

Remarkable diversification of the lichenized genus *Fissurina* (*Graphidales*) in Hawai‘i

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Article info

Received: 29 Apr. 2026

Revision received: 28 Jun. 2026

Accepted: 29 Jun. 2026

Published: 31 Jul. 2026

Associate Editor

Harrie Sipman

Abstract. We present a molecular phylogenetic and taxonomic revision of the genus *Fissurina* (*Graphidales*) in Hawai‘i. Compared to eight previously reported species, we distinguish a total of 26 species. Only four of the previously reported species are tentatively confirmed, namely *F. columbina*, *F. globulifica*, *F. stromatoides*, and *F. zahlbruckneriana*. An additional four species are new records for the archipelago, including *F. consentanea*, *F. crassilabra*, *F. deficiens*, and *F. hyalinella*. The following 18 species are described as new to science: *F. alani* sp. nov., differing from *F. chrysocarpoides* in the larger ascospores; *F. biliana* sp. nov., differing from *F. hyalinella* in the longer ascospores; *F. brevicarpa* sp. nov., differing from *F. hyalinella* in the short, broad, somewhat gall-forming lirellae; *F. fissa* sp. nov., differing from *F. tachygrapha* in the thicker thallus, the weak apical carbonization of the labia, and the relatively narrower ascospores; *F. fuscella* sp. nov., differing from *F. tectigera* in the apically carbonized labia and the shorter ascospores becoming brown when mature; *F. fuscispora* sp. nov., differing from *F. dumastii* and similar species in the ascospores becoming brown, and from *F. fujisanensis* in the non-carbonized labia; *F. graphidoides* sp. nov., differing from *F. gomphospora* in the dark labia contrasting with the lighter thallus, and from *F. decipiens* in the more distinct, dark grey labia lacking a black line along the slit; *F. implicatoides* sp. nov., differing from *F. capsulata* in the thin, largely endoperidermal thallus and in the shorter, broader ascospores; *F. kokeensis* sp. nov., differing from *F. hyalinella* in the presence of distinct (albeit thin) labia and in the weakly amyloid ascospores; *F. mauiensis* sp. nov., differing from *F. fissa* in the slightly smaller ascospores; *F. montiformis* sp. nov., differing from *F. alligatorensis* in the minutely gall-forming lirellae with concealed disc and the somewhat narrower ascospores; *F. nigriannulata* sp. nov., differing from *F. hyalinella* in the irregular black rim bordering the gaping disc of the lirellae; *F. papillosa* sp. nov., differing from *F. insidiosa* in the even thallus with numerous, tiny papillae; *F. sandwicensis* sp. nov., differing from *F. fissa* in the larger, muriform ascospores; *F. serpentina* sp. nov., differing from *F. insidiosa* in the very long, radiating lirellae; *F. subcoarctata* sp. nov., differing from *F. coarctata* in the more robust, less crowded lirellae; *F. subcrassilabra* sp. nov., differing from *F. crassilabra* in the less emergent lirellae with concealed disc and in the only weakly amyloid ascospore; and *F. subtimidula* sp. nov., differing from *F. fissa* in the much larger ascospores and from *F. sandwicensis* in the 3-septate ascospores. Based on our study, the number of species of *Fissurina* now known from Hawai‘i has more than tripled and potential endemism has increased from zero to 78%. A key to all species now reported for Hawai‘i is presented. This study is dedicated to our esteemed colleague and friend, André Aptroot, on the occasion of his 65th birthday, for his numerous contributions to the taxonomy of tropical crustose lichens.

Key words: Endoperidermal, *Fissurinaceae*, *Fissurinoideae*, *Graphidaceae*

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Introduction

The lichen-forming fungal genus *Fissurina* Fée is characterized by lirellate, often slit-like ascomata emerging from a corticate, olive-green thallus, mostly lacking carbonization, and typically small, 3-septate to (sub-)muriform ascospores with thick outer walls. It occurs throughout the tropics, but extends into subtropical regions, such as northeastern North America and Macaronesia (Staiger 2002; Lendemer 2007; Makhija & Adawadkar 2007; Lücking & Rivas Plata 2008; Kantvilas 2010; Lücking et al. 2011; Sharma et al. 2012; Lendemer & Harris 2014; Van den Boom et al. 2023). It is either classified in the family *Graphidaceae* Dumort, specifically subfamily *Fissurinoideae* Rivas Plata, Lücking & Lumbsch (Staiger 2002; Frisch et al. 2006; Rivas Plata et al. 2013; Lücking et al. 2014; Lücking 2019) or in a separate family *Fissurinaceae* B.P. Hodk., when a more fine-grained family level division of the order *Graphidales* is used (Hodkinson 2012; Kraichak et al. 2018). Here, we refer to this clade as *Fissurina* clade.

Although *Fissurina* was established at the beginning of the 19th century by Fée (1825), its species were for a long time included in the collective genera *Graphis* Adans. and *Graphina* Müll. Arg., using the ascospore-based genus concept of Müller (1880, 1882a, b). The genus was resurrected at the turn of the millennium, placing emphasis on a combination of morphological and anatomical characters, initially recognizing 30 species (Kalb & Hafellner 1992; Staiger 2002). Molecular studies confirmed its difference from *Graphis* s.str. and other lirellate genera, placing species of *Fissurina* in an early diverging clade (Rivas Plata et al. 2013). Within the *Fissurina* clade, the genus *Fissurina* itself appears paraphyletic, since other genera with quite different morphologies, such as *Clandestinotrema* Rivas Plata, Lücking & Lumbsch, *Cruentotrema* Rivas Plata, Papong, Lumbsch & Lücking, *Dyplolabia* A. Massal., and *Pycnotrema* Rivas Plata & Lücking, are nested within *Fissurina* s.lat. (Rivas Plata et al. 2012, 2013; Lumbsch et al. 2014).

Following the first revision by Staiger (2002), 130 additional species have been described in or transferred to *Fissurina*, resulting in 160 currently accepted species, making *Fissurina* one of the largest genera in the *Graphidaceae*-*Fissurinaceae* alliance (Lücking et al. 2017a). The addition of so many species to the genus, in part supported by molecular data, has revealed a remarkable degree of morphological variation, including species with ecorticate or endoperidermal thallus, lirellae forming conspicuous labia, sometimes with heavy carbonization, multiseptate or large ascospores, and a diversity of secondary substances (Archer 2009; Lücking et al. 2011; Sharma et al. 2012; Luch & Lücking 2018; Herrera-Campos et al. 2019).

In spite of this extraordinary diversity, the genus *Fissurina* is not well studied and no regional modern monograph exists so far. As a consequence, the listing of names in checklists is often based on identifications using improper literature, assuming broad geographic distribution of species and substantial morphological variation.

This is also the case for island ecosystems. For example, together with the Galapagos Islands, Madagascar, and the Mascarenes, Hawai'i is considered one of the laboratories of evolution, with high levels of endemism and harboring unique lineages (Givnish et al. 2009; Gillespie 2016; O'Grady & DeSalle 2018; Stallman et al. 2023). Yet, lichenized fungi were often considered an exception to this rule. In the case of Hawai'i, only about 25–28% of the species have been considered putatively endemic to the archipelago (Magnusson 1955; Eldredge & Miller 1995; Smith 1995). However, recent molecular studies have shown that presumably widespread, morphologically defined taxa hide unrecognized, often endemic lineages, such as in the *Lobariaceae* Chevall. or the genera *Coccocarpia* Pers. and *Dirina* Fr., resulting in rates of endemism of up to 80% in these clades (Tehler et al. 2013; Moncada et al. 2014, 2020, 2021a, b; Lücking et al. 2017b, 2020; Coca et al. 2025).

In the present study, we expanded our molecular phylogenetic revisions of Hawaiian lichens to the genus *Fissurina* to test whether previous concepts assuming few, widely distributed taxa would hold. Prior to this study, eight species of this genus were listed for the Hawaiian Islands, namely *F. columbina* (Tuck.) Staiger, *F. globulifera* (Nyl.) Staiger, *F. homichlodes* (Redinger) Luch & Lücking, *F. radiata* Mont., *F. stromatoides* (H. Magn.) Luch & Lücking, *F. tachygrapha* (Nyl.) Staiger, *F. triticea* (Nyl.) Staiger, and *F. zahlbruckneriana* Luch & Lücking [= *Graphis triticea* f. *lactea* Zahlbr., non *Fissurina lactea* Fée] (Magnusson 1955; Elix & McCarthy 1998; Luch & Lücking 2018). *Fissurina triticea* was recently split into two species, segregating the presumably European-Asian *F. consentanea* Nyl. from the neotropical *F. triticea* s.str. (van den Boom et al. 2023), and it is unclear which taxon is present in Hawai'i. Most of the listed taxa are presumably widespread, known from either the Neotropics or the Paleotropics. Exceptions are *F. stromatoides* and *F. zahlbruckneriana* as putative Hawaiian endemics (Staiger 2002; Luch & Lücking 2018), resulting in an inferred degree of endemism of 25%. Based on new collections made on the islands of Kaua'i, Maui, and O'ahu, as well as revision of herbarium material, we postulated that *Fissurina* would be more diverse in Hawai'i than previously assumed and that a higher proportion of the identified lineages would be unique and putatively endemic to the archipelago.

Material and methods

Sampling

Fresh material of *Fissurina* was collected, together with many other lichen taxa, during a field trip organized in 2013 covering the islands of Kaua'i, O'ahu, and Maui, by BM, RL, and on Kaua'i also by TF and on O'ahu also by CWS. Out of a total of roughly 1,600 lichen samples, 58 turned out to represent the genus *Fissurina*. This material was then complemented by specimens housed in the herbaria BISH, HAW, and PTBG.

All freshly collected specimens were photographed in the field, using a NIKON D3100, a CANON Power-shot G15, and (for close-up macrophotographs) a SONY DSC-H90 digital camera, the NIKON equipped with a NIKKOR Micro 55 mm F/3.5 macro lens. Representative material was collected and carefully dried and curated. Duplicates are housed in the herbaria of BISH, HAW, PTBG, B, and F. All specimens were preidentified based on morphological features of thallus, ascumata, ascospores, and secondary chemistry, using an unpublished working key including all currently accepted taxa, which in turn was based on a character matrix derived from the corresponding publications and revision of type material whenever possible, either from own type studies or via *JSTOR Global Plants* (Lücking, unpubl.). Spot tests were done on the thallus surface (commercial bleach: C; paraphenylene-diamine: P) or in microscopic sections (10% potassium hydroxide solution: K). Amyloidity was tested on microscopic sections of ascumata using Lugol's iodine solution (I). Measurements were made in water.

We targeted the mitochondrial small subunit rDNA (mtSSU), the nuclear large subunit rDNA (nuLSU), and the DNA-directed RNA polymerase II subunit *rpb2* (*rpb2*) to reconstruct the molecular phylogeny of Hawaiian *Fissurina*. The laboratory work was conducted by EK in the Pritzker DNA laboratory of the Field Museum, Chicago. DNA was extracted using the Sigma REXtract-N-Amp Plant PCR Kit (St. Louis, Missouri, USA), following the manufacturer's instructions, except that 40 µL of extraction buffer and 40 µL dilution buffer were used. DNA dilutions (10×) were used in PCR reactions for the aforementioned markers. Primers for amplification were mr-SSU1 and Mr-SSU3R (Zoller et al. 1999) for the mtSSU, AL2R (Mangold et al. 2008), and nu-LSU-1125-3' (= LR6) for the nuLSU (Vilgalys & Hester 1990), and fRPB2-7cF and fRPB2-11aR (Liu et al. 1999) for *rpb2*. PCR reactions contained 4.5 µL R4775 SigmaREXtract-N-Amp™ PCR ReadyMix, 0.5 µL of each primer (10 µM), 2 µL genomic DNA extract and 2 µL distilled water for a total of 10 µL. Thermal cycling parameters were initial denaturation for 5 min at 95°C, followed by 35 cycles of 45 s at 94°C, 1 min at 50°C, 1 min 30 s at 72°C, and a final elongation for 10 min at 72°C for the mtSSU; initial denaturation for 5 min at 94°C, followed by 35 cycles of 30 s at 95°C, 30 s at 58°C, 1 min at 72°C, and a final elongation for 10 min at 72°C for the nuLSU; and initial denaturation for 3 min at 95°C, then 1 min at 95°C, and 37 cycles of 1 min at 57°C, 1 min at 58°C, 1 min at 59°C, 1 min at 60°C, 1 min at 61°C, 1 min at 62°C, 1 min at 63°C, 1 min at 64°C and 1.5 min at 72°C, and a final elongation for 10 min at 72°C for *rpb2*. Samples were visualized on a 1% ethidium bromide-stained agarose gel under UV light and bands were gel extracted, heated at 70°C for 10 minutes, cooled to 45°C for 5 minutes, treated with 1 µL GELase (Epicentre Biotechnologies, Madison, WI, USA) and incubated at 45°C for at least 24 hours. The 10 µL cycle sequencing reactions consisted of 1–1.5 µL of Big Dye version 3.1 (Applied Biosystems, Foster City, California, USA), 2.5–3 µL of Big Dye buffer,

6 µM primer, 0.75–2 µL gelated PCR product and water. Samples were sequenced with PCR primers. The cycle sequencing conditions were as follows: 96°C for 1 minute, followed by 25 cycles of 96°C for 10 seconds, 50°C for 5 seconds and 60°C for 4 minutes. Samples were precipitated and sequenced using Applied Biosystems 3730 DNA Analyzer (Foster City, California, USA).

The obtained sequences were checked in NCBI Nucleotide BLAST [<https://blast.ncbi.nlm.nih.gov/Blast.cgi>] using megablast (Boratyn et al. 2013; Madden 2013) and then assembled in SeqMan 4.03 (DNASTAR) and submitted to GenBank (Table 1). The assembled contigs were aligned with all available sequences of *Fissurinaceae*/*Fissurinoideae* from GenBank, using the *Fissurina nigrolabiata* subclade for internal routing following the topology from Rivas Plata et al. (2013). Ingroup routing was selected since the *Fissurina* clade is molecularly quite distinct from the next outgroup and outgroup routing would have resulted in the loss of numerous sites that cannot be reliably aligned with an outgroup, particularly in the mtSSU marker. Overall, 156 terminals were included in the analysis, with 127 mtSSU, 108 nuLSU, 19 ITS, and 27 *rpb2* sequences (Table 1).

The sequences of each of the four markers were subjected to automated alignment with MAFFT 7 (Katoh & Standley 2013), with subsequent manual inspection (see File S1 for the concatenated alignment). The few and short ambiguously aligned regions in the mtSSU and the ITS were manually adjusted, but not deleted. The phylogenetic tree was reconstructed by means of maximum likelihood, with 1,000 bootstrap pseudoreplicates and employing the universal GTRGamma model, using RAxML 8.2.0 (Stamatakis 2014). Tree visualization was done in FigTree 1.4.4 [<https://tree.bio.ed.ac.uk/software/figtree>; File S2].

Results

Molecular phylogeny

We successfully obtained new sequence data for 50 terminals of Hawaiian *Fissurina*, with a total of 43 new mtSSU, 43 nuLSU, and 11 *rpb2* sequences. The overall topology of the clade was similar to that found in previous studies, although the backbone of the ingroup clade was not supported (Fig. 1). *Cruentotrema* and *Dyplolabia* formed an unsupported sister group relationship with *Clandestinitotrema*, whereas *Enigmotrema* and *Pycnotrema* were nested within a weakly supported clade also containing *Fissurina pseudostromatica* and other species, a constellation rendering *Fissurina* s.lat. highly paraphyletic. The sequenced terminals from Hawai'i were recovered in four clades (Fig. 1): one singleton (*F. fuscisporea*) in a supported clade containing also *F. inabensis* and *F. marginata*, among other species; three smaller clades including two (*F. kokeensis*, *F. montiformis*), one (*F. hyalinella*), and three species (*F. fissa*, *F. sandwicensis*, *F. subtimidula*), respectively, and one large, unsupported clade including the remaining species from Hawai'i, with seven terminals from the USA, Puerto Rico, Tanzania, the Philippines, and Taiwan, nested within.

Table 1. GenBank accession numbers and voucher information of the samples used for the phylogenetic analysis. Newly generated sequences are in boldface.

Name of taxa	mtSSU	nuLSU	ITS	<i>rpb2</i>	Sample	Country	Voucher
<i>Clandestinotrema clandestinum</i>	JX421014	–	–	–	DNA0789	Costa Rica	Sipman 44327
<i>Clandestinotrema clandestinum</i>	DQ384925	–	–	–	–	Tanzania	Frisch 99Tz1536
<i>Clandestinotrema leucomelaenum</i>	JX421015	–	–	–	DNA2908b	Costa Rica	Lücking et al. LCB6b
<i>Clandestinotrema leucomelaenum</i>	JX421016	–	–	–	DNA3440	Ecuador	Lücking et al. 26216
<i>Clandestinotrema stylothecium</i>	HQ639597	HQ639662	–	–	DNA3226a	Nicaragua	Lücking et al. 28636
<i>Clandestinotrema stylothecium</i>	–	JX421470	–	–	DNA3226b	Nicaragua	Lücking et al. 28636
<i>Cruentotrema cruentatum</i>	HQ639587	HQ639660	–	–	DNA2169	Brazil	Lücking et al. 263
<i>Cruentotrema thailandicum</i>	JF828960	JF828975	–	–	DNA3139a	Thailand	Lumbsch 19955
<i>Cruentotrema thailandicum</i>	JX421020	–	–	–	DNA3139b	Thailand	Lumbsch 19955
<i>Cruentotrema thailandicum</i>	JX421021	–	–	–	DNA3139c	Thailand	Lumbsch 19955
<i>Dyplolabia afzelii</i>	DQ431950	AY640013	–	–	–	Australia	Kalb 33915
<i>Dyplolabia afzelii</i>	–	KP012902	–	–	MEL-2382721	Australia	Barrett s.n.
<i>Dyplolabia afzelii</i>	–	OQ676632	–	–	YN222489	China	[unknown]
<i>Dyplolabia afzelii</i>	DQ431949	DQ431922	–	–	–	Dom. Republic	Kalb 33153
<i>Dyplolabia afzelii</i>	–	OR602550	–	OR604573	RKCSP3160A01	India	[unknown]
<i>Dyplolabia afzelii</i>	OR602547	OR602549	–	OR604572	RKCSP316RK05	India	AMH22-75
<i>Dyplolabia afzelii</i>	HQ639594	HQ639628	–	KC020273	DNA3160a-DYPAFZ	USA	Lücking et al. 26509
<i>Dyplolabia afzelii</i>	JX421027	JX421483	–	–	DNA3160b	USA	Lücking et al. 26509
<i>Dyplolabia afzelii</i>	–	JX421484	–	–	DNA3160c	USA	Lücking et al. 26509
<i>Dyplolabia afzelii</i>	JX421028	–	–	–	DNA5734	USA	Common 9074
<i>Dyplolabia darwinii</i>	JX421029	–	–	–	DNA2641	Philippines	Rivas Plata 1194D
<i>Enigmatrema rubrum</i>	JX421030	–	–	–	DNA3433a	Costa Rica	Lücking et al. 21006a
<i>Enigmatrema rubrum</i>	JX421031	–	–	–	DNA3433b	Costa Rica	Lücking et al. 21006b
<i>Fissurina adscribens</i>	–	–	OR264084	–	FJ211195	China	[unknown]
<i>Fissurina adscribens</i>	OR264107	OR264068	OR264085	–	FJ220250	China	[unknown]
<i>Fissurina adscribens</i>	OR264108	OR264070	OR264094	–	HNX18044	China	[unknown]
<i>Fissurina adscribens</i>	JX421032	–	–	–	DNA4779	Thailand	Lumbsch 20200c
<i>Fissurina</i> aff. <i>dumastii</i>	JX421033	–	–	–	DNA5664	Brazil	Lücking et al. 31224a
<i>Fissurina</i> aff. <i>dumastii</i>	JX421034	JX421487	–	–	DNA4743	Thailand	Kalb 38899
<i>Fissurina</i> aff. <i>humilis</i>	DQ431948	DQ431921	–	–	–	Tanzania	Frisch 99Tz2002
<i>Fissurina</i> aff. <i>nitidescens</i>	–	JX421488	–	–	DNA1764	Australia	Mangold 32zg
<i>Fissurina</i> aff. <i>nitidescens</i>	–	JX421489	–	–	DNA1774a	Australia	Mangold 32d1
<i>Fissurina</i> aff. <i>nitidescens</i>	DQ431953	AY640010	–	–	–	Costa Rica	Lücking et al. 16116b
<i>Fissurina aggregatula</i>	JX421036	JX421490	–	JX420871	DNA3240	Peru	Rivas Plata 107C
<i>Fissurina aggregatula</i>	JX421037	–	–	–	DNA4764	Thailand	Kalb 38890
<i>Fissurina aggregatula</i>	JX421038	–	–	–	DNA5722	Thailand	Lücking et al. 24019
<i>Fissurina alani</i>	PZ538689	PZ538646	–	–	DNA8300	Hawaii	Lücking et al. 35649
<i>Fissurina alani</i>	PZ538704	PZ538647	–	–	DNA8301	Hawaii	Lücking et al. 36272
<i>Fissurina alani</i>	PZ538706	PZ538649	–	–	DNA8303	Hawaii	Lücking et al. 36490b
<i>Fissurina amazonica</i>	KJ608633	KJ608633	–	–	DNA7039	Brazil	Cáceres 11030
<i>Fissurina biliana</i>	PZ538711	–	–	–	DNA8312	Hawaii	Lücking et al. 35819
<i>Fissurina biliana</i>	PZ538702	PZ538676	–	–	DNA8334	Hawaii	Lücking et al. 35813
<i>Fissurina biliana</i>	PZ538726	PZ538680	–	–	DNA8338	Hawaii	Lücking et al. 35817a
<i>Fissurina biliana</i>	PZ538709	–	–	–	DNA8308b	Hawaii	Lücking et al. 35820b
<i>Fissurina brevicarpa</i>	–	PZ538670	–	–	DNA8328	Hawaii	Lücking et al. 36266b
<i>Fissurina bullata</i>	JX421041	KF875537	–	JX420838	DNA1623-CHAR64	Australia	Mangold 6f
<i>Fissurina comparimuralis</i>	JX421042	JX421492	–	–	DNA3202	El Salvador	Lücking et al. 28103
<i>Fissurina consentanea</i>	PZ538731	–	–	–	DNA8350	Hawaii	Lücking et al. 35821
<i>Fissurina crassilabra</i>	OR264114	OR264065	OR264081	–	FJ211425	China	[unknown]
<i>Fissurina crassilabra</i>	PZ538707	PZ538650	–	PZ568705	DNA8304	Hawaii	Lücking et al. 36263
<i>Fissurina crystallifera</i>	–	KF875538	–	KF875521	CHAR66	Puerto Rico	Mercado 4462
<i>Fissurina deficiens</i>	JX421035	–	–	–	DNA5666	China	Kalb 38696
<i>Fissurina deficiens</i>	PZ538712	PZ538658	–	–	DNA8313	Hawaii	Lücking et al. 35823
<i>Fissurina dumastii</i>	DQ384926	–	–	–	–	Cameroon	Frisch 99Ka3855
<i>Fissurina dumastioides</i>	JX421043	–	–	–	DNA5723	Thailand	Lücking et al. 24020

Table 1. Continued.

