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Article

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Four new species of *Hygrocybe* sect. *Pseudofirmae* (Hygrocybaceae, Agaricales) from the Cristalino basin in the Southern Brazilian Amazon

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Abstract

Hygrocybe subgen. *Hygrocybe* sect. *Pseudofirmae,* includes tropical species with dimorphic basidiospores and basidia, and an often perforated pileus. Field expeditions in the Cristalino basin in the Southern Brazilian Amazon revealed four new species of *Hygrocybe* sect. *Pseudofirmae*: *Hygrocybe cristalinoensis*, forming entirely deep green basidiomes, with a convex-umbilicate, perforated pileus and whitish fringed margin; *H. viridilacerata*, characterized by basidiomes with green, umbonate pileus that is perforated at the centre, whitish lamellae and predominantly 2-spored microbasidia; *H. pegleri,* characterized by a squamulose pileus and a long stipe (> 100 mm); and *H. vinaceosquamulosa*, characterized by a squamulose, purple to pink pileus, pale yellow to pinkish lamellae and oblong to cylindrical macrospores with a middle constriction. These new species are proposed based on combined morphological and ITS sequence data. Phylogenetic analyses revealed the placement and uniqueness of the new species in the sect. *Pseudofirmae* clade, and their relationship with close species of the section. Descriptions, illustrations, and phylogenetic analyses results for the new species are provided. In addition, the new species are compared with closely related taxa.

Key words: Funga, ITS, Mato Grosso, phylogeny, taxonomy

Introduction

Hygrocybe subgen. *Hygrocybe* (Fr.) P. Kumm. (1871: 26) includes species with brightly coloured basidiomes, which can sometimes stain black or grey in age or when bruised, with free to adnexed or uncinate lamellae that have a trama with long parallel elements and basidia usually 3 to 5 times the length of their basidiospores (Lodge *et al*. 2013). Species in subg. *Hygrocybe* can be mono- or dimorphic in their basidia and basidiospores sizes and are classified in five sections: *Hygrocybe* (Fr.) P. Kumm., *Chlorophanae* (Herink) Arnolds ex Candusso, *Microsporae* Boertm., *Pseudofirmae* Lodge, Padamsee & S.A. Cantrell, and *Velosae* Lodge, Ovrebo & Padamsee. The dimorphism of basidia and basidiospores was first mentioned by Petch (1917) and was later recognised by various tropical agaricologists (Heinemann 1963, Courtecuisse 1989, Heim 1967, Pegler 1983, Cantrell & Lodge 2001, Lodge *et al*. 2013). These species were classified into a single section within *Hygrocybe*, viz. *Firmae* Heinemann (1963). Recently, in a multi-locus phylogenetic and morphological study, Lodge *et al*. (2013) recognised that the dimorphism had multiple origins,

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occurring in two other sections of *Hygrocybe* subg. *Hygrocybe*, viz. *Pseudofirmae* and *Velosae*, while sect. *Firmae* is now classified in subg. *Pseudohygrocybe* Bon.

Section *Pseudofirmae* groups tropical dimorphic species characterized by having an often-perforated pileus that is smooth to tomentose or squamulose, macrobasidia usually broadly clavate or clavate-stipitate, which are conspicuously wider than the microbasidia, a regular lamellar trama with parallel hyphae often mixed with interwoven refractive hyphae, and a pileipellis that can vary from being a cutis to a trichoderm with or without a gelatinous layer (Lodge *et al*. 2013).

The Brazilian Amazon is a vast territory, but very little is known about its Funga. Therefore, unsurprisingly, recent and ongoing field expeditions in the Brazilian Amazon are resulting in the discovery of many new species (e.g., Komura *et al*. 2016, 2020, Oliveira *et al*. 2021, Silva-Filho *et al*. 2020, 2021, 2023, Cardoso *et al*. 2023, Soares *et al*. 2024). With the increase in deforestation—especially in the Southern Amazon, an area known as the "Arc of Deforestation"—species extinction is expected to occur rapidly (Stropp *et al.* 2020), and many undescribed species are at risk of extinction. From August 2018 to July 2019, 1,702 km^2 of Amazon Forest were deforested in the state of Mato Grosso, representing 16.8% of the total loss of Amazon Forest in the Brazilian territory during this period (INPE 2020).

The Cristalino Private Reserve of Natural Heritage (RPPN) is an important conservation area in this fragile and threatened region. Together with other conservation units such as Cristalino State Park, Juruena National Park, Serra do Cachimbo Springs Biological Reserve, the Indigenous Lands, and the Brazilian Air Force Base, they form a protection layer against the constantly rising deforestation in the region (Fundação Ecológica Cristalino 2025). The Reserve is managed by the NGO Cristalino Ecological Foundation (Fundação Ecológica Cristalino—FEC), and one of its projects is the Cristalino Fungi Project, created in 2015 by the fungal parataxonomist and citizen scientist Susanne Sourell. So far, more than 1,381 fungal collections have been documented in this project and are stored at the FLOR Fungarium (Neves *et al*. 2018). The main goal of the project is to raise awareness about fungal conservation, highlighting the importance of protecting forests, especially in the constantly threatened Southern Amazon.

In this study, we propose four new species of subgen. *Hygrocybe* sect. *Pseudofirmae* from the Cristalino basin Amazon Forest in Mato Grosso state, based on morphology and ITS sequence data, inferring their uniqueness and relationships with close species in phylogenetic analyses. An identification key to the species of *Hygrocybe* subg. *Hygrocybe* sect. *Pseudofirmae* occurring in Brazil, including the newly described species, is provided.

Material and methods

Study area

The specimens were collected in RPPN Cristalino, located along the Cristalino River in the very North of the Mato Grosso state, close to the boundary with the Pará state, between Alta Floresta and Novo Mundo municipalities, in the Southern Amazon (9°35'51" S, 55°55'52" W). The Cristalino River is a tributary of the Teles Pires River, which empties into the Tapajós River, the fifth-largest tributary of the Amazon River (WCS 2025). The area is characterised mostly by clayish soils typical of *terra-firme* (upland) forests (Pires & Prance 1985).

Morphological analysis

Specimens were photographed *in situ*, tagged with collection details (Rathnayaka *et al.* 2025), taken to the laboratory, and morphologically described while still fresh. Specimens were dried at 40ºC until no more moisture was left and preserved in zipped plastic bags (Hu *et al*. 2022). Morphological descriptions were conducted following Largent (1986) and Largent *et al*. (1977). Colour codes are from the *Online Auction Color Chart* (Kramer 2004). Micromorphological features were observed in a LEICA DM2500 microscope under magnifications of 1000x from hand-cut sections of different parts of the basidiomes mounted in KOH 3% or 5% and Congo Red 1%, and another section mounted with Melzer's reagent. Thirty macrospores and 30 microspores of each specimen were measured, excluding the hilar appendage. The basidiospore quotient (Q, length/width ratio) and mean values were calculated for each specimen, separately for macro- and microspores. The mean values for basidiospore dimensions and Q are indicated between the measurements in italic font. Specimens were deposited at FLOR Fungarium, and new names were registered in the MycoBank database. A fragment of each specimen was crushed on FTA Cards to preserve DNA for later extraction.

Phylogenetic analyses

Under the registration number A76D0E6 on the platform of the National System for the Management of Genetic Heritage and Associated Traditional Knowledge (SISGen) in accordance with Brazilian Law 13.123/2015, the samples were sent abroad for DNA sequencing. Following the protocols of Dentinger *et al.* (2010), DNA extraction, PCR amplification, purification, and sequencing were conducted at the Molecular Systematics Laboratory of the Royal Ontario Museum (ROM). Genomic DNA was extracted from the samples in the FTA Cards. ITS1F/ITS4 primers were used to amplify the Internal Transcribed Spacer (ITS) (Gardes & Bruns 1993, Lodge *et al*. 2013, White *et al*. 1990) as the ITS is informative for distinguishing and relating closely related *Hygrocybe* species (Lodge *et al*. 2013). Reads were checked for quality, assembled, and edited in Geneious R7 (https://www.geneious.com). The sequences were deposited in the GenBank NCBI database (https://www.ncbi.nlm.nih.gov/genbank/).

The Dataset 1 strategy for the phylogenetic analysis was to combine ITS+LSU data, where ITS resolves more terminal nodes and LSU, more conservative, resolves deeper nodes, providing a backbone framework. BLAST searches were conducted using the ITS queries and the newly produced sequences against the NCBI GenBank database. Within the first hundred entries deemed the closest in GenBank, identified via BLAST searches of each query, entries of species belonging to *Hygrocybe* subg. *Hygrocybe* representing sect. *Pseudofirmae*, sect. *Hygrocybe* and sect. *Chlorophanae* were selected in particular when the LSU of the corresponding specimens was also available. Representatives of *Hygrocybe* subg. *Pseudohygrocybe* were selected to serve as the outgroup. All ITS and LSU sequences, when corresponding to the same specimen, were downloaded from the GenBank database (Table 1). Non-determined taxa were included in the analyses to fill gaps in diversity within the sampling space.

The ITS and LSU datasets were separately aligned using Muscle v3.8.31 (Edgar 2004). The alignments were edited in Geneious R7 to resolve ambiguous blocks and trim ends. The best-scored nucleotide substitution models for each dataset were selected in ModelTest-NG (Darriba *et al*. 2020) using the AKAIKE Information Criterion (AIC). The best model for both datasets was GTR+I+G. Then, the ITS and LSU datasets were combined using the concat.jar application. For the specimens lacking LSU, missing data were allowed by filling with an unspecified base (N), ensuring that each clade and subclade has representatives including LSU sequences, and aiming for a balanced framework for grouping more terminal branches resolved by ITS data. Based on the resulting tree from the Dataset 1 analyses, a more restricted Dataset 2 of the species clade in which the new species were grouped (sect. *Pseudofirmae* clade) was prepared, using only ITS for a single-locus analysis, with some representatives of sect. *Hygrocybe* as the outgroup.

Maximum Likelihood analyses (ML) were conducted in RAxML 7.0.4 (Stamatakis 2006) using fast-bootstrapping with 1,000 pseudoreplicates, implementing GTRGAMMAI with GAMMA+P-Invar Model parameters estimated up to an accuracy of 0.001 Log Likelihood units for both Dataset 1 and 2. The best-scored ML tree was chosen after full ML optimization. Bayesian analyses (BA) were performed in MrBayes 3.2.1 (Ronquist *et al*. 2012), consisting of MCMCMC using selected models to determine the parameters Nst = 6 for both partitions. The BA implemented two independent runs of: 1) 10,000,000 generations, sampling every 1,000 generations, six independent chains, and two swaps for the Dataset 1; and 2) 1,000,000 generations, sampling every 100 generations, four independent chains, and two swaps for the Dataset 2. The burn-in was set at 10%. Final BA trees were summarized using the 50 % majority-rule consensus method. Branch lengths were summarized from the 95 % highest posterior density trees. The trees generated were visualized in FigTree v1.4.3 (Rambaut 2007) and edited in CorelDraw X7 (Corel Corporation ©).

