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Christophe Vieira, Olivier de Clerck, Antoine de Ramon N'yeurt, Sofie D'hondt, Laurent Millet, et al.. Diversity, systematics and biogeography of French Polynesian Lobophora (Dictyotales, Phaeophyceae). *European Journal of Phycology*, 2022, 58 (2), pp.226 - 253. <10.1080/09670262.2022.2092216>. <hal-05108478>

HAL Id: hal-05108478

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To cite this article: Christophe Vieira, Olivier De Clerck, Antoine De Ramon N'Yeurt, Sofie D'hondt, Laurent Millet, Myung Sook Kim, Claude Payri & Mayalen Zubia (2022): Diversity, systematics and biogeography of French Polynesian *Lobophora* (Dictyotales, Phaeophyceae), European Journal of Phycology, DOI: [10.1080/09670262.2022.2092216](https://doi.org/10.1080/09670262.2022.2092216)


To link to this article: <https://doi.org/10.1080/09670262.2022.2092216>

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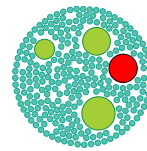
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Diversity, systematics and biogeography of French Polynesian *Lobophora* (Dictyotales, Phaeophyceae)

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ABSTRACT

We re-evaluated the diversity of *Lobophora* using an integrative taxonomic approach based on a broad sampling across French Polynesian archipelagos. Our results show that French Polynesia supports at least 37 *Lobophora* species of which ~57% (21) are endemic. This level of endemism is comparable to that presently known in the Caribbean and the western Indian Ocean, while French Polynesian coastlines cover a much smaller length. With a third of the species in common, French Polynesia shares considerable biogeographic affinities with the Melanesian Islands, situated over 4000 km to the west. Distribution ranges of a few species reach the western Indian Ocean, and two species also occur in the Atlantic. We hypothesize that *Lobophora* species in French Polynesia have mainly evolved into endemic species from colonizers originating from the Central Indo-Pacific. These rare dispersal events to ocean archipelagos followed by a long period of isolation and speciation represent an important process responsible for the high level of endemism in remote archipelagos. While south-eastern Pacific Islands could be considered an 'evolutionary graveyard' for the genus *Lobophora* as little local radiation occurred, this may simply be due to recent evolutionary history. Based on these new data, the diversity of *Lobophora* represents ~10% of French Polynesian seaweed diversity. Eighteen new species of *Lobophora* are here described from French Polynesia.

HIGHLIGHTS

- *Lobophora* species diversity and biogeography in French Polynesia were investigated.
- Twenty-three species of *Lobophora* were newly identified, and 18 new species were described.
- This is the first inter-archipelago diversity and biogeographic study for a macroalgal genus in the French Polynesian region.

ARTICLE HISTORY Received 16 March 2022; Revised 18 May 2022; Accepted 4 June 2022

KEYWORDS Algae; *cox3*; molecular taxonomy; new taxa; *psbA*; *rbcL*

Introduction

Located in the central southern Pacific, the French Polynesian archipelagos originated as linear chains of volcanic islands on the Pacific tectonic plate resulting from several underlying hotspots. French Polynesia is structured into five archipelagos, the Society, Marquesas, Austral, Gambier and Tuamotu Islands (Fages, 1975). The Tuamotu and Gambier Islands originated out of the same hotspot and form the longest chain of islands of the five archipelagos (Andréfouët & Adjeroud, 2019). The 120 French Polynesian Islands disperse in a south-east to north-west direction over more than 2000 km, through 15° of latitude and 20° of longitude, and are at different stages of the tropical volcanic island life cycle, ranging from high islands to atolls and guyots. The large geographic coverage of the French Polynesian Islands

results in considerable regional climatic variation. The age of the islands increases from south-east to north-west. Except for the Tuamotu Islands, which age estimates date to 47.4 Ma, the islands are relatively young and were formed between 12.1–0.03 Ma (Table 1).

The biodiversity in French Polynesia is overall rather low with 893 indigenous plant species; 320 and 2053 species of terrestrial and marine molluscs, respectively; 20 and 800 species of terrestrial and marine crustaceans; 800 species of fishes; 625 species of insects; 170 species of corals, and 425 species of algae including Cyanophyceae (Florence, 1987; Gargominy, 2003; N'Yeurt & Payri, 2010; Lorence *et al.*, 2016; Salvat & Trondle, 2017). This relatively low number of species is explained by its isolation (~6500 km away from the Indo-Australian-Archipelago) and

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Table 1. Geologic and geomorphologic characteristics of the five French Polynesian archipelagos. Data from Bonneville (2009) and Meyer & Salvat (2009).

| Archipelago | Latitude | Longitude | Age (Mya) | Total number of islands | Land area (km ²) |
|------------------------|----------|------------|-----------|-------------------------|------------------------------|
| Austral | 21–28° S | 144–155° W | 12.1–1.6 | 7 | 148 |
| Gambier | 21–24° S | 134–137° W | 6.3–5.7 | 22 | 40 |
| Marquesas | 7–10° S | 138–140° W | 5.5–1.3 | 13 | 1050 |
| Society | 15–18° S | 149–154° W | 6.8–0.03 | 14 | 1598 |
| Tuamotu | 14–24° S | 134–148° W | 47.4–9.5 | 64 | 683 |
| Total French Polynesia | 7–28° S | 134–154° W | 47.4–0.03 | 120 | 3519 |

the relatively small size of its islands (Kulbicki, 2007). There are more than 2500 vascular plant species, taking into account introduced species (1700 species) which represent twice the number of indigenous species (893 species) (Gargominy, 2003). The level of endemism varies drastically among groups and islands, ranging from 100% in terrestrial molluscs, 58% in land plants, 11.8% in marine molluscs to only 6.1% in reef fishes, with high levels of endemism in the Australs and in particular Rapa Island due to their isolation from the rest of the islands (Gargominy, 2003; Kulbicki, 2007; Salvat & Trondle, 2017).

Biological colonization of the French Polynesian Islands mainly occurred through transoceanic dispersal using intermediate archipelagos as stepping-stones for eastward dispersal (Gillespie *et al.*, 2008; Cowman & Bellwood, 2013). To a lesser extent, colonization from the East (the Americas) also occurred in some taxa such as those including terrestrial invertebrates (Gillespie *et al.*, 2008). Within the French Polynesian Islands colonization occurred from older to younger hotspot islands following the westward drifting of the landmasses. While the Austral and Marquesas Islands represent depauperate regions (with the exception of Rapa for some taxa), a general longitudinal gradient of diversity is observed from west to east, with the Society Islands supporting the highest diversity and the Tuamotu and Gambier Islands hosting only a fraction of this diversity (Florence, 1987; N'Yeurt & Payri, 2006, 2007, 2010; Kulbicki, 2007; Gillespie *et al.*, 2008; Salvat & Trondle, 2017). The major factors influencing species composition are island size, latitude and distance from a biodiversity centre (Kulbicki, 2007). The species from French Polynesia have affinities with the North (e.g. Hawaiian Islands) and South (e.g. Pitcairn and Cook Islands) Polynesian Islands, as well as with Micronesia and Melanesia (Kulbicki, 2007; N'Yeurt & Payri, 2010; Salvat & Trondle, 2017).

To date, a total of 312 species of marine macroalgae have been documented from French Polynesia (Payri *et al.*, 2000; N'Yeurt & Payri, 2006, 2007, 2010; Theophilus *et al.*, 2020). DNA-based taxonomic approaches have only been used since 2007 to study

the French Polynesian marine algal flora, but so far this has resulted in the identification of only a few additional taxa (see Caragnano *et al.*, 2018; Theophilus *et al.*, 2020) due to limited sampling in only a few localities. DNA-based taxonomic methods have proven remarkably efficient in unveiling unsuspected cryptic diversity in several marine algal groups (Leliaert *et al.*, 2014, 2018; Vieira *et al.*, 2014), provided that comprehensive sampling efforts are being made. It is expected that molecular approaches based on greater sampling effort and covering larger geographic areas across French Polynesia will disclose a greater diversity than is presently known for groups such as Cyanophyceae, Dictyotales, Rhodymeniales and Corallinales, despite the inherent limitations of an impoverished flora compared with the Indo-Pacific region.

The genus *Lobophora* provides perhaps one of the most remarkable examples of the effectiveness of molecular tools in the reassessment of its taxonomic diversity with the identification of over 100 species in less than 10 years (Vieira *et al.*, 2014, 2017, 2018, 2020a, 2020b; Vieira, 2020). The exceptional diversity within this chiefly tropical genus is the result of historico-biogeographic, ecological and evolutionary processes (Vieira *et al.*, 2017, 2021b). There have been reports of *Lobophora* from French Polynesia since 1926 from different localities, identified as *Lobophora* sp., *L. variegata* or its synonyms (see N'Yeurt & Payri, 2006): Bora Bora (Guilcher *et al.*, 1966), Makatea (Montaggioni *et al.*, 1987), Mataïva (Delesalle *et al.*, 1985), Moorea (Naim, 1980; Payri, 1982, 1987), Mopelia (Guilcher *et al.*, 1966), Moruroa (Guilcher *et al.*, 1966; Bablet *et al.*, 1995), Rangiroa (Ricard, 1985), Raroia (Doty, 1954), Takaroa (Leca Sauze, 1993), Takopoto (Chevalier & Denizot, 1979; Leca Sauze, 1993), Tahiti (Setchell, 1926a, 1926b), Tikehau (Harmelin-Vivien, 1985), Tubuai (Brousse *et al.*, 1980); and *Lobophora pacifica* (Setch.) C.W. Vieira *et al.* [as *Aglaozonia pacifica* Setch.] from Tahiti (Setchell, 1926a, 1926b). Vieira *et al.* (2016) conducted an extensive molecular-based taxonomic study of the genus *Lobophora* from several localities in the world, including from Tahiti, French Polynesia, which led to the transfer of *Aglaozonia pacifica* to

Lobophora as *L. pacifica*, and in the identification of *L. obscura* (originally described from Mangaia, Cook Islands as *Zonaria obscura*) and 12 undescribed cryptic species from French Polynesia (Vieira *et al.*, 2016: 26, fig. 2), which are still in need of a formal diagnosis.

The present study aims to reassess the species diversity of the genus *Lobophora* from French Polynesia across the five archipelagos, and to discuss biogeographic patterns in relation to other parts of the Pacific and within French Polynesia. It provides the first molecular-based taxonomic study of marine algae in French Polynesia using a large and broad sampling effort covering the five archipelagos. New species identified from French Polynesia are described, including the formal diagnosis of some of the species previously identified in Vieira *et al.* (2016).

Materials and methods

Sampling localities

A total of 412 *Lobophora* specimens were collected from the French Polynesian Islands over the course of several field campaigns between 1995 and 2019, by snorkelling or scuba (Supplementary table S1). Specimens were preserved in silica gel for molecular analyses, and pressed vouchers were prepared using standard herbarium techniques for later deposition at the University of French Polynesia Herbarium (UPF) or at the Institut de Recherche pour le Développement (IRD) Herbarium in Nouméa, Nouvelle-Calédonie (NOU).

Molecular and morphological analyses

Total genomic DNA was extracted from tissue samples dried in silica gel using a cetyl-trimethyl ammonium bromide (CTAB) extraction method. Sequences were generated from the mitochondrial encoded cytochrome c oxidase III gene (*cox3*) as well from two chloroplast genes (*psbA*, *rbcL*). New sequences were added to the datasets from Vieira *et al.* (2021a), and aligned using the default settings in MUSCLE v.3.5 (Edgar, 2004). Specimen-level phylogenies were generated based on *cox3* (724 bp), *psbA* (1007 bp) and *rbcL* (1349 bp) sequences individually, and species-level trees were reconstructed based on the concatenated *cox3+psbA+rbcL* sequences (3080 bp), using Bayesian inference (BI) and maximum likelihood (ML) analyses. For the reconstruction of the species tree, the longest sequences from representative specimens were selected for each species and for each gene (*cox3*, *psbA*, *rbcL*). BI analyses were run using MrBayes v.3.2.2 (Ronquist *et al.*, 2012), with the

implementation of the GTR + I + G nucleotide substitution model, initiated with a random starting tree and four chains of Markov chain Monte Carlo iterations simultaneously for 250 000 000 generations, keeping one tree every 1000 generations. The first 25% trees were discarded as burn-in, based on the stationarity of log-likelihood as assessed using Tracer v.1.7.1 (Rambaut *et al.*, 2018). ML phylogeny was reconstructed using IQ-TREE v.1.6.8 under ultrafast bootstraps with 1000 replicates (Nguyen *et al.*, 2015), on the online platform (<http://www.iqtree.org>), under the GTR + F + I + G4 nucleotide substitution model, identified as the best-fitting model in ModelFinder implemented in IQ-TREE. Morphological observations of *Lobophora* specimens included analyses of the external and internal structures of the specimens following the methods in Vieira *et al.* (2014).

Results

Molecular phylogenetic analyses

In the course of this study 338 sequences (176 *cox3*, 89 *psbA*, 110 *rbcL* sequences) were generated from 309 specimens (Supplementary table S2). *Lobophora* specimens from French Polynesia were positioned in 37 well-supported lineages in both ML and BI analyses (Figs 1, 2, Supplementary figs S1–S4), which we equate to species in line with previous studies (Vieira *et al.*, 2016). Among these 37 species, nine corresponded to previously described species: *L. abscondita*, *L. endeavouriae*, *L. lamourouxii*, *L. pacifica*, *L. petila*, *L. providenceae*, *L. rechercheae*, *L. setchellii* and *L. sonderi*. Among the 28 remaining undescribed lineages, 12 were previously documented (Vieira *et al.*, 2016): *L. sp6*, *L. sp11*, *L. sp13*, *L. sp17*, *L. sp19*, *L. sp31*, *L. sp32*, *L. sp57*, *L. sp70*, *L. sp73*, *L. sp74* and *L. sp97*; and 16 are newly identified lineages: *L. obscura8*, *L. obscura11*, *L. sp103*, *L. sp122*, *L. sp123*, *L. sp124*, *L. sp125*, *L. sp126*, *L. sp127*, *L. sp128*, *L. sp129*, *L. sp130*, *L. sp131*, *L. sp132*, *L. sp133* and *L. sp134* (Figs 1, 2, Supplementary fig. S1). Among the new lineages, two belong to the *L. obscura* complex, i. e. *L. obscura8* and *L. obscura11*. Of the 37 lineages, five consist of singletons (i.e. lineages represented by only one specimen; *L. sp32*, *L. sp103*, *L. sp123*, *L. sp128*, *L. sp132*, *L. sp133*) and four of doubletons (i.e. lineages represented by two specimens; *L. sp122*, *L. sp127*, *L. sp130*, *L. sp131*). In addition, three lineages reported previously from elsewhere consisted of only one sequenced specimen from French Polynesia (*L. petila*, *L. rechercheae*, *L. sp6* and *L. sp70*). For these specimens, additional data are cautiously recommended to confirm their phylogenetic identity and presence in French Polynesia.

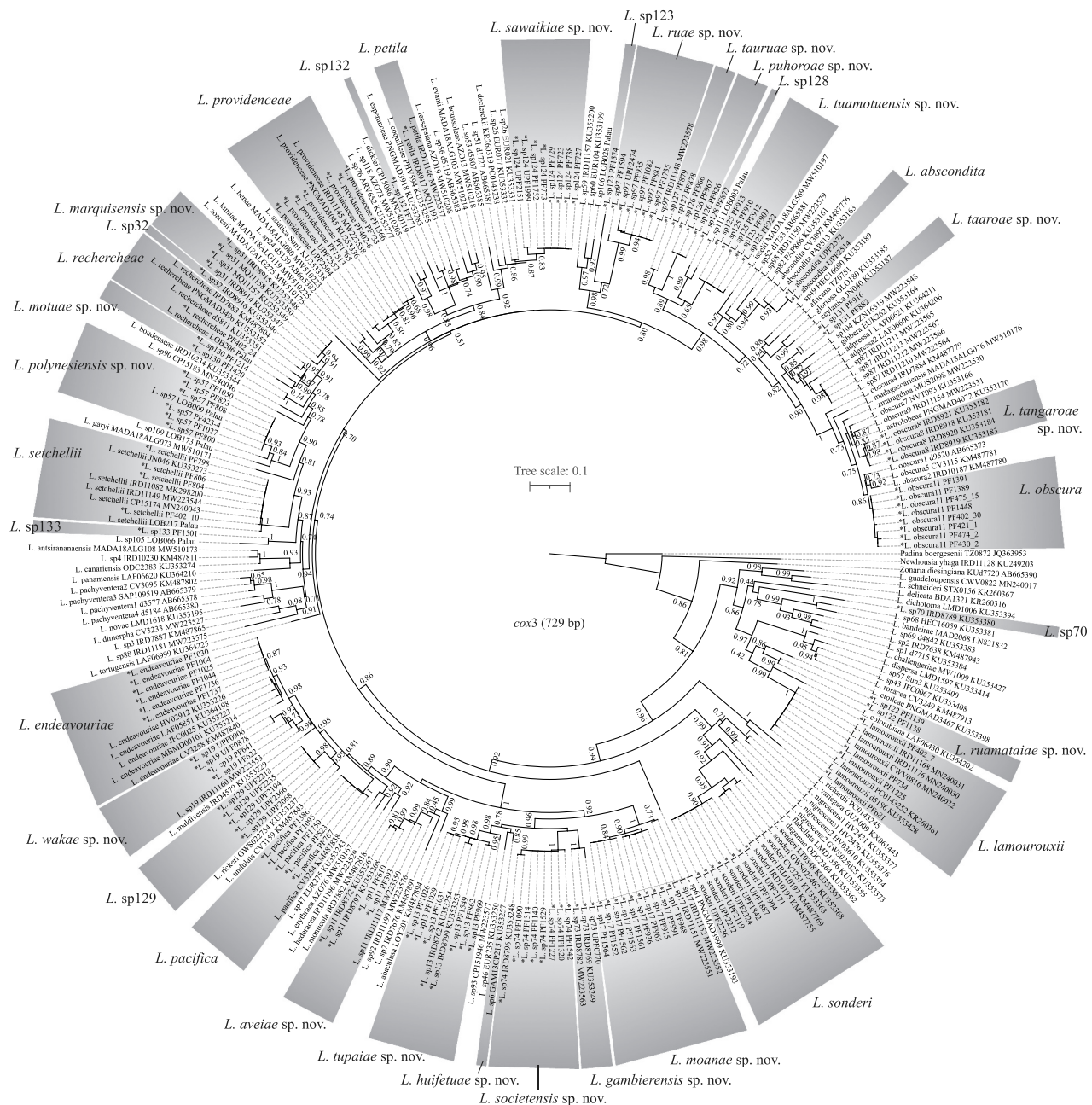


Figure 1. Specimen-level phylogeny of the brown algal genus *Lobophora* (Dictyotales, Phaeophyceae). Phylogenetic tree inferred based on *cox3* sequences (724 bp) using maximum likelihood method. Numbers at nodes indicate bootstrap values. Two species did not have *cox3* sequences and were identified based on *psbA* (*L. sp103*, *L. sp134*) and *rbcl* (*L. sp134*). *Lobophora* species from French Polynesia are indicated with an asterisk and shaded in grey.

