

Hygrophoraceae (Agaricales) of the Greater Antilles : *Hygrocybe* subgenus *Pseudohygrocybe* section *Firmae*

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A key to 13 species in the genus *Hygrocybe* subgenus *Pseudohygrocybe* section *Firmae* is provided for the Greater Antilles. Seven new species and one species that is a new report for the Greater Antilles are described. The new species are *H. brunneosquamosa*, *H. cinereofirma*, *H. flavocampanulata*, *H. laboyi*, *H. miniatofirma*, *H. neofirma* and *H. olivaceofirma*. The new report is *H. trinitensis*.

INTRODUCTION

Section *Firmae* of subgenus *Pseudohygrocybe* within *Hygrocybe* is characterized by short parallel to subparallel hyphae that make up the lamellar trama. Section *Firmae* is further defined by the presence of dimorphic basidia and spores on the same basidiome (Heinemann 1963). Several species classified in section *Firmae* deviate from other members of the subgenus *Pseudohygrocybe*, however, in having long, tapered lamellar trama hyphae sometimes up to 200-300 µm in length, typical of subgenus *Hygrocybe*. This section is pantropical, but it is especially speciose in the neotropics (Courtecuisse 1989, Dennis 1953, 1970, Pegler 1983, Pegler & Fiard 1978, Lodge & Pegler 1990). Within the Caribbean basin, species belonging to section *Firmae* have been reported from French Guyana (Courtecuisse 1989, Heim 1967) Mexico (Singer 1957), Trinidad (Dennis 1953, 1970) and throughout the Lesser Antilles (Pegler 1983, Pegler & Fiard 1978). In the Greater Antilles, species in section *Firmae* have been reported only from Cuba (*H. trinitensis*; as *Agaricus laccatus* determined by Berkley & Curtis, and redetermined by Pegler 1987) and Puerto Rico (Lodge & Pegler 1990). As far as we know, there are no published reports of species in section *Firmae* from Hispaniola.

Lodge & Pegler (1990) previously reported six taxa from Puerto Rico in section *Firmae*: *H. chloochlora*, *H. batistae*, *H. prieta*, *H. hypohaemacta*, *H. occidentalis* var. *occidentalis* and *H. occidentalis* var. *scarletina*.

Recent collecting in Puerto Rico has revealed seven new

species and one new report for section *Firmae*. *Hygrocybe miniatofirma* has macro- and microspores with partially overlapping dimensions, but the basidia are distinctly dimorphic. The new species *H. olivaceofirma* is notable for apparent affinities with several species from the paleotropics such as *H. diversicolor* and *H. purpurea*. Two of the new species, *H. brunneosquamosa*, and *H. cinereofirma*, have dull grey and brown pigments that are unusual for section *Firmae*. Most members of this section have red, yellow, green, or purple colouration. While most members of section *Firmae* have a pileus that is broadly convex or depressed, three of the new taxa, *H. cinereofirma*, *H. flavocampanulata*, and *H. laboyi*, have a pileus disc that is umbonate or cuspidate. *Hygrocybe brunneosquamosa* is the only known member of this section possessing a squamulose pileus surface besides the type species, *H. firma* and *H. anisa* from Sri Lanka and a previously undescribed neotropical relative, *H. neofirma*. While dimorphic basidia and spores are assumed to have arisen only once in the genus, the diverse characters represented by most of the new species described here are more typical of different subsections of section *Coccineae*. Heinemann (1963) found that macrospores of dimorphic species from Africa had binucleate macrospores and multiple pairs of nuclei in the macrobasidia, and hypothesised that they may be polyploid derivatives of species classified in section *Coccineae*. Other species in section *Firmae* suggest other affinities, however. Two of the new species, *H. flavocampanulata* and *H. laboyi*, and *H. hypohaemacta* have long, tapering trama hyphae cells, resembling those in subgenus *Hygrocybe*. However, only molecular data would resolve whether section *Firmae* is mono- or polyphyletic.

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MATERIALS AND METHODS

The study areas in Puerto Rico are described in Cantrell & Lodge (2000).

In the section on specimens examined that follows each description, the collection information often includes different kinds of numbers assigned to the same specimens. Numbers with the prefix CFMR-PR refer to the unique database number at the Center for Forest Mycology Research in Puerto Rico that are being used for the Basidiomycetes of the Greater Antilles project. Collector's ledger numbers are also provided, if assigned. All recent collections have been deposited in the recognized herbaria noted (CFMR, DUKE, F, II, K, NY, UPRRP).

Microstructures were studied using hand-cut sections mounted in aqueous 3% KOH or Melzer's reagent after rehydration in 70% alcohol. Capitalised colour names are Ridgway-colours as reproduced by Smithe (1975). Munsell colour code notations have been added in brackets. The spore dimensions are based upon 10-20 spores; length of the spores includes the hilar appendage. Descriptions are based on a single collection unless otherwise noted; deviations from the description among other collections are noted under comments. For the most part, we used Boertmann's (1995) concepts of subgenera and sections within subgenus *Pseudohygrocybe* and Heinemann's (1963) definition of section *Firmae*.

TAXONOMY

Hygrocybe (Fr.) Kummer 1871

Subgenus Pseudohygrocybe section Firmae

Hygrocybe batistae Singer, *Atlas Inst. Micol.* 2: 28 (1965).

Description: Lodge & Pegler (1990)

Specimens examined: Puerto Rico: Mun. RioGrande: Caribbean National Forest, Luquillo Mts, Mt. Britton Trail, 18° 18' 8" N, 65° 47' 45" W, 900 m, on mineral soil, 21 Jun. 1996, E. Horak & S. A. Cantrell, CFMR-PR 3325 (UPRRP); *ibid*, on clay soil, 24 May 1997, E. Horak (CFMP-PR 4550); *ibid*, Caimitillo Trail, 18° 18' 9" N, 65° 47' 11" W, 700 m, on clay soil, 11 Jun. 1997, R. Vilgalys, CFMR-PR 4548 (DUKE); *ibid*, Big Tree Trail, 18° 18' 34" N, 65° 46' 27", 490 m, on soil, 7 Jul. 1998, N. Perez & D. J. Lodge, CFMR-PR 5431, (N. Perez 17) (K); *ibid*, Palo Hueco, near El Cacique, 18° 18' 51" N, 65° 49' 21" W, 850 m, on soil, 21 Aug. 1997, S. A. Cantrell & J. Ramirez, (S. A. Cantrell PR-9783) (CFMR-PR 4744); *ibid*, main trail, 18° 18' 51" N, 65° 49' 21" W, 650 m, on soil, 9 Sept. 1998, S. A. Cantrell & N. Clum (S. A. Cantrell PR-9885), (CFMR-PR 5377); *ibid*, CFMR-PR 5378, (S. A. Cantrell PR-9886). (UPRRP).

Hygrocybe brunneosquamosa Lodge & S. A. Cantrell, *sp. nov.* Fig. 1-7

Etym.: *brunneus*, brown; *squamosus*, scaly, covered with coarse brown scales.

Pileus 22 mm diametro, convexus, in centro parum depressus, revolutus, in centro atrogrieseobrunneus, cinnamomeobrunneus, tomentososquamulosus, recurvatosquamulosus vel squarrosus, siccus. Lamellae late adnatosubdecurrentes vel arcuatae, cinnamomeobrunneae, subdistances, ad aciem sinuato usque crenato, concolores, lamellis aequilongis. *Stipes* centralis, 33 × 7 mm cylindrico, compressus, fuscus, apicaliter floccosus. *Sporae* dimorphae, hyalinae levels, parietibus tenuibus; macrospora 15-20.8 × 6.6-9.4 μm, Q = 1.8-2.75 (media 2.08), late ellipsoideae, guttulis refractivis; microspora 5.8-8.3 × 3-5 μm, Q = 1.4-2.18 (media 1.66), subglobose vel

ellipsoideae. *Basidia* dimorpha, 4-spora, clavata; macrobasidia 32-56 × 12.8-16.8 μm, in KOH parum brunneola; microbasidia 24-28 × 4.8-8 μm. *Margo lamellaris* fertilis. *Pleurocystidia* et *cheilocystidia* nulla. *Trama hymenophoralis* regulare vel subregulare; ex hyphis 28-132 × 8.8-48 μm instructis; filum centrale in reagente Melzeri parum vinaceum tinctum; subhymenium ex hyphis 2.5-4 μm diametro dense intertextis compositum; hyphae laticiferae sparsae 2.5-4 μm diametro. *Pileipellis* ex hyphis 47.2-52.5 × 11.6-15 μm, trichodermium formantibus, pigmento brunneo et in iodi ope porphyreo impletis. *Contentum pilei* hyphis laticiferis 4-5.6 μm diametro et hyphis regularibus 9-27 μm diametro intertextis. *Hyphis tramae pilei* usque 48 μm tumidis fibulis abundantibus. *Stipitipellis* trichodermium est; hyphae 17-41 × 7-8 μm, elementis terminalibus strangulatis, colore parum brunneo.