TABLE 1. Sequences used in the phylogenetic analyses, including taxon name, country, voucher, and GenBank accession numbers for ITS and LSU. Sequences generated in this study are presented in bold type. MD indicates missing data.

Taxon	Country	Voucher	ITS	**LSU**
Hygrocybe acutoconica	Ukraine	CWU(MYC)8343	OK157454	MD
Hygrocybe acutoconica	Ukraine	CWU(MYC)8339	OK157449	MD
Hygrocybe acutoconica	Canada	ubco39	OP456289	MD
Hygrocybe acutoconica	USA	MICH139910	OM985861	MD
Hygrocybe acutoconica var. *microspora*	USA	OMDL iNat 164322057	OR987249	MD
Hygrocybe acutoconica var. *microspora*	USA	PUL:PUL00034569(2)	ON561595	MD

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TABLE 1. (Continued)

Taxon	Country	Voucher	ITS	**LSU**
Hygrocybe acutoconica var. *microspora*	USA	OMDL iNat 173306097	OR785940	MD
Hygrocybe acutoconica var. *microspora*	USA	OMDL iNat 176367795	OR824663	MD
Hygrocybe acutoconica var. *microspora*	USA	OMDL MO 520623	OR783493	MD
Hygrocybe acutoconica var. *pallidocarnea*	Spain	AH39432	PP965551	PP965546
Hygrocybe acutoconica var. *pallidocarnea*	Italy	SIENA-5495	PP965547	MD
Hygrocybe acutoconica as *H. persistens*	USA	TRTC155647	JN021038	MD
Hygrocybe acutoconica as *H. persistens*	Switzerland	KN_1149	OR194908	KF291169
Hygrocybe acutoconica as *H. persistens*	Italy	9266	JF908062	MD
Hygrocybe acutoconica as *H. persistens*	Australia	MEL:2416713	OL771708	MD
Hygrocybe acutoconica as *H. persistens*	China	G06.seq	OP317307	MD
Hygrocybe chloochlora	Puerto Rico	SAC-PR-9899 (CFMR PR-5350)	KF381522	MD
Hygrocybe aff. *chloochlora*	Belize	CFMR BZ-3042	EU435147	EU435147
Hygrocybe chlorophana	Denmark	CFMR Boertmann 2002/9	EU435148	EU435148
Hygrocybe chlorophana	Sweden	F282	PQ641308	PQ641308
Hygrocybe citrinovirens	Sweden	F1249	PQ653342	PQ653342
Hygrocybe citrinovirens	Sweden	MV1008	PQ653436	PQ653436
Hygrocybe citrinovirens	United Kingdom	RBG Kew K(M)126565	EU784292	MD
Hygrocybe citrinovirens	Hungary	isolate_H44	FM208889	MD
Hygrocybe citrinovirens	United Kingdom	RBG_Kew_K_M_126105	EU784291	MD
Hygrocybe citrinovirens	Switzerland	13140	OP538820	MD
Hygrocybe citrinovirens	Switzerland	12126	OP538807	MD
Hygrocybe citrinovirens	Hungary	isolate_H2	FM208853	MD
Hygrocybe citrinovirens	United Kingdom	RBG Kew K(M)12694	EU784293	MD
Hygrocybe conica	China	HMJAU61878	ON045774	ON046286
Hygrocybe conica	India	KUBOTKRMK202061	MW449855	MW449854
Hygrocybe conica var. *conicoides*	China	QHU20235	OM970939	OM942720
Hygrocybe cristalinoensis	**Brazil**	**CJL647_FLOR67406**	**PX675223**	MD
Hygrocybe cristalinoensis	**Brazil**	**JS556_FLOR67424**	**PX675224**	MD
Hygrocybe cristalinoensis	**Brazil**	**CJL652_FLOR67408**	**PX675225**	MD
Hygrocybe sp. as *H. flavescens*	China	HMJAU61910	ON054950	MD
Hygrocybe chlorophana as *H. flavescens*	United Kingdom	RBG Kew K(M)61287	EU784301	MD
Hygrocybe helobia as *Pseudohygrocybe coccineocrenata var. sphaginophila*	Russia	A. Kovalenko 99-9-1 (LE)	KF291182	KF291183
Hygrocybe helobia	Sweden	F2639	PQ652789	PQ652789
Hygrocybe helobia	Italy	14600	JF908056	MD
Hygrocybe konradii	Mexico	ECO-TA-HO 7869	MF156251	MD
Hygrocybe konradii	Malta	SM670 (B436a)	OR567846	MD
Hygrocybe konradii var. *konradii*	China	QHU20330	OM970947	MD
Hygrocybe macrosiparia	Ecuador	QCAM4359	KY582490	KY582490

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TABLE 1. (Continued)

Taxon	Country	Voucher	ITS	**LSU**
Hygrocybe miniata as *Pseudohygrocybe coccineocrenata*	Russia	Kovalenko 00-7-209 (LE)	KF291179	KF291180
Hygrocybe miniata	Canada	ubc f16574	FJ627028	FJ627028
Hygrocybe miniata	Slovakia	SNMH250	MW996448	MW996446
Hygrocybe miniata	Canada	UBC F16295	EU486456	EU486456
Hygrocybe miniata	Australia	MEL:2060103	OL771710	MD
Hygrocybe miniata f. *longipes*	USA	AFTOLID_1891	DQ490630	DQ457677
Hygrocybe mollis	United Kingdom	RBG Kew K(M)139410	EU784329	MD
Hygrocybe mollis var. *mollis*	United Kingdom	RBG Kew K(M)62585	EU784330	MD
Hygrocybe nigrescens	China	clone_58	MZ919418	MD
Hygrocybe nigrescens var. *brevispora*	Puerto Rico	SAC-0005 (CFMR PR-5964)	KF291130	KF291131
Hygrocybe occidentalis	French Guiana	RC-Guy-09-073	MK546630	MD
Hygrocybe occidentalis	French Guiana	RC-GUY-12-075	MK546842	MD
Hygrocybe occidentalis var. *occidentalis*	Puerto Rico	PR-6493	EU435151	EU435151
Hygrocybe cf. *occidentalis*	Ecuador	RLC_633_iNat_122526305	OQ878423	MD
Hygrocybe pegleri	**Brazil**	**JS561_FLOR67428**	**PX675227**	MD
Hygrocybe* aff. *pegleri	**Brazil**	**JS593_FLOR67453**	**PZ577558**	MD
Hygrocybe acutoconica as *H. persistens* var. *persistens*	Canada	4613HRL_1176	KM248897	MD
Hygrocybe prieta	French Guiana	RC-GUY-12-095	MF038954	MD
Hygrocybe pseudoconica	Italy	5159	JF908060	MD
Hygrocybe rosea	Puerto Rico	DJLPR4_CFMR_PR6526	KF291197	KF291198
Hygrocybe sangayensis	Ecuador	QCAM4254	KY582489	KY582489
Hygrocybe sp.	Sweden	DS2024b_SNMH798	MD	OR614491
Hygrocybe sp.	Spain	JP2024a_AH60277	MD	PP965548
Hygrocybe sp.	Sweden	DS2024b_SNMH798	OR614484	MD
Hygrocybe sp.	Ecuador	RLC_780_iNat_126148798	OQ878431	MD
Hygrocybe sp.	Ecuador	RLC83	OQ211589	MD
Hygrocybe sp.	Thailand	NanCU3	AB453022	MD
Hygrocybe sp.	Spain	JP2024a_AH60277	PP965552	MD
Hygrocybe sp. *'poena'*	Ecuador	QCAM4115	MN419324	MN419324
Hygrocybe sp. 1	Australia	GMB2014_MEL_2382719	KP012900	MD
Hygrocybe spadicea	United Kingdom	GriffithHafod 26Oct2006	KF291199	MD
Hygrocybe spadicea	United Kingdom	DJH2003	MT940836	MD
Hygrocybe spadicea	United Kingdom	GriffithWauenfawr 25Oct2006	KF291201	MD
Hygrocybe spadicea var. *spadicea*	Hungary	H32	FM208879	MD
Hygrocybe sparsifolia	China	GDGM_40080	KJ747391	KJ747393
Hygrocybe vinaceosquamulosa	**Brazil**	**JS543_FLOR67412**	**PX675228**	MD
Hygrocybe viridilacerata	**Brazil**	**JS583_FLOR67446**	**PX675226**	MD
Hygrocybe* aff. *viridilacerata	**Brazil**	**JS555_FLOR67423**	**PZ577559**	MD
Hygrophoraceae sp.	USA	iNat87025957	ON856353	MD
Uncultured fungus clone	Puerto Rico	GL12217_110_S049	KY687683	KY687683

Results and discussion

Phylogeny

The ML phylogenetic analyses of Dataset 1 resulted in the best-scoring tree depicted in Figure 1, which agrees with the BA tree (not shown) and is largely congruent with the results presented in Lodge *et al.* (2013). The nodes include the bootstrap (BS) and posterior probability (PP) statistical support values resulting from the ML and BA analyses, respectively. Three out of the five sections of subgenus *Hygrocybe* are represented in distinct clades in Figure 1: sect. *Hygrocybe* is sister to sect. *Pseudofirmae* with moderate support (BS 73/ PP 0.95), and sect. *Chlorophanae* is basal (BS 84 / PP 1.0). The four new *Hygrocybe* species presented here branched within a clade representing sect. *Pseudofirmae*, whose monophyly is strongly supported (BS 88 / PP 1.0), which provides phylogenetic evidence for their classification in that section. Likewise, in Dataset 1, the relationship among species in the Dataset 2 tree (Figure 2) is not well-resolved nor supported, even for the analysis restricted to the sect. *Pseudofirmae* using only ITS. Only species-levels or a few branches are supported, indicating that ITS alone cannot resolve relationships (Figure 2) and suggesting no improvement in this strategy.

In the Dataset 1 tree (Figure 1), *H. vinaceosquamulosa sp. nov.* is sister to *H. sangayensis* (BS 90 / PP 0.98); these two species are followed by *H. macrosiparia*, then *H. pegleri sp. nov.*, then *H.* aff. *pegleri*. All these five species form a clade with strong support (BS 87 / PP 0.99). In the Dataset 2 tree (Figure 2), based only on the ITS, however, *H. vinaceosquamulosa sp. nov.* is clustered sister to *H. macrosiparia*, with weak support (BS 70), and these are sister to *H. sangayensis* (BS 87 / 1.0). *Hygrocybe* aff. *pegleri* is morphologically similar to *H. pegleri sp. nov.* and was previously thought to be conspecific, but it diverged as paraphyletic, and these two are genetically very distinct (82.47% E-value 8e-113 based on the ITS). *Hygrocybe cristalinoensis sp nov.* (BS 100 / 1.0) formed an independent branch, not closely related to any species in the clade, both in the Datasets 1 and 2 trees (Figures 1 and 2). *Hygrocybe viridilacerata sp. nov.* is sister to *H.* aff. *viridilacerata* (Figures 1 and 2), which was previously considered conspecific based on morphology. However, these are genetically divergent (88% E-value 2e-142 based on the ITS), and the branch support is moderate (BS 74/PP 0.99 in the Dataset 1 tree and BS 78/PP 1.0 in the Dataset 2 tree). This species is also not closely related to other species in the sect. *Pseudofirmae* clade.