Name of taxa	mtSSU	nuLSU	ITS	<i>rpb2</i>	Sample	Country	Voucher
<i>Fissurina fissa</i>	PZ538697	PZ538660	–	PZ568710	DNA8317	Hawaii	Lücking et al. 35992a
<i>Fissurina fissa</i>	PZ538713	PZ538661	–	PZ568711	DNA8318	Hawaii	Lücking et al. 35992b
<i>Fissurina fissa</i>	PZ538727	PZ538685	–	–	DNA8344	Hawaii	Lücking et al. 36267a
<i>Fissurina fuscispora</i>	PZ538695	–	–	PZ568706	DNA8314	Hawaii	Lücking et al. 36264
<i>Fissurina graphidioides</i>	PZ538698	PZ538662	–	–	DNA8319	Hawaii	Lücking et al. 35991
<i>Fissurina hyalinella</i>	PZ538714	PZ538663	–	–	DNA8320	Hawaii	Lücking et al. 35781a
<i>Fissurina hyalinella</i>	PZ538715	PZ538664	–	–	DNA8321	Hawaii	Lücking et al. 35781b
<i>Fissurina hyalinella</i>	PZ538716	PZ538665	–	–	DNA8322	Hawaii	Lücking et al. 35781c
<i>Fissurina hyalinella</i>	PZ538722	PZ538675	–	PZ568708	DNA8333	Hawaii	Lücking et al. 35652
<i>Fissurina illiterata</i>	JX421045	–	–	–	DNA5720	USA	Common 9115B
<i>Fissurina implicatoides</i>	PZ538699	PZ538666	–	PZ568709	DNA8324	Hawaii	Lücking et al. 35645
<i>Fissurina inabensis</i>	OR264104	OR264066	OR264088	–	FJ211545	China	[unknown]
<i>Fissurina inabensis</i>	OR264105	OR264071	OR264087	–	GZ18113	China	[unknown]
<i>Fissurina inabensis</i>	OR264109	OR264067	OR264086	–	YN221499	China	[unknown]
<i>Fissurina inabensis</i>	–	–	PV130918	–	ED904	Russia	Ezhkin 1286
<i>Fissurina inabensis</i>	JX421046	–	–	–	DNA4761	Thailand	Kalb 38778
<i>Fissurina indica</i>	–	OP881397	–	–	SBRSP02	India	Pradhan s.n.
<i>Fissurina insidiosa</i>	OR264111	–	OR264080	–	HN19093	China	[unknown]
<i>Fissurina insidiosa</i>	BK072976	–	–	–	[unknown]	USA	[unknown]
<i>Fissurina insidiosa</i>	DQ972995	DQ973045	–	DQ973083	AFTOL-ID-1662	USA	Lendemer 4793
<i>Fissurina insidiosa</i>	KR017325	KR017185	KR017123	KR017505	P131	USA	Spribille 39035
<i>Fissurina inspersa</i>	JX421047	–	–	–	DNA5719	USA	Common 9113G
<i>Fissurina irregularis</i>	JX421044	–	–	–	DNA5665	Brazil	Lücking et al. 31241
<i>Fissurina isidiifera</i>	DQ431954	DQ431923	–	–	–	Mexico	Lücking et al. RLD051
<i>Fissurina isidiifera</i>	JX421039	–	–	JX420843	DNA1998a	Mexico	Lücking et al. RLD057a
<i>Fissurina isidiifera</i>	JX421040	JX421491	–	–	DNA1998b	Mexico	Lücking et al. RLD057b
<i>Fissurina kokeensis</i>	PZ538700	PZ538667	–	–	DNA8325	Hawaii	Lücking et al. 36269
<i>Fissurina marginata</i>	AY648902	AY640012	–	–	–	Australia	Kalb 33944a
<i>Fissurina marginata</i>	DQ431951	–	–	–	–	Australia	Kalb 33944b
<i>Fissurina marginata</i>	HQ639613	HQ639629	–	–	DNA3418a	Thailand	Lücking et al. 24122
<i>Fissurina marginata</i>	–	JX421493	–	–	DNA3418b	Thailand	Lücking et al. 24122
<i>Fissurina mauiensis</i>	PZ538708	PZ538654	–	–	DNA8308a	Hawaii	Lücking et al. 35820a
<i>Fissurina mauiensis</i>	PZ538693	PZ538655	–	–	DNA8309	Hawaii	Lücking et al. 35825
<i>Fissurina mauiensis</i>	PZ538730	–	–	PZ568707	DNA8349	Hawaii	Lücking et al. 35828b
<i>Fissurina monilifera</i>	KF875560	KF875539	–	KF875522	CHAR69	Puerto Rico	Mercado 156
<i>Fissurina monilifera</i>	KJ435167	KJ440941	–	–	DNA6480	Puerto Rico	Mercado 838
<i>Fissurina montiformis</i>	PZ538701	PZ538668	–	PZ568704	DNA8326	Hawaii	Lücking et al. 36273
<i>Fissurina montiformis</i>	PZ538717	PZ538669	–	PZ568703	DNA8327	Hawaii	Lücking et al. 36266a
<i>Fissurina montiformis</i>	PZ538719	PZ538672	–	–	DNA8330	Hawaii	Lücking et al. 36266d
<i>Fissurina montiformis</i>	PZ538724	PZ538678	–	–	DNA8336	Hawaii	Lücking et al. 35818
<i>Fissurina montiformis</i>	PZ538728	PZ538687	–	–	DNA8346	Hawaii	Lücking et al. 36267c
<i>Fissurina nigroannulata</i>	PZ538691	PZ538652	–	–	DNA8306	Hawaii	Lücking et al. 35814a
<i>Fissurina nigroannulata</i>	PZ538692	PZ538653	–	–	DNA8307	Hawaii	Lücking et al. 35814b
<i>Fissurina nigroannulata</i>	PZ538718	PZ538671	–	–	DNA8329	Hawaii	Lücking et al. 36266c
<i>Fissurina nigrolabiata</i>	JF828961	JF828976	–	JF828943	DNA2852	Philippines	Rivas Plata 1198B
<i>Fissurina nigrolabiata</i>	–	JX421494	–	–	DNA2853	Philippines	Rivas Plata 1016E
<i>Fissurina nitidescens</i>	JX421048	–	–	–	DNA5718	USA	Common 9113C
<i>Fissurina papillosa</i>	–	PZ538681	–	–	DNA8340	Hawaii	Lücking et al. 35643
<i>Fissurina papillosa</i>	–	PZ538682	–	–	DNA8341	Hawaii	Lücking et al. 35644
<i>Fissurina papillosa</i>	–	PZ538684	–	–	DNA8343	Hawaii	Lücking et al. 35824
<i>Fissurina pseudostromatica</i>	JX421049	–	–	–	DNA5716	Bolivia	Lücking et al. 29014
<i>Fissurina pseudostromatica</i>	OR264100	OR264075	OR264091	–	YN210691	China	[unknown]
<i>Fissurina pseudostromatica</i>	OR264098	OR264074	OR264089	–	YN222451	China	[unknown]
<i>Fissurina pseudostromatica</i>	OR264099	OR264072	OR264090	–	YN222474	China	[unknown]
<i>Fissurina pseudostromatica</i>	–	JX421495	–	JX420929	DNA4765	Thailand	Kalb 38827
<i>Fissurina pseudostromatica</i>	JX421050	–	–	–	DNA5717	USA	Common 9113A
<i>Fissurina pseudostromatica</i>	JX421051	–	–	–	DNA5721	USA	Common 9126B

Table 1. Continued.

Name of taxa	mtSSU	nuLSU	ITS	<i>rpb2</i>	Sample	Country	Voucher
<i>Fissurina redingeria</i>	–	JX421496	–	–	DNA4165	Venezuela	Lücking et al. 32210
<i>Fissurina rufula</i>	JX421052	–	–	–	DNA5078	Fiji	Lumbsch 20500l
<i>Fissurina rufula</i>	JX421053	JX421497	–	–	DNA5079	Fiji	Lumbsch 20521l
<i>Fissurina sandwicensis</i>	–	PZ538686	–	–	DNA8345	Hawaii	Lücking et al. 36267b
<i>Fissurina serpentina</i>	PZ538710	PZ538656	–	–	DNA8310	Hawaii	Lücking et al. 35647
<i>Fissurina serpentina</i>	PZ538696	PZ538659	–	PZ568712	DNA8316	Hawaii	Lücking et al. 36265
<i>Fissurina soralifera</i>	JX421056	–	–	–	DNA3712	Thailand	Lücking et al. 24022
<i>Fissurina</i> sp. 1	ON507261	–	–	–	P14158	South Africa	Medeiros 2126
<i>Fissurina</i> sp. 2	ON507268	ON507245	–	ON492043	P14177	South Africa	Medeiros 2133
<i>Fissurina</i> sp. 3	ON507269	ON507256	–	ON492044	P14178	South Africa	Medeiros 2148
<i>Fissurina</i> sp.	JX421054	–	–	–	DNA1319	Australia	Lumbsch 19174f
<i>Fissurina</i> sp.	–	AY605071	–	–	–	Costa Rica	Lücking et al. 15070a
<i>Fissurina</i> sp.	–	JX421498	–	–	DNA5075	Fiji	Lumbsch 20522c
<i>Fissurina</i> sp.	–	JX421499	–	–	DNA5086	Fiji	Lumbsch 20501x
<i>Fissurina</i> sp.	KJ766393	KJ766560	–	–	AFTOL-ID-2101	Gabon	Ertz 9427
<i>Fissurina</i> sp.	JX421055	–	–	–	DNA2469a	India	Lumbsch 19730f
<i>Fissurina</i> sp.	JX421057	–	–	–	DNA2633	Philippines	Rivas Plata 1077
<i>Fissurina</i> sp.	JX421058	–	–	–	DNA2653	Philippines	Rivas Plata 1000N
<i>Fissurina</i> sp.	–	JX421500	–	–	DNA3137	Philippines	Rivas Plata 2114
<i>Fissurina</i> sp. eDNA	–	MF338401	–	–	OTU-0-209-5	Taiwan	G-jav1-LSU2
<i>Fissurina stromatoides</i>	PZ538720	PZ538673	–	–	DNA8331	Hawaii	Lücking et al. 35646
<i>Fissurina stromatoides</i>	PZ538721	PZ538674	–	–	DNA8332	Hawaii	Lücking et al. 35648
<i>Fissurina subcoarctata</i>	PZ538705	PZ538648	–	–	DNA8302	Hawaii	Lücking et al. 36490a
<i>Fissurina subcoarctata</i>	PZ538694	PZ538657	–	–	DNA8311	Hawaii	Lücking et al. 35651
<i>Fissurina subcoarctata</i>	–	PZ538683	–	–	DNA8342	Hawaii	Lücking et al. 35650
<i>Fissurina subcomparimuralis</i>	OR264112	OR264079	–	–	GD19219	China	[unknown]
<i>Fissurina subcomparimuralis</i>	OR264113	OR264078	–	–	GD19359	China	[unknown]
<i>Fissurina subcrassilabra</i>	PZ538690	PZ538651	–	–	DNA8305	Hawaii	Lücking et al. 35642
<i>Fissurina subfurfuracea</i>	KJ608635	KJ608632	–	–	DNA7038	Brazil	Cáceres 11030
<i>Fissurina subnitens</i>	JX421059	–	–	–	DNA5088	Fiji	Lumbsch 20501l
<i>Fissurina subtimidula</i>	PZ538703	PZ538688	–	PZ568702	DNA8347	Hawaii	Lücking et al. 35812
<i>Fissurina subtimidula</i>	PZ538729	–	–	–	DNA8348	Hawaii	Lücking et al. 35828a
<i>Fissurina subundulata</i>	OR264110	–	OR264082	–	FJ220370	China	[unknown]
<i>Fissurina subundulata</i>	OR264106	OR264069	OR264083	–	GZ18148	China	[unknown]
<i>Fissurina triticea</i>	DQ431952	AY640011	–	–	–	Tanzania	Frisch 99Tz1855
<i>Fissurina undulata</i>	–	–	OP901516	–	Shik-17	Russia	Konoreva LE-L-18645
<i>Fissurina wuyinensis</i>	OR264102	OR264077	OR264096	–	FJ230464	China	[unknown]
<i>Fissurina wuyinensis</i>	OR264101	OR264076	OR264095	–	FJ230605	China	[unknown]
<i>Fissurina wuyinensis</i>	OR264103	OR264073	OR264097	–	FJ230610	China	[unknown]
<i>Fissurina zahlbruckneriana</i>	PZ538723	PZ538677	–	–	DNA8335	Hawaii	Lücking et al. 35815
<i>Fissurina zahlbruckneriana</i>	PZ538725	PZ538679	–	–	DNA8337	Hawaii	Lücking et al. 35822
<i>Pycnotrema pycnoporellum</i>	HQ639584	HQ639658	–	KC020277	DNA3159-MY-RPYC	USA	Lücking et al. 26545
<i>Pycnotrema pycnoporellum</i>	JX421295	JX421615	–	KF875513	DNA3171-CHAR177	USA	Lücking et al. 26546

Integrating molecular with morphological, anatomical, and chemical data, we assigned the Hawaiian terminals to a total of 23 species, 17 of which appear to be undescribed and are formally introduced below. An additional new species was detected in herbarium material in PTBG, for a total of 24 taxa treated here and 26 overall reported for Hawai'i.

Taxonomy

As mentioned in the introduction, eight species of *Fissurina* were previously recorded for Hawai'i (Magnusson 1955; Elix & McCarthy 1998; Luch & Lücking 2018). Comparison with the sequenced material revealed that two

of these names, *F. stromatoides* and *F. zahlbruckneriana*, could be applied to clades identified in our molecular phylogenetic analysis. Three further names are likely misidentifications of additional clades representing previously unrecognized species, as their descriptions or specimens match the corresponding sequenced specimens. The material of the previously listed *F. homichlodes* is not that species, but represents the newly described *F. subcoarctata*, which is somewhat reminiscent of a species of *Platythecium* Staiger; notably, Magnusson (1955) already reported that the historical material had alternatively been identified as *Platythecium grammitis* (Fée) Staiger. Likewise, the material of the previously reported *F. radiata* represents the newly described *F. serpentina*. Although

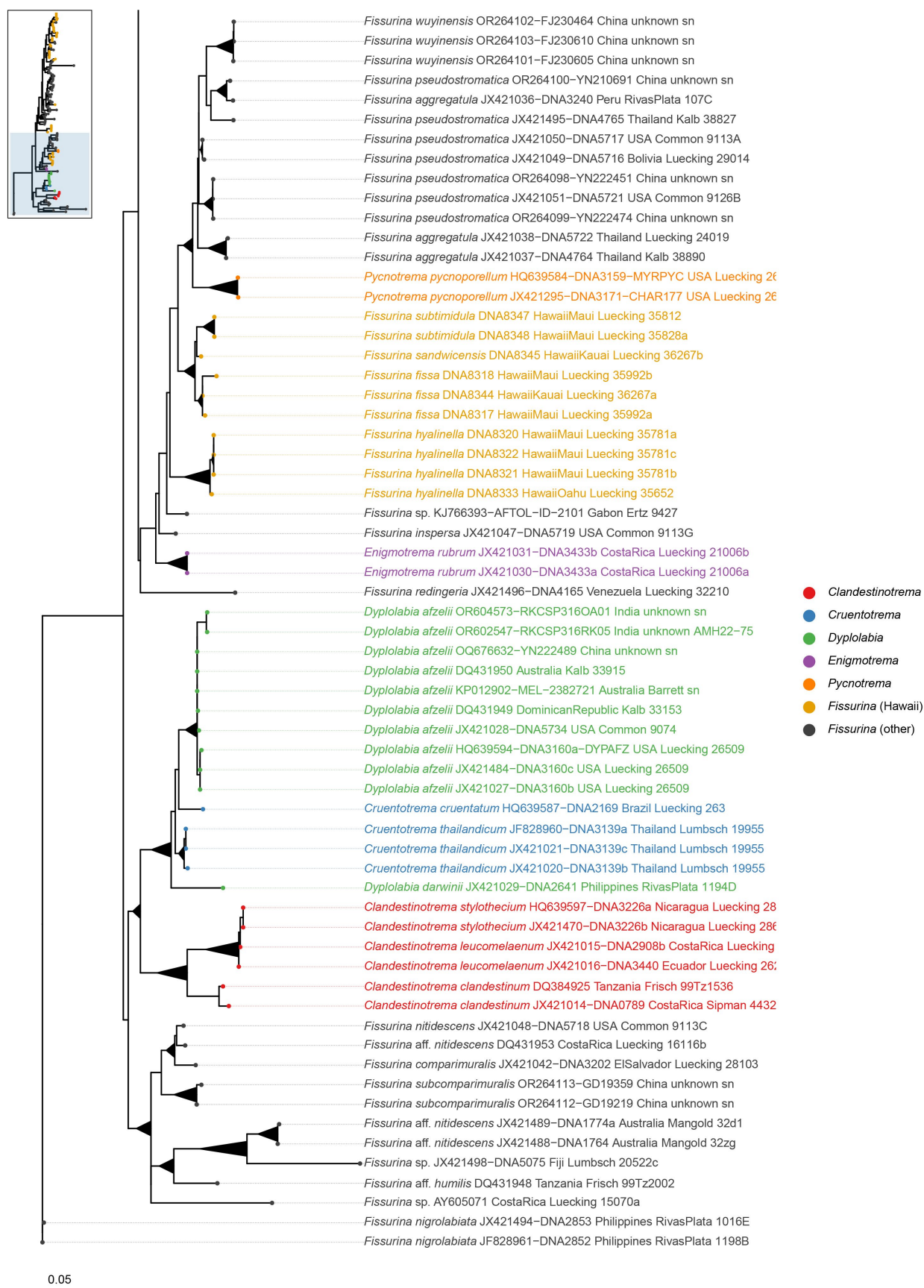


Figure 1. Best-scoring maximum likelihood tree of *Fissurinaceae*/*Fissurinoideae* based on four concatenated markers (mtSSU, nuLSU, ITS, *rpb2*). Supported branches are marked by black triangles (continued on next page).

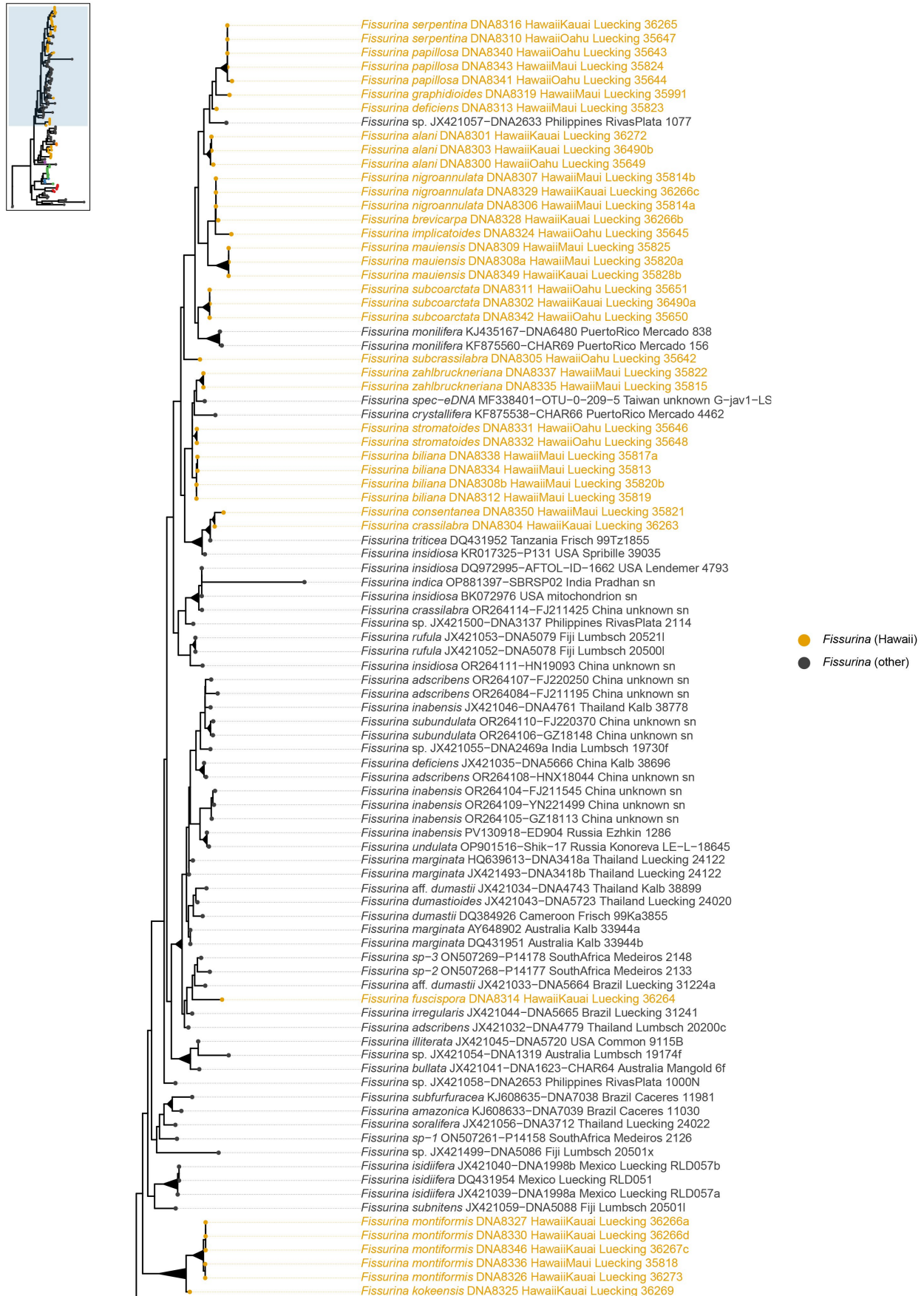


Figure 1. Continued.

we have not been able to revise the earlier reported material identified as *F. tachygrapha*, it is likely that it represents the newly described *F. fissa*. Hawaiian material previously identified as *F. triticea* appears to represent *F. consentanea*. The two remaining taxa, *F. columbina* and *F. globulifica*, could not be checked; given that both produce psoromic acid and none of the material studied by us displayed this chemistry. For the time being, we continue to include them in the list of Hawaiian *Fissurina*. Two of the sequenced taxa were identified with more widely distributed species not previously reported from Hawai‘i, namely *F. hyalinella* and *F. crassilabra*.

As a result, the number of species of *Fissurina* reported for Hawai‘i has more than tripled, from previously eight to 26, but only four of the previously listed taxa can be maintained, two of them, *F. stromatoides* and *F. zahlbruckneriana*, already representing putative endemics.

Distribution and ecology

Based on our study, we recognize 27 species of *Fissurina* in Hawai‘i. Of these, 21 have not yet been found elsewhere, resulting in a putative endemism of 78%. The remaining six taxa are distributed as follows: two species are presumably pantropical, viz. *F. columbina* and *F. hyalinella*, whereas four species are eastern Paleotropical, namely *F. consentanea*, *F. crassilabra*, *F. deficiens* and *F. globulifica*.

A remarkably high number of 16 species of Hawaiian *Fissurina* (57%) have endoperidermal, whitish thalli. Prior to this study, this feature was only known from a dozen species out of more than one hundred, including *F. albonitens* (Müll. Arg.) A.W. Archer, *F. alligatorensis* Lendemer & R.C. Harris, *F. cinereodisca* Altamirano, Colín & N. Sánchez, *F. duplicans* M. Cáceres, Aptroot & Lücking, *F. hyalinella*, *F. ilicicola* Lendemer & R.C. Harris, *F. illiterata* (R.C. Harris) Lendemer, *F. lactea* Fée, *F. lactinella* (Nyl.) Nyl., *F. tachygrapha*, and *F. tenuimarginata* Herrera-Camp., A.B. Peña & Lücking.

Discussion

The high diversity of *Fissurina* in the Hawaiian archipelago, with a four times higher number of species than previously recorded and the high potential endemism of 78% are remarkable, but in line with previous results of molecular phylogenetic revisions of Hawaiian lichens in lobioid *Peltigerales*. A study on *Pseudocyphellaria* (Moncada et al. 2014), previously thought to contain only widespread species in Hawai‘i, almost doubled the number of known species and suggested a putative endemism of 75%. In *Lobariella*, the number of species was quadrupled, with an inferred endemism of likewise 75% (Lücking et al. 2017b). The number of species in the genus *Sticta* was increased by almost 50% and endemism revised to 69%. Our findings for *Fissurina* thus add to a growing body of evidence that putative endemism in Hawaiian lichenized fungi is comparable to that of plants, with about 80% (Wagner et al. 1999; Wagner & Herbst 2002; Evenhuis & Eldredge 2002a, b). Preliminary data

for *Coccocarpia* (*Coccocarpiaceae*) draw a similar picture (Coca et al. 2025), suggesting that this pattern may be widespread among Hawaiian lichens.

The aforementioned *Coccocarpia* study (Coca et al. 2025) currently provides the strongest evidence of a predominantly eastern paleotropical context of the Hawaiian lichen biota. In *Fissurina*, the six widespread taxa are either eastern paleotropical (4) or widespread (2), although no molecular data are yet available to test these presumed ranges. In our phylogenetic reconstruction, there is no supported relationship of any Hawaiian taxon with a non-Hawaiian taxon or terminal, with the exception of two specimens identified as *F. consentanea* and *F. crassilabra*, which cluster with Tanzanian material named *F. triticea* (but likely represents *F. consentanea*). In the cases of *Pseudocyphellaria* and *Sticta*, both paleotropical and neotropical relationships could be reconstructed, whereas *Lobariella* is a strictly neotropical genus. This draws a rather complex picture of evolutionary relationships of the Hawaiian lichen biota, with strong affinities to the eastern Paleotropics, but influence from the Neotropics as well. Contrary to the situation in Madagascar and the Mascarenes, where a strong radiation was detected for the genus *Sticta* (Simon et al. 2018), the hitherto available data for Hawai‘i suggest a pattern of multiple independent colonizations, which in some cases resulted in “mini-radiations”, such as in *Lobariella* or in *Fissurina*.

The strikingly high proportion of species of *Fissurina* with endoperidermal thalli may be related to the high proportion of trees and treelets with soft bark in the Hawaiian flora. The identified phorophytes include mostly endemic species of *Cheirodendron* (*Araliaceae*), *Clermontia* (*Campanulaceae*), *Metrosideros polymorpha* (*Myrtaceae*), *Myrsine* (*Primulaceae*), and *Planchonella* (formerly *Pouteria*) *sandwicensis* (*Sapotaceae*). Given that many of the species were found in wet montane forest with strong influence of wind, leading to potentially higher levels of evapotranspiration, the development of the thallus within the outer periderm layers (cork) of the bark may be a useful adaptation to reduce water stress.

Key to the species of *Fissurina* in the Hawaiian Islands

- 1 Ascospores (sub-)muriform 2
 Ascospores transversely 3(–5)-septate; thallus variable 6
- 2(1) Ascospores becoming brown; labia distinctly carbonized ***F. fuscella***
 Ascospores hyaline; labia not or indistinctly carbonized 3
- 3(2) Thallus olive-green to yellow-brown, epidermal; psoromic acid present 4
 Thallus white, endoperidermal; no substances 5
- 4(3) Ascospores subglobose, 8–14 × 7–9 µm; lirellae erumpent to prominent (to sometimes sessile), with white labia ***F. globulifica***
 Ascospores broadly ellipsoid, 20–35 × 10–20 µm, lirellae erumpent, with thin, gently sloping labia (roof-like) ... ***F. columbina***

- 5(3) Lirellae thalloloid, with gaping, dark grey disc and lacking labia; ascospores $25\text{--}35 \times 18\text{--}25 \mu\text{m}$ *F. sandwicensis*
Lirellae hemithecioid, with concealed disc and distinct labia, usually on elevated bark tissue; ascospores $20\text{--}25 \times 8\text{--}10 \mu\text{m}$ *F. montiformis*
Remarks: *Fissurina cypressi* would key out here, with two collections reported for Hawai'i (Kaua'i, Tucker 16611, 16613); however, the taxonomy of this species is unclear: in the protologue and the type material in PH and G, the ascospores are given as small ($16\text{--}18 \times 10\text{--}12 \mu\text{m}$ in the drawings on the specimens), whereas in the key by Harris (1990) and the combination by Lendemer (2007), the ascospores are given as $85\text{--}105 \times 20\text{--}28 \mu\text{m}$, a size confirmed by rechecking the type material in PH (J. Lendemer, pers. comm. March 2026). We have not examined the material from Hawai'i, but if it contains large, muriform ascospores, it could also represent a species of *Diorygma* or *Thalloloma*.
- 6(1) Ascospores (3–)5-septate; thallus white, endoperidermal *F. zahlbruckneriana*
[= *G. triticea* f. *lactea* Zahlbr., non *F. lactea* Fée]
Ascospores persistently 3-septate 7
- 7(6) Ascospores becoming olive-brown; thallus mottled white-green, epidermal; lirellae fissurinoid, dense, much branched and seemingly anastomosing *F. fuscisporea*
Ascospores persistently hyaline; thallus and lirellae variable, but not as above. 8
- 8(7) Thallus olive-green to yellow-brown, epidermal; clusters of calcium oxalate crystals, if present, below photobiont layer or sometimes intermingled, but not above. 9
Thallus white or rarely light greenish white, endoperidermal or seemingly epidermal due to periderm dissolving, but then always with thick layer of calcium oxalate crystal clusters above photobiont layer. 17
- 9(8) Stictic acid present; thallus in section with K+ persistently yellow efflux. 10
No substances; thallus in section K-. 12
- 10(9) Thallus densely white-papillose. *F. papillosa*
Thallus lacking papillae 11
- 11(10) Lirellae orange to orange-brown, fissurinoid *F. alani*
Lirellae whitish, hemithecioid *F. consentanea* [= *F. triticea* auct.]
- 12(9) Lirellae with distinct labia, hemithecioid 13
Lirellae with thin labia, fissurinoid 15
- 13(12) Excipulum carbonized apically *F. graphidoides*
Excipulum not carbonized 14
- 14(13) Labia erect, gaping and partially exposing the disc *F. crassilabra*
Labia gently sloping, convergent and with the disc concealed *F. subcrassilabra*
- 15(12) Ascospores $20\text{--}25 \times 10\text{--}12 \mu\text{m}$; labia apically carbonized *F. deficiens*
Ascospores $12\text{--}18 \times 6\text{--}8 \mu\text{m}$; labia not carbonized ... 16
Remarks: *Fissurina subnitidula* has been reported based on several collections from Hawai'i (Tucker 16482, 16509, 16512, 16518); we have not checked these specimens; based on descriptions in the packets, they may represent one or more of the other taxa distinguished here. *Fissurina nitidula* itself is characterized by carbonized, fissurinoid (roof-like) labia and small, amyloid ascospores ($10\text{--}13 \times 5\text{--}7 \mu\text{m}$).
- 16(15) Lirellae very long, much bent and curved, with the disc concealed *F. serpentina*
[= *F. radiata* auct.]
Lirellae short, gaping with the disc partially exposed ... *F. subcoarctata* sp. nov. [= *F. homichlodes* auct.]
- 17(8) Ascospores usually longer than $20 \mu\text{m}$; lirellae gaping with the dark grey disc exposed and lacking labia (thalloloid). 18
Ascospores up to $20 \mu\text{m}$; lirellae hemithecioid or fissurinoid. 19
- 18(17) Ascospores $25\text{--}35 \times 10\text{--}12 \mu\text{m}$ *F. subtimidula*
Ascospores $18\text{--}25 \times 7\text{--}8 \mu\text{m}$ *F. fissa*
- 19(17) Ascospores $15\text{--}20 \mu\text{m}$ long 20
Ascospores $11\text{--}15 \mu\text{m}$ long 23
- 20(19) Lirellae with broad black rim along or near the slit ... *F. nigroannulata*
Lirellae whitish to pale yellowish or sometimes marginally darkened 21
- 21(20) Lirellae radiating; excipulum not carbonized *F. biliana*
Lirellae elongate; excipulum partly apically carbonized 22
- 22(21) Lirellae with an orange-brown slit and whitish margins *F. stromatoides*
Lirellae with a blackish slit and sometimes darkened margins *F. mauiensis*
Fissurina tachygrapha has also been reported from Hawai'i (e.g., check Selling 5946b, Skottsberg 1938), but that material is likely *F. mauiensis*
- 23(19) Lirellae immersed, lacking distinct labia *F. hyalinella*
Lirellae erumpent to prominent, with distinct labia ... 24
- 24(23) Labia erect, gaping, with the disc partially exposed ... *F. kokeensis*
Labia inclined, convergent, with the disc concealed. ... 25
- 25(24) Lirellae short, usually on elevated bark tissue; thallus white *F. brevicarpa*
Lirellae long, not on elevated bark tissue; thallus light greenish-white *F. implicatoides*

Taxonomic treatment

Fissurina alani Lücking, Kraichak & C.W. Sm., sp. nov. (Fig. 2)

Index Fungorum IF 905647

Diagnosis: Differing from *Fissurina chrysocarpoides* in the larger ascospores.