Typus: Puerto Rico: Mun. Río Grande: Caribbean National Forest, El Verde Research Area, 20 May 1993 D. J. Lodge, M. Boyd & L. Fish (CFMR-PR 1155 - holotypus)

Pileus 22 mm diam, broadly convex, slightly depressed in Centre, with inrolled margin; surface Dark Greyish Brown (6.0 R 2.5/1.0) at Centre, Cinnamon Brown (7.0 YR 4.0/4.0) near margin, tomentose, squamulose, recurved-squamulose to squarrose, dry. *Lamellae* slightly arcuate, broadly adnate with a decurrent tooth to sinuate, Cinnamon Brown (7.0 YR 4.0/4.0) to Ground Cinnamon (8.7 YR 5.2/3.6), subdistant (1-2 per mm), with lamellulae of one length; edge wavy to crenate, concolorous. *Stipe* central, 33 × 7 mm, compressed; surface Fuscous (5.0 YR 3.5/1.3), granular, floccose at the apex. Spores dimorphous, hyaline, smooth, thin-walled; macrospores 15-20.8 × 6.6-9.4 μm, Q = 1.8-2.75 (mean 2.08), broadly ellipsoid, with refractive guttules; microspores 5.8-8.3 × 3-5 μm, Q = 1.4-2.18 (mean 1.66), subglobose to ellipsoid. *Basidia* dimorphous, 4-spored; macrobasidia 32-56 × 12.8-16.8 μm, clavate-stipitate, slightly brownish in KOH; microbasidia 24-28 × 4.8-8 μm, clavate. *Lamella-edge* fertile. *Pleurocystidia* and *cheilocystidia* none. *Hymenophoral trama* regular to subregular, hyphae 28-132 × 8.8-48 μm; central strand stained slightly vinaceous in Melzer's reagent; subhymenium of densely interwoven hyphae 2.5-4 μm wide; laticiferous hyphae sparse, 2.5-4 μm wide. *Pileipellis* a trichodermium, with swollen end cells filled with reddish-brown contents in KOH and Melzer's reagent, 47.2-52.5 × 11.6-15 μm. *Pileus context* with interwoven laticiferous hyphae 4-5.6 μm wide, and regular hyphae 9-27 μm wide, inflated up to 48 μm, with abundant clamp-connections. *Stipitipellis* a trichodermium, hyphae 17-41 × 7-8 μm, terminal elements strangulated, with a slight brown intracellular tint.

Comments: This unusual species grows on mineral soil in Subtropical Wet Forest. It is superficially reminiscent of a *Chroogomphus* sp. because of its shape and the colour of the lamellae. However, *H. brunneosquamosa* belongs in the Hygrophoraceae because of the waxy and oily texture of the lamellae, the presence of hyaline and inamyloid spores, and the size of the basidia (5-7 times as long as the spores). Within section *Firmae*, brown pigments and squamules are very unusual. *Hygrocybe helvolofirma* Pegler has similar pigments, but *H. brunneosquamosa* lacks staining reactions, has a squamose pileus, and has a smaller stature while *H. helvolofirma* stains greyish blue violet, has a smooth pileus surface and is more robust (Pegler, 1983). *Hygrocybe neofirma* (see p. 221) has smaller squamules that are concentrated in the centre of the

pileus, and it also differs from *H. brunneosquamosa* in overall colour (yellow to scarlet with blackish staining). Microscopically, *H. neofirma* differs from *H. brunneosquamosa* in having slightly shorter macrospores (13.5-19 µm vs 15-21 µm), slightly longer macrobasidia (50-60 µm vs 32-56 µm), and more inflated subhymenial hyphae (15-30 µm vs 2.5-4 µm wide). *Hygrocybe firma* (Berk. & Broome) Singer and *H. anisa* (Berk. & Broome) Pegler from Sri Lanka both have a trichodermial pileipellis, but they are yellow rather than brown and also differ in having a pileipellis with chains of subglobose and some stipitate-capitate elements, narrower macrobasidia (6-12 vs 12.8-16 µm), and macrospores mostly less than 13.5 µm.

Specimens examined: **Puerto Rico:** Mun. Rio Grande: Caribbean National Forest, Luquillo Mts, El Verde Research area, trail to Rio Sonadora, 18° 19' 24" N, 65° 49' 12" W, 350 m, on mineral soil on edge of pit from tree fall, 20 May 1993, *D. J. Lodge, M. Boyd & L. Fish* (CFMR-PR 1155 -holotype); *ibid*, above Road 9966, close to

Quebrada Jiménez, 400 m, on soil, 4 Dec 1997, *J. Mercado, CFMR-PR 4723* (N. Legon PR 336) (UPRRP).

Other material examined: *H. helvolofirma*: **Dominica:** Gros. Bois, St. Andrew, 6 Nov. 1977, *J. P. Fiard 1062a* (K(M) 50478-Holotype).

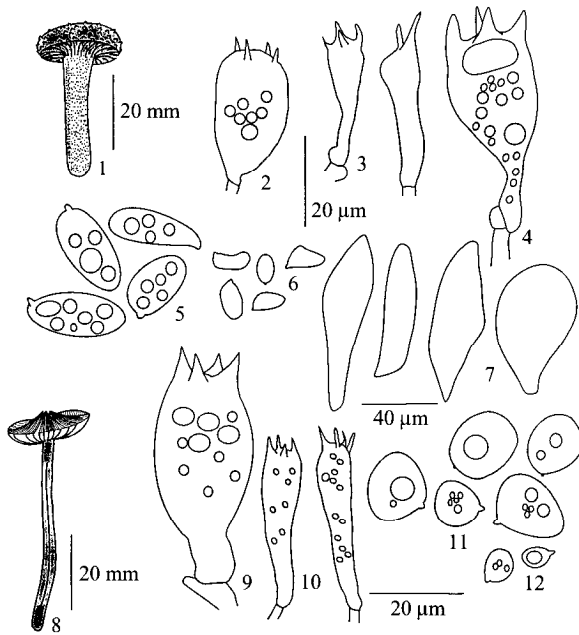
Hygrocybe chloochlora Pegler & Fiard, *Kew Bull.* **32:** 303 (1978).

Description: Lodge & Pegler (1990).

Specimens examined: **Puerto Rico:** Mun. Rio Grande: Caribbean National Forest, Luquillo Mts, El Verde Research Area, 18° 19' 24" N, 65° 49' 4" W, 370 m, on mineral soil, 30 Aug. 1988, *M. Aponte, (CFMR-PR 409 & PR 412); ibid*, 31 Aug. 1988, (CFMR-PR 410); *ibid*, *D. L. Lodge, CFMR-PR 578* (K); *ibid*, on soil, 27 Jun. 1993, *M. Boyd, (CFMR-PR 1206); ibid*, 11 Nov. 1988, on soil, *D. J. Lodge, CFMR-PR 4294* (CORT); *ibid*, Mt Britton trail, 18° 18' 8" N, 65° 47' 45" W, 900 m, on soil, 8 Jun. 1997, *P. Roberts, CFMR-PR 4552* (UPRRP); *ibid*, 19 Jun. 1997, on soil, *M. Serrano, (CFMR-PR 4564)* (*M. Serrano 9723*); *ibid*, Caimitillo Trail, 18° 18' 9" N, 65° 47' 11" W, 700 m, on soil, 19 Jun. 1997, *M. Serrano, CFMR-PR 4566, (M. Serrano 9721)* (NY); *ibid*,

Key to Greater Antillean species of Hygrocybe section Firmae

- Hymenophoral trama regular, composed of long elements, usually with many exceeding 200 µm in length, some hyphae with tapered ends; lamellae always adnexed to free (if basidia and spores are dimorphic, see 2 below) . . . **Subgen. Hygrocybe**
 Hymenophoral trama regular to subregular, composed of short elements, the longest not exceeding 200 µm in length, usually without tapered ends; lamellae variously attached (adnexed, adnate, decurrent) . . . **Subgen. Pseudohygrocybe** 2
- 2(1) Basidia and spores dimorphous **Sect. Firmae** 4
 Basidia and spores monomorphous 3
- 3(2) Pileus and stipe viscid to glutinous; lamella-edge sometimes gelatinised **Sect. Glutinosae**
 Pileus viscid or dry; stipe dry or slightly lubricous at most; lamella-edge never gelatinised **Sect. Coccineae**
- 4(2) Pileus with grey, grey-brown, or olive-brown colours 5
 Pileus with yellow, orange, red, green or purple colours. 7
- 5(4) Pileus tomentose, recurved-squamulose to squarrose; lamellae brown **brunneosquamosa**
 Pileus radially fibrillose or fibrillose-silky; lamellae not brown 6
- 6(5) Pileus plane, but depressed and perforated at the centre, radially fibrillose-silky, translucent-striate; lamellae Flesh Ochre with Lime Green to Citrine near margin **olivaceofirma**
 Pileus broadly conical or umbonate with a stellate split at the centre, radially fibrillose, not translucent-striate; lamellae pale grey **cinereofirma**
- 7(4) Pileus or lamellae with purple or green colouration 8
 Pileus and lamellae without green or purple colouration 9
- 8(7) Pileus Yellow Green, sometimes flushed with rufous when dry, translucent-striate at margin; lamellae white or pale green **chloochlora**
 Pileus Burnt Lake purple to Mahogany Red with flushes of green, and a chartreuse sterile margin, non-striate; lamellae dark green **prieta**
- 9(7) Pileipellis a trichoderm 10
 Pileipellis a cutis of repent hyphae or an ixocutis 11
- 10(-) Centre of pileus rugulose to rugose and not perforated when mature; surface not blackening; lamellae white **batistae**
 Pileus perforated at the centre when mature; surface tomentose to squamulose, blackening; lamellae yellow **neofirma**
- 11(9) Pileus and stipe glutinous. Pileus 10-23 mm diam, convex to plano-convex with age; lamellae adnexed or free, white; cheilocystidia present **hypohaemacta**
 Pileus and stipe not glutinous; lamellae broadly attached; cheilocystidia absent or present 12
- 12(11) Pileus indented, may be perforated at centre 13
 Pileus campanulate or convex-umbonate, not indented or perforated at centre 15
- 13(12) Pileus 4-8(-10) mm diam, cylindrical or truncate-parabolic, umbilicate, with scalloped yellow margin; cheilocystidia absent **trinitensis**
 Pileus greater than 10 mm diam, broadly convex or plane, indented and sometimes perforated at the centre, margin even or irregular but not scalloped; cheilocystidia present 14
- 14(13) Lamellae Scarlet or Geranium red, 2-3 mm broad. Macrospores up to 15 µm diam, microspores up to 9 µm diam **miniatofirma**
 Lamellae red, orange, yellow or cream, 4-10 mm broad. Macrospores up to 10 µm diam, microspores up to 5 µm diam **occidentalis**
 [There are two varieties that differ only in pigmentation. The yellow form is var. *occidentalis*, and the red var. *scarletha*.]
- 15(12) Pileus campanulate with an umbonate disc, translucent-striate; lamellae 2-3 mm broad, with a blunt margin in cross section, Microspores 5.6-8 × 3.2-4.8 µm; cheilocystidia cylindrical or ventricose, without clamp-connections **flavocampanulata**
 Pileus convex, with a mammillate disc, non-striate; lamellae 5 mm broad, with tapered margin (acicular) in cross section. Microspores 7.2-8.8 × 4-5.6 µm; cheilocystidia cylindrical, with medallion clamp-connections **laboyi**