Taxonomy

Hygrocybe cristalinoensis J.S. Cardoso, M.A. Neves & J.S. Oliveira, *sp. nov.* (Figs. 3. a–c, 5)
MycoBank # 861151

Etymology:—*cristalinoensis* refers to the type locality, the Cristalino River Region.

Type:—BRAZIL. Mato Grosso: Alta Floresta, Reserva Particular do Patrimônio Natural Cristalino, Trilha do Francisco, 9º35'52" S, 55º56'12" W, 250 m, 4 January 2019, *Santos, C.* CJL647 (FLOR67406, holotype!). GenBank: PX675223 (ITS).

Diagnosis:—Basidiomes entirely deep green, pileus convex-umbilicate, perforated, with whitish fringed margin. Differs from *Hygrocybe prieta* Lodge & Pegler (1990: 453) in the lack of purple, red and orange tints in the basidiomes and presence of cheilocystidia.

Description:—*Pileus* 10–36 mm diam., convex when young, then becoming umbilicate, often perforated at the centre, smooth, radially fibrillose, moist to lubricous, intense dark green (oac103) or sometimes leaf green (oac89), with flushes of olive green (oac866) to brownish green (oac831), light green (oac75) to yellowish-green (oac24, oac10) at the centre, translucent-striate towards margin; margin straight to slightly incurved, with a whitish to very pale green (oac51) minutely appendiculate fringe. *Lamellae* decurrent to uncinate, subdistant, narrow to broad, up to 6 mm broad, green (oac82, oac112); edge entire or eroded, very pale green (oac67) to pale yellow (oac858); lamellulae of one or two lengths. *Stipe* (20–) 49–104 × 2–7 mm, central, regular to flexuous, hollow, tapering towards the base, dry to lubricous, silky, fibrillose, vivid green (oac103) at the apex, then fading to lighter hues of green (oac89, oac68, oac77), base yellow (oac5, oac857) to whitish.

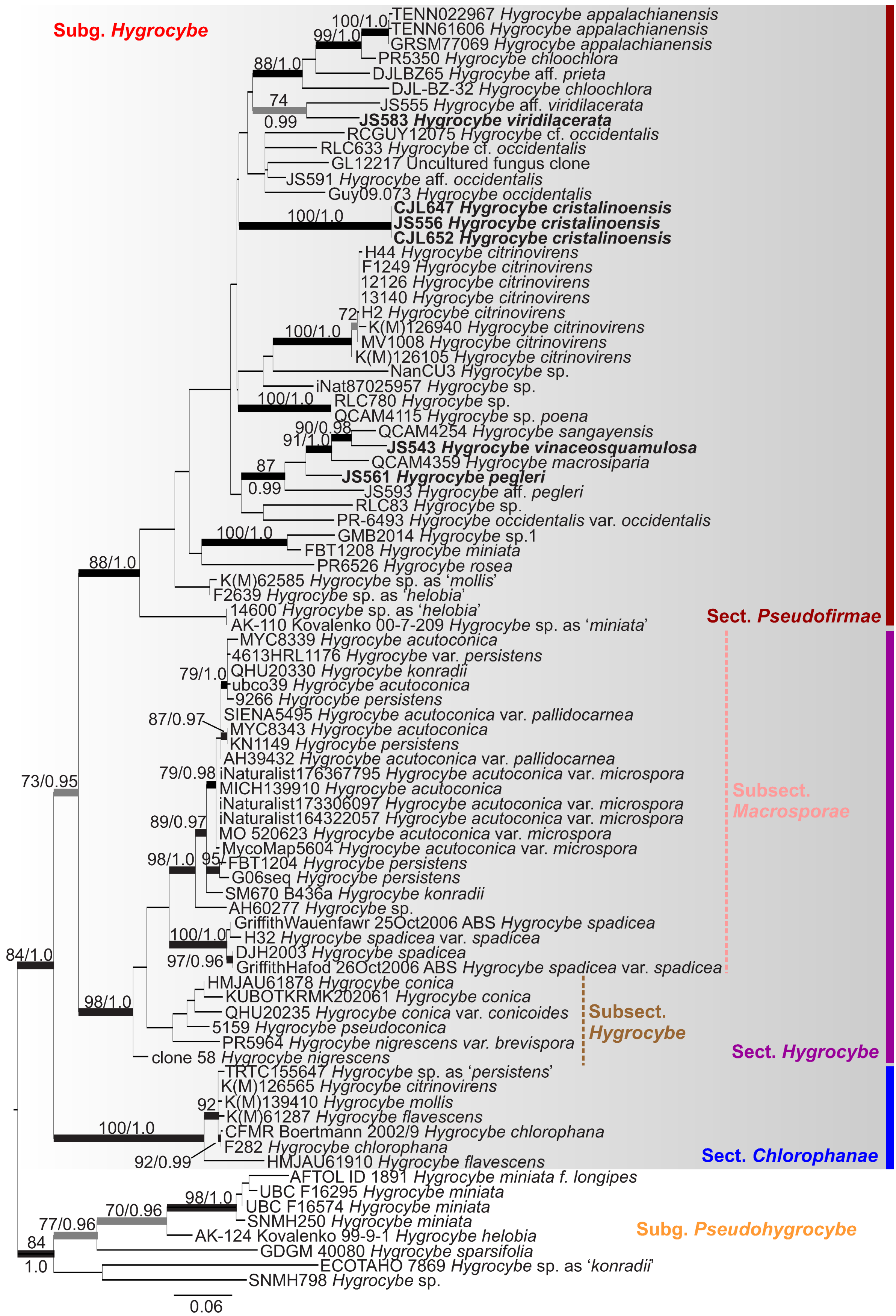

FIGURE 1. ML phylogenetic tree of concatenated ITS and LSU Dataset 1. Branches in black bold are those with pp ≥ 0.97 and bootstrap ≥ 80 %, branches in grey bold are those with pp 0.95–0.97 and bootstrap 70–80%.

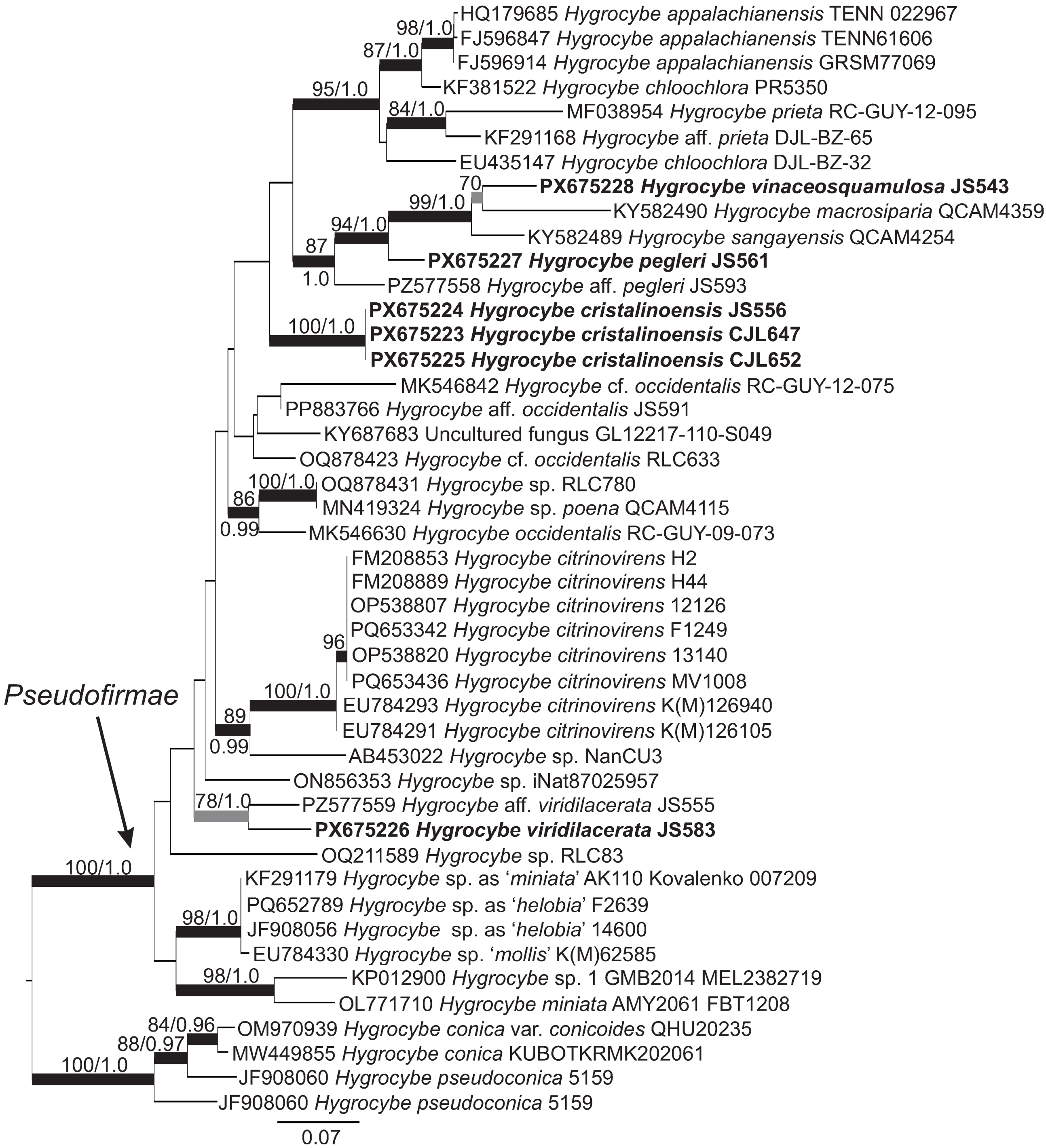

FIGURE 2. ML phylogenetic trees of the ITS Dataset 2 composed of the sect. *Pseudofirmae* clade. Branches in black bold are those with pp ≥ 0.97 and bootstrap ≥ 80 %, branches in grey bold are those with pp 0.95–0.97 and bootstrap 70–80%.

FIGURE 3. a–c. *Hygrocybe cristalinoensis* (JS251). d–h. *Hygrocybe pegleri*. e, f, g. JS561; d. JS268; h. JS551. Scales = 10 mm, except for h, scale = 5 mm. Photos a–c by S. Sourell, d–h by J.S. Cardoso.