Taxonomic results

Here we describe 18 new species of *Lobophora* (Table 2; Figs 3–89) from French Polynesia, for which we collected sufficient material for morphological examinations and at least two sequenced specimens for phylogenetic analyses: *L. aveiaie* sp. nov., *L. gambierensis* sp. nov., *L. huifetuae* sp. nov., *L. marquisensis* sp. nov., *L. moanae* sp. nov., *L. motuae* sp. nov., *L. polynesiensis* sp. nov., *L. puhoroae* sp. nov., *L. ruae* sp. nov., *L. ruamataiae* sp. nov., *L. sawaikiae* sp. nov., *L. societensis* sp. nov., *L. taaroae* sp. nov., *L. tangaroae* sp. nov., *L. tauruae* sp. nov., *L. tuamotuensis* sp. nov., *L. tupaiae* sp. nov. and *L. wakae* sp.

nov. Additionally, we provide a more detailed description of *L. pacifica* and *L. obscura*. As discussed in the taxonomic treatment section, *L. obscura*11 was identified as the authentic *L. obscura* originally described from the Cook Islands. The species names are chosen to pay tribute to the traditional Polynesian culture, renowned for its navigation skills, used for thousands of years to make long voyages across hundreds of kilometres of open Pacific Ocean. We name these new species after some great Polynesian navigators, canoes, navigational systems, mythology, localities, islands and archipelagos.

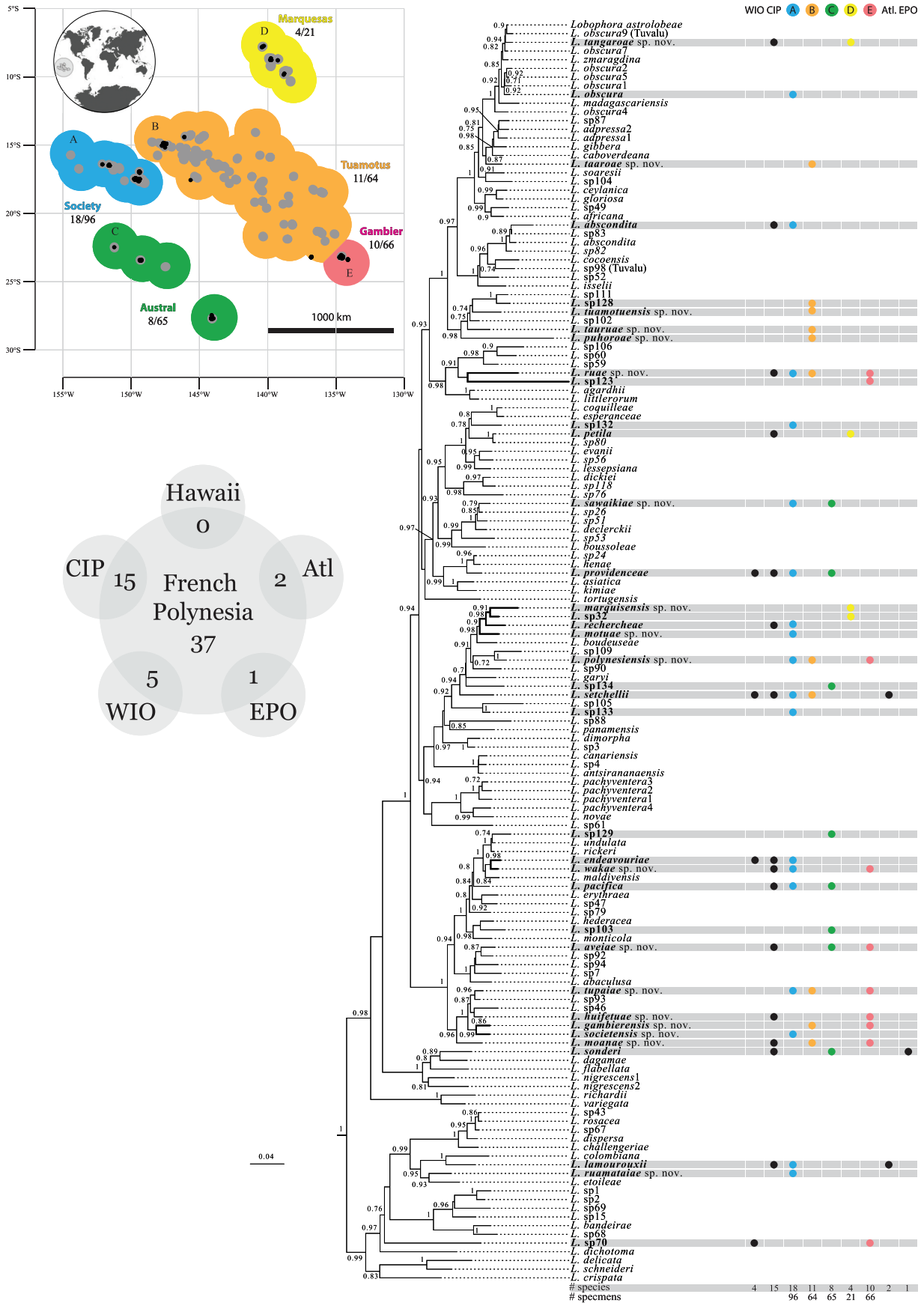


Figure 2. Species-level phylogenetic tree and species diversity map of the brown algal genus *Lobophora* (*Dictyotales*, *Phaeophyceae*) within French Polynesia. Phylogenetic tree inferred based on the concatenated *cox3*, *psbA* and *rbcL* sequences (3080 bp) using maximum likelihood method. Numbers at nodes indicate bootstrap values. *Lobophora* species from French Polynesia are indicated in bold and shaded in grey. On the right of the tree are indicated the distribution per archipelago within French Polynesia of the 37 species of *Lobophora* documented to date from this region: Society (A; blue), Tuamotu (B; orange), Austral (C; green), Marquesas (D; yellow) and Gambier (E; red) archipelagos. The total numbers of *Lobophora* species (left) and specimens collected (right) are provided under the archipelago's name on the top left corner map. The Venn diagram is showing the overlap of species with other marine regions. Atl: Atlantic; CIP: Central Indo-Pacific, EPO: eastern Pacific Ocean; WIO: western Indian Ocean.

Table 2. Anatomical and morphological features of the newly described species of *Lobophora* (Dictyotales, Phaeophyceae) from French Polynesia.

| | <i>L. aveiaae</i> | <i>L. gambierensis</i> | <i>L. huifetuae</i> | <i>L. marquisensis</i> | <i>L. moanae</i> | <i>L. motuae</i> | <i>L. obscura</i> | <i>L. pacifica</i> | <i>L. polynesiensis</i> | <i>L. puhoroae</i> |
|--------------------|------------------------|---------------------------|---------------------------|--------------------------|-------------------------|--|--|---|---|-------------------------|
| Thallus | | | | | | | | | | |
| # cells | Ave. ± SD | 5 | 5 | 5 | 5 | 3 | 9 | 8 | 3 | 5 |
| | Min-Max | 5-6 | 5-6 | 5-6 | 5-6 | 3-4 | 9-10 | 6-9 | 3-5 | 5-6 |
| Thick. | Ave. ± SD | 219.9 ± 64.1 | 101.4 ± 12.7 | 131.5 ± 10.9 | 75.8 ± 6.6 | 117.2 ± 11.1 | 214.0 ± 10.8 | 186 ± 17 | 68.0 ± 13.2 | 93.3 ± 3.6 |
| | Min-Max | 132-304 | 82-122 | 112-160 | 70-80 | 104-140 | 200-225 | 168-202 | 50-94 | 89-98 |
| Dorsal | | | | | | | | | | |
| # cells | Ave. ± SD | 4 | 2 | 2 | 3 | 1 | 4 | 4 | 1 | 2 |
| | Min-Max | 3-5 | 2-3 | 2-3 | 2-3 | 1-2 | 4-5 | 3-4 | 1-2 | 2-3 |
| Height | Ave. ± SD | 92.8 ± 29.6 | 34.8 ± 7.8 | 43.2 ± 6.8 | 36.4 ± 15.7 | 22.0 ± 5.7 | 91.0 ± 8.9 | 70 ± 13 | 20.4 ± 7.5 | 35.1 ± 5.0 |
| | Min-Max | 52-144 | 26-52 | 32-52 | 20-62 | 15-30 | 80-100 | 57-83 | 12-34 | 32-44 |
| Ventral | | | | | | | | | | |
| # cells | Ave. ± SD | 4 | 2 | 2 | 2 | 1 | 4 | 4 | 1 | 2 |
| | Min-Max | 3-4 | 2 | 2 | 2 | 1 | 4 | 3-4 | 1-2 | 2 |
| Height | Ave. ± SD | 74.7 ± 22.7 | 30.2 ± 4.2 | 33.4 ± 4.8 | 23.4 ± 3.4 | 17.0 ± 4.5 | 70.0 ± 6.1 | 57 ± 3 | 16.2 ± 4.7 | 25.4 ± 2.6 |
| | Min-Max | 40-108 | 24-36 | 20-40 | 18-26 | 15-25 | 65-80 | 53-60 | 10-26 | 23-29 |
| Medulla | | | | | | | | | | |
| Length | Ave. ± SD | 103.6 ± 8.3 | 70 ± 15.8 | 79.1 ± 11.1 | 56.4 ± 13.3 | 71.0 ± 4.2 | 83.0 ± 10.4 | 71 ± 10 | 60.8 ± 5.8 | 91.1 ± 10.6 |
| | Min-Max | 92-120 | 50-90 | 60-100 | 84-39 | 65-75 | 70-95 | 60-80 | 54-70 | 76-104 |
| Height | Ave. ± SD | 52.4 ± 15.1 | 36.4 ± 3.4 | 54.9 ± 12.6 | 29.4 ± 2.8 | 41.0 ± 7.1 | 63.0 ± 10.4 | 54 ± 7 | 31.4 ± 4.5 | 34.8 ± 4.1 |
| | Min-Max | 32-80 | 30-40 | 40-80 | 25-35 | 34-50 | 50-75 | 47-60 | 26-40 | 30-40 |
| Width | Ave. ± SD | 30.4 ± 5.7 | 43.6 ± 6.8 | 36.4 ± 3.8 | 22.4 ± 5.3 | 30.4 ± 3.0 | 30.0 ± 3.5 | 30 ± 6 | 28.8 ± 4.1 | 36.2 ± 4.3 |
| | Min-Max | 20-40 | 34-50 | 30-40 | 14-32 | 26-34 | 25-35 | 24-36 | 24-34 | 32-43 |
| Thallus morphology | Growth-form/ colour | decumbent/ light brown | crustose/ orange-brown | crustose/ green-khaki | crustose/ dark green | decumbent to crustose/ light brown | crustose/ dark brown with grey lines | decumbent to crustose/ light to dark brown | crustose to procumbent/ light to dark brown | crustose/ dark brown |
| Max width/height | | 6/5 | 11/5 | - | - | 10/3 | 4/2 | 6/4 | 2/1 | - |
| Figures | | 3, 30, 60 | 5, 32, 62 | 33, 63 | 7, 35, 65 | 8, 36, 66 | 10, 38, 68 | 12, 40, 69 | 13, 41, 70 | 15, 43, 72 |
| Thallus | | | | | | | | | | |
| # cells | Ave. ± SD | 5 | 3 | 3 | 5 | 9 | 5 | 5 | 7 | 8 |
| | Min-Max | 3-4 | 3 | 3 | 5 | 8-10 | 4-6 | 3-5 | 6-7 | 5-10 |
| Thick. | Ave. ± SD | 110.4 ± 7.5 | 51.1 ± 2.6 | 54.6 ± 2.2 | 103.2 ± 6.2 | 164.0 ± 4.2 | 115.0 ± 3.5 | 65.6 ± 3.1 | 135.6 ± 11.1 | 190.8 ± 15.1 |
| | Min-Max | 98-120 | 48-61 | 52-58 | 92-116 | 160-170 | 110-120 | 61-68 | 120-148 | 156-214 |

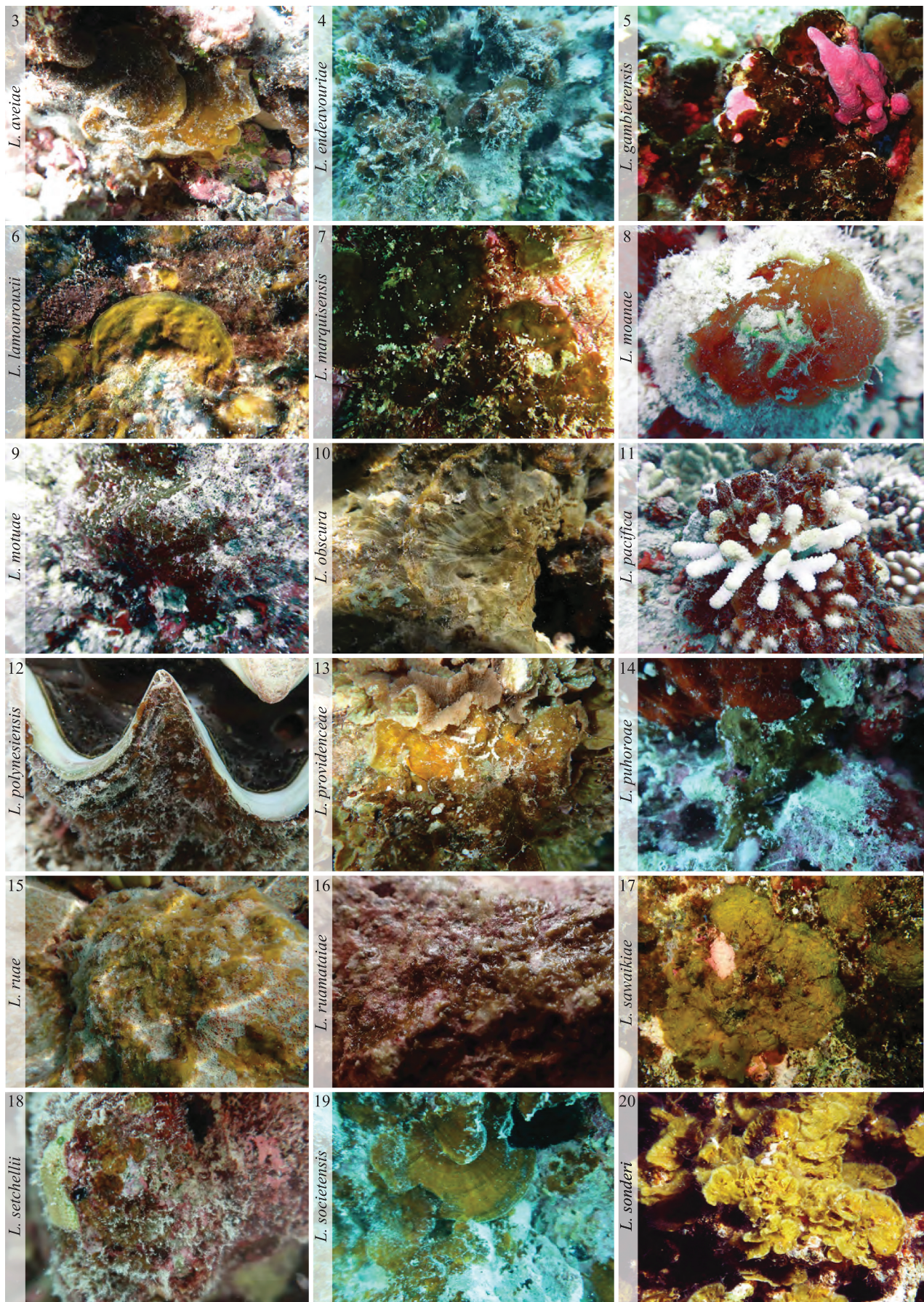
(Continued)