Figs 1-12. **Figs 1-7.** *Hygrocybe brunneosquamosa*. **Fig. 1.** Basidiome. **Fig. 2.** Macrobasidium from holotype. **Fig. 3.** Microbasidia from holotype. **Fig. 4.** Macrobasidium from paratype. **Fig. 5.** Macrospores from holotype. **Fig. 6.** Microspores from holotype. **Fig. 7.** Cheilocystidia. **Figs 8-12.** *H. cinereofirma*. **Fig. 8.** Basidiome. **Fig. 9.** Macrobasidium. **Fig. 10.** Microbasidia. **Fig. 11.** Macrospores. **Fig. 12.** Microspores.

Tradewinds Trail, 18° 17' 27" N, 65° 47' 50" W, 800 m, on soil, 15 Jul. 1997, S. A. Cantrell, D. Llorens & M. Serrano, (CFMR-PR 4599), S. A. Cantrell PR-9761); *ibid*, Palo Hueco main trail, 18° 18' 51" N, 65° 49' 21" W, 600 m, on soil, 9 Sept. 1998, S. A. Cantrell & N. Clum, CFMR-PR 5376 (S. A. Cantrell PR-9884), (UPRRP); *ibid*, Quebrada Grande, 18° 18' 51" N, 65° 49' 21" W, 700 m, on soil, 5 Nov. 1998, S. A. Cantrell, (CFMR-PR 5350), (S. A. Cantrell PR-9899); *ibid*, El Cacique, 18° 18' 51" N, 65° 49' 21" W, 700 m, on soil, S. A. Cantrell & J. Ramírez, (CFMR-PR 5409, (S. A. Cantrell PR-9785).

Hygrocybe cinereofirma Lodge, S. A. Cantrell & Baroni,
sp. nov. (Figs 8-12)

Etym.: *cinereus*, ash grey; *firma*, belonging to section *Firmae*.

Pileus 22 mm, diametro, planus, ad sicum cuspidatus, margine rimoso, isabellinus, sordidus vel pallide sordidus, radialiter fibrillosa, humida. *Lamellae* sinuatae, pallide griseae, ad aciem concolores, lamellis longitudinalibus duabus, margine plano alba. *Stipes* centralis 50 × 3-5 mm, cylindricus, compressus, aequalis, cavus, brunneus, basim versus pallidior, laeveis, humida. *Sporae* dimorphae, globosae vel subglobosae, hyalinae, laeves, parietibus tenuibus, guttulis refractivis; macrospora 10.8-17.4 × 10.0-13.3 μm, Q = 1.0-1.4 (media 1.15); microspora 4.6-7.5 × 4.0-6.6 μm, Q = 1.0-1.45 (media 1.16). *Basidia* dimorpha, clavata, 2- vel 4-sporea, guttulis numerosis; macrobasidia 44-60 × 16-20 μm; microbasidia 25-40 × 4.9-10.0 μm. *Margo lamellaris* fertilis. *Pleurocystidia* et *cheilocystidia* nulla. *Trama hymenophoralis* regularis, ex hyphis 29-66 × 11.6-20.0 μm compositis; hyphae laticiferae refractivae 4.0-6.6 μm diametro praesentes. *Pileipellis* ex hyphis 4.0-20.8 μm instructis, cutem fomatibus, fibulis praesentibus. *Contextus pilei* hyphis gracilibus 2.7-5.3 μm diametro catenis cellularum brevium inflatarum 28-160 × 8-44 μm implexis, fibulis praesentibus.

Typus: **Puerto Rico**: Mun. Naguabo: Caribbean National Forest,

Tradewinds Trail, 28 Jun. 1996, T. J. Baroni (CFMR-PR 3355 - holotypus).

Pileus 22 mm diam, plano-cuspidate, with a rimose margin; surface Drab (9.0 YR 5.5/2.5) to Light Drab (0.2 Y 5.8/2.5), radially fibrillose, moist. *Lamellae* sinuate, pale grey, with lamellulae of two lengths; edge even, white. *Stipe* central, 50 × 3-5 mm, equal, compressed, hollow; surface Hair Brown (9.1 YR 3.3/2.0), paler at the base, smooth, moist. *Spores* dimorphous, globose or subglobose, hyaline, smooth, thin-walled, with refractive guttules; macrospores 10.8-17.4 × 10.0-13.3 μm, Q = 1.0-1.4 (mean 1.15); microspores 4.6-7.5 × 4.0-6.6 μm, Q = 1.0-1.45 (mean 1.16). *Basidia* dimorphous, clavate, 2-4 spored, with many guttules; macrobasidia 44-60 × 16-20 μm; microbasidia 25-40 × 4.9-10.0 μm. *Lamella-edge* fertile. *Pleurocystidia* and *cheilocystidia* none. *Hymenophoral trama* regular, of short broad hyphae, 29-66 × 11.6-20.0 μm; laticiferous hyphae present, refractive, 4.0-6.6 μm wide. *Pileipellis* of repent hyphae, some with brown contents, 4.0-20.8 μm wide, clamp-connections present. *Pileus context* with slender hyphae, 2.7-5.3 μm wide tangled in with chains of short inflated cells 28-160 × 8-44 μm, clamp-connections present. *Stipitipellis* a cutis of repent hyphae, 21.2-99.7 × 6.6-17.3 μm, with few uplifted hyphal ends, with clamp-connections.

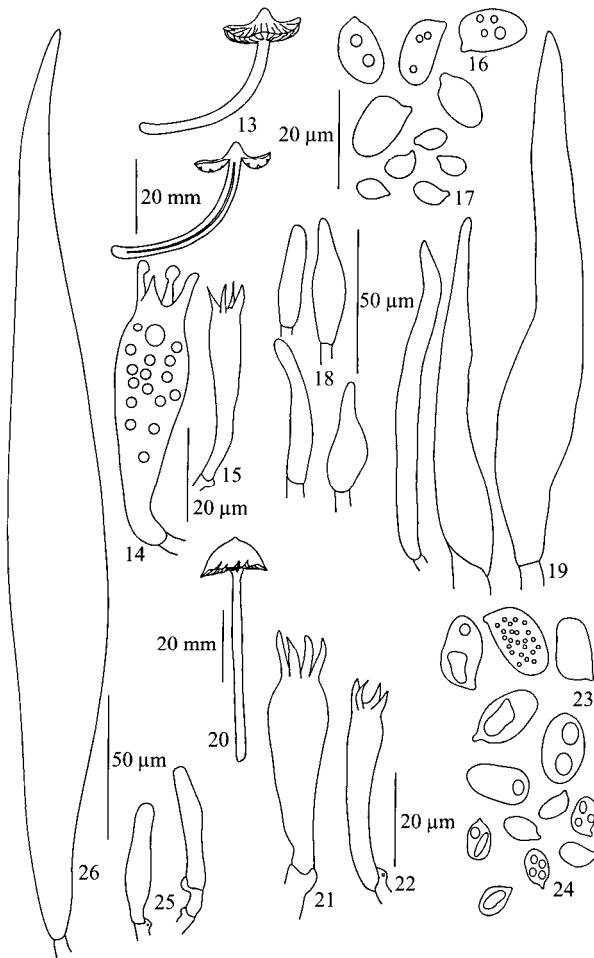
Comments: This species was found on soil in Lower Montane Wet Forest. The dull pigments of the pileus suggest section *Caccineae*, subsection *Ovinae*, but the presence of strongly dimorphic basidia and spores place *H. cinereofirma* within section *Firmae*. Within this section, *H. helvolofirma* has similar coloration, but the cuspidate rather than indented and perforated pileus, absence of a pinkish-violet staining reaction in the lamellae, and distinctly globose spores of *H. cinereofirma* clearly distinguish these species.

Specimens examined: **Puerto Rico**: Mun. Rio Grande: Caribbean National Forest, Luquillo Mts, Tradewinds trail, 18° 7' N, 65° 47' W, 800 m, on soil, 28 Jun. 1996, T. J. Baroni (CFMR-PR 3355 - holotypus).

Hygrocybe flavocampanulata S. A. Cantrell & Lodge,
sp. nov. (Figs 13-19)

Etym.: *flavus*, yellow; *campanulatus*, bell; yellow bell-shaped pileus.