Type: USA, Hawaii: O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; $21^{\circ}19'55''\text{N}$, $157^{\circ}48'43''\text{E}$, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some

planted trees, corticolous; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35649 (BISH – holotype!; B, F, HAW, PTBG – isotypes!).

Etymology. The epithet, a noun in apposition, refers to the orange color of the lirellae, represented by the Hawaiian word ‘ālanī for orange.

Description. Thallus corticolous, epiperidermal, up to 10 cm diam., continuous; surface smooth to uneven, light olive-green suffused with orange, shiny; prothallus absent. Thallus in section 100–150 μm thick, with dense, prosoplectenchymatous cortex 30–60 μm thick, with upper, thick portion yellowish and lower portion

colorless, splitting between photobiont layer, photobiont layer in 2–3 layers between lower portions of splitting cortex, each layer 15–30 μm thick, medulla 40–60 μm thick, densely encrusted with small, grey crystals; clusters of calcium oxalate crystals indistinct or absent except bordering the ascomata. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish to orange green, 10–13 $\times$ 7–10 μm . Ascomata lirelliform, fissurinoid, more or less straight, mostly unbranched, erumpent, roof-like, with complete thalline margin, 1–2 mm long, 0.15–0.25 mm wide, 0.15–0.2 mm high; disc concealed, visible as dark slit; proper margin indistinct, forming thin labia covered by thalline layer

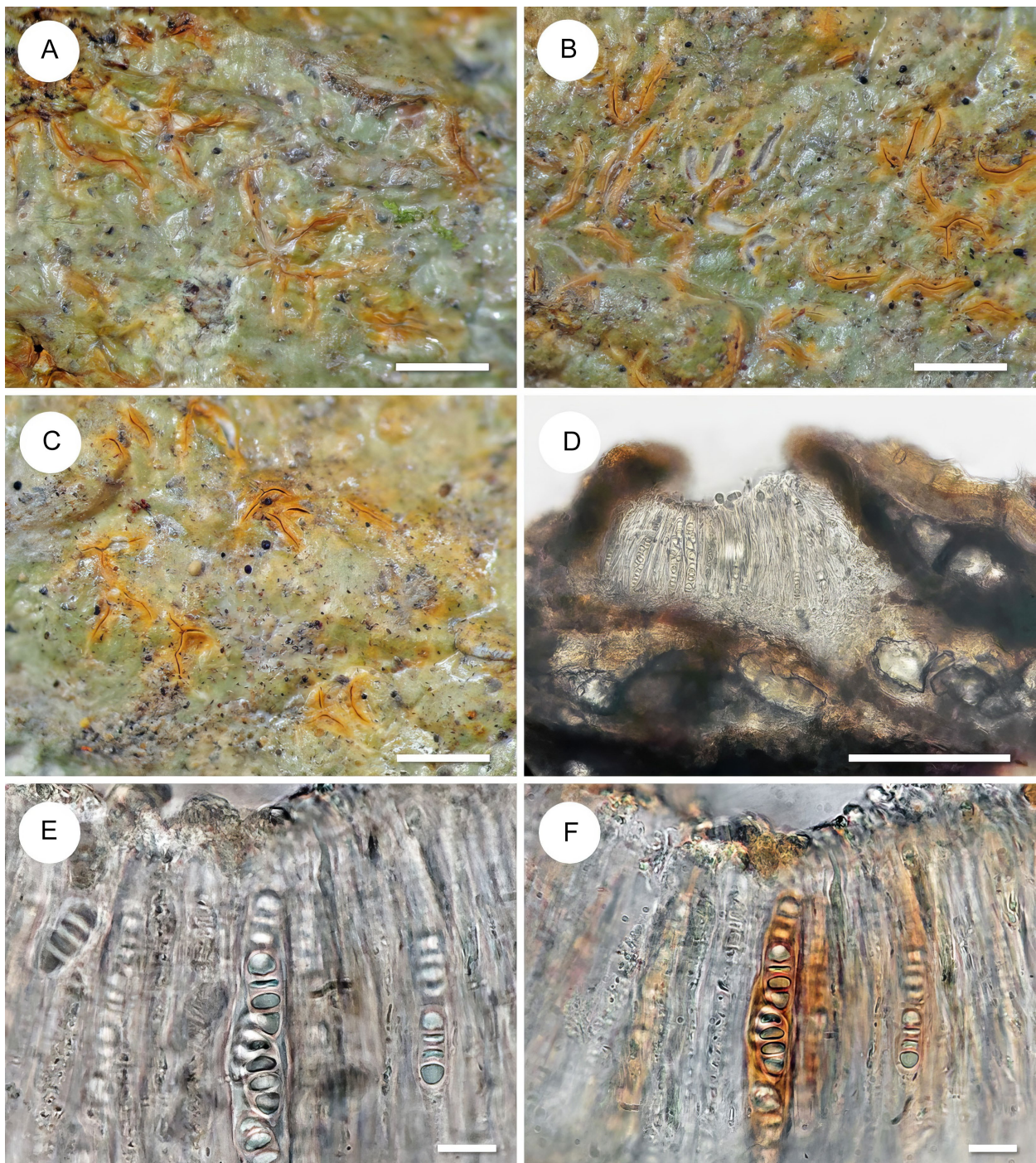


Figure 2. *Fissurina alani* (holotype except C: Lücking et al. 36272). A–C – thallus with lirellae; D – section through lirella; E, F – hymenium with asci and ascospores, in F after treatment with I. Scales: A–C = 1 mm; D = 100 μm ; E, F = 10 μm .

with vivid orange to brownish orange color. Excipulum entire, pale yellow, apically to upper half dark brown, 25–50 μm wide; laterally covered by corticate thalline layer with large clusters of calcium oxalate crystals; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 10–15 μm high, pale yellowish; hymenium 100–120 μm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 100–110 $\times$ 13–16 μm . Ascospores 8 per ascus, uniseriate, ellipsoid, 3-septate, 14–20 $\times$ 5–8 μm , 2–2.5 times as long as wide, hyaline, with slightly thickened outer wall and thickened septa and lens-shaped lumina, lacking distinct halo, I– to very faintly I+ amyloid.

Secondary chemistry. Stictic acid detected by TLC; thallus in section with K+ persistently yellow efflux.

Distribution and ecology. Potentially more widespread in Hawai'i, known from the islands of Kaua'i, O'ahu, and Maui, found on bark in diverse types of vegetation, including undisturbed and disturbed forest and secondary vegetation, in the submontane to montane belt.

Remarks. *Fissurina alani* has a typical *Fissurina* morphology, with fissurinoid lirellae formed on a corticate, green thallus. It resembles *F. dumastioides* (Fink) Staiger in morphology and chemistry (stictic acid), but apart from the orange lirellae, it differs in having smaller ascospores. A few other species of *Fissurina* feature lirellae with an orange pigment. In *F. aurantiacolirellata* Papong, Lücking & Kraichak, described from New Caledonia (Papong et al. 2014), the lirellae are prominent, with a gaping disc, the thallus is furnished with isidia, and the ascospores are 1-septate. *Fissurina aurantiacostellata* Mercado-Díaz, Lücking & Parmen from Puerto Rico (Mercado-Díaz et al. 2014) is similar to the new species in lirellae morphology, but the thallus is isidiate, the lirellae are radiately branched, and the ascospores are much smaller (8–12 $\times$ 3–4 μm). The eastern paleotropical taxon *F. chrysocarpoides* (Vain.) Lücking (Cáceres et al. 2014) (synonym: *F. taeniocarpoides* Makhija & Adaw.) is most similar to *F. alani* in overall morphology, the thallus lacking isidia, but the ascospores are also smaller (10–16 $\times$ 5–6 μm).

Additional specimens examined. USA. HAWAII: Kaua'i island, Kaua'i County, South Kaua'i, southern slopes of Mount Wai'ale'ale, Kahili Ridge Trail above Kahili Mountain Park, 10 km W of Lihue off Kaumuali'i Highway, steep ridge trail; 21°57'52"N, 159°29'29"E, 300–450 m; secondary vegetation formed by dense patches of *Gleicheniaceae* ferns mixed with small groups of introduced and native trees, corticolous; 16 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36490b (B, BISH, F, HAW, PTBG), R. Lücking, B. Moncada & T. Flynn 36491 (B, F). Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Lihue, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36272 (B, F, PTBG). Kaua'i, Waimea District, Kuai Natural Area Reserve, upper

Kuai Valley; 22.1333°N, 159.6667°E, 996 m; mixed mesic forest with *Acacia koa*, *Zanthoxylum*, *Santalum*, *Kadua*, *Psycotria* and *Psidium cattleianum*, epiphytic on trunk of *Santalum pyrularium*; 18 Dec. 2014, T. Flynn 8012 (BG, BISH, PTBG). O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35746b (B, F, HAW). O'ahu, Ko'olau, Mānoa Valley, Mānoa Falls Trail; 249 m; closed woodland of introduced species; 18 Sept. 1981; C.W. Smith 7532, P.W. James & T. Nash (HAW). O'ahu, Pauoa Flats Trail above Pu'u 'Ōhi'a (Tantalus); 21.3390°N, 157.8118°E, 524 m; from *Cinnamomum burmannii* bark in wet, shady understory, habitat highly degraded, composed of *C. burmannii*, *Ardisia elliptica*, *Eucalyptus* sp; 27 Feb. 2026, K. Faccenda 4364 (BISH). Maui, Honokohau Drainage Basin; on *Aleurites moluccana*; 17 Oct. 1917, C.N. Forbes 580-M (BISH).

Fissurina biliana Lücking, Kraichak & Lumbsch, sp. nov. (Fig. 3A–D)

Index Fungorum IF 905648

Diagnosis: Differing from *Fissurina hyalinella* in the longer ascospores.

Type: USA, Hawaii: Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedy-chium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35813 (BISH – holotype!; B, F – isotypes!).

Etymology. The epithet honors Patrick (Pat) Bily, the “weed warrior”, from The Nature Conservancy, Hawai'i, for his tireless efforts to conserve Hawaiian natural forest environments, especially on the island of Maui.

Description. Thallus corticolous, endoperidermal, up to 10 cm diam., continuous; surface uneven, white, shiny; prothallus absent. Photobiont layer immersed in the periderm (up to 100 μm deep), 30–50 μm thick, covered by 2–3 layers of dead periderm cells filled with large clusters of calcium oxalate crystals; a prosoplectenchymatous cortex present, 10–15 μm thick. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, bright green to yellowish green, 8–12 $\times$ 6–10 μm . Ascomata lirelliform, fissurinoid, flexuose, irregularly to sometimes radiately branched, immersed, with complete thalline margin, 1–3(–5) mm long, 0.2–0.3 mm wide, 0.15–0.2 mm high; disc slightly gaping, flesh-colored, slit 0.1–0.15 mm wide; proper margin indistinct, labia absent, but thallus bordering disc usually with a thin, light brownish-yellow line. Excipulum entire, colorless to pale yellow, appearing brown in upper half in microscopic sections, 20–30 μm wide; laterally covered by thick thalline layer embedded in periderm, including photobiont cells, layer of crystal clusters, and cortex; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous

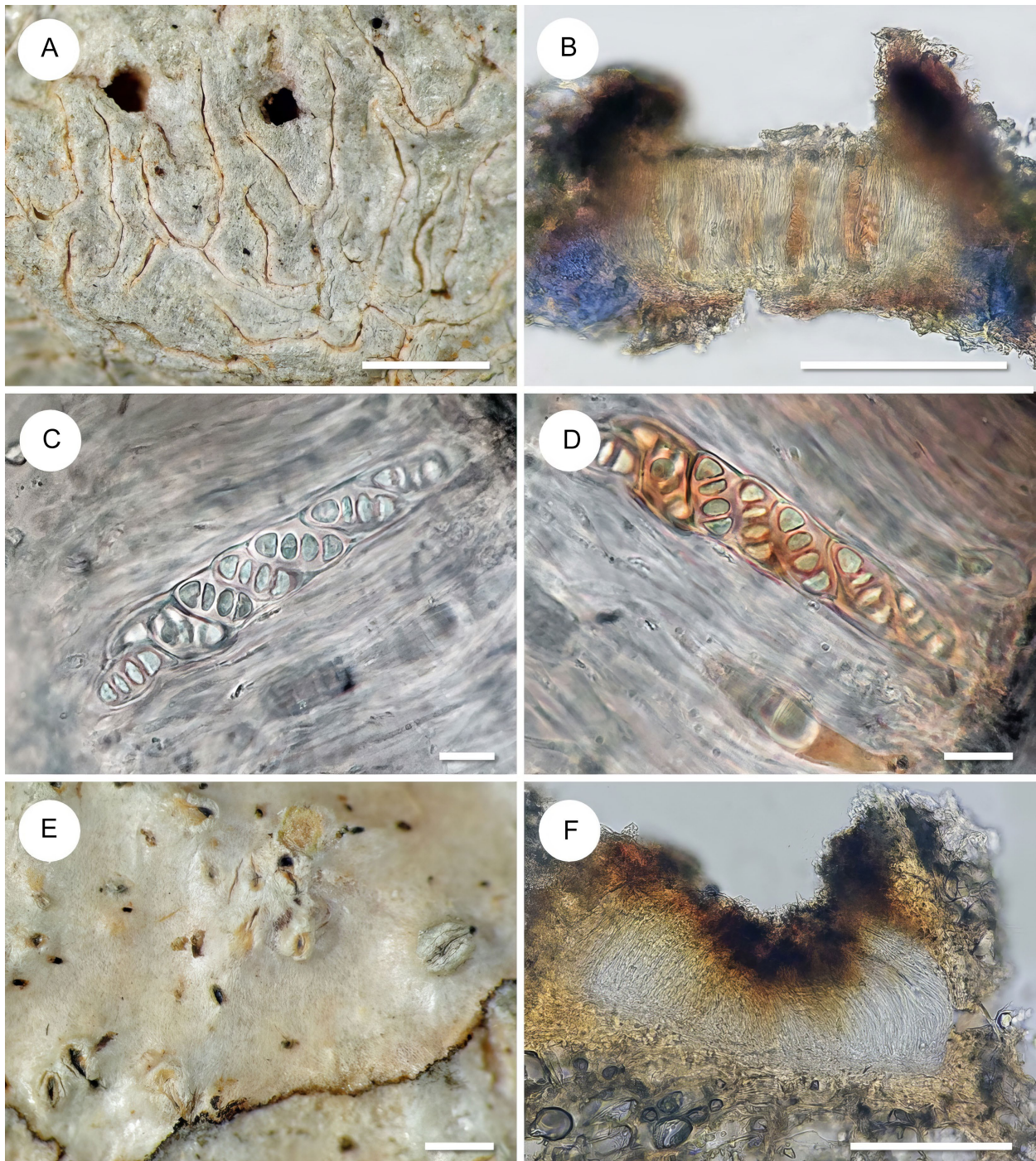


Figure 3. A–D – *Fissurina biliana* (holotype). A – thallus with lirellae; B – section through lirella; C, D – hymenium with asci and ascospores, in D after treatment with I; E, F, – *F. brevicarpa* (holotype), thallus with lirellae. Scales: A, E = 1 mm; B, F = 100 μ m; C, D = 10 μ m.

tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 5–10 μ m high, colorless; hymenium 100–110 μ m high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 100–105 $\times$ 12–15 μ m. Ascospores 8 per ascus, uniseriate, ellipsoid, 3-septate, 14–18 $\times$ 6–7 μ m, 2.3–2.8 times as long as wide, hyaline, with slightly thickened wall (1 μ m) and septa and lens-shaped lumina, and distinct halo, I– to rarely very weakly I+ violet.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from the Ko‘olau Mountains on O‘ahu and the Lower Waikamoi Preserve

on Maui, growing on bark of diverse trees in a gradient from introduced woodlands to disturbed primary forest.

Remarks. *Fissurina biliana* is characterized by an endoperidermal, whitish thallus, 3-septate, usually non-amyloid ascospores, and lack of secondary compounds. It differs from the superficially similar, pantropical *F. hyalinella* (also present in Hawai‘i) in the longer ascospores (10–15 $\times$ 6–7 μ m in *F. hyalinella*) and from *Fissurina illiterata* in the partly epiperidermal thallus and more distinctly developed labia, often with a split towards the thallus, in the latter (Harris 1990; Lendemer & Knudsen 2008).

Additional specimens examined. USA. HAWAII: O'ahu, Ko'olau Mountains, Waimānalo Forest Reserve, Ohana Trail close to Honolulu Base Yard; 21.372°N, 157.745°E, 79 m; closed woodland of introduced species, on *Aleurites moluccana*; 21 Aug. 2025, Smith s.n. (HAW). O'ahu, Ko'olau Mountains, Waimānalo Forest Reserve, Head of Rock Garden Trail; 21.3448°N, 157.7417°E, 55 m; closed woodland of introduced species, on *Heptapleurum actinophyllum*; 22 Jun. 2020, Smith 2020-0622 (HAW). Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35817 (B, BISH, F), R. Lücking, B. Moncada & P. Bily 35819 (B, F), R. Lücking, B. Moncada & P. Bily 35825 (B, F).

Fissurina brevicarpa Lücking, B. Moncada & T. Flynn, sp. nov. (Fig. 3E, F)

Index Fungorum IF 905649

Diagnosis: Differing from *Fissurina hyalinella* in the short, broad, somewhat gall-forming lirellae.

Type: USA, Hawaii: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Līhu'e, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous on *Clermontia* sp.; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36266b (BISH – holotype!; F – isotype!).

Etymology. The epithet refers to the comparatively short and broad lirellae.

Description. Thallus corticolous, endoperidermal, up to 3 cm diam., continuous; surface smooth to uneven, following the contours of the bark, white, slightly shiny; prothallus absent. Photobiont layer immersed in the periderm (up to 100 µm deep), 30–50 µm thick, covered by 1–2 layers of dead periderm cells filled with clusters of calcium oxalate crystals and small, grey crystals, ecorticate. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish green, 8–11 × 6–9 µm. Ascomata rounded to elongate, hemithecioid, straight, unbranched, causing the bark to swell and hence appearing prominent, but the actual lirellae remaining thin, with complete thalline margin, 0.5–1 mm long, 0.5–0.8 mm wide, 0.2–0.4 mm high including the swollen bark; disc slightly gaping, dark grey; proper margin thin, forming white labia leveled with the surrounding thallus. Excipulum entire, yellow, apically dark grey to carbonized, 20–30 µm wide; laterally covered by dense layer of crystals up to 100 µm thick; hypothecium prosoplectenchymatous, 10–15 µm high, yellow; hymenium 70–80 µm high, colorless, clear; epithecium indistinct to granular, grey. Paraphyses unbranched, apically smooth; periphysoids short, along the uppermost, dark grey portion of the inner excipulum, 5–10 µm long, smooth to shallowly warty, but not spinulose; asci fusiform, 70–80 × 8–10 µm. Ascospores 8 per ascus, more or less uniseriate, ellipsoid, 3-septate, 12–15 × 6–7 µm, 1.8–2.3 times

as long as wide, hyaline, with slightly thickened outer wall and thickened septa and lens-shaped lumina, lacking distinct halo, I– or + very weakly violet.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from the islands of Kaua'i, O'ahu, and Hawai'i, growing corticolous in diverse forests and woodlands, from almost sea level to nearly 2,000 m.

Remarks. Given its endoperidermal thallus and its rather small, 3-septate ascospores, *Fissurina brevicarpa* would key out close to *F. hyalinella*, from which it differs clearly in the dispersed, short and broad, emergent (somewhat gall-forming) lirellae. Somewhat similar in appearance is *F. montiformis*, described below, which is also gall-forming, but can be distinguished by the much larger ascospores. *Fissurina subtimidula*, another taxon with short lirellae, deviates by the gaping, grey disc and the much larger, amyloid ascospores.

Additional specimens examined. USA. HAWAII: Kaua'i, Waimea Drainage Basin, West side; 3–18 Jul. 1918. C.N. Forbes 1410K (BISH). O'ahu, Ko'olau Mountains, Nu'uānu Valley, Old Pali Highway, close to Board of Water Supply Station; 21.3496°N, 157.8187°E, 249 m; on *Panax guilfoyliae*; 8 Aug. 2020, C.W. Smith 082020-5 (HAW). O'ahu, Ko'olau Mountains, Waimānalo Forest Reserve, close to Honolulu City Baseyard; 21.372°N, 157.745°E, 79 m; closed woodland of introduced species, on *Heptapleurum actinophyllum*; 21 Aug. 2025, C.W. Smith s.n. (HAW). Maui, Hana District, Kipahulu Forest Reserve, Healani Stream; 1995 m; native forest of *Dryopteris*, *Sadleria*, *Cheirodendron*, *Metrosideros* and *Vaccinium*; 11 Jun. 1976, P.K. Higashino & G. Mizuno s.n. (HAW). Hawai'i, Hawai'i Volcanoes National Park, Research Centre; 29.4202°N, 155.2472°E, 1,159 m; open lawned area between buildings, on *Metrosideros polymorpha*; 16 Sept. 2019, C.W. Smith s.n. (HAW).

Fissurina consentanea Nyl., Lich. Nov. Zeland. (Paris): 126. 1888. (Fig. 4A, B)

Remarks. *Fissurina consentanea* is morphologically and chemically close to *F. triticea* (Nyl.) Staiger, in featuring lirellae with distinct, prominent labia, 3-septate ascospores about 15–25 × 8–12 µm in size, and a stictic acid chemistry. It was considered a synonym of *F. triticea*, but was recently segregated due to morphological differences, correlated with distribution: neotropical material, corresponding to *F. triticea* s.str., usually has exposed, yellowish to whitish labia and a sometimes gaping disc, whereas paleotropical material, for which the name *F. consentanea* was taken up, differs in the labia covered by (sometimes uneven to verrucose) thallus and the concealed disc (van den Boom et al. 2023). The Hawaiian material corresponds to *F. consentanea*; however, this complex requires further study. In the phylogenetic analysis, a specimen identified as *F. triticea* from Africa, possibly representing *F. consentanea*, clusters with the Hawaiian material, but another Hawaiian sample identified as *F. crassilabra* (see below), lacking secondary compounds, also falls in this clade.

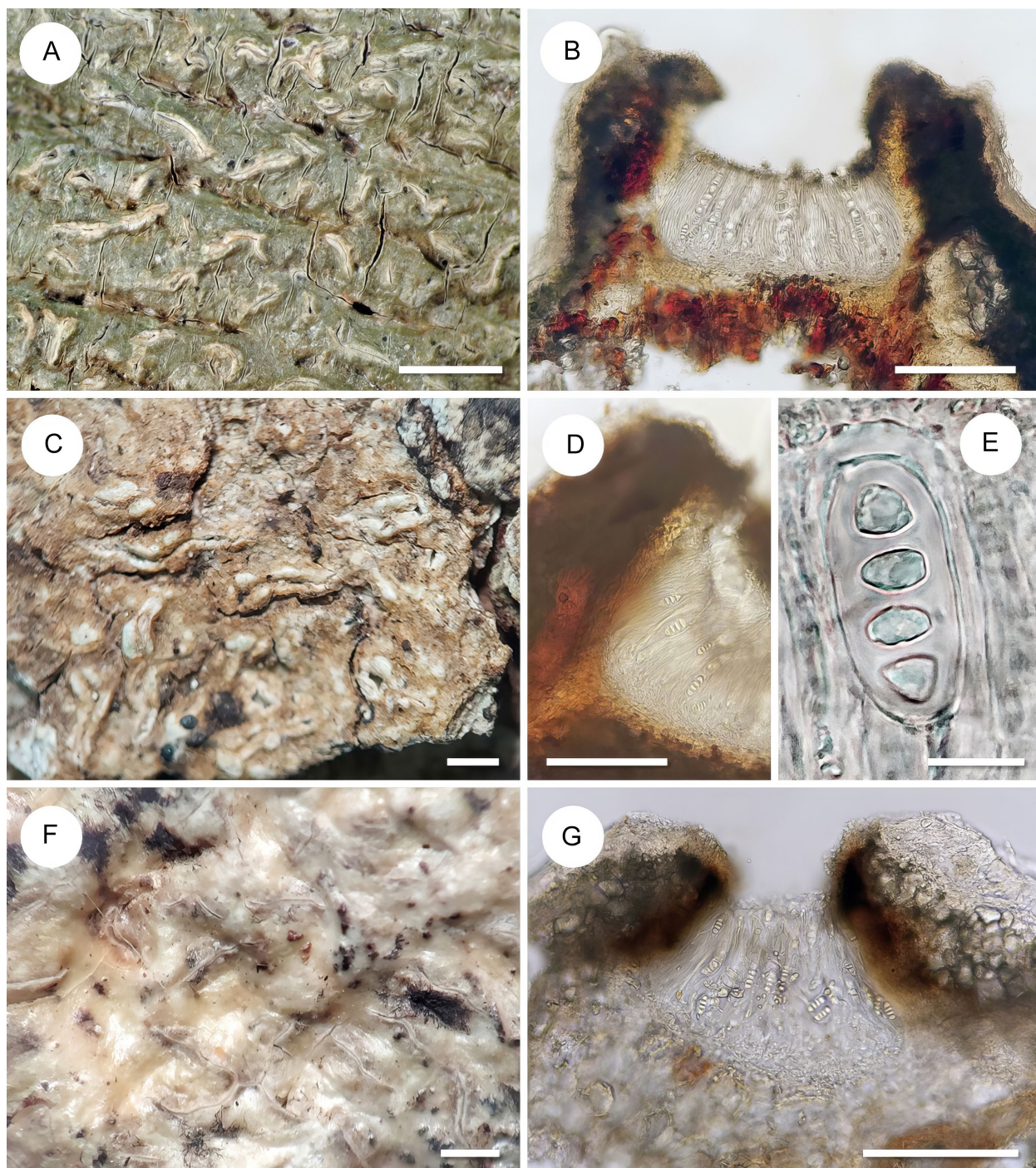


Figure 4. A, B – *Fissurina consentanea* (Lücking et al. 35821). A – thallus with lirellae; B – section through lirella; C–E – *F. crassilabra* (Lücking et al. 36263); C – thallus with lirellae; D – partial section through lirella; E – ascospore; F, G – *F. deficiens* (Lücking et al. 35823); F – thallus with lirellae; G – section through lirella. Scales: A, C, F = 1 mm; B, D, G = 100 μ m; E = 10 μ m.