Table 2. (Continued).

| | L. ruae | L. ruamataiae | L. sawaikaiae | L. societensis | L. sonderi | L. iaaroae | L. tangaroae | L. tauroae | L. tuamotuensis | L. tupaiiae | L. wakaie |
|--------------------|-------------------------------|-------------------------------------|-----------------------|---|---|----------------------|---------------------|--|---------------------|---|-------------------------------|
| Dorsal | | | | | | | | | | | |
| # cells | 2 | 1 | 1 | 2 | 4 | 5 | 5 | 2 | 2 | 3 | 4 |
| Ave. \pm SD | | | | | | | | | | | |
| Min-Max | 2 | 1-2 | 1 | 2 | 4-5 | 4-5 | 4-5 | 2-3 | 1-2 | 3 | 2-5 |
| Height | 35.2 \pm 4.1 | 14.3 \pm 5.6 | 14.3 \pm 2.1 | 33.2 \pm 3.2 | 56.0 \pm 2.2 | 99.8 \pm 7.1 | 86.0 \pm 9.1 | 42.4 \pm 2.0 | 24.9 \pm 1.4 | 53.4 \pm 4.7 | 71.5 \pm 8.7 |
| SD | | | | | | | | | | | |
| Min-Max | 30-40 | 6-21 | 11-17 | 30-40 | 55-60 | 92-109 | 76-102 | 40-46 | 23-27 | 50-60 | 50-80 |
| Ventral | | | | | | | | | | | |
| # cells | 2 | 1 | 1 | 2 | 4 | 4 | 4 | 2 | 2 | 3 | 3 |
| Ave. \pm SD | | | | | | | | | | | |
| Min-Max | 2 | 1 | 1 | 2 | 4 | 3-4 | 3-5 | 1-2 | 1-2 | 2-3 | 2-4 |
| Height | 33.0 \pm 3.6 | 25.8 \pm 3.8 | 12.4 \pm 1.6 | 28.4 \pm 2.1 | 56 \pm 4.2 | 75.7 \pm 10.4 | 55 \pm 4.0 | 33.0 \pm 4.4 | 20.7 \pm 1.6 | 46.8 \pm 8.0 | 63.5 \pm 9.2 |
| SD | | | | | | | | | | | |
| Min-Max | 28-40 | 11-16 | 11-15 | 24-30 | 50-60 | 61-88 | 50-63 | 30-41 | 18-22 | 34-60 | 50-80 |
| Medulla | | | | | | | | | | | |
| Length | 83.6 \pm 9.4 | 56.5 \pm 3.2 | 78.4 \pm 4.5 | 56.0 \pm 11.3 | 95.0 \pm 5.0 | 74.0 \pm 11.7 | 78.9 \pm 13.1 | 133.0 \pm 9.4 | 72.9 \pm 7.6 | 50.0 \pm 10.0 | 93.6 \pm 17.0 |
| SD | | | | | | | | | | | |
| Min-Max | 76-100 | 52-61 | 73-85 | 44-70 | 90-100 | 55-86 | - | 70-94 | 64-80 | 40-60 | 74-120 |
| Height | 42.2 \pm 3.6 | 21.3 \pm 6.2 | 29.5 \pm 2.5 | 41.6 \pm 3.4 | 49.0 \pm 2.2 | 57.5 \pm 8.6 | 43.0 \pm 2.9 | 46.5 \pm 5.3 | 23.8 \pm 2.8 | 35.4 \pm 6.9 | 55.8 \pm 7.1 |
| SD | | | | | | | | | | | |
| Min-Max | 36-46 | 15-30 | 25-32 | 36-48 | 45-50 | 47-67 | 39-47 | 38-52 | 20-27 | 30-50 | 44-70 |
| Width | 34.8 \pm 2.3 | 48.2 \pm 4.0 | 33.1 \pm 3.7 | 40.8 \pm 1.8 | 25.0 \pm 3.5 | 44.3 \pm 3.9 | 21.8 \pm 5.5 | 28.4 \pm 2.2 | 33.3 \pm 1.4 | 40.0 \pm 2.8 | 32.2 \pm 5.0 |
| SD | | | | | | | | | | | |
| Min-Max | 32-38 | 45-55 | 30-38 | 40-44 | 20-30 | 41-48 | 15-26 | 21-32 | 31-35 | 36-44 | 24-40 |
| Thallus morphology | decumbent/light to dark brown | crustose to procumbent/yellow-brown | crustose/yellow-brown | crustose to procumbent/light brown to green | decumbent to crustose/light to dark brown | stipitate/dark brown | crustose/dark brown | crustose/dark brown to green with gray lines | crustose/dark brown | decumbent to procumbent/brown with dark lines | decumbent/light to dark brown |
| Max width/height | 6/4 | 3/2 | 0.1/0.1 | 5/3 | 5/4 | 10/13 | - | 4/2 | - | 4/3 | 8/4 |

Figures 16, 44, 73 17, 45, 74 16, 44, 73 17, 45, 74 18, 46, 75 20, 47, 77 21, 48, 78 22, 49, 79 11, 39, 80 23, 50, 81 24, 51, 82

Anatomical measurements (cell layers thickness, height, length, width) are in μ m, and morphological measurements (thallus maximum width and height) in cm. Abbreviations: Thick, thickness; Ave. \pm SD, average \pm standard deviation; min, minimum; max, maximum.



Figs 3–29. Habit photographs of *Lobophora* (Dictyotales, Phaeophyceae) species from French Polynesia. **Fig. 3.** *Lobophora aveiaae* sp. nov. from Tubuai, Austral, voucher PF093. **Fig. 4.** *L. endeavouriaae* from Tetiaroa, Society, voucher PF1044. **Fig. 5.** *L. gambierensis* sp. nov. from Mangareva, Gambier, voucher GAM13-CP103. **Fig. 6.** *L. lamourouxii* from Tahiti, Society, voucher PF770. **Fig. 7.** *L. marquisensis* sp. nov. from Marsquesas, voucher MQ11-158. **Fig. 8.** *L. moanae* sp. nov. from Rangiroa, Tuamotus, voucher PF829. **Fig. 9.** *L. motuae* sp. nov. from Moorea, Society, voucher PF1420. **Fig. 10.** *L. obscura*

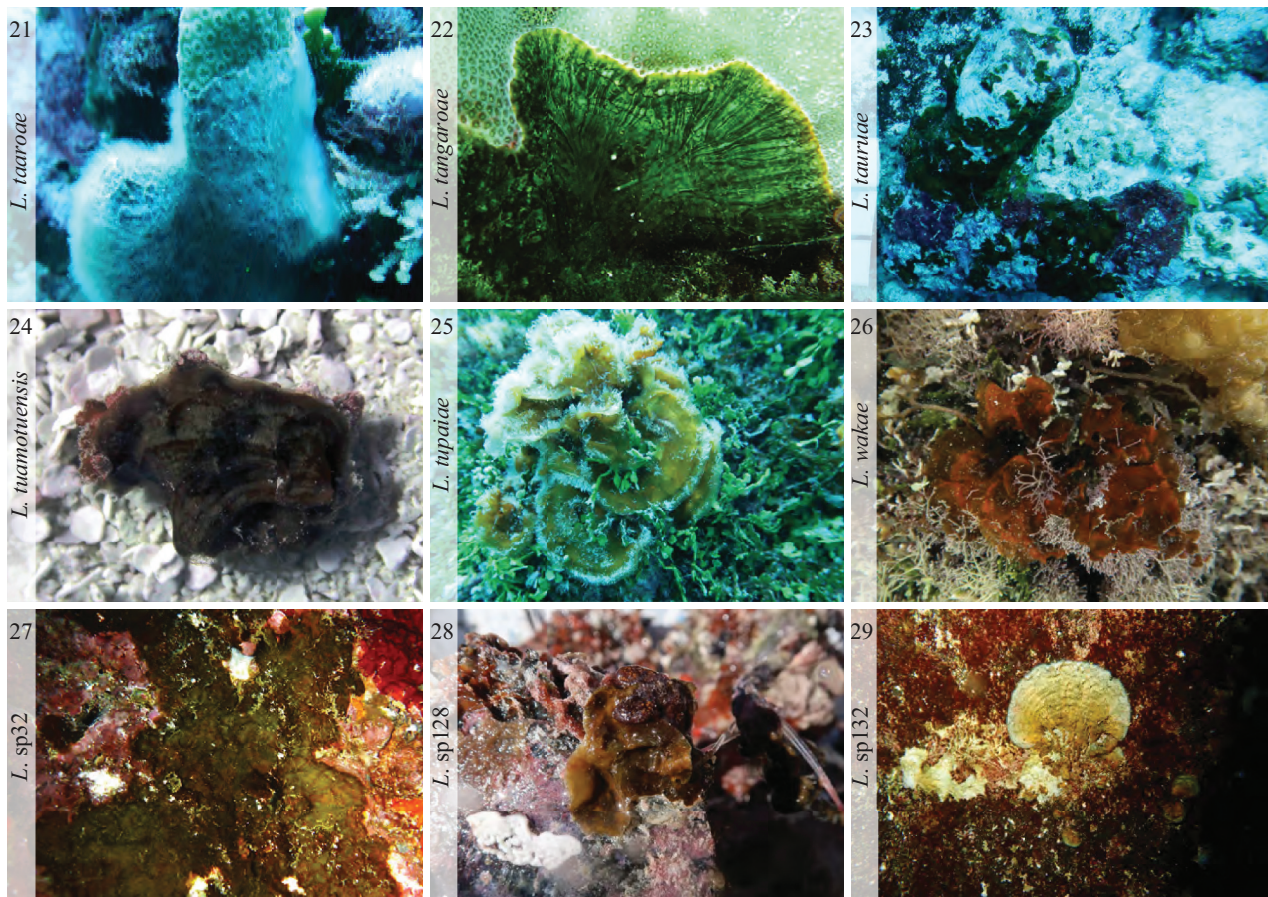
Biogeography

A total of 37 species occurred in French Polynesia. Among them, 15 species were distributed in the Central Indo-Pacific (Fig. 2), while four species extended their distribution to the western Indian Ocean, including three in the Central Indo-Pacific. The fourth species (*L.* sp70) has not yet been reported from the Central Indo-Pacific. Another two species were also present in the Caribbean: *L. setchellii* (Curaçao, Juan de Nova, New Caledonia, Papua New Guinea, Saint Vincent, Tuvalu); and *L. lamourouxii* (Guadeloupe, Malaysia, Martinique, Saint Vincent). Only one species from French Polynesia was present in the eastern Pacific Ocean (*L. sonderi*; Easter Islands). Twelve species were distributed in Melanesian and Polynesian Islands, including five only

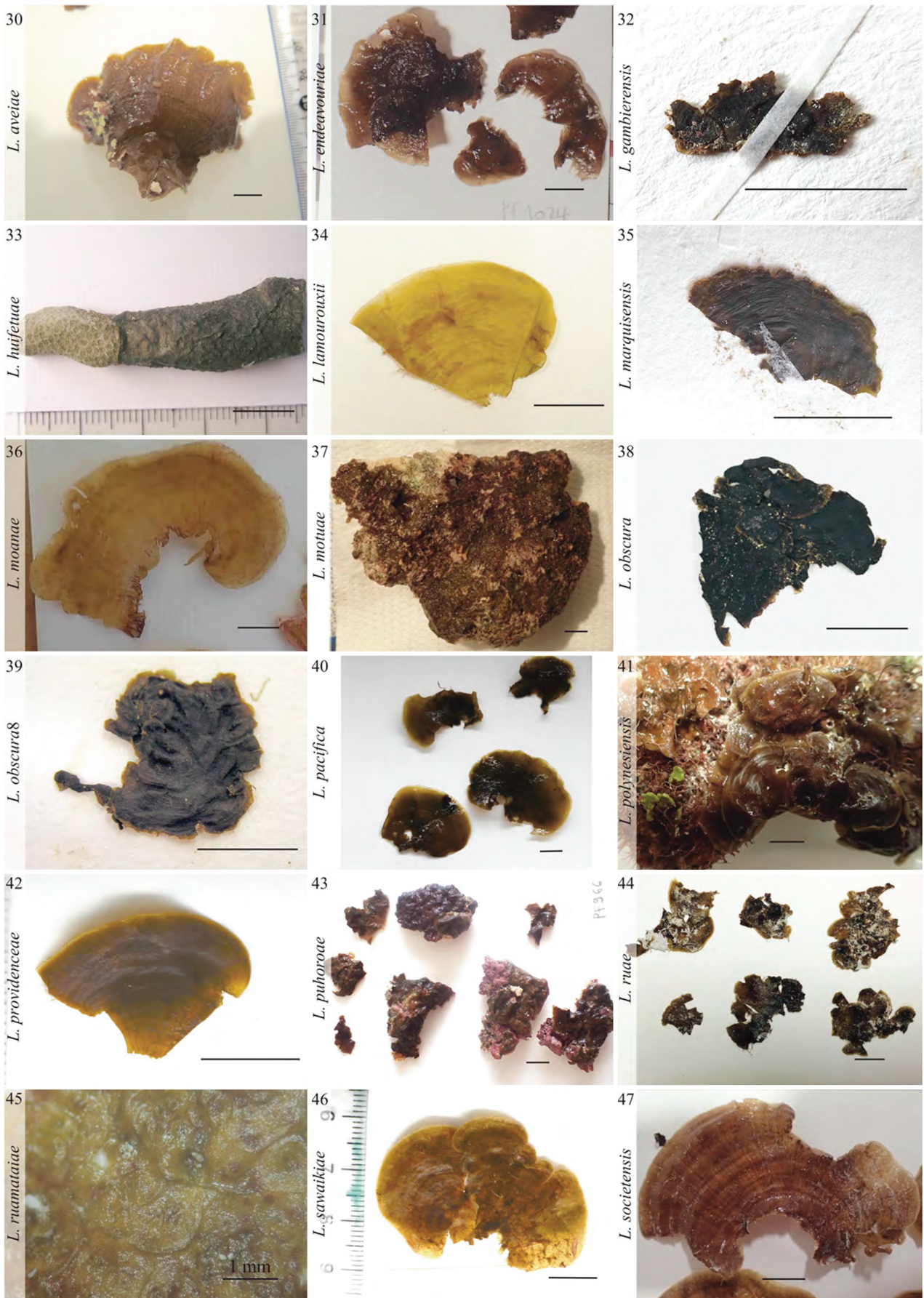
found in these two regions: *L. huifetuae* sp. nov. (New Caledonia); *L. aveiaae* sp. nov. (New Caledonia); *L. tangaroae* sp. nov. (Papua New Guinea), *L. pacifica* (New Caledonia), *L. petila* (New Caledonia, Papua New Guinea). Twenty-one species of *Lobophora* were found only in French Polynesia. A total of 8, 10, 4, 18 and 11 species were found in the Austral, Gambier, Marquesas, Society and Tuamotu Islands, respectively.