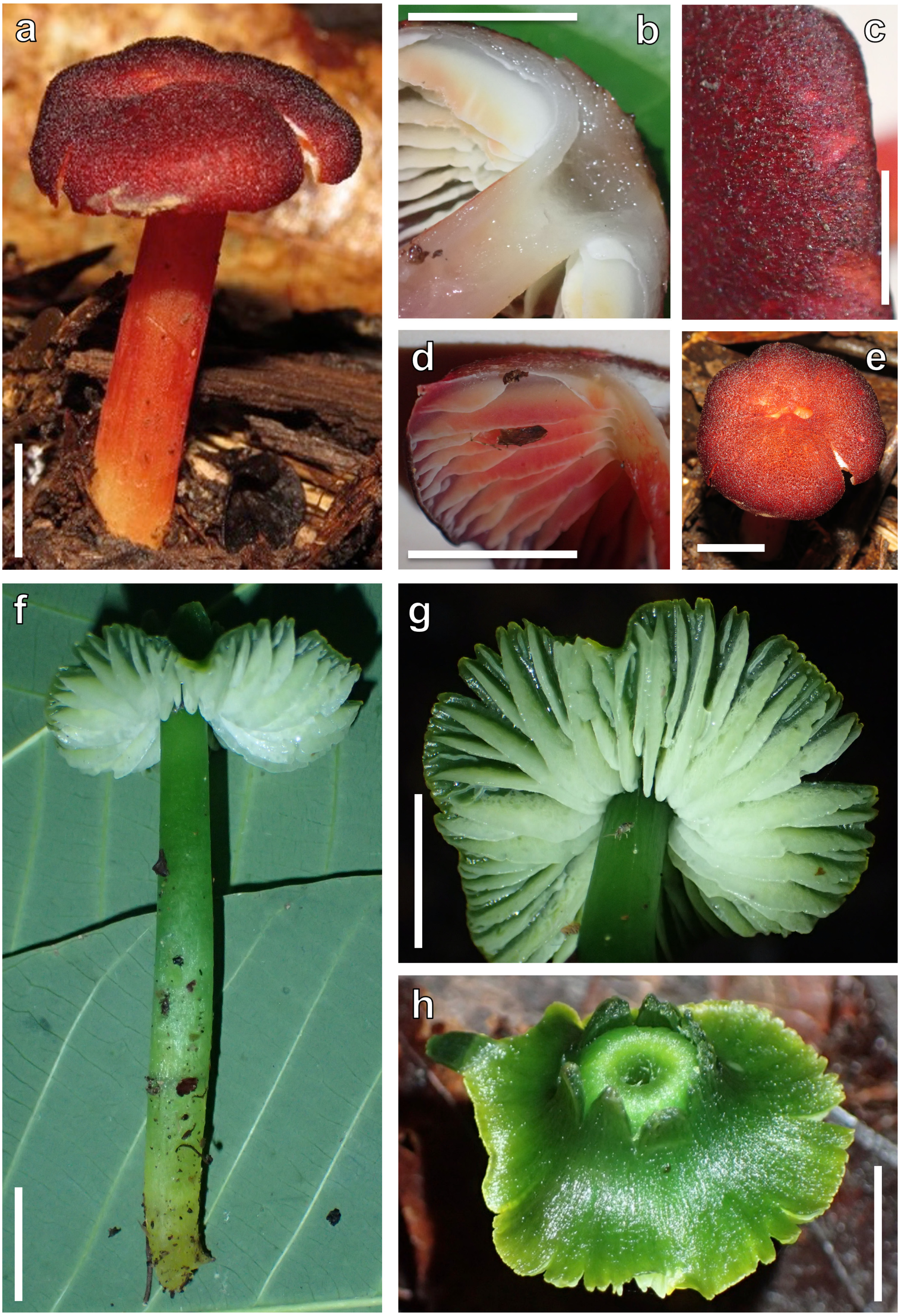

FIGURE 4. a–e. *Hygrocybe vinaceosquamulosa*. a, b, e. JS186; c, d. JS543. f–h. *Hygrocybe viridilacerata* (CJL648). Scales = 10 mm, except for c, scale = 5 mm. Photos a, e by R. C. Hoyer; b–d by J. S. Cardoso; f–h by S. Sourell.

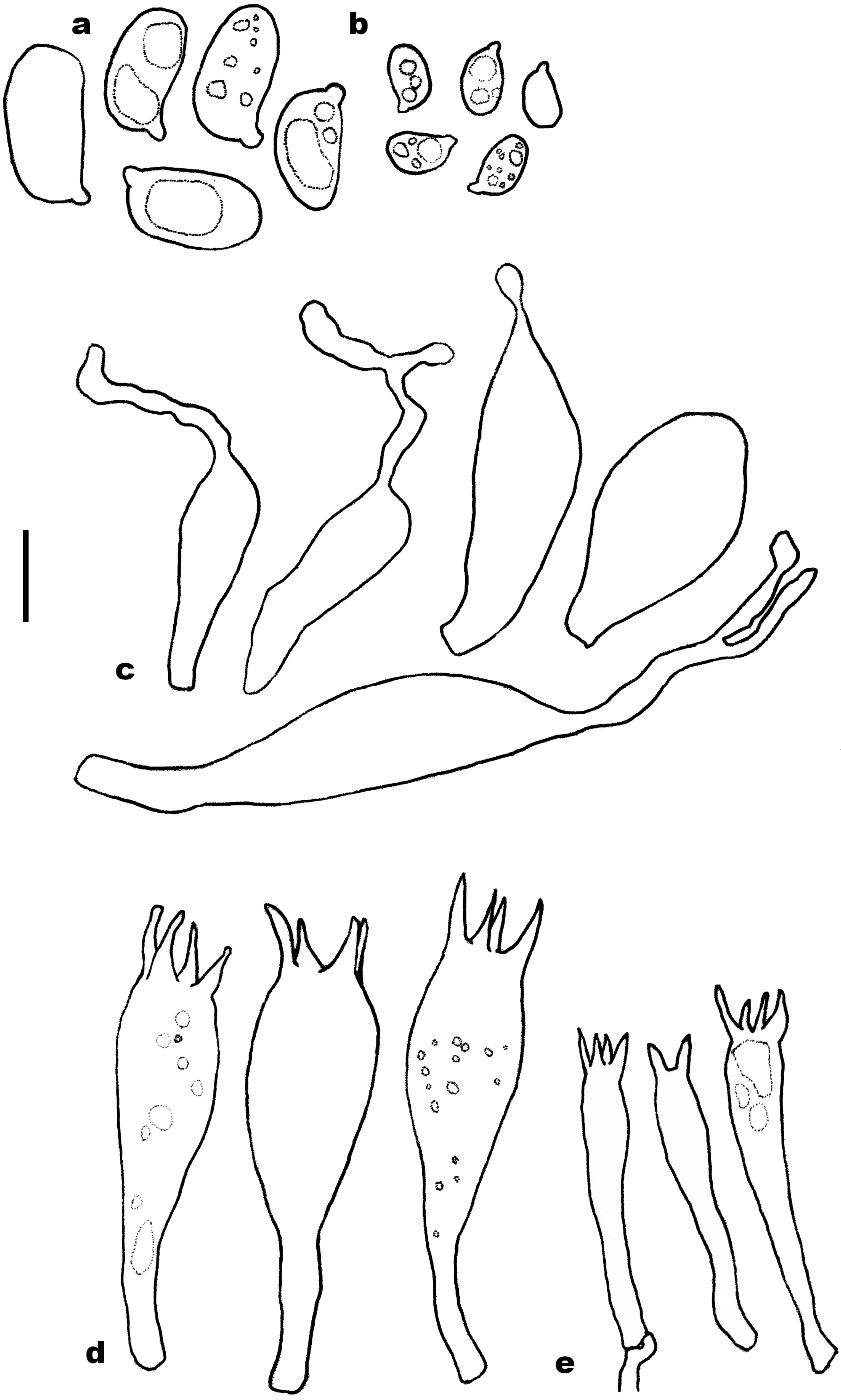

FIGURE 5. *Hygrocybe cristalinoensis* (CJL647). a. macrospores, b. microspores, c. cheilocystidia, d. macrobasidia, e. microbasidia. Scale = 10 µm.

Basidiospores and *basidia* dimorphic. *Macrospores* 11.1–*13.70*–15.9 (–17.6) × 6.2–*7.89*–9.8 µm, Q = 1.640–*1.740*–1.839, oblong, smooth, thin-walled, hyaline, inamyloid, guttulate. *Microspores* 4.8–*5.91*–7.7 × 2.8–*3.57*–4.6 µm, Q = 1.640–*1.655*–1.671, oblong, smooth, thin-walled, hyaline, inamyloid, guttulate. *Macrobasidia* 32.8–55.3 × 10.8–18.4 µm, clavate, thin-walled, hyaline, inamyloid, guttulate, with basal clamp connections, 4-spored, sterigmata up to 9.7 µm. *Microbasidia* 27.7–39.6 × 4.6–7.9 µm, cylindro-clavate, thin-walled, hyaline, inamyloid, guttulate, with basal clamp connections, 4-spored, sterigmata up to 6.5 µm. *Lamellar edge* fertile. *Cheilocystidia* 20.6–89.7 × 3.9–13.0 µm, ventricose-rostrate, mucronate, papillate, oval or ogival, frequently with apical hyphoid projections or with a digitiform appendix, thin-walled, hyaline, with basal clamp connections. *Pleurocystidia* and *pseudocystidia* absent. *Lamellar trama* regular, with parallel inflated hyphae, 9.7–15.0 µm diam., clamp connections present. *Pileipellis* a cutis with a thin layer of uplifted hyphae, 69.9–171.7 × 7.8–9.0 µm, encrusted pigments present but not abundant, clamp connections present. *Stipitipellis* a cutis with clusters of erect interwoven hyphae, terminal hyphae very thin, 2.8–4.9 µm diam., contorted, interlaced, with abundant clamp connections.

Additional specimens examined:—BRAZIL, Mato Grosso, Alta Floresta, Reserva Particular do Patrimônio Natural Cristalino, Trilha do Francisco, 9º35'52"S, 55º56'12"W, 250 m, 4 January 2019, *Santos, C.* CJL652 (FLOR67408, paratype); 10 January 2019, *Cardoso J.S. & Furtado A.N.M.* 605 (FLOR67462, paratype); Trilha da Serra Nova, 9º34'26"S, 55º55'18"W, 250 m, 12 January 2018, *Ribeiro, R.S.* CJL554 (FLOR63512, paratype); Trilha do Dr. Haffer, 9º33'24"S, 55º54'54"W, 250 m, 6 January 2019, *Cardoso J.S. & Furtado A.N.M. 556* (FLOR67424, paratype); Trilha do Cajá, 9º35'58"S, 55º55'55"W, 250 m, 7 January 2019, *Cardoso J.S. & Furtado A.N.M.* 570 (FLOR67438, paratype); Novo Mundo, Reserva Particular do Patrimônio Natural Cristalino, Trilha da Torre 2, 9º35'50"S, 55º55'27"W, 250 m, 24 January 2018, *Cardoso, J.S.* 249 (FLOR63509, paratype); *Cardoso, J.S.* 251 (FLOR63511, paratype); Trilha da Castanheira, 9º33'44"S, 55º54'24"W, 250 m, 5 January 2019, *Cardoso J.S. & Furtado A.N.M. 545* (FLOR67414, paratype).