Specimens examined. USA. HAWAII: Kaua‘i, Halelea Forest Reserve, Along road just beyond Keahua Forestry Arboretum; 22.0727°N, 156.4195°E, 187 m; secondary non-indigenous forest, epiphytic on *Falcataria moluccana* trunk; 16 Jul. 2024, T. Flynn 9992 (BISH). Kaua‘i, Naimea drainage basin W side; 22.05°N, 159.5°E; on bark of *Xanthoxylum dipetalum*; 3 Jul. to 18 Aug. 1917, C.N. Forbes 1211K (US, WIS), 1222K (US). O‘ahu, Ko‘olau Mountains, Waimānalo Forest Reserve, close to Honolulu City Baseyard; 21.372°N, 157.745°E, 79 m; closed woodland of introduced species, on *Citharexylon spinosum*; 21 Aug. 2025, C.W. Smith s.n. (HAW). Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and

18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48’23”N, 156°15’19”E, 1200–1300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35821 (B, F).

Fissurina crassilabra Mont. & Bosch in Montagne, Syll. Gen. Sp. Crypt. (Paris): 354. 1856. (Fig. 4C–E)

Remarks. *Fissurina crassilabra* belongs in a small group of species that feature lirellae with distinct labia, combined with 3-septate ascospores and lack of secondary

compounds. It is characterized by rather thick labia and a distinctly gaping disc, with ascospores $15\text{--}20 \times 7\text{--}10\ \mu\text{m}$ in size. The Hawaiian material is quite close to the type. Phylogenetically, it clusters with the *F. consentanea/triticea* complex (see above), and morphologically the species is somewhat similar to *F. triticea*, although the latter has at best slightly gaping discs and produces stictic acid. Based on the molecular data alone, one could therefore identify this material, and perhaps also the type of *F. crassilabra*, as an acid-deficient, morphologically deviating form of the *F. consentanea/triticea* complex. For the time being, we keep the morphological identifications as this complex is not well-studied.

Specimens examined. USA. HAWAII: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Lihue, at end of Koke'e Road, Pihea Trail; $22^{\circ}08'51''\text{N}$, $159^{\circ}37'53''\text{E}$, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36263 (B, F, PTBG). Maui, Haleakalā Crater; on *Sophora chrysophyllum*; August 1919, C.N. Forbes 1400M (BISH).

Fissurina deficiens (A.W. Archer) Lücking in van den Boom, Lücking & Sipman, Diversity 15(7, no. 817): 5. 2023. (Fig. 4F, G)

Description. Thallus corticolous, epiperidermal, up to 3 cm diam., continuous; surface smooth to uneven, sometimes splitting, light green to mottled white-green, shiny; prothallus absent. Thallus in section 50–100 μm thick, with dense, prosoplectenchymatous cortex 20–30 μm thick, photobiont layer 20–30 μm thick, and indistinct medulla except for near the ascomata. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish to orange green, $8\text{--}12 \times 7\text{--}10\ \mu\text{m}$. Ascomata lirelliform, fissurinoid, flexuose, sparsely to irregularly branched, immersed to erumpent, with complete thalline margin, 1–3 mm long, 0.15–0.25 mm wide, 0.15–0.2 mm high; disc concealed, visible as grey-brown slit; proper margin distinct, forming thin labia covered by thalline layer, greyish-brown along the slit. Excipulum entire, yellowish brown, apically dark brown to carbonized, 25–50 μm wide; laterally covered by corticate thalline layer; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ violet-blue; hypothecium prosoplectenchymatous, 10–15 μm high, colorless to pale yellowish; hymenium 120–130 μm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids short, along the uppermost, dark brown portion of the inner excipulum, 5–10 μm long, smooth; asci cylindrical, $110\text{--}120 \times 15\text{--}18\ \mu\text{m}$. Ascospores 8 per ascus, uniseriate, broadly ellipsoid, 3-septate, $20\text{--}25 \times 10\text{--}12\ \mu\text{m}$, 1.8–2.3 times as long as wide, hyaline, with thick outer wall (1–1.5 μm) and thickened septa and rounded to lens-shaped lumina, lacking distinct halo, I+ weakly violet.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from the eastern Paleotropics (Australia) and from Hawai'i from the islands of

Kaua'i and Maui, found in little disturbed montane forest (1,200–1,350 m) on tree bark.

Remarks. The present material fits the specimens from Australia quite well, in particular the fissurinoid, only lightly erumpent lirellae with apical carbonization (visible as a thin black line along the slit), the size range of the ascospores ($18\text{--}22 \times 10\text{--}14\ \mu\text{m}$ in Australian material according to Archer 2009) and their weakly amyloid reaction, and the lack of secondary substances. A sequenced specimen from China identified with this name clusters with *F. adscribens*, far from the Hawaiian material (Fig. 1), and may not represent *F. deficiens* in the strict sense.

Specimens examined. USA. HAWAII: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Lihue, at end of Koke'e Road, Pihea Trail; $22^{\circ}08'51''\text{N}$, $159^{\circ}37'53''\text{E}$, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous on *Cheirodendron* sp.; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36268 (B, F, PTBG). Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; $20^{\circ}48'23''\text{N}$, $156^{\circ}15'19''\text{E}$, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35823 (B, F).

Fissurina fissa Lücking, B. Moncada & Lumbsch, sp. nov. (Fig. 5)

Index Fungorum IF 905650

Diagnosis: Differing from *Fissurina tachygrapha* in the thicker thallus, the weak apical carbonization of the labia, and the relatively narrower ascospores.

Type: USA, Hawaii: Maui island, Maui County, East Maui, Haleakalā Volcano, Upper Waikamoi Preserve (The Nature Conservancy), 12 km SE of Pukalani and 25 km SE of Kahului, upper access trail to preserve bordering Haleakalā National Park; $20^{\circ}46'07''\text{N}$, $156^{\circ}14'17''\text{E}$, 1,800–2,100 m; introduced mixed conifer forest intermingled with *Acacia koa* and other native trees, corticolous; 12 Jun. 2013, R. Lücking, B. Moncada & P. Thomas 35992 (BISH – holotype!; B, F – isotypes!).

Etymology. The epithet refers to the slightly gaping lirellae.

Description. Thallus corticolous, seemingly epiperidermal (periderm dissolved), up to 5 cm diam., continuous; surface uneven, white, shiny; prothallus absent. Thallus in section 80–120 μm thick, with dense, prosoplectenchymatous cortex 10–15 μm thick, layer of calcium oxalate crystals intermingled with small grey crystals 50–70 μm thick, and photobiont layer 30–50 μm thick. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, bright green to yellowish green, $8\text{--}12 \times 7\text{--}10\ \mu\text{m}$. Ascomata lirelliform, thallolomoid, straight to flexuose, unbranched to very sparsely branched, immersed, with complete thalline margin, 0.5–1.5 mm long, 0.1–0.2 mm wide, 0.15–0.2 mm high; disc slightly gaping, flesh-colored to dark grey, slit 0.05–0.1 mm wide;

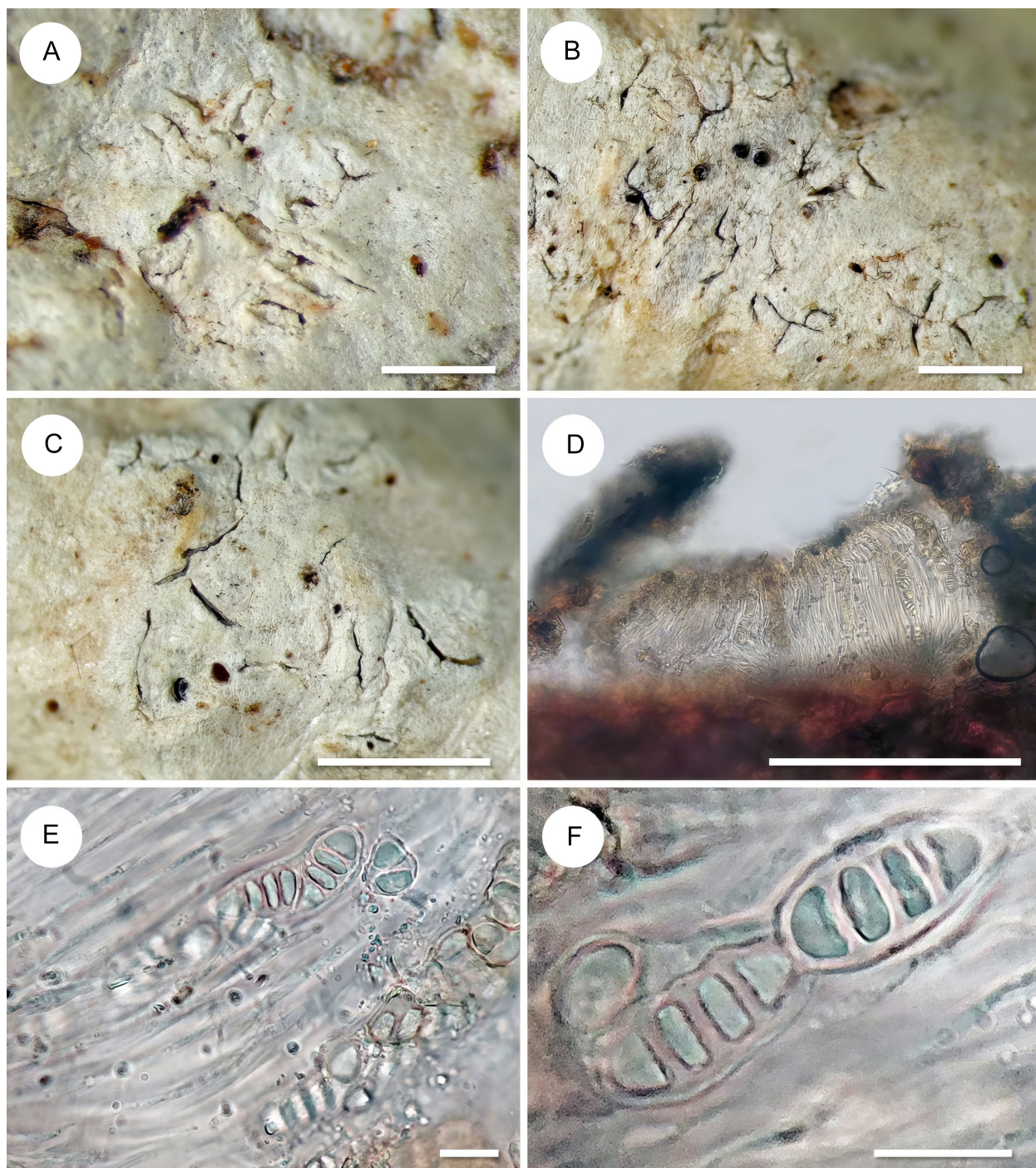


Figure 5. *Fissurina fissa* (holotype except B, C: Lücking et al. 36267a). A–C – thallus with lirellae; D – section through lirella; E, F – hymenium with asci and ascospores. Scales: A–C = 1 mm; D = 100 µm; E, F = 10 µm.

proper margin indistinct, labia absent. Excipulum entire, yellow-olive, apically dark brown, 25–50 µm wide; laterally covered by thick layer of crystal clusters and cortex; hypothecium prosoplectenchymatous, 10–15 µm high, yellowish; hymenium 90–100 µm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct, along the uppermost, dark brown portion of the inner excipulum, 3–5 µm long, smooth; asci fusiform, 80–90 × 17–20 µm. Ascospores 8 per ascus, irregularly arranged, ellipsoid, 3-septate, 18–25 × 7–8 µm, 2.5–3.5 times as long as wide, hyaline, with slightly thickened wall and septa and rectangular lumina, but lacking distinct halo, I– or rarely very

weakly I+ amyloid, old ascospores sometimes becoming faintly brownish.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Apparently, a Hawaiian montane species, known from the Upper Waikamoi Preserve on Maui, at 1,800–2,100 m, growing corticolous in an introduced mixed conifer forest intermingled with *Acacia koa* and other native trees, and from Koke'e State Park and Kuai Natural Area Reserve on the island of Kaua'i, at almost 1,000–1,350 m, growing corticolous in mostly undisturbed montane mesic forest on *Clermontia* and *Santalum*. *Fissurina fissa* is one of a few species confirmed

by molecular data to occur on at least two islands; most other such instances are based on records with and without molecular data.

Remarks. *Fissurina fissa* would key out close to *F. tachygrapha*, described from Colombia and also reported for Hawai'i (Magnusson 1955; Elix & McCarthy 1998; Luch & Lücking 2018). Both agree in having an endoperidermal thallus, in the immersed lirellae with somewhat gaping disc and indistinct labia, in the apical carbonization, and in ascospore length. However, *F. fissa* has a thicker thallus with a thin, but distinct cortex, more distinctly gaping lirellae, an apically brown rather than carbonized excipulum, and narrower ascospores (8–12 µm wide and 1.8–2.5 times as long as wide in *F. tachygrapha*). We have not seen the material on which the report of *F. tachygrapha* from Hawai'i is based, but it is possible that it represents either *F. fissa* or *F. mauiensis* (see below). On the other hand, the exact delimitation and distribution of *F. tachygrapha* is unclear and requires a broad global sampling for molecular analysis.

Additional specimens examined. USA. HAWAII: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Līhu'e, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous on *Clermontia* sp.; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36267a (F, PTBG). Kaua'i, Waimea District, Kuai Natural Area Reserve, upper Kuai Valley; 22.1333°N, 159.6667°E, 996 m; mixed mesic forest with *Acacia koa*, *Zanthoxylum*, *Santalum*, *Kadua*, *Psycotria* and *Psidium cattleianum*, epiphytic on trunk of *Santalum pyrularium*; 18 Dec. 2014, T. Flynn 8012 (BG, BISH, PTBG).

Fissurina fuscella Lücking, B. Moncada & T. Flynn, sp. nov. (Fig. 6)

Index Fungorum IF 905651

Diagnosis: Differing from *Fissurina tectigera* in the apically carbonized labia and the shorter ascospores becoming brown when mature.

Type: USA, Hawaii: Kaua'i island, Kaua'i County, Kōloa district, Lawai Valley; 200–480 ft (60–150 m); secondary vegetation dominated by *Syzygium cumini*, *Psidium* spp., *Schinus terebinthifolius*, and *Casuarina equisetifolia*, with *Pothos*, *Odontonema*, and *Coffea* along the stream, epiphytic on trunk of *Syzygium cumini*; 17 Oct. 1991, T. Flynn 4766 (PTBG [PTBG1000022897] – holotype!; B, WIS – isotypes!).

Etymology. The epithet refers to the grey-brown lirellae with brown to carbonized labia and the ascospores becoming brown.

Description. Thallus corticolous, partly epidermal, partly endoperidermal, up to 5 cm diam., continuous; surface smooth, light yellow-olive; prothallus absent. Thallus in section 50–80 µm thick, with proso- to paraplectenchymatous cortex 15–30 µm thick, and irregular photobiont layer 30–40 µm thick, medulla indistinct, incrustated with crystals. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, olive-green, 7–12 × 7–10 µm. Ascomata lirellate, unbranched, straight, erumpent to prominent, 1–2 mm long and 0.25–0.4 mm

broad, 0.12–0.15 mm high; disc concealed; labia distinct, entire, grey-brown, upper portion whitish or with black line along the slit, laterally covered by thallus. Excipulum in upper part dark brown to carbonized, 40–50 µm wide, otherwise orange-brown to orange-yellow; laterally covered by algiferous, corticate thallus with large clusters of calcium oxalate crystals; hypothecium prosoplectenchymatous, 10–15 µm high, hyaline to yellowish; hymenium 80–90 µm high, hyaline, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 80–90 × 10–12 µm. Ascospores 8 per ascus, uniseriate to irregularly arranged, broadly ellipsoid, submuriform with (2–)3 transverse septa and 0–2 longitudinal septa per segment, 12–16 × 7–9 µm, 1.8–2 times as long as wide, becoming grey-brown when mature and dark brown and shriveling when old, distoseptate with lens-shaped to rounded lumina, I–.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from a single collection on Kaua'i island, growing corticolous in secondary vegetation.

Remarks. This is the only new species described from Hawai'i for which no sequence data were available, as the only collection dates back to 1991. It is formally described here due to the unusual character of its ascospores becoming brown. Only few other species in the genus are known with brown(ish) ascospores, as discussed under the next species, *F. fuscispora*. None of these has small, submuriform ascospores. Superficially, the new species resembles *F. comparimuralis* Staiger and *F. tectigera* (Eschw.) Lücking, but both have a completely carbonized excipulum and the ascospores are colorless and either larger (*F. comparimuralis*) or longer (*F. tectigera*). *Fissurina novae-zelandiae* C. Knight, described from New Zealand, agrees in the apically carbonized labia, but has a thicker, pale thalline cover of the labia and its ascospores are also larger and colorless.

Fissurina fuscispora Lücking, Kraichak & T. Flynn, sp. nov. (Fig. 7)

Index Fungorum IF 905652

Diagnosis: Differing from *Fissurina dumastii* and similar species in the ascospores becoming brown, and from *F. fujisanensis* in the non-carbonized labia.

Type: USA, Hawaii: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Līhu'e, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36264 (BISH – holotype!; F – isotype!).

Etymology. The epithet refers to the ascospores becoming brown.

Description. Thallus corticolous, epidermal, up to 10 cm diam., continuous; surface smooth to uneven, partially splitting, light olive-green mottled with white, shiny; prothallus absent. Thallus in section 70–130 µm thick,

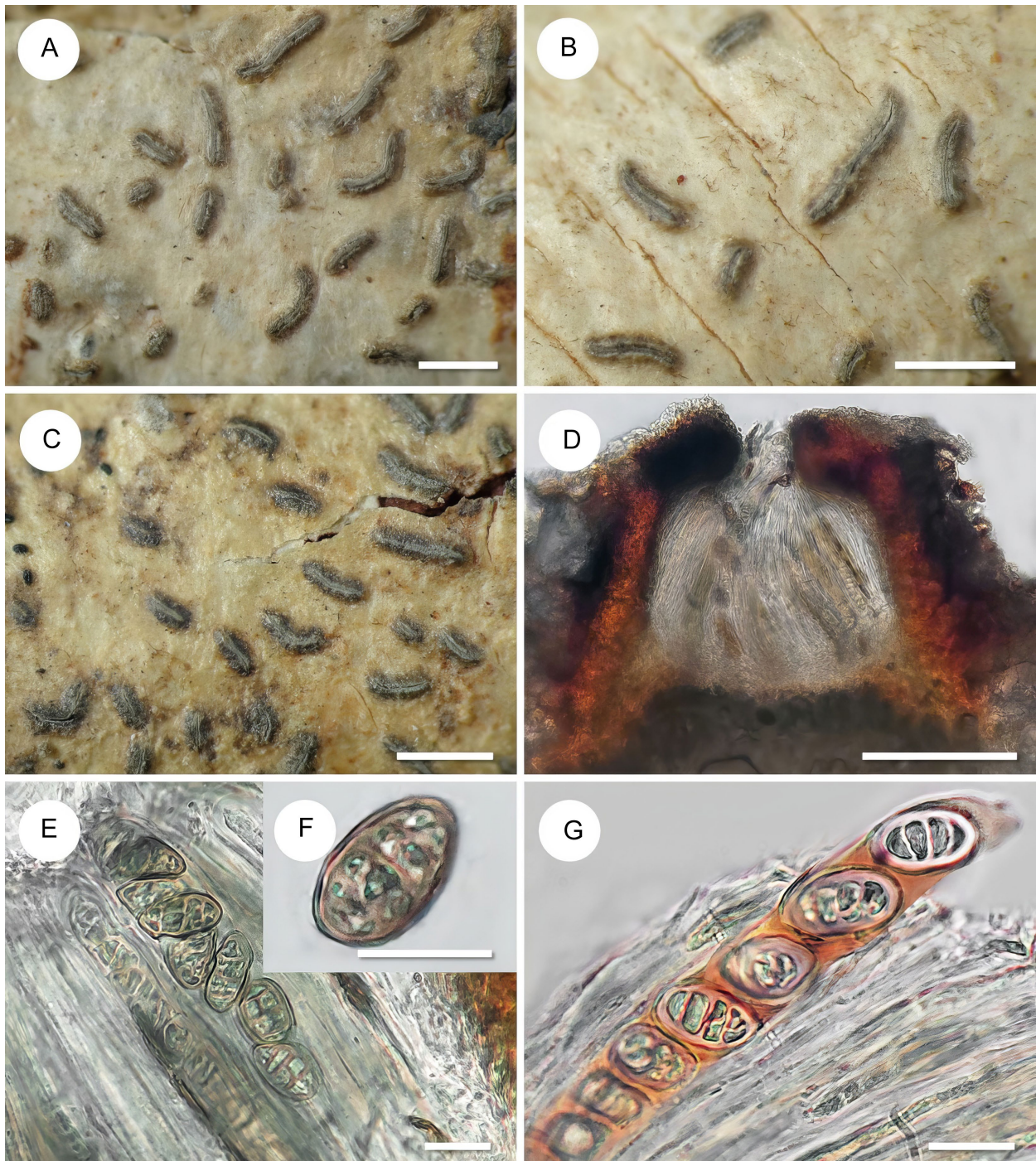


Figure 6. *Fissurina fuscella* (holotype). A–C – thallus with lirellae; D – section through lirella; E–G – hymenium with asci and ascospores, in G after treatment with I. Scales: A–C = 1 mm; D = 100 μ m; E–G = 10 μ m.

with dense, prosoplectenchymatous cortex 20–30 μ m thick, photobiont layer 20–30 μ m thick, and indistinct medulla except for near the ascomata, there 50–70 μ m thick and strongly encrusted with clusters of calcium oxalate crystals. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish to orange green, 8–13 $\times$ 6–10 μ m. Ascomata lirelliform, fissurineoid, straight to flexuose, dense, abundantly branched and seemingly anastomosing, erumpent, with complete thalline margin, 1–5 mm long, 0.2–0.3 mm wide, 0.15–0.2 mm high; disc slightly gaping, grey, slit 0.1–0.2 mm wide; proper margin distinct, forming thin labia covered by thalline layer, white along the slit. Excipulum entire,

indistinct, colorless, 5–10 μ m wide; laterally covered by corticate thalline layer including a thick layer of clusters of calcium oxalate crystals; hypothecium prosoplectenchymatous, 10–15 μ m high, colorless to pale yellowish; hymenium 110–120 μ m high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; paraphysoids absent; asci cylindrical, 110–120 $\times$ 10–12 μ m. Ascospores 8 per ascus, uniseriate to irregularly arranged, ellipsoid to fusiform, 3-septate, 12–15 $\times$ 5–6 μ m, 2–2.8 times as long as wide, olive-brown when mature, with thin outer wall (thickened when young and hyaline) and thin septa and rectangular lumina, lacking distinct halo, I+ weakly sordid violet.