Discussion

This study presents the first wide-ranging molecular-based taxonomic and biogeographic study on a particular group of marine algae from French Polynesia, covering the five archipelagos (Austral, Gambier,



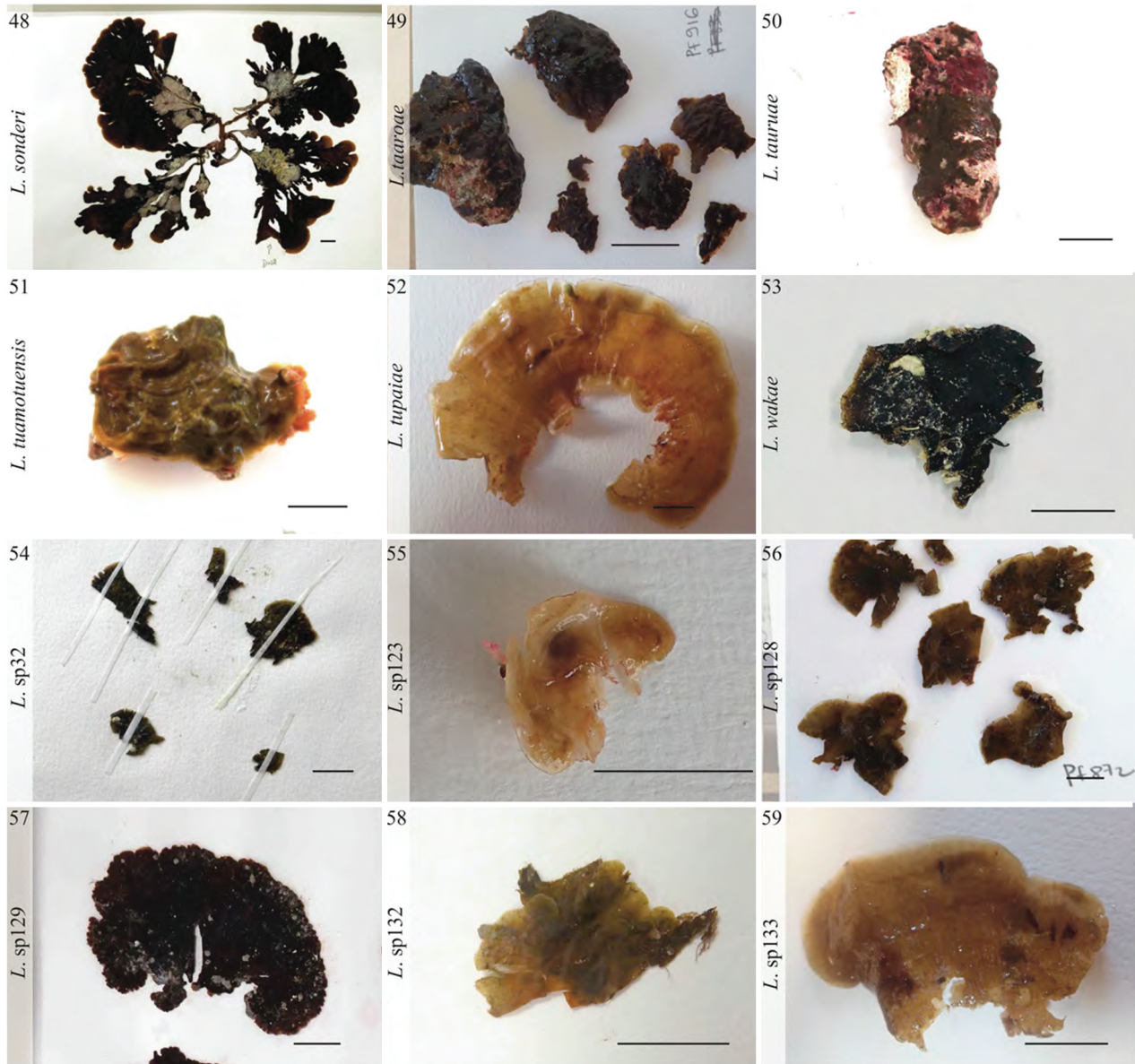
Figs 3–29. (Continued). from Tetiaroa, Society, voucher PF446. **Fig. 11.** *L. pacifica* from Tetiaroa, Society, voucher PF1115. **Fig. 12.** *L. polynesiensis* sp. nov. from Rangiroa, Tuamotus, voucher PF794. **Fig. 13.** *L. providenceae* Tahiti, Society, voucher PF739. **Fig. 14.** *L. puhoroae* sp. nov. Rangiroa, Tuamotus, voucher PF826. **Fig. 15.** *L. ruae* sp. nov. from Morane, Gambier, voucher PF1587. **Fig. 16.** *L. ruamataiae* sp. nov. from Tetiaroa, Society, voucher PF1138. **Fig. 17.** *L. sawaikiae* sp. nov. from Tahiti, Society, voucher PF773. **Fig. 18.** *L. setchellii* from Rangiroa, Tuamotus, voucher PF804. **Fig. 19.** *L. societensis* sp. nov. from Tetiaroa, Society, voucher PF1090. **Fig. 20.** *L. sonderi* from Rapa, Austral. **Fig. 21.** *L. taaroae* sp. nov. from Rangiroa, Tuamotus, voucher PF882. **Fig. 22.** *L. tangaroae* from Eiao, Marquesas, voucher MQ11-170. **Fig. 23.** *L. tauruae* sp. nov. from Rangiroa, Tuamotus, voucher PF878. **Fig. 24.** *L. tuamotuensis* sp. nov. from Rangiroa, Tuamotus, voucher PF910. **Fig. 25.** *L. tupaiae* sp. nov. from Rangiroa, Tuamotus voucher PF969. **Fig. 26.** *L. wakae* sp. nov. from Mangareva, Gambier, voucher PF622. **Fig. 27.** *L. sp32* from Tahuataa, Marquesas, voucher MQ11-475. **Fig. 28.** *L. sp128* from Rangiroa, Tuamotus, voucher PF872. **Fig. 29.** *L. sp132* from Tahiti, Society, voucher PF771.



Figs 30–59. Ex situ photographs of *Lobophora* (Dictyotales, Phaeophyceae) species from French Polynesia. **Fig. 30.** *Lobophora aveiaei* sp. nov. from Tubuai, Austral, voucher PF093. **Fig. 31.** *L. endeavouriae* from Tetiaroa, Society, voucher PF1024. **Fig. 32.** *L. gambierensis* sp. nov. from Mangareva, Gambier, voucher GAM13-CP103. **Fig. 33.** *L. huifetuae* sp. nov. from New Caledonia, voucher CV3210. **Fig. 34.** *L. lamourouxii* from Tahiti, Society, voucher PF770. **Fig. 35.** *L. marquisensis* sp. nov. from Eiao, Marquesas, voucher MQ11-156. **Fig. 36.** *L. moanae* sp. nov. from Rangiroa, Tuamotus,

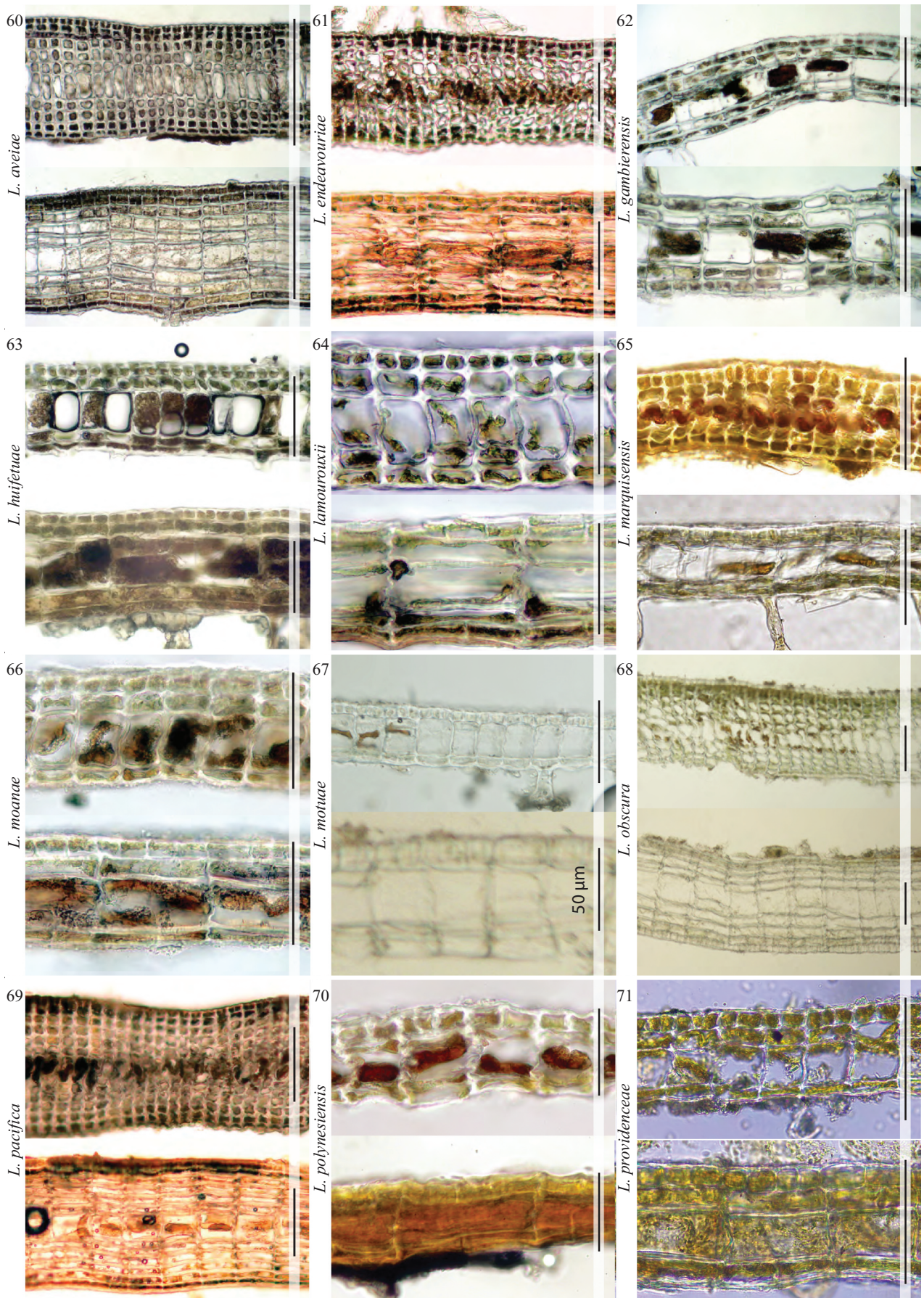
Marquesas, Society and Tuamotu). It significantly improves our current knowledge of *Lobophora* species diversity and biogeography in the Central Pacific and provides new insights into marine algal biogeographic distribution in this region. We provide the most comprehensive species-level phylogeny to date

for the genus *Lobophora*, including all taxonomically accepted species for which sequences (*cox3*, *psbA* or *rbcL*) are available.

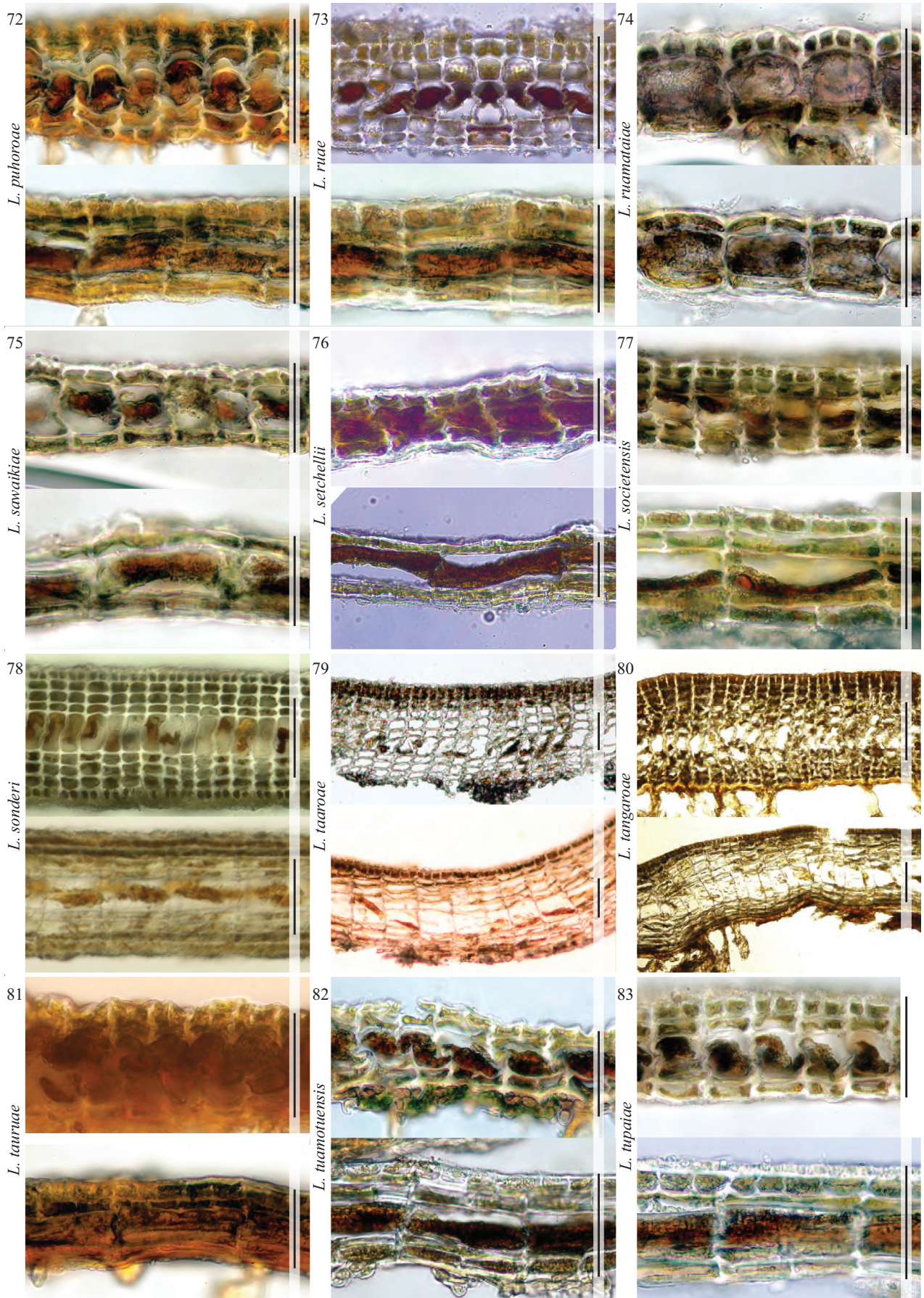


Figs 30–59. (Continued)

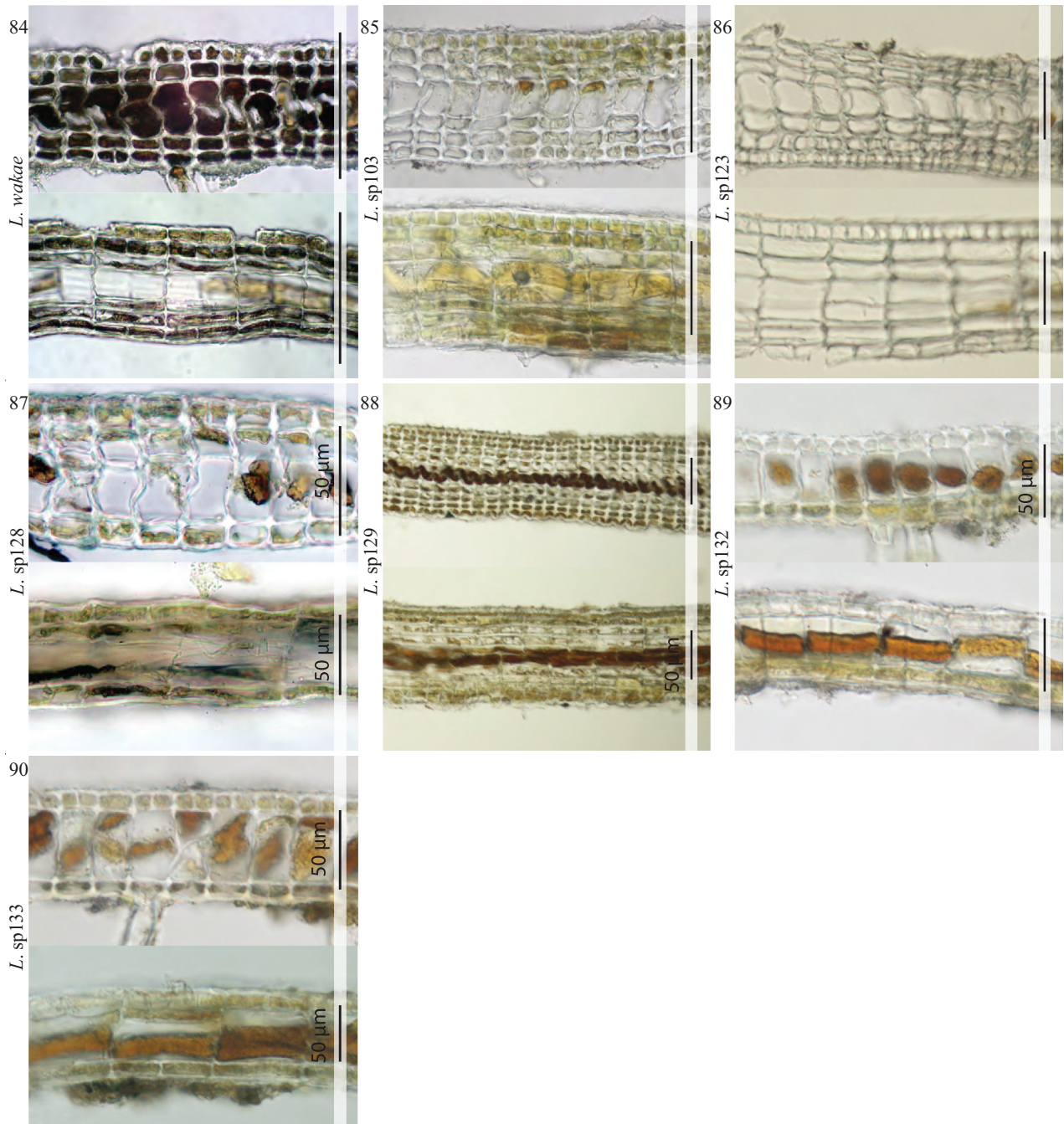
voucher PF990. **Fig. 37.** *L. motuae* sp. nov. from Moorea, Society, voucher PF1420. **Fig. 38.** *L. obscura* from Tetiaroa, Society, voucher PF461. **Fig. 39.** *L. pacifica* from Tahiti, Society, voucher PF026. **Fig. 40.** *L. polynesiensis* sp. nov. from Tetiaroa, Society, voucher PF1050. **Fig. 41.** *L. providenceae* Tahiti, Society, voucher PF733. **Fig. 42.** *L. puhoroae* sp. nov. Rangiroa, Tuamotus, voucher PF966. **Fig. 43.** *L. ruae* sp. nov. from Morane, Gambier, voucher PF1587. **Fig. 44.** *L. ruamataiae* sp. nov. from Tetiaroa, Society, voucher PF1138. **Fig. 45.** *L. sawaikiae* sp. nov. from Tahiti, Society, voucher PF728. **Fig. 46.** *L. societensis* sp. nov. from Tetiaroa, Society, voucher PF1090. **Fig. 47.** *L. sonderi* from Rapa, Austral, voucher UPF 1842. **Fig. 48.** *L. taaroae* sp. nov. from Rangiroa, Tuamotus, voucher PF916. **Fig. 49.** *L. tangaroae* from Ua Huka, Marquesas, voucher MQ11-322. **Fig. 50.** *L. tauruae* sp. nov. from Rangiroa, Tuamotus, voucher PF878. **Fig. 51.** *L. tuamotuensis* sp. nov. from Rangiroa, Tuamotus, voucher PF910. **Fig. 52.** *L. tupaiae* sp. nov. from Rangiroa, Tuamotus voucher PF969. **Fig. 53.** *L. wakae* sp. nov. from Mangareva, Gambier, voucher PF622. **Fig. 54.** *L. sp32* from Tahuataa, Marquesas, voucher MQ11-475. **Fig. 55.** *L. sp123* from Morane, Gambier, voucher PF1574. **Fig. 56.** *L. sp128* from Rangiroa, Tuamotus, voucher PF872. **Fig. 57.** *L. sp129* from Rapa, Austral, voucher UPF 2218. **Fig. 58.** *L. sp132* from Tahiti, Society, voucher PF771. **Fig. 59.** *L. sp133* from Moorea, Society, voucher PF1501. Scale bars = 1 cm (Figs 30–59).