Distribution:—Known only from the type locality, in the Southern Amazon.

Habitat:—Growing solitary or in groups in soils of *terra-firme* forests.

Comments:—This is the most common *Hygrocybe* species forming green basidiomes at RPPN Cristalino. There are three green dimorphic *Hygrocybe* species previously described for the neotropics: *Hygrocybe chloochlora* Pegler & Fiard (1978: 303) from Martinique, *H. prieta* from Puerto Rico, and *Hygrocybe viridis* Capelari & Maziero (1988: 192) from Northern Brazil (Lodge & Pegler 1990). The general morphology of the basidiomes of *H. cristalinoensis* is very similar to *H. prieta*, but basidiomes of *H. prieta* have purple, red and orangish colours and conspicuous waxy squamules on the stipe (Lodge & Pegler 1990). In microscopy, *H. cristalinoensis* differs from *H. prieta* in the presence of cheilocystidia and by having microspores that are slightly wider (2.5–3.6 µm, Q = 1.78–1.95 in *H. prieta*), becoming oblong rather than elongate (Lodge & Pegler 1990). The second most closely related taxon, *H. chloochlora*, differs by having lighter green colours on the pileus, lamellae that are white to very pale green and a stipe that is yellowish green (Pegler & Fiard 1978). Microscopically, the macrospores of *H. chloochlora* are bigger (17.5 × 10.0 µm) and the cheilocystidia are hyphoid to narrowly clavate or cylindrical rather than predominantly ventricose-rostrate with apical projections as found in *H. cristalinoensis* (Lodge & Pegler 1990). The other green dimorphic species, *H. viridis*, was described for the Brazilian Amazon, in Rondônia State (Capelari & Maziero 1988). *Hygrocybe viridis* differs in having an overall green basidiome, with no traces of yellow, much smaller macrospores (8.4–11.0 × 4.8–6.0 µm), narrower macrobasidia (8.4–9.6 µm) and absence of cheilocystidia (Capelari & Maziero 1988). Finally, *H. cristalinoensis* differs from the other green dimorphic species described in this work by the following: *Hygrocybe viridilacerata sp. nov.* has a conic-convex to umbonate pileus with a star-shaped perforation at the centre, the pileus is vivid green, never dark green, the lamellae are white or pale green and almost free, the microspores are slightly bigger (7.6 × 4.8 µm), the microbasidia are predominantly 2-spored, and the cheilocystidia are absent.

Hygrocybe pegleri J.S. Cardoso, M.A. Neves & J.S. Oliveira, *sp. nov.* (Figs. 3 d–h, 6)
MycoBank # 861153

Etymology:—in honour of David N. Pegler, who described and studied many neotropical *Hygrocybe* species.

Type:—BRAZIL. Mato Grosso: Novo Mundo, Reserva Particular do Patrimônio Natural Cristalino, Trilha da Castanheira, 9º33'44"S, 55º54'24"W, 250 m, 6 January 2019, *Cardoso, J.S. & Furtado, A.N.M.* 561 (FLOR67428, holotype!). GenBank: PX675227 (ITS).

Diagnosis:—Pileus squamulose, stipe > 100mm length, basidiospores and basidia dimorphic. Differs from *Hygrocybe firma* var. *firma* (Berk. & Broome) Singer (1958: 355) by having a smaller pileus, taller stipe, with no colour changes in the basidiomes, fertile lamellar edge and branched hyphae with brown pigments in the pileipellis.

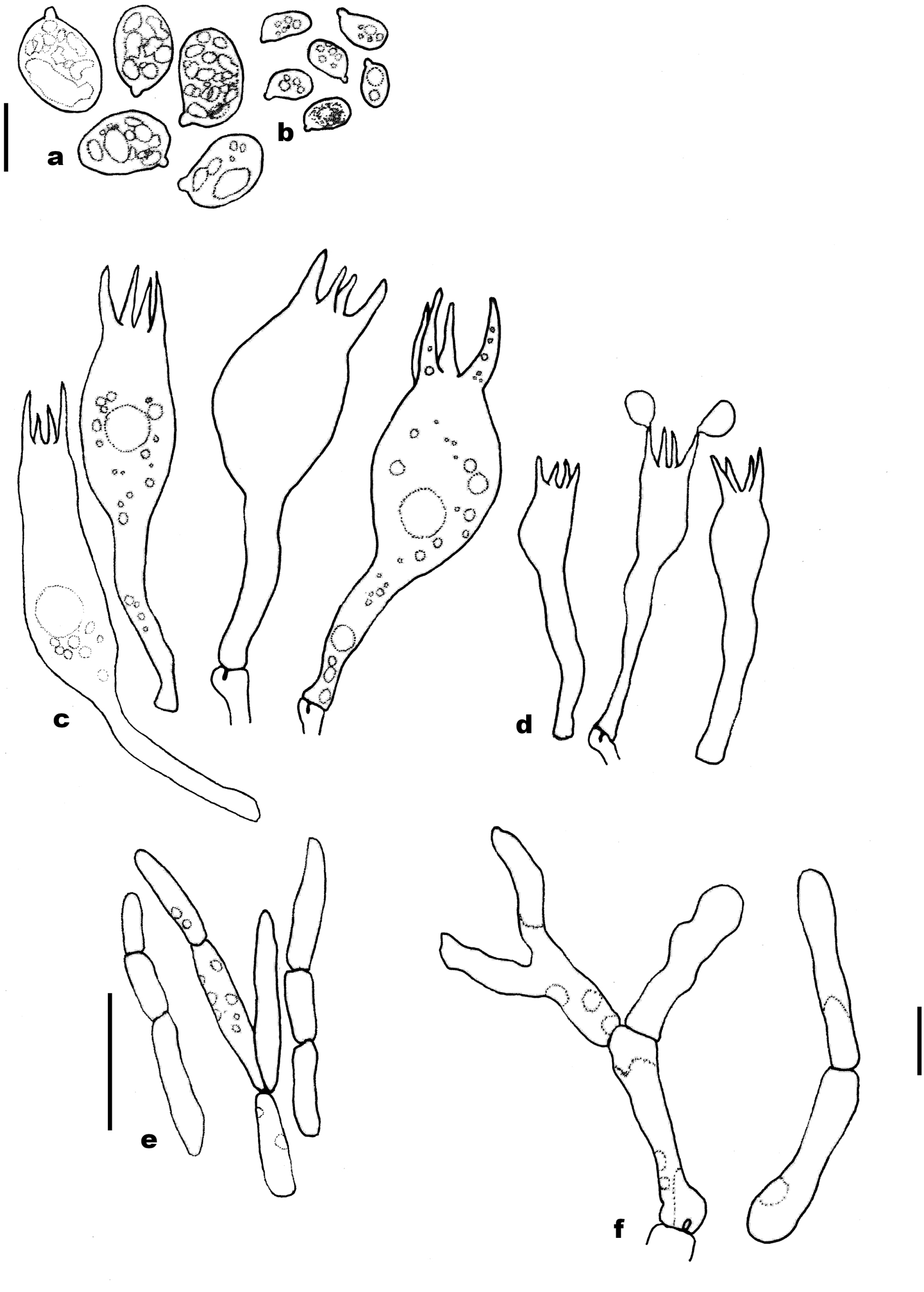

FIGURE 6. *Hygrocybe pegleri* (JS561). a. macrospores, b. microspores, c. macrobasidia, d. microbasidia, e. pilepellis terminal hyphae, f. stipitipellis hyphae. a–d. Scale = 10 µm. e, f. Scales = 50 µm.

Description:—*Pileus* 32–47 mm diam., umbilicate, depressed, squamulose, squamules more abundant in the centre and margin, moist to dry, pale yellow (oac899, oac857) to pale orange (oac812, oac810) with brown (oac733, oac734) squamules; margin arched or straight, entire, sometimes splitting, concolorous with the pileus, but with an aspect of being darker due to the concentrated squamules. *Lamellae* decurrent to uncinate, ventricose, up to 10 mm broad, subdistant, pale yellow (oac855) to almost white (oac899), margin eroded, concolorous; lamellulae of 3 lengths. *Stipe* 102–155 × 4–8 mm, central, sometimes eccentric, equal, hollow, usually with longitudinal fissure, tomentose, dry, yellow (oac855, oac857), covered with brown (oac734) microsquamules. Solitary on clay soils.

Basidiospores and *basidia* dimorphic. *Macrospores* 12.4–*15.06*–20.0 × 7.5–*9.67*–10.9 (–12.0) µm, Q = 1.487–*1.597*–1.775, ellipsoid to oblong, smooth, thin-walled, hyaline, inamyloid, multiguttulate. *Microspores* 5.7–*7.14*–9(–9.5) × 3.4–*4.40*–5.0(–5.5) µm, Q = 1.533–*1.622*–1.735, ellipsoid to oblong, smooth, thin-walled, hyaline, inamyloid, multiguttulate. *Macrobasidia* 49.3–70.2 (–82.0) × 11.7–18.9 (–25.0) µm, ventricose-clavate, thin-walled, hyaline, 4-spored, sterigmata up to 14.2 µm, with basal clamp connections. *Microbasidia* 30.8–51.0(–55.0) × 5.6–8.6(–10.0) µm, clavate, thin-walled, hyaline, 4-spored, sterigmata up to 8.6 µm, with basal clamp connections. *Lamellar edge* fertile. *Cystidia* absent. *Lamellar trama* regular, with parallel inflated hyphae, 76.8–282.8 × 12.8–30.7 µm, refractive hyphae present, interwoven, clamp connections present. *Pileipellis* a trichoderm with clusters of brown pigmented terminal hyphae (14–)22–67.7(–81) × 7–17.9(–23) µm, branched, forming a pyramidal structure, clamp connections present. *Stipitipellis* a trichoderm with clusters of interwoven brown hyphae, 14.5–49.4 × 3.3–9.3 µm, clamp connections present.