Pileus 21 mm diametro, campanulatus vel umbonatus, ad marginem recurvatus, luteus, radialiter fibrillososericeus, straitus, translucentistriatus, humidus, lubricus. *Lamellae* adnexae vel subsinuatae, stramineae, 3 mm latae, lamellis longitudinalibus duabus, ad aciem concolores. *Stipes* centralis, 45 × 3 mm, cylindricus, aequalis, solidus usque fartus, pileo concolor, glabrus, humidus, lubricus. *Sporae* dimorphae, subglobosae vel ovoideo-ellipsoideae, hyalinae, laeves, parietibus tenuibus; macrospora 11.2-16.0 × 7.2-10.4 μm, Q = 1.4-1.9 (media 1.74); microspora 5.6-8.0 × 3.2-4.8 μm, Q = 1.33-2.0 (media 1.66). *Basidia* dimorpha, 4-sporea; macrobasidia clavata, 50.4-60.0 × 12-16 μm, guttulis numerosis; microbasidia cylindrica, 36.0-41.6 × 5.6-7.2 μm. *Margo lamellaris* sterilis. *Pleurocystidia* nulla. *Cheilocystidia* cylindrica ventricosa, 36.0-41.6 × 6.6-14.6 μm, fibulis nullis. *Pseudocystidia* 97-183 × 8.0-21.3 μm, cylindrica, numerosa. *Trama hymenophoralis* subregularis ad marginem non angustata ex hyphis ducentibus longis et latis 140-300 × 8-20 μm et hyphis intertextis tenuibus composita, fibulis praesentibus.



Figs 13-26. **Figs 13-19.** *H. flavocampanulata*. **Fig. 13.** Basidiome. **Fig. 14.** Macrobasidium. **Fig. 15.** Microbasidium. **Fig. 16.** Macrospores. **Fig. 17.** Microspores. **Fig. 18.** Cheilocystidia. **Fig. 19.** Pseudocystidia. **Figs 20-26.** *H. laboyi*. **Fig. 20.** Basidiome. **Fig. 21.** Macrobasidium. **Fig. 22.** Microbasidium. **Fig. 23.** Macrospores. **Fig. 24.** Microspores. **Fig. 25.** Cheilocystidia. **Fig. 26.** Pseudocystidia.

Pileipellis cutis est ex hyphis allantoideis repentibus, 47.8-106.0 × 8.0-14.6 μm composita, hyphis laticiferis et fibulis praesentibus. *Stipitipellis* cutis est ex hyphis repentibus composita, ixocute tenui et fibulis et hyphis laticiferis praesentibus.

Typus: **Puerto Rico:** Mun. Río Grande: Caribbean National Forest, Palo Hueco, 13 Apr. 1998, S. A. Cantrell & C. Laboy (CFMR-PR 4828 -holotypus).

Pileus 21 mm diam., campanulate, umbonate, margin uplifted; surface Spectrum Yellow (6.0 Y 8.5/12.0), radially fibrillose-silky, translucent-striate, moist, lubricous. *Lamellae* adnexed to slightly sinuate, Straw Yellow (5.0 Y 8.0/6.0), 3 mm broad, with lamellulae of two lengths; edge even, concolorous. *Stipe* central, 45 × 3 mm, equal, solid or stuffed; surface Spectrum Yellow (6.0 Y 8.5/12.0), smooth, moist, lubricous. *Spores* dimorphous, subglobose, ellipsoid or ovoid, hyaline, smooth, thin-walled; macrospores 11.2-16.0 × 7.2-10.4 μm, Q = 1.4-1.9 (mean 1.74); microspores 5.6-8 × 3.2-4.8, Q = 1.33-2.0 (mean 1.66). *Basidia* dimorphous, macrobasidia clavate, 4-spored, with many guttules, 50.4-60.0 × 12-16 μm; microbasidia cylindrical, 4-spored, 36.0-41.6 × 5.6-7.2 μm. *Pleurocystidia* none. *Lamella-edge* sterile. *Cheilocystidia* cylindrical, ventricose, 38.5-46.6 × 6.6-14.6 μm, without

clamp-connections. *Pseudocystidia* also present at the lamellar edge, numerous, cylindrical, ventricose, 97-183 × 8.0-21.3 μm. *Hymenophoral trama* subregular, not narrowed at the margin, composed of long and broad conductive hyphae, 140-300 × 8-20 μm and thin interwoven hyphae, clamp-connections present. *Pileipellis* a thin ixocutis, hyphae 2.4-4 μm diam, subgelatinised, overlaying sausage shaped hyphae 47.8-106.0 × 8.0-14.6 μm, laticiferous hyphae and clamp-connections present. *Stipitipellis* a cutis of repent hyphae, with a thin ixocutis, clamp-connections and laticiferous hyphae present.

Comments: This beautiful bright yellow species with a campanulate pileus is unique because of its colour, the shape of the pileus, and microcharacteristics. It is found in Subtropical Wet and Lower Montane Wet Forest types. The most similar, and probably closely related species is *H. laboyi*, described below. Refer to comments under *H. laboyi* for characters that distinguish these two taxa. *Hygrocybe subflavida* is also similar in pileus shape and colour but it lacks dimorphic basidia and spores. The shape and size of the spores and cheilocystidia of *H. flavocampanulata* are similar to those of *H. occidentalis* var. *occidentalis* (see Lodge & Pegler 1990), but *H. flavocampanulata* cannot be confused with that species because of its more slender basidiocarps (pileus 20-22 mm and stipe 3 mm diam vs pileus 10-70 mm diam and stipe 4-20 mm diam, respectively), an umbonate disc instead of a depressed disc that becomes perforated with age, the presence of numerous pseudocystidia, a thick, sterile lamella-edge, and larger macro- and microbasidia.

Dennis (1953) described a collection from Trinidad as *Hygrophorus earlei*, which Hesler and Smith (1963) and Pegler (1983) classified as *H. subflavida*. We noted that the basidia and spores are dimorphic in this collection and not monomorphic as described by these authors and it fits our concept of *H. flavocampanulata*.

Specimens examined: **Puerto Rico:** Mun. Río Grande: Caribbean National Forest, Luquillo Mts, Palo Hueco, 18° 18' 51" N, 65° 49' 21" W, 600 m, on soil, 13 Apr. 1998, S. A. Cantrell & C. Laboy, (S. A. Cantrell PR-9849) (CFMR-PR 4828 -holotype), Mun. Luquillo: *ibid*, Bisley Trail, 18° 18' 52" N, 65° 44' 49" W, 300 m, on soil, 15 Apr. 1997, E. Terranova & Mercado, CFMR-PR 4829, (S. A. Cantrell PR-9853) (UPRRP). - **Trinidad:** beside trail on crest of range north of Arima, on humus, 25 Sept. 1949, R. W. G. Dennis 50 (K(M) 5049).

Hygrocybe hypohaemacta (Corner) Pegler, *Kew Bull.* **32: 299 (1978).**

Descriptions: Lodge & Pegler (1990), Pegler (1983).

Comments: This bright red, glutinous species is one of the few species in sect. *Firmae* that occurs in Subtropical Moist Forests, and is the only glutinous species in the section. It also differs from most members of section *Firmae* in having long trama hyphae with tapered ends and adnexed to free lamellae, typical of subgenus *Hygrocybe* rather than subgenus *Pseudo-hygrocybe*.

Specimens examined: **Jamaica:** Crownland, Trelawny Parish, 18° 15' 39" N, 77° 39' 6" W, 600 m, on humus, 10 Jun. 1999, T. J. Baroni, (S. A. Cantrell J-9), (CFMR-JAM 156, II); *ibid*, Bird Cave Rock, on soil, 18 Sept. 1996, D. J. Lodge JAM-16 (II). - **US Virgin Islands:**

St. John, Bordeaux Mtn., 18° 21' 28" N, 64° 42' 30" W, 400 m, on soil, 10 Dec. 1997, D. J. Lodge, K. Nakasone & W. Henderson, CFMR-St. J. 389 (Lodge SJ-27) (NY).

Hygrocybe laboyi S. A. Cantrell & Lodge, **sp. nov.**
(Figs 20-26)

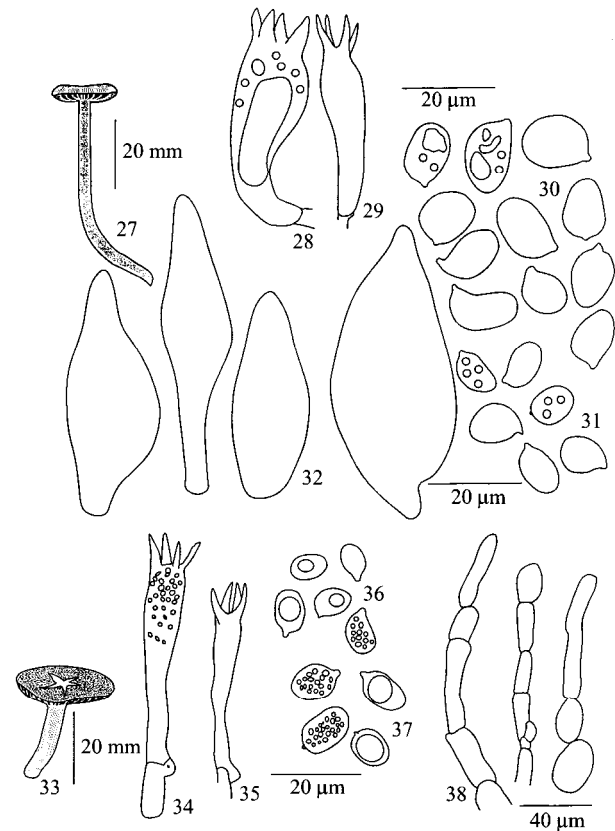
Etym.: Named after Carlos Laboy, one of the collectors.