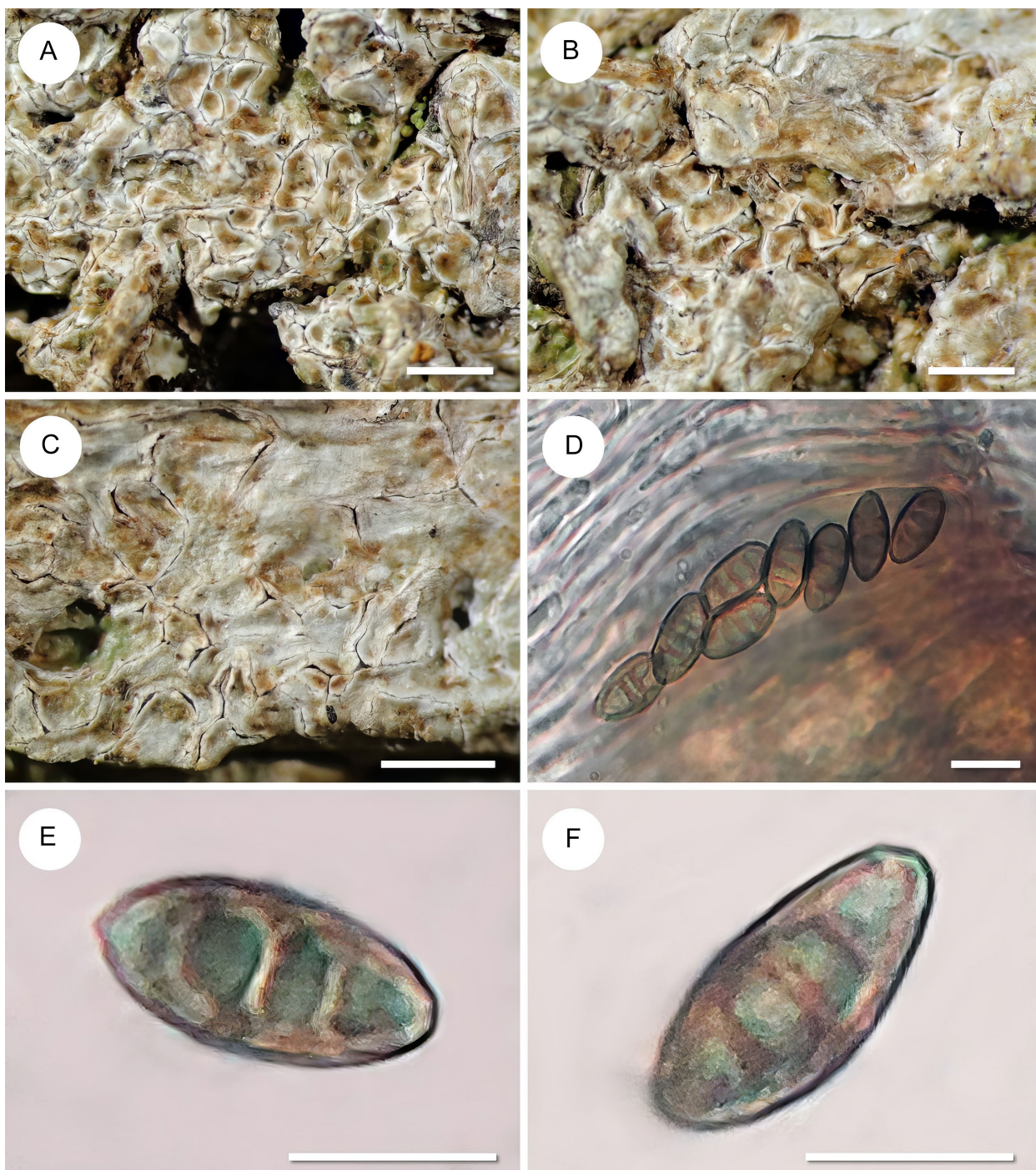


Figure 7. *Fissurina fuscispora* (holotype). A–C – thallus with lirellae; D – hymenium with ascus and ascospores; E, F – ascospores. Scales: A–C = 1 mm; D–F = 10 µm.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from a single collection in Koke'e State Park on the island of Kaua'i, growing corticolous in mostly undisturbed montane mesic forest.

Remarks. *Fissurina fuscispora* morphologically represents a typical representative of the genus, with corticate, olive-green thallus and fissurine lirellae. It differs from all known species with this morphology, including the similar *F. dumastii* complex, in the olive-brown ascospores when mature. Only few other species of the genus have ascospores becoming brownish, but not distinctly brown: *F. fujisanensis* (Kashiw. & M. Nakan.) M. Nakan.

& Kashiw., with apically carbonized labia; *F. flavicans* (Kashiw.) M. Nakan. & Kashiw., with echinocarpic acid; *F. fuscella*, described above, with submuriform ascospores, and *Phaeographina nitidescens* Fink, with large, muriform ascospores.

Fissurina globulifica (Nyl.) Staiger, Biblioth. Lichenol. 85: 137. 2002.

Remarks. *Fissurina globulifica* has been previously listed for Hawai'i (Elix & McCarthy 1998; Luch & Lücking 2018). We have not been able to revise the underlying material, but found a matching specimen in the collections restudied by us. The species is well characterized

by a densely corticate thallus, erumpent to prominent (to sometimes sessile) lirellae with distinct, white labia and usually concealed disc, small, subglobose ascospores $8\text{--}14 \times 7\text{--}9 \mu\text{m}$ in size, and a psoromic acid chemistry.

Specimen examined. USA. HAWAII: Maui, Haleakalā National Park, Paliku area, in gully from Paliku to Kuiki; 20.7170°N , 156.1390°E , 2,066 m; native forest; R.B.I. Hale & C.W. Smith 2228 (HAW).

Fissurina graphidoides Lücking, B. Moncada & Lumbsch, sp. nov. (Fig. 8)

Index Fungorum IF 905653

Diagnosis: Differing from *Fissurina gomphospora* in the dark labia contrasting with the lighter thallus, and from *F. decipiens* in the more distinct, dark grey labia lacking a black line along the slit.

Type: USA, Hawaii: Maui island, Maui County, East Maui, Haleakalā Volcano, Upper Waikamoi Preserve (The Nature Conservancy), 12 km SE of Pukalani and 25 km SE of Kahului, upper access trail to preserve bordering Haleakalā National Park; $20^\circ46'07''\text{N}$, $156^\circ14'17''\text{E}$, 1,800–2,100 m; introduced mixed conifer forest intermingled with *Acacia koa* and other native trees, corticolous; 12 Jun. 2013, R. Lücking, B. Moncada & P. Thomas 35991 (BISH – holotype!; B, F, HAW – isotypes!).

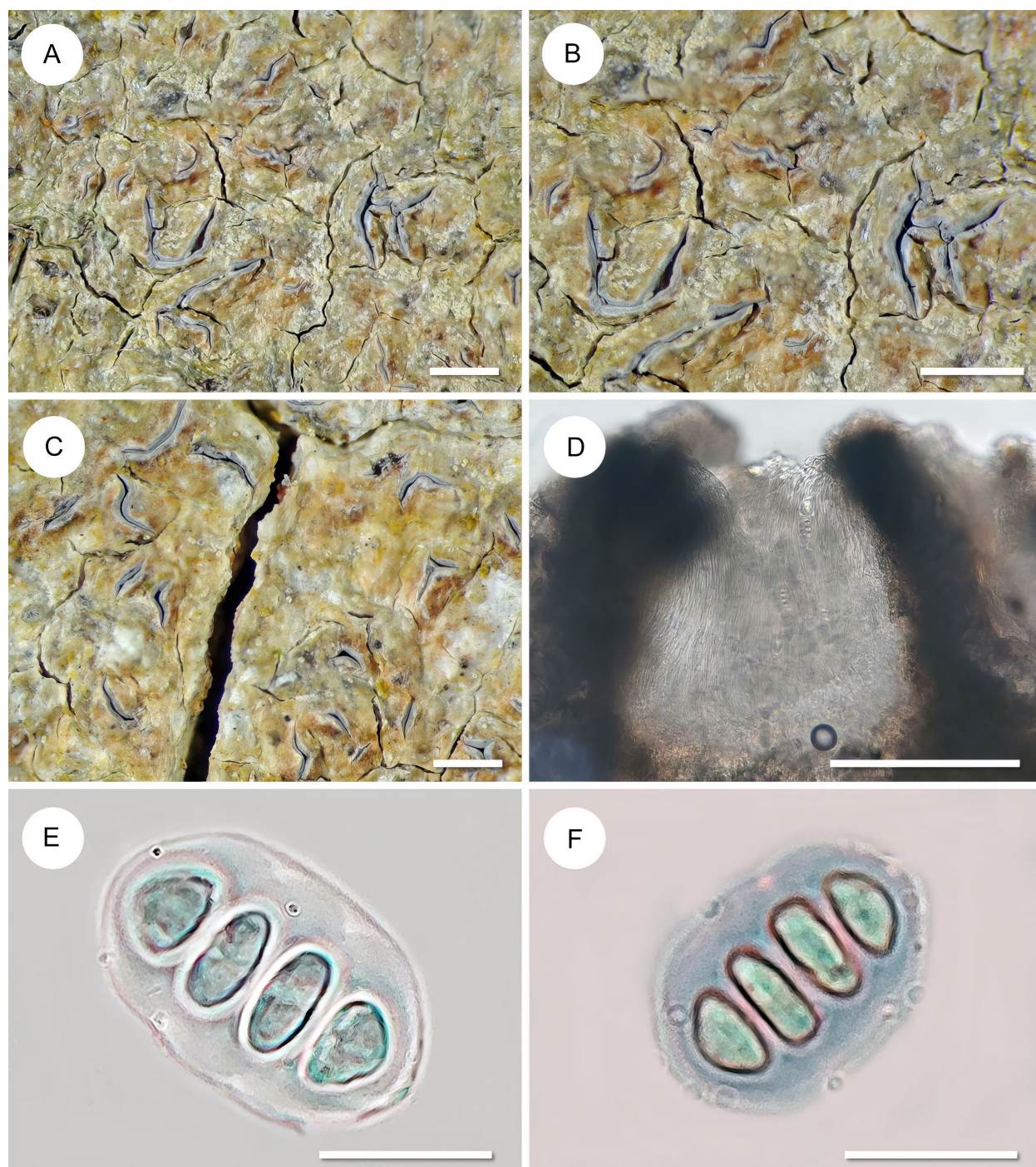


Figure 8. *Fissurina graphidoides* (holotype). A–C – thallus with lirellae; D – section through lirella; E, F – ascospores, in F after treatment with I. Scales: A–C = 1 mm; D = 100 μm ; E, F = 10 μm .

Etymology. Named after the similarity to a species of *Graphis*.

Description. Thallus corticolous, epiperidermal, up to 10 cm diam., continuous; surface uneven, mottled green-white with reddish areas, especially near the ascomata, slightly shiny; prothallus absent. Thallus in section 120–150 µm thick, with dense, prosoplectenchymatous cortex 20–30 µm thick, photobiont layer 50–70 µm thick, and medulla 50–70 µm thick, strongly encrusted with large clusters of calcium oxalate crystals. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish to orange green, 10–14 × 8–10 µm. Ascomata lirelliform, hemithecioid, straight to flexuose, sparsely to irregularly branched, erumpent, with lateral thalline margin, 1–2 mm long, 0.2–0.3 mm wide, 0.15–0.2 mm high; disc slightly gaping, flesh-colored, slit 0.1–0.2 mm wide; proper margin distinct, forming distinct, grey labia leveled with the bordering thalline margin. Excipulum entire, upper portion carbonized and thickened, 25–60 µm wide, basally or in lower portion orange-brown; laterally covered by corticate thalline layer; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 10–15 µm high, colorless to pale yellowish; hymenium 100–120 µm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 100–110 × 14–16 µm. Ascospores 8 per ascus, uniseriate, broadly ellipsoid, 3-septate, 15–22 × 10–13 µm, 1.4–1.7 times as long as wide, hyaline, with thick outer wall (1–2 µm) and thickened septa and lens-shaped lumina, with distinct halo especially at the ends, I+ light violet-blue.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. So far only known from Upper Waikamoi Preserve on Maui and the Honouliuli Forest Reserve on O'ahu; corticolous in introduced mixed native/alien (conifer) forest intermingled with *Acacia koa* and other native trees, at mid to higher elevations.

Remarks. *Fissurina graphidoides* resembles a species of *Graphis*, due to its lirellae with distinct labia and apical carbonization, appearing grey from above and darker than the thallus. *Fissurina gomphospora* (Müll. Arg.) Lücking comb. nov. [bas.: *Graphis gomphospora* Müll. Arg., J. Linn. Soc., Bot. 30: 458. 1895; Index Fungorum IF 905666], described from Mauritius, agrees in the lirellae with distinct labia with apical carbonization, as well as ascospore size, but the labia have a thick whitish cover, contrasting with the darker thallus. *Fissurina deficiens* has indistinct labia, with the apical carbonization visible as a narrow, blackish line along the slit.

Additional specimens examined. USA. HAWAII: O'ahu, Waianae Mountains, Honouliuli Forest Reserve, Palikea/Palehua trail; 21°24.380'N, 158°5.871'E, 790 m (2,592 ft); mixed native/alien forest, on *Myrica faya*; 27 Dec. 1993, C.W. Smith s.n. (HAW).

Fissurina hyalinella (Müll. Arg.) Lücking, in Cáceres, Aptroot, Parnmen & Lücking, Phytotaxa 189(1): 126. 2014. (Fig. 9A, B)

Remarks. *Fissurina hyalinella* is the most common and widespread of the species with endoperidermal, ecorticate, whitish thallus. Its lirellae lack distinct labia and the slightly gaping disc gives the impression of a species of *Thalloloma*. The 3-septate, non-amyloid ascospores are rather small (10–15 × 6–7 µm). The Hawaiian material fits the type from Africa (Tanzania) rather well.

Specimens examined. USA. HAWAII: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Līhu'e, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36271 (F), R. Lücking, B. Moncada & T. Flynn 36270 (B, F, PTBG), R. Lücking, B. Moncada & T. Flynn 36258b (B, F, PTBG). O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous on *Metrosiderus polymorpha*; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35652 (B, F, HAW). O'ahu, Ko'olau Mountains, Waimānalo Forest Reserve, Old Kalaniana'ole Road, Honolulu city Baseyard; 21.372°N, 157.745°E, 79 m; closed woodland of introduced species, on *Heptapleurum actinophyllum*; 21 Aug. 2025, C.W. Smith s.n. (HAW). Maui island, Maui County, East Maui, north coast, Hana Highway, bordering Garden of Eden Botanical Arboretum, 50 km ESE of Kahului, mile 10 on Hana Highway, along highway (north side); 20°52'10"N, 156°10'45"E, 150 m; planted trees of *Spathodea campanulata* with dense canopy, corticolous on *Spathodea campanulata*; 10 Jun. 2013, R. Lücking & B. Moncada 35781 (B, BISH, F, HAW, PTBG).

Fissurina implicatoides Lücking, Kraichak & C.W. Sm., sp. nov. (Fig. 9C–F)

Index Fungorum IF 905654

Diagnosis: Differing from *Fissurina capsulata* in the thin, largely endoperidermal thallus and in the shorter, broader ascospores.

Type: USA, Hawaii: O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35645 (BISH – holotype!; F – isotypes!).

Etymology. The epithet refers to the superficial similarity with *Graphis implicata*.

Description. Thallus corticolous, largely endoperidermal, but thinly corticate, up to 10 cm diam., continuous; surface uneven, following the contours of the bark, mottled pale greenish yellow; prothallus absent. Photobiont layer immersed in the periderm, 30–50 µm thick, covered by 1–2 layers of dead periderm cells; cortex indistinct except near the ascomata, there dense, 10–20 µm thick. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish green, 8–12 × 6–10 µm.

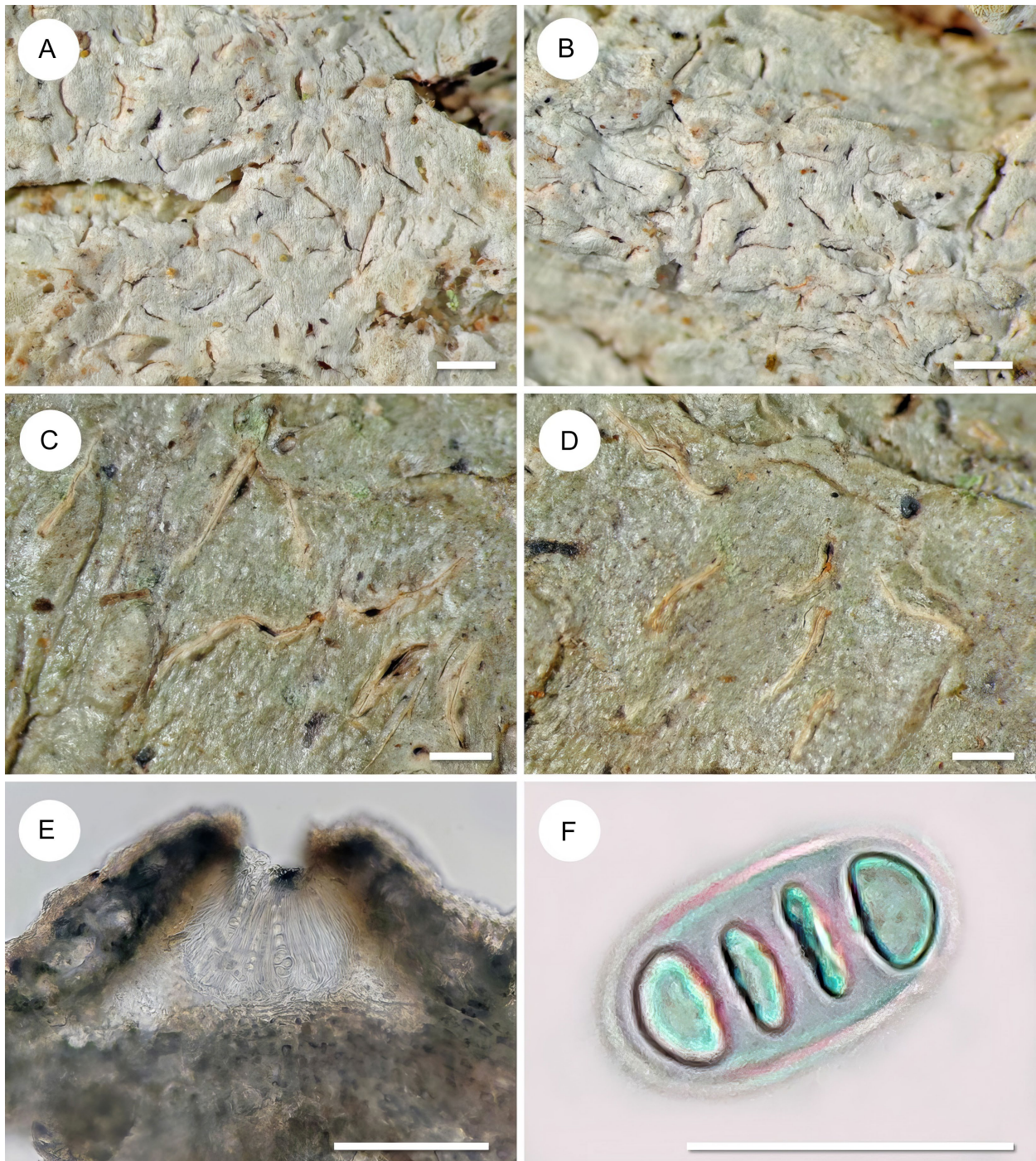


Figure 9. A, B – *Fissurina hyalinella* (Lücking et al. 35781), thallus with lirellae; C–F – *F. implicatoides* (holotype); C, D – thallus with lirellae; E – section through lirella; F – ascospore after treatment with I. Scales: A–D = 1 mm; E = 100 μ m; F = 10 μ m.

Ascomata lirelliform, hemithecioid, straight to flexuose, sparsely branched, erumpent, with lateral thalline margin, 1–3 mm long, 0.2–0.3 mm wide, 0.1–0.15 mm high; disc concealed to slightly gaping, flesh-colored; proper margin distinct, forming distinct, cream-colored labia. Excipulum entire, yellow, apically dark grey-brown, 25–50 μ m wide; laterally covered by photobiont layer immersed in 1–2 layers of dead periderm cells, basally covered by a layer of large clusters of calcium oxalate crystals and a dense cortex; hypothecium prosoplectenchymatous, 5–10 μ m high, colorless; hymenium 70–80 μ m high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically spinulose; periphysoids short and dense, along

the uppermost, dark portion of the inner excipulum, 5–10 μ m long, smooth to uneven; asci cylindrical, 70–80 $\times$ 10–12 μ m. Ascospores 8 per ascus, uniseriate, ellipsoid, 3-septate, 10–12 $\times$ 6–7 μ m, 1.5–2 times as long as wide, hyaline, with slightly thickened outer wall and thickened septa and lens-shaped lumina, lacking distinct halo, I– to I+ faintly violet-blue.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. One of several species found so far exclusively on O‘ahu, along Mānoa Cliffs Trail in Mānoa Valley (Ko‘olau Range), growing corticolous in partially disturbed secondary forest.

Remarks. *Fissurina implicatoides* is characterized by a thin, endoperidermal, but corticate thallus and lirellae with distinct labia. It resembles *Graphis implicata* and similar species, but differs in the *Fissurina*-type, 3-septate, non-amyloid ascospores. Most similar is *F. capsulata* Makhija & Adaw., described from India, which differs in the epiperidermal thallus and the slightly longer and narrower ascospores ($11\text{--}16 \times 4\text{--}5\ \mu\text{m}$). *Fissurina rufula* Mont. has prominent, rather robust lirellae and larger ascospores ($15\text{--}20 \times 6\text{--}10\ \mu\text{m}$).

Additional specimens examined. USA. HAWAII: O'ahu, Ko'olau Mountains, Waimānalo Forest Reserve, Old Kalaniana'ole Road, Honolulu city Baseyard; 21.372°N , 157.745°E ,

79 m; closed woodland of introduced species, on *Heptapleurum actinophyllum*; 21 Aug. 2025, C.W. Smith s.n. (HAW).

Fissurina kokeensis Lücking, B. Moncada & T. Flynn, sp. nov. (Fig. 10)

Index Fungorum IF 905655

Diagnosis: Differing from *Fissurina hyalinella* in the presence of distinct (albeit thin) labia and in the weakly amyloid ascospores.

Type: USA, Hawaii: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Līhu'e, at end of Koke'e Road, Pihea Trail; $22^\circ08'51''\text{N}$, $159^\circ37'53''\text{E}$, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous;

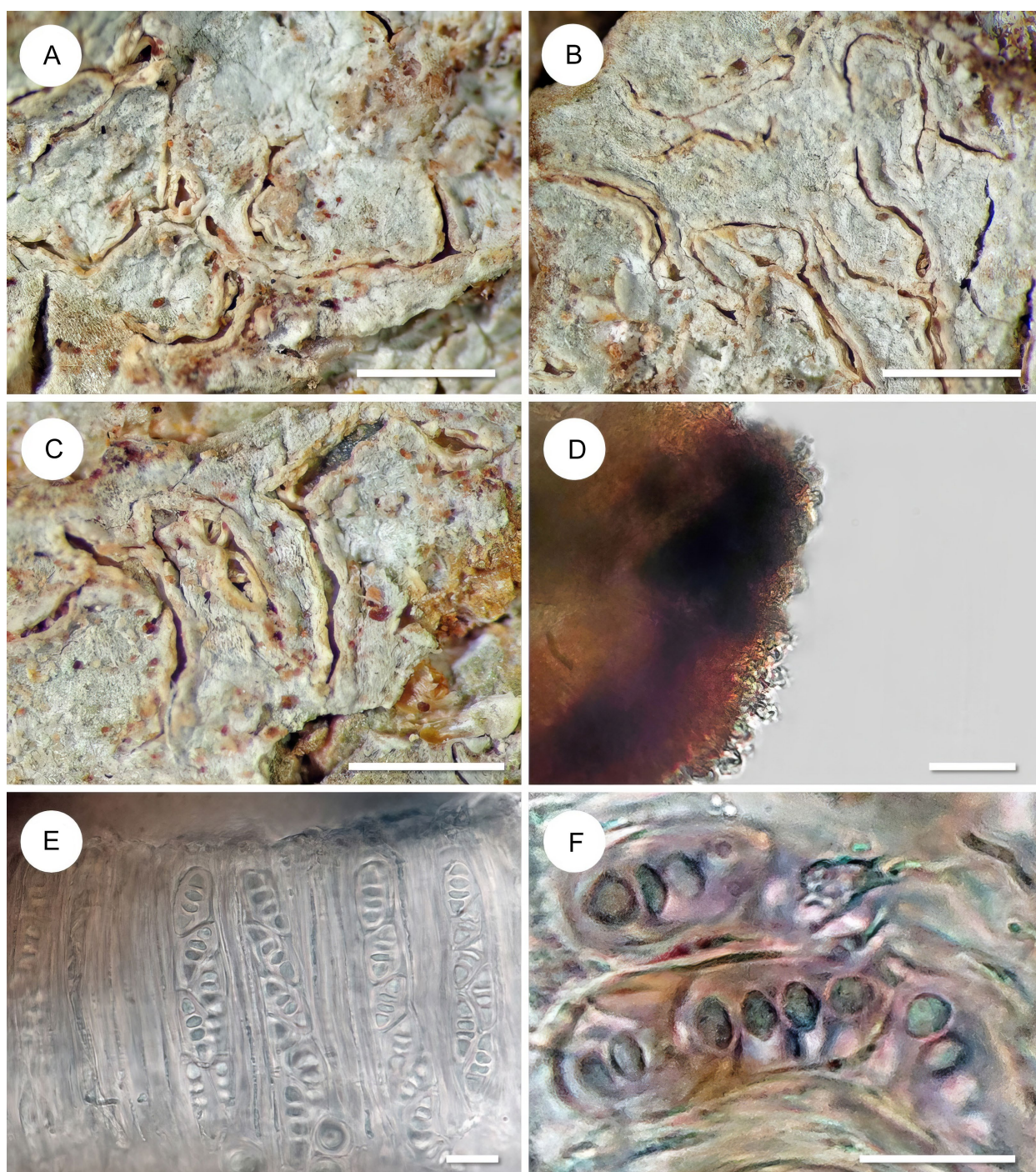


Figure 10. *Fissurina kokeensis* (holotype). A–C – thallus with lirellae; D – section of excipulum showing warty periphysoids; E – section through hymenium with asci and ascospores; F – ascus with ascospores after treatment with I. Scales: A–C = 1 mm; D–F = 10 μm.

15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36269 (PTBG – holotype!; BISH – isotype!).

Etymology. Named after the type locality, Koke'e State Park.

Description. Thallus corticolous, endoperidermal, up to 5 cm diam., continuous; surface uneven, following the contours of the bark, in part splitting, light greenish white, slightly shiny; prothallus absent. Photobiont layer immersed in the periderm, 30–50 µm thick, covered by 2–3 layers of dead periderm cells. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish green, 8–14 × 6–10 µm. Ascomata lirelliform, fissurinoid, straight to flexuose, sparsely to irregularly branched, erumpent, with complete thalline margin, 1–3 mm long, 0.2–0.3 mm wide, 0.2–0.25 mm high; disc distinctly gaping, flesh-colored, slit 0.1–0.2 mm wide; proper margin distinct, forming inclined to almost erect, thin labia. Excipulum entire, yellow, apically olive-brown, 15–25 µm wide, with short, warty periphysoids; laterally covered by orange-brown periderm; hypothecium prosoplectenchymatous, 10–15 µm high, yellow; hymenium 60–70 µm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically spinulose; periphysoids short, along the uppermost, dark olive portion of the inner excipulum, 5–10 µm long, spinulose; asci clavate to cylindrical, 60–70 × 8–10 µm. Ascospores 8 per ascus, irregularly arranged, ellipsoid to oblong, 3-septate, 12–17 × 5–8 µm, 2.2–2.7 times as long as wide, hyaline, with thickened outer wall (1–2 µm) and thickened septa and slightly rounded lumina, lacking distinct halo, I+ weakly violet.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Another species known only from Koke'e State Park on the island of Kaua'i, growing corticolous in mostly undisturbed montane mesic forest.

Remarks. *Fissurina kokeensis* is another new taxon keying out close to *F. hyalinella*. Besides being phylogenetically distinctive, it differs from the latter in the distinct, albeit thin and irregular labia bordering the gaping disc. Contrary to *F. hyalinella*, the ascospores are persistently, though weakly amyloid. Phylogenetically, the new species forms a strongly supported sister group relationship with *F. montiformis*, described below, which differs clearly in the gall-forming, short lirellae and the muriform ascospores.

Fissurina mauiensis Lücking, Kraichak & Lumbsch, sp. nov. (Fig. 11)

Index Fungorum IF 905656

Diagnosis: Differing from *Fissurina fissa* in the slightly smaller ascospores.

