil-Rodríguez, A.Sentíes, G. & M.T.Fujii, TFC Phyc 13134	Cassano <i>et al.</i> (2009)	<i>rbcl</i>
<i>Palisada perforata</i>	EU256326	Brazil, Rio de Janeiro, Rio das Ostras, Areias Negras, 3.VIII.2005, V.Cassano, M.B.B.Barreto, HRJ 10838	Cassano <i>et al.</i> (2009)	<i>rbcl</i>
<i>Palisada perforata</i>	EU256327	Spain, Canary Islands, Tenerife, Bahía Izquierda, Faro, Punta del Hidalgo, 6.X.2005, M.C.Gil-Rodríguez, TFC Phyc. N#13068	Cassano <i>et al.</i> (2009)	<i>rbcl</i>
<i>Palisada perforata</i>	EU256331	Brazil, Rio de Janeiro, Parati, Praia Vermelha, 30.XII.2005, V.Cassano, HRJ 10840	Cassano <i>et al.</i> (2009)	<i>rbcl</i>
<i>Palisada perforata</i>	KF492773	Spain, Canary Islands, Tenerife, Punta del Hidalgo, 13.I.2012, M.C.Gil-Rodríguez, M.Machín-Sánchez, MMS0093	Machín-Sánchez <i>et al.</i> (2014)	COI-5P
<i>Palisada perforata</i>	MH388710	Venezuela, Falcon, Playa Buchuacos, 6.X.2012, G.García-Soto, GGS012	García-Soto & Lopez-Bautista (2018)	COI-5P
<i>Palisada rigida</i> (J.Agardh) Metti	OM328131	Australia, Queensland, Redcliffe (27°13'59.7"S, 153°07'03.7"E), 30.V.2013, A.J.K.Millar & P.Ogilvie, NSW1114937, Q014	Metti 2022	<i>rbcl</i>
<i>Palisada tenerima</i> (Cremades) Serio, Cormaci, G.Furnari & Boisset	MF544099	Italy, Torre Faro, Messina, 08.X.2009, V.Fiore, PhL686	Manghisi <i>et al.</i> (2019)	COI-5P
<i>Palisada tenerima</i>	MG030782	Tunisia, Chebba, 22.VI.2014, R. Miladi, RM0081	Manghisi <i>et al.</i> (2019)	COI-5P
<i>Palisada yamadana</i> (M.A.Howe) K.W.Nam	HQ422794	United States, Hawaii, ARS03490.	Sherwood <i>et al.</i> (2010)	COI-5P
<i>Vertebrata foetidissima</i> (Cocks ex Bornet) Díaz-Tapia & Maggs	JQ653283	Portugal, Algarve, Olhos d'Aqua (37°05'20"N, 8°11'27"W), 20.II.2011, P.Díaz & I.Barbara, OLHOS	Díaz-Tapia <i>et al.</i> (2012)	<i>rbcl</i>
<i>Yuzurua poiteaui</i> (J.V.Lamouroux) Martin-Lescanne var. <i>gemmifera</i> (Harvey) M.J.Wynne	EF061649	Mexico, Yucatan, Cancun, Playa del Carmen, 2004, J.Díaz-Larrea, A.Sentíes	Díaz-Larrea <i>et al.</i> (2007)	<i>rbcl</i>
<i>Yuzurua poiteaui</i> var. <i>gemmifera</i>	EF061650	Cuba, Rincon de Guanabo, La Havana, 2005, J.Díaz-Larrea, A.A.Mallea	Díaz-Larrea <i>et al.</i> (2007)	<i>rbcl</i>
<i>Yuzurua poiteaui</i> var. <i>gemmifera</i>	EF061652	United States, Florida, Long Key, Ovan Side, 1998, S.Frederik	Díaz-Larrea <i>et al.</i> (2007)	<i>rbcl</i>

APPENDIX. — Continuation.

Species	Accession number	Location and collecting data	Reference	Marker
<i>Yuzurua poiteaui</i> var. <i>gemmifera</i>	<a href="#">EF061653</a>	Mexico, Yucatan, Cancun, Playa del Carmen, 2005, J.Díaz-Larrea, A.Senties	Díaz-Larrea <i>et al.</i> (2007)	<i>rbcL</i>
<i>Yuzurua</i> sp.	<a href="#">KX146198</a>	Guadeloupe, Antilles, Carribean, Chenal ilet Colas, Grand Cul-de-Sac Marin, 03.V.2012, F.Rousseau, Y.Buske, J.Espinosa, M.Snyder, G.Dirberg, FRA1041	Rousseau <i>et al.</i> (2017)	<i>rbcL</i>
<i>Yuzurua</i> sp.	<a href="#">KX258843</a>	Guadeloupe, Antilles, Carribean, Chenal ilet Colas, Grand Cul-de-Sac Marin, 03.V.2012, F.Rousseau, Y.Buske, J.Espinosa, M.Snyder, G.Dirberg, FRA1041	Rousseau <i>et al.</i> (2017)	COI-5P