Pileus 15 mm diametro, late convexus campanulatus, umbone mamillato, superficie lutea radialiter fibrilloso-sericea, nitida, sicca. *Lamellae* sinuatae, luteae spectri, 5 mm latae, distantes, margine eroso tenerrimo concoloro. *Stipes* centralis, 53 × 4 mm, apice dilatatus, cavus, superficie lutea spectri fibrillosa sericea, nitida, sicca. *Sporae* dimorphae ellipsoideae vel elongatae vel cylindricae hyalinae laeves parietibus tenuibus guttulateae; macrospora 13.6-16.8 × 7.2-9.6 μm, Q = 1.54-2.1 (media 1.78); microspora 7.2-8.8 × 4.0-5.6 μm, Q = 1.54-2.1 (media 1.78). *Basidia* dimorpha 4-spora clavata; macrobasidia 50.4-68.0 × 11.2-13.6 μm; microbasidia 35.2-48.0 × 6.4-8.0 μm. *Margo lamellae* sterilis, margine sterili ca. 640-680 μm profunditate. *Pleurocystidia* nulla. *Cheilocystidia* cylindrica 32.0-65.6 × 6.4-8.8 μm, fibulis insignis. *Pseudocystidia* ventricosa 360 × 40-52 μm praesentibus. *Trama hymenophoralis* subregularis ad marginem angustata (in sectione transversali acicularis) ex elementis ducentibus latis 14-40 μm diametro elementis intertextis tenuibus 4-8 μm diametro immixtis composita, fibulis praesentibus. *Pileipellis* cutis est ex hyphis repentibus 48-72 × 9.6-14.4 μm composita, hyphis erectis paucis, fibulis praesentibus. *Stipitipellis* cutis est ex hyphis repentibus composita, ixocute tenui et fibulis et hyphis laticiferis praesentibus.

Typus: **Puerto Rico**: Mun. Río Grande: Palo Hueco, Caribbean National Forest, 1 Jul. 1998, S. A. Cantrell, C. Laboy & R. Negrón (CFMR-PR 4870 - holotypus).

Pileus 15 mm diam, broadly convex, campanulate, with a mammillate umbo; surface Spectrum Yellow (6.0 Y 8.5/12.0), radially fibrillose-silky, shiny, dry. *Lamellae* sinuate, Spectrum Yellow (6.0 Y 8.5/12.0), 5 mm broad, distant; edge eroded, very thin, concolorous. *Stipe* central, 53 × 4 mm, flared at apex, hollow; surface Spectrum Yellow (6.0 Y 8.5/12.0), fibrillose-silky, shiny, dry. *Spores* dimorphous, ellipsoid, elongate, cylindric, hyaline, smooth, thin-walled, guttulate; macrospores 13.6-16.8 × 7.2-9.6 μm, Q = 1.54-2.1 (mean 1.78); microspores 7.2-8.8 × 4.0-5.6 μm, Q = 1.54-2.1 (mean 1.78). *Basidia* dimorphous, 4-spored, clavate; macrobasidia 50.4-68.0 × 11.2-13.6 μm; microbasidia 35.2-48.0 × 6.4-8.0 μm. *Lamella-edge* sterile, sterile edge approx. 640-680 μm deep. *Phrocyctidia* none. *Cheilocystidia* cylindric, 32.0-65.6 × 6.4-8.8 μm, with medallion clamp-connections. *Pseudocystidia* present, ventricose, 360 × 40-52 μm. *Hymenophoral trama* subregular, narrowed to the margin (acicular in cross section) composed of broad conductive elements 14-40 μm wide, intermixed with thin interwoven elements 4-8 μm wide, with clamp-connections. *Pileipellis* a cutis of repent hyphae, 48-72 × 9.6-14.4 μm, with few erect hyphae, clamp-connections present. *Stipitipellis* a cutis of repent hyphae, with a thin ixocutis, clamp-connections and laticiferous hyphae present.

Comments: This species was found in Lower Montane Wet Forest. It differs from *H. flavacampanulata* by having a non-striate instead of a translucent-striate pileus margin, lamellae that are 5 mm broad, pure yellow, and acicular in cross section rather than 2-3 mm broad, straw yellow, and with a blunt



Figs 27-38. **Figs 27-32.** *H. miniatofirma*. **Fig. 27.** Basidiome. **Fig. 28.** Macrobasidium. **Fig. 29.** Microbasidium. **Fig. 30.** Macrospores. **Fig. 31.** Microspores. **Fig. 32.** Cheilocystidia. **Figs 33-38.** *H. neofirma*. **Fig. 33.** Basidiome. **Fig. 34.** Macrobasidium. **Fig. 35.** Microbasidium. **Fig. 36.** Microspores. **Fig. 37.** Macrospores. **Fig. 38.** Trichodermial elements.

edge in cross section, and dry, silky-fibrillose pileus and stipe surfaces instead of moist and lubricous gelatinized surfaces. Microscopically, these two species differ by their cheilocystidia. *Hygrocybe laboyi* has cylindric cheilocystidia with distinctive medallion clamp-connections while *H. flavacampanulata* has cylindric or ventricose cheilocystidia that lack clamp-connections at their base.

Specimens examined: **Puerto Rico**: Mun. Río Grande: Caribbean National Forest, Luquillo Mts, Palo Hueco, east of Río Espíritu Santo, 18° 18' 1" N, 65° 49' 21" W, 650 m, on soil, 1 Jul. 1998, S. A. Cantrell, C. Laboy & R. Negrón, (S. A. Cantrell 9860) (CFMR-PR 4870 - holotype).

Hygrocybe miniatofirma S. A. Cantrell & Lodge, **sp. nov.**
(Figs 27-32)

Etym.: *miniato*, Scarlet or Geranium Red; *firma*, from sect. *Firmae*.

Pileus 16 mm diametro, obtuse convexus dein planus vel subdepressus, perforatus, superficie scarlatina, gerania, in Centro aurantio-lutea, radialiter fibrilloso-sericea, humida, hygrophana, lubrica, margine aurantia-luteo, translucenstistriatus. *Lamellae* adnatae vel sinuatae, pileo concolores, 2 mm latae, distantes, lamellulis longitudinibus duabus, margine concoloro vel interdum aurantio-luteo, undulato, *Stipes* centralis, 30-55 × 3 mm, cylindricus, aequalis, pileo concolor, fibrillososericeus, humidus, hygrophanus, lubricus. *Sporae* dimorphae,

subglobosae vel late ellipsoideae vel ellipsoideae vel elongatae, hyalinae, levis, parietibus tenuibus, guttulate; macrospora 12.8-16.0 × 8.0-15.2 μm, Q = 1.05-1.9 (media 1.57), microspora 8.8-12.0 × 5.6-8.8 μm, Q = 1.1-1.8 (media 1.45). *Basidia* dimorpha, clavata, 4-sporea; macrobasidia 40-72 × 11.2-17.6 μm, contento oleoso plena; microbasidia 28-48 × 6.8-10.4 μm, guttis olei parvis paucis. *Pleurocystidia* nulla. *Cheilocystidia* 44-56 × 12-24 μm, late ventricosa vel late fusiformia interdum apice cylindrico-nodulosa, fibulis nullis. *Margo lamellaris* fertilis. *Trama hymenophoralis* subregularis ex hyphis latis 12-20 μm diametro et hyphis intertextistenuibus fibulatis 3.2-4.0 μm diametro composita. *Pileipellis* cutis est ex hyphis repentibus 2.8-13.6 μm diametro, fibulatis composita. *Stipitipellis* cutis est ex hyphis repentibus 3.2-12.0 μm diametro fasciculis caulocystidiorum vermiformium cylindricorum 12-3 × 4.0-6.4 μm composita.

Typus: **Puerto Rico:** Mun. Río Grande: Caribbean National Forest, Luquillo Mts, Palo Hueco, 1 Jul 1998 (CFMR-PR 4868 - holotypus; NY - isotypus).

Pileus 15-16 mm diam, broadly convex to plane, slightly depressed in the centre, rarely perforated; surface Scarlet (8.75 R 4.5/16.5), Geranium (7.5 R 4.0/15.0), Orange-Yellow (10.0 YR 8.0/14.0) at the centre, radially fibrillose-silky, moist, hygrophanous; margin Orange-Yellow (10.0 YR 8.0/14.0), translucent-striate. *Lamellae* adnate, or sinuate, Scarlet (8.75 R 4.5/16.5), Geranium (7.5 R 4.0/15.0), 2 mm broad, distant, with lamellulae of two lengths; edge concolorous or Orange-Yellow (10.0 YR 8.0/14.0) in some, wavy. *Stipe* central, 30-55 × 3 mm, equal, hollow; surface Orange Yellow (10.0 YR 8.0/14.0), Spectrum Orange (5.0 YR 6.5/16.0), Chrome Orange (2.5 YR 6.0/16.0), silky-fibrillose, moist, hygrophanous. *Spores* dimorphous, subglobose, broadly ellipsoid, ellipsoid or elongate, hyaline, smooth, thin-walled, guttulate; macrospores 12.8-16.0 × 8.0-15.2 μm, Q = 1.05-1.9 (mean 1.57); microspores 8.8-12.0 × 5.6-8.8 μm, Q = 1.1-1.8 (mean 1.45). *Basidia* distinctly dimorphous, clavate, a-spored; macrobasidia 40-72 × 11.2-17.6 μm, filled with oily contents; microbasidia 28-48 × 6.8-10.4 μm, with few small oil drops. *Pleurocystidia* none. *Lamella-edge* fertile, composed of basidia mixed with cheilocystidia. *Cheilocystidia* 44-56 × 12-24 μm broadly ventricose or broadly fusiform, some are cylindric nodulose at the apex, without clamp-connections. *Hymenophorul trama* subregular, composed of broad hyphae, 12-20 μm wide, and thin interwoven hyphae with clamp-connections: 3.2-4 μm wide. *Pileipellis* a cutis of repent hyphae, 2.8-13.6 μm wide with clamp-connections. *Stipitipellis* a cutis of repent hyphae, 3.2-12.0 μm wide, with clusters of cylindric, vermiform caulocystidia, 12-36 × 4.0-6.4 μm.