Type: USA, Hawaii: Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive

Hedychium gardnerianum in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35825 (BISH – holotype!; F – isotype!).

Etymology. The epithet refers to the island of Maui, where the species was mostly found.

Description. Thallus corticolous, partly endoperidermal, partly epiperidermal, up to 5 cm diam., continuous; surface uneven, white; prothallus absent. Thallus in section 80–100 µm thick, with dense, prosoplectenchymatous cortex 10–15 µm thick, photobiont layer 20–30 µm thick, and irregular medulla 50–70 µm thick, strongly encrusted with large clusters of calcium oxalate crystals and small grey crystals. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, bright green to yellowish green, 8–12 × 6–10 µm. Ascomata lirelliform, thallobolomoid, straight to flexuose, unbranched to irregularly or stellately branched, immersed, with complete thalline margin, 1–3(–5) mm long, 0.1–0.2 mm wide, 0.15–0.2 mm high; disc concealed or slightly gaping, flesh-colored to dark grey, slit 0.05–0.1 mm wide; proper margin thin, without distinct labia, usually forming a blackish slit, the surrounding thalline margin whitish or darkened. Excipulum entire, yellow-olive, apically dark grey-brown, 25–50 µm wide; laterally covered by thick layer of crystal clusters and cortex; hypothecium prosoplectenchymatous, 10–15 µm high, yellowish; hymenium 90–100 µm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct, along the uppermost, dark brown portion of the inner excipulum, 3–5 µm long, smooth; asci fusiform, 80–90 × 17–20 µm. Ascospores 8 per ascus, more or less uniseriate, ellipsoid, 3-septate, 15–20 × 7–8 µm, 2–2.5 times as long as wide, hyaline, with slightly thickened wall and septa and rectangular lumina and thin lateral halo, I–.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from Maui, growing on bark in disturbed to pristine lower montane rain forest.

Remarks. *Fissurina mauiensis* is a remarkable case of homoplasy with *F. fissa*, from which it differs only in the slightly smaller, uniseriately arranged ascospores. Phylogenetically, both species are resolved in quite distant clades (Fig. 1): *F. fissa* in a small clade with *F. sandwicensis* and *F. subtimidula*, and *F. mauiensis* in a larger, unsupported clade containing most of the Hawaiian *Fissurina*. Both are overall similar to *F. tachygrapha* in the endoperidermal, whitish thallus, apical carbonization of the labia, and 3-septate ascospores, but differ mainly in the thicker thalli with a thin, but distinct cortex. The partly darkened thalline margin surrounding the lirellae also reminds of *F. nigriannulata*, which has a blackened thalline margin surrounding pale lirellae.

Additional specimens examined. USA. HAWAII: Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m;

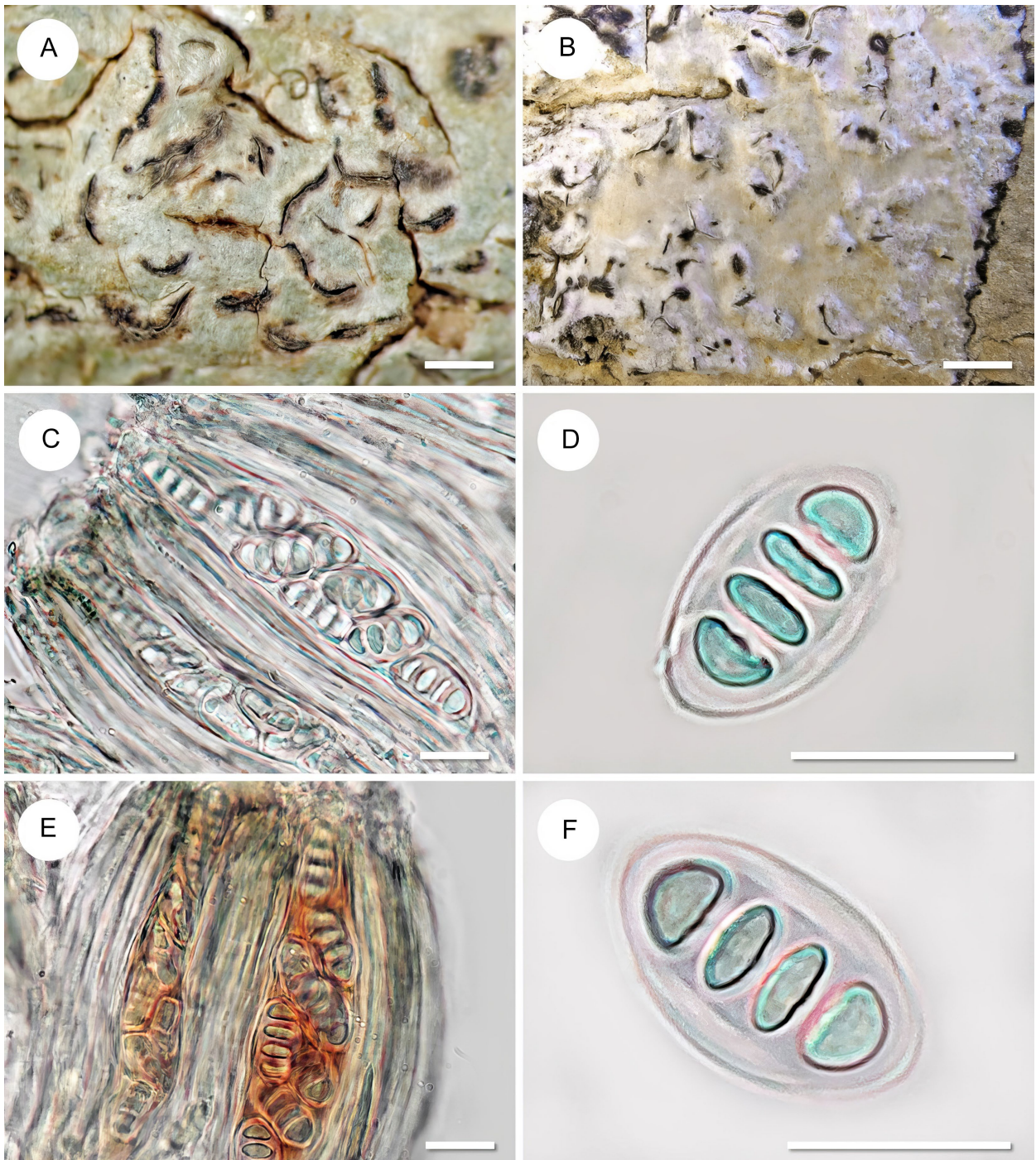


Figure 11. *Fissurina mauiensis* (holotype). A, B – thallus with lirellae; C, E – section through hymenium with asci and ascospores, in E after treatment with I; D, F – ascospores, in F after treatment with I. Scales: A, B = 1 mm; C–F = 10 μ m.

disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedygium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35820a (B, F). Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedygium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35828b (B, BISH, F, HAW, PTBG; filed under *F. subtimidula*).

Fissurina montiformis Lücking, Kraichak & T. Flynn, sp. nov. (Fig. 12)

Index Fungorum IF 905657

Diagnosis: Differing from *Fissurina alligatorensis* in the minutely gall-forming lirellae with concealed disc and the somewhat narrower ascospores.

Type: USA, Hawaii: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Līhu'e, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous on *Clermontia* sp.; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36273 (PTBG – holotype!; BISH – isotype!).

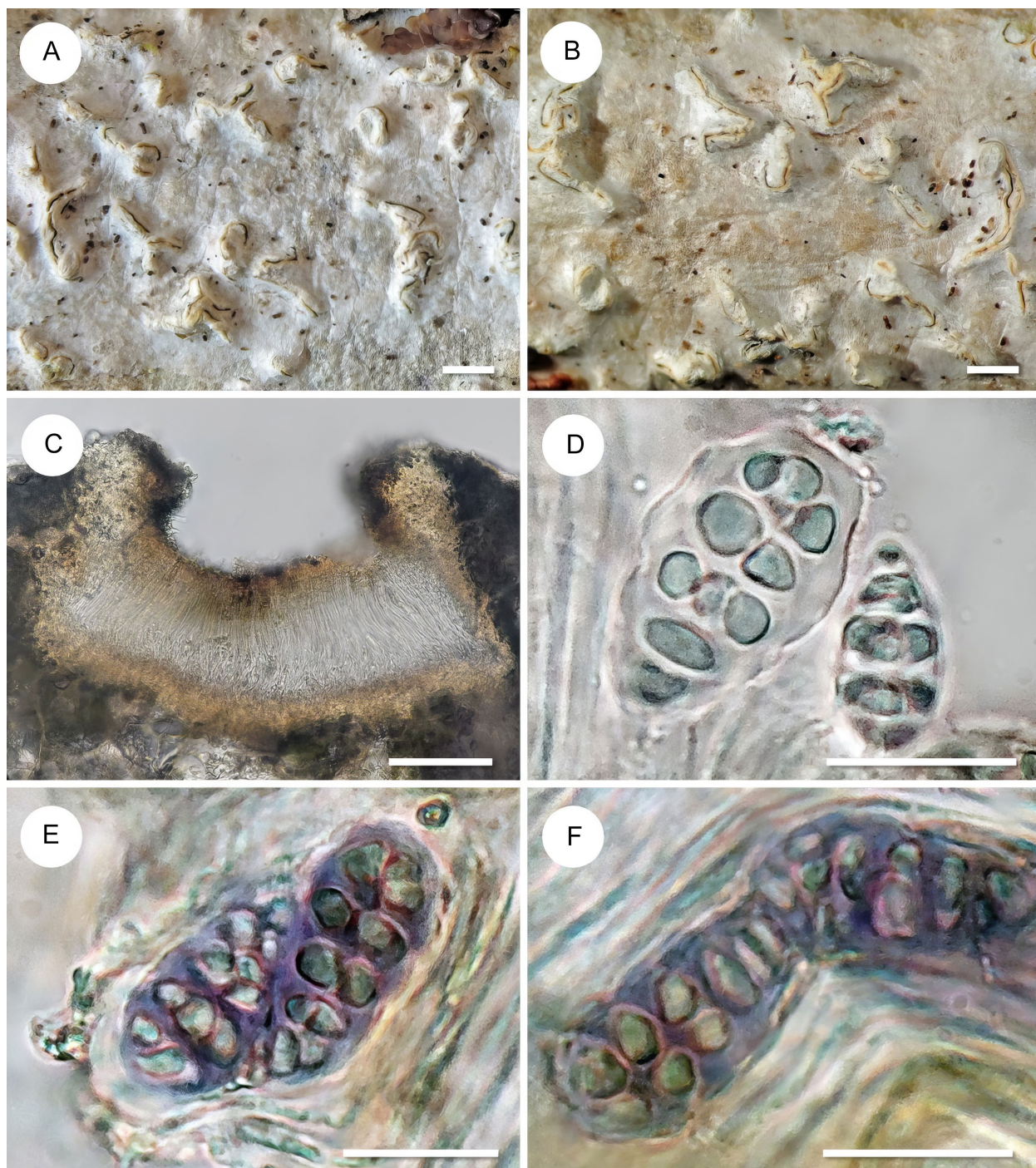


Figure 12. *Fissurina montiformis* (holotype). A, B – thallus with lirellae; C – section through lirella; D–F – ascospores, in E, F after treatment with I. Scales: A, B = 1 mm; C = 100 μ m; D–F = 10 μ m.

Etymology. The epithet refers to the gall-forming lirellae which emerge from the thallus like minute mountains.

Description. Thallus corticolous, endoperidermal, up to 10 cm diam., continuous; surface uneven, following the contours of the bark, white, slightly shiny; prothallus absent. Photobiont layer deeply immersed in the periderm (up to 300 μ m deep), 30–50 μ m thick, covered by 2–3 layers of dead periderm cells filled with clusters of calcium oxalate crystals and small, grey crystals; a thin, prosoplectenchymatous cortex usually present, especially near the ascomata, 10–15 μ m thick. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups,

yellowish green, 8–10 $\times$ 6–8 μ m. Ascomata lirelliform, hemithecioid, straight to flexuose, irregularly branched, causing the bark to swell and hence appearing prominent, but the actual lirellae remaining thin, with lateral thalline margin, 1–5 mm long, 0.5–0.7 mm wide, 0.3–0.5 mm high including the swollen bark; disc concealed; proper margin distinct, forming light brownish yellow labia leveled with the surrounding thallus. Excipulum entire, yellow, apically dark grey, 50–70 μ m wide; laterally covered by dense layer of crystals up to 100 μ m thick; hypothecium prosoplectenchymatous, 10–15 μ m high, yellow; hymenium 60–70 μ m high, colorless, clear; epithecium indistinct to granular, grey. Paraphyses unbranched,

apically smooth; periphysoids short, along the uppermost, dark grey portion of the inner excipulum, 5–10 µm long, shallowly warty, but not spinulose; asci fusiform, 65–70 × 20–25 µm. Ascospores 8 per ascus, irregularly arranged, ellipsoid, submuriform with 3–5 transverse and 0–2 longitudinal septa per segment, 20–25 × 8–10 µm, 2.2–2.7 times as long as wide, hyaline, with thickened outer wall (1–1.5 µm) and thickened septa and rounded lumina, lacking distinct halo, I+ violet-blue.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. One of the more widespread Hawaiian species, known Kaua'i, O'ahu, Maui, and Hawai'i, growing corticolous in woodlands to montane mesic forest on various phorophytes.

Remarks. *Fissurina montiformis* is one of few species with submuriform ascospores found among Hawaiian *Fissurina*. It otherwise features an endoperidermal, ecorticate thallus and labia with slight apical carbonization; the lirellae are typically formed on minute galls apparently induced by the lichen. The new species would key out close to *Fissurina alligatorensis* Lendemer & R.C. Harris, which differs in the absence of gall formations and the somewhat gaping lirellae with indistinct labia, as well as the broader ascospores. *Fissurina montiformis* agrees with *F. brevicarpa*, described above, in the minutely gall-forming lirellae, but the latter has short and broad lirellae and 3-septate ascospores. The closest relative is *F. kokeensis* (see above), with a different morphology and 3-septate ascospores.

Additional specimens examined. USA. Hawaii: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Lihue, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous on *Clermontia* sp.; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36266a, 36266d (B, BISH, F, HAW, PTBG), R. Lücking, B. Moncada & T. Flynn 36267c (B, BISH, F, HAW, PTBG). Kaua'i, Kaua'i County, Na Pali-Kona Forest Reserve, Pihea Trail between Pihea Peak and junction with Alakai Swamp Trail; 22.1522°N, 159.6166°E, 1,227 m; *Metrosideros* dominated wet forest, with *Melicope*, *Elaeocarpus*, *Cheirodendron*, *Clermontia*, *Coprosma*, *Elaphoglossum*, on *Clermontia* branch; 4 Dec. 2013, T. Flynn 7705 (PTBG). O'ahu, Ko'olau Mountains, Waimānalo Forest Reserve, Old Kalaniana'ole Road, Honolulu city Baseyard; 21.372°N, 157.745°E, 79 m; closed woodland of introduced species, on *Heptapleurum actinophyllum*; 21 Aug. 2025, C.W. Smith s.n. (HAW). O'ahu, Waianae District, Waianae Kai Forest Reserve, Honua Stream; 19°40.856'N, 155°9.232'E, 600 m; on *Cordyline terminalis* growing in open area on ridge; 15 Mar. 1975, C.W. Smith 1616 (HAW). O'ahu, Ko'olau Mountains, Waimānalo Forest Reserve, Old Kalaniana'ole Road, Honolulu city Baseyard; 21.372°N, 157.745°E, 79 m; closed woodland of introduced species, on *Hibiscus tiliaceus*; 21 Aug. 2025, C.W. Smith s.n. (HAW). Maui, East Maui, Haleakalā, 1.25 miles west of Pu'u Ni'aniau; 1890–1950 m (6200–6400 ft); corticolous on *Metrosideros* in native forest at tree line; 10 Nov. 1981, C.W. Smith 5049 (HAW). Hawai'i, Hawai'i Volcanoes National Park, Research Centre; 29.4202°N, 155.2472°E, 1,159 m; open lawned area between buildings, on *Metrosideros polymorpha*; 16 Sept. 2019, C.W. Smith s.n. (HAW). Maui island, Maui

County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35818 (B, F). Hawai'i, Hilo District, Puainako St just below Kaumana Road turnoff, *Albizzia* grove on right hand side of the road approaching Hilo; 19°40.856'N, 155°9.232'E, 421 m; corticolous on *Paraserianthes falcataria*; 18 Sept. 2013, C.W. Smith s.n. (HAW).

Fissurina nigriannulata Lücking, B. Moncada & Lumbsch, sp. nov. (Fig. 13A–D)

Index Fungorum IF 905658

Diagnosis: Differing from *Fissurina hyalinella* in the irregular black rim bordering the gaping disc of the lirellae.

Type: USA, Hawaii: Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35814 (BISH – holotype!; B, F – isotypes!).

Etymology. The name reflects the black rim around the gaping disc of the lirellae.

Description. Thallus corticolous, endoperidermal, up to 5 cm diam., continuous; surface smooth to uneven, white, shiny; prothallus absent. Photobiont layer immersed in the periderm (up to 200 µm deep), very irregular, 50–150 µm thick, intermingled with large clusters of calcium oxalate crystals; a prosoplectenchymatous cortex present, 10–20 µm thick. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, bright green to yellowish green, 8–13 × 7–10 µm. Ascomata lirelliform, fissurinoid, straight to flexuose, unbranched to very sparsely branched, immersed to erumpent, with complete thalline margin, 0.5–1.5 mm long, 0.4–0.5 mm wide, 0.2–0.25 mm high; disc slightly gaping, flesh-colored to brownish, slit 0.1–0.2 mm wide; proper margin indistinct, labia absent, but thallus bordering disc with a broad black rim. Excipulum entire, pale yellow, apically dark brown to distinctly carbonized, 20–50 µm wide; laterally covered by thick thalline layer embedded in periderm, including photobiont cells, crystal clusters, and cortex, becoming dark brown in upper and lateral parts and also below the hymenium; basally between excipulum and covering thalline layer a thin layer of colorless, plectenchymatous tissue reacting I+ blue; hypothecium prosoplectenchymatous, 5–10 µm high, colorless to pale yellowish; hymenium 90–100 µm high, colorless, clear, in lateral parts patchily I+ blue; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids short, along the upper, dark brown portion of the inner excipulum, 5–10 µm long, smooth; asci cylindrical, 90–100 × 12–16 µm. Ascospores 8 per ascus, uniseriate, ellipsoid, 3-septate, 15–20 × 6–8 µm, 2.3–2.7 times as long as wide,

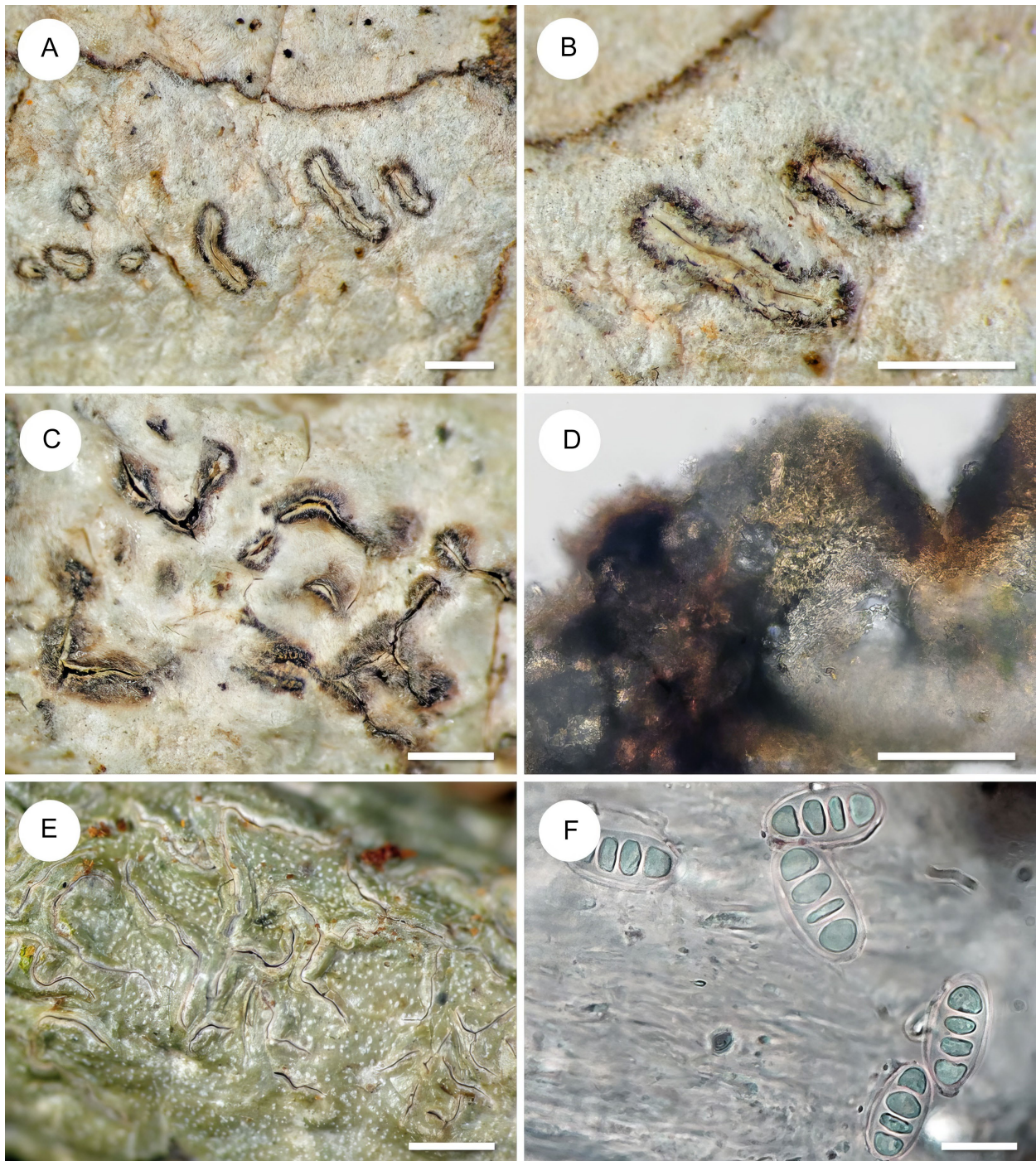


Figure 13. A–D – *Fissurina nigriannulata* (holotype); A–C – thallus with lirellae; D – section through excipulum. E, F – *F. papillosa* (holotype). E – thallus with lirellae; F – ascospores. Scales: A–C, E = 1 mm; D = 100 μ m; F = 10 μ m.

hyaline, with slightly thickened wall and septa and lens-shaped lumina, lacking distinct halo, I[–].

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Similar to *Fissurina montiformis*, known from Koke'e State Park on the island of Kaua'i, in mostly undisturbed montane mesic forest, and from the Lower Waikamoi Preserve on Maui, in disturbed primary forest dominated by *Acacia koa*, in both cases corticolous.

Remarks. This is another new species that compares with *Fissurina hyalinella* in the endoperidermal thallus, the somewhat gaping lirellae lacking labia, and the 3-septate,

non-amyloid ascospores. The main difference is in the distinct, irregular black rim bordering the disc. There is currently no other species known with such a morphology.

Additional specimens examined. USA. HAWAII: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Lihu'e, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous on *Clermontia* sp.; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36266c (F).

Fissurina papillosa Lücking, B. Moncada & C.W. Sm., sp. nov. (Fig. 13E, F)

Index Fungorum IF 905659

Diagnosis: Differing from *Fissurina insidiosa* in the even thallus with numerous, tiny papillae.

Type: USA, Hawaii: O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous on *Pouteria sandwicensis*; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35644 (BISH – holotype!; B, F – isotypes!).

Etymology. The epithet refers to the numerous, tiny papillae on the thallus surface.

Description. Thallus corticolous, epiperidermal, up to 10 cm diam., continuous; surface densely papillose, olive-green, shiny, papillae 0.03–0.05 mm diam., white; prothallus absent. Thallus in section 100–150 µm thick, with dense, massive prosoplectenchymatous cortex 50–80 µm thick, photobiont layer 30–50 µm thick, and medulla 20–30 µm thick, encrusted with small, grey crystals; clusters of calcium oxalate crystals absent except bordering the ascomata. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish to orange green, 10–12 × 7–10 µm. Ascomata lirelliform, fissurinoid to hemithecioid, flexuose to sinuose, irregularly branched, erumpent, with complete thalline margin, 1–4 mm long, 0.3–0.4 mm wide, 0.2–0.25 mm high; disc concealed, visible as dark, grey-brown slit; proper margin distinct, forming thin to distinct labia covered by thalline layer. Excipulum entire, olive, apically dark olive-brown, 25–50 µm wide; laterally covered by corticate thalline layer with large clusters of calcium oxalate crystals above photobiont layer and below cortex; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 10–15 µm high, colorless to pale yellowish; hymenium 90–100 µm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 90–100 × 13–16 µm. Ascospores 8 per ascus, uniseriate, ellipsoid, 3-septate, 15–20 × 7–8 µm, 2–2.5 times as long as wide, hyaline, with slightly thickened outer wall and thickened septa and rounded to lens-shaped lumina, lacking distinct halo, I–.

Secondary chemistry. Stictic acid detected by TLC; thallus in section with K+ persistently yellow efflux.

Distribution and ecology. Known from Kaua'i, O'ahu, and Maui, corticolous in low to mid elevation non-native and native forest.

Remarks. *Fissurina papillosa* is a rather typical *Fissurina*, with corticate, olive-green thallus and fissurine to hemithecioid lirellae. It is somewhat reminiscent of *F. insidiosa* C. Knight & Mitt., which agrees in the erumpent lirellae with more or less distinct labia and the non-amyloid ascospores. However, the thallus of

F. insidiosa is uneven to shallowly verrucose and lacks the minute papillae which are a unique feature of *F. papillosa*. The function of the papillae is not known; they may represent tiny pseudocyphellae, found also in some other crustose lichens, such as *Pyrenula*. Phylogenetically, *F. papillosa* cannot be resolved from *F. serpentina*, which differs in the much longer, radiating lirellae, the lack of papillae, and the absence of secondary compounds. This lack of phylogenetic resolution, combined with a disparate morphology, has also been reported from Hawaiian plants and other lichens (Givnish et al. 2009; Lücking et al. 2017b).