Figs 60–90. Transverse (up) and longitudinal (down) sections of thallus of *Lobophora* (Dictyotales, Phaeophyceae) species from French Polynesia. **Fig. 60.** *Lobophora aveiae* sp. nov. from Tubuai, Austral, voucher IRD8764. **Fig. 61.** *L. endeavouriaae* from Tetiaroa, Society, voucher PF1024. **Fig. 62.** *L. gambierensis* sp. nov. from Mangareva, Gambier, voucher GAM13-CP103. **Fig. 63.** *L. huifetuae* sp. nov. from New Caledonia, voucher CV3210. **Fig. 64.** *L. lamourouxii* from Tahiti, Society, voucher PF736. **Fig. 65.** *L. marquisensis* sp. nov. from Eiao, Marquesas, voucher MQ11-156. **Fig. 66.** *L. moanae* sp. nov.



Figs 60–90. (Continued).



Figs 60–90. (Continued). from Rangiroa, Tuamotus, voucher PF990. **Fig. 67.** *L. motuae* sp. nov. from Moorea, Society, voucher PF1214. **Fig. 68.** *L. obscura* from Tetiaroa, Society, voucher PF431. **Fig. 69.** *L. pacifica* from Tahiti, Society, voucher PF1095. **Fig. 70.** *L. polynesiensis* sp. nov. from Tetiaroa, Society, voucher PF803. **Fig. 71.** *L. providenceae* Tahiti, Society, voucher PF733. **Fig. 72.** *L. puhoroae* sp. nov. Rangiroa, Tuamotus, voucher PF966. **Fig. 73.** *L. ruae* sp. nov. from Morane, Gambier, voucher PF888. **Fig. 74.** *L. ruamataiae* sp. nov. from Tetiaroa, Society, voucher PF1139. **Fig. 75.** *L. sawaikiae* sp. nov. from Tahiti, Society, voucher PF728. **Fig. 76.** *L. setchellii* from Rangiroa, Tuamotus, voucher PF804. **Fig. 77.** *L. societensis* sp. nov. from Tetiaroa, Society, voucher PF1090. **Fig. 78.** *L. sonderi* from Rapa, Austral, voucher UPF 2365. **Fig. 79.** *L. taaroae* from Rangiroa, Tuamotus, voucher PF916. **Fig. 80.** *L. tangaroae* from Ua Huka, Marquesas, voucher MQ11-170. **Fig. 81.** *L. tauruae* sp. nov. from Rangiroa, Tuamotus, voucher PF878. **Fig. 82.** *L. tuamotuensis* sp. nov. from Rangiroa, Tuamotus, voucher PF922. **Fig. 83.** *L. tupaiae* sp. nov. from Rangiroa, Tuamotus voucher PF969. **Fig. 84.** *L. wakae* sp. nov. from Mangareva, Gambier, voucher IRD2638. **Fig. 85.** *L. sp103* from Morane, Gambier, voucher PF049. **Fig. 86.** *L. sp123* from Morane, Gambier, voucher PF1574. **Fig. 87.** *L. sp128* from Rangiroa, Tuamotus, voucher PF872. **Fig. 88.** *L. sp129* from Rapa, Austral, voucher UPF 2194. **Fig. 89.** *L. sp132* from Tahiti, Society, voucher PF771. **Fig. 90.** *L. sp133* from Moorea, Society, voucher PF1501. Scale bar = 100 µm (Figs 60–90).

Diversity

With an additional 23 species documented in this study, *Lobophora* diversity in French Polynesia now stands at 37 species. This study has brought the total number of *Lobophora* species known in the eastern Indo-Pacific to 41, with the previous records of *L. obscura*1 from Hawaii (Sun *et al.*, 2012; Vieira *et al.*, 2016), *L. obscura*9 and *L. sp98* from Tuvalu (Vieira *et al.*, 2021b) and *L. papenfussii* from the Marshall Islands (Vieira *et al.*, 2016). The eastern Indo-Pacific is the third most diverse marine region for the genus *Lobophora* after the central Indo-Pacific and the western Indian Ocean, which support 60 and 43 species, respectively (Vieira *et al.*, 2017, 2021a). Taking into consideration the geographic isolation of the Polynesian Islands, *Lobophora* diversity in this part of the world is remarkably high in comparison to the global diversity of the genus and approaches the level of diversity so far known in the western Indian Ocean. Furthermore, other parts of the Central Pacific remain poorly sampled – in particular the North Central Pacific (e.g. Hawaiian Islands) – and they most likely support a much greater *Lobophora* diversity than presently known (one species). However, this is equally true for parts of the Central Indo-Pacific and the western Indian Ocean (Vieira *et al.*, 2021a). The present contribution more than doubles the hitherto known diversity of brown algae from French Polynesia, previously evaluated as 32 species (N'Yeurt & Payri, 2006, 2010), and brings the total number of known marine algae in French Polynesia to 350 species. Remarkably, *Lobophora* diversity now represents ~10% of French Polynesian marine algal diversity. This substantial increase in species diversity for just a single genus highlights the importance of molecular-based studies to complement the morphological investigations of species with simple morphologies and few diagnostic characters.

According to our data, the Society Islands supported the highest *Lobophora* species diversity, with 18 species, followed by the Tuamotu (11 species), Gambier (10 species), Austral (8 species) and Marquesas (4 species) archipelagos. We observed an eastward decrease in species diversity from the Society to the Gambier Islands, and also as we approach the equator (Marquesas) and more southerly latitudes (Austral). Similar patterns were found in other taxa (e.g. reef fishes, marine molluscs; Kulbicki, 2007; Salvat & Trondle, 2017). These patterns of diversity within French Polynesia have been explained by several factors including island size, latitude and distance to centres of biodiversity (Kulbicki, 2007), but can also be a result of unequal sampling efforts. The Society archipelago is generally the best-sampled archipelago, with 96 specimens

(Fig. 2). It is located on the western part of French Polynesia, relatively closer to the Indo-Australian archipelago and is composed of several high volcanic islands, harbouring a greater number of habitats in comparison to the low-lying Tuamotu atolls. The lower diversity in the Tuamotu Archipelago, composed mostly of atoll islands, is mainly attributable to fewer habitats in comparison to the Society Islands. The low diversity in the Marquesas archipelago is attributed to its isolation from the centre of diversity formed by the Society–Tuamotu–Gambier archipelagos, as well as the very limited presence of living coral reef systems without barrier reefs and thus lagoons (Aswani & Allen, 2009; Andréfouët *et al.*, 2014), its relatively young geological age, and proximity to the equator characterized by climatic stability (Mittelbach *et al.*, 2007; Willig & Presley, 2018). Similarly, the low diversity in the Austral archipelago can be explained by its geographic isolation from the Society–Tuamotu–Gambier archipelagos and the higher latitude, with fewer reefs (Adjeroud *et al.*, 2016) and markedly cooler waters, for instance in Rapa. Previous studies showed that *Lobophora* diversity peaks in tropical waters and drastically decreases in temperate regions (Vieira *et al.*, 2017, 2018, 2020a), thus confirming the diversity patterns observed in French Polynesia.

Endemism

A total of 21 *Lobophora* species were found in French Polynesia (Fig. 2), including three restricted to the Austral (42.8% of endemism in Austral; *L. sp103*, *L. sp129*, *L. sp134*), two restricted to the Marquesas (50% of endemism in Marquesas; *L. sp31*, *L. sp32*), one to the Gambier (10% of endemism in Gambier; *L. sp123*), seven to the Society (36.8% of endemism in Society; *L. obscura*11, *L. sp74*, *L. sp122*, *L. sp124*, *L. sp130*, *L. sp132* and *L. sp133*), six to the Tuamotu (45.4% of endemism in Tuamotu; *L. sp125*, *L. sp126*, *L. sp127*, *L. sp128*, *L. sp131*), one to the Tuamotu and Gambier (*L. sp73*), and two to the Society, Tuamotu and Gambier (*L. sp13* and *L. sp57*). The overall level of endemism for *Lobophora* in French Polynesia stands at 57%, which is quite remarkable for a single brown algal genus. The present study increases the known incidence of endemism in marine algae from French Polynesia by six-fold from 1% (3 endemic species) (N'Yeurt & Payri, 2006, 2007, 2010) to 6% (24 endemic species), which is comparable with other groups such as in reef fishes (6.1%; Kulbicki, 2007) or marine molluscs (11.8%; Salvat & Trondle, 2017). However, it falls short of the endemism found in land plants (58%; Florence, 1987; Gargominy, 2003). The proportion of endemism in French Polynesian marine algae was found to be similar to that in other parts of the Central Pacific,

such as the Hawaiian islands (10.8% overall endemism; 14.1, 2.9, 4.8% for the red, green and brown algae; Tsuda, 2014). However, the low reported level of endemism of *Lobophora* in other island groups (e.g. one species in Hawaii and in the Cook Islands) could most likely be the result of overlooking cryptic and pseudo-cryptic diversity.

Biogeographic patterns within archipelagos

The Society archipelago has the highest affinities of *Lobophora* species compared with the rest of French Polynesia, sharing three species in common with the Australs, four species with the Tuamotu and three species with the Gambier. The Marquesas have no species in common with any of the other archipelagos, such as *Codium* (Payri *et al.*, 2016). The Australs share one species in common with the Gambier (*L. aveia* sp. nov.). The Tuamotu shares the most affinity with the Gambier with five species in common. Species from southern Austral Islands (*L. sonderi*, *L. sp129*, *L. sp134*) are sub-tropical species not present in the northern part of French Polynesia. Marquesas Islands species are not found in the rest of French Polynesia, but two occur in the Central Indo-Pacific (*L. tangaroae* sp. nov. and *L. petila*), both in Papua New Guinea. These observations point to the role and importance of short-distance dispersal in structuring species composition across French Polynesian archipelagos. While the Society, Tuamotu and Gambier stretch over 2000 km, the relative proximity of their islands allowed eastward dispersal, hopping from island to island, for several species. The greater distance between the Austral and Marquesas limited or thwarted these dispersals. Curiously, while the Marquesas shares no species in common with the other archipelagos, it shares two species with the Melanesian Islands (see below).

Affinities with the Indo-Pacific

French Polynesian *Lobophora* presents the highest affinity with the Central Indo-Pacific region, with 14 species shared in common (Fig. 2). Within the Central Indo-Pacific, this affinity is more specifically related to Melanesian Islands (New Caledonia, Papua New Guinea, Vanuatu) and Polynesian outliers (Tuvalu, Rotuma). French Polynesian *Lobophora* presents a lesser affinity with the western Indo-Pacific (four species in common including three species distributed in the Central Indo-Pacific) and shares only one species in common with the eastern Pacific Ocean (*L. sonderi*; Easter Island). It is noteworthy that the two species of *Lobophora* reported from

Easter Island (*L. undulata* and *L. sonderi*) are also present in New Caledonia and Australia, and *L. undulata* is related to another species from Rapa (*L. sp129*), indicating affinities between Rapa Island and Easter Island, which are located roughly at the same latitude, yet ~3500 km apart. Species of *Lobophora* in Easter Island are possibly cases of human-mediated introduction from Melanesia and Polynesian outliers such as Tuvalu and Rotuma (N'Yeurt, 1996) through the southern Austral Islands. The absence of species in common with the eastern Pacific (American coasts) is primarily explained by the long distance and ocean currents.

As is the case with other terrestrial and marine taxa (e.g. algae, reef fishes, marine molluscs, terrestrial invertebrates; Kulbicki, 2007; N'Yeurt & Payri, 2007; Gillespie *et al.*, 2008; Salvat & Trondle, 2017), we expect that French Polynesian *Lobophora* share a high level of affinities with other Polynesian islands. So far only one Polynesian outlier island, Tuvalu, located ~3500 km north-west of the Society Islands is relatively well-sampled and shares four species of *Lobophora* in common with French Polynesia, while two species including *L. obscura* occur in the Cook Islands (Vieira *et al.*, 2016; N'Yeurt, unpubl.). The absence of data from the rest of Polynesia prevents further comparisons.

Only two species of *Lobophora* are shared between the Atlantic, Central Indo-Pacific and eastern Indo-Pacific (*L. lamourouxii* and *L. setchellii*). *Lobophora setchellii* is related to Indo-Pacific species and present in the western Indo-Pacific, likely dispersed eastward and westward from the Central Indo-Pacific or western Indian-Ocean. In contrast, *L. lamourouxii* is related to a western Atlantic species (*L. colombiana*) and is absent from the western Indo-Pacific, and only recorded from one locality in Central Indo-Pacific (Malaysia). It is therefore very possible that the latter dispersed from the Caribbean to the Pacific via the central American seaway prior to its closure during the Middle Miocene, 15–13 million years ago (Montes *et al.*, 2015). Another species (*L. schneideri*) was reported from the Atlantic and the eastern Pacific (only from Clipperton Island), but probably as a result of a recent introduction from the Atlantic (Vieira *et al.*, 2018). Aside from *L. schneideri*, the only three species known so far from the eastern Pacific (*L. adpressa*, *L. cocoensis*, *L. panamensis*) are neither present in the Atlantic, Central or western Indo-Pacific (Camacho *et al.*, 2019). Additional samplings are warranted in the eastern Pacific to confirm present affinities with the Central Pacific, as well as to confirm the origin of *L. lamourouxii*.

Evolution and ancestral biogeography

Lobophora species diversity in the French Polynesian Islands is primarily the result of repeated establishments from the Central Indo-Pacific followed by isolation and speciation (Vieira *et al.*, 2017). We count at least 30 establishment events (Fig. 2). Only three clades appeared to have subsequently diverged within French Polynesia: (C1) *L. gambierensis* sp. nov. – *L. societensis* sp. nov.; (C2) *L. marquisensis* sp. nov. – *L. motuae* sp. nov. – *L. sp32* – *L. rechercheae*, (C3) *L. ruae* sp. nov. – *L. sp123* (Fig. 2). Diversification of C1 and C2 seems to be the result of isolation by distance from the Society to Marquesas Islands. Within French Polynesia, colonization will generally be from older hotspot islands westward to younger islands.

Limited local diversification events indicate that south-eastern Pacific Islands maybe considered evolutionary graveyards for the genus *Lobophora* with limited speciation. Nevertheless, considering the relatively young geological ages of the French Polynesian Islands, 15–0.01 Ma with the exception of the Tuamotus (47.4 Ma) (Table 1), diversification processes may have only recently been ongoing across French Polynesian archipelagos.

The absence in French Polynesia of *Lobophora* species from the American Pacific coasts confirms the role of the East Pacific barrier in the dispersal of *Lobophora* across the Pacific. Nevertheless, evidence of biogeographic affinities with the eastern Pacific may also have been obscured by the closing of the Central American Seaway, which hypothetically resulted in the extinction of some *Lobophora* species (Vieira *et al.*, 2020b).

Taxonomic treatment

*Asterisk before word to identify it as a protosound.