Additional specimens examined:—BRAZIL. Mato Grosso: Novo Mundo, Reserva Particular do Patrimônio Natural Cristalino, Trilha da Torre 2, 9º35’50”S, 55º55’27”W, 250 m, 5 January 2019, *Cardoso J.S. & Furtado A.N.M.* 551 (FLOR67419, paratype); Alta Floresta, Reserva Particular do Patrimônio Natural Cristalino, Trilha do Francisco, 9º35’52”S, 55º56’12”W, 250 m, 9 January 2018, *Cardoso, J.S.* 268 (FLOR63558, paratype); Santa Catarina: Parque Estadual da Serra do Tabuleiro, Santo Amaro da Imperatriz, Plaza Caldas da Imperatriz, Trilha da Cachoeira, 27°44’24.7”S, 48°48’25.0”W, 10 April 2014, *Magnago, A.C. & Cardoso, J.S.* 1029 (FLOR 57243).

Distribution:—Southern Amazon in the Mato Grosso state.

Habitat:—Growing on soil amongst litter in *terra-firme* forest in the Amazon.

Comments:—This taxon is similar to *Hygrocybe firma* var. *firma* (Berk. & Broome) Singer *sensu* Pegler (1983) based on collections from the Antilles, but it differs significantly in the colour photographs and illustrations provided in previous publications (e.g., from Africa by Heinemann, 1966; from the Lesser Antilles by Pegler & Fiard 1978 and Pegler 1983). *Hygrocybe firma* was originally described from Sri Lanka as *Hygrophorus firmus* Berk. & Broome. In the macromorphology, *H. firma* var. *firma sensu* Pegler differs by having a wider pileus [(20–)40–70 mm vs. 32–47 mm diam. in *H. pegleri*], a shorter stipe (up to 110 mm vs. 155 mm height in *H. pegleri*), and colour changes on bruising or with time.

Microscopically, *H. firma* var. *firma sensu* Pegler differs by having a sterile lamellar edge with basidioles, smaller macrobasidia [50–60 × 14–16 µm vs. 49.3–70.2 (–82.0) × 11.7–18.9 (–25.0) µm in *H. pegleri*] and unbranched hyphae with no pigments in the pileipellis (Pegler 1983). Other closely related taxa with squamulose pileus, dimorphic basidia and basidiospores are *H. brunneosquamosa* Lodge & S.A. Cantrell (2001: 216) and *H. neofirma* Lodge & S.A. Cantrell (2001: 221) (Cantrell & Lodge 2001). *Hygrocybe brunneosquamosa* also has brown pigmented hyphae in the trichodermal pileipellis, but it has an entire brown pileus that lacks yellow or orange pigments, the lamellae are cinnamon brown, and the macrospores are oblong to cylindrical (Cantrell & Lodge 2001). *Hygrocybe neofirma* differs from *H. pegleri* by the presence of staining reactions, by a much shorter stipe, and by the absence of brown pigmented pileipellis hyphae (Cantrell & Lodge 2001).

In the phylogenetic tree (Figure 1), a supported clade is shown with *H. pegleri* and the following taxa: *H. vinaceosquamulosa sp. nov.*, *H. sangayensis* Barili, C.W. Barnes, J.A. Flores & Ordoñez in Crous (2017: 335), and *H. macrosiparia* Barili, C.W. Barnes, J.A. Flores & Ordoñez in Crous (2017: 337), along with another specimen morphologically similar to *H. pegleri*, but molecularly divergent, which is displayed in the phylogenetic tree as *H.* aff. *pegleri* (JS593, Figure 1). They all share similar characteristics, such as a squamulose pileus, dimorphic basidia, and basidiospores. The other new species presented herein, *H. vinaceosquamulosa*, differs from *H. pegleri* by the presence of purple and pink colours in the basidiomes, a shorter stipe (28–55 mm high), and macrospore sizes, which are oblong to cylindrical (Q = 2.014). Both *H. sangayensis* and *H. macrosiparia* are described from high-altitude (1,500m) locations in Ecuador. Besides the different habitat, *H. sangayensis* differs from *H. pegleri* by having a broader pileus (50mm) and shorter stipe (70mm high), and the presence of cheilo- and pleurocystidia in the hymenium; *H. macrosiparia* differs by a shorter stipe (70mm high), and much shorter macrospores (10.5 × 6.5 µm).

A morphologically similar specimen (ACM1029) was collected in 2014 from a hilly area with well-preserved remnants of the Atlantic Rainforest in Southern Brazil, but its identity was not confirmed by molecular analyses.

Hygrocybe vinaceosquamulosa J.S. Cardoso, M.A. Neves & J.S. Oliveira, *sp. nov.* (Figs. 4 a–e, 7)
MycoBank # 861154

Etymology:—From Latin "vinaceus" = purple and "squamulosus" = refers to the squamules on the pileus.

Type:—BRAZIL. Mato Grosso: Novo Mundo, Reserva Particular do Patrimônio Natural Cristalino, Trilha da Castanheira, 9º33'44" S, 55º54'24" W, 250 m, 6 January 2019, *Cardoso, J.S. & Furtado, A.N.M.* 543 (FLOR67412, holotype!). GenBank: PX675228 (ITS).

Diagnosis:—Pileus squamulose, purple to pink, lamellae pale yellow with pink shades, macrospores oblong to cylindrical with a middle constriction. Differs from *Hygrocybe siparia* (Berk.) Singer (1965: 17) by the convex pileus, which is never umbilicate, by the colour of the pileus and the lamellae, by a fibrillose stipe, and by the length of both macro- and microspores.

Description:—*Pileus* 19–38 mm diam., convex, tomentose-squamulose, moist to dry, dark cherry red (oac563, oac600, oac601, oac607), crimson (oac579, oac586), pink (oac617), sometimes with flushes of orange (oac632) covered with dark purple small squamules; margin entire, decurved, slightly incurved, concolorous or paler. *Context* translucent to white, gelatinous. *Lamellae* adnate to slightly sinuate, up to 4 mm broad, pale yellow (oac857, oac898) to orangish (oac812) or beige (oac766, oac 814) with shades of dark pink (oac594), or stained with orangish pink (oac615) towards the edge; edge entire to finely fimbriate, sometimes eroded, concolorous; lamellulae of two lengths. *Stipe* 28–55 × 4–6 mm, central, regular, hollow, fibrillose, moist to dry, yellowish orange (oac789, oac812) with shades of cherry red (oac614), or pink (oac572) stained with pale orange (oac632), base pale yellow (oac858).

Basidiospores and *basidia* dimorphic. *Macrospores* (11.4–) 12.2–*14.75*–19 (–20.7) × 5.5–*7.38*–8.7 µm, Q = 1.728–*2.014*–2.300, oblong to cylindrical, often constricted at the middle, smooth, thin-walled, hyaline, inamyloid, multiguttulate. *Microspores* 6.0–*7.52*–9.5 (–10.9) × 3.2–*4.26*–5.1 µm, Q = 1.622–*1.762*–1.902, oblong, often constricted at the middle, smooth, thin-walled, hyaline, inamyloid, multiguttulate. *Macrobasidia* 41.7–61.2 × 11.2–16.2 (–17.1) µm, clavate, thin-walled, hyaline, predominantly 4-spored, or 1–2–3-spored also common, sterigmata up to 13.5 µm, with basal clamp connections. *Microbasidia* 29.0–44.3 (–54.3) × 6.0–8.3 (–10.2) µm, cylindro-clavate, thin-walled, hyaline, predominantly 4-spored, 1–2–3-spored also common, 5-spored rare, sterigmata up to 10.0 µm, with basal clamp connections. *Lamellar edge* fertile. *Cystidia* absent. *Lamellar trama* regular to subregular, inflated hyphae with pigments, 4.9–22.1 µm diam., clamp connections present, interlaced with refractive hyphae, 4.2–5.3 µm diam., with clamp connections of the medallion type. *Pileipellis* a trichoderm, with pigmented hyphae forming chains arranged in pyramidal form, therefore creating the squamules, terminal elements 15.9–116.0 × 6.6–12.3 µm, branching, with clamp connections, brown in KOH. *Pileus trama* with abundant interwoven refractive hyphae. *Stipitipellis* a trichoderm of thin hyphae, 2.6–7.1 µm diam., slightly brownish in KOH.

Additional specimens examined:—BRAZIL. Mato Grosso: Novo Mundo, Reserva Particular do Patrimônio Natural Cristalino, Trilha da Castanheira, 9º33'44"S, 55º54'24"W, 250 m, 17 January 2018, *Cardoso, J.S.* 186 (FLOR63504, paratype); 7 January 2019, *Cardoso, J.S. & Furtado, A.N.M.* 566 (FLOR67434, paratype); 1 January 2019, *Santos, C.* CJL624 (FLOR67398, paratype).

Distribution:—Only known from the type locality.

Habitat:—Growing solitary or gregarious on clay soils in *terra-firme* forest.

Comments:—This species is very remarkable due to its cherry colours and dark purple squamules in the pileus. It resembles *Hygrocybe siparia*, which was first described by Berkeley (1856, p. 134) based on a collection from the Upper Rio Negro region, in the Uaupés River in the Amazon; it was later recollected by Singer (1965) in the Northeast of Brazil (Pernambuco state) and also re-examined by Pegler (1997) from collections found in the Southeast of Brazil (São Paulo state). *Hygrocybe siparia* differs in the pileus shape, which is umbilicate, in the lack of pink tints on the lamellae, and in a stipe that is smooth rather than fibrillose. Microscopically, *H. siparia* has ellipsoid macrospores, which are shorter (up to 13 µm, Q = 1.53), and the microspores are also shorter and are ellipsoid (up to 6.7 µm, Q = 1.42).

Hygrocybe macrosiparia differs in the lack of pink or purple colours on the basidiomes, macrospore sizes (10.5 × 6.5 µm), and the much shorter sterigmata (6.5 µm in macrobasidia and 6.0 µm in microbasidia) (Crous *et al*. 2017). *Hygrocybe sangayensis* also differs in the lack of purple and pink colours in the basidiomes, and by the presence of cheilo- and pleurocystidia in the hymenium (Crous *et al*. 2017). Unfortunately, the species authors (Barili & Barnes) did not provide Q values for the basidiospores, and the pileipellis description (in Crous *et al*. 2017) is not well detailed.