Additional specimens examined. USA. HAWAII: Kaua'i, Kaua'i County, Halele Forest Reserve, along road just beyond Keahua Forestry Arboretum; 22.0726°N, 159.4196°E, 187 m; secondary forest with *Falcataria moluccana*, *Hibiscus tiliaceus*, *Spathodea campanulata*, *Chrysophyllum oliviforme*, *Leucaena leucocephala*, *Miconia crenata*, *Christella* spp., on *Falcataria*; 16 Jul. 2024, T. Flynn 9992 (PTBG); *ibid.*, 190 m; on *Falcataria*; T. Flynn 9988 (PTBG); *ibid.*, 187 m; on *Falcataria*; 16 Jul. 2024, T. Flynn 9993 (PTBG). Kaua'i, Hanalei District; Hono O Na Pali Natural Area Reserve, along Kalalau Trail at Honolulu; 22.2003°N, 159.608°E, 171 m; disturbed coastal forest with *Metrosideros*, *Cordyline*, *Pandanus*, *Nephrolepis*, *Sphenomeris*, from trunk of *Aleurites*; 11 Apr. 2023, T. Flynn 9761 (F, PTBG). Kaua'i, Kaua'i County, Līhu'e-Kōloa Forest Reserve, ridge directly below Iole, just S of Iole Stream; 22.0265°N, 159.4808°E, 325 m; *Psidium* thicket in valley bottom, with *Psidium cattleianum*, *Clidemia*, remnant *Metrosideros*, *Antidesma*, *Ceodes*, on branches of massive *Melastoma*; 19 Sept. 2024, T. Flynn 10082 (PTBG). O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous on *Pouteria sandwicensis*; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35643 (B, F). O'ahu, Wailupe Valley, Laulaupoe Gulch, about 1 km above end of housing development; 21.3085°N, 157.7515°W, 231 m; invasive-dominated mesic forest, moist forest in gulch bottom, from *Aleurites moluccana*, living bark, shady understory; 6 Feb. 2016, K. Faccenda & M. Ross 4260 (BISH). Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35824 (F).

Fissurina sandwicensis Lücking, Kraichak & T. Flynn, sp. nov. (Fig. 14)

Index Fungorum IF 905660

Diagnosis: Differing from *Fissurina fissa* in the larger, muriform ascospores.

Type: USA, Hawaii: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Līhu'e, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous on *Clermontia* sp.; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36267b (BISH – holotype!; B, F – isotypes!).

Etymology. The epithet refers to the older name for the Hawaiian archipelago, the Sandwich Islands.

Description. Thallus corticolous, seemingly epidermal (periderm dissolved), up to 3 cm diam., continuous; surface uneven, white, shiny; prothallus absent. Thallus in section 90–130 μm thick, with dense, prosoplectenchymatous cortex 10–20 μm thick, layer of calcium oxalate crystals intermingled with small grey crystals 50–60 μm thick, and photobiont layer 50–60 μm thick. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, bright green to yellowish green, 8–13 $\times$ 6–10 μm . Ascomata lirelliform, thallolomoid, straight to flexuose,

unbranched, immersed, with complete thalline margin, 0.5–1.0 mm long, 0.2–0.3 mm wide, 0.15–0.2 mm high; disc slightly gaping, dark grey, slit 0.1–0.2 mm wide; proper margin indistinct, labia absent. Excipulum entire, yellow-olive, apically dark brown, 40–60 μm wide; laterally covered by thick layer of crystal clusters and cortex; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 10–15 μm high, yellow-olive; hymenium 90–100 μm high, colorless except for uppermost portion which is aeruginous, clear; epithecium granular, dark aeruginous brown. Paraphyses unbranched, apically smooth; periphysoids short, along

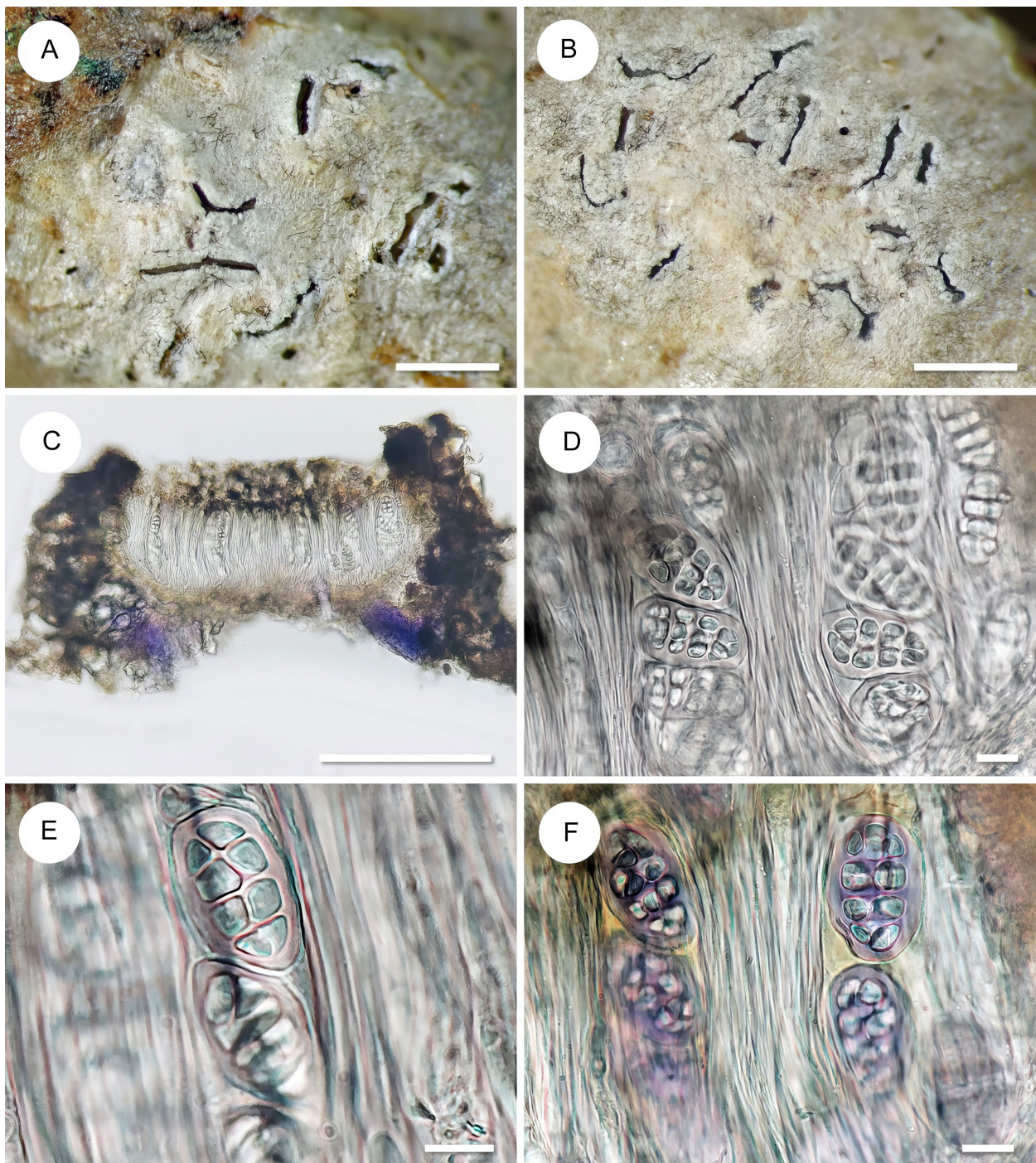


Figure 14. *Fissurina sandwicensis* (holotype). A, B – thallus with lirellae; C – section through lirella; D–F – asci with ascospores, in F after treatment with I. Scales: A, B = 1 mm; C = 100 μm ; D–F = 10 μm .

the uppermost, dark brown portion of the inner excipulum, 5–10 µm long, smooth; asci fusiform, 90–100 × 20–25 µm. Ascospores 4 per ascus, uniseriate, broadly ellipsoid, muriform with 3 transverse and 1–3 longitudinal septa per segment, 25–35 × 18–25 µm, 1.2–1.5 times as long as wide, hyaline, with thick outer wall (1.5–2 µm) and thickened septa and rounded lumina, lacking distinct halo, I+ light blue-violet.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from Kaua'i, O'ahu, and Hawai'i, growing corticolous in diverse types of forests and (non-native) woodlands.

Remarks. *Fissurina sandwicensis* is another new species sharing the same morphology and anatomy as *F. fissa* and *F. mauiensis* (see above). It differs from these two species in the larger, muriform ascospores. Phylogenetically, it is related to *F. fissa*, but distant from *F. sandwicensis*. *Fissurina ilicicola* Lendemer & R.C. Harris, described from North America (Lendemer & Harris 2014), has similarly large, but narrower, muriform ascospores; its thallus somewhat resembles that of *F. sandwicensis*, but lacks a distinct cortex and is instead minutely grainy from large clusters of calcium oxalate crystals, and it has distinct, whitish labia concealing the disc.

Additional specimens examined. USA. HAWAII: O'ahu, Ko'olau Mountains, Roundtop, Mānoa Cliff Trail; 467 m; closed woodland of introduced species, in *Psidium guajava* thicket, on *Cordyline terminalis*; 2 Jul. 1977, G. Daida 469 (HAW). O'ahu, Ko'olau Mountains, Luana Hills on track on Olomana side of the Golf Course; 21.3541°N, 157.7579°E; closed woodland of introduced species, on *Hibiscus tiliaceus*; 13 Aug. 2020, C.W. Smith s.n. (HAW). Hawai'i, Puna District, Kalali Point; 19.6196°N, 154.9449°E, 5 m; coastal, non-indigenous woodland, on fallen *Casuarina equisetifolia* major branch, fully exposed to coastal spray; C.W. Smith, J. Tamaariki & L. Hara s.n. (BISH 803995).

Fissurina serpentina Lücking, B. Moncada & T. Flynn, sp. nov. (Fig. 15)

Index Fungorum IF 905661

Diagnosis: Differing from *Fissurina insidiosa* in the very long, radiating lirellae.

Type: USA, Hawaii: Kaua'i island, Kaua'i County, West Kaua'i, western slopes of Mount Wai'ale'ale, Koke'e State Park, 20 km ENE of Waimea and 35 km NW of Lihue, at end of Koke'e Road, Pihea Trail; 22°08'51"N, 159°37'53"E, 1,250–1,350 m; mostly undisturbed montane mesic forest, corticolous; 15 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36265 (PTBG – holotype!; BISH, F – isotypes!).

Etymology. The epithet refers to the long, flexuose, often radiating lirellae.

Description. Thallus corticolous, epiperidermal, up to 5 cm diam., continuous; surface smooth to uneven, sometimes splitting, light green to mottled white-green, shiny; prothallus absent. Thallus in section 100–150 µm thick, with dense, massive prosoplectenchymatous cortex 30–50 µm thick, photobiont layer 20–40 µm thick, and medulla 50–70 µm thick, medulla and partly also photobiont layer encrusted with large clusters of calcium

oxalate crystals. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish to orange green, 8–12 × 7–10 µm. Ascomata lirelliform, fissurinoid, flexuose to sinuose, irregularly to radiately branched, immersed to erumpent, with complete thalline margin, 3–5 mm long, 0.3–0.4 mm wide, 0.15–0.2 mm high; disc concealed, visible as grey-brown slit; proper margin distinct, forming thin labia covered by thalline layer. Excipulum entire, pale yellowish, 25–50 µm wide; laterally covered by corticate thalline layer; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ violet-blue; hypothecium prosoplectenchymatous, 10–15 µm high, colorless to pale yellowish; hymenium 90–100 µm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 90–100 × 12–16 µm. Ascospores 8 per ascus, uniseriate, ellipsoid, 3-septate, 13–18 × 6–8 µm, 2–2.5 times as long as wide, hyaline, with slightly thickened outer wall and thickened septa and rounded to lens-shaped lumina, lacking distinct halo, I–.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from O'ahu (Mānoa Cliffs Trail), in partially disturbed secondary forest, and from Kaua'i (Koke'e State Park), in mostly undisturbed montane mesic forest, in both cases corticolous. Apparently with a wider ecological amplitude and perhaps overlooked.

Remarks. Hawaiian material of this newly described taxon was previously reported under the name *Fissurina radiata*. The latter shares the radiately branching lirellae, but the labia are usually erumpent, albeit thin, and border a slightly gaping, flesh-colored disc; the ascospores are weakly amyloid. *Fissurina serpentina* is phylogenetically unresolved from *F. papillosa*, although there are several differences: the lack of papillae on the uneven thallus, the very long, radiating lirellae with flat labia, and the absence of secondary compounds. Given the somewhat uneven thallus and the flat labia, the new species also bears some resemblance to *F. insidiosa*, from which it differs clearly in the very long, sinuous, radiating lirellae.

Additional specimens examined. USA. HAWAII: Kaua'i, Kaua'i County, Halelea Forest Reserve, along road just beyond Keahua Forestry Arboretum; 22.0726°N, 159.4196°E, 190 m; secondary forest with *Falcataria moluccana*, *Hibiscus tiliaceus*, *Spathodea campanulata*, *Chrysophyllum oliviforme*, *Leucaena leucocephala*, *Miconia crenata*, *Christella* spp., on *Leucaena* trunk; 16 Jul. 2024, T. Flynn 9980 (PTBG). O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35647 (B, BISH, F).

Fissurina stromatoides (H. Magn.) Luch & Lücking, Willdenowia 48(3): 418. 2018. (Fig. 16A, B)

Type: USA, Hawaii: Hawai'i Island (Big Island), Kohala Mountains, Hamakua Ditch Trail; on 8 mm thick branch of

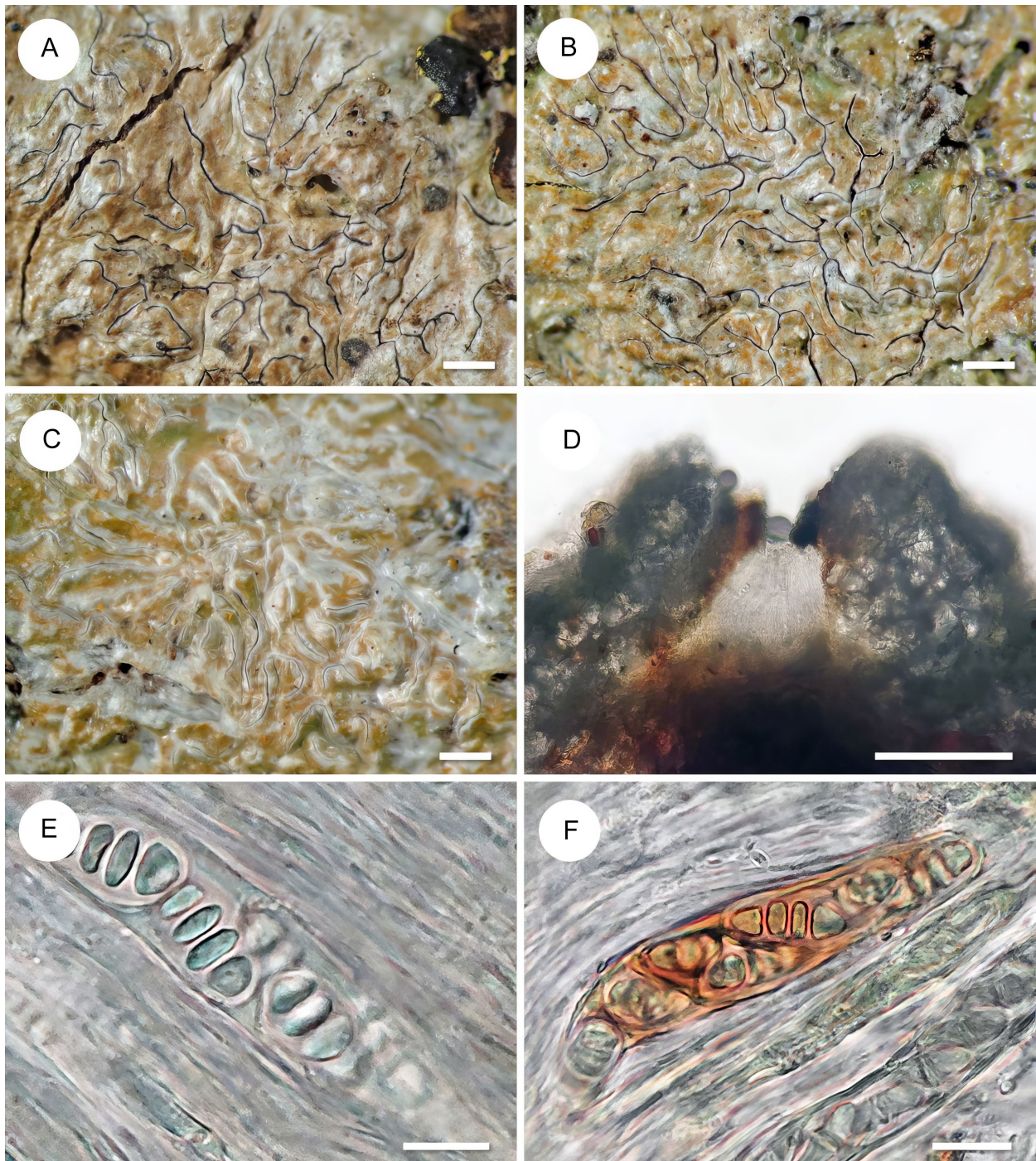


Figure 15. *Fissurina serpentina* (holotype). A–C – thallus with lirellae; D – section through lirella; E, F – ascus with ascospores, in F after treatment with I. Scales: A–C = 1 mm; D = 100 μ m; E, F = 10 μ m.

Rubus hawaiiensis; 1948, F. Fagerling & C. Skottsberg 7088 (S – holotype!).

Description. Thallus corticolous, seemingly epidermal (periderm dissolved), up to 10 cm diam., continuous; surface uneven, white, shiny; prothallus absent. Thallus in section 100–140 μ m thick, with dense, prosoplectenchymatous cortex 20–25 μ m thick, layer of calcium oxalate crystals 50–70 μ m thick, and photobiont layer 20–50 μ m thick. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, bright green to yellowish green, 8–13 $\times$ 7–10 μ m. Ascomata lirelliform, fissurinoid, flexuose, sparsely to irregularly branched,

immersed, with complete thalline margin, 0.5–1.5 mm long, 0.1–0.2 mm wide, 0.12–0.15 mm high; disc concealed; proper margin indistinct, labia absent. Excipulum entire, colorless to pale yellow, 20–30 μ m wide; laterally covered by thick thalline layer including thin periderm, photobiont cells, layer of crystal clusters, and cortex; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 5–10 μ m high, colorless; hymenium 90–100 μ m high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 85–95 $\times$ 12–15 μ m. Ascospores 8 per ascus, uniseriate,

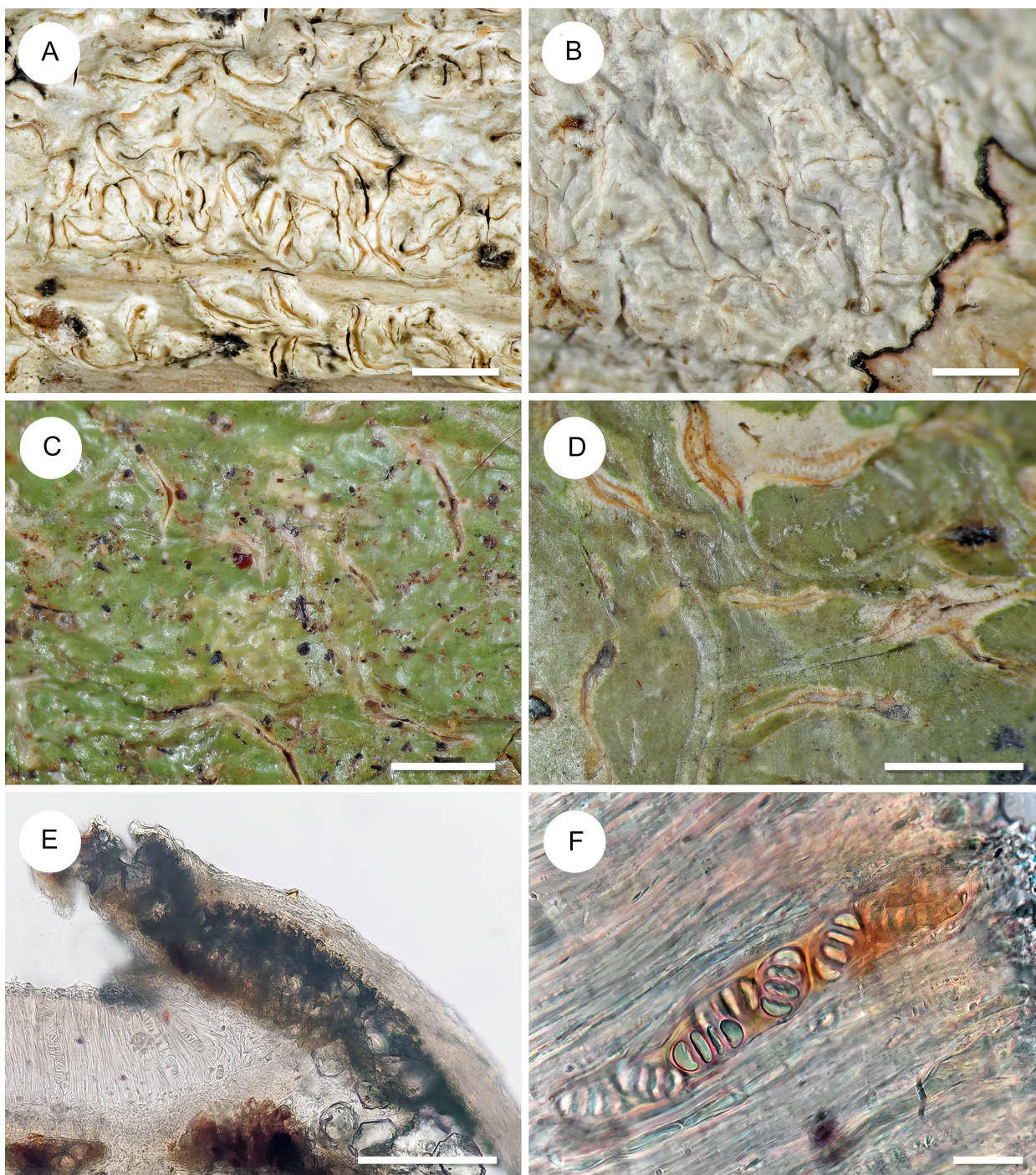


Figure 16. A, B – *Fissurina stromatoides* (A: holotype; B: Lücking et al. 34656), thallus with lirellae. C–F – *F. subcoarctata* (holotype). C, D – thallus with lirellae; E – section through lirella; F – ascus with ascospores. Scales: A–D = 1 mm; E = 100 μ m; F = 10 μ m.

ellipsoid, 3-septate, $15\text{--}18 \times 6\text{--}8 \mu\text{m}$, 2.3–2.7 times as long as wide, hyaline, with thickened wall (1–1.5 μ m) and septa and rectangular to slightly rounded lumina, but lacking distinct halo, I– to very weakly I+ violet.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Found on the islands of O‘ahu and Mau‘i, growing corticolous in low to mid elevation forests and woodlands.

Remarks. The present material is characterized by a seemingly endoperidermal (caused by dissolution of the outer periderm), whitish thallus, which nevertheless features a thin cortex, 3-septate ascospores, and the lack

of secondary substances. In overall morphology, the taxon comes close to *F. fissa* and *F. mauiensis*, from which it can be distinguished by the non-carbonized excipulum. It is otherwise similar to *F. hyalinella*, which has a thinner thallus and lacks a cortex. The type material of *Fissurina stromatoides* agrees with the sequenced specimens and so the name was adopted here. Magnusson (1955) did not explain why he chose the epithet *stromatoides*, but from the discussion it likely refers to the usually dense arrangement of the lirellae.

Additional specimens examined. USA. HAWAII: O‘ahu island, O‘ahu County, Ko‘olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane‘ohe, Mānoa Cliffs

Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35646 (B, F), R. Lücking, B. Moncada & C. Smith 35648 (B, BISH, F); *ibid.*, corticolous on *Myrsine* sp.; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35641 (F). Hawai'i, Hilo District, Puainako St just below Kaumana Road turnoff, *Albizia* grove on right hand side of the road approaching Hilo; 19°40.856'N, 155°9.232'E, 421 m; corticolous on *Paraserianthes falcata*; 18 Sept. 2013, C.W. Smith s.n. (HAW). O'ahu, Ko'olau, Mānoa Valley, Mānoa Falls Trail; 249 m; closed woodland of introduced species, on *Leucena leucocephala*; 18 Sept. 1981; C.W. Smith 7532, P.W. James & T. Nash (HAW). O'ahu, Ko'olau Mountains, Roundtop, Mānoa Cliff Trail; closed woodland of introduced species; 13 May 2023, C.W. Smith s.n. (HAW). Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35816 (F), R. Lücking, B. Moncada & P. Bily 35826 (B, F), R. Lücking, B. Moncada & P. Bily 35827 (B, F).

Fissurina subcoarctata Lücking, B. Moncada & C.W. Sm., sp. nov. (Fig. 16C–F)

Index Fungorum IF 905662

Diagnosis: Differing from *Fissurina coarctata* in the more robust, less crowded lirellae.

Type: USA, Hawaii: O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35651 (BISH – holotype!; B, F – isotypes!).

Etymology. The name refers to the similarity with *Fissurina coarctata*.

Description. Thallus corticolous, epiperidermal, up to 5 cm diam., continuous; surface smooth to uneven, sometimes splitting, light green, shiny; prothallus absent. Thallus in section 150–200 µm thick, with dense, massive prosoplectenchymatous cortex 40–60 µm thick, photobiont layer 20–30 µm thick, and medulla 80–120 µm thick, strongly encrusted with large clusters of calcium oxalate crystals. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish to orange green, 8–13 × 6–10 µm. Ascomata lirelliform, fissurinoid to platythecioid, straight to slightly bent, unbranched to very sparsely branched, immersed, with complete thalline margin, 1–2 mm long, 0.2–0.3 mm wide, 0.13–0.16 mm high; disc slightly gaping, flesh-colored, split 0.1–0.2 mm wide; proper margin indistinct, forming thin labia covered by thalline layer, along the split cream-colored. Excipulum entire, pale yellow to externally olive-brown, 25–50 µm wide; laterally covered by corticate thalline layer; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 10–15 µm

high, colorless to pale yellowish; hymenium 90–100 µm high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 90–100 × 13–16 µm. Ascospores 8 per ascus, uniseriate, ellipsoid, 3-septate, 12–18 × 6–8 µm, 1.8–2.4 times as long as wide, hyaline, with slightly thickened outer wall and thickened septa and rounded to lens-shaped lumina, lacking distinct halo, I– to I+ very faintly violet-blue.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from Kaua'i and O'ahu, growing corticolous in partially disturbed secondary forest.

Remarks. This new species belongs in the *Fissurina dumastii* complex, characterized by a corticate, olive-green thallus, fissurine lirellae, 3-septate ascospores, and lack of secondary substances. Within this complex, it is most similar to *F. coarctata* Makhija & Adaw., in the dispersed lirellae with somewhat gaping disc and the apically smooth paraphyses, as well as the similarly sized ascospores. It differs from the latter mainly in the more robust, less crowded lirellae (less than 1 mm long in *F. coarctata*).