Comments: This scarlet species of Lower Montane Wet forest resembles a small form of *H. occidentalis* var. *scarletina*, but it differs macroscopically from the latter in usually lacking a perforated pileus, and having lamellae that are usually a deeper red and narrower than those of *H. occidentalis* var. *scarletina* (2-3 mm vs 4-10 mm broad) (Lodge & Pegler 1990). Microscopically, these two species are similar, although the separation of macro- and microspores is more distinct in *H. occidentalis*, and both macro- and microspores are clearly broader in *H. miniatofirma* than in *H. occidentalis* (8-15 vs 6-10 μm and 5.6-8.8 vs 3-5 μm broad for macro- and microspores, respectively) (Lodge & Pegler 1990).

Specimens examined: Puerto Rico: Mun. Río Grande: Caribbean National Forest, Luquillo Mts, Palo Hueco, east of Río Espiritu Santo, 18° 18' 51" N, 65° 49' 21" W, 650 m, on humus, 1 Jul. 1998, S. A. Cantrell, C. Laboy & R. Negrón (S. A. Cantrell 9859), CFMR-PR 4868 - holotype, NY - isotype); *ibid*, 9 Nov. 1998, C. Laboy (CFMR-PR 5352); *ibid*, El Cacique, 18° 18' 51" N, 65° 49' 21" W, 850 m, on soil, 3 Sept. 1997, C. Laboy & V. Cuevas, CFMR-PR 5220 (UPRRP); Caribbean National Forest, Luquillo Mts, El Verde, upper Quebrada Sonadora, 18° 19' 24" N, 65° 49' 3" W, 500 m, on soil, 2 Sept. 1998, C. Laboy & V. Cuevas, CFMR-PR 5221 (NY).

Hygrocybe neofirma S. A. Cantrell & Lodge, **sp. nov.**

(Figs 33-38)

Etym.: *neo*, from the new world; *firma*, after *H. firma*.

Pileus 28 mm diametro, parum concavus ad centrum foramine ad instar stellae, superficie luteoaurantia, squamis atrobunneis tingentibus, tomentosa squamis minutis, contextu 2 mm crasso, prope marginem rubro-aurantio vivido pallido, prope stipitem luteo splendido. *Lamellae* adnatae dente decurrenti, luteae dilutae usque luteae splendidae, 3 mm latae, subdistantes (1 per mm) crassae, lamellis longitudinalibus duabus, margine aetate purpureo-brunneo tincto. *Stipes* centralis, 22 × 4-10 mm, complanatus cavus, superficie basi lutea pallida, aetate ibris purpureo-brunneis tinctis. *Spores* dimorphae, late ellipsoideae vel ellipsoideae, hyalinae, laeves, parietibus tenuibus; macrospora 12.8-17.6 × 8-10.4 μm, Q = 1.46-1.80 (media 1.63); microspora 6.4-8.0 × 4.0-6.3 μm, Q = 1.30-1.67 (media 1.50). *Basidia* dimorpha, clavata, 4-sporea, fibula basali; macrobasidia 44.0-68 × 10.8-15.2 μm, sterigmatibus 8.4-12 μm; microbasidia 32-58 × 4.8-8 μm, sterigmatibus usque ad 8 μm. *Trama hymenophoralis* regularis, hyphis 28-226 × 8-20 μm, hyalinis vel contento brunneo; hyphae laticiferae numerosae, contento refractivo sine fibulis. *Pileipellis* trichodermium, est hyphis 26.6-133 × 6.6-24 μm, allantoideis fibulis paucis; hyphae laticiferae praesentes.

Typus: **Puerto Rico:** Mun. Río Grande, Caribbean National Forest, Palo Hueco, El Cacique area, 21 Jul. 1999, S. A. Cantrell & C. Laboy, (CFMR-PR 5667 - holotypus; UPRRP - isotypus).

Pileus 28 mm diam, slightly concave, with a star-shaped perforation at centre; surface yellow-orange with blackish brown staining scales, tomentose with tiny squamules; context 2 mm thick, pale vibrant red-orange near margin, brilliant yellow near stipe. *Lamellae* adnate with a decurrent tooth, light yellow to brilliant yellow, 3 mm broad, subdistant (1 per mm), thick, with lamellulae of two lengths; edge stained purple brown in age. *Stipe* central, 22 × 4-10 mm, flattened, hollow; surface pale yellow at the base with purple-brown stained fibres in age. *Spores* dimorphous, broadly ellipsoid or ellipsoid, hyaline, smooth, thin-walled; macrospores 12.8-17.6 × 8-10.4 μm, Q = 1.46-1.80 (mean 1.63); microspores 6.4-8.0 × 4.0-6.3 μm, Q = 1.30-1.67 (mean 1.50). *Basidia* dimorphous, clavate, d-spored, with basal clamp-connection; macrobasidia 44-68 × 10.8-15.2 μm with sterigmata 8.4-12 μm; microbasidia 32-58 × 4.8-8 μm, with sterigmata up to 8 μm. *Hymenophoral trama* regular, hyphae 28-226 × 8-20 μm, hyaline or with brown contents; laticiferous hyphae numerous with refractive contents, clampless. *Pileipellis* trichoderm, hyphae 26.6-133 × 6.6-24 μm, sausage-shaped, with few clamp-connections; laticiferous hyphae present.

Comments: This neotropical species is found in Subtropical and Lower Montane Wet Forest types in the Greater and

Lesser Antilles. *Hygrocybe neofirma* differs macroscopically from the type collection of *H. firma* from Sri Lanka in the pileus which is orange rather than pure yellow and radially fibrillose with squamules rather than tomentose, and the black staining reaction with bruising and with age and drying. Microscopically, *H. neofirma* differs from *H. firma* in the structure of the pileipellis (absence of stipitate-capitate terminal elements between the scales, and a more radial arrangement of the trichodermial elements), macrospores that are larger (9.6-12-15(-17)-19 in the Lesser Antilles) \times 7.2-10.4 μ m rather than 8-10.4(-13.4) \times 5.6-8 μ m; and macrobasidia that are very stout and much broader than the microbasidia (10.8-15.2 vs. 6.4-8 μ m wide).

Pegler's (1986) description, which incorporated Petch's concept of *H. firma*, was apparently based on two different species. Petch's collections (Petch 2299 and 4078) have a repent cutis with some upturned hyphal ends rather than a trichoderm, and a thin ixocutis 2-8 μ m deep; they more closely resemble *H. occidentalis*. In addition, the macrobasidia in the type of *H. firma* are narrow but longer than the microbasidia, whereas Petch's collections have stout macrobasidia. There is a discrepancy in macrospore dimensions for *H. firma* between those given by Pegler (1986: 11-16 \times 6-10 μ m), the dimensions in Pegler's drawings of the type [10.6-12(-13.5) \times 6.7-7.5 μ m] and the spores we measured from the type (7.8-10.4 \times 5.4-8 μ m). We believe the dimensions given in the text by Pegler (1986) include Petch's collections.

Another species from Sri Lanka, *H. anisa*, differs from *H. neofirma* in its caespitose habit, yellow colour, stipitate-capitate trichodermial elements, and lack of staining in the pileipellis hyphae. Only two other species in Section *Firmae* with a trichodermial pileipellis are known from the Antilles. *Hygrocybe butistue*, differs from *H. neofirma* in having white rather than yellow lamellae, shorter macrospores (9.5-15.6 vs 12.8-17.6 μ m), and coralloid trichodermial elements that do not stain black. *Hygrocybe brunneosquamosa* is entirely brown and further differs from *H. neofirma* in having a squamose pileus, and broader macrobasidia that are clavate-stipitate rather than narrowly clavate.

Specimens examined: Puerto Rico: Mun. Rio Grande: Caribbean National Forest, El Verde Research Area, 18° 19' 23" N, 65° 48' 58" W, in humus from a rotten stump, 20 Aug. 1990, L. Walker (CFMR-PR 5461); *ibid*, Palo Hueco, El Cacique area, 18° 18' 51" N, 65° 49' 21" W, 800 m, S. A. Cantrell & C. Laboy, (S. A. Cantrell PR 9921) (CFMR-PR 5667 - holotype; UPRRP - isotype). **Guadelupe:** Bains Jaunes, 24 Aug. 1973, (Fiard 568) (K(M)).