Lobophora aveiae C.W.Vieira, Payri & M.Zubia, sp. nov. (Figs 3, 30, 60)

Description

Thallus coarse predominantly decumbent, light brown in colour with lighter margins, ruffled, covered with surface hairs, up to 6 cm wide and 5 cm tall, 132–304 µm thick, attached to the substratum by basal rhizoids. Margins entire. Structure with 7–10 cell layers: a single-cell-layered medulla, a dorsal cortex of 3–5 cell layers, and a ventral cortex of 3–4 cell layers.

HOLOTYPE: UPF 4461 (PF093), Tubuai, Austral Islands, French Polynesia (–23.35395, –149.4195), 7.V.2014, leg. M. Zubia.

ISOTYPE: UPF 4460 (PF071), Tubuai, Austral Islands, French Polynesia (–23.35395, –149.4195), 7.V.2014, leg. M. Zubia.

PARATYPE: UPF 4458 (PF060), Tubuai, Austral Islands, French Polynesia (–23.40385, –149.52662), 6.V.2014, leg. M. Zubia.

REPRESENTATIVE DNA SEQUENCES: OK030275 (*cox3*, from the isotype), MW225679 (*psbA*, from the holotype), and MW223352 (*rbcL*, from the holotype). ETYMOLOGY: The specific epithet *aveiae* comes from the Tahitian word *avei'a* for ‘zenith guide stars’, from the proto-polynesian **kaweina* ‘that which is steered for’, that is, a star used for navigation, in reference to the navigational star path system used by ancient Polynesians.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the decumbent growth habit, coarse and ruffled thallus, light brown colour, ecological habit growing on hard substrata, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Austral and Gambier Islands (French Polynesia), New Caledonia. Growing on hard substrata in shallow habitats (0.5–2 m); on rocks, crustose coralline algae, basal part of *Acropora* corals.

SPECIMENS EXAMINED: Mangareva, Gambier Islands, French Polynesia, January 30, 2013, leg. C. Payri NOU 201847 (GAM13-CP036), January 31, 2013, NOU 201556, NOU 201557, NOU 201558 (GAM13-CP051, GAM13-CP052, GAM13-CP053), February 1, 2013, NOU 201559, NOU 201560, NOU 201561, NOU 201562, NOU 201563 (GAM13-CP102, GAM13-CP131, GAM13-CP147, GAM13-CP178, GAM13-CP179), 2 February 2013, NOU 201564, NOU 201565 (GAM13-CP216, GAM13-CP217), 6 February 2013, NOU 201566 (GAM13-CP459), 8 February 2013, NOU 201567 (GAM13-CP533), Temoe, Gambier Islands, French Polynesia, 9 February 2013, NOU 201568, NOU 201569 (GAM13-CP539, GAM13-CP567, GAM13-CP575); Tubuai, Austral Islands, French Polynesia, May 6, 2014 leg. M. Zubia UPF 4459 (PF060), May 7, 2014, UPF 4460, UPF 4461 (PF071, PF093), May 8, 2014, UPF 4463 (PF122), May 10, 2014, UPF 4462 (PF178); Mangareva, Gambier Islands, French Polynesia, May 5, 2017, leg. M. Zubia UPF 4667 (PF393); Tubuai, Austral Islands, French Polynesia, November 12, 2017, leg. M. Zubia UPF 5550 (PF610).

COMMENTS: This species corresponds to *Lobophora* sp11 of Vieira *et al.* (2016).

Lobophora gambierensis C.W.Vieira, Payri & M. Zubia, sp. nov. (Figs 5, 32, 62)

Description

Thallus predominantly crustose, thin, somewhat transparent, homogeneously orange-brown in colour, up to 11 cm wide and 5 cm tall, 82–122 µm thick, attached to the substratum by ventral rhizoids. Margins entire. Structure with 5–6 cell layers: a single-cell-layered medulla, a dorsal cortex of 2–3 cell layers, and a ventral cortex of 2 cell layers.

HOLOTYPE: NOU 201663 (GAM13-CP316), Mangareva, Gambier Islands, French Polynesia (–23.1911, –135.093), 1.II.2013, *leg.* C. Payri.

PARATYPE: NOU 201662 (GAM13-CP103), Mangareva, Gambier Islands, French Polynesia (–23.236, –134.901), 1.II.2013, *leg.* C. Payri.

REPRESENTATIVE DNA SEQUENCES: MW223563 (*cox3*, from the holotype), MW225699 (*psbA*, from the holotype) and MW223372 (*rbcL*, from the holotype).

DISTRIBUTION AND HABITAT: Gambier and Tuamotu Islands (French Polynesia). Growing on hard substrata in shallow waters on the outer slope or inner barrier reef down to 3–6 m; on crustose coralline algae, corals mixed with other seaweeds (e.g. Dictyotales, *Caulerpa*).

ETYMOLOGY: The specific epithet *gambierensis* pertains to the type locality, Gambier archipelago (French Polynesia), ‘*archipel des Gambier*’ in French. DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose growth habit, orange-brown colour, ecological habit growing on hard substrata, and the distinctive DNA sequences.

SPECIMENS EXAMINED: Mangareva, Gambier Islands, French Polynesia, 1 February 2013, *leg.* C. Payri NOU 201663 (GAM13-CP316), 4 February NOU 201662 (GAM13-CP103); Vairaatea, Tuamotu Islands, French Polynesia, 2000, *leg.* C. Payri UPF 0770 (s.n.).

COMMENTS: This species corresponds to *Lobophora* sp73 of Vieira *et al.* (2016).

***Lobophora huifetuae* C.W.Vieira & Payri, sp. nov. (Figs 33, 63)**

Description

Thallus predominantly crustose, green-khaki in colour, closely following substratum contours, 112–160 µm thick attached to coral by basal rhizoids on the entire ventral surface. Margins entire. Structure with 5–6 cell layers: single-cell-layered medulla, a dorsal cortex of 2–3 cell layers, and a ventral cortex of 2 cell layers.

HOLOTYPE: PC 0063023 (CV3210), Mbere Reef, Noumea, South Province, New Caledonia (–22.34693, 166.23257), 3.IV.2013, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: KM487892 (*cox3*, from the holotype), KM488037 (*psbA*, from the holotype) and KM488145 (*rbcL*, from the holotype). ETYMOLOGY: The specific epithet *huifetuae* derives from the Tahitian word *hui-fetū* for ‘group of stars that appears to form a figure’ or ‘constellations’, which forms the backbone of the navigational star path system used by ancient Polynesians.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose growth habit, green-khaki colour, ecological habit growing on corals, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Society Islands (French Polynesia), New Caledonia. Growing on hard substrata, on the outer barrier reef slope, at 12 m; on surface of live coral *Porites cylindrica* from the base to the tips of the branches.

SPECIMENS EXAMINED: Mbere Reef, Noumea, South Province, New Caledonia, April 3, 2013, *leg.* C. Vieira PC 0063023 (CV3210); Mangareva, Gambier Islands, French Polynesia, February, 2013, *leg.* C. Payri (GAM13-CP215);

COMMENTS: This species corresponds to *Lobophora* sp6 of Vieira *et al.* (2016).

***Lobophora marquisensis* C.W.Vieira & Payri, sp. nov. (Figs 7, 35, 65)**

Description

Thallus predominantly crustose, large, homogeneously dark green in colour, forming large patches, 70–80 µm thick, attached to the substratum by ventral rhizoids. Margins entire. Structure with 5–6 cell layers: single-cell-layered medulla, a dorsal cortex of 2 cell layers, and a ventral cortex of 2 cell layers.

HOLOTYPE: NOU 201593 (MQ11-156), Eiao, Marquesas Islands, French Polynesia (–7.95515, –140.662), 23.XI.2011, *leg.* C. Payri.

PARATYPE: NOU 201592 (MQ11-067), Nukuhiva Anaho, Marquesas Islands, French Polynesia (–7.95515, –140.662), 23.XI.2011, *leg.* C. Payri.

REPRESENTATIVE DNA SEQUENCES: KU353348 (*cox3*, from the holotype), KU352888 (*psbA*, from the holotype) and KU353054 (*rbcL*, from the holotype).

ETYMOLOGY: The specific epithet *marquisensis* pertains to the Type locality, the Marquesas Archipelago (French Polynesia), ‘*archipel des Marquises*’ in French.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose growth habit, homogeneous dark green colour, ecological habit growing on coarse sand-covered rocks, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Marquesas Islands (French Polynesia). Growing on hard substrata down to 23 m depth; on coarse sand-covered rocks, crustose coralline algae.

SPECIMENS EXAMINED: Nukuhiva Anaho, Marquesas Islands, French Polynesia, 23 November 2011, *leg.* C. Payri NOU 201592 (MQ11-067) Eiao, 26 November, 2011, NOU 201593, NOU213954, NOU213955, (MQ11-156, MQ11-157, MQ11-158).
 COMMENTS: This species corresponds to *Lobophora* sp31 of Vieira *et al.* (2016).

***Lobophora moanae* C.W.Vieira, Payri & M.Zubia, sp. nov. (Figs 8, 36, 66)**

Description

Thallus decumbent to crustose, translucent homogeneously light brown in colour, torn at the base, covered with surface hairs regularly distributed, up to 10 cm wide and 3 cm tall, 104–140 µm thick, attached to the substratum by ventral rhizoids. Margins entire. Thalli overlapping. Structure with 5–6 cell layers: single-cell-layered medulla, a dorsal cortex of 2–3 cell layers, and a ventral cortex of 2 cell layers.

HOLOTYPE: UPF 5708 (PF 990), Rangiroa, Tuamotu Islands, French Polynesia (–15.099683, –147.92242), 17.V.2019, *leg.* C. Vieira.

ISOTYPES: UPF 5558, UPF 5559, UPF 5561 (PF936, PF965, PF991), Rangiroa, Tuamotu Islands, French Polynesia (–15.099683, –147.92242), 17.V.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030300 (*cox3*, from the holotype), OK030391 (*psbA*, from the holotype), and OK030488 (*rbcl*, from the holotype).
 ETYMOLOGY: The specific epithet *moanae* comes from the Tahitian word *moana* (also used in other Polynesian languages) for ‘sea beyond the reef’ or ‘ocean’, in reference to the Pacific Ocean, an integral part of the Polynesian culture.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the decumbent to crustose growth habit, dense surface hairs regularly distributed, translucent homogeneous light brown colour, ecological habit growing on bedrocks, dead corals and crustose coralline algae in turbid habitats, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Gambier and Tuamotu Islands (French Polynesia), Tuvalu. Growing between 0–20 m, in turbid habitats on hard substrata covered with a fine layer of sediments; on rocks, crustose coralline algae, dead corals, at the base of corals (e.g. *Porites*).

SPECIMENS EXAMINED: Rangiroa, Tuamotu Islands, November 19, 2019, *leg.* S. Andrefouët (RGR01, RGR02); Rangiroa, Tuamotu Islands, May 14, 2019, *leg.* C. Vieira UPF 5715, UPF 5716, UPF 5717, UPF 5714 (PF825, PF828, PF829, PF853), May 15, UPF 5712 (PF880), May 16, UPF 5710, UPF 5711, UPF 5718, UPF 5557, UPF 5713 (PF908, PF911, PF914, PF915, PF917), May 17, UPF 5558, UPF 5559, UPF 5560, UPF 5709, UPF 5707, UPF 5708,

UPF 5561 (PF936, PF965, PF968, PF971, PF989, PF990, PF991); Morane, Gambier Islands, French Polynesia, November 6, 2019, *leg.* M. Zubia UPF 5562 (PF1552), November 7, UPF 5563, UPF 5564, UPF 5565, UPF 5566 (PF1561, PF1562, PF1563, PF1564); Funafuti, Tuvalu, November 18, 2014, *leg.* C. Payri (TV24), November 19 (TV75, TV87).

COMMENTS: This species corresponds to *Lobophora* sp17 of Vieira *et al.* (2016).

***Lobophora motuae* C.W.Vieira, sp. nov. (Figs 9, 37, 67)**

Description

Thallus predominantly crustose, dark brown in colour, 65–75 µm thick. Margins entire. Structure with 3–4 cell layers: single-cell-layered medulla, a dorsal cortex of 1–2 cell layers, and a ventral cortex of 1 cell layer.

HOLOTYPE: UPF 5521 (PF1420), Moorea, Society Islands, French Polynesia (–17.47055, –149.77754), 25.VI.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030249 (*cox3*, from the holotype), OK030429 (*psbA*, from the holotype) and OK030516 (*rbcl*, from the holotype).

ETYMOLOGY: The specific epithet *motuae* comes from the Tahitian word *motu* (also used in other Polynesian languages) for ‘island’, an integral part of the Polynesian culture.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose growth habit, small thallus, brown colour, ecological habit growing on hard substrata, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Moorea (French Polynesia). Growing on the outer barrier reef slope at 10–13 m; on bedrock, crustose coralline algae.

SPECIMENS EXAMINED: Moorea, Society Islands, French Polynesia, 25 June 2019, *leg.* C. Vieira UPF 5520 (PF1214), 28 June 2019, UPF 5521 (PF1420).

COMMENTS: This species corresponds to *Lobophora* sp130.

***Lobophora obscura* (Dickie) C.W.Vieira, De Clerck & Payri (Figs 10, 38, 68)**

BASYONIM: *Zonaria obscura* Dickie in J. Linn. Soc. Bot. 15:31. 1875

HOLOTYPE: BM 563329 (s.n.), Cook Islands, Mangaia, W.W.Gill.

DIAGNOSIS: Thallus coarse predominantly crustose, dark brown to black in colour, presenting grey iridescent lines, up to 4 cm wide and 2 cm tall, 200–225 µm thick, attached to the substratum by ventral rhizoids. Margin entire. Structure with 9–10 cell layers: single-cell-layered medulla, a dorsal cortex of 4–5 cell layers, and a ventral cortex of 4 cell layers.

REPRESENTATIVE DNA SEQUENCES: OK030260 (*cox3*, from the PF1389), OK030410 (*psbA*, from the PF1389) and OK030501 (*rbcL*, from the PF1389). Short *rbcL* fragment from the holotype available in Vieira *et al.* (2016) Electronic Supplement (Supplementary table S3). DISTRIBUTION AND HABITAT: Cook Islands, French Polynesia. Growing in lagoons at shallow depths (0–1 m) on hard substrata; on rocks and dead corals.

SPECIMENS EXAMINED: Tetiaroa, Society Islands, French Polynesia, May 7, 2018, *leg.* M. Zubia (PF402-30), May 8 (PF421, PF430-2, PF431), May 9 UPF 4759 (PF446) May 10 (PF461); PK16, Tahiti, Society Islands, French Polynesia, June 10, *leg.* M. Zubia (PF474, PF471-17, PF474-2, PF474-3, PF474-24, PF474-12, PF474-9, PF474-10, PF474-11, PF474-27, PF474-14, PF474-18, PF474-1, PF474-26, PF474-25, PF474-8); Temae Beach, Moorea, Society Islands, French Polynesia, July 7, 2017, *leg.* M. Zubia (PF475-15); Moorea, Society Islands, French Polynesia, June 27, 2019, *leg.* M. Zubia UPF 5523, UPF 5524 (PF1389, PF1391); August 26, 2019, UPF 5037 (PF1448).

COMMENTS: The *Lobophora obscura*-complex consists of several lineages distributed across the Indo-Pacific some of which have been recently recognized as distinct species. Two lineages of the *Lobophora obscura*-complex were documented so far from French Polynesia, *L. obscura*8 and *L. obscura*11. The latter was identified in this study as the authentic *L. obscura* [*Zonaria obscura*], originally described from the Cook Islands (Mangaia), based on a sequence of the type generated by Vieira *et al.* (2016).

***Lobophora pacifica* (Setchell) C.W.Vieira, De Clerck & Payri (Figs 11, 39, 69)**

Basionym

BASYONIM: *Aglaozonia pacifica* Setch. In Univ. Calif. Publ. Bot. 12: 90, pl. 7–22. 1926.

HOLOTYPE: UC 261174 (5057a), barrier reef off Papeete, French Polynesia, May 1922, *leg.* W.A.Setchell. EPITYPE: UPF 4268 (PF026), Fa'aa, Tahiti, Society Islands, French Polynesia (–17.59173, –149.62462), 27.II.2014, *leg.* M. Zubia.

Diagnosis

Thallus flabellate, coarse, predominantly decumbent, light to dark brown in colour, up to 6 cm wide and 4 cm tall, 168–202 µm thick, attached to the substratum by basal rhizoids. Margins entire. Structure with 6–9 cell layers: single-cell-layered medulla, dorsal and ventral cortices of 3–4 cell layers.

REPRESENTATIVE DNA SEQUENCES: KX581361 (*cox3*, from the epitype), MW225652 (*psbA*, from the epitype), and KX581362 (*rbcL*, from the epitype).

DIAGNOSTIC CHARACTERS: The species could be distinguished from sympatric species by the decumbent growth habit, coarse thallus, dark brown colour, ecological habit growing in crevices on bedrock, hidden under coral assemblages, and on unhealthy coral colonies (e.g. *Porites*), and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Gambier, Tuamotu and Society Islands (French Polynesia). Growing on hard and soft substrata; sand and rocks on shallow habitats; common on barrier reefs near the front reef, in exposed areas subject to wave action, down to –30 m.

COMMENTS: Mistakes in the epitype collection and herbarium numbers and locality were made in Vieira *et al.* (2016). The correct voucher and herbarium numbers are UPF 4268 (PF026) and not UPF026 (PC0063045), and the epitype was collected in Tahiti, not in Moorea.

***Lobophora polynesiensis* C.W.Vieira, Payri & M. Zubia, sp. nov. (Figs 12, 40, 70)**

Description

Thallus crustose to procumbent, light to dark brown in colour, up to 2 cm wide and 1 cm tall, 50–94 µm thick, attached to the substratum by ventral rhizoids. Margins entire. Structure with 3–5 cell layers: single-cell-layered medulla, dorsal and ventral cortices of 1–2 cell layers.

HOLOTYPE: UPF 5526 (PF1050) Tetiaroa, Society Islands, French Polynesia (–16.993045, –149.56571), 30.V.2019, *leg.* C. Vieira.

PARATYPES: UPF 5568, UPF 5569 (PF800, PF808) Tetiaroa, Society Islands, French Polynesia (–14.976678, –147.634388), 30.V.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030243 (*cox3*, from the holotype), OK030425 (*psbA*, from the holotype), and OK030507 (*rbcL*, from the holotype). ETYMOLOGY: The specific epithet *polynesiensis* pertains to the Type locality, French Polynesia, *Polynésie française* in French.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose to decumbent growth habit, ecological habit growing on bivalve shells, dead coral or seaweeds, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Gambier, Society Islands and Tuamotu (French Polynesia). Growing on hard and soft substrata; on rocks, bivalve shells, dead corals, seaweeds (e.g. crustose coralline algae, red fleshy algae); between 0–15 m.

SPECIMENS EXAMINED: Mangareva, Gambier Islands, French Polynesia, 31 January 2013, *leg.* C. Payri NOU 201595 (GAM13-CP078); Tetiaroa, Society Islands, French Polynesia, May 8, 2017, *leg.* M. Zubia (PF423-4, PF430-3); Rangiroa, Tuamotu Islands, French Polynesia, May 13, 2019, *leg.* C. Vieira UPF 5721, UPF

5722, UPF 5723, UPF 5568, UPF 5720, UPF 5569 (PF794, PF796, PF797, PF800, PF803, PF808), May 14, UPF 5570, UPF 5719 (PF823, PF832), May 29, UPF 5571 (PF1027), May 30, UPF 5526 (PF1050).

COMMENTS: This species corresponds to *Lobophora* sp57 of Vieira *et al.* (2016).

***Lobophora puhoroae* C.W.Vieira & M.Zubia, sp. nov. (Figs 14, 42, 72)**

Description

Thallus coarse, predominantly crustose, homogeneously dark brown in colour, 89–90 µm thick, firmly attached to the substratum by ventral rhizoids, closely following the substratum contours. Margins entire. Structure with 5–6 cell layers: single-cell-layered medulla, a dorsal cortex of 2–3 cell layers, and a ventral cortex of 2 cell layers.

HOLOTYPE: UPF 5537 (PF966), Rangiroa, Tuamotu Islands, French Polynesia (–15.018861, –147.758355), 17.V.2019, *leg.* C. Vieira.

ISOTYPE: s.n. (PF967), Rangiroa, Tuamotu Islands, French Polynesia (–15.018861, –147.758355), 17.V.2019, *leg.* C. Vieira.

PARATYPE: UPF 5536 (PF826), Rangiroa, Tuamotu Islands, French Polynesia (–14.92756, –147.82481), 14.V.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030336 (*cox3*, from the holotype), OK030418 (*psbA*, from the holotype) and OK030495 (*rbcL*, from the holotype).

ETYMOLOGY: This species is named in honour of the Makatean (Tuamotus, French Polynesia) *fa'atere* (pirogue pilot) and master navigator Puhoro (1700s), who became the pilot of captain José de Andía y Varela (1730–?) aboard the *Jupiter* and steered the Spanish through the Society Islands and across the Pacific to Lima (Peru) in 1774. Puhoro is considered an excellent source of knowledge about Tahitian navigational methods and revealed the Polynesian wind compass (*rua mata'i*) to José de Andía y Varela.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose growth habit, coarse thallus, dark brown colour, ecological habit growing on rocks and crustose coralline algae, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Tuamotu Islands (French Polynesia). Growing on hard substrata; on bedrock, rocks and crustose coralline algae; at 15 m.

SPECIMENS EXAMINED: Rangiroa, Tuamotu Islands, French Polynesia, May 14, 2019, *leg.* C. Vieira UPF 5536 (PF826), May 17 UPF 5537, s.n. (PF966, PF967).

COMMENTS: This species corresponds to *Lobophora* sp126 in this study.

***Lobophora ruae* C.W.Vieira, A.D.R. N'Yeurt & M. Zubia, sp. nov. (Figs 15, 43, 73)**

Description

Thallus crustose to procumbent, small, translucent yellow-brown in colour, torn at the base, covered with surface hairs, up to 3 cm wide and 2 cm tall, 98–120 µm thick, attached to the substratum by ventral rhizoids. Margins entire. Structure with 5 cell layers: single-cell-layered medulla, dorsal and ventral cortices of 2 cell layers.

HOLOTYPE: UPF 5529 (PF888), Rangiroa, Tuamotu Islands, French Polynesia (–15.238085, –147.707423), 15.V.2019, *leg.* M. Zubia.

PARATYPE: UPF 5528 (PF1587), Rangiroa, Tuamotu Islands, French Polynesia (–14.97183, –147.62213), 15.V.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030365 (*cox3*, from the holotype), OK030421 (*psbA*, from the holotype) and OK030455 (*rbcL*, from the holotype).

ETYMOLOGY: The specific epithet *ruae* comes from the Tahitian word *rua* for 'series of stars that form alignments' or 'star-path', an elemental part of the navigational star path system used by ancient Polynesians.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose to procumbent growth habit, small thallus, translucent light brown colour, ecological habit growing on bedrock, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Gambier, Society Islands and Tuamotu (French Polynesia), Thailand and Tuvalu. Growing on hard substrata; on bedrock; between 0–20 m.

SPECIMENS EXAMINED: Rangiroa, Tuamotu Islands, French Polynesia, July 20, 2002, *leg.* A. D. R. N'Yeurt UPF 2473, UPF 2474 (s.n., s.n.); Rangiroa, Tuamotu Islands, French Polynesia, May 15, 2019, *leg.* C. Vieira UPF 5573 (PF881), *leg.* M. Zubia UPF 5529 (PF888), May 17, 2019, *leg.* M. Zubia UPF 5574 (PF935), *leg.* C. Vieira UPF 5727 (PF970); Tetiaroa, Society Islands, French Polynesia, May 30, 2019, *leg.* C. Vieira UPF 5575, UPF 5729 (PF1082, PF1083); Morane, Gambier Islands, French Polynesia, November 9, 2019, *leg.* M. Zubia UPF 5528 (PF1587), November 10, UPF 5576 (PF1594); Funafuti, Tuvalu, November 18, 2014, *leg.* C. Payri (TV48).

COMMENTS: This species corresponds to *Lobophora* sp97 of Vieira *et al.* (2016).

***Lobophora ruamataiae* C.W.Vieira & M.Zubia, sp. nov. (Figs 16, 44, 74)**

Description

Thallus circular, predominantly crustose, translucent yellow-brown in colour, very small and thin, up to

1.5 mm in diameter, 48–61 µm thick. Margins entire. Structure with 3–4 cell layers: single-cell-layered medulla, a dorsal cortex of 1–2 cell layers, and a ventral cortex of 1 cell layer.

HOLOTYPE: UPF 5530 (PF1138), Tetiaroa, Society Islands, French Polynesia (–16.985356, –149.551368), 3.VI.2019, *leg.* C. Vieira.

ISOTYPE: UPF 5531 (PF1139), Tetiaroa, Society Islands, French Polynesia (–16.985356, –149.551368), 3.VI.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030234 (*cox3*, from the holotype), OK030377 (*psbA*, from the holotype), and OK030438 (*rbcL*, from the holotype).

ETYMOLOGY: The specific epithet *ruamataiaie* comes from the Tahitian *rua mata'i* for the wind compass, incorporating 16 winds, used by ancient Polynesians, revealed to the Spanish captain José de Andia y Varela by the Makatean (Tuamotu, French Polynesia) pilot Puhoro in 1774.

DIAGNOSTIC CHARACTERS The species was distinctive from sympatric species in the crustose growth habit, circular, small and thin thallus resembling the seaweed *Newhousia* Kraft, Saunders, Abbott et Haroun, translucent yellow-brown colour, ecological habit growing on rocks, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Society Islands (French Polynesia). Growing on hard substrata; on rocks; at 20 m.

SPECIMENS EXAMINED: Tetiaroa, Society Islands, French Polynesia, June 3, 2019, *leg.* C. Vieira UPF 5530, UPF 5531 (PF1138, PF1139).

COMMENTS: This species corresponds to *Lobophora* sp122 in this study. *Lobophora tetiaroaensis* morphologically resembles *Newhousia*.

***Lobophora sawaikiae* C.W.Vieira, sp. nov. (Figs 17, 45, 75)**

Description

Thallus crustose to procumbent, heterogeneously light brown to green in colour with darker concentric lines, torn at the base, up to 5 cm wide and 3 cm tall, 52–58 µm thick, attached to the substratum by ventral rhizoids. Margin entire. Structure with 3 cell layers: single-cell-layered medulla, dorsal and ventral cortices of 1 cell layer.

HOLOTYPE: UPF 5533 (PF728), PK16, Puna'auia, Tahiti, Society Islands, French Polynesia (–17.640383, –149.60990), 9.IV.2019, *leg.* C. Vieira.

ISOTYPES: UPF 5577, UPF 5578, UPF 5579, UPF 5580 (PF723, PF727, PF729, PF738), PK16, Puna'auia, Tahiti, Society Islands, French Polynesia (–17.640383, –149.60990), 9.IV.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030350 (*cox3*, from the holotype), OK030405 (*psbA*, from the holotype) and OK030446 (*rbcL*, from the holotype).

ETYMOLOGY: The specific epithet *sawaikiae* comes from the proto-Polynesian word **sawaiki* (Hawai'i in Tahitian, spelled O-Heavai according to Tupai, and identified as Savai'i in Samoa), the 'father of all islands', in reference to the mythological holy land or traditional homeland from where Tahitian and occidental Polynesians migrated from.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose to procumbent growth habit, coarse thallus, light brown and green colour with darker concentric lines, ecological habit growing on bedrock, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Society Islands (French Polynesia). Growing on hard substrata; on bedrock; and other seaweeds (e.g. crustose coralline algae); between 0–15 m.

SPECIMENS EXAMINED: PK16, Puna'auia, Tahiti, Society Islands, French Polynesia, April 9, 2019, *leg.* C. Vieira UPF 5577, UPF 5734, UPF 5736, UPF 5735, UPF 5578, UPF 5533, UPF 5579, UPF 5733, UPF 5580 (PF723, PF724, PF725, PF726, PF727, PF728, PF729, PF730, PF738); Fa'a'a, Tahiti, Society Islands, French Polynesia, April 26, 2019, *leg.* C. Vieira UPF 5532, UPF 5731, UPF 5732 (PF773, PF774, PF775); Bora Bora, Society Islands, French Polynesia, September 18, 2020, *leg.* M. Zubia UPF 5730 (PF1752); Rapa, Austral Islands, November 6, 2002, *leg.* C. Payri UPF 1999 (s.n.), November 6, 2002, *leg.* J.L. Menou UPF 2364 (s.n.), November 8, 2002, *leg.* IRD UPF 2151 (s.n.), November 16, 2002, *leg.* J.L. Menou UPF 2215 (s.n.).

COMMENTS: This species corresponds to *Lobophora* sp124 in this study.

***Lobophora societensis* C.W.Vieira, Payri & M. Zubia, sp. nov. (Figs 19, 46, 77)**

Description

Thallus decumbent to crustose, light to dark brown in colour with lighter radial lines in decumbent individuals with occasionally large greyish concentric bands, homogeneously orange-brown in colour in crustose individuals, up to 5 cm wide and 4 cm tall, 92–116 µm thick, attached to the substratum by basal rhizoids. Margins entire. Structure with 5 cell layers: single-cell-layered medulla, dorsal and ventral cortices of 2 cell layers.

HOLOTYPE: UPF 5527 (PF1090), Tetiaroa, Society Islands, French Polynesia (–17.016667, –149.55358), 31.V.2019, *leg.* C. Vieira.

PARATYPE: UPF 5032 (PF1140), Tetiaroa, Society Islands, French Polynesia (–17.016667, –149.55358), 6.VI.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030283 (*cox3*, from the holotype), OK030392 (*psbA*, from the paratype) and OK030479 (*rbcL*, from the holotype).

ETYMOLOGY: The specific epithet *societensis* pertains to the type locality, Society archipelago (French Polynesia) or *Archipel de la Société* in French.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the procumbent to crustose growth habit, ecological habit growing on hard substrata, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Society Islands (French Polynesia). Growing on hard substrata; rocks, and crustose coralline algae in sandy bottoms; often covered with fine sand particles; between 10–80 m.

SPECIMENS EXAMINED: Tetiaroa, Society Islands, French Polynesia, 31 May 2019, leg. C. Vieira UPF 5527 (PF1090), 6 January 2019, leg. C. Vieira UPF 5725 (PF1096); Tetiaroa, Society Islands, French Polynesia, 6 March 2019, leg. C. Vieira UPF 5726 (PF1137), UPF 5032 (PF1140); Moorea, Society Islands, French Polynesia, 25 June 2019, leg. C. Vieira UPF 5033, s.n. (PF1212, PF1227); 26 June 2019, leg. C. Vieira s.n., UPF 5572 (PF1314, PF1320); Moorea, Society Islands, French Polynesia, 30 October 2019, leg. M. Zubia s.n., s.n. (PF1529, PF1542); Temoe, Gambier Islands, French Polynesia, 9 February 2013, leg. C. Payri NOU 201597 (GAM13-CP538).

COMMENTS: This species corresponds to *Lobophora* sp74 of Vieira *et al.* (2016).

***Lobophora sonderi* C.W.Vieira, De Clerck & Payri (Figs 20, 47, 78)**

Basionym

BASIONYM: *Zonaria nigrescens* Sonder

LECTOTYPE: MEL 16822 (s.n.), Western Australia, Australia, leg. L. Preiss.

DIAGNOSIS: Thallus erect, stipitate, dark brown in colour, multilobed, up to 10 cm wide and 13 cm tall, 160–170 µm thick, attached to the substratum by an obvious holdfast of mixed sand and slender fibres. Margins entire. Structure with 9–10 cell layers: single-cell-layered medulla, a dorsal cortex of 4–5 cell layers, and a ventral cortex of 4 cell layers.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the erect-stipitate growth habit, dark brown colour, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Gambier, Tuamotu and Society Islands (French Polynesia), Australia, Easter Island (Chile), New Caledonia. Growing on hard and soft substrata; sand and rocks on shallow habitats.

SPECIMENS EXAMINED: Rapa, Austral Islands, French Polynesia, November 2002, leg. unknown UPF 1904, November 1, 2002, leg. C. Payri UPF 1849, November 15, 2002, leg. J.L. Menou UPF 2212, November 18, 2002, leg. M. Adjeroud UPF 2236, November 23, 2002, leg. J.L. Menou UPF 2324, November 1, 2002, leg. J.L. Menou UPF 1842, 2002, leg. unknown UPF 1887, UPF 1888; McDonald Bank, Austral Islands, French Polynesia, November 4, 2002, leg. IRD, UPF 2119, UPF 2120, UPF 2121, UPF 2171.

***Lobophora taaroae* C.W.Vieira & M.Zubia, sp. nov. (Figs 21, 48, 79)**

Description

Thallus coarse, predominantly crustose, homogeneously dark brown in colour, 211–247 µm thick, firmly attached to the substratum, closely following the substratum contours, covered with surface hairs. Margins entire. Structure with 8–10 cell layers: single-cell-layered medulla, a dorsal cortex of 4–5 cell layers, and a ventral cortex of 3–4 cell layers.

HOLOTYPE: UPF 5031 (PF916), Rangiroa, Tuamotu Islands, French Polynesia (–14.97195, –147.6221), 16.V.2019, leg. C. Vieira.

PARATYPE: UPF 5541 (PF882), Rangiroa, Tuamotu Islands, French Polynesia (–14.97183, –147.62213), 15.V.2019, leg. C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030254 (*cox3*, from the holotype), OK030409 (*psbA*, from the holotype), and OK030497 (*rbcL*, from the holotype).

ETYMOLOGY: This species is named after ta'aroa the supreme creator god in the mythology of the Society Islands of French Polynesia.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the decumbent growth habit, coarse thallus, greyish appearance resulting from the long and dense surface hairs, ecological habit growing on bedrock and corals, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Tuamotu Islands (French Polynesia). Growing on outer reefs slope, on hard substrata; on bedrock, live and dead corals; at 20 m.

SPECIMENS EXAMINED: Rangiroa, Tuamotu Islands, French Polynesia, May 15, 2019, leg. C. Vieira UPF 5541 (PF882), May 16 UPF 5031 (PF916).