Additional specimens examined. USA. HAWAII: Kaua'i island, Kaua'i County, South Kaua'i, southern slopes of Mount Wai'ale'ale, Kahili Ridge Trail above Kahili Mountain Park, 10 km W of Līhu'e off Kaumuali'i Highway, steep ridge trail; 21°57'52"N, 159°29'29"E, 300–450 m; secondary vegetation formed by dense patches of *Gleicheniaceae* ferns mixed with small groups of introduced and native trees, corticolous; 16 Jun. 2013, R. Lücking, B. Moncada & T. Flynn 36490a (B, BISH, F, HAW, PTBG). O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35650 (B, F). O'ahu, Kawai'iki Ridge; 1,300 ft; 10 May 1945, J.A. Moore s.n. (BISH).

Fissurina subcrassilabra Lücking, Kraichak & C.W. Sm., sp. nov. (Fig. 17)

Index Fungorum IF 905663

Diagnosis: Differing from *Fissurina crassilabra* in the less emergent lirellae with concealed disc and in the only weakly amyloid ascospores.

Type: USA, Hawaii: O'ahu island, O'ahu County, Ko'olau Range, Mānoa Valley, 6 km ENE of Honolulu and 8 km WSW of Kane'ohe, Mānoa Cliffs Trail, Moleka Trailhead to Forestry Exclosure; 21°19'55"N, 157°48'43"E, 410–575 m; partially disturbed secondary forest, with some exposed vegetation and some planted trees, corticolous on *Myrsine* sp.; 09 Jun. 2013, R. Lücking, B. Moncada & C. Smith 35642 (BISH – holotype!; B, F – isotypes!).

Etymology. Referring to the similarity with *F. crassilabra*.

Description. Thallus corticolous, epiperidermal, up to 5 cm diam., continuous; surface uneven to verrucose, light

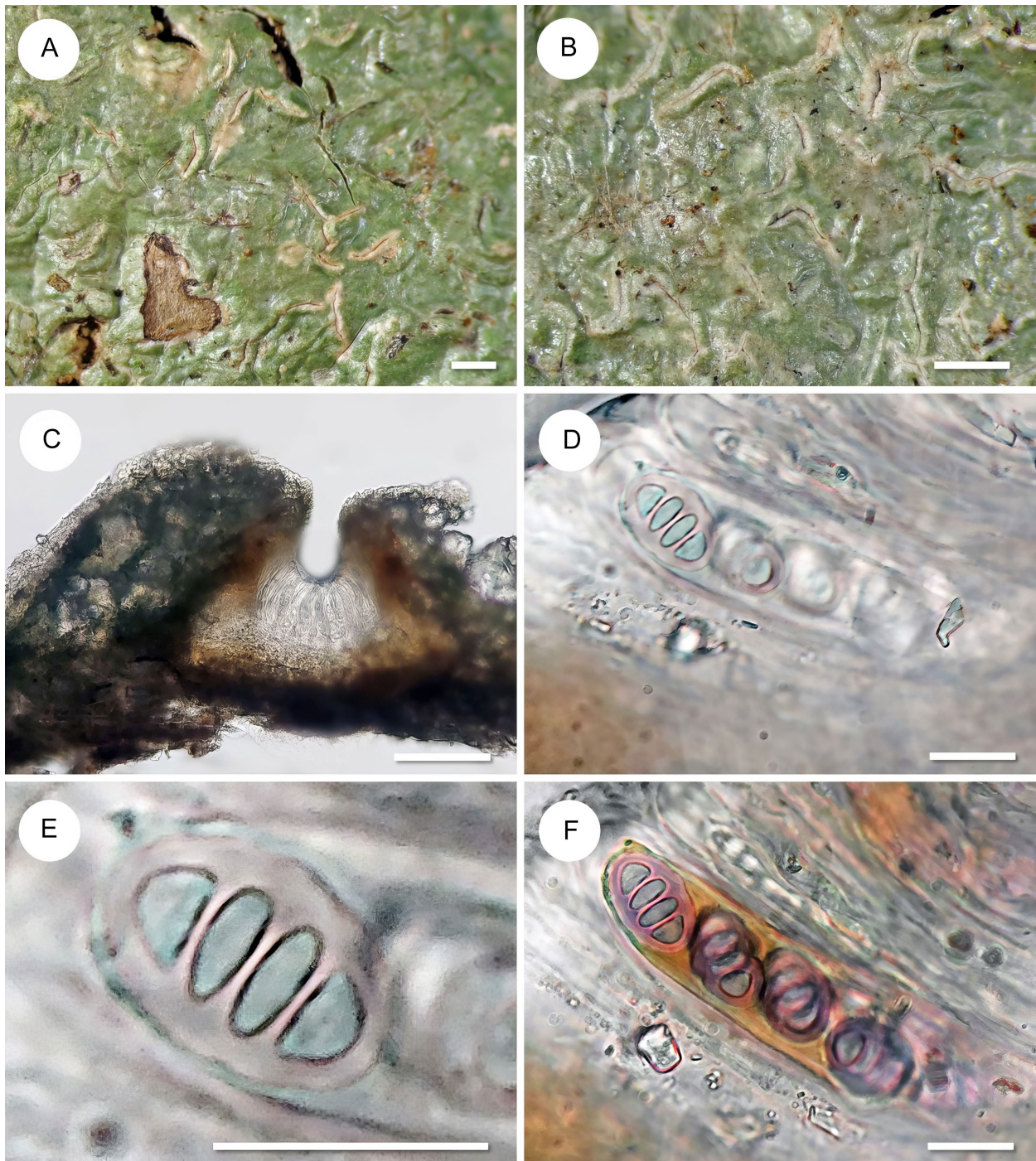


Figure 17. *Fissurina subcrassilabra* (holotype). A, B – thallus with lirellae; C – section through lirella; D–F – asci with ascospores, in F after treatment with I. Scales: A, B = 1 mm; C = 100 μ m; D–F = 10 μ m.

grey-green, shiny; prothallus absent. Thallus in section 100–200 μ m thick, with dense, prosoplectenchymatous cortex 25–50 μ m thick, photobiont layer 25–50 μ m thick, with scattered clusters of calcium oxalate crystals, and medulla 50–100 μ m thick, strongly encrusted with large clusters of calcium oxalate crystals. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, yellowish to orange green, 8–14 $\times$ 7–10 μ m. Ascomata lirelliform, hemithecioid, straight to flexuose, unbranched to sparsely branched, immersed, with complete thalline margin, 1–3 mm long, 0.3–0.4 mm wide, 0.2–0.25 mm high; disc concealed; proper margin distinct, forming thickened labia mostly covered by thalline

layer, along the split and above cream-colored. Excipulum entire, orange-yellow to becoming brownish, 30–60 μ m wide; laterally covered by corticate thalline layer including large clusters of calcium oxalate crystals; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 10–15 μ m high, colorless to pale yellowish; hymenium 90–100 μ m high, colorless, clear; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 90–100 $\times$ 14–16 μ m. Ascospores 8 per ascus, uniseriate, ellipsoid, 3-septate, 15–18 $\times$ 8–10 μ m, 1.7–2 times as long as wide, hyaline, with thick outer

wall (1–1.5 μm) and thickened septa and rounded to lens-shaped lumina, lacking distinct halo, I+ weakly violet.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Known from Kaua‘i, O‘ahu, and Maui, growing corticolous in diverse forests and woodlands from sea level to high elevations.

Remarks. This new species differs from the superficially similar *F. crassilabra* (see above) in the less emergent lirellae with concealed disc and the weakly amyloid ascospores. Phylogenetically, it takes an isolated position in the large, unsupported clade containing most of the Hawaiian *Fissurina*, distant from the Hawaiian material identified as *F. crassilabra*. It is otherwise similar to *F. insidiosa*, but lacks the verrucose appearance of the latter and differs further in the slightly amyloid ascospores. The morphologically similar *F. triticea* differs in the presence of stictic acid.

Additional specimens examined. USA. HAWAII: O‘ahu, Ko‘olau Mountains, Nu‘uanu Valley, Old Pali Highway, close to Board of Water Supply Station; 21.3496°N, 157.8187°E, 249 m; on *Panax guilfoiae*; 8 Aug. 2020, C.W. Smith 082020-5 (HAW). O‘ahu, Pauoa Flats Trail above Pu‘u ‘Ōhi‘a (Tantalus); 21.3393°N, 157.8111°E, 510 m; habitat highly degraded, composed of *Cinnamomum burmannii*, *Ardisia elliptica*, *Eucalyptus* sp., from *Cinnamomum burmannii* bark in wet, shady understory; 27 Feb. 2026, K. Faccenda 4358 (BISH). Maui, East Maui, Hana district, Hanawi Natural Area Reserve; Westing 2296218, Easting 798239, 2040–2165 m (6,700–7,100 ft); wet montane *Metrosideros* forest, east side of Hanawi Stream, above and west of Frisbee Meadow Camp; Oppenheimer H42306 with K. Bustamente, Z. Pezzillo & D. Peters (HAW).

Fissurina subtimidula Lücking, B. Moncada & Lumbsch, sp. nov. (Fig. 18)

Index Fungorum IF 905664

Diagnosis: Differing from *Fissurina fissa* in the much larger ascospores and from *F. sandwicensis* in the 3-septate ascospores.

Type: USA, Hawaii: Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35812 (BISH – holotype!; B, F – isotypes!).

Etymology. This new species is named after its similarity with *Fissurina timidula* in the rather large, amyloid ascospores.

Description. Thallus corticolous, endoperidermal, up to 3 cm diam., continuous; surface uneven, white, shiny; prothallus absent. Photobiont layer immersed in the periderm (up to 100 μm deep), irregular, 30–50 μm thick, intermingled with, and covered by, large clusters of calcium oxalate crystals; cortex absent. Photobiont *Trentepohlia*; cells rounded to irregular in outline, in irregular groups, bright green to yellowish green, 8–14 $\times$ 6–10 μm . Ascomata angular to lirelliform, thallolomoid,

straight to flexuose, unbranched or sparsely branched, immersed, with complete thalline margin, 0.5–1.5 mm long, 0.2–0.3 mm wide, 0.15–0.2 mm high; disc gaping, dark grey, slit 0.1–0.2 mm wide; proper margin indistinct, labia absent. Excipulum entire, yellow-olive, apically dark olive-grey, 40–60 μm wide; laterally covered by thick layer of periderm including crystal clusters; basally between excipulum and covering thalline layer a layer of colorless, plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 10–15 μm high, pale yellow; hymenium 100–110 μm high, colorless except for uppermost portion which is partially aeruginous, clear; epithecium indistinct to granular, dark aeruginous brown. Paraphyses unbranched, apically smooth; periphysoids short, along the uppermost, dark brown portion of the inner excipulum, 5–10 μm long, smooth; asci fusiform, 90–100 $\times$ 12–15 μm . Ascospores 4 per ascus, uniseriate, ellipsoid, 3-septate, 25–35 $\times$ 10–12 μm , 2–3 times as long as wide, hyaline, with thick outer wall (1.5–2 μm) and thickened septa and rounded lumina, lacking distinct halo, I+ violet-blue.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. Collected in the Lower Waikamoi Preserve on Maui, at 1200–1300 m in disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, as well as in the National Tropical Botanic Garden on Kaua‘i, around sea level, on cultivated *Plumeria*.

Remarks. *Fissurina subtimidula* agrees with *F. timidula* (Nyl.) Lücking comb. nov. [bas: *Graphis timidula* Nyl., Flora, Regensburg 69(11): 174. 1886; Index Fungorum IF 905667] in the rather large, amyloid ascospores. Morphologically, the two species are quite distinct, as *F. timidula* has a densely corticate, dark brown thallus and the short lirellae feature conspicuous, whitish labia contrasting with the dark thallus. Another species with similar ascospores is *F. cinereodisca* Altamirano, Colín & N. Sánchez, described from Mexico (Herrera-Campos et al. 2019). It has an endoperidermal yet thinly corticate, greenish thallus with a splitting cortex and thin, roof-like labia. *Fissurina subtimidula* falls in a clade with *F. fissa* and *F. sandwicensis* (Fig. 1). All three are morphologically indistinguishable and form a sort of mini-radiation in Hawai‘i. *Fissurina fissa* also has 3-septate, but much smaller ascospores, whereas those of *F. sandwicensis* are of a similar size as *F. subtimidula*, but muriform.

Additional specimens examined. USA. HAWAII: Kaua‘i, Kaua‘i County, Lawai Valley, National Tropical Botanical Garden, Allerton Garden, *Plumeria* grove around Phoenix House; 21.8948°N, 159.50223°E, 41 m; cultivated, epiphytic on bark of *Plumeria rubra*; 23 May 2013, T. Flynn 7603 (PTBG). Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35828a (B, BISH, F, HAW, PTBG).

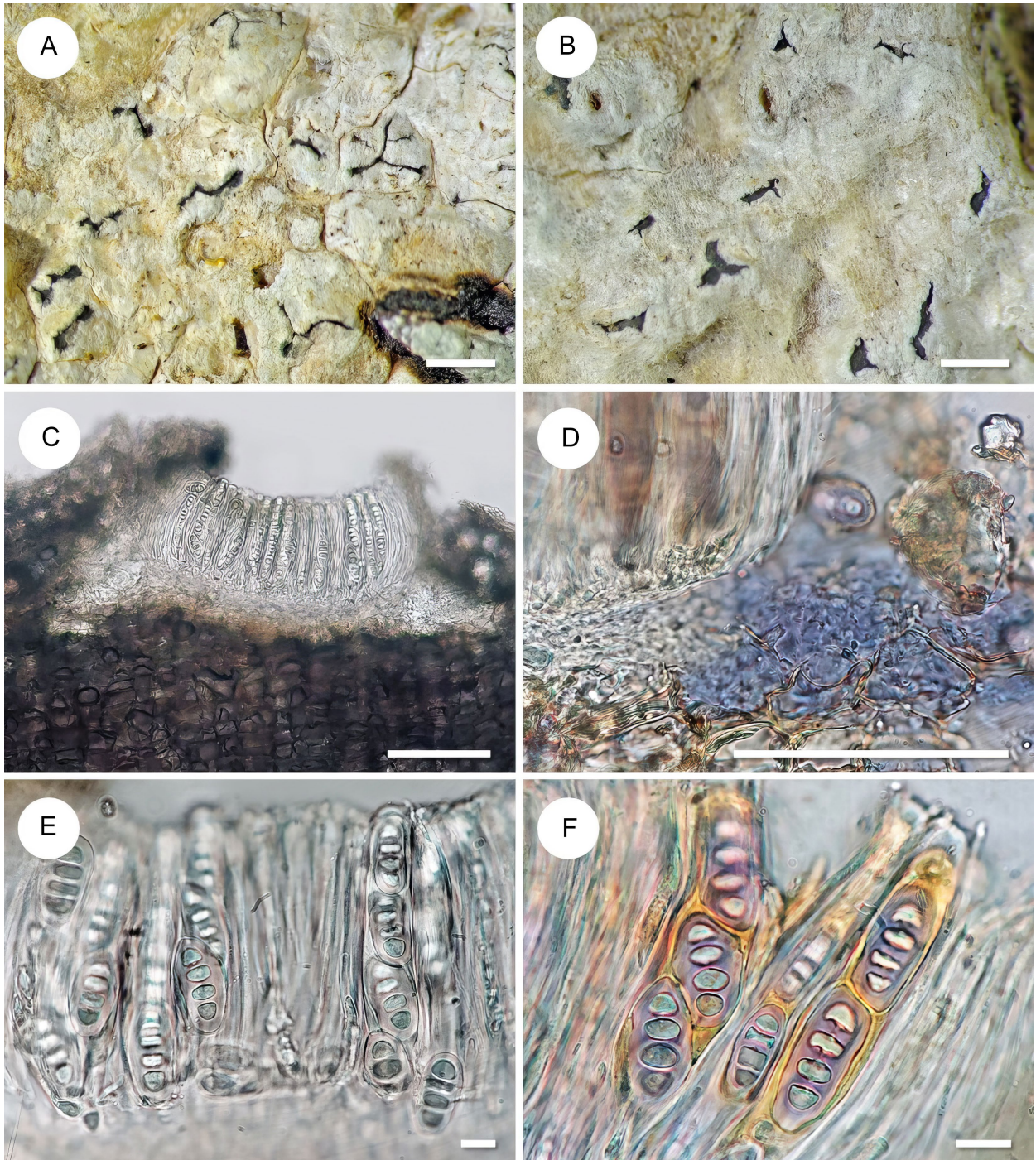


Figure 18. *Fissurina subcrassilabra* (holotype). A, B – thallus with lirellae; C – section through lirella; D – section through lateral/basal excipulum showing I+ blue reaction; E, F – asci with ascospores, in F after treatment with I. Scales: A, B = 1 mm; C, D = 100 μ m; E, F = 10 μ m.

Fissurina zahlbruckneriana Luch & Lücking, Willdenowia 48(3): 421. 2018. (Fig. 19)

≡ *Graphis triticea* f. *lactea* Zahlbr., in Reehinger, Denkschr. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 88: 27. 1911.

Description. Thallus corticolous, endoperidermal, up to 5 cm diam., continuous; surface uneven, white, shiny; prothallus absent. Photobiont layer immersed in the periderm (up to 100 μ m deep), 30–40 μ m thick, covered by 2–3 layers of dead periderm cells filled with large clusters of calcium oxalate crystals; a prosoplectenchymatous cortex present, especially near ascomata, 10–15 μ m thick. Photobiont *Trentepohlia*; cells rounded

to irregular in outline, in irregular groups, bright green to yellowish green, 8–14 $\times$ 7–10 μ m. Ascomata lirelliform, fissurinoid, flexuose, irregularly branched, immersed to erumpent, with complete thalline margin, 1–3 mm long, 0.2–0.3 mm wide, 0.15–0.2 mm high; disc slightly gaping, flesh-colored to brownish, slit 0.1–0.2 mm wide; proper margin indistinct, labia absent, but thallus bordering disc usually with a thin, grey-brown line. Excipulum entire, yellow-olive, apically olive-brown, 20–30 μ m wide; laterally covered by thick thalline layer embedded in periderm, including photobiont cells, layer of crystal clusters, and cortex; basally between excipulum and covering thalline layer a layer of colorless,

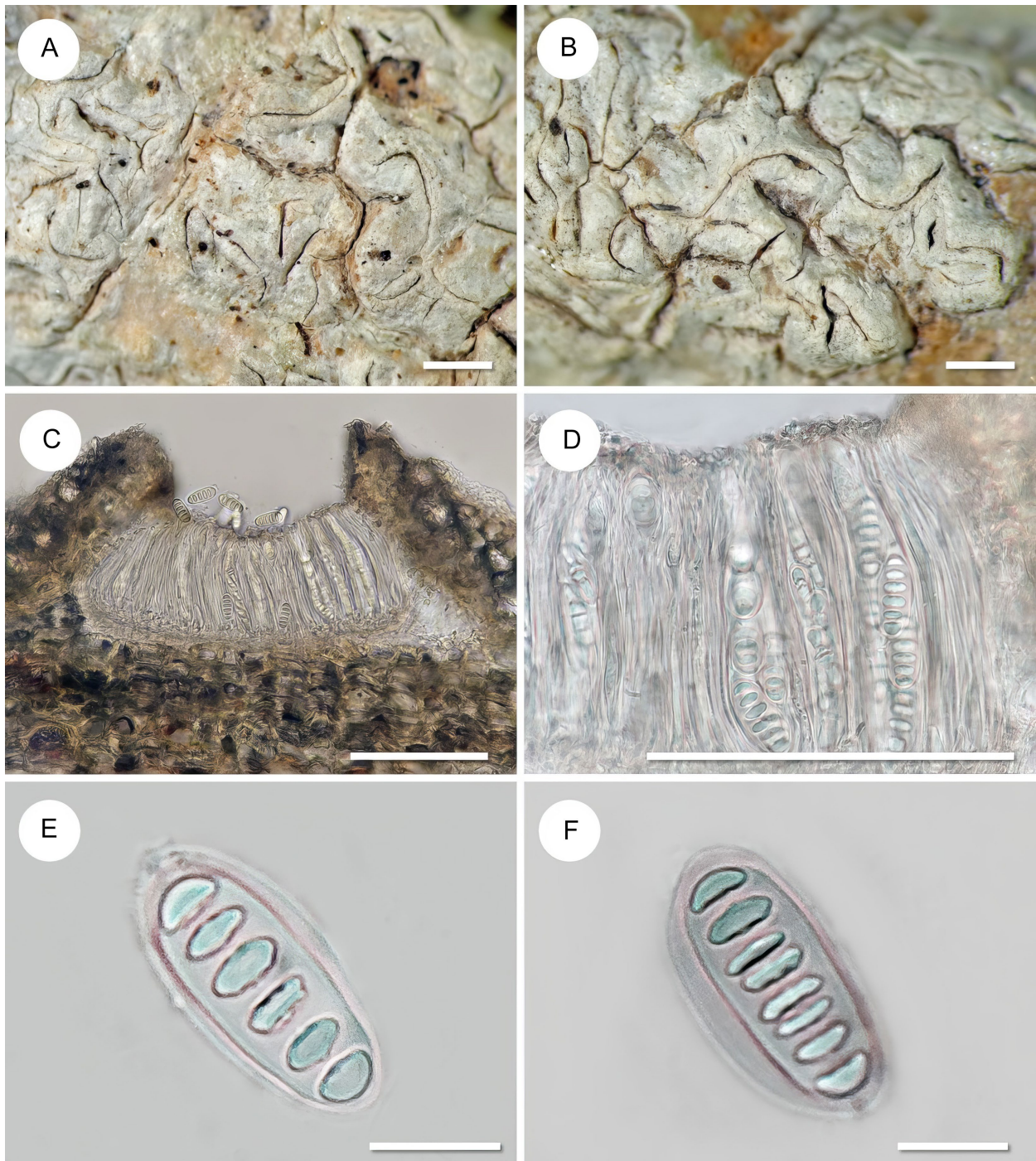


Figure 19. *Fissurina zahlbruckneriana* (Lücking et al. 35822). A, B – thallus with lirellae; C – section through lirella; D – section through hymenium with asci and ascospores; E, F – ascospores. Scales: A, B = 1 mm; C, D = 100 μ m; E, F = 10 μ m.

plectenchymatous tissue reacting I+ sky-blue; hypothecium prosoplectenchymatous, 5–10 μ m high, colorless to pale yellowish; hymenium 100–120 μ m high, colorless, clear, in lateral parts patchily I+ blue; epithecium indistinct. Paraphyses unbranched, apically smooth; periphysoids indistinct; asci cylindrical, 100–110 $\times$ 12–16 μ m. Ascospores 8 per ascus, uniseriate, ellipsoid, (3–)5–7-septate, 20–27 $\times$ 8–11 μ m, 2.3–2.7 times as long as wide, hyaline, with slightly thickened wall and septa and lens-shaped lumina, and distinct halo (caps) at both ends, I– to rarely very weakly I+ violet.

Secondary chemistry. No substances detected by TLC.

Distribution and ecology. In the same habitat as *Fissurina biliana* (see above); known only from the type material of *Graphis triticea* f. *lactea* (Big Island) and from the Lower Waikamoi Preserve on the island of Maui, growing on bark of unidentified trees in disturbed primary forest dominated by then endemic tree species *Acacia koa* A. Gray.

Remarks. We have not been able to locate the type material of *Graphis triticea* f. *lactea*. However, the description given by Zahlbruckner (1911), in particular the 3–5-septate ascospores combined with a white thallus, fits the sequenced material quite well, so we adopted the proposed

replacement name for this taxon (Luch & Lücking 2018), as the combination *Fissurina lactea* is blocked by an earlier name established by Fée. Superficially, *F. zahlbruckneriana* is quite similar to *F. biliana* and *F. hyalinella*, but differs in the larger, up to 7-septate ascospores. The neotropical *F. varieioseptata* Common & Lücking, with 5–7-septate ascospores and an ecorticate thallus, deviates by the shorter and much narrower ascospores (12–18 × 4–5 µm; Lücking et al. 2011).

Specimens examined. USA. HAWAII: Maui island, Maui County, East Maui, Haleakalā Volcano, Lower Waikamoi Preserve (The Nature Conservancy), 5 km SE of Pukalani and 18 km SE of Kahului, lower access trail to preserve off Olinda Road; 20°48'23"N, 156°15'19"E, 1,200–1,300 m; disturbed primary forest dominated by *Acacia koa* and *Campanulaceae*, with invasive *Hedychium gardnerianum* in lower portions, corticolous; 11 Jun. 2013, R. Lücking, B. Moncada & P. Bily 35815 (B, BISH, F), R. Lücking, B. Moncada & P. Bily 35822 (B, F).

Acknowledgements

Data were obtained and field work was done for this study as part of several projects funded by the National Science Foundation: Phylogeny and Taxonomy of Ostropalean Fungi, with Emphasis on the Lichen-forming *Thelotrema* (DEB 0516116 to The Field Museum; PI H.T. Lumbsch; Co-PI R. Lücking), ATM – Assembling a taxonomic monograph: The lichen family *Graphidaceae* (DEB-1025861 to The Field Museum; PI H.T. Lumbsch, CoPI R. Lücking), and Collaborative Research: Evolution, Diversification, and Conservation of a Megadiverse Flagship Lichen Genus (DEB-1354884; PI H.T. Lumbsch, CoPI R. Lücking). BM and RL are grateful to Patrick Bily (The Nature Conservancy Hawai'i), Daniel Pomaika'i (Maui Soil and Water Conservation Districts, Maunala'i Arboretum), and Philip Thomas (Research Corporation of the University of Hawai'i and the Hawaiian Ecosystems at Risk Project), who provided invaluable field assistance on Maui and Kaua'i and shared their profound knowledge of Hawaiian ecosystems and fauna and flora. Jill Kajikawa-Kent (University of Hawai'i) and Rae Matthews and the Clark family (National Tropical Botanical Garden) assisted with logistics. The Hawai'i Department of Land & Natural Resources, Divisions of Forestry and Wildlife and Division of State Parks, kindly provided collecting and research permits. Chelsea Carineo, Wendee Kokubun, Ryan Peralta, Patrick Porter, Matthew Rittenhouse and Lance de Silva are thanked for processing permit requests. Ellen Larsson is thanked for providing high resolution photographs of the specimen previously identified as *Fissurina tachygrapha*. James Lendemer kindly helped clarify the status of *Fissurina cyressi*. Mounes Bakhshi (Royal Botanic Gardens Kew) kindly assisted with bulk registration of the new species names and combinations in Index Fungorum.

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Supplementary electronic materials

File S1. Concatenated alignment of four markers (mtSSU, nuLSU, ITS, RPB2) of the *Fissurina* clade. [Download file](#)

File S2. Best-scoring maximum likelihood tree based on a concatenated alignment of four markers (mtSSU, nuLSU, ITS, RPB2) of the *Fissurina* clade. [Download file](#)

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