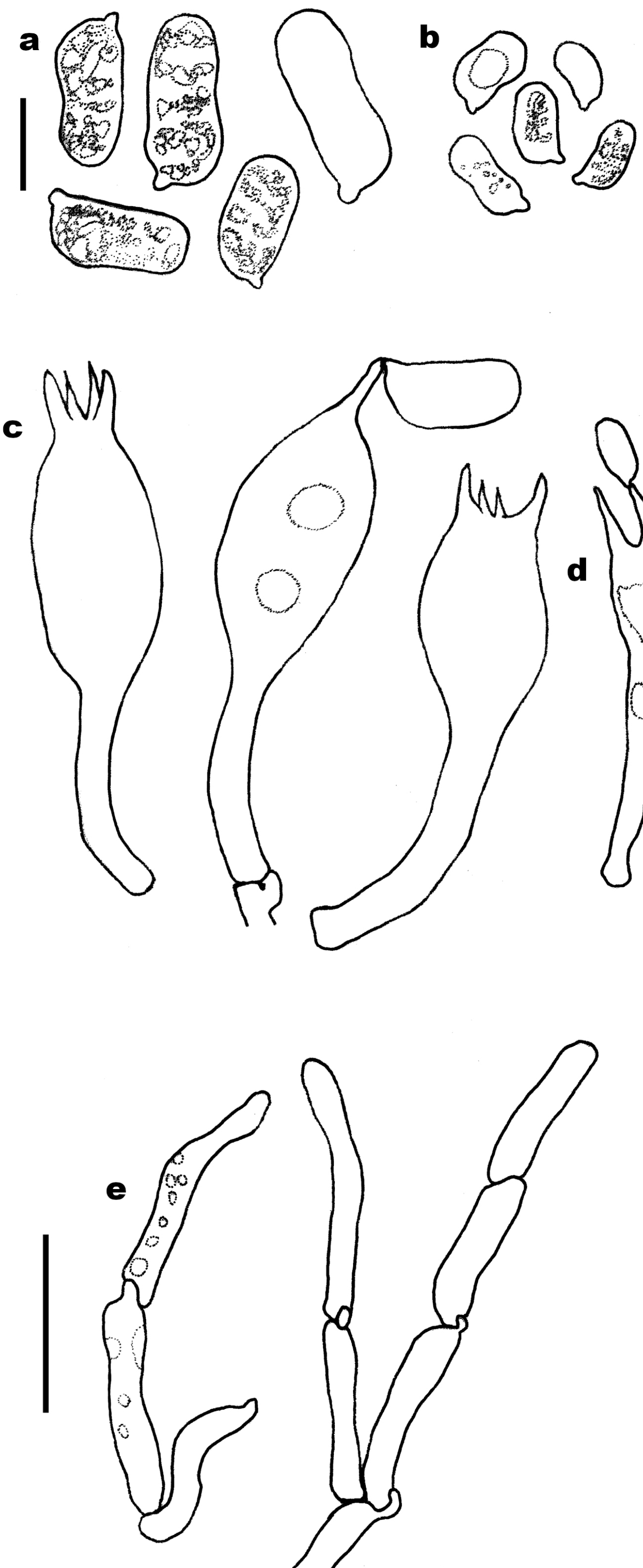

FIGURE 7. *Hygrocybe vinaceosquamulosa* (JS543). a. macrospores, b. microspores, c. macrobasidia, d. microbasidia, e. pilepiellis terminal hyphae. a–d. Scale = 10 µm. e. Scale = 50 µm.

Hygrocybe viridilacerata J.S. Cardoso, M.A. Neves & J.S. Oliveira, *sp. nov.* (Figs. 4.f–h, 8, 9)
MycoBank # 861152

Etymology:—From the Latin "viridis" = green and "lacerata" = refers to the ragged pileus centre.

Type:—BRAZIL. Mato Grosso: Alta Floresta, Reserva Particular do Patrimônio Natural Cristalino, Trilha do Francisco, 9º35'52"S, 55º56'12"W, 250 m, 8 January 2018, *Cardoso, J.S. & Furtado, A.N.M.* 583 (FLOR67446, holotype!). GenBank: PX675226 (ITS).

Diagnosis:—Pileus umbonate and perforated like a star-shaped rupture at the centre, vivid green; lamellae whitish; stipe green to yellow near the base; microbasidia predominantly 2-spored. Differs from *H. cristalinoensis* in the lack of deep green lamellae and the lack of cheilocystidia.

Description:—*Pileus* 11–37 mm diam., conic to convex when young, umbonate or plane-convex at maturity, ragged like a star-shaped rupture at the centre, smooth, fibrillose, moist to lubricous, translucent-striate towards margin, vivid green (oac110, oac117) to olive green (oac82, oac38) with brownish-green (oac866) to brown (oac719) tints when old; margin straight, decurved or uplifted, translucent-striate, irregular, plicate to eroded, often splitting, light green (oac32) to yellow (oac854, oac896). *Lamellae* adnexed or uncinate, sometimes free, subdistant, broad to ventricose, up to 6 mm broad, white to very pale green (oac30, oac67) with greenish tints (oac50, oac51, oac97, oac90); margin eroded, concolor; lamellulae of two or three lengths. *Stipe* 41–83 × 3–6 mm, central, rarely eccentric, regular to flexuous, hollow, smooth, dry to moist, green (oac47, oac68, oac83) to pale yellow (oac855, oac856) at the base. Solitary to gregarious on clay soils.

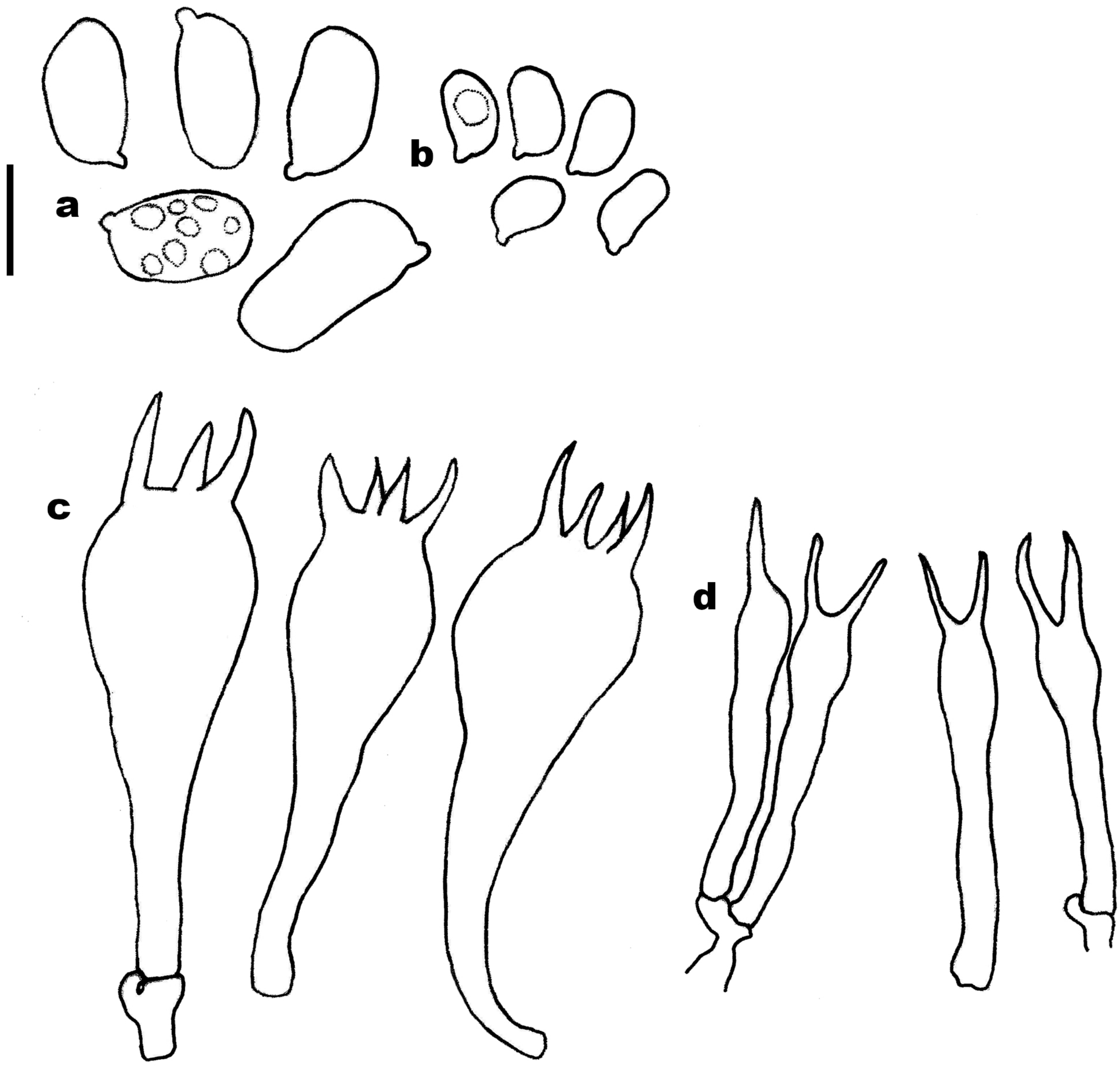

FIGURE 8. *Hygrocybe viridilacerata* (JS583). a. macrospores, b. microspores, c. macrobasidia, d. microbasidia. Scale = 10 µm.

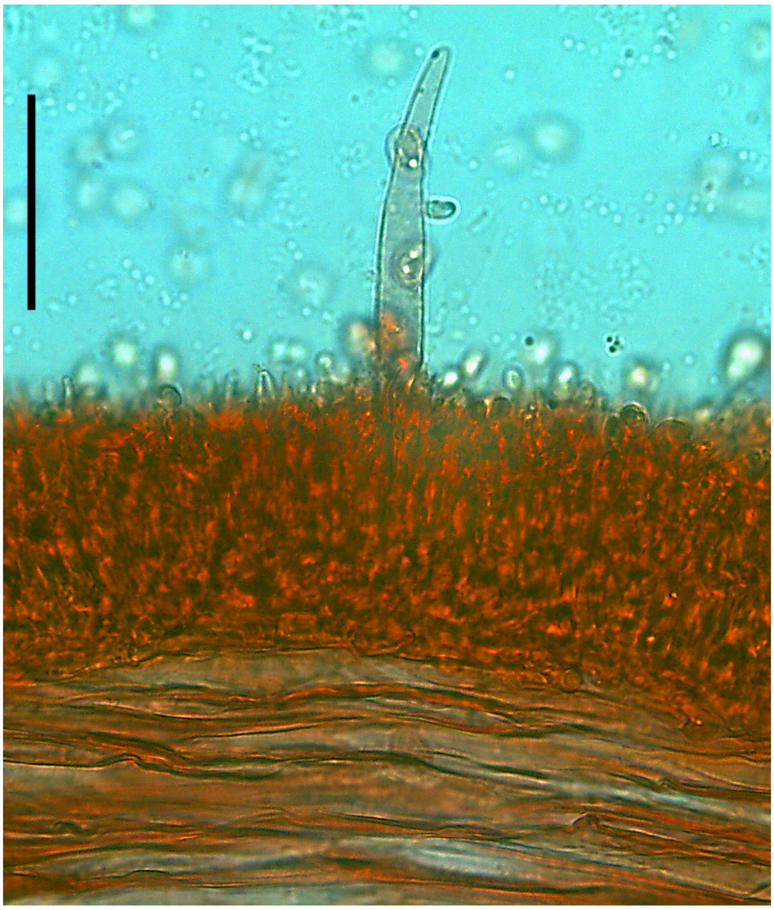

FIGURE 9. *Hygrocybe viridilacerata* (JS583). Detail of the hymenium showing the pseudocystidia emerging from the lamellar trama. Scale = 50 µm.