Other material examined: Hygrocybe anisa: Sri Lanka: Peredeniya, Nov. 1868, Thwaites 831 (K(M) 61345). *Hygrocybe firma: Sri Lanka:* Peredeniya, Jan. 1869, Thwaites 880 (K(M) 61329 - holotype). Material excluded from *H. firma: Sri Lanka:* Peredeniya, Nov. 1906, T. Petch 2299 (K(M) 61328); 3 Jul. 1914, T. Petch 4078 (K(M) 61327).

H. occidentalis (Dennis) Pegler, *Kew Bull.* **32** : 310 (1978).

var. occidentalis

Description: Lodge & Pegler (1990).

Specimens examined: Puerto Rico: Mun. Rio Grande: Caribbean National Forest, Luquillo Mts, Palo Hueco, main trail, 18° 17' 44" N,

65° 49' 21" W, 700 m, on soil, 9 Sept. 1997, S. A. Cantrell & N. Clum, CFMR-PR 5375 (S. A. Cantrell PR-9883) (UPRRP); *ibid*, El Verde Research Area, 18° 19' 29" N, 65° 49' 0" W, 375 m, on mossy clay bank, D. J. Lodge (DJL 4&5); (CFMR-PR 3667), *ibid*, Big Tree Trail, 18° 18' 34" N, 65° 46' 27" W, 500 m, on soil among debris of broadleaved tree, 29 Jun. 1996, E. & A. Horak (CFMR-PR 4458) (ZT 5745); Mun. Naguabo, Caribbean National Forest, Luquillo Mts, Tradewinds Trail, 18° 17' 43" N, 65° 47' 33" W, 740 m, on soil, 8 Apr. 1997, P. J. Brooks & D. J. Lodge (CFMR-PR 4191); *ibid*, East Peak to Río Prieto, 18° 15' 39" N, 65° 46' 7" W, 650 m, on soil, 18 Jun. 1997, S. A. Cantrell, V. Cuevas & C. Laboy, (S. A. Cantrell PR-9740, (CFMR-PR 4583) Mun. Orocovis, Toro Negro Commonwealth Forest, El Bolo Trail, 18° 9' 14" N, 66° 32' 10" W, 1000 m, 10 Nov. 1996, S. A. Cantrell & C. Betancourt, CFMR-PR 3727 (S. A. Cantrell PR-96147) (UPRRP).

var. scarletina Pegler & Fiard, *Kew Bull.* **32** : 311 (1978).

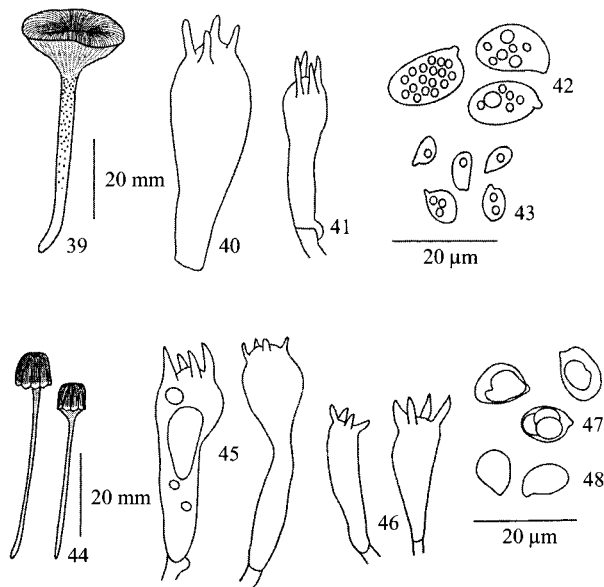
Description: Lodge & Pegler (1990).

Specimens examined: Puerto Rico: Mun. Rio Grande: Caribbean National Forest, Luquillo Mts, Caimitillo Trail, 18° 18' 17" N, 65° 47' 20" W, 700 m, on soil, 2 Oct. 1996, S. A. Cantrell, (S. A. Cantrell PR-9694); (CFMR-PR 3441) *ibid*, El Yunque trail, 18° 18' 17" N, 65° 47' 20" W, 700 m, on soil, 21 May 1999, A. Arguello & D. J. Lodge, (AA-2); (CFMR-PR 5812) *ibid*, El Verde Research Area, 18° 19' 24" N, 65° 49' 4" W, 370 m, E. Taylor (CFMR-PR 4285); *ibid*, El Verde Field Station, 18° 19' 25" N, 65° 49' 13" W, 350 m, on mineral soil, 25 Nov. 1996, D. J. & E. McLaughlin, CFMR-PR 3672 (DJM-1075) (min); *ibid*, Palo Hueco, 18° 18' 51" N, 65° 49' 21" W, 600 m, on soil, 7 Oct. 1996, S. A. Cantrell, CFMR-PR 3448 (S. A. Cantrell PR-96105) (UPRRP); Mun. Naguabo, *ibid*, East Peak to Prieto River, 18° 15' 33" N, 65° 46' 21" W, 650 m, on soil, 18 Jun. 1997, S. A. Cantrell, V. Cuevas & C. Laboy, CFMR-PR 4584 (S. A. Cantrell PR-9741) (UPRRP); *ibid*, Tradewinds Trail, 18° 17' 43" N, 65° 47' 33" W, 740 m, on soil, 28 Jun. 1996, E. & A. Horak, (CFMR-PR 4444) (ZT 5731); *ibid*, 16 Jul. 1997, M. Serrano, CFMR-PR 4631 (UPRRP); *ibid*, 18° 17' 43" N, 65° 47' 33" W, 740 m, on soil, 8 Jun. 1997, T. J. Baroni, CFMR-PR 5048 (TJB-8509) (CORT).

Hygrocybe olivaceofirma Lodge, S. A. Cantrell & Nieves-Rivera, **sp. nov.** (Figs 39-43)

Etym.: *olivaceus*, olive brown; *firma*, belonging to section *Firmae*.

Pileas 25 mm diametro planus depressus, perforatus; margine translucensti-striato, revoluto, undulato, superficie margine crudosenensi, ad centrum olivacea-brunnea hygrophana, usque fumosogrisea, grisea sordida, straminea, ad centrum et margine marronina deflorescenti radialiter fibrillosa-sericea, humida, nitida. *Lamellae* decurrentes, prope stipitem cameo-ochraceae, usque citrino-virides gradientes versus marginem citrinae, 4-5 mm latae, distantes (1 per mm), lamellulis longitudinalibus duabus, margine sinuato usque parum eroso, pallidiore. *Stipes* centralis, 44 \times 3-5 mm, basi angustatus, cavus, superficie apice rufa Prattsii, aurantio-lutea, basi lutea spectri, apice pruinosa, basi laevi, hebeti humida. *Sporae* dimorphae subglobosae vel ellipsoideae, hyalinae, laeves, parietibus tenuibus, guttulis numerosis; macrospora 10.4-16.0 \times 6.4-10.0 μ m, Q = 1.4-1.9 (media 1.6); microspora 5.2-8.8 \times 3.2-6.0 μ m, Q = 1.0-1.8 (media 1.6). *Basidia* dimorpha, crasso-clavata, 4spora; macrobasidia 32.0-37.5 \times 9.6-13.6 μ m; microbasidia 22.4-35 \times 4.0-7.2 μ m. *Pleurocystidia* et *cheilocystidia* nulla. *Margo lamellae*



Figs 39-48. **Figs 39-43.** *H. olivaceofirma*. **Fig. 39.** Basidiome. **Fig. 40.** Macrobasidium. **Fig. 41.** Microbasidium. **Fig. 42.** Macrospores. **Fig. 43.** Microspores. **Figs 44-48.** *H. trinitensis*. **Fig. 44.** Basidiomes. **Fig. 45.** Macrobasidia. **Fig. 46.** Microbasidia. **Fig. 47.** Macrospores. **Fig. 48.** Microspores.

fertilis. *Truma* hymenophoralis regularis ex hyphis longis, latis, composita 18-30 μ m diametro hyphis tenuibus, 4-8 mm diametro intertextis mixtis, fibulis conspicuis. *Pileipellis* ixocutis est. *Hyphae laticiferae* et in trama hymenophorali et in pileipelle abundantes.

Typus : **Puerto Rico** : Mun. Luquillo, Caribbean National Forest, Bisley Watershed, 19 Jun. 1997 (CFMR-PR 4391 - holotypus)

Pileus 25 mm diam, plane, depressed, and perforated at the centre; margin translucent-striate, inrolled, undulating; surface Raw Sienna (5.5 YR 4.0/6.8) at margin, Olive Brown (10.0 YR 4.0/2.0) at centre, hygrophanous, fading to Smoke Grey (2.5 Y 6.0/2.4), Drab Grey (0.1 Y 6.8/2.1), Straw Yellow (5.0 Y 8.0/6.0) at the centre and Maroon (7.5 R 2.5/5.0) at the margin, radially fibrillose-silky, moist, shiny. *Lamellae* decurrent, Flesh Ochre (3.0 YR 6.0/8.0) near the stipe grading to Lime Green (1.0 GY 7.0/5.0) and Citrine (6.3 Y 5.0/5.0) toward the margin, 4-5 mm broad, distant (1 per mm) with lamellulae of two lengths; edge wavy to slightly eroded, paler. *Stipe* central, 44 \times 3-5 mm, tapered at base, hollow; surface Pratts Rufous (1.2 YR 4.3/9.0) at the apex, Orange Yellow (10.0 YR 8.0/14.0), Spectrum Yellow (6.0 Y 8.5/12.0) at the base, apex pruinose, base smooth, dull, moist. *Spores* dimorphous, subglobose or ellipsoid, hyaline, smooth, thin-walled, with many guttules; macrospores 10.4-16.0 \times 6.4-10.0 μ m, $Q = 1.4-1.9$ (mean 1.6); microspores 5.2-8.8 \times 3.2-6.0 μ m, $Q = 1.0-1.8$ (mean 1.6). *Basidia* dimorphous, stout-clavate, 4-spored; macrobasidia 32.0-37.5 \times 9.6-13.6 μ m; microbasidia 22.4-35.0 \times 4.0-7.2 μ m. *Pleurocystidia* and *cheilocystidia* none. *Lamella-edge* fertile. *Hymenophoral trama* regular, of long, broad hyphae, 18-30 μ m wide, mixed with interwoven thin hyphae 4-8 μ m wide, clamp-connections conspicuous. *Pileipellis* an ixocutis. *Laticiferous* hyphae abundant in both the hymenophoral trama and pileipellis. *Stipitipellis* a trichoderm, hyphae 28-68 \times 3.2-6.4 μ m, clamp-connections and laticiferous hyphae present.