COMMENTS: This species corresponds to *Lobophora* sp131 in this study.

***Lobophora tangaroae* C.W.Vieira, Payri & M.Zubia, sp. nov. (Figs 22, 49, 80)**

Description

Thallus coarse predominantly crustose, dark brown to dark green in colour, presenting grey iridescent lines, up to 4 cm wide and 2 cm tall, 200–270 µm

thick, attached to the substratum by ventral rhizoids. Margin entire. Structure with 9–11 cell layers: single-cell-layered medulla, a dorsal cortex of 4–5 cell layers, and a ventral cortex of 3–5 cell layers.

HOLOTYPE: NOU 201862 (MQ11-322), Ua Huka, Marquesas Islands, French Polynesia (–8.93695, –139.556), 20.XI.2011, *leg.* C. Payri.

ISOTYPE: NOU 201863 (MQ11-324), Ua Huka, Marquesas Islands, French Polynesia (–8.93695, –139.556), 20.XI.2011, *leg.* C. Payri.

REPRESENTATIVE DNA SEQUENCES: KU353183 (*cox3*, from MQ11-192), KU352945 (*psbA*, from MQ11-192) and KU353017 (*rbcL*, from MQ11-192).

ETYMOLOGY: The specific epithet *tangaroae* comes from the Polynesian mythological god of the ocean Tangaroa, who made laws to protect the ocean and its sea creatures.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose growth habit, coarse thallus, dark brown colour with grey iridescent lines, dark brown colour, ecological habit growing on *Porites* corals, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Marquesas (French Polynesia), Papua New Guinea. Growing on the outer barrier reef slope at 10–13 m; on bedrock, crustose coralline algae, basal part of *Porites* corals.

SPECIMENS EXAMINED: Tahuataa, Marquesas Islands, French Polynesia, 6 December 2011, *leg.* C. Payri NOU 201483 (MQ11-516), Ua Huka, Marquesas Islands, French Polynesia, 30 November 2011, *leg.* C. Payri NOU 201862, NOU 201863 (MQ11-322, MQ11-324), Nuku Hiva, Marquesas Islands, French Polynesia, 27 November 2011, *leg.* C. Payri NOU 201481, NOU 201482 (MQ11-192, MQ11-194), Eiao, Marquesas Islands, French Polynesia, 24 November 2011, *leg.* C. Payri NOU 201479 (MQ11-94), 26 November 2011 NOU 201480 (MQ11-170), Kavieng, Papua New Guinea, 18 August 2014, *leg.* C. Payri (KVG14-CP579, KVG14-CP580).

COMMENTS: This species corresponds to *Lobophora obscura*8 in Vieira *et al.* (2016).

***Lobophora tauruae* C.W.Vieira & M.Zubia, sp. nov. (Figs 23, 50, 81)**

Description

Thallus predominantly crustose, small, dark brown in colour, 110–120 µm thick, attached to the substratum by ventral rhizoids. Margins irregular. Structure with 4–6 cell layers: single-cell-layered medulla, a dorsal cortex of 2–3 cell layers, and a ventral cortex of 1–2 cell layers.

HOLOTYPE: UPF 5538 (PF878), Tiputa, Rangiroa, Tuamotu Islands, French Polynesia (–14.97183, –147.62213), 15.V.2019, *leg.* C. Vieira.

ISOTYPE: UPF 5539 (PF879), Tiputa, Rangiroa, Tuamotu Islands, French Polynesia (–14.97183, –147.62213), 15.V.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030340 (*cox3*, from the holotype), OK030415 (*psbA*, from the holotype), and OK030502 (*rbcL*, from the holotype).

ETYMOLOGY: The specific epithet *tauruae* derives from the Tahitian word *ta'uruua* for ‘guide star on the horizon’, that is, a star used to locate a ‘rua’ or ‘an alignment of stars’ along an east to west-directed axis, in reference to the navigational star path system used by ancient Polynesians.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the crustose growth habit, dark brown colour, ecological habit growing on rocks, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Tuamotu Islands (French Polynesia). Growing on hard substrata; bedrock, rocks and crustose coralline algae; in lagoon near pass; at 20 m.

SPECIMENS EXAMINED: Tiputa, Rangiroa, Tuamotu Islands, French Polynesia, May 15, 2019, *leg.* C. Vieira UPF 5538, UPF 5539 (PF878, PF879).

COMMENTS: This species corresponds to *Lobophora* sp127 in this study.

***Lobophora tuamotuensis* C.W.Vieira, sp. nov. (Figs 24, 51, 82)**

Description

Thallus decumbent to procumbent, brown in colour with darker concentric lines and speckled with white dots, up to 4 cm wide and 3 cm tall, 61–68 µm thick, attached to the substratum by ventral rhizoids. Margins entire. Structure with 3–5 cell layers: single-cell-layered medulla, dorsal and ventral cortices of 1–2 cell layers.

HOLOTYPE: UPF 5534 (PF910), Rangiroa, Tuamotu Islands, French Polynesia (–14.97195, –147.62210), 16.V.2019, *leg.* C. Vieira.

ISOTYPE: s.n., UPF 5581, UPF 5582, UPF 5535 (PF909, PF912, PF913, PF922), Rangiroa, Tuamotu Islands, French Polynesia (–14.97195, –147.62210), 16.V.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030344 (*cox3*, from the holotype), OK030413 (*psbA*, from the holotype) and OK030504 (*rbcL*, from the holotype).

ETYMOLOGY: The specific epithet *tuamotuensis* pertains to the Type locality, Tuamotu archipelago Islands (French Polynesia), *Archipel des Tuamotu* in French.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the decumbent to procumbent growth habit, thin thallus, dark brown colour with darker concentric lines and white dots, ecological habit growing on rocks and bedrock, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Tuamotu Islands (French Polynesia). Growing on hard substrata; rocks and bedrock; at 20 m.

SPECIMENS EXAMINED: Rangiroa, Tuamotu Islands, French Polynesia, May 16, 2019, *leg.* C. Vieira s.n., UPF 5534, UPF 5581, UPF 5582, UPF 5535 (PF909, PF910, PF912, PF913, PF922).

COMMENTS: This species corresponds to *Lobophora* sp125 in this study.

***Lobophora tupaiae* C.W.Vieira, Payri & M.Zubia, sp. nov. (Figs 25, 52, 83)**

Description

Thallus predominantly decumbent, homogeneous light to dark brown in colour, torn at the base, covered with surface hairs particularly dense on the margin, up to 8 cm wide and 4 cm tall, 120–148 µm thick, attached to the substratum by ventral rhizoids. Margins entire. Structure with 6–7 cell layers: single-cell-layered medulla, a dorsal cortex of 3 cell layers, and a ventral cortex of 2–3 cell layers.

HOLOTYPE: UPF 5552 (PF969), Rangiroa, Tuamotu Islands, French Polynesia (–15.018861, 147.75836), 17.V.2019, *leg.* C. Vieira.

PARATYPE: UPF 5551 (PF862), Rangiroa, Tuamotu Islands, French Polynesia (–14.986402, –147.61537), 15.V.2019, *leg.* C. Vieira.

REPRESENTATIVE DNA SEQUENCES: OK030278 (*cox3*, from the holotype), OK030393 (*psbA*, from PF1026) and OK030484 (*rbcl*, from the holotype).

ETYMOLOGY: This species is named in honour of the Ra'iatean (Polynesian) ari'oi priest, chiefly advisor and master navigator Tupa'ia (~1725 – December 20, 1770) who travelled with Captain James Cook – and the naturalist Joseph Banks – as guide from Tahiti to Batavia (present-day Jakarta, Indonesia) aboard HMS *Endeavour* between 1769 and 1770, during which he drew the famous Tuapa'ia's Map showing interconnected voyaging routes ranging between roughly Samoa and Rapa Nui, and the Society Islands and Hawaii. Tupa'ia is considered an excellent source of knowledge about Tahitian navigational methods.

DIAGNOSTIC CHARACTERS: The species was distinctive from sympatric species in the decumbent growth habit, homogeneous brown colour with dense surface hairs on the margin, torn base, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Gambier, Tuamotu and Society Islands (French Polynesia). Growing on hard and soft substrata; on rocks, dead corals, seaweeds (e.g. *Halimeda*), bivalve shells; between 0–15 m.

SPECIMENS EXAMINED: Mangareva, Gambier Islands, French Polynesia, 30 January 2013, *leg.* C. Payri NOU 201582 (GAM13-CP030), 5 February 2013 (GAM13-CP378), 6 February 2013, s.n., NOU

201583 (GAM13-CP433, GAM13-CP460), Temoe, Gambier Islands, French Polynesia, 9 February 2013 NOU 201584 (GAM13-CP572), 10 February 2013, s. n. (GAM13-CP577, GAM13-CP578); Rangiroa, Tuamotu Islands, French Polynesia, May 15, 2019, *leg.* C. Vieira UPF 5551 (PF862), May 17, 2019 UPF 5552 (PF969); Tetiaroa, Society Islands, French Polynesia, May 29, 2019, *leg.* C. Vieira UPF 5553, UPF 5554, UPF 5555 (PF1026, PF1029, PF1031); Morane, Gambier Islands, June 11, 2019, *leg.* M. Zubia UPF 5556 (PF1549).

COMMENTS: This species corresponds to *Lobophora* sp13 of Vieira *et al.* (2016).

***Lobophora wakae* C.W.Vieira, Payri & M.Zubia, sp. nov. (Figs 26, 53, 84)**

Description

Thallus coarse, predominantly procumbent, dark orange in colour, covered with surface hairs irregularly distributed, up to 10 cm wide and 8 cm tall, 156–214 µm thick, attached to the substratum by ventral rhizoids. Margins entire. Structure with 5–10 cell layers: single-cell-layered medulla, a dorsal cortex of 2–5 cell layers, and a ventral cortex of 2–4 cell layers.

HOLOTYPE: UPF 5525 (PF622), Rikitea, Mangareva, Gambier Islands, French Polynesia (–23.119683, –134.963933), 13.XI.2017, *leg.* M. Zubia.

PARATYPE: UPF 5567 (PF641), Taururu Roa, Mangareva, Gambier Islands, French Polynesia (–23.10689, –134.86186), 13.XI.2017, *leg.* M. Zubia.

REPRESENTATIVE DNA SEQUENCES: OK030334 (*cox3*, from the holotype), OK030383 (*psbA*, from the paratype) and OK030474 (*rbcl*, from the holotype).

ETYMOLOGY: The specific epithet *wakae* comes from the Māori word *waka* for canoe, in reference to the double-hulled canoes (*waka hourua* in Māori) that ancient Polynesians developed to sail in rougher waters of the open Pacific.

DIAGNOSTIC CHARACTERS: The species was distinct from sympatric species in the procumbent growth habit, coarse thallus, dark orange colour, ecological habitat, growing on rocks, corals and seaweeds, and the distinctive DNA sequences.

DISTRIBUTION AND HABITAT: Gambier and Society Islands (French Polynesia), New Caledonia, Vanuatu. Growing in turbid habitats on hard substrata covered with a fine layer of sediments; on bedrock, live and dead corals (e.g. *Acropora*), live and dead seaweeds (e.g. *Halimeda*, crustose coralline algae, *Amphiroa*); between 0 and 27 m.

SPECIMENS EXAMINED: Mangareva, Gambier Islands, French Polynesia, 1 February 2013, *leg.* C. Payri NOU 201570 (GAM13-CP132), 2 February 2013, NOU 201848, NOU 201571 (GAM13-CP257, GAM13-CP269), 3 February 2013, NOU 201572,

NOU 201849, NOU 201850 (GAM13-CP275, GAM13-CP276, GAM13-CP277), 4 February 2013, s.n., NOU 201573 (GAM13CP329, GAM13-CP336), 5 February 2013 NOU 201574, NOU 201575, NOU 201851 (GAM13-CP386, GAM13-CP387, GAM13-CP392), 8 February 2013 NOU 201576, NOU 201577, NOU 201578, NOU 201579, NOU 201580 (GAM13-CP515, GAM13-CP516, GAM13-CP517, GAM13-CP531, GAM13-CP532); Santo, Vanuatu, 10 August 2006, *leg. C. Payri & J.L. Menou* (VU054), 11 August 2006 (VU110); Île des Pins, New Caledonia, 3 November 2013, *leg. C. Payri* (IDP13-CP339); Île aux Canards, 3 November 2015, *leg. C. Vieira* (CV3261); Moorea, Society Islands, French Polynesia, 12 March 2015, *leg. C. Payri* UPF 4263 (PF268), 11 March 2015 UPF 4261 (PF271), 10 April 2015 UPF 4260 (PF274); Rikitea, Mangareva, Gambier Islands, French Polynesia, November 13, 2017, *leg. M. Zubia* UPF 5525 (PF622); Taururu Roa, Mangareva, Gambier Islands, French Polynesia 13.XI.2017, M. Zubia UPF 5567 (PF641).

COMMENTS: This species corresponds to *Lobophora* sp19 of Vieira *et al.* (2016).

Acknowledgements

CV is a Postdoctoral Research Fellow at the Research Institute for Basic Sciences, Jeju National University, Republic of Korea. We are indebted to several colleagues who collected specimens for this project: Serge Andréfouët, René Galzin, André Pham, Denis Schneider, Jean-Louis Menou, Joël Orempüller, Tohei Theophilus, Mehdi Adjeroud and Jean Marc Zanini.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This research work was supported by a LABEX CORAIL research grant under the programme ALGALREEF ('Les communautés algues des récifs coralliens: diversité, structure et fonctions écologiques'). This work used resources and facilities provided by UGent as part of the Belgian contribution to EMBRC-ERIC (FWO GOH3817N). CV is indebted to Ghent University for a grant as postdoctoral researcher (16/PDO/141). CV's mobility was supported by The Research Foundation – Flanders (FWO) grant V406219N. Previously published sequences came from material collected during several research campaigns in the Gambier and Marquesas islands sponsored and coordinated by the French Agency for Marine Protected Areas (Agence des Aires Marines Protégées, AAMP) and the *Khaled bin Sultan Living Oceans Foundation (Global reef expedition in French Polynesia)*.

Supplementary information

The following supplementary material is accessible via the Supplementary Content tab on the article's online page at <https://doi.org/10.1080/09670262.2022.2092216>

Supplementary table S1: Voucher information and GenBank accession data for material of *Lobophora* from French Polynesia used in this study. In bold the specimens sequenced in this study.

Supplementary table S2: Voucher and GenBank accession data for additional specimens used for phylogenetic reconstructions.

Supplementary table S3: Anatomical and morphological features of undescribed species of *Lobophora* (Dictyotales, Phaeophyceae) from French Polynesia. Anatomical measurements (cell layers thickness, height, length, width) are in μm , and morphological measurements (thallus maximum width and height) in cm. Abbreviations: Thick., thickness; Ave. \pm SD, average \pm standard deviation; min, minimum; max, maximum; #, numbers.

Supplementary fig. S1: Phylogenetic tree of the genus *Lobophora*, based on *cox3* sequences, using Bayesian method, generated with MrBayes v.3.2.2. The values shown at each node represent posterior probabilities. Two species did not have *cox3* sequences and were identified based on *psbA* (*L. sp103*, *L. sp134*) and *rbcL* (*L. sp134*). *Lobophora* species from French Polynesia are indicated with an asterisk and shaded in grey.

Supplementary fig. S2: Phylogenetic trees of the genus *Lobophora*, based on *psbA* sequences, reconstructed with Bayesian method, generated with MrBayes v.3.2.2 (A), and with the maximum likelihood method using a best fit substitution model and a SPR branch swapping algorithm in PhyML 3.0 (Guindon *et al.*, 2010) (B). The values shown at each node represent the posterior probabilities (A) and bootstrap values (B). *Lobophora* species from French Polynesia are indicated with an asterisk and shaded in grey.

Supplementary fig. S3: Phylogenetic tree of the genus *Lobophora*, based on *rbcL* sequences, reconstructed with Bayesian method, generated with MrBayes v.3.2.2 (A), and with the maximum likelihood method using a best fit substitution model and a SPR branch swapping algorithm in PhyML 3.0 (Guindon *et al.*, 2010) (B). The values shown at each node represent the posterior probabilities (A) and bootstrap values (B). *Lobophora* species from French Polynesia are indicated with an asterisk and shaded in grey.

Supplementary fig. S4: *Lobophora* species tree generated from a concatenated alignment including *cox3*, *psbA* and *rbcL* using Bayesian Bayesian method, generated with MrBayes v.3.2.2. The values shown at each node represent posterior probabilities. *Lobophora* species from French Polynesia are indicated with an asterisk and shaded in grey.

Author contributions

C. Vieira: funding acquisition, original concept, methodology, sample collection, data curation, generation and analysis of morphological and molecular data, drafting and editing manuscript; O. De Clerck: editing of manuscript; C. Payri: sample collection, data curation, generation of morphological data; editing of manuscript; A.D.R. N'Yeurt: sample collection, editing of manuscript; S. D'hondt: generation of molecular data, editing of manuscript; L. Millet: generation of molecular data, editing of manuscript; M.S. Kim: editing of manuscript; M. Zubia:

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