Basidiospores and *basidia* dimorphic. *Macrospores* (9.7–) 10.6–*13.54*–17.6 (–18.4) × 5.8–*7.64*–9.5 (–10.0) µm, Q = 1.672–*1.771*–1.853, oblong, smooth, thin-walled, hyaline, inamyloid, guttulate. *Microspores* 5.6–*7.65*–9.7 × 3.7–*4.85*–6.6 µm, Q = 1.533–*1.578*–1.635, ellipsoid to oblong, smooth, thin-walled, hyaline, inamyloid, guttulate. *Macrobasidia* 30.3–47.7 (–51.1) × 10.4–17.7 (–19.4) µm, broadly clavate, thin-walled, hyaline, predominantly 4-spored, few 1–3-spored, sterigmata up to 9 µm, with basal clamp connections. *Microbasidia* (19.7–) 21.9–34.3 (–39.1) × 4.4–9.5 (–10.8) µm, clavate, predominantly 2-spored, or 1-3-4-spored, thin-walled, hyaline, sterigmata up to 8.8 µm, with basal clamp connections. *Lamellar edge* fertile, microbasidia more abundant. *Cheilocystidia* and *pleurocystidia* absent, but *pseudocystidia* sometimes present (Figure 7), as hyphae projecting from the lamellar trama up to 80 µm above the hymenium, cylindrical, tapering towards a rounded apex. *Lamellar trama* regular, with inflated parallel elements 19.3–54.7 µm diam., with interwoven refractive hyphae 2.1–4.3 µm diam., clamp connections present. *Pileipellis* a cutis of repent hyphae, 6.5–31.4 µm diam., inflated, sometimes with encrusted pigments, refractive hyphae present, but not abundant, clamp connections present. *Stipitipellis* a cutis, 7.6–19.0 µm diam., inflated hyphae with encrusted pigments, similar to the pileipellis, clamp connections present.

Additional specimens examined:—BRAZIL. Mato Grosso: Alta Floresta, Reserva Particular do Patrimônio Natural Cristalino, Trilha do Francisco, 9º35’52”S, 55º56’12”W, 250 m, 4 January 2019, *Santos, C.* CJL648 (FLOR67407, paratype); *Santos, C.* CJL654 (FLOR67378 paratype); Trilha do Dr. Haffer, 9º33’24”S, 55º54’54”W, 25 January 2018, *Cardoso, J.S.* 273 (FLOR63560, paratype); 30 December 2018, *Santos, C.* CJL606 (FLOR67388, paratype); 6 January 2019, *Cardoso, J.S. & Furtado, A.N.M.* 554 (FLOR67422, paratype); Trilha da Torre 1, 9º36’2”S, 55º56’9”W, 250 m, 31 December 2018, *Santos, C.* CJL613 (FLOR67392, paratype); Trilha do Saleiro Novo, 9º35’52”S, 55º56’2”W, 250 m, 16 January 2019, *Cardoso, J.S. & Furtado, A.N.M.* 538 (FLOR67409, paratype); Santa Catarina: Lages, Coxilha Rica, 28°00’18.3” S, 50°19’05.3” W, 916 m, 28 February 2016, *Santos, B.B.* 001.

Distribution: Known from the Southern Brazilian Amazon in Mato Grosso state.

Habitat: Growing in *terra-firme* forest in the Amazon.

Comments:—This species is easily distinguished from the other green dimorphic *Hygrocybe* species due to its pileus shape, which is never umbilicate, but somewhat umbonate to plane-convex at maturity and the umbo seems to tear up forming a star-shaped rupture in the centre of the pileus. The lamellae are whitish and almost free, while the other taxa have broadly attached lamellae that have deep green tints. The microscopy does not show many distinct characteristics, except for the microbasidia that are often predominantly 2-spored, a feature not reported for the closely related taxa, and the presence of pseudocystidia emerging from the hymenium. A morphologically similar specimen (JS555) has been shown to be divergent in the ITS sequence and is named in the phylogenetic tree as *H.* aff. *viridilacerata* (Figure 1). Another morphologically similar specimen was found in the high plains of Southern Brazil (BBS001), but the identity was not confirmed through molecular analyses.

Identification Key to Sections of *Hygrocybe* subg. *Hygrocybe*

1. Lamellae broadly attached, often decurrent, lamellar trama subregular with short elements, not exceeding 140 µm long, basidia long, cylindro-clavate with a mean ratio of basidiospore to basidia length usually greater than 5............... Subg. *Pseudohygrocybe*
1. Lamellae free, adnexed or with a decurrent tooth, lamellar trama regular or subregular, with long parallel hyphae (> 200 µm) and tapered ends, basidia clavate, mean ratio of basidiospores to basidia length 3 to 5... Subg. *Hygrocybe*, 2
2. Basidiospores and basidia monomorphic 3
2. Basidiospores and basidia dimorphic 5
3. Basidiomes stain black or slightly grey on the stipe .... Sect. *Hygrocybe*
3. Basidiomes without dark staining reactions 4
4. Pileus conical or conico-campanulate, dry, tomentose, squamulose or fibrillose, basidiospores mostly < 10 µm long, pileipellis a trichoderm.. Sect. *Microsporae*
4. Pileus convex-applanate, sometimes umbonate, viscid to glutinous, smooth, basidiospores often > 10 µm long, pileipellis an ixotrichoderm ....Sect. *Chlorophanae*
5. Basidiomes entirely glutinous, red or pink, pileus not perforated at the centre, stipe usually with a glutinous annulus, lamellar edge with pseudocystidia, basidiospores globose, subglobose to broadly ellipsoid, macrobasidia clavate ....Sect. *Velosae*
5. Basidiomes not glutinous, but pileus often viscid, usually red, orange, yellow, green or purple, pileus often perforated at the centre, without annulus on the stipe, pseudocystidia sometimes present, basidiospores usually ellipsoid, oblong or cylindrical, macrobasidia broadly clavate or clavate-stipitate..Sect. *Pseudofirmae*

Identification Key for *Hygrocybe* subg. *Hygrocybe* sect. *Pseudofirmae* occurring in Brazil

1. Basidiomes predominantly green or tinted green on pileus, lamellae or stipe 2
1. Basidiomes predominantly red, orange, yellow, pink or purple 6
2. Pileus convex to umbilicate, perforated at the centre, entirely green or with green tints on the pileus, lamellae or stipe.................3
2. Pileus conico-convex, umbonate, umbo surface ruptured and ragged, vivid green ....***H. viridilacerata***
3. Basidiomes green with yellow, red, orange and/or purple tints 4
3. Basidiomes entirely green, without yellow tints ....*H. viridis*
4. Pileus conspicuously green, with or without a fringed margin, lamellae green without purple tints, stipe mostly green, without squamules 5
4. Pileus a mixture of purple, crimson, dark red and green, with a white fringe, lamellae green turning purplish, stipe green to orange-yellow, turning purplish, most with furfuraceous waxy squamules .... *'H. prieta'* sensu Pegler and *Hygrocybe* spp. aff. *prieta*
5. Pileus deep dark green, with a pale green fringed margin, lamellae deep green, stipe central, equal, cheilocystidia 20.6–89.7 × 3.9–13.0 µm..***H. cristalinoensis***
5. Pileus vivid green, margin eroded, lamellae greyish green, stipe often eccentric, tapering towards the base, cheilocystidia absent, from the Cristalino basin ....*H.* aff. *chloochlora* (FLOR63533, FLOR67391, FLOR67418)
6. Pileus glabrous or finely fibrillose 7
6. Pileus tomentose to squamulose...13
7. Basidiomes predominantly yellow 8
7. Basidiomes predominantly red, orange or violaceous...9
8. Basidiomes entirely yellow, pileus convex, glabrous, slightly depressed at the centre, moist to vaguely viscid, macrospores 16.5–22 × 11–14 µm, cheilocystidia 100 × 7–12 µm...*H. megistospora*
8. Basidiomes predominantly yellow, pileus convex-applanate, finely fibrillose, translucent-striate, perforated at the centre, dry to moist, macrospores (9–)11–15 × 6.3–10(–12) µm, cheilocystidia 37–60 × 5–20 µm .... *H. occidentalis* var. *occidentalis*
9. Basidiomes entirely red 10
9. Basidiomes orange or violaceous carmine 12
10. Pileus ≤10 mm diam., convex-umbilicate, red with a yellow margin, lamellae decurrent, macrospores 10–13 × 6–7.5 µm............. ....*H. trinitensis*
10. Pileus >10 mm diam., pileus convex-depressed, lamellae adnexed, sinuate or adnate with a decurrent tooth, macrospores usually wider 11
11. Pileus translucent-striate, finely fibrillose, perforated at the centre, lamellae sinuate or adnate with a decurrent tooth, macrospores (9–)11–15 × 6.3–10(–12) µm, cheilocystidia 37–60 × 5–20 µm, basidiomes growing in soil ....*H. occidentalis* var. *scarletina*
11. Pileus glabrous, smooth, not perforated, lamellae adnexed, macrospores 11.5–15 × 7.3–11.5 µm, cheilocystidia 19 × 3.5 µm, basidiomes found on well-decayed pieces of wood in white sand forests ....*H. campinaranae*

12. Pileus 9–10 mm diam., orange, margin yellow, lamellae orange with yellow margin, stipe orange, macrospores 16.5–18.5 × 10–12 µm, from Brazilian Amazon .... *H. amazoniensis*
12. Pileus 10–15 mm diam., violaceus carmine, lamellae pinkish vinaceous, stipe yellow with pinkish vinaceous apex, macrospores 10–14 × 6.5–8 µm, from Trinidad .... *H. naranjana*
13. Pileus yellow to orange with brown to black squamules 14
13. Pileus red to crimson or violaceous, tomentose to squamulose 15
14. Pileus not perforated, yellow with brown small squamules, basidiomes without staining reactions, stipe 102–155 mm tall, tomentose, macrospores 12.4–20 × 7.5–10.9(–12) µm, pileipellis a trichoderm with brown pigmented hyphae .... ***H. pegleri***
14. Pileus with a star-shaped perforation at the centre, yellow-orange with blackish-brown staining squamules, lamellae and stipe staining, stipe up to 22 mm long, fibrillose, macrospores 12.8–17.6 × 8–10.4 µm, pileipellis a trichoderm without pigmented hyphae........ *H. neofirma*
15. Pileus convex-umbilicate, red to crimson, tomentose to furfuraceous, lamellae pale yellow, stipe glabrous, macrospores 10–13 × 6–8.5 µm, pileipellis a disrupted trichoderm without pigmented hyphae .... *H. siparia*
15. Pileus convex, crimson with dark purple squamules, lamellae pale yellow with pink tints, stipe fibrillose, macrospores (11.4–) 12.2–19(–20.7) × 5.5–8.7 µm, pileipellis a trichoderm with brown pigmented hyphae .... ***H. vinaceosquamulosa***

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