Comments: This species was found only once on clay soil in Subtropical Wet Forest. It is a distinctive species within section *Firma* because of the combination of colours of the pileus, lamellae, and stipe. Pegler (1983) described *H. naranjana* from Trinidad but this species differs from *H. olivaceofirma* in lacking green tints in the pileus (Rose Red to Burnt Lake Purple instead of Olive Brown) and lamellae (Pinkish Vinaceous to Indian Red instead of Flesh Ochre grading to Lime Green). In *H. naranjana*, the stipe is pinkish vinaceous to buff yellow rather than rufous to orange-yellow and yellow, the stipe apex is smooth (lacking caulocystidia), the macrobasidia are narrower (7.5-9.5 versus 9.6-13.6 μ m) and the clamp-connections are inconspicuous. *Hygrocybe diversicolor* from Sri Lanka is somewhat similar to *H. olivaceofirma* but it differs by having a darker stipe (greenish yellow to purplish grey or purplish black rather than rufous, orange-yellow, and yellow), smaller macrospores (9-11.5 \times 5.2-7 μ m vs. 10.4-16 \times 6.4-10 μ m), and larger basidia (Pegler 1986). Another possible relative is *H. purpurea* (Beeli) Heinem. described from southern Africa. However, *H. purpurea* differs from *H. olivaceofirma* in having a blackish red pileus and stipe and larger macro- and microbasidia (50-56 \times 14-15 vs 32-37.5 \times 9.6-13.6 μ m and 40-50 \times 7-9 vs. 22-35 \times 4-7 μ m, respectively), bean shaped or slightly constricted spores, and less conspicuous clamp-connections (Heinemann 1963). *Hygrocybe olivaceofirma* could be mistaken for a faded *H. prieta*, but the shape of the macrobasidia (stout-clavate versus clavate-stipitate), orange-rufous tint in the lamellae, and absence of sterile pileus margin distinguish it from the latter species. *Hygrocybe olivaceofirma* can be distinguished from faded *H. chloochlora* by the olive-brown pigments in the pileus, the orange-rufous flush in the lamellae versus green or white, the stout clavate versus clavate-stipitate basidia, and smaller macrospores (10.4-16 \times 6.4-10 μ m vs 15-22 \times 7.5-12.5 μ m) (Lodge & Pegler 1990).

Specimens examined : **Puerto Rico** : Mun. Luquillo : Caribbean National Forest, Luquillo Mts, Bisley Watershed, trail to canopy tower, 18° 18' 52" N, 65° 44' 42" W, 215 m, on soil, 19 Jun. 1997, A. M. Nieves-Rivera (CFMR-PR 4391 - holotype).

Hygrocybe prieta Lodge & Pegler, *Mycol. Res.* **94**: 453 (1990).

Description: Lodge & Pegler (1990).

Specimens examined: **Puerto Rico:** Mun. Rio Grande: Caribbean National Forest, Luquillo Mts., La Coca Trail, 18° 19' 7" N, 65° 46' 20" W, 450 m, on soil, 29 May 1993, D. J. Lodge & J. M. Wunderle (CFMR-PR 1171); *ibid*, Caimitillo trail, 18° 18' 9" N, 65° 47' 11" W, 645 m, on mineral soil, 21 Jun. 1996, D. J. Lodge & T. J. Buroni, CFMR-PR 3347 (UPRRP); *ibid*, Big Tree Trail, 18° 18' 34" N, 65° 46' 27" W, 490 m, on soil, 29 Jun. 1996, E. & A. Horak, (CFMR-PR 4463) (ZT 5750); *ibid*, 7 Jul. 1998, N. Perez & D. J. Lodge, (N. Perez 16) (CFMR-PR 5430); *ibid*, El Verde Research Area, 18° 19' 24" N, 65° 49' 12" W, 350 m, on soil, 23 Dec. 1995, D. J. Lodge & J. M. Wunderle family, CFMR-PR 4027 (NY); *ibid*, Palo Hueco, main trail, 18° 18' 51" N, 65° 49' 21" W, 600 m, on soil, 9 Sept. 1998, S. A. Cantrell & N. Clum, CFMR-PR 5373 (S. A. Cantrell PR-9881) (UPRRP); *ibid*, El Cacique, 18° 15' 51" N, 65° 49' 21" W, 800 m, on soil, 21 Aug. 1997, S. A. Cantrell & J. Ramirez, (S. A. Cantrell PR-9782) (CFMR-PR 5381); MUN. LUQUILLO, *ibid*, Sabana, 18° 19' 20" N,

65° 43' 47" W, 100 m, on soil, 21 Jul. 1999, *M. Santana & J. Mercado*, CFMR-PR 5537 (UPRRP); *ibid*, Bisley Watersheds, 18° 18' 52" N, 65° 44' 44" W, 260 m, on soil, 28 Jul. 1999, (CFMR-PR 5688) (NCC 9965.1).

Hygrocybe trinitensis (Dennis) Pegler, *Kew Bull.* 32: 306 (1978). (Figs 44-48)

Pileus 4-8 mm, cylindrical or truncate-parabolic, umbilicate, margin scalloped; surface Crimson (6.6 R 3.3/12.3), Poppy Red (5.9 R 3.8/14.3), with Orange-Yellow (10.0 YR 8.0/14.0) sterile margin, translucent-striate, radially fibrillose-silky, shiny, moist. *Lamellae* adnate with a decurrent tooth or decurrent, Crimson (6.6 R 3.3/12.3) to Peach Red (8.4 R 5.5/10.1), 3-3 mm broad; edge wavy, Orange Yellow (10.0 YR 8.0/14.0). *Stipe* central, 17-40 × 1.0-1.5 mm, equal, flared at apex; surface Crimson (6.6 R 3.3/12.3) at apex, Orange Yellow (10.0 YR 8.0/14.0) at base, smooth, silky, moist. *Spores* dimorphous, subglobose or ellipsoid, hyaline, smooth, thin-walled, guttulate; macrospores 8.8-12.0 × 6.4-8.0 µm, Q = 1.2-1.8 (mean 1.35); microspores 6.4-8.8 × 4.4-6.4 µm, Q = 1.2-1.6 (mean 1.4). *Basidia* dimorphous, clavate; macrobasidia 32-55 × 8.8-12.8 µm, 4-spored, with basal clamp-connection; microbasidia 16.0-31.2 × 5.6-8.8 µm, 2-4-spored, sterigmata up to 7.2 µm long. *Cheilocystidia* and *pleurocystidia* none. *Lamella-edge* fertile. *Hymenopharal trama* regular to subregular, hyphae 26-120 × 8.0-22.5, constricted at the septum to 3.2 µm, with large clamp-connections; highly interwoven laticiferous hyphae present with refractive contents, 2.0-4.0 µm wide, branched with occasional septations with clamp-connections. *Pileipellis* with a thin gelatinous coating, hyphae 3.2-12.8 µm wide, with clamp-connections. *Stipitipellis* a cutis of repent hyphae, 4.0-22.6 µm wide, clamp-connections and laticiferous hyphae present.

Comments: This small, red species has been reported previously only from the type locality in Trinidad (Dennis 1953) and from Cuba (Pegler 1987). There is also a collection from southern Texas at F. Most of our collections are from high elevations (Lower Montane Wet and Subtropical Rain Forest types) in the Luquillo Mts of Puerto Rico, but it was once collected at a lower elevation (300 m; Subtropical Wet Forest).

Specimens examined: **Puerto Rico:** Mun. Rio Grande: Caribbean National Forest, Luquillo Mts, Caimitillo Trail, 18° 18' 9" N, 65° 47' 11" W, 700 m, on soil, 11 June, 1997, *T. J. Baroni, L. Baroni & D. J. Lodge* (CFMR-PR 4546, NY); *ibid*, 16 Jun. 1997, *D. Llorens, D. J. Lodge & R. Bonilla*, CFMR-PR 5219 (*D. Llorens* 146) (F); *ibid*, 29 Jun. 96, *T. J. Baroni*, CFMR-PR 3645 (*TJB-7976*) (K); Mt. Britton Trail, 18° 18' 8" N, 65° 47' 45" W, 900 m, on mineral soil, 21 Jun. 1996, *E. Horak & S. A. Cantrell*, CFMR-PR 3324 (UPRRP); MUN. LUQUILLO, Caribbean National Forest, Luquillo Mts, Bisley Watershed, 18° 18' 52" N, 65° 44' 42" W, 300 m, on soil, 6 Jun. 1997, *M. Serrano*, CFMR-PR 4551 (NY).

NOTE

For colour images of some of these beautiful species see the website: <<http://www.cortland.edu/nsf/ga.html>